DILLON CONSULTING

ORLEN UPSTREAM CANADA LTD.

Environmental Impact Assessment (EIA) Registration

Stoney Creek Oil and Gas Wellfield Decommissioning Project
Westmorland and Albert Counties, New Brunswick

July 2022 – 21-2269

July 6, 2022

New Brunswick Department of Environment and Local Government
Environmental Impact Assessment Branch
P.O. Box 6000
20 McGloin Street, 3rd Floor
Fredericton, NB
E3B 5H1

Attention: Ms. Crystale Harty
Acting Director, Environmental Impact Assessment Branch

RE: Environmental Impact Assessment (EIA) Registration
Stoney Creek Oil and Gas Wellfield Decommissioning Project
Westmorland and Albert Counties, New Brunswick

Dear Ms. Harty:

On behalf of ORLEN Upstream Canada Ltd. (ORLEN), Dillon Consulting Limited (Dillon) is pleased to submit this environmental impact assessment (EIA) registration document for the proposed decommissioning of the Stoney Creek Oil and Gas Wellfield in Westmorland and Albert Counties, New Brunswick, for your review and consideration.

Dillon looks forward to your timely review of the documentation. Please contact the undersigned if you have any questions or require additional information.

Sincerely,

DILLON CONSULTING LIMITED

Matt Hopps, P.Geo.
Project Manager

DLM:trw
Attachment: EIA Registration
cc: Bruce Cawston, Vice President, Engineering – ORLEN Upstream Canada Ltd.

Our file: 21-2269

DILLON CONSULTING

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Dillon Consulting Limited

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Acronyms, Abbreviations, Definitions

Acronym or Unit	Definition
a.m.	morning
AST	above-ground storage tank
AC CDC	Atlantic Canada Conservation Data Centre
AFRP	archaeological field research permit
AHB	Archaeology and Heritage Branch
AIA	archaeological impact assessment
bbl	barrel
bgs	below ground surface
BOP	blow-out preventer
°C	degrees Celsius
CAC	criteria air contaminant
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CH_4	methane
cm	centimetre
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWQG	Canadian Water Quality Guidelines
CWS	Canadian Wildlife Service
dBA	A-weighted decibels
DFO	Department of Fisheries and Oceans Canada
DO	dissolved oxygen
e.g.	*exempli gratia* (meaning “for example”)
ECCC	Environment and Climate Change Canada
EIA	environmental impact assessment
ESA	Environmentally Sensitive Area
ESC	erosion and sedimentation control
et al.	*et alia* (meaning “and others”)
etc.	*et cetera* (meaning “and so forth”)
FWAL	freshwater aquatic life
GCDWQ	Guidelines for Canadian Drinking Water Quality
GHG	greenhouse gas
GIS	geographic information system

Acronym or Unit	Definition
GPS	global positioning system
H_2S	hydrogen sulphide
ha	hectare
HADD	harmful alteration, disruption, or destruction (of fish habitat)
i.e.	*id* est (meaning “in other words” or “that is”)
IA	impact assessment
IAA	*Impact Assessment Act*
IBA	Important Bird Area
IPCC	Intergovernmental Panel on Climate Change
km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kPa	kiloPascals
L	litre
L/min	litres per minute
LAA	local assessment area
Leq	equivalent sound pressure level
Lmax	maximum sound pressure level
LOO	License of Occupation
LSD	Local Service District
m	metre
m^2	square metre
m^3	cubic metre
m^3/s	cubic metres per second
m amsl	metres above mean sea level
MBBA	Maritimes Breeding Bird Atlas
MBCA	*Migratory Birds Convention Act*
m bgs	metres below ground surface
mg/L	milligrams per litre
mm	millimetre
Mt	megatonne (metric)
MTI	Mi’gmawe’l Tplu’taqnn Incorporated
N_2O	nitrous oxide
NAAQO	National Ambient Air Quality Objectives
NB	New Brunswick
NBDELG	New Brunswick Department of Environment and Local Government
NBDNRED	New Brunswick Department of Natural Resources and Energy Development
NBDTHC	New Brunswick Department of Tourism, Heritage and Culture

Acronym or Unit	Definition
NBDTI	New Brunswick Department of Transportation and Infrastructure
NB SARA	New Brunswick *Species at Risk Act*
NO_x	nitrogen oxides
NTU	nephelometric turbidity unit
OWLS	online well log system
p.m.	evening
pg.	page
pH	A measure of the acidity or alkalinity of a substance
PID	parcel identifier
PM	total particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns
PM_{10}	particulate matter less than 10 microns
PNA	Protected Natural Area
pp.	pages
ppm	parts per million
RCNM	Roadway Construction Noise Model
RFA	recreational fishing area
RPC	Research and Productivity Council
RSC	Regional Service Commission
SAR	species at risk
SARA	*Species at Risk Act*
SO_2	sulphur dioxide
SOCC	species of conservation concern
t	tonne (metric)
TLRU	traditional land and resource use
TOC	total organic carbon
TRC	Technical Review Committee
TSP	total suspended particulate
TSS	total suspended sediment
$\mu g/m^3$	microgram per cubic metre
UNFCCC	United Nations Framework Convention on Climate Change
µS/cm	microSiemens per centimetre
VC	valued component
WAWA	watercourse and wetland alteration
WHO	World Health Organization
WMZ	wildlife management zone
WNNB	Wolastoqey Nation in New Brunswick

1.0 Introduction

This document is an Environmental Impact Assessment (EIA) Registration document for the Stoney Creek Oil and Gas Wellfield Decommissioning Project (the Project) proposed by ORLEN Upstream Canada Ltd. (ORLEN) in Westmorland and Albert Counties, New Brunswick, Canada.

The Project is an "undertaking" under item (f) of Schedule A of the New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (EIA Regulation) ["*(f) all commercial extraction or processing of combustible energy-yielding materials, except fuelwood*"]. As such, the Project must be registered under Section 5(1) of the EIA Regulation, and at minimum a determination review will be conducted. Following the EIA review and approval, other permits and approvals at the federal and provincial levels will be required.

This EIA Registration document is submitted to the New Brunswick Department of Environment and Local Government (NBDELG) under Section 5(2) of the New Brunswick *Environmental Impact Assessment Regulation* 87-83 of the *Clean Environment Act*. It has been prepared by Dillon Consulting Limited (Dillon) on behalf of ORLEN to provide information to the NBDELG and its associated Technical Review Committee (TRC) to assist in the EIA review of the Project.

1.1 Proponent Information

The Project may be referred to as the "Stoney Creek Oil and Gas Wellfield Decommissioning Project". The proponent of the Project is ORLEN Upstream Canada Ltd. The Proponent's contact information is provided in **Table 1.1.1** below.

Table 1.1.1 Proponent Information

Name of Project:	Stoney Creek Oil and Gas Wellfield Decommissioning Project
Name of Proponent:	ORLEN Upstream Canada Ltd. (ORLEN)
Mailing Address of Proponent:	Suite 400, 850 - 2nd Street SW Calgary, Alberta, T2P 0R8
Chief Executive Officer:	Lukasz Brodowski
Proponent's Contact Person for the purposes of this EIA Registration:	Bruce Cawston, Vice President, Engineering Tel: 403.265.4115 Email: Bruce.Cawston@orlenupstream.ca
Environmental Consultant that led the preparation of this EIA Registration:	Matthew Hopps, P.Geo. Project Manager Dillon Consulting Limited 274 Sydney Street, Suite 100 Saint John, NB E2L 0A8 Tel.: 506.633.5000 ext. 5421 Email: mhopps@dillon.ca

1.2 About the Stoney Creek Oil and Gas Wellfield in Southern New Brunswick

The Stoney Creek Oil and Gas Wellfield collectively refers to a series of 44 active and inactive oil and gas wells centred in the Stoney Creek, Hillsborough, Memramcook, and Monteagle areas of Westmorland and Albert Counties, in Southern New Brunswick (**Figure 1.2.1**).

The first drilling exploration for hydrocarbons in New Brunswick was in the Dover-St. Joseph region near Memramcook in 1858. A number of shallow wells were drilled producing crude oil and natural gas; however, with the dropping oil prices and the discovery of vast reserves in Pennsylvania at the time, exploration efforts were abandoned (Foley 1989).

The Stoney Creek portion of the wellfield is located southeast of Moncton, in Albert County, New Brunswick. In 1908, exploration in the Stoney Creek area commenced by Maritimes Oilfield Ltd. The wellfield produced oil and natural gas from 1909 to 1991. The wellfield supplied natural gas to Moncton and Hillsborough from approximately 1912 until the wellfield was shut-in in 1991 (Foley 1989). Contact Exploration Inc. entered into an agreement with Irving Oil Limited, who hold the lease to the wellfield. The agreement gave Contact Exploration a working interest in the field related to specified wells, and potentially new development. Between 2005 and 2008, Irving Oil decommissioned the 42 wells that were not transferred. Contact Exploration then reactivated a number of the original wells and commissioned several new wells.

In 2007, Contact Exploration received an Approval to Construct a main production facility (consisting of up to six 63,633 L (400 barrels, or bbl) above-ground storage tanks [ASTs]) and up to nine new oil or gas wells within the Stoney Creek field. Through the approvals process with the New Brunswick Department of Natural Resources and Energy Development (NBDNRED), NBDELG, and others, Contact Exploration had constructed the production facility and drilled five new wells. The two most recent wells were drilled in the latter part of 2010. The production facility operated with two ASTs until late 2010, when the final four ASTs were approved and constructed. There are a total of six ASTs currently in use, with three as spares or replacements if needed in the future.

In 2014, Contact Exploration merged with Donnycreek Energy Inc. to form Kicking Horse Energy Inc., which was purchased by ORLEN in 2015. ORLEN is the current owner of the Stoney Creek wellfield, which has continued to produce a limited amount of crude oil over the past decade. ORLEN has indicated their desire to decommission the wells that remain in ORLEN's care, and to eventually completely exit the region.

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

SITE LOCATIONS

FIGURE 1.2.1

★ Site Locations

0 5 10 20 Kilometers

SCALE 1:1,500,000

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
DATA PROVIDED BY: DILLON CONSULTING LIMITED, SNB & NB DEPARTMENT OF NATURAL RESOURCES

MAP CREATED BY: RCP
MAP CHECKED BY: MH
MAP PROJECTION: NAD 1983 CSRS NEW BRUNSWICK STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 21-2269

STATUS: FINAL

DATE: 2022-07-06

As shown in **Figure 1.2.2**, the primary wellfield, currently consisting of 35 wells (17 active, 18 inactive) along with the main production facility, are located in the Stoney Creek area; however, there are secondary wellfield areas including:

- five inactive wells near Hillsborough;
- two inactive wells on the east side of the Petitcodiac River, south of Memramcook; and
- two inactive wells in Monteagle, north of Salisbury.

These secondary wellfield areas will be referred to as ancillary well locations. See **Figures 1.2.3** to **1.2.6** for site locations.

The primary wellfield located in the Stoney Creek area (referred to herein as the Stoney Creek wellfield, and currently consisting of 17 active and 18 inactive wells, for a total of 35 wells; **Figure 1.2.3**) is primarily a rural forested area with limited private residences located on the south and southeastern limits of the wellfield. All of the well sites are located on privately-owned lands, for which ORLEN pays an annual rental fee to the surface landowner. As oil and gas reserves are owned by the Crown, ORLEN pays annual rentals to them. Apart from oil and gas development, this area is primarily used for lumber harvesting, aggregate resource extraction and recreation. The majority of the wells are accessed via a network of gravel forestry roads in various states of repair. The majority of the gravel forestry roads are well maintained, while others are partially overgrown and narrow, and in some cases completely overgrown and impassable by vehicular traffic. A number of wetlands are present in the wellfield, and one watercourse is crossed by a causeway with concrete culverts to allow for the passage of water. Each well site has an associated well pad that would have been built at the time of drilling. The well pads vary in size, with the majority being 40-50 m^2. The well pads were originally completed with local pit run gravel to provide a level working area for drilling equipment, service rigs, and extraction equipment. As with the access roads, the well pads are in various states of repair and vegetation growth; the well sites that are actively producing are very well maintained, level, and clear of overgrowth. The majority of the well pads have some overgrowth of grasses and shrubs, and the exceptional few that are completely overgrown with shrubs/alders.

The Stoney Creek wellfield contains the only actively producing oil and gas wells. As many as 17 of the wells would be considered active; however, this would depend on market prices and production rates. The actively producing wells are equipped with a down hole crude oil pump, a generator powered by natural gas from the well, insulated crude oil distribution lines, and a crude oil storage tank. The stored crude oil is collected and temporarily stored at the main production facility tanks until sufficient volume is collected, at which time it is transported to the Irving Oil refinery in Saint John, New Brunswick for processing.

The main production facility at Stoney Creek is accessed off of Highway 114 at the end of the Beech Hill Road. The facility consists of a security trailer, equipment laydown area, six above-ground crude oil storage tanks, well pumping equipment, and piping distribution lines. The facility occupies an approximate area of 39,000 m^2.

MONTEAGLE

MONCTON

SALISBURY

MEMRAMCOOK

STONEY CREEK

HILLSBOROUGH

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

STONEY CREEK WELLFIELD AND ANCILLARY WELL LOCATIONS

FIGURE 1.2.2

- Oil and Gas Well
- Highway

0 1 2 4 Kilometers

SCALE 1:160,000

N W E S

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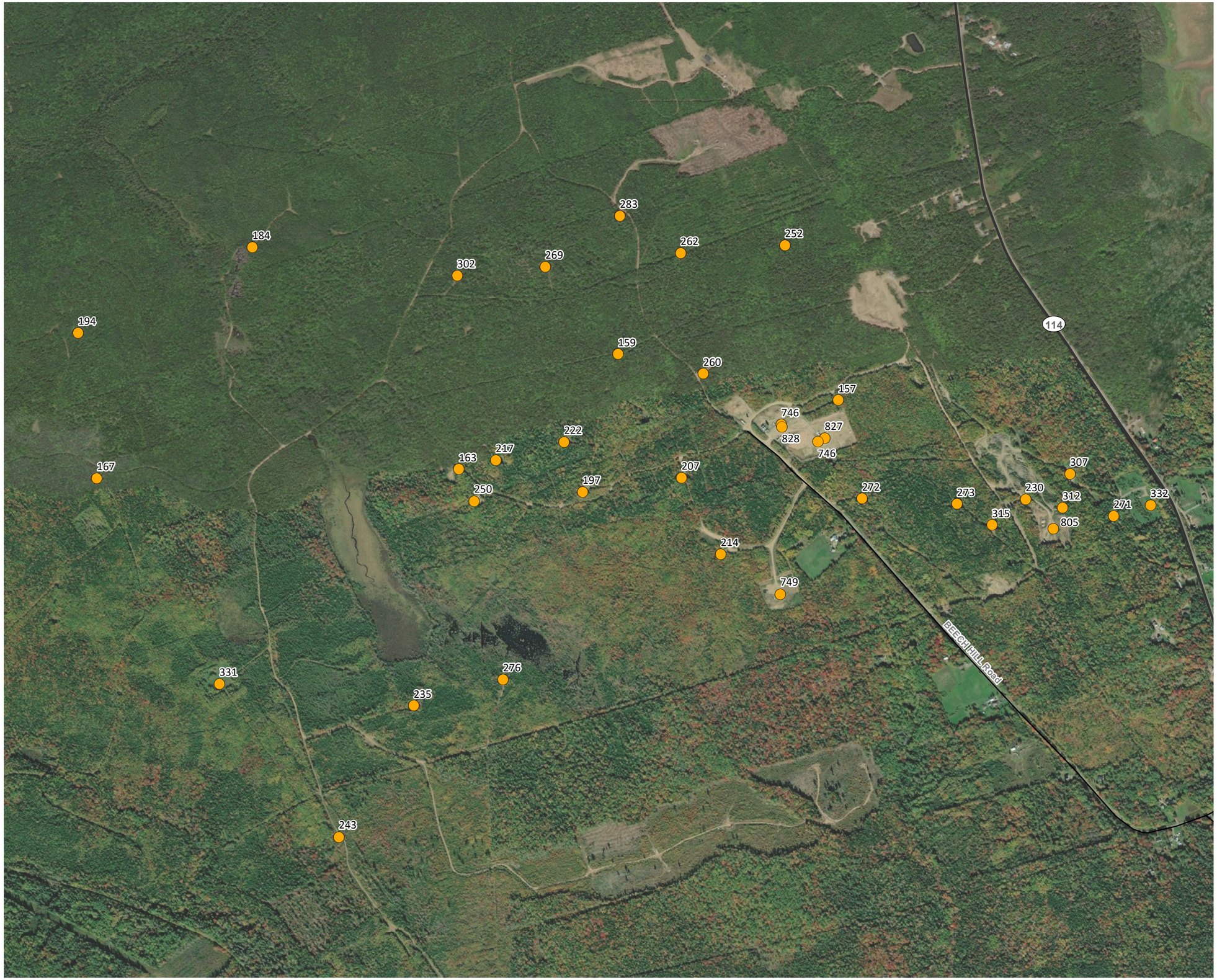

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

STONEY CREEK WELLFIELD

FIGURE 1.2.3

- Oil and Gas Well
- Local Road
- Highway

0 50 100 200 m

SCALE 1:12,000

N W E S

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STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

ANCILLARY WELL LOCATION - SOUTH OF HILLSBOROUGH

FIGURE 1.2.4

- Oil and Gas Well
- Local Road
- Highway

0 125 250 500 m

SCALE 1:32,500

N
W E
S

MAP DRAWING INFORMATION:
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STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

ANCILLARY WELL LOCATION - SOUTH OF MEMRAMCOOK

FIGURE 1.2.5

- Oil and Gas Well
- Local Road
- Highway

0 125 250 500 m

SCALE 1:32,500

N W E S

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STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

ANCILLARY WELL LOCATIONS - MONTEAGLE

FIGURE 1.2.6

- Oil and Gas Well
- Local Road
- Highway

0 125 250 500 m

SCALE 1:20,000

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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The ancillary well location near Hillsborough (**Figure 1.2.4**), a small community south of Moncton on Highway 114, consists of five inactive wells. These are also located in rural primarily forested areas and a former gypsum mine. Private residences on Highway 114 are located between 150-300 m from two of the well sites. All of the well sites are located on privately-owned lands and are accessed via private gravel access roads.

The ancillary well location south of Memramcook (**Figure 1.2.5**) consists of two inactive wells located on rural primarily forested land. These well sites are also on privately-owned land and accessed via private gravel access roads. Private residences and recreational cabins are located within 200-400 m from the well sites.

The ancillary wells location north of Salisbury in Monteagle (**Figure 1.2.6**) also consists of two inactive wells located on rural primarily forested land. These well sites are also on privately-owned land and accessed via private gravel access roads. Private residences are located within 250-300 m from the well sites.

For the majority of the inactive wells, non-producing well sites, all that remains is the wellhead. As the wells were drilled and completed over several decades, the style of wellhead varies from site to site. Remaining infrastructure to also be decommissioned includes empty above-ground storage tanks and horizontal distribution piping. Additional information on the infrastructure is presented in **Section 2.1.1**.

The wells vary in total depth and construction methodologies as technology has changed over the years. The vertical depths range from 630 m to 1,300 m below ground surface (m bgs). From approximately 1909 to 1940, all of the wells would have been completed using cable tools. A heavy bit would have been dropped from surface, with the impact breaking up the bedrock (also referred to as percussion drilling tools). A bailing tool was then used to remove the rock material. Wooden constructed derricks would have been used to support the drilling activities. Over time, the drilling methodologies have become more sophisticated and are now completed using specialized drilling bits on a rotating drilling pipe string, and the drilling cuttings removed with drilling fluids. A limited number of directional wells have been completed in the wellfield. These wells have a vertical component that ranges in depth with a directional leg that is angled from the vertical axis. The most recent well was completed in 2010.

1.3 The Undertaking

A high-level description of the undertaking is presented in this section.

1.3.1 Project Overview (Nature of the Undertaking)

The Project would see the decommissioning of the remaining 44 oil and gas wells that remain as part of the Stoney Creek Oil and Gas Wellfield including wells located in Stoney Creek as well as the three ancillary well locations in Monteagle, south of Hillsborough, and south of Memramcook. The main production facility at Stoney Creek would be decommissioned as well. The well decommissioning would see the placement of cement plugs at various depths in the well bore to isolate the oil and gas bearing zones. Following the placement of the cement plugs, the casing would be cut and capped with a welded

on steel plate at a minimum of 1.5 m bgs. All surface infrastructure including the wellhead and ancillary piping would be removed from the well pad and disposed of appropriately. In the event that petroleum contamination is identified in soil, the soil would be excavated and disposed of at a licenced facility.

Following the decommissioning, the well sites and access roads will no longer be required. Pending approval from the landowner, the well sites and access roads will be graded to match the local topography and revegetated with native plant species. Some access roads currently used by the landowners may remain in place, at the discretion of the landowner.

Following the completion of the EIA review and obtaining all applicable permits, it is projected that the decommissioning work would begin in the summer of 2022, assuming the EIA review process is completed by then. It is anticipated that each year, batches of wells (approximately 6-10 wells per year on average) would be decommissioned between May and November, with an estimated completion year of approximately 2026-2027.

1.3.2 Rationale and Need for the Project

Oil and gas exploration and production first began in Stoney Creek in 1908-1909. Production and exploration continued until approximately 1991 when the majority of the wells were shut in. The viability of the Stoney Creek Oil and Gas Wellfield was reviewed by various proponents in 1999-2010, with limited additional exploration. Some decommissioning activities took place in 2005-2009 in an effort to eliminate the environmental liability of wells with limited production potential. Forty-two wells were successfully decommissioned at that time, along with accessory infrastructure.

The economic viability of the remaining wells for production is limited in the current and expected future economic climate. There is simply insufficient production in the active wells, and limited potential for additional development, to take advantage of economies of scale at this wellfield that are required for a stable and viable operation in an ever-changing and volatile global oil and gas market. While some wells remain active (though with generally low yield), others have been shut in for the past number of years/decades. Appropriate decommissioning, per the NBDNRED's specified oil and gas well decommissioning process, will further mitigate environmental impact potential from these wells in the future. Combined with rising crude oil prices and a move towards decarbonizing the Canadian economy, ORLEN has decided to concentrate its exploration and development operations to higher yield, more diverse oil and gas reserves in Western Canada and around the world and to decommission low-producing or unviable operations.

Exploration occurred at the ancillary locations, outside of the Stoney Creek wellfield, in 2000-2010. These wells are now shut in and considered for decommissioning as part of this undertaking.

1.3.2.1 Project Purpose

In consideration of the above, the purpose of the Project is to permanently decommission all remaining oil and gas wells at the Stoney Creek wellfield and the ancillary well locations, as well as the main production facility. The intent is to permanently secure and isolate the oil and gas production zones,

improve the overall environmental footprint of the Project area, and allow the areas to revegetate following planting of native vegetation.

1.3.2.2 Alternatives to the Project

In consideration of the Project purpose as stated in **Section 1.3.2.1** above, there are no alternatives to the Project that would meet the Project purpose.

1.4 Regulatory Context

The potential environmental regulatory frameworks that may apply to the Project at the federal, provincial, and local levels are summarized in **Table 1.4.1**.

Table 1.4.1 Potential Provincial, Federal, and Local Environmental Permitting Requirements

Legislation	Nature of Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Provincial			
Clean Environment Act	*Environmental Impact Assessment Regulation:* EIA Registration.	Yes.	EIA registration (likely limited to the determination review level) is required, since the Project involves the decommissioning and abandonment of a facility for the commercial extraction or processing of energy-yielding materials. While at the Minister's sole discretion, a comprehensive review is unlikely to be required.
Clean Environment Act	*Water* Quality *Regulation*: • Water Quality Approval to Construct; and • Water Quality Approval to Operate.	Yes currently, but eventually will no longer be needed.	While there is Approval to Operate under the *Water Quality Regulation* that is in force currently for the operation of the wellfield, a specific Approval for the decommissioning of the Project is not believed to be required. Further, once decommissioning is complete, there will no longer be a need for an Approval to Operate because there will no longer be a "source" of contaminants to the waters of the province.
Clean Water Act	*Watercourse and Wetland Alteration Regulation*: Watercourse and Wetland Alteration (WAWA) Permit Application.	Possibly.	A WAWA permit is required for work within 30 metres (m) of a watercourse or wetland before commencement of the Project. Any decommissioning activities within 30 m of a watercourse or wetland will require a WAWA permit.

Legislation	Nature of Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Clean Air Act	*Air Quality Regulation*: • Air Quality Approval to Construct; and • Air Quality Approval to Operate.	No.	An Approval under the *Air Quality Regulation* is not believed to be required currently or in the future because the wellfield is not considered a "source" of contaminants to the atmosphere.
Petroleum Act	*Petroleum Act*: Approval for Abandonment of a well. Section 42(1) of the *Petroleum Act* prohibits the holder of a well license from abandoning a well without the approval of the Minister. New Brunswick has adopted the decommissioning procedures from the Alberta Directive 020, created by the Alberta Energy Regulator (AER 2021).	Yes.	Well-specific decommissioning plans are submitted to NBDNRED for approval. During the decommissioning, daily reports are submitted to NBDNRED including (activities completed for that day, health and safety information and the next days planned activities). Following the successful decommissioning, a completion report is prepared and submitted for review and approval by NBDNRED.
Crown Lands and Forests Act	Land use, ownership, commercial and industrials activities permit application(s) (Licence of Occupation).	No.	A Licence of Occupation (LOO) is not required because all features of the Project to be decommissioned are located on privately-owned land, and no aspect of the proposed decommissioning activities as part of the Project will be conducted on Crown land.
Heritage Conservation Act	Archaeological Field Research Permit for carrying out archaeological investigations.	No.	An archaeological impact assessment is not required for the Project because there is no anticipated disturbance of previously undisturbed land expected for the Project to be carried out.
	Site Alteration Permit for any alteration of registered archaeological sites.	No.	A Site Alteration Permit is required for any alterations within 100 m of registered archaeological sites, should any be present. However, there are no known registered archaeological sites in proximity to any of the well sites.
Quarriable Substances Act	Permits for the extraction/processing of minerals in the Province.	No.	Should the Project involve excavation on-site or at unapproved borrow sources on Crown land, a permit may be required before the commencement of that activity.

Legislation	Nature of Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
		Federal	
Impact Assessment Act (IAA)	Impact Assessment.	No.	A federal impact assessment is not required since the decommissioning of land-based oil and gas wells and related developments are not a designated physical activity under the *Physical Activities Regulations* and there are no aspects of the proposed decommissioning activities as part of the Project will be conducted on federal land.
Fisheries Act	*Fisheries Act* Authorization and Offsetting Plan.	No.	Temporary or permanent in-water works only that are determined by DFO result in harmful alteration, disruption or destruction of fish and fish habitat (DFO 2019) would require an authorization under the *Fisheries Act*. However, since there are no in-water works associated with the proposed decommissioning activities as part of the Project, such an authorization is not required.
Canadian Navigable Waters Act	Approval Application.	No.	In-water works only that result in the disruption of navigation and related activities would require an Approval under the *Canadian Navigable Waters Act*. However, since there are no in-water works associated with the proposed decommissioning activities as part of the Project, such an Approval is not required.
Species at Risk Act (SARA)	Authorization/additional protection measures outlined by Environment and Climate Change Canada (ECCC)/Canadian Wildlife Service (CWS).	Not likely.	For Project works that would cause the unavoidable destruction or harm to species at risk and/or their critical habitat.
Migratory Birds Convention Act (MBCA)	Authorization/additional protection measures outlined by ECCC/CWS.	Not likely.	For Project works that would cause the unavoidable destruction or harm to migratory birds and/or their nests, or for work conducted between April 8 and August 28 (nesting zone C3 for southern New Brunswick) that may disturb or harass migratory birds, their eggs, their chicks, or their nests.
		Local	
Community Planning Act	Building permits, demolition approval, heritage approval, possible other permits from the Regional Service Commission.	No.	Oil and gas wells are not believed to be subject to approvals under the *Community Planning Act*.

1.5 Purpose and Organization of this Document

The purpose of this EIA Registration document is to provide information to the NBDELG and its TRC as part of its review of the environmental effects of the Project in accordance with the EIA Regulation. The EIA Registration document provides a description of the Project, describes existing environmental conditions, identifies mitigation to be employed to minimize the environmental effects of the Project, and characterizes residual environmental effects of the Project after mitigation and best management practices have been applied.

This EIA Registration document is organized in 11 chapters, as follows:

- Chapter 1 provides an introduction to the Project, including proponent information, a Project overview, the purpose, rationale, need for the Project, and an overview of the applicable regulatory framework;
- Chapter 2 provides a high-level description of the Project as currently conceived, and describes how the Project will be carried out. Emissions and wastes from the Project are also described;
- Chapter 3 provides an overview of the environmental setting of the Project;
- Chapter 4 provides information on the scope of the EIA, and the methods that were used to evaluate the potential interactions between the Project and the environment;
- Chapter 5 provides the assessment of potential interactions between the Project and the environment, on various valued components (VCs) of the environment that are of relevance and importance to this EIA Registration, for each applicable Project phase;
- Chapter 6 provides an assessment of potential effects of the environment on the Project;
- Chapter 7 provides an assessment of accidents, malfunctions, and unplanned events;
- Chapter 8 describes planned Indigenous, public, and stakeholder consultation activities in respect of the Project;
- Chapter 9 provides other information relevant to the EIA Registration to meet the requirements of the NBDELG's EIA Guide (NBDELG 2018);
- Chapter 10 provides closing remarks; and
- Chapter 11 provides the references and personal communications cited in this EIA Registration document.

Additional supporting information is provided in the appendices to this EIA Registration document.

2.0 Project Description

This section provides a high level description of the activities that will be required to complete the Project, as currently conceived and based on the information available at the time of writing. The Project description provided in the section presents a conservative estimate of the scope, footprint and anticipated environment effects of the Project.

The key aspects of the Project are described below, including:

- The Project location and property ownership;
- A brief description of the existing Stoney Creek and ancillary oil and gas wells (wells) to be decommissioned as part of the Project;
- The activities that will be carried out during decommissioning and subsequent site restoration;
- The planned Project schedule; and
- Project related emissions and wastes.

2.1 Project Location

As was shown in **Figure 1.2.3**, the primary Stoney Creek wellfield is located southeast of Moncton, in Albert County, New Brunswick. The closest community is the village of Hillsborough located approximately 6.5 km from the centre of the wellfield. The wellfield is accessed from Highway 114 via the Beach Hill Road. The ancillary well locations are located in three rural areas: south of Hillsborough near Edgetts Landing (**Figure 1.2.4**); southeast of Memramcook on the eastern side of the Petitcodiac River (**Figure 1.2.5**), and north of Salisbury in Monteagle (**Figure 1.2.6**).

2.1.1 Property Ownership and Description

Both the primary Stoney Creek wellfield and the ancillary well locations are located on privately owned land. Irving Oil currently holds the lease to 28 of the wells in the Stoney Creek wellfield. ORLEN has entered into an agreement with Irving Oil, which gives ORLEN a working interest in the wellfield. The lease to the remaining Stoney Creek wells and the ancillary well locations are owned by ORLEN. Since the wells are located on private land, lease agreements are drafted between the leaseholder and the landowners. The lease agreements stipulate the terms and clauses including but not limited to duration of activities, compensation (e.g., rentals), and provisions for abandonment and reclamation. The parcel identifiers for the remaining 44 active and inactive well sites are provided in **Table 2.1.1**.

Table 2.1.1 Property Ownership

Wellfield	Unique Well Identifier (UWI)	Parcel Identifier (PID)
Stoney Creek	157	00613067
Stoney Creek	159	00612697
Stoney Creek	163	05004502
Stoney Creek	167	00619460
Stoney Creek	184	00619494
Stoney Creek	194	05043831
Stoney Creek	197	00613067
Stoney Creek	207	00613067
Stoney Creek	214	05070586
Stoney Creek	217	05004502
Stoney Creek	222	05004502
Stoney Creek	230	00612713
Stoney Creek	235	05070594
Stoney Creek	243	00614388
Stoney Creek	250	00613067
Stoney Creek	252	00612697
Stoney Creek	260	05004502
Stoney Creek	262	00612697
Stoney Creek	269	00619460
Stoney Creek	271	00612713
Stoney Creek	272	05070586
Stoney Creek	273	05070586
Stoney Creek	276	05070594
Stoney Creek	283	00619460
Stoney Creek	302	00619460
Stoney Creek	307	00612713
Stoney Creek	312	00612713
Stoney Creek	315	05070594
Stoney Creek	331	05000013
Stoney Creek	332	05009451
Stoney Creek	746	00613067
Stoney Creek	749	05070594
Stoney Creek	805	00612713
Stoney Creek	827	00613067
Stoney Creek	828	00613067

Wellfield	Unique Well Identifier (UWI)	Parcel Identifier (PID)
South of Hillsborough	689	05055066
South of Hillsborough	703	00623041
South of Hillsborough	708	00613836
South of Hillsborough	760	00611574
South of Hillsborough	825	00613174
Monteagle	712	70070164
Monteagle	718	00955831
South of Memramcook	707	00916015
South of Memramcook	732	00923557

2.2 Overview of the Existing Facilities at the Stoney Creek Wellfield and Ancillary Well Locations

A brief overview of the existing facilities currently in place at the Stoney Creek wellfield and ancillary well locations is provided in this section.

2.2.1 Stoney Creek Wellfield

There are currently a total of 35 wells in the Stoney Creek wellfield. The wells are described by the following categories: targeted resource (i.e., crude oil or gas), operational status (i.e., active or inactive), and construction details (i.e., vertical or horizontal).

2.2.1.1 Active Crude Oil Wells

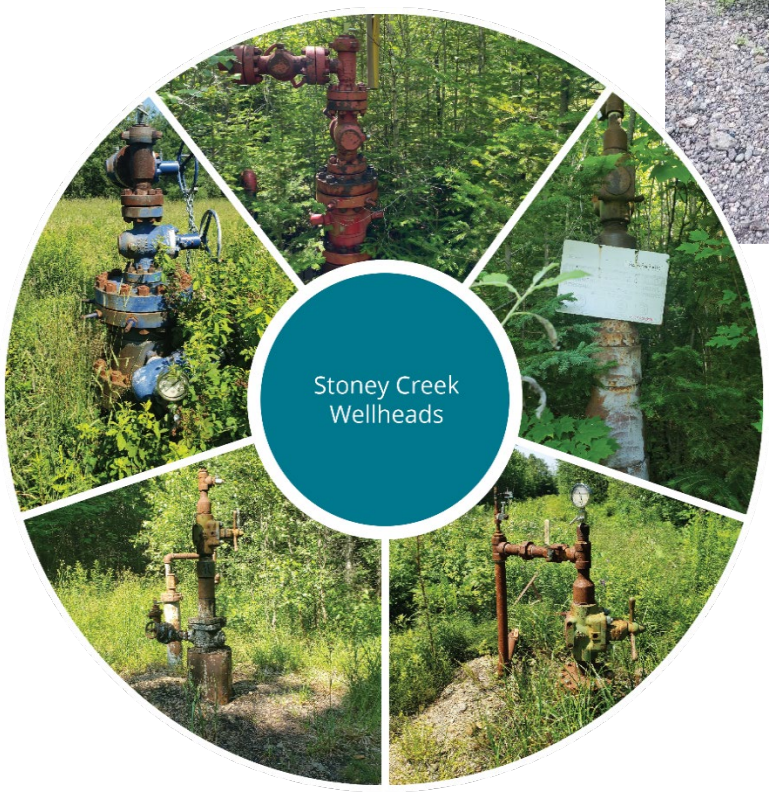
As in the photograph to the left, active crude oil wells have extraction and storage equipment that include a wellhead, pump jack, generator, transfer lines, and a storage tank. The number of actively producing crude wells varies at any given time and is dependent on crude market prices, production rates and transportation costs. As of March 2022, 12 crude oil wells were in production.

2.2.1.2 Active Gas Wells

Gas from the active gas wells is distributed to the main production facility to power evaporators and crude heating systems. As in the photograph of UWI 260 to the right, active gas wells have a wellhead and gas distribution lines. There remain three active gas wells in the Stoney Creek wellfield.

2.2.1.3 Inactive Crude Oil and Gas Wells

There remain 18 inactive oil and gas wells in the Stoney Creek wellfield that have not yet been decommissioned. Limited surface infrastructure is present at the inactive or shut-in oil and gas wells. While abandoned distribution lines may be present at some sites, the majority of the wells are only distinguished by the remaining wellhead within a small clearing in the forest. As some of the wells have not been accessed in many years, shrubs and bushes have grown over many of the former access roads and well pads. Some examples of these inactive oil and gas wells are shown in the photographs to the left.



Vertical and Directional Wells

The majority of the wells are vertical, ranging from 600-1,200 m in depth (below ground surface, or bgs). Directional wells have a vertical component that ranges in depth, with a directional leg that is angled from the vertical axis. Surface infrastructure is indistinguishable between a vertical or horizontal well. Depending on the age of the well, the wellhead is either threaded onto the steel casing or a casing bowl is welded onto the casing and wellhead sealed and flanged onto the casing bowl. The wellhead is used to secure the well from the release of product and prevent foreign objects from entering the well. The wellhead is generally equipped with pressure relief valves and gauges to measure pressure. The wells are completed with multiple casings that are used to isolate various lithologies and water-bearing units. The annulus between the casings can be sealed with cement or other products.

2.2.2 Stoney Creek Main Production Facility

The main production facility, completed 2007-2010, is located at the top of Beech Hill Road on a surface lease of PID #00613067, also referred to as site A-89. The facility, shown in the photograph below and in **Figure 2.2.1**, consists of:

- Three horizontal oil wells;
- Six 400 barrel (bbl) above-ground storage tanks (ASTs); three additional ASTs are not in service and are considered spare or to be used for future replacement;
- Transfer lines;
- Flare; and
- Security and equipment trailers.

The secondary production facility, referred to as I-88, is located on a surface lease of PID #05070594. Additional oil has been produced from other older reactivated wells within the field.

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

STONEY CREEK MAIN PRO5¦/¢Lhb FACILITY A-89

FIGURE 2.2.1

- Oil and Gas Well
- Local Road
- Highway

0 5 10 20 m

SCALE 1:1,000

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: GEONB BASEMAP
ESRI, HERE, GARMIN, INTERMAP, INCREMENT
P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
DATA PROVIDED BY: DILLON CONSULTING LIMITED, SNB & NB DEPARTMENT OF NATURAL RESOURCES

MAP CREATED BY: RCP
MAP CHECKED BY: MH
MAP PROJECTION: NAD 1983 CSRS NEW BRUNSWICK STEREOGRAPHIC

DILLON CONSULTING

PROJECT: 21-2269

STATUS: FINAL

DATE: 2022-07-06

Crude oil produced in the field is transported by tanker truck (such as that shown in the photograph to the right) to the main production facility at site A-89, and stored in one of the six active ASTs until being trucked to the Irving Oil refinery in Saint John for processing. Produced water is either trucked by an approved operator to an approved disposal facility, or evaporated on-site and the solids (mainly salt) are taken to an approved facility for disposal. Interconnecting piping at the production facility is above ground. There are no other underground services within the tank farm area.

The petroleum tanks are licensed by the NBDELG and are equipped with internal and external coatings to prevent corrosion. The tanks have been installed within a secondary containment system consisting of a graded containment area and perimeter of a steel wall dyke complete with an impervious liner. The secondary containment system is designed to hold a volume of 100% of the largest tank plus 10% of the aggregate volume of all the tanks. The secondary containment system ensures safe handling of spills and reduction of potential impacts to the environment.

Chemical use at the wellfield is minimal. Currently, the only additive being used is a de-emulsifying agent to help oil separate from water. Chemicals are stored at the main production facility, site A-89.

Monoethylene glycol is used as the heat transfer fluid, a closed system used to heat the oil to help separate out water. Up to two barrels (160 L each) are stored on site for make-up use at any given time. The monoethylene glycol is supplied pre-mixed with water in a 50%/50% solution for use as the heat medium. It is delivered to site in barrels in that manner. A de-emulsifier chemical is required to aid in the separation and treatment of the oil and produced water production fluids.

2.2.3 Ancillary Well Locations – South of Hillsborough

There are five inactive wells in the area south of Hillsborough. Three wells are adjacent to Highway 114 (Unique Well Identifier or UWI 703, 708, and 825), also referred to as Edgetts Landing. The other two wells (UWI 689 and 760) are located further inland approximately 4 km and 6 km west of Highway 114 respectively (**Figure 1.2.4**). The infrastructure remaining at Hillsborough includes:

- UWI 703: one AST and berm, as shown in the photograph to the right;
- UWI 708: two ASTs, berm, pump jack, piping and generator, as shown in the two photographs below; and

- UWI 825: drill tubing, as shown in the photograph to the right.

2.2.4 Ancillary Well Locations – South of Memramcook

There are two inactive wells (UWI 707, 732) south of the Memramcook area, on the eastern side of the Petitcodiac River. UWI 707 is located west of Boudreau Village in a rural forested area. The well site is accessed via a gravel road. No infrastructure remains on-site with the exception of the wellhead, as shown in the photo to the right.

UWI 732 is located west of Gautreau Village, in a rural forested and agricultural area. The well site is accessed via a gravel road. The wellhead is visible in a large overgrown clearing, no other infrastructure is present.

2.2.5 Ancillary Well Locations – Monteagle

There are two inactive wells in the Monteagle area (UWI 712, 718). Monteagle is a rural area north of the village of Salisbury and is primarily forested area with the occasional agricultural farm and private residence. UWI 712 is accessed via a narrow gated forestry road with the wellhead visible at surface in a small clearing. UWI 718 is located within wetland with the wellhead visible at surface. A former AST containment berm remains on-site, as shown in the photograph to the right.

2.3 Decommissioning of the Stoney Creek Wellfield and Ancillary Well Locations

The proposed process to decommission the Stoney Creek wellfield, main production facility, and ancillary well locations is discussed in this section.

2.3.1 Planning for the Well Decommissioning Program – Overall EIA Registration

Dillon has prepared this overall EIA Registration for the phased decommissioning of the Stoney Creek wellfield and ancillary well locations. The intention is that the overall EIA Registration document describes, for all remaining 44 wells to be decommissioned:

- The anticipated well decommissioning process;
- Well decommissioning procedures;

- Remediation measures to be implemented in the event that contamination is discovered;
- Procedures for site rehabilitation;
- The existing environmental conditions generally in the Stoney Creek, Hillsborough, Memramcook, and Monteagle areas, based solely on desktop information (to be supplemented later by a site-specific ecological review for each well site through field work that is conducted annually for the next batch of wells to be decommissioned, as supplemental site-specific information on the existing environment at each well site); and
- Environmental interactions, proposed mitigation, and residual interactions for each valued component (VC) of concern.

This phased EIA approach will be combined with annual well decommissioning applications, which will allow additional information about each set of wells to be decommissioned/reclaimed to be submitted to regulators immediately prior to that year's work. While site-specific field work for all 44 wells to be decommissioned is not provided in this EIA Registration (because some biological data have a limited shelf life and environmental conditions may change by the time a particular well is decommissioned), it is anticipated that conditions of the EIA approval for the overall Project would include a requirement to submit a well decommissioning application the year prior to the proposed decommissioning of a particular well site (including the results of ecological field work) for each well site proposed to be decommissioned in the following year. This supplemental information would provide the TRC the opportunity to review additional site-specific conditions for each well site ahead of their planned decommissioning, even if following the EIA review process.

The number of actual wells decommissioned per year will depend on the NBDNRED approvals, EIA approval, and complexities of the well decommissioning. For the purposes of this document, we will assume a range of 6-10 wells to be completed annually, to tentatively bring the Project to a close by the end of 2026 or early 2027.

2.3.2 Well Site-Specific Decommissioning Plans

Each year following the overall EIA approval, a well-specific decommissioning plan and application will be prepared and submitted to NBDNRED for review and approval in accordance with the Alberta Directive 020 for well abandonment. Well-specific decommissioning plans will be completed by a licensed petroleum engineer using the available provincial records, and submitted to NBDNRED for review. The plans will provide a step-by-step process outlining all aspects of the decommissioning for each well, from mobilizing the service rig onto the well to the final stages of decommissioning. A critical component of the plan is the vertical location, size, and method of completion of the cement plugs, as shown in the example in **Figure 2.3.1** below.

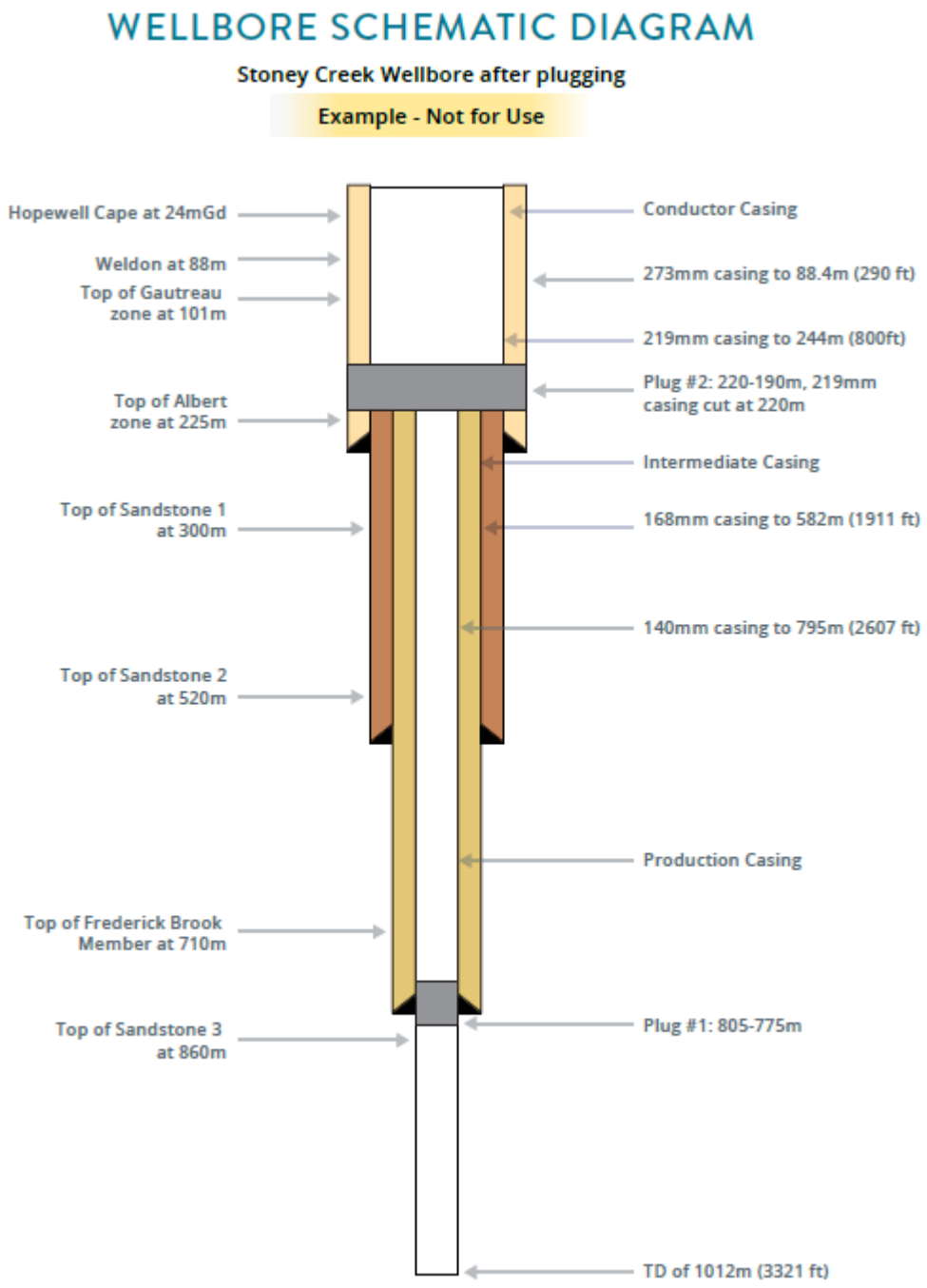


Figure 2.3.1 Example of Supporting Information for Well Decommissioning Plan

The cement plugs are designed to isolate the oil and gas-bearing zones from the upper lithologies to prevent to potential migration of hydrocarbons. The example schematic illustrates the casing sizes, depths, and proposed placement of cement plugs.

In the event that the downhole conditions are later discovered to differ from the available records, an amendment of the well decommissioning plan will be completed and submitted to NBDNRED.

2.3.3 Ecological Review – Field Evaluation

Part of the planning phase to be completed when selecting the wells for decommissioning in the subsequent year will include an Ecological Review of each well site to be decommissioned through biological field work. The field work will be carried out by qualified biologists during suitable growing conditions each summer, and will include the following:

- A desktop review for environmental constraints (including Atlantic Canada Conservation Data Centre [AC CDC] reports, previous EIAs an reports, geographic information systems [GIS] information, LiDAR data, and other available sources of information) is conducted to assist in scoping the required field work for each site;
- Biophysical surveys are conducted for key VCs, including but not limited to: vegetation and rare plants, migratory birds, and wetlands and watercourses (if present within 30 m of a specific well site); and
- A supplemental report of the field work is prepared to detail the results of the biophysical surveys and site-specific mitigation to be implemented based on their findings, for submission as supplemental information to the NBDELG and NBDNRED in support of their review and approval of the proposed well decommissioning plan for the batch of well sites to be decommissioned in the following year.

It is noted that, given that each of the well sites have been influenced by human activity through development of the well pads and related infrastructure, an archaeological impact assessment of the well sites is not believed to be required, subject to confirmation by the TRC.

2.3.4 Well Decommissioning

The following section is a description of the step-by-step process for decommissioning a typical well, following all required provincial approvals.

It is important to note that during the decommissioning activities, daily reports will be prepared and submitted to NBDNRED outlining the tasks completed, health and safety information, and tasks to be completed the following day, in accordance with the NBDNRED requirements.

2.3.4.1 Site Preparation

Active Wells

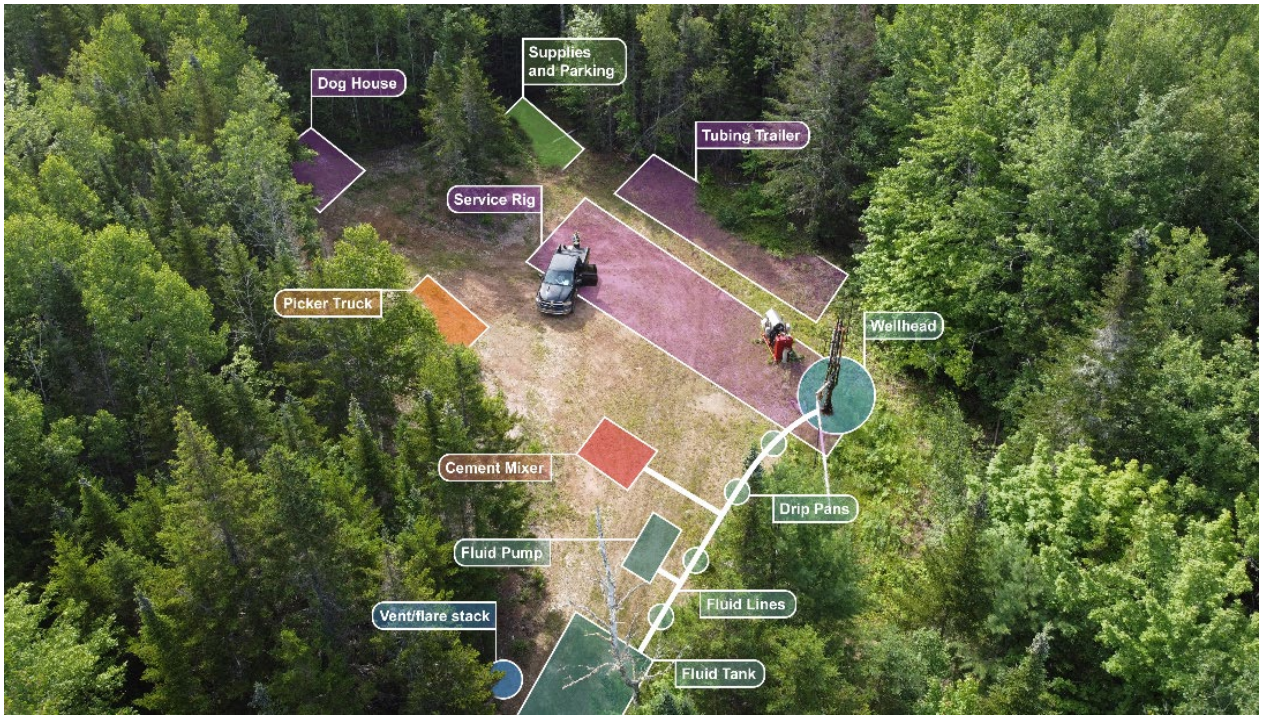
Prior to any decommissioning activities, surface equipment would be removed. As discussed in **Section 2.2.1.1**, this may include above ground storage tanks, transfer lines, generators, pump jacks, bottom hole pumps and tubing string. The actual earthworks required to prepare a previously active well site is limited or non-existent, as there will be sufficient space on the well pad for the service rig and associated equipment. With pumping equipment now removed, the service rig may secure the well and begin decommissioning operations, as detailed below.

Inactive Wells

For inactive wells, the next stage is determining the access and condition of the well site to ensure it can accommodate a service rig and provide an adequate area for work activities and equipment. Accessing certain well pads with the service rig and supporting vehicles/equipment may require some minor road reconditioning, along with grading and brush/tree removal and trimming of the well pad, depending on how much vegetation growth has occurred since the well was last in production or accessed by a service rig. A typical inactive well site is shown in the photograph to the right, which shows the extent of required vegetation removal for decommissioning a typical inactive well.

2.3.4.2 Well Site Setup for Decommissioning

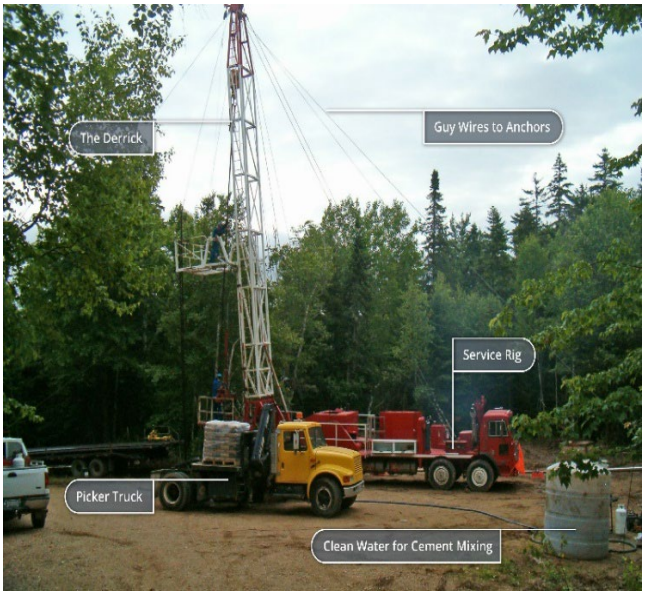
The service rig and supporting equipment will then be mobilized to the well site; typical equipment and components required to accomplish the decommissioning activities are shown in the photograph below.

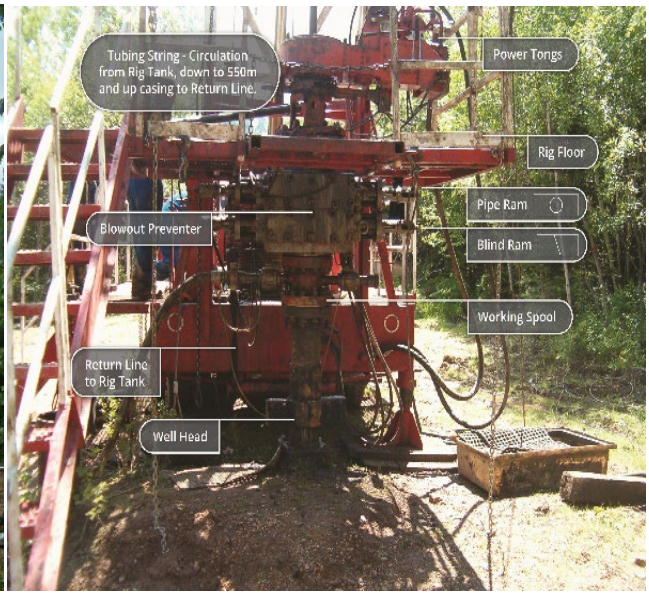


The supporting equipment will be positioned on the well pad to meet the required safety offsets from the well, and to efficiently conduct the decommissioning activities. All of the fluid transfer lines will be connected to the wellhead, fluid pump, and fluid holding tank or rig tank. Drip pans will be placed at each line connection to collect any released fluids.

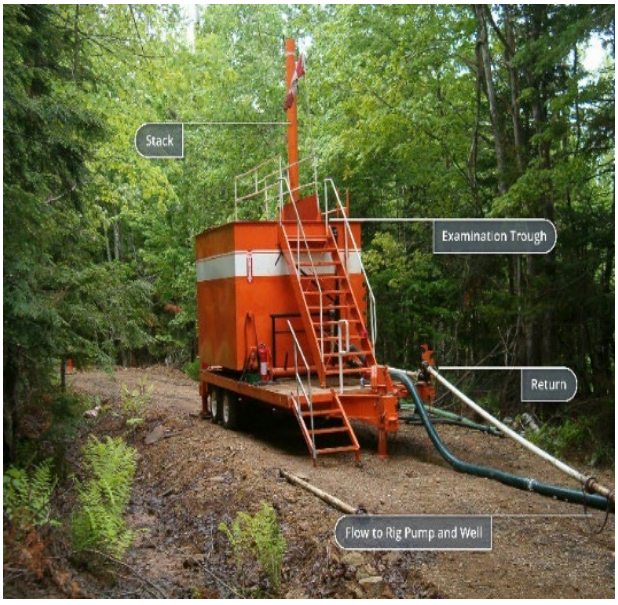
2.3.4.3 Service Rig and Blow-Out Preventers (BOPs)

The service rig will then take position at the wellhead and the blow-out preventer (BOP) will be attached. BOPs are hydraulically-operated safety equipment used to monitor and control the well and prevent an uncontrolled release of crude or gas (also called a "kick"). The photographs below show the typical equipment associated with the service rig.





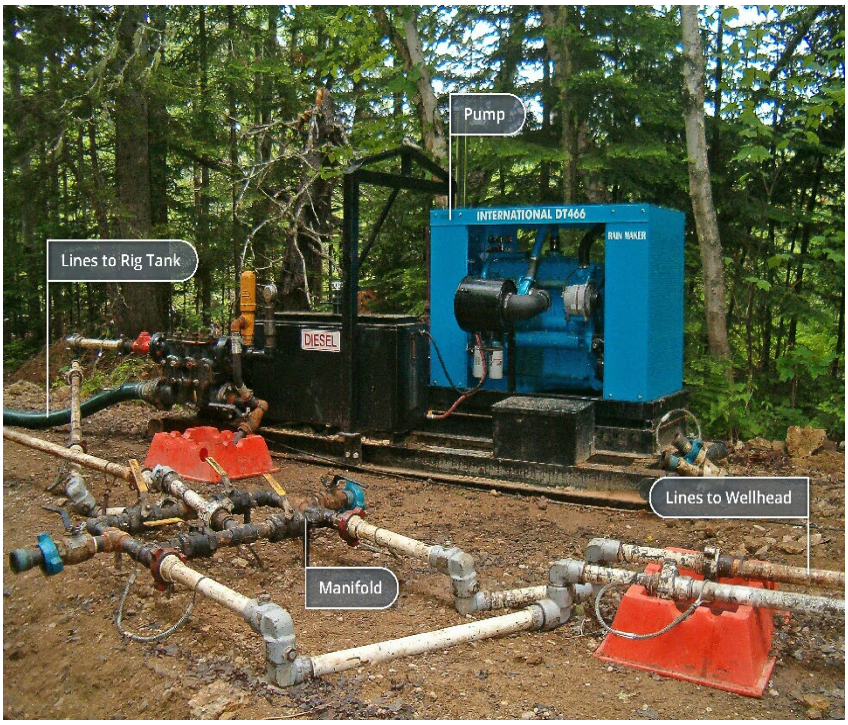
2.3.4.4 Well Control



The well decommissioning operates in a closed fluid system whereby fluids are controlled and contained by the equipment on-site. As in the picture below on the right, a high capacity fluid pump is responsible for delivering fluids (i.e., water and cement) downhole. The rig tank, pictured on the left, is filled with approximately 10-12 m^3 of water (depending on the size of the tank) that is sourced from local springs near the well sites. With the derrick raised into place, the crew will run the work string tubing (i.e., a series of steel tubing threaded together) to the open hole portion of the well (note that depths vary depending on the well construction). Water is pumped downhole to circulate the well over to water. If present, crude

oil and gas will be displaced by water. The displaced crude oil and flowback water will be captured in the rig tank to later be recycled or disposed of at a licenced facility. Attempts would be made to reuse flowback water to limit overall water consumption for the Project. The limited displaced gas, <5m^3, will be released to the atmosphere through the rig tank stack.

An example of pumping equipment and supply lines is shown in the picture below, a critical part of the closed fluid system.



2.3.4.5 Setting Cement Plugs

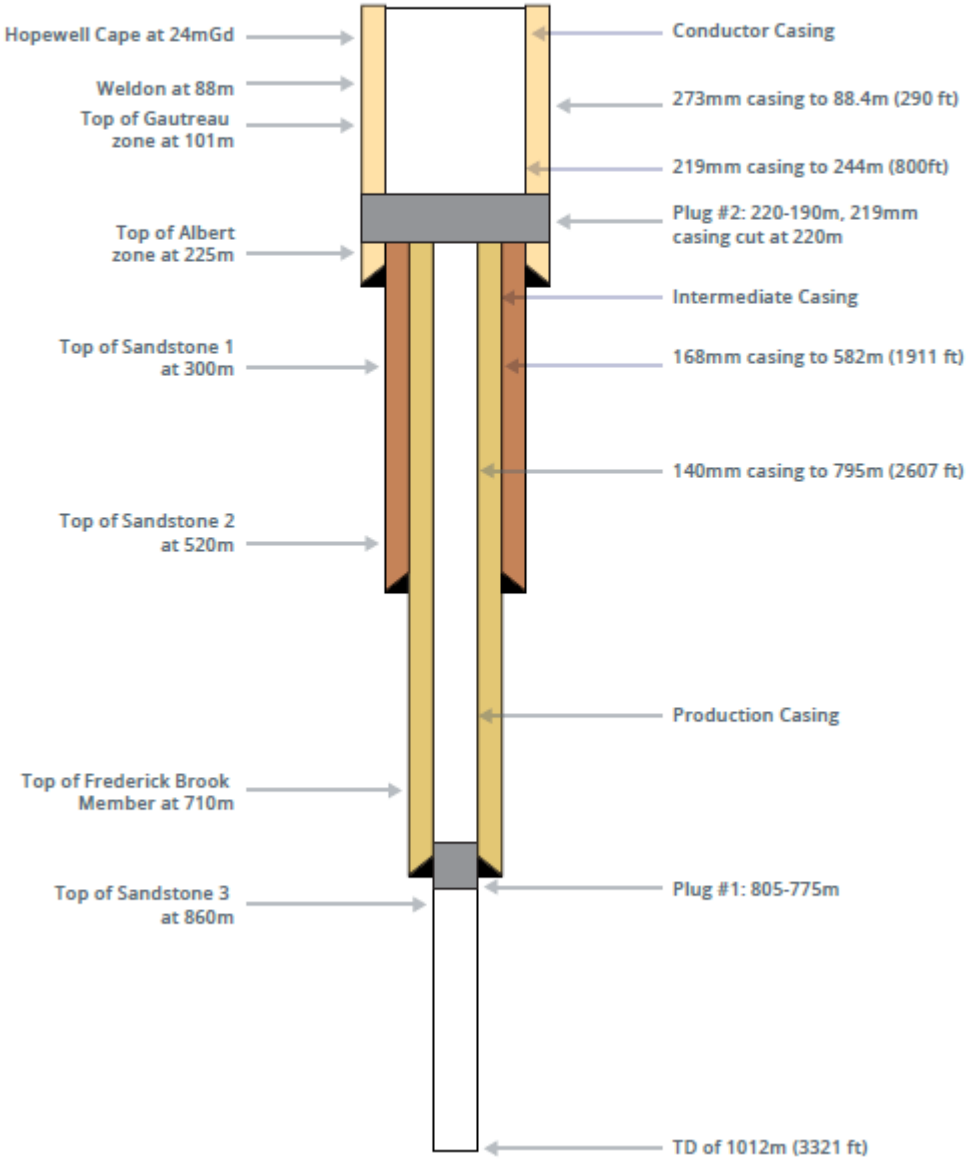
The first cement plug placed is a minimum of 30 vertical metres. The cement will be mixed in a portable cement mixer and pumped into place at the well-specific target depth via the working tubing. The cement plug is intended to span the termination of the production casing as per the example shown in the diagram to the right. The plug will be allowed to set for a 24 hour period to cure. To ensure the integrity and position of the plug the working tubing sting will be lowered to “tag” the plug at the anticipated depth and the weight of the tubing string is then allowed to rest on the plug. A successfully installed plug is located at the desired depth and able to support the weight of the tubing string.

A second cement plug will then be placed to seal the uppermost oil-bearing formation (typically the Albert zone), at depths ranging from 350 m to 200 m below ground surface (bgs) depending on the well location in the oil field. In the example diagram to the right, the second plug is set at 220-190 m depth. The cement plug will then be “squeezed” into the annulus via a cut completed in the casing using a cutting tool of rotating carbide teeth on the end of the tubing string. In the example diagram to the right, plug #2 is placed in the 219 mm casing and 219 mm – 273 mm annulus. Again, the integrity and the placement of the plug will be verified prior to moving to the next stage of decommissioning. A third plug may be required depending on the information provided in the well logs. The service rig will now begin preparing to move to the next well for decommissioning.

WELLBORE SCHEMATIC DIAGRAM

Stoney Creek Wellbore after plugging

Example - Not for Use



2.3.4.1 Cutting and Capping the Well

Once the service rig and accessory equipment have vacated the well site, an excavator will be used to remove soil from around the well casing to a depth of 1.5-2 m below ground surface. The well casing will then be cut, and steel plates will be welded onto the casing. A typical example is shown in the photograph to the right.

2.3.5 Environmental Site Assessment and Surface Reclamation

Following well decommissioning, an environmental site assessment (ESA) will be conducted to determine if, and to what extent, surface and near-surface soils require remediation to remove contamination. In this context, surface reclamation means the processes and procedures to be implemented following well decommissioning but prior to site rehabilitation that are intended to assess the extent of possible contamination of surface soils and near-surface soils to meet environmental quality goals in consideration of the site's intended land use.

Once a well site has been fully decommissioned, the wellhead has been capped, and all surface equipment has been removed, an environmental site assessment (ESA) of the well site will be completed by a qualified site professional. The ESA will generally follow the Atlantic Risk-Based Corrective Action (RBCA) for impacted sites in Atlantic Canada. Atlantic RBCA was created to guide qualified site professionals through the process of assessing sites impacted with refined petroleum products (e.g., gasoline, diesel/fuel oil, and lube oils) originating from petroleum storage, distribution facilities, and accidental releases of these products. Atlantic RBCA does not specifically address the assessment of former oil and gas wells or the assessment of crude oil impacted sites. Once the source of potential contamination has been removed, and in consideration of the low solubility and low potential mobility of crude oil, the following is a description of the ESA and surface reclamation procedures.

In the final stages of well decommissioning, the well casing must be cut and capped 1.5 m below grade. To facilitate this, a 1.5 m deep excavation is completed around the well casing; surface soils excavated from the area surrounding the well casing will be stockpiled on the well site for later reuse for backfilling or disposal at appropriate facilities, as the case may be. Soil samples will be collected from the stockpiled soil, walls and the base of the excavation and submitted to an accredited laboratory for petroleum hydrocarbon (PHC) analysis. Up to five test pits will be completed across the well site to an approximate depth of 1.5 m below grade. Soil horizons will be documented, and two soil samples will be collected per test pit (for a total of ten soil samples per well site, plus one quality assurance/quality control sample) for petroleum hydrocarbon analysis.

Pending favourable results, and assuming PHC concentrations are below the applicable Atlantic RBCA guidelines for the intended ultimate use of the well site, no further action is required; in such cases, the

efforts are documented and submitted to NBDELG, and the excavated on-site soils from surrounding the well casing will be backfilled into the excavation in preparation for site rehabilitation.

If PHC concentrations are found to exceed the applicable Atlantic RBCA guidelines for a particular land use, additional test pits will be completed to delineate the impacts on-site. Once delineation has been achieved, soil exceeding the Atlantic RBCA guidelines will be excavated and disposed of at a licenced facility. Soil samples will be collected from vertical and horizontal extents of the excavation to establish that the soil exceeding guidelines has been removed appropriately. NBDELG and the landowner will be notified of the remedial exaction and soil results. No further action is required.

In the event that efforts to delineate impacts in soil are not achieved, or the site professional suspects that groundwater may be impacted, then the assessment would follow the New Brunswick Guideline for the Management of Contaminated Sites Version 2, November 2003.

2.3.6 Site Rehabilitation

In this context, site rehabilitation means the processes and procedures to be implemented following well decommissioning and soil remediation (as applicable) that are intended to return the well sites to as near a natural state as possible, subject to the desires of the landowner. Because all well sites are leased by ORLEN under specific agreements with the landowner, it is possible that the landowner may wish to rehabilitate the well site to near natural conditions, or conversely, to keep the well site and related areas in a certain active state to be repurposed for other uses beyond their former use for oil and gas extraction.

Prior to initiating site rehabilitation, agreements will be reached with the landowner to determine their intended future land use for their property. Landowners may agree to site rehabilitation to return the site to near natural conditions, or to use and maintain the access roads and well sites for forest harvesting, recreation, or other purposes. The following procedure is to be followed for site rehabilitation of a well site, assuming the landowner would like their property rehabilitated.

Following the completion of the well decommissioning, environmental site assessment, and soil remediation activities, the property will be reviewed to ensure all oil and gas-related materials and equipment have been removed, and to confirm with ORLEN or their onsite representative that no additional environmental remediation activities are required. In the event that environmental groundwater monitor infrastructure, including monitoring wells, are present, they must be identified with high visibility indicators to prevent damaging the sampling points.

Well pads are traditionally shaped and constructed of locally sourced gravel and pit-run aggregate. The well pad material will be reshaped and contoured to match the local topography as much as possible, removing tire ruts or other depressions that would otherwise direct or store overland surface flow. If the gravel base is not suitable for vegetation uptake, the well site may be covered with suitable topsoil or organic material to promote the later growth of vegetation. Water control structures such as ditches or culverts would be removed or regraded. A similar procedure applies to raised or built up access roads.

To reduce the introduction and propagation of invasive species, a selection of native vegetation will be incorporated into the hydroseed mixture. The access roads and well sites will be hydroseeded between May and September, as feasible, the same year as the well is decommissioned; if a well site is decommissioned late in the season, hydroseeding would be carried out the following spring, after the spring freshet. This would allow sufficient time for root beds to establish prior to the onset of winter. Efforts will be made to avoid the application of hydroseed prior to heavy rain events. Existing erosion and sedimentation control measures used during well site decommissioning (e.g., hay bales, check dams, silt fences) would remain in place and be maintained until such time as vegetation has taken root and stabilized. Access to these areas will be temporary limited also until the vegetation has taken root and stabilized.

The affected areas will be revisited in the summer months of the following year to document/ characterize the vegetative growth. In the event that the area is devoid of a suitable vegetative cover, a second application of hydroseed will be completed.

Site conditions and activities during the site rehabilitation will be documented and submitted to NBDELG as part of the site closure requirements.

2.3.7 Final Reporting

Following the completion of the well decommissioning program each year, a completion report will be prepared for each well that was decommissioned that particular year in order to document the outcomes of the well site-specific decommissioning process. The completion reports will be submitted to both NBDNRED and NBDELG for their review and approval.

2.4 Project Schedule

Following the completion of the EIA review and after obtaining all applicable permits, it is projected that the decommissioning work would begin in the summer of 2022, assuming the EIA review process is completed by then. It is anticipated that each subsequent year, batches of wells (approximately 6-10 wells per year on average) would be decommissioned between May and October of each year, with an estimated overall completion year of 2026-2027.

2.5 Emissions and Wastes

The anticipated emissions and wastes associated with the Project are discussed in this section. ORLEN, through the conditions of the various permits and approvals it will receive to enable the decommissioning of the Project, will meet or exceed the compliance standards outlined in applicable regulations and guidelines with respect to waste, emissions, and discharges from the Project. Where no such standards exist, industry best practices will be adopted, where applicable. Emissions and wastes will be reduced through best management practices, following applicable legislation, and mitigation planning.

2.5.1 Air Contaminant Emissions

Air contaminant emissions from the Project will occur primarily from dust generated from decommissioning activities as well as from fossil fuel combustion in trucks and mobile equipment used to accomplish those activities. Emissions of concern are generally classified as criteria air contaminants (CACs) and include carbon monoxide (CO), nitrogen oxides (NO_X), sulphur dioxide (SO_2), and total particulate matter (PM, including its size fractions PM_{10} and $PM_{2.5}$). In addition, it is possible that odour emissions may be released as part of decommissioning activities. Given the relatively straightforward nature of the Project, measurable emissions of other air contaminants (other than greenhouse gases) are not expected. Since the product remaining in the well will be removed and stored in a closed vessel, odours are not expected beyond the well site itself.

Emissions during the decommissioning activities are generally related to the generation of dust and routine emissions from construction equipment or other construction activities. Control measures such as use of dust suppression techniques will be used, if required, to reduce the fugitive dust, and routine inspection and maintenance of construction equipment will reduce exhaust fumes. Timing of activities to avoid undue nuisance to off-site receptors (e.g., limiting intrusive activities to between 7:00 a.m. and 7:00 p.m. [i.e., average daylight hours] will be important. The burning of waste brush/slash material will not be permitted.

Greenhouse gas (GHG) emissions from the Project, consisting of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), as carbon dioxide equivalents (CO_2e), will be generated from fossil fuel combustion in trucks and mobile equipment used to accomplish the decommissioning activities. Given the relatively straightforward nature and short duration of the Project activities, these emissions are not expected to be substantive.

An assessment of environmental interactions due to Project-related air contaminant emissions is provided in **Section 5.2**.

2.5.2 Noise

Noise emissions from the Project will occur primarily from the operation of mobile equipment for use in decommissioning activities. Noise will be intermittent as equipment is operated on an as-needed basis while decommissioning activities are taking place, and mostly during daytime hours. Noise sources will be mitigated through the use of mufflers on all equipment, carrying out routine maintenance of equipment to maintain it in good working order, and limiting intrusive noise-producing operations to daytime (7:00 a.m. and 7:00 p.m.).

An assessment of the interactions between the Project and the acoustic environment is provided in **Section 5.3**.

2.5.3 Liquid Wastes

Liquid wastes generated during decommissioning activities include crude oil and flowback water from the well, oils and lubricants from the mobile equipment. These wastes are considered dangerous goods and will be collected and disposed of in accordance with applicable local and provincial regulations. The displaced crude oil and flowback water will be captured in the rig tank to later be recycled or disposed of at a licenced facility. Attempts would be made to reuse flowback water to conserve water consumption for the Project.

2.5.4 Solid Wastes

Solid wastes generated during decommissioning activities will primarily include scrap metal/steel from the decommissioned wells, main production facility equipment, and related facilities; and some concrete, metal and wood from demolition of the main production facility buildings. Scrap metal that has been in contact with hydrocarbons will first be cleaned in a contained area prior to either recycling them as salvage material or disposal at approved facilities. Other demolition debris that has not been in contact with hydrocarbons will either be recycled or disposed of at approved facilities.
Dangerous goods will be removed from the site by a licensed contractor and recycled or disposed at approved facilities.

3.0 Overview of Environmental Setting

A high-level overview of the environmental setting for the Project is provided in this section.

3.1 Physical Setting

3.1.1 Physiography and Geography

The Stoney Creek wellfield and the ancillary well location south of Hillsborough are located in Albert County, approximately 15 kilometres (km) south of Moncton, in southeastern New Brunswick. Ancillary well locations are also located near the communities of Monteagle and Memramcook, Westmorland County, in southeastern New Brunswick.

3.1.2 Topography and Drainage

The Stoney Creek wellfield and the ancillary well locations are located in the Petitcodiac Ecodistrict, a low-lying, gently rolling area with ridges and valleys that encompass the broad Petitcodiac River basin. (Zelazny 2007).

The Stoney Creek wellfield itself is an elevated section of terrain known as “Oil Hill”, with the peak of this topography situated near the centre of the main wellfield area. The Petitcodiac River is located approximately 2 km to the east of the Stoney Creek wellfield (Dillon 2011).

3.1.3 Surficial Geology

Based on available surficial geology maps (Rampton 1984), the native surficial soils in the Stoney Creek, southern Memramcook, and Monteagle areas consist of both Late Wisconsinan and Wisconsinan-aged of morainal sediments deposited by ice or with minor re-working by water. The younger Late Wisconsinan-aged sediments consists of a blanket, generally 0.5 to 3 m thick, of loamy lodgment till, minor ablation till, silt sand, gravel, and rubble. The older Wisconsinan-aged sediments consists of a discontinuous veneer over rock, less than 0.5 m thick, of loamy lodgement till, minor ablation till, silt, sand, gravel, and rubble. In the Stoney Creek and southern Memramcook study areas, the younger Late Wisconsinan sediments are located closer to the Petitcodiac River, and the older Wisconsinan-aged sediments are present inland. In the Monteagle area, a third unit is present in the region: Holocene-aged organic sediments, generally 1 to 5 m thick, consisting of bogs, fens, swamps, peat, muck, minor silt, and fine sand that are deposited in shallow basins and on poorly drained surfaces are present regionally. The native surficial soils in the Project area south of Hillsborough consist of the Wisconsinan-aged sediments detailed above, and pre-quaternary-aged rock of various lithologies that have been weathered and partially disintegrated due to glacial activity.

3.1.4 Groundwater

The shallow aquifer (water table) in the Stoney Creek wellfield area ranges widely between ground surface and approximately 30 m deep. Shallow groundwater in the overburden flows to local watercourses and then ultimately into the Petitcodiac River to the east of the wellfield. The high topographic relief appears to control the direction of groundwater flow. Domestic and communal wells in the general area, typically at depths of approximately 100 to 135 m in the bedrock aquifer, provide the local potable water supply.

3.1.5 Bedrock Geology

The bedrock geology of the Project areas varies. Based on the Department of Natural Resources and Energy Development's Geological Map of New Brunswick (NBDNR 2008), the bedrock geology in the Project areas consists of the following.

South of Memramcook area – Early Carboniferous-aged terrestrial sediments of the Mabou Group's Hopewell Cape Formation (adjacent to the Petitcodiac River) and Devonian-Early Carboniferous-aged terrestrial sediments of the Horton Group's Gautreau Formation (inland) (NBDNR 2008). The terrestrial sediments of the Hopewell Cape Formation are predominantly comprised of a sequence of brownish red, commonly poorly sorted, pebble-cobble, polymictic conglomerate, coarse-grained to pebbly lithic sandstone and fine- to coarse-grained, feldspathic-micaceous sandstone that typically fines upwards into brick red to maroon fine- to very fine-grained, ripple laminated and massive sandstone, siltstone and mudstone. Calcrete nodules, bedded calcrete and reduction spheroids are common within the finer grained units.(Van de Poll 1994; revised by St. Peter and Johnson 2009) The terrestrial sediments of the Gautreau Formation are predominantly comprised of grey to locally greyish green and reddish brown (in upper part of section) typically calcareous mudstone and shale interbedded with fine-grained sandstone that becomes coarser and more abundant in toward the top of the section; intervals of rock salt, glauberite, anhydrite, gypsum and rock salt up to 10 m thick; rare pebble conglomerate and grey limestone (Hamilton 1961a; St. Peter 1992; St. Peter and Johnson 2009).

Monteagle area – Early carboniferous-aged terrestrial sediments of the Sussex Group's Ridge Brook Formation (NBDNR 2008). The terrestrial sediments of the Ridge Brook Formation predominantly consist of reddish brown, polymictic, granule to cobble conglomerate interbedded with lesser medium- to coarse-grained lithic sandstone; beds are typically greater than 30 cm thick, and most are lenticular. Pebbles and cobbles are mainly well rounded with rare outsized boulders of granite up to 40 cm in diameter. The conglomerate varies from clast- to matrix-supported, and the matrix is compositionally indistinguishable from that of the interbedded sandstones. Clasts in the conglomerate comprise green to brown quartzite, medium to dark grey metasiltstone, feldspar porphyry, medium-grained biotite granite, minor intermediate plutonic rocks, biotite schist, gabbro, muscovite granite, and vein quartz (St. Peter 2006; St. Peter and Johnson, 2009).

South of Hillsborough area – Late Carboniferous-aged terrestrial sediments of the Cumberland Group's Grande Anse Formation (NBDNR 2008). The terrestrial sediments of the Grande Anse Formation

predominantly consist of red to reddish brown and lesser bluish grey silty mudstone, siltstone and very fine-grained sandstone alternating with sandstone-conglomerate units that are typically about 5 m thick. Mottled maroon and buff sandy and silty paleosols with well-developed rooted zones are a common feature of the fine-grained rocks. The sandstone units consist of red or pinkish grey and buff, trough cross-bedded, quartz-rich arenites, pebbly arenites and conglomerate. Pebbles in the sandstone consist of well-rounded, pea-size quartz with locally abundant mudstone intraclasts and/or lithic fragments (Norman 1941a).

Stoney Creek Area – Since exhaustive descriptions of the members that vary considerably geographically are available in literature extensively referred to in documents by others (e.g., Foley 1989; St. Peter 1992; St. Peter and Johnson 2009) only brief descriptions from the Stoney Creek vicinity are given here. The Dawson Settlement comprises coarse- to fine-grained feldspathic sandstone intercalated with kerogenous mudstone and locally pyritic shale, and the Frederick Brook is dominated by kerogenous shale and minor siltstone, sandstone, intraformational mudstone and sandstone breccias. Minor amounts of limestone is also interbedded with these clastic sedimentary rocks of the Frederick Brook in places. The Hiram Brook contains interbedded kerogenous, commonly calcareous siltstone, sandstone, mudstone and shale.

The main focus of the more recent exploration and development within the Albert Formation units has been in specific parts of the Moncton Subbasin for mainly conventional deposits and later in all subbasins for unconventional plays as well. The Hiram Brook and Dawson Settlement members have demonstrated potential to yield economically viable conventional and unconventional oil and gas in the Stoney Creek wellfield and in the McCully Field near Sussex, while the intervening Frederick Brook Member is viewed and as having very significant unconventional gas potential throughout the region.

3.2 Biophysical Setting

3.2.1 Climate

New Brunswick has a humid continental climate, with slightly milder winters on the Gulf of St. Lawrence coastline. Southern New Brunswick experiences a more moderate maritime climate than the northern or central parts of the province as the Bay of Fundy never fully freezes, thus moderating the winter temperatures and providing generally cooler summer temperatures compared to other inland locations.

The nearest representative weather station to the project area is located at the Turtle Creek reservoir (approximately 10 km to the west). On average, temperatures are lowest in the winter and early spring, and highest during the summer months. Daily averages range from a low of -8.6°C in January to a high of 19.0°C in July. Precipitation, on average, is highest during the spring (March to May). From 1981 to 2010, the region has received an average of 1,094.2 mm of precipitation per year, of which 823.3 mm was rain and 270.9 cm was snowfall (as water equivalent) (GOC 2021a).

3.2.2 Atmospheric Environment

The Stoney Creek wellfield is located in a largely rural area within the community of Weldon, Albert County. Ancillary well locations are also located near the communities of Memramcook and Monteagle in Westmorland County. Some industrial sources, which tend to release air contaminants, are located nearby in the city of Moncton (15 km to the north of the Stoney Creek wellfield). Sources of air contaminants in the immediate vicinity are mainly limited to vehicle and home heating emissions. The ambient air quality in the area is generally considered to be moderate to good based on data collected at the Moncton monitoring station, which is the closest representative station. The low population density and rural character of the area, and the lack of substantive emission sources in the area, likely contribute to favourable ambient air quality.

3.2.3 Freshwater Environment

The main waterbody/watercourse in the vicinity of the Project is the Petitcodiac River, which flows within Westmorland, Albert, and Kings counties. The watershed covers an area of 2,831 km^2 and flows southeasterly into Shepody Bay, which in turns flows into the eastern portion of the Bay of Fundy. There are at least 14 fish species in the Petitcodiac River watershed. These include: American eel, American shad, Atlantic salmon, Atlantic tomcod, blueback herring, alewife, brook trout, brown bullhead, chain pickerel, rainbow smelt, smallmouth bass, striped bass, white perch, and white sucker (NBDELG 2007), among possible others. Due to their connection with the Petitcodiac River, Stoney Creek, Downing Creek, Weldon Creek, Boyd Creek, their associated tributaries, and small tributaries to the Petitcodiac River have the potential to support these fish species as well.

The Stoney Creek wellfield and ancillary well locations, with the exception of the wells near Monteagle, are located in the Petitcodiac River drainage basin, with minor watercourses that include Stoney Creek, Downing Creek, Weldon Creek, Boyd Creek, and their associated tributaries and small tributaries to the Petitcodiac River. The Turtle Creek Watershed (Protected Watershed – A11) is situated approximately 4-5 km to the west/northwest of the Stoney Creek wellfield.

The two wells near Monteagle are part of the Canaan River watershed and are located in the headwater areas of Nevers Brook, a major tributary to the Canaan River.

3.2.4 Terrestrial Environment

The Project is located within the Eastern Lowlands ecoregion and, more specifically, within the Petitcodiac ecodistrict. The Petitcodiac River dominates the landscape. It begins in the boggy plateau of the Castaway Ecodistrict and flows southwest to the village of Petitcodiac. There, it turns abruptly northeast to parallel the regional bedrock structure until reaching Moncton, where it angles again to pour southward into a river estuary and Shepody Bay (Zelazny 2007).

Red spruce dominates the forest, together with white spruce, black spruce, balsam fir, red maple, white birch, and trembling aspen. Other species such as tamarack, white pine, and hemlock, may be present.

Tolerant hardwood stands of sugar maple, beech, and yellow birch are found on ridgetops or upper slopes, especially over slightly calcareous soils (Zelazny 2007).

3.3 Socioeconomic Setting

3.3.1 Demographic and Economic Overview

The Stoney Creek wellfield is mostly within the Hillsborough Parish Census Subdivision in the 2021 Census, the most recent Census for which some data is beginning to be publicly available at the time of writing. The population of this Census Subdivision in 2021 was 1,397, which is a 6.8% increase from 2016 population numbers (Statistics Canada 2022). Data regarding age were not available from the 2021 Census data at the time of writing this document; as such, data from 2016 were reviewed for age statistics. Based on the 2016 Census data, the population of the area is above the provincial median age of 45.7, with a median age of 48.9 (Statistics Canada 2017). These data are in line with the province of New Brunswick's trends of urbanizing and aging populations.

The median total income level of those that live in the Census subdivision is $28,368, based on 2016 Census data. Most of the people who lived in the Hillsborough Parish Census Subdivision in 2016 commuted to a different census subdivision (CSD) and census division (CD) within the province (62%), likely to nearby Moncton/Dieppe. The majority of the workforce was in the service, sales, or trades industries (Statistics Canada 2017).

3.4 Land Use

The land in the Stoney Creek wellfield and ancillary well locations is moderately isolated, largely undeveloped forested and agricultural lands with rural residential developments, and contains infrastructure from historical oil and natural gas production activities. The general development pattern surrounding the Stoney Creek wellfield and ancillary well locations is predominantly rural with residential ribbon development along Highway 114 and evidence of small scale agricultural uses to the west. Designated recreational lands or facilities within the Stoney Creek wellfield and ancillary well locations could not be identified. However, there is evidence of extensive ATV activity.

3.4.1 Infrastructure and Services

The Project area is mostly within the Regional Service Commission 7 and the Hillsborough Local Service District. The Regional Service Commission provides solid waste and recycling collection, emergency and policing services, recreational services, and some infrastructure services. Most residential and camp lots near the well pads are serviced by private, on-site wells and septic systems, although residences within incorporated areas generally have access to municipal water and wastewater infrastructure. Storm water is managed by road-side ditching systems. New Brunswick Department of Transportation and Infrastructure (NBDTI) manages the road system in the immediate area.

3.4.2 Built Heritage

According to the New Brunswick Department of Tourism, Heritage and Culture, designated Provincial Historic Sites or Districts could not be identified within the Stoney Creek wellfield and ancillary well locations. The nearest designated Provincial Historic Site is the Albert Mines Provincial Historic Site at Albert Mines, located south of the Stoney Creek wellfield.

The Canadian Inventory of Historic Buildings (CIHB) indicated no historic structures near the Stoney Creek wellfield. Several inventoried historic structures are documented in the communities of Stoney Creek (4), Weldon (13), and Hillsborough (76). In the area of the Project, there appear to be four inventoried historic structures located along Highway 114, west of sites A-89 (main production facility) and I-88 (secondary production facility).

3.4.3 Archaeological and Palaeontological Resources

According to the New Brunswick Department of Department of Tourism, Heritage and Culture, there are no registered archaeological sites identified in the area of the Project.

3.4.4 Traditional Land and Resource Use

Historically, the Project lies within the traditional Mi'kmaq territory of *Sigenigteoag*. It intersects the main portage route between the Bay of Fundy and Gulf of St. Lawrence, and possessed multiple resources such as shellfish, waterfowl, seabirds, wild rice, and sweet grass. Although little is known about early native villages in the area, it likely supported many settlements over its several thousand years of aboriginal habitation (Zelazny 2007).

The areas surrounding the Project may still be used by Indigenous people for traditional practices such as hunting, fishing, ceremonial, and gathering purposes. Within the well sites, hunting is not permitted and recreational fishing is restricted. It is more likely that hunting, fishing, ceremony, and gathering would also take place within other more natural areas, as these areas are more forested with less restrictions for access and use.

4.0 Environmental Impact Assessment Registration Scope and Methods

Environmental impact assessment (EIA) is used as a planning tool in the initial stages of project conceptualization, planning, and design. Its intention is to identify or predict Project-related effects (based on results of scientific assessment or traditional knowledge), as well to design mitigative strategies to avoid, reduce, or eliminate adverse environmental effects. The scope of the assessment and the methods used to prepare this EIA Registration document, including the characterization of the factors to be considered, and the details of the assessment of each valued component of the environment are provided below.

4.1 Scope of the EIA Registration

As noted in **Section 1.4**, the proposed Project must be registered under the New Brunswick EIA Regulation. This EIA Registration document is intended to fulfill the requirements for registration of the Project under the provincial regulation, to initiate an EIA review of the Project by a technical review committee (TRC); however, as described in **Table 1.4.1**, there are no known requirements for a federal impact assessment under the *Impact Assessment Act* since the Project is not located on federal land and it is not listed in the *Physical Activities Regulations* under that Act.

The Project assessed herein includes the decommissioning of the remaining 44 oil and gas wells that remain as part of the Stoney Creek Oil and Gas Wellfield, including wells located in Stoney Creek in addition to the three ancillary well locations in Monteagle, south of Hillsborough, and south of Memramcook (refer to **Figure 1.2.1** for site locations). This also includes the decommissioning of the main production facility at Stoney Creek. Following decommissioning, soil remediation will be carried out as necessary, and with approval from landowners, the roads and well sites will be graded to match local topography and revegetated with native vegetation. The landowners may choose to leave roads in place, if they are currently being used. The ultimate fate of the well sites following the completion of all well decommissioning, surface reclamation, and site rehabilitation activities is at the discretion of the landowner and is not part of the scope of this EIA Registration document.

4.2 Approach

As noted previously in **Section 2.3.1**, Dillon has prepared this overall EIA Registration document for the phased decommissioning of the Stoney Creek wellfield and ancillary well locations. The intention is that the overall EIA Registration document describes, for all remaining 44 wells to be decommissioned:

- The anticipated well decommissioning process;
- Well decommissioning procedures;

- Remediation measures to be implemented in the event that contamination is discovered;
- Procedures for site rehabilitation;
- The existing environmental conditions generally in the Stoney Creek, Hillsborough, Memramcook, and Monteagle areas, based solely on desktop information (to be supplemented later by a site-specific ecological review for each well site through field work that is conducted annually for the next batch of wells to be decommissioned, as supplemental site-specific information on the existing environment at each well site); and
- Environmental interactions, proposed mitigation, and residual interactions for each valued component (VC) of concern.

This phased EIA approach will be combined with annual well decommissioning applications, which will allow additional information about each set of wells to be decommissioned/reclaimed to be submitted to regulators immediately prior to that year's work. While site-specific field work for all 44 wells to be decommissioned is not provided in this EIA Registration document (because some biological data have a limited shelf life and environmental conditions may change by the time a particular well is decommissioned), it is anticipated that conditions of the EIA approval for the overall Project would include a requirement to submit a well decommissioning application the year prior to the proposed decommissioning of a particular well site (including the results of ecological field work) for each well site proposed to be decommissioned in the following year. This supplemental information would provide the TRC the opportunity to review additional site-specific conditions for each well site ahead of their planned decommissioning, even if following the EIA review process.

The number of actual wells decommissioned per year will depend on the NBDNRED approvals, EIA approval, and complexities of the well decommissioning. For the purposes of this document, a range of 6-10 wells is assumed to be completed annually, to tentatively bring the Project to a close by the end of 2026 or early 2027.

4.2.1 Selection of Valued Components

Valued components (VCs) are those components of the biophysical and human environments that are of value or interest to regulatory agencies, the public, other stakeholders, and Indigenous peoples. VCs are typically selected for assessment on the basis of: regulatory issues, legislation, guidelines, policies, and requirements; consultation with regulatory authorities, the public, stakeholders groups, and First Nations; field reconnaissance, and professional judgement.

A multi-phased approach to this Project in different geographical areas presents some complexity. Sites may not have the same VCs (e.g., some well sites may have interactions with watercourses that would require consideration of interactions with fish and fish habitat, whereas others may not); however, the overall Project assessed in this EIA Registration document captures a broader area and covers a wider range of potentially affected VCs in order to be conservative and in accordance with the approach outlined in **Section 4.2** above. The specific environmental interactions at each individual well site will be documented through well site-specific field work conducted the year prior to a particular well being

decommissioned, to confirm site-specific environmental conditions, required additional mitigation measures, and residual interactions.

The VCs selected for this EIA Registration document and the rationale for their selection in relation to the Project are outlined below (**Table 4.2.1**).

Table 4.2.1 Valued Components for the Project, and Rationale for their Selection

Valued Component (VC)	Rationale for Selection of the VC
Atmospheric environment	• Emissions of particulate matter (e.g., dust) and combustion gases related to Project activities may interact with the atmospheric environment and adjacent receptors.
Acoustic environment	• Sound related to Project activities may interact with adjacent receptors.
Groundwater	• The service rig used to abandon the oil and gas wells may come into contact with local groundwater due to the nature of well decommissioning. Localized surface excavations may alter groundwater flow patterns. Any soil contamination present may affect groundwater quality.
Surface water	• The Project may interact with the quality of surface water, particularly overland drainage through erosion or spills. Localized surface excavations and ground reshaping may alter surface water flow patterns. Any soil contamination present may affect surface water quality.
Fish and fish habitat	• Project activities may interact with fish-bearing streams and fish habitat through sedimentation/erosion or spills.
Vegetation and wetlands	• The Project activities may interact with sensitive or at-risk vegetation and may interact with wetlands through sedimentation/erosion or spills. • Project activities will also include revegetation of well sites and roads, pending landowner interest.
Wildlife and wildlife habitat	• Project activities may interact with wildlife (e.g., sensory disturbance and avoidance due to Project activities). • Site rehabilitation will return habitats to near natural states, over time.
Socioeconomic environment	• The Project will result in a change in land use (i.e., change from an active oil or gas well to whatever landowners choose to do with their property moving forward and/or revegetation). • Project activities could result in temporary increases in noise or traffic in the area.
Heritage resources	• Any earth-moving activities related to the Project activities could result in the potential accidental discovery of previously unknown heritage resources that may be present on the Project site.
Traditional land and resource use	• The Project is located in the traditional Mi'kmaq territory of *Sigenigteoag*. The Project areas have been historically used, and may also be currently used for practicing traditional activities such as hunting, fishing, trapping, and gathering through the practice of unextinguished Aboriginal and treaty rights.

4.2.2 Spatial Boundaries

The spatial boundaries for the assessment, which represent the area in which a potential effect could occur and will vary by VC, will typically be based on natural system boundaries for biophysical VCs, or administrative/political boundaries for socioeconomic VCs. The assessment of potential environmental interactions with the VCs encompasses two spatial boundaries: the individual well sites (common for all VCs) and the local assessment area (LAA; varies from one VC to another).

4.2.2.1 Individual Well Sites

As discussed in **Section 2.2**, there are currently 35 wells that remain in the Stoney Creek wellfield as well as a main production facility, some which are active and some which are inactive. In addition, there are three ancillary well locations, with five inactive wells in the area south of Hillsborough, two inactive wells in the area south of Memramcook, and two inactive wells in the Monteagle area. Each well site has a well pad that was built at the time of drilling. The well pads vary in size, but most are between 40-50 m^2. This represents the general spatial boundary for each well site.

4.2.2.2 Local Assessment Area

The local assessment area (LAA) is defined as the maximum area where Project-specific environmental interactions can be predicted and measured with a reasonable degree of accuracy and confidence (i.e., the zone of influence of the Project for each VC). The LAA, which can vary by VC, is summarized for each VC in **Table 4.2.2**.

Table 4.2.2 Local Assessment Area for Valued Components

Valued Component	Local Assessment Area (LAA)
Atmospheric environment	A 1 km buffer around any well site where work is being conducted.
Acoustic environment	A 1 km buffer around any well site where work is being conducted.
Groundwater	An approximate 500 m radius surrounding each well site.
Surface water	Watercourses and water bodies located within 30 m of any well site, including a 30 m riparian buffer on each side of watercourses.
Fish and fish habitat	Watercourses and water bodies located within 30 m of any well site, including the 30 m riparian buffer on each side of watercourses.
Vegetation and wetlands	The footprint of each well site/pad where ground disturbance will be taking place plus a 30 m buffer surrounding each well site, including a 30 m buffer around any wetlands present in proximity of the well sites.
Wildlife and wildlife habitat	The footprint of each well site/pad where ground disturbance will be taking place plus a 100 m buffer surrounding each well site.
Socioeconomic environment	The general area of the Stoney Creek wellfield and ancillary well locations at Hillsborough, Memramcook, and Monteagle, focused on the Hillsborough Parish Census Subdivision of Statistics Canada.
Heritage resources	The footprint of each well site/pad where ground disturbance will be taking place.
Traditional land and resource use	The footprint of each well site/pad where ground disturbance will be taking place.

4.2.3 Temporal Boundaries

Temporal boundaries vary according to the different Project phases and potential effects. In typical phases, specific construction-related effects are typically short-term (for example, effects related to the use of laydown areas for Project-related activities).

The temporal boundaries for the Project correspond to the timing of site preparation, well decommissioning, and surface reclamation and site rehabilitation activities as they were defined in the Project schedule in **Section 2.4**.

It is predicted that decommissioning work would begin in summer 2022, on the condition that the EIA process is completed by then. The number of wells decommissioned between May and November of each year would vary between 6-10 wells per year, on average, with an estimated completion year of 2026-2027.

4.3 Environmental Impact Assessment Methods

This EIA Registration document was developed based on a desktop level assessment, which will be followed by the completion of confirmatory field studies prior to the submission of each well-specific decommissioning plan (outside of the scope of this EIA registration) to confirm the predictions of the desktop level EIA Registration. In general, this EIA Registration document considers the following factors:

- Interactions between the physical activities associated with the Project;
- Mitigation measures that are technically and economically feasible and that would mitigate any anticipated significant adverse environmental effects of the Project, including requirements for follow-up studies or monitoring;
- The environmental effects of malfunctions or accidents that may occur in connection with the Project;
- Any change to the Project that may be caused by the environment; and
- Comments received from the public, Indigenous persons, regulatory agencies, or other stakeholders.

As a first step, Dillon uses a streamlined and focussed approach in the preparation of the analysis of interactions between the Project and VCs. During the environmental effects analysis, Project-VC interactions are first identified through a matrix table. If a Project-VC interaction is not identified, a rationale is provided to explain its exclusion from the assessment.

Following the identification of Project-VC interactions, potential interactions that could occur with the VC in the absence of mitigation are outlined in each VC section, and mitigation and best management practices are outlined to lessen or eliminate the potential interaction between the Project and VCs. Then, the anticipated Project-VC interactions following the planned application of mitigation are

characterized, and potential environmental effects as a result of these interactions are predicted. The environmental assessment methodology involved the following generalized steps:

- **Scope of VC** - This involves the scoping of the assessment for the VC, and includes a definition of the VC and a rationale for its selection and a description of the temporal and spatial boundaries. This step relies upon the scoping undertaken by regulatory authorities; consideration of the input of the public, stakeholders, and First Nations (as applicable); and the professional judgment of the Study Team.
- **Existing Conditions** - This step involves the establishment of existing (baseline) environmental conditions for the VC. In many cases, existing conditions expressly and/or implicitly include those environmental effects that may be or may have been caused by other past or present projects or activities that have been or are being carried out. Existing conditions were defined based on desktop information sources.
- **Assessment of Project-VC interactions** - Project interactions with each VC are assessed. The assessment includes:
    - a description of how a potential interaction could occur (in the absence of mitigation);
    - a discussion of the mitigation and environmental protection measures that are proposed to avoid, reduce, or eliminate adverse interactions between the Project and the VC; and
    - a characterization of the interactions and prediction of potential environmental effects that could occur as a result of the interactions. All phases of the Project are assessed. The evaluation also considers the effects of the environment on the Project.
- **Summary** - A summary of the assessment for the VC is provided, leading to an overall conclusion in respect of the interactions and associated effects of the Project on the VC. The summary also outlines the planned follow-up confirmatory field studies and/or predictive modelling that is recommended for each VC in order to confirm the predicted environmental effects.

Accidents, malfunctions, and unplanned events that could occur from the Project as planned are also assessed in a standalone chapter.

5.0 Assessment of Environmental Interactions with the Project

An assessment of the environmental effects of the Project on each of the identified valued components (VCs) is provided in this chapter. The identification of potential interactions between the Project and the VCs will be undertaken in consideration of the overall Project and its planned activities. The assessments of environmental interactions with the overall Project, described below, are limited to a high level general assessment. Tailored, well pad specific, assessments including an ecological review conducted in the field will be forthcoming as the Project progresses each year and wells are selected for decommissioning.

5.1 Project Interactions with the Environment

The potential interactions with the surrounding environment have been considered in terms of the current plans for decommissioning and restoration activities associated with the Project as planned.

The initial screening (i.e., Project interaction matrix) provided in **Table 5.1.1** below assists in determining if an interaction between the activities being carried out in each Project phase/activity of the proposed Project and the VC is possible. A qualitative rating system was used to evaluate the potential for interactions between the Project and the environment. One of the following two ratings was prescribed for each individual VC:

- An interaction between the Project and the environment could occur (which is identified with a checkmark in the matrix below), which are carried forward for further assessment; or
- No interaction occurs between the Project and the environment (which is identified by a blank cell in the matrix below), and therefore no further assessment is required and the issue is not discussed further.

Based on the Project description (refer to **Section 2.0**), the environmental setting (refer to **Section 3.0**), and the scope of the EIA (refer to **Section 4.0**), the potential interactions between the Project and the environment are summarized in **Table 5.1.1** below.

Table 5.1.1 Project Interactions with Valued Components of the Environment

Valued Component (VC)	Activities to be Conducted in the Decommissioning Phase		
	Site Preparation	Well Decommissioning	Surface Reclamation and Site Rehabilitation
Atmospheric environment	✓	✓	✓
Acoustic environment	✓	✓	✓
Groundwater		✓	✓
Surface water	✓	✓	✓
Fish and fish habitat			✓
Vegetation and wetlands	✓		✓
Wildlife and wildlife habitat	✓	✓	✓
Socioeconomic environment	✓	✓	✓
Heritage resources	✓	✓	✓
Traditional land and resource use	✓		✓

Legend: ✓ = Potential interaction

In the table above, the interaction with a particular VC is identified when the interaction first occurs. VCs for which an interaction occurs are carried forward in the environmental effects assessment in **Sections 5.2** to **5.11**, below.

The following sections are organized by VC, and describe: the scope of each VC; their existing conditions (based on the qualitative assessments described herein); potential interactions that could occur between the Project and the VC in the absence of mitigation; planned mitigation to offset, reduce or eliminate predicted adverse interactions; and residual interactions that may occur after the implementation of general- and site-specific mitigation and lead to unmitigated environmental effects. Furthermore, and where applicable, specific follow-up or monitoring plans to verify the effects predictions or the effectiveness of mitigation will be described.

5.2 Atmospheric Environment

The potential interactions between the Project phases and activities and the atmospheric environment are assessed in this section.

5.2.1 Scope of VC

The atmospheric environment is defined as the layer of air above the earth's surface to a height of approximately 10 km. The atmospheric environment includes climate, air quality, and greenhouse gases (GHGs), which are characterized as follows:

- Climate is characterized by the long-term historical seasonal weather conditions of a region, which can include temperature, humidity, precipitation, sunshine, cloudiness, and winds, among other parameters. Statistical climate data are typically averaged over a period of several

decades, and climate "normals" are normally based on historical averages and extremes over a period of 30 years. The most recent climate normals available are for the 30-year period of 1981-2010;

- Air quality is characterized by the composition of the ambient air, including the presence and quantity of air contaminants in the atmosphere in comparison to applicable air quality objectives; and
- Project-based releases of greenhouse gases (GHG), such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), are typically used as an indicator of the potential for environmental interactions with climate change. It is understood that GHG releases on a global scale from both natural processes/sources and human activities are increasing global concentrations of GHGs in the atmosphere and they contribute to climate change.

The atmospheric environment has been selected as a valued component (VC) because the atmosphere helps maintain the health and well-being of humans, wildlife, vegetation, and other biota. The atmospheric environment constitutes a VC due to:

- Emissions of contaminants to the atmosphere during decommissioning activities which may present a pathway for humans and biota to be exposed to air contaminants;
- Provisions regarding air contaminant emissions under the New Brunswick *Air Quality Regulation*; and
- Releases of GHGs and their accumulation in the atmosphere influence global climate and may affect emission reduction targets for GHGs that have been set or are being developed federally and provincially.

This assessment of the atmospheric environment considers the air contaminants that are typically associated with this type of project, which are regulated provincially (and in some cases federally). These air contaminants are generated from fuel combustion and fugitive dust generated from the movement of mobile equipment and material transfers during various decommissioning activities. For the Project components and activities assessed herein, fugitive dust and combustion gases (including but not limited to sulphur dioxide [SO_2], carbon monoxide [CO], and nitrogen oxides [NO_x]), and particulate matter (PM) are considered to be the potential contaminants of concern relating to air quality , along with potential odours from decommissioning activities. Releases of GHGs from the combustion of fossil fuels in mobile equipment are also considered in relation to the potential for interactions with climate change.

Air quality in New Brunswick is regulated pursuant to the New Brunswick *Air Quality Regulation* under the *Clean Air Act*, administered by the NBDELG. Federally, the main instrument for managing air quality is the *Canadian Environmental Protection Act* (CEPA) as well as Canada-Wide Standards developed by the Canadian Council of Ministers of the Environment (CCME). In addition, the Canadian Ambient Air Quality Standards (CAAQS) developed by the CCME provide additional ambient limits for nitrogen dioxide (NO_2), and additional standards for SO_2, fine particulate matter, and ozone (O_3) have been proposed. New Brunswick's *Air Quality Regulation* specifies maximum permissible ground-level

concentrations for five air contaminants, namely total suspended particulate (TSP), CO, SO_2, NO_2, and hydrogen sulphide (H_2S) as presented in **Table 5.2.1** below.

Table 5.2.1 Ambient Air Quality Standards in New Brunswick

Air Contaminant	Averaging Period	New Brunswick *Air Quality Regulation* Maximum Permissible Ground Level Concentration (µg/m³)
Total suspended particulate (TSP)	24 hour	120
	Annual	70 (geometric mean)
Carbon monoxide (CO)	1 hour	35,000
	8 hour	15,000
Nitrogen dioxide (NO_2)	1 hour	400
	24 hour	200
	Annual	100
Sulphur dioxide (SO_2)	1 hour	900
	24 hour	300
	Annual	60
Hydrogen sulphide (H_2S)	1 hour	15
	24 hour	5

Source: New Brunswick Regulation 97-133

The local assessment area (LAA) for the atmospheric environment includes each well site as well as a 1 km buffer surrounding each well site.

5.2.2 Existing Conditions

Existing (baseline) conditions with respect to the atmospheric environment are discussed in this section.

5.2.2.1 Climate

New Brunswick has a humid continental climate, with slightly milder winters on the Gulf of St. Lawrence coastline. Northern New Brunswick experiences a subarctic climate, particularly in the more elevated area in the far north. Conversely, southern New Brunswick experiences a more moderate maritime climate than the northern or central parts of the province since the Bay of Fundy never fully freezes, thus moderating the winter temperatures and providing generally cooler summer temperatures compared to other inland locations.

Climate normals from the nearest representative weather station (located in Turtle Creek) are presented in **Table 5.2.2** below. Data at the Turtle Creek weather station are limited to temperature and precipitation; therefore, climate normals from the Moncton (A) weather station are also presented in **Table 5.2.3** to capture additional parameters.

5.2.2.2 Ambient Air Quality

The air quality can be defined from historical air quality monitoring conducted in the region for the key contaminants of concern.

There is no ambient air quality monitoring station within the immediate vicinity of the Project, nor one regionally that collects data for every parameter. Therefore, for the purpose of this EIA Registration, air quality is characterized using data collected regionally from the NBDELG's ambient air quality monitoring station at Moncton (approximately 15 km north of Stoney Creek) as the closest representative station to the Project area. The Moncton monitoring station measures particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), and ground-level ozone (O_3).

The maximum measured concentrations from the Moncton air quality monitoring station data for the respective averaging periods of each contaminant during 2019, as reported in the NBDELG's most recent ambient air quality monitoring report titled "2019 Air Quality Monitoring Results" (NBDELG 2021a) and its supplementary data report (NBDELG 2021b), are presented in **Table 5.2.4**. It is noted that since the data presented in these reports is in graphical form (i.e., raw numerical values are not presented in the reports), the values in the **Table 5.2.4** below are interpolated from the graphs and should be considered approximate.

Table 5.2.2 Climate Normals, Turtle Creek, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals, Turtle Creek (1981 - 2010)													
Daily Average (°C)	-8.6	-7.3	-2.6	3.9	10.6	15.6	19	18.2	13.4	7.7	1.9	-4.4	5.6
Daily Maximum (°C)	-3.4	-1.8	2.6	9	16.7	21.7	24.8	24	18.9	12.6	5.8	0.0	10.9
Daily Minimum (°C)	-13.8	-12.7	-7.7	-1.1	4.4	9.6	13.1	12.3	7.9	2.8	-2	-8.8	0.3
Precipitation Normals, Turtle Creek (1981 - 2010)													
Rainfall (mm)	28.1	29.6	46.4	60.6	92.2	87.6	83.3	76.7	94.4	97.4	76.9	50.1	823.3
Snowfall (cm)	70	55	59.3	24	2.9	0.0	0.0	0.0	0.0	0.4	10.1	49.3	270.9
Precipitation (mm)	98	84.7	105.6	84.6	95	87.6	83.3	76.7	94.4	97.8	87	99.5	1094.2

Source: Canadian Climate Normals (GOC 2021a)

Table 5.2.3 Climate Normals, Moncton A, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals, Moncton A (1981 - 2010)													
Daily Average (°C)	-8.9	-7.6	-2.9	3.5	10	15.2	18.8	18.2	13.6	7.6	1.9	-4.8	5.4
Daily Maximum (°C)	-3.7	-2.4	2	8.5	16	21.2	24.7	24	19.5	12.8	6.1	-0.2	10.7
Daily Minimum (°C)	-14	-12.7	-7.8	-1.4	4	9.1	12.9	12.2	7.7	2.3	-2.4	-9.4	0.1
Precipitation Normals, Moncton A (1981 - 2010)													
Rainfall (mm)	28.8	28.4	49.2	62.3	92.5	94.6	92.1	80.8	93.5	112.1	87.3	54.2	875.7
Snowfall (cm)	78.1	64.7	64.5	31.2	3.8	0	0	0	0	1.2	19.4	62.4	325.3
Precipitation (mm)	103.3	90.9	115.6	97.6	96.9	94.6	92.1	80.8	93.5	113.4	107.2	114.4	1200.4
Wind Normals, Moncton A (1981 - 2010)													
Maximum Hourly Wind Speed (km/h)	80	92	80	89	64	65	56	61	103	80	76	80	N/A
Direction of Maximum Hourly Speed*	SW	NE	SW	N	S	N	N	S	S	NE	NW	E	N/A

Source: Canadian Climate Normals (GOC 2021b)
Notes:
* indicates the direction from which the wind is blowing
N/A = not applicable

Table 5.2.4 Ambient Air Quality Monitoring Data – 2019 Maximums – Moncton Air Quality Monitoring Station

Air Contaminant	Averaging Period	Maximum Ground-Level Concentration Recorded in 2019
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hour	18 µg/m^3
Nitrogen dioxide (NO_2)	1 hour	90.3 µg/m^3 (48 ppb)
Ground-level ozone (O_3)	1 hour	110 µg/m^3 (56 ppb)
Carbon monoxide (CO)	1 hour	1.15 µg/m^3 (1 ppb)

The maximum reported values for each contaminant are below their respective ambient air quality standards and objectives.

NBDELG (2021a) identifies provincial "air zones" which assists the Department in managing air quality in these regions. The Central Air Zone, within which the Station is located, is described as follows: *"The central air zone is the largest of the three provincial air zones, and occupies New Brunswick's middle latitudes. It encompasses five of New Brunswick's major population centers: Moncton, Dieppe, Fredericton,* Miramichi*, and Edmundston. Although small by international standards, these cities can experience "big city" air quality issues (that is, the combined impact from many small pollution sources in close proximity - vehicles, homes, businesses, etc.).*

In consideration of this information and the data presented in **Table 5.2.4** above, the ambient air quality in the Moncton region is generally moderate to good.

5.2.2.3 Greenhouse Gases

Greenhouse gas emissions in Canada totalled 730 megatonnes (Mt CO_2e, as CO_2-equivalents) in 2019 (ECCC 2020a), as published in Canada's most recent annual report on GHG emissions. Total GHGs for New Brunswick were 14.3 Mt CO_2e in 2017 (the most recent year for which New Brunswick data are available publicly), whereas they were 16.1 Mt CO_2e in 1990 and 20.0 Mt CO_2e in 2005 (CER 2021). Since 2005, New Brunswick has seen a 28.5% decrease in total GHG emissions.

5.2.3 Assessment of Potential Interactions between the Project and the Atmospheric Environment

The environmental effects of the Project on the atmospheric environment are assessed in this section.

5.2.3.1 Potential Interactions

Without mitigation, the Project could interact with the atmospheric environment in the following ways:

- Emissions of combustion gases from the combustion of fossil fuels by heavy equipment and vehicles associated with on-site decommissioning activities and from transport of materials on- and off-site could result in air contaminants that could disperse in the atmosphere to off-site receptors;

- Emissions of fugitive dust from unpaved roads and parking areas, from earth moving activities, and from transport of materials on- and off-site during construction activities could be generated and disperse in the atmosphere to off-site receptors; and
- The combustion of fossil fuels from the operation of mobile equipment and on-site trucks during construction activities could result in emissions of greenhouse gases.

In addition, it is possible that odour emissions may be released as part of decommissioning activities as crude oil in the well is extracted prior to decommissioning the well. However, since the product remaining in the well will be removed and stored in a closed vessel, odours are not expected beyond the well site itself. Odours are thus not discussed further.

5.2.3.2 Mitigation

The following mitigation measures will be implemented to reduce environmental effects on the atmospheric environment:

- Vehicles and equipment will be maintained in proper working order;
- Limiting the conduct of intrusive activities to 7:00 a.m. to 7:00 p.m., Monday to Saturday excluding holidays;
- Instituting and following a non-idling policy; and

5.2.3.3 Characterization of Potential Interactions Following Mitigation

Interactions between the Project and the atmospheric environment are expected to be primarily related to the operation of heavy mobile equipment and vehicles as well as the transport of materials on- and off-site. These activities have the potential to result in changes to the local air quality through the generation of emissions of fugitive dust and particulate matter from material movement as well as combustion emissions associated with the combustion of fossil fuels in heavy equipment.

Emissions of combustion gases from the combustion of fossil fuels by heavy equipment and vehicles during on-site construction activities and from transport of materials on- and off-site will be mitigated by implementing a non-idling policy and ensuring that equipment is in good working order. Given that the nearest residential receptor is located over 130 m away from the nearest wellhead, with the application of the above mentioned mitigation measures, the effects of combustion gases are not expected to be substantive.

As outlined in **Section 2.3**, the Project phases and activities will be spread over an approximate five-year period and all activities are of temporary nature. Furthermore, it is not likely all of these pieces of equipment will be operating simultaneously and continuously as listed, and it is more likely they will be used intermittently.

Fugitive emissions of particulate matter (including dust) and those associated with fuel combustion in heavy equipment will largely be localized to the decommissioning activities within the immediate area

of each well site. The surrounding vegetation and forested areas around the wellheads and gravel roads will also provide a natural buffer for any fugitive particulate matter (dust).

Similarly with emissions of combustion gases, the emissions of greenhouse gases from the operation of mobile equipment and on-site trucks during construction activities will be mitigated by a no-idling policy. Equipment will also be in good working order which will also keep emissions of GHGs as low as possible.

Due to the very limited footprint of the Project, the temporary nature of the activities, in addition to the rural setting of the Project, fugitive emissions, if any, are expected to be nominal, very localized, and are not anticipated to negatively contribute to local or regional air quality. In addition, given the relatively low magnitude of emissions associated with the Project, GHG emissions are expected to be low and inconsequential given the limited scale and duration of the Project.

5.2.4 Summary

The effects of the Project activities on ambient air quality due to fugitive dust and emissions from heavy equipment are expected to be temporary, intermittent, very localized and minimal, using standard mitigation as identified. It is unlikely that Project-related emissions will exceed New Brunswick air quality standards or objectives.

Greenhouse gas emissions from the Project are not anticipated to materially contribute to overall emissions in the region or the province, given the low magnitude of these emissions and given that emissions are temporary.

In light of the above, the potential interactions between the Project and the atmospheric environment are not expected to be substantive.

Given the relatively straightforward and transient nature of the Project, the limited activities arising from it, and the anticipated lack of substantive interactions with the atmospheric environment, no follow-up or monitoring is proposed to monitor environmental interactions with the atmospheric environment.

5.3 Acoustic Environment

The potential interactions between the Project and the acoustic environment are assessed in this section. We first provide an overview of the existing environment as it pertains to the acoustic environment, then conduct an evaluation of potential interactions on the acoustic environment, and then present a plan for follow-up and monitoring during key activities associated with the Project.

5.3.1 Scope of VC

The acoustic environment focuses on ambient noise, both natural and human-made. It is identified as a valued component (VC) because noise is defined as a contaminant in the New Brunswick *Air Quality*

Regulation – Clean Air Act, and noise levels may be of concern in relation to human health, socioeconomic values, and potential disturbance of ecological functions.

Potential changes to the acoustic environment may affect humans and wildlife. Components considered under this VC are Project-related sound pressure levels that could affect nearby receptors. Unwanted changes to sound pressure levels that are nuisance is generally referred to as noise.

The assessment of potential interactions on the acoustic environment is characterized by the type, frequency, intensity, and duration of noise (unwanted sound) in the outdoor environment. Vibration, or oscillation in matter that may lead to noise or stress in materials of adjacent structures, is also considered as an element of the acoustic environment. Given the nature of the Project phases and activities to be carried out for the Project, substantive sources of vibration are not expected, and as such the focus of the discussion below shall be largely on noise.

Specific regulations or guidelines related to sound quality have not been established in New Brunswick and may be addressed through the Certificate of Approvals process for industrial facilities under the *Air Quality Regulation*. In the absence of local guidance, the following generally accepted criteria that have been applied in Certificates of Approval in New Brunswick in the past are proposed for the purpose of the assessment (Glynn, M., pers. comm., 2012):

- 65 A-weighted decibels (dBA) measured as a 1-hour equivalent sound level (Leq) from 06:00 to 22:00 (daytime); and
- 55 dBA measured as a 1-hour Leq from 22:00 to 06:00 (nighttime).

The LAA for the acoustic environment includes each well site as well as a 1 km buffer around each well site.

5.3.2 Existing Conditions

The emission of sound waves from natural and manmade sources, their propagation through the atmosphere, and their detection through auditory or other means at a noise sensitive receptor in the ambient environment characterizes sound quality. Sound pressure level in units of A-weighted decibels (dBA) is the typical measure of sound. The A-weighting scale is the most commonly used scale for expressing the perception of audible noise by humans. Since sound propagation and attenuation occurs largely as a function of increasing distance from the source (among other lesser factors such as topography as well shielding by natural and human-made obstructions), the potential interactions of Project-related noise with a human receptor located in the acoustic environment are more related to the distance between the noise source and receptor rather than specific location or setting. Therefore, for the purposes of this assessment, we focus on predicted noise levels at a specific well site in the Stoney Creek wellfield that is located within 100 m of a residence, with the assumption that Project-related interactions with the acoustic environment at other ancillary well locations would be similar.

Since no baseline noise monitoring has been completed for the Project, the baseline noise levels assumed to be present at or near the project area were estimated using guidance provided by Health Canada (2017), Alberta Energy Regulator (AER 2007), and United States Environmental Protection

Agency (USEPA 1974). Based on the population density (Statistics Canada 2017) and the lack of other potential substantive noise sources near the well sites (most are in forested areas), it was determined that the noise levels within the Project area would be expected to be typical of a quiet rural area, with estimated baseline sound levels of approximately 45 dBA (USEPA 1974; Health Canada 2017).

Given the rural character and low population density of the area (4.3 people/km^2 [Statistics Canada 2017]) with no substantive industrial or commercial sources of noise nearby, baseline noise monitoring is not considered to be necessary to adequately characterize the baseline ambient sound levels.

5.3.3 Assessment of Potential Interactions between the Project and the Acoustic Environment

The potential interactions and effects of the Project on the acoustic environment are assessed in this section.

5.3.3.1 Potential Interactions

Without mitigation, the Project could produce changes in the acoustic environment at nearby acoustic sensitive receptors from movement of materials and heavy equipment during all phases of the Project.

5.3.3.2 Mitigation

The following mitigation measures will be used to control nuisance noise during the Project:

- Scheduling restrictions, where possible (or alternative mitigation implemented), to ensure that decommissioning activities with elevated noise emissions occur during the daytime (7:00 a.m. to 7:00 p.m.), Monday to Saturday excluding holidays. Only non-intrusive activities will occur during the nighttime (7:00 p.m. to 7:00 a.m.) or on Sundays or holidays;
- Vehicles and equipment shall be maintained in good working order with quality mufflers;
- Regular discussions will be conducted with workers and contractors on noise minimization practices;
- Drivers will be informed of the designated vehicle routes, parking locations, no-idling policy, normal delivery hours, and use of engine brakes policy; and
- The Proponent will communicate verbally (either via telephone or in person) and in writing with local residents who have questions or concerns related to Project-related matters including noise.

5.3.3.3 Characterization of Potential Interactions Following Mitigation

Potential interactions with the acoustic environment following the application of mitigation are assessed below. New Brunswick has no specific regulations or guidelines for noise; therefore, the generally accepted criteria of 65 dBA for the daytime will be used, since noise-producing activities will not occur during nighttime.

Activities related to well decommissioning and site rehabilitation have the potential to result in noise emissions with potential disturbance effects for humans or wildlife outside of the well sites. To determine the potential interactions that Project-related activities will have on nearby receptors, acoustic modelling of the potential sound emissions and their associated levels at the nearest discrete residential receptor (located approximately 100 m from the closest well site) was undertaken.

The United States Department of Transportation's Federal Highway Administration Roadway Construction Noise Model (RCNM) (USDOT 2006) was used to predict noise levels from Project-related activities. While the model was initially designed to predict the change in sound levels from the construction of highways, it has been used throughout Canada and the United States on a wide variety of industrial sites. A list of anticipated heavy equipment, and the measured sound pressure levels (USDOT 2006) associated with them, is provided in **Table 5.3.1**.

Table 5.3.1 Typical Construction Equipment Sound Pressure Levels during the Project (USDOT 2006)

Description	Maximum (Lmax, dBA measured at 15 m from the equipment)	Assumed Number of Each Type of Equipment Used During the Project
Flatbed Truck	84	1
Excavator	85	1
Dump Truck	84	1
Front End Loader	80	1
Service Rig	85	1

The RCNM was used to predict the equivalent sound level (Leq) at the closest receptor previously mentioned. The RCNM predicted that the Leq for the residential receptor located 100 m away was 66 dBA, which is slightly above the accepted criteria of 65 dBA. The actual Project activities for site preparation, well decommissioning and site reclamation at each well pad will have a limited duration and not all equipment will be operated at the same time; thus the above model results are conservative. For example, the service rig will not likely be operating at the same time as the excavator; removal of either equipment from the model results in equivalent sound levels below the 65 dBA criteria.

5.3.4 Summary

During the site preparation, well decommissioning, and surface reclamation and site rehabilitation activities, sources of noise are expected to be primarily related to operation of heavy equipment. Project activities have the potential to result in changes in local noise levels due to the operation of heavy equipment. Noise levels are expected to be fairly localized, short-term, intermittent, and reversible. As such, and in consideration of the noise modelling results being at or less than the recommended levels provided in guidance from regulatory agencies, the potential interactions of the Project-related activities on the acoustic environment are not expected to be substantive. Noise monitoring may be conducted during construction activities in response to noise complaints.

5.4 Groundwater

The potential interactions between the Project and groundwater are assessed in this section.

5.4.1 Scope of VC

Water is essential for life on Earth. As humans, we need water for drinking, bathing, sanitation, recreation, and for the production of food and goods. Fish, wildlife, and vegetation also rely on the availability of water to live and flourish. Changes in the availability of water or the quality of the water may affect the lives of people and other living things.

Groundwater is considered a valued component (VC) because it is an important part of the hydrologic cycle through infiltration of precipitation or surface water, and it is important to local ecosystems and for potable water supplies. There is potential for groundwater to be affected by the Project through changes in groundwater quality or quantity arising from decommissioning activities.

In general, groundwater flows from recharge areas (areas of high elevation) to discharge areas (areas of low elevation), which are commonly lakes, streams, and rivers. Groundwater is contained in aquifers, which are geological units such as gravels, sands, or fractured bedrock. The natural quality of the groundwater contained in aquifers varies depending on the geochemical composition of the material (i.e., soil, sediment and/or bedrock) in which the water flows.

5.4.1.1 Regulations and Policies Relevant to Groundwater

Where applicable, the Project will adhere to standard provincial and federal legislation and associated regulations, including the following:

Federal

- Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines; and
- Guidelines for Canadian Drinking Water Quality (GCDWQ) – administered by Health Canada (rev. 2020).

Provincial

- *Clean Water Act* – administered by the New Brunswick Department of Environment and Local Government (NBDELG); and
- *Clean Environment Act* – administered by the NBDELG.

The construction of potable wells and the extraction of groundwater is regulated under the New Brunswick *Clean Water Act* and associated *Water Well Regulation* and *Potable Water Regulation*. Groundwater sources used as public drinking water supplies are protected under the *Wellfield Protected Area Designation Order - Clean Water Act.*

Objectives for the quality of surface water and groundwater as a source of drinking water are provided in Health Canada's *Guidelines for Canadian Drinking Water Quality* (GCDWQ) (Health Canada 2020).

Though not having force of law unless formally adopted by provincial legislation, these guidelines provide guidance to decision-makers with respect to the potability of drinking water for human use.

The local assessment area (LAA) for groundwater is defined as an approximate 500 m radius surrounding each well site, in recognition of the localized effect of construction-related disturbance on groundwater.

5.4.2 Existing Conditions

The following is a review of historic, public and provincial information that provides hydrogeological information for the Project areas including but not limited to: provincial watershed and wellfield information, provincial potable well database, and previous hydrogeological studies.

Surficial and Bedrock Geology

Based on available surficial geology maps (Rampton 1984), the native surficial soils in the Stoney Creek, southern Memramcook, Hillsborough and Monteagle study areas consists of both Late Wisconsinan and Wisconsinan-aged of morainal sediments of various size, also referred to as glacial till, deposited by ice or with minor re-working by water. Surficial geology variances in the project areas include organic material-based bogs, fens, swamp, peat and muck in the Monteagle Project area and exposed weathered rock in the Hillsborough study area. Depending on the permeability of the glacial till and rock, it can be used as a localized aquifer for groundwater.

The bedrock geology of the study areas varies. Based on the Department of Natural Resources' Bedrock Geology Map of New Brunswick (NBDNR 2008), the bedrock geology in the areas can be generalized as early to late carboniferous aged terrestrial sediments. This bedrock can be porous and/or fractured to be suitable as an aquifer for groundwater.

5.4.2.1 Wellfield Protected Areas

According to the Government of New Brunswick (GNB) website, "*a wellfield protected area is the area (surface and* subsurface*) surrounding a water well or wellfield which supplies a public water supply system*". In a wellfield protected area, there are prohibitions or limitations on chemical storage and land use activities. The provincial database of designated wellfield protected areas provides the locations of 55 designated wellfield protected areas; each protected area is denoted by the name of the village, town, or city that it services with potable water.

Each designated wellfield protected area is separated into three zones (i.e., Zone A, Zone B, and Zone C) based on potential level of risk to potable water. Zone A is closest to the wellhead and is therefore the most environmentally sensitive; Zone B lies more distant from the wellhead and surrounds Zone A; and Zone C is located farthest from the wellhead and surrounds Zones A and B. The Province regulates the commercial activities within each Zone, with Zone A having the highest level of conservatism as it is closest to the municipal wellhead(s).

The Stoney Creek wellfield and the ancillary well locations are not located within the provincially-designated wellfield protected areas. The nearest designated wellfield protected areas are the

Hillsborough and Memramcook wellfields which are located approximately 9.1 km and 4.5-5.0 km from the nearest well sites, respectively.

5.4.2.2 Watershed Protected Areas

Although protected watersheds consist of surface water instead of groundwater, they are discussed here (rather than in **Section 5.5, Surface Water**) in order to address all municipal water supplies together.

According to the Government of New Brunswick (GNB) website, "*surface watersheds are an area of land that drains a system of streams, lakes and rivers. In New Brunswick 40% of the population obtain their water supply from surface watersheds*". The *Watershed Protected Area Designation Order* under the *Clean Water Act* places limitations on developers, constructors, operators, or maintenance operations within a watershed protected area. Similarly to protected wellfield areas, the provincial database of designated watershed protected areas provides the locations of 29 protected watersheds; each watershed is denoted by a watercourse present within the watershed.

Each designated watershed protected area is separated into three zones (i.e., Zone A, Zone B, and Zone C) based on potential level of risk to watercourses. Zone A is any watercourse within the watershed area, Zone B is a 75-metre setback from the watercourse, and Zone C is the remaining area within the watershed. The Province regulates the commercial activities within each Zone, with Zone A having the highest level of conservatism as it is a watercourse.

The Stoney Creek wellfield and the ancillary well locations are not located within the provincially designated watershed protected areas. The nearest designated watershed protected areas are the Ruisseau Turtle Creek protected watershed (total area of 164 km^2) and the Ruisseau Ogden Mill Brook protected watershed (total area of 2.44 km^2).

5.4.2.3 Potable Wells

The "Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick, Updated Rules for Industry" (GNB 2022) guidance for the abandonment of oil and gas production wells has recently implemented regulation regarding potable water wells. In the event that an owner of a potable water supply well located within 500 m of a proposed oil or gas well pad files a complaint with the lease owner or NBDELG regarding a negative change to their water quality prior to decommissioning, the operator of the oil or gas well must either:

- Provide a temporary water source replacement or repair, remediate, or replace the permanently impacted potable water well; or
- Hire a third-party engineer or geoscientist to investigate the complaint. If it is determined that the operator is responsible for negative impacts to a third-party potable water well, the operator will be responsible to repair, remediate, or replace any permanently impacted potable water well(s).

It is Dillon's understanding that neither NBDELG nor ORLEN has received complaints of negative water quality from private and/or public potable water well owners within the Project areas. Potable water quality testing may be conducted during construction activities in response to complaints of reduction of water quality.

The NBDELG's Online Well Log System (OWLS) database was also used to identify private potable water wells within 250 m and 500 m of oil and gas wells near the wellfield areas (herein called "offsets"). The OWLS database does not provide spatial coordinates of wells, nor does it provide records of wells completed prior to 1994. As such, aerial imagery was used to supplement the OWLS system to identify the approximate locations of private potable wells adjacent to the wellfield areas. Further information is provided below. The information and general offsets applied is to simply provide a current condition surrounding the wellfield areas.

Stoney Creek Wellfield

The Ruisseau Turtle Creek watershed and reservoir provide drinking water to the cities of Moncton, Dieppe, and Riverview. The Turtle Creek Watershed Protected Area is located approximately 4.0-4.2 km to the west of the Stoney Creek wellfield and the Hillsborough ancillary well location, at its nearest point, and measured from the nearest oil well in the wellfield area to Zone C of the Turtle Creek protected watershed. **Table 5.4.1** below presents the number of private potable water wells located within 250 m and 500 m offsets from the closest oil and gas wells in the Stoney Creek wellfield. The reported potable water well depths are 30-43 m.

Table 5.4.1 Potable Water Wells Near the Stoney Creek Wellfield

Stoney Creek Wellfield	Number of Private Potable Water Wells within 250 m and 500 m of the Wellfield	
	250 m	500 m
	5	11

Ancillary Well Location South of Hillsborough

The Village of Hillsborough Wellfield Protected Area is located approximately 4.8 km south of Hillsborough. There are two water wells within the Hillsborough Wellfield Protected Area completed in 2003 and updated in 2014. The five inactive oil wells in the Hillsborough ancillary well location are located approximately 0.95 km, 1.0 km, 1.78 km, 2.7 km, and 5.8 km, respectively, from Zone C of the wellfield protected area.

The Ruisseau Turtle Creek watershed and reservoir provide drinking water to the cities of Moncton, Dieppe, and Riverview. The Turtle Creek Watershed Protected Area is located approximately 4.0-4.2 km to the west of the Stoney Creek wellfield and the Hillsborough ancillary well location, at its nearest point, and measured from the nearest oil well in the wellfield to Zone C of the Turtle Creek protected watershed.

Table 5.4.2 below presents the number of private potable water wells located within 250 m and 500 m offsets from the closest oil and gas wells. The reported potable water well depths are 27-68 m.

Table 5.4.2 Potable Water Wells Near the Ancillary Well Location South of Hillsborough

Hillsborough Unique Well Identifier (UWI)	Number of Private Potable Water Wells within 250 m and 500 m of the UWI	
	250 m	500 m
760	1	1
703	8	21
708	0	14
825	0	6
689	0	0

Ancillary Well Location – South of Memramcook

The Memramcook wellfield protected area is 4.5-5.0 km from the two ancillary oil and gas wells located south of Memramcook. The protected wellfield consists of seven water wells installed in 2006/2007 which supply water to the Village of Memramcook.

The Ruisseau Ogden Mill Brook watershed protected area is located approximately 15.7 km southeast of the ancillary well locations south of Memramcook.

Table 5.4.3 below presents information on the number of private potable water wells located within 250 m and 500 m offsets from the closest oil and gas well sites. The majority of the private potable water wells identified predate the OWLS database; the estimated potential potable water well depths are approximately 50 m.

Table 5.4.3 Potable Water Wells Near the Ancillary Well Location South of Memramcook

Memramcook Unique Well Identifier (UWI)	Number of Private Potable Water Wells within 250 m and 500 m of the UWI	
	250 m	500 m
707	0	0*
732	0	11

Notes:
*A recreational cabin is located within 500 m of the UWI 707; however, it is unknown if it has a potable well.

Ancillary Well Location – Monteagle

Table 5.4.4 below provides information on the number of private potable water wells located within 250 m and 500 m offsets from the closest well sites. Potable water wells in this area predate the OWLS database, thus no further information was available.

Table 5.4.4 Potable Water Wells Near the Ancillary Well Location at Monteagle

Monteagle Unique Well Identifier (UWI)	Number of Private Potable Water Wells within 250 m and 500 m of the UWI	
	250 m	500 m
712	0	0
718	0	7

5.4.2.4 Previous Hydrogeological Studies

Residential Potable Water Wells

Oil and natural gas exploration wells are generally terminated at much greater depths than domestic water wells and the drilling programs must meet specific standards that are protective of the aquifers in the area. A more extensive groundwater assessment has been conducted via a survey/sampling program of domestic wells surrounding the Stoney Creek wellfield.

Residential properties not serviced by the Village of Hillsborough obtain potable water via on-site domestic potable water wells. Domestic and communal water wells that were surveyed as part of the program are typically at depths ranging between 9 m to 60 m in the bedrock aquifer. Based on the type of overburden material as noted above, a shallow groundwater aquifer is likely present.

A private potable water well survey was conducted in April 2006 by Dillon at 98 landowner properties within a 500 m radius of the Stoney Creek wellfield. The report provided groundwater quality results of the wells prior to the oil exploration activities in 2007. The results were compared with the Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ).

Domestic water supplies in the Stoney Creek area consisted of drilled wells, dug wells, and natural springs. The depths of drilled wells reportedly ranged from 9-60 m. Based on the findings of this baseline report, the following conclusions were made:

- Salt concentrations (i.e., chloride and sodium) did not indicate brine impacts to domestic water supplies within the survey area;
- Petroleum hydrocarbon constituents F2 to F4 were below laboratory detection limits in the water supply samples analyzed; and
- Groundwater conditions at the sample locations do not indicate impacts due to past oil and gas activities in the area.

Investigations conducted by Dillon Consulting and documented in a report titled "*Private Well Survey Stoney Creek Well Field, Albert County, New Brunswick*", dated July 2006, determined that site groundwater is geochemically similar to water found in the shallow aquifer elsewhere in the area. The isotopic data indicates that the water in the aquifer in the wellfield represents typical coastal precipitation/recharge and does not contain a significant component of deeper formation water. The water quality is not typical of oilfield brines, and the presence of low concentrations of specific parameters suggests that there is currently minimal to no impact on the shallow aquifer from historical Stoney Creek wellfield operations.

5.4.3 Assessment of Potential Interactions between the Project and Groundwater

The nature of the project and its activities are not such that they would be expected to result in substantive changes to groundwater quantity because groundwater from near surface aquifers will not be extracted during the Project activities and because surface excavations needed for well

decommissioning and potential soil remediation will be shallow and not expected to affect groundwater quantity. Therefore, the change in storage of near surface aquifers used as a source of local potable water will not decrease. As such, potential interactions that would have an effect on groundwater quantity are not discussed further.

The potential interactions between the Project and groundwater that may have an effect on groundwater quality are assessed below.

5.4.3.1 Potential Interactions

Without mitigation, the Project may interact with groundwater in the following ways:

- Water quality could be affected by accidental release of lubricants and or refined fuels (i.e., gasoline, diesel) from vehicles and equipment at the well sites during well decommissioning activities—should this occur, it would be considered an accident, malfunction, or unplanned event that is assessed in **Section 7.0**;
- Water quality (i.e., turbidity of shallow groundwater) could be affected by the excavation of soils from around the wellhead or by the completion of test pits at the well site during the site reclamation activities;
- Water quality of the local groundwater aquifer could be affected by interaction with displaced crude oil and flow back water in the event the casing and cement sealed annulus are compromised, allowing groundwater to enter the well; and
- Water quality could be impacted through accidental release of crude oil and flow back water from the wellhead, piping system, or rig tank—should this occur, it would be considered an accident, malfunction, or unplanned event that is assessed in **Section 7.0**.

5.4.3.2 Mitigation

Standard mitigation and best management practices that are relevant to the groundwater VC will be implemented for the life extension activities of the Project. These are based on normal operating procedures and regulatory requirements, and include mitigation specific to the groundwater VC, such as the following.

- Operating under the standard operating procedures specified by both the service rig operators and by the petroleum engineer in well decommissioning plans.
- A closed loop fluid control system is established during the well decommissioning activities to avoid the accidental release of displaced crude or flow back water from each well. Fluids displaced from the wells (i.e., crude oil and flow back water) are monitored and controlled between a rig tank (i.e., crude oil and flowback water storage device), pumping equipment, and the wellhead by secured steel piping. The rig tank has a storage capacity of 10-12 m^3 to receive crude oil and flowback water from the well; fluid levels in the rig tank are continually monitored during the well decommissioning procedures. Once the rig tank has reached capacity or is

needed to be mobilized to another site, a licenced waste disposal contractor is commissioned to remove and dispose of the fluids at a licenced facility. While the site is unoccupied, the rig tank valves and steel covers are secured to prevent valve failure or rain water from entering the tank.

- The interaction of the work string, flowback water and/or crude with the local groundwater aquifer is considered a low potential. The wells are completed with multiple sets of steel casings and the annuli of the casings are sealed with cement or other water barriers that would prevent interaction of shallow groundwater with the well. The intent of the well decommissioning program is to prevent the potential migration of hydrocarbons vertically to the water-bearing units by the placement of cement plugs at various locations in the well bore. During this process, the integrity of the casing would be determined. If compromises to the integrity of the casing are identified, additional cement plugs are added to the wellbore to ensure integrity of the seal. The majority of the wells in the Project area have been shut in for many years with little to no pressure and limited production of crude. Therefore, excess pressure accumulation in the wellbore that would compromise the integrity of the steel casings, cement seals, or water barrier seals are not expected.
- The area of disturbance of the Project will be limited to that which is absolutely necessary to achieve the Project purpose.
- All fuels and lubricants used during decommissioning activities will be stored according to containment standards (e.g., secondary containment) in designated areas and will not be located within 30 m of preferential pathways (i.e., oil and gas wells, watercourses, wetlands).
- Special precautions will be implemented while refueling machinery to prevent spills (e.g., absorbent pads located below nozzles and spill response kits located at the refueling location).
- Emergency response plans will be in place for spill response with spill kits and trained personnel present on-site at all times.
- Spills of petroleum in Project areas will be remediated to the appropriate criteria selected by a Site Professional applying the Atlantic Risk-based Corrective Action Version 4 User Guidance.

5.4.3.3 Characterization of Potential Interactions Following Mitigation

Well decommissioning activities have the potential to result in changes to groundwater quality without the proper mitigation employed. Substantive interactions between the Project and groundwater that would result in a decline in groundwater quality are not anticipated, considering the following scenarios.

- It is Dillon's understanding that the oil and gas wells have been completed with casings, cement seals, and/or water barrier seals that would not allow shallow groundwater (i.e., potable water) to penetrate into the well bore. However, there is potential for the well casings and cement to have failed. This will not be able to be visually observed; however, some indicators may imply that casing failure is an issue including: unexpected blockages of the well bore observed by the work string or failed shut-in tests when portions of the well bore do not hold a negative pressure seal. In the event of any indication that the protective casing and cement have been

compromised, a petroleum engineer will be contacted for recommendations to decommission the well without impacting shallow groundwater quality.

- Considering the potential for refined fuels (i.e., gasoline, diesel and/or lubricants) that may be spilled on-site, several precautions will be implemented to prevent the petroleum product from interacting with shallow groundwater. For example, fuels and lubricants will be stored at least 30 metres from preferential pathways and in/on secondary containment units to prevent spills. Absorbent pads will be placed under service rig refueling devices to protect the ground surface from potential spill of petroleum hydrocarbons. In the event that lubricants or fuels are discharged to the ground surface during the Project, an absorbent pad and/or granular absorbent material will immediately be employed by on-site personnel to limit petroleum infiltration into soils. An oil absorbent boom will be placed topographically downgradient of the spill if it is suspected that the quantity of petroleum product will runoff. Dillon personnel trained in emergency spill response will be present during the project to document all spills and remediate the loss to an acceptable level in order to protect the quality potable groundwater. Remedial action may include excavation of impacted soils and disposal of the material at an NBDELG approved facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality of shallow potable water.
- There is potential for displaced crude oil and/or flowback water to be spilled onto the ground surface prior to being stored in the rig tank prior to off-site disposal at an NBDELG approved facility. This is not expected due to controlling the flow of displaced crude oil and flowback water in a closed system that discharges directly to the rig tank. In the event that crude oil or flowback water is discharged to the ground surface during the Project, an absorbent pad and/or granular absorbent material will immediately be employed by on-site personnel to limit petroleum infiltration into soils. An oil absorbent boom will be placed topographically downgradient of the spill if it is suspected that the quantity of petroleum product will runoff. Dillon personnel trained in emergency spill response will be present during the project to document all spills and remediate the loss to an acceptable level in order to protect the quality potable groundwater. Remedial action may include excavation of impacted soils and disposal of the material at an NBDELG approved facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality of shallow potable water.
- Further to the mitigation measures listed above, the soils immediately adjacent to well heads will be excavated following the decommissioning of the wells to ensure no petroleum hydrocarbons (i.e., refined products, crude oil and/or impacted flowback water) are present. This will be verified by screening petroleum vapour concentrations in soil with an appropriate instrument or by collecting confirmatory soil samples for laboratory analysis. In the event that petroleum is observed or detected in soils adjacent to the well heads, the soil will be remediated to an acceptable level, considering the risk to potable groundwater. Remedial action may include excavation of impacted soils and disposal of the material at an NBDELG approved

facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality of shallow potable water.

The Stoney Creek wellfield and the ancillary well locations are not located within any designated wellfield protected area or watershed protected area. Therefore, there will be no interaction with groundwater in protected wellfields or watersheds.

5.4.4 Summary

In summary, the potential groundwater interactions associated with decommissioning the oil and gas wells are temporary in nature. Given the above, and in light of the Project as currently planned and the planned mitigation measures to reduce or eliminate negative environmental effects, the potential interactions between the Project and groundwater are not expected to be substantive. This conclusion will be re-evaluated once site specific information is gathered while decommissioning the individual oil and gas wells.

5.5 Surface Water

The potential interactions between the Project and surface water are assessed in this section. Water is essential for life on Earth. As humans, we need water for drinking, bathing, sanitation, recreation, and for the production of food and goods. Fish, wildlife, and vegetation also rely on the availability of water to live and flourish. Changes in the availability of water and the quality of the water may affect the lives of people and other living things.

5.5.1 Scope of VC

Surface water consists of wetlands, watercourses (mapped and unmapped), water bodies, and surface water drainage channels within the areas that may be potentially affected by the Project. Surface water was selected as a valued component (VC) based on the importance of the resource to both humans and biota, including its importance in supporting fish and fish habitat and other aquatic life, and because of the potential for these resources to be affected by the Project through changes in surface water quality and/or quantity.

The potential interactions of the Project with surface water quantity and quality resulting from well decommissioning are considered for this VC. Assessment of interactions with the surface water VC are particularly important components due to the potential for impacts along the tributaries to the Petitcodiac and Canaan Rivers. This VC includes water levels, flows, surface water quality, and sediment quality. Discussion will include activities that may affect surface water. Potential interactions with the VC are discussed within the context of the Project.

In general, surface water flows from high topographic elevations and flows downgradient to topographic lows (e.g., lakes, rivers, wetlands, etc.). The natural quality of surface water is dependent on its natural course in the environment and the interactions it has with anthropogenic and non-anthropogenic

materials prior to discharging to waterbodies. Potential interactions of the Project with the VC during the site preparation, well decommissioning, and surface reclamation and site rehabilitation are discussed.

5.5.1.1 Regulations and Policies Relevant to Surface Water

Where applicable, the Project will adhere to standard provincial and federal government legislation and associated regulations and guidelines, including the following related to surface water:

Federal

- *Canadian Environmental Protection Act* (CEPA) – administered by Environment and Climate Change Canada (ECCC);
- Fisheries *Act* – administered by both Fisheries and Oceans Canada (DFO) and ECCC, the Act has requirements in relation to surface water, such as requirements prohibiting harmful alteration, disruption or destruction (HADD) of fish habitat (administered by DFO), requirement for flow maintenance for fish passage (administered by DFO), and prohibiting the release of deleterious substances (administered by ECCC);
- Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines (CCME 1999); and
- Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada 2020) – administered by Health Canada (rev. 2020).

Provincial

- *Clean Water Act* – administered by the New Brunswick Department of Environment and Local Government (NBDELG); and
- *Clean Environment Act* – administered by the NBDELG.

Watercourses and areas meeting the definition of a wetland in New Brunswick are regulated by the New Brunswick *Clean Water Act* including its *Watercourse and Wetland Alteration Regulation*, and the New Brunswick "Wetlands Conservation Policy" (NBDNRE-NBDELG 2002). Surface water supplies used as public drinking water sources are protected under the *Watershed Protected Area Designation Order – Clean Water Act*.

Objectives for the quality of drinking water are provided in Health Canada's "Guidelines for Canadian Drinking Water Quality" (Health Canada 2020). Additionally, the Canadian Council of Ministers of Environment's (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG FWAL) (CCME 1999) provide environmental quality objectives for protecting fish from lethal and sub-lethal effects. Though not having force of law unless formally adopted by provincial legislation, these guidelines provide guidance to decision-makers with respect to the suitability of water for various uses as well as the potability of drinking water for human use.

The local assessment area (LAA) for surface water includes the watercourses and water bodies located within 30 m of any well site, including a 30 m riparian buffer on each side of watercourses.

5.5.2 Existing Conditions

The Project areas include the following locations:

- The Stoney Creek wellfield located approximately 15 km south of Moncton, in the community of Hillsborough, near the Petitcodiac River;
- The south of Memramcook wellfield located approximately 20 km southeast of Moncton in the community of Memramcook, near the Petitcodiac River;
- The south of Hillsborough wellfield located approximately 25 km south of Moncton in the community of Hillsborough, near the Petitcodiac River; and
- The Monteagle wellfield located approximately 8.5 km north of the community of Salisbury, with tributaries to both the Canaan River and Petitcodiac River.

The Stoney Creek, Memramcook, and Hillsborough wellfields are located in the Petitcodiac River drainage basin, which includes Stoney Creek and Weldon Creek and their associated tributaries. The Turtle Creek Watershed (Protected Watershed – A11) is situated approximately 4-5 km to the west/northwest of the Stoney Creek wellfield. The Petitcodiac River has a total contributing watershed of approximately 2,831 km^2 (NB DELG, 2007), which consists of predominantly undeveloped wooded terrain, partially shown in **Figure 5.5.1**. The Petitcodiac River flows through the city of Moncton before discharging to the Shepody Bay, and eventually into the Bay of Fundy.

There are two wells near Monteagle that are not part of the Petitcodiac River drainage basin. These are part of the Canaan River watershed and are located in the headwater areas of Nevers Brook, a major tributary to the Canaan River. The Canaan River has a total contributing watershed of approximately 2,167 km^2 (GNB 2007), which also consists of predominantly undeveloped wooded terrain, partially shown in **Figure 5.5.1**. The Canaan River flows through several small communities (i.e., New Canaan, Cherryvale, Canaan-Forks, Hunters-Home, Brookvale, Coles Island, and Cambridge-Narrows) prior to discharging to the Saint John River.

5.5.2.1 Water Levels

According to a previous EIA Registration document (Dillon 2011), watercourses within and in the immediate vicinity of the Stoney Creek wellfield ranged in depths of 0.10 m to 0.30 m in the unnamed, smaller tributaries, and 0.20 m to 0.60 m in Stoney Creek and Hiram Brook (Dillon 2011). These depths may not be representative of the current conditions, and nearby watercourse characteristics will vary depending on each well site.

Based on a review of online mapping, the watercourses in the vicinity of the ancillary well locations are also smaller unnamed tributaries. Detailed assessments accompanying site-specific well decommissioning plans will document surface water conditions and water levels for each well site, if direct interactions to surface water are expected at a particular well site.

5.5.2.2 Surface Water Quality

As part of the 2011 EIA Registration document completed by Dillon (Dillon 2011), surface water samples were collected at ten locations within the Stoney Creek wellfield from February to July 2006. These surface water samples were collected to establish baseline conditions prior to commencement of activities associated with the proposed development of the wellfield for the production of oil and natural gas in 2011. Samples were tested for concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX) and modified total petroleum hydrocarbons (TPH) as well as general chemistry analyses (Dillon 2011).

In-situ water quality parameters were also collected during the 2006 aquatic environment assessments in the unnamed tributaries, Hiram Brook and Stoney Creek. Water temperatures at the time ranged from 0.4 to 17.8 degrees Celsius (^{o}C), and dissolved oxygen ranged between 7.86 and 11.92 milligrams per litre (mg/L). There were no detectable concentrations of petroleum hydrocarbons evident in the water (Dillon 2011). As with water level conditions described above, the surface water quality reported in 2011 may not be representative of current conditions, and are provided here for general context only. Site-specific surface water quality assessments will accompany future well decommissioning plans for individual well sites, if direct interactions to surface water are expected at a particular well site.

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

PROJECT AREA WATERSHEDS

FIGURE 5.5.1

- Oil and Gas Well
- Highway
- Waterbody
- GeoNB-mapped Wetland

0 0.5 1 2 Kilometers

SCALE 1:135,000

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
DATA PROVIDED BY: DILLON CONSULTING LIMITED, SNB & NB DEPARTMENT OF NATURAL RESOURCES

MAP CREATED BY: GM
MAP CHECKED BY: AS
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

DILLON CONSULTING

PROJECT: 21-2269

STATUS: FINAL

DATE: 2022-07-06

5.5.3 Assessment of Potential Interactions between the Project and Surface Water

The potential interactions between the Project and surface water that may have an effect on surface water quantity and quality are assessed below.

5.5.3.1 Potential Interactions

Without mitigation, the Project may interact with surface water in the following ways:

- Surface water quality could be affected by accidental release of lubricants and/or refined fuels (i.e., gasoline and/or diesel) from vehicles and equipment at the well sites during well decommissioning activities – should this occur, it would be considered an accident, malfunction, or unplanned event that is assessed in **Section 7.0**;
- Surface water quality could be affected by equipment interactions with surface water from site preparation, mobilization of equipment, and/or demobilization of equipment. Effects to surface water through this interaction could include runoff impacted by lubricated machinery or disturbance of soils that would lead to erosion;
- Surface water quality could be affected by erosion or sedimentation of excavated and stockpiled soils adjacent to the wellheads during test pitting examination of potential surface soil impacts;
- Surface water quality could be affected by interaction with waste materials generated on the project Site (i.e., general waste, recovered casing material, or displaced crude and/or brine water stored in the rig tank); and
- Surface water quantity will be affected by sourcing approximately 10-12 m^3 of water from local springs, water wells, or tributaries to use in the rig tank as circulation water to displace crude oil from each well in a closed loop system.

5.5.3.2 Mitigation

Standard mitigation and best management practices that are relevant to the surface water VC will be implemented for the Project. These are based on normal operating procedures and regulatory requirements, and include mitigation specific to the surface water VC, such as the following:

- Application for a watercourse and wetland alteration (WAWA) permit for any alterations in, or within 30 m of, a watercourse or wetland (if present). A copy of the permit will be maintained on-site and the conditions of the permit will be followed;
- The area of disturbance of the Project will be limited to that which is absolutely necessary to achieve the Project purpose;
- Natural vegetation will be preserved when possible;
- The area of exposed soil will be limited, and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover) will be reduced through scheduled work progression;

- Erosion and sedimentation control structures (e.g., check dams, silt curtains) will be maintained throughout the site preparation, well decommissioning, and related surface reclamation and site rehabilitation activities and inspected regularly, in particular before and after heavy rain events. These structures will remain in place until the area is stabilized or naturally re-vegetated;
- A plan for handling fill and construction materials for the site will be communicated to the contractor (i.e., if stockpiling is required, materials will be stored away from any watercourse or removed from site to a pre-determined location) with an intent to minimize soil stockpiled, and the duration that soil is stockpiled at the site;
- Fill and excavated materials will not be stockpiled for long periods of time to reduce the likelihood of sedimentation. Fill/excavation material piles will be covered with tarps if left standing for more than 24 hours;
- All fuels and lubricants used during the Project will be stored according to containment standards (e.g., secondary containment) in designated areas. Storage areas will not be located within 30 m of watercourses, wetlands (if present), or water supply areas (including the location of known private wells);
- Temporary storage of waste materials on-site will be located at least 30 m from watercourses, wetlands (if present), and water supply areas (including known private wells);
- Water stored in the rig tank that is impacted by displaced crude oil and/or flowback water will be taken off-site for disposal at an NBDELG facility by a licenced contractor;
- Refueling of machinery will not occur within 30 m of watercourses and water supply areas (including known locations of private wells). Where stationary equipment is situated near a wetland (if present), special precautions will be implemented to prevent spills during refueling (e.g., absorbent pads located below nozzles and spill response kits located at the refueling location); and
- Emergency response plans will be in place for spill response with spill kits and trained personnel present on-site at all times.

5.5.3.3 Characterization of Potential Interactions Following Mitigation

Well decommissioning activities have the potential to result in changes to surface water quality and quantity without the proper mitigation employed. Substantive interactions between the Project and surface water that would result in a decline in surface water quality and/or quantity are not anticipated, considering the following scenarios.

- Considering the potential for refined fuels (i.e., gasoline, diesel and/or lubricants) that may be spilled on-site, several precautions will be implemented to prevent the petroleum product from interacting with surface water. For example, fuels and lubricants will be stored at least 30 metres from any wetland or watercourse and in/on secondary containment units to prevent spills. Absorbent pads will be placed under service rig refueling devices to protect the ground surface from any potential spill of petroleum hydrocarbons. In the event that lubricants or fuels

are discharged to the ground surface during the Project, an absorbent pad and/or granular absorbent material will immediately be employed by on-site personnel to limit petroleum runoff to surface water features. An oil absorbent boom will be placed topographically downgradient of the spill if it is suspected that the quantity of petroleum product will runoff. Dillon personnel trained in emergency spill response will be present during the project to document all spills and remediate the loss to an acceptable level in order to protect the quality local surface water. Remedial action may include excavation of all impacted soils and disposal of the material at an NBDELG approved facility. Further, confirmatory soil samples would be collected from any excavation to ensure that all losses, if any, are remediated to the appropriate level to conserve the quality of local surface water.

- Considering the potential for sediment disturbance that may initially occur during the site preparation and mobilization phase, vehicles and equipment travelling on access roads to the well sites may loosen surficial soil such that it becomes sediment. In the event of a rainfall event, loosened sediment may be eroded and displaced to surface water features. The increase in discharged sediment beyond background levels may decrease the water quality of surface water features. Given the potential for sedimentation of surface water features beyond natural levels, in the event that soil is loosened within 30 metres of a wetland or watercourse precautions will be implemented to prevent erosion of the material. Precautions may include implementing a local silt fence and/or re-compacting the material.
- While excavating near surface soil adjacent to the well head to establish the potential for any local impacts to soil, the soils will be stockpiled in a designated area on each well pad at least 30 m away from any wetland or watercourse until it is determined that the soil is suitable to be used as backfill. Temporary storage of stockpiled soil on the ground surface has the potential to allow soil to migrate off-site as sediment in runoff. Considering the potential for sediment to runoff into local surface water features, stockpiles will not be placed within 30 m of a wetland or watercourse. Further, the soil assessment will be completed in a timely manner to decrease the potential period for precipitation to come into contact with exposed soil. In the event that it is suspected that rain water will cause substantive sediment erosion from any soil stockpile, the field team may opt to postpone soil excavation in consideration of the risk to local surface water bodies. In the event that stockpiles of soil are planned to be left on-site for a period of more than 24-hours, the material will be covered with a tarp to minimize interaction with any unexpected precipitation. Further, prior to any soil disturbance, materials required for mitigation efforts will be obtained and installed when possible and extra/replacement materials will be obtained and available for replacement in the event of failure (see **Section 7.3.2** for more information associated with failure of erosion and sediment control structures).
- The well pads surrounding the wellheads have had time to develop vegetation that may limit access to the wellhead or pose a safety risk to field personnel. In some cases, the vegetation on well pads will be required to be cleared and grubbed to establish a safe work area for the field team. Any grubbing, clearing or grading along roadways and well sites within 30 m of a watercourse will require a WAWA permit. No works will commence without such permit and all

conditional requirements outlined will be followed, this will ensure minimal (if any) interactions with surface water.

- Following well decommissioning, local site works may occur to regrade the well pads to allow the area to return to a natural vegetated state. Potential site works include: grading soil, landscaping, and placement of sediment control structures. Following the regrading of the well pads, all exposed erodible soil shall be permanently stabilized with perennial vegetation native to the area and blanketed with mulch. If final grading takes place outside the growing season when perennial vegetation can become re-established, temporary stabilization shall be upgraded to perform its function throughout winter and snowmelt/spring break-up conditions. Wherever temporary over-winter stabilization is used, it shall be replaced with non-invasive perennial vegetation native to the area early in the next growing season.
- Project activities require a source of water to circulate the well over to water. The water is planned to be sourced from springs or waterbodies local to the project areas in a manner that conforms with a WAWA permit. Therefore, field personnel will identify local surface water that is suitable for Project use and have it pumped into the on-site rig tank for temporary storage. Prior to retrieving water and temporarily storing it in the on-site rig tank, the minimum volume of water required for Project applications will be estimated to minimize surface water withdrawal from the Project areas. Displaced crude oil and flowback water will be taken off-site for disposal and/or treatment at an NBDELG approved facility.

With the implementation of the planned mitigation indicated above, including obtaining a WAWA permit for any activity carried out within 30 m of a watercourse, interactions between the Project and surface water is not anticipated to be substantive and are limited to the local environment temporarily. However, as is the case with many projects in close proximity to environmentally sensitive areas, unforeseen accidents, malfunctions and unplanned events have potential to impact local watercourses and wetlands. Environmental interactions that may arise through accidents, malfunctions and unplanned events are outlined in **Section 7.0**.

5.5.4 Summary

In summary, the potential surface water interactions associated with decommissioning the oil and gas wells, are temporary in nature. Given the above, and in light of the Project as currently planned and planned mitigation to reduce or eliminate negative environmental effects, the potential interactions between the Project and surface water are not expected to be substantive. This conclusion will be re-evaluated once site specific information on surface water is gathered prior to decommissioning of individual well sites.

5.6 Fish and Fish Habitat

The potential environmental effects of the Project on fish and fish habitat (including aquatic species at risk) are assessed in this section.

5.6.1 Scope of VC

The fish and fish habitat valued component (VC) includes aquatic life such as freshwater fish, benthic invertebrate species, and the habitat that supports them, as well as aquatic species at risk (SAR). Fish and fish habitat are considered a VC: because of their importance in supporting aquatic life; as a fisheries resource; as food source for humans, other fish, and wildlife; for providing recreational opportunities; and because they are of importance to the public, stakeholders, and Indigenous communities.

Fish and fish habitat are protected through the federal *Fisheries Act* as well as the New Brunswick *Fish and Wildlife Act* and the New Brunswick *Watercourse and Wetland Alteration Regulation – Clean Water Act*. The federal *Fisheries Act* provides protection for all fish and fish habitat (DFO 2019). Section 35(1) of the *Fisheries Act* prohibits the harmful alteration, disruption or destruction (HADD) of fish habitat; Section 34.4(1) prohibits the death of fish by means other than fishing; and Section 36(3) prohibits the release of a deleterious substance into waters frequented by fish. Additionally, aquatic SAR are protected under both the federal *Species at Risk Act* (SARA) and New Brunswick *Species at Risk Act* (NB SARA). Although the Canadian Council of Ministers of Environment's (CCME) Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CWQG FWAL) (CCME 1999) do not have force of law on their own, they provide environmental quality objectives for protecting fish from lethal and sub-lethal effects.

In this EIA Registration document, we define "species at risk" (abbreviated SAR) as those species that are listed as "Extirpated", "Endangered", "Threatened", or "Special Concern" on Schedule 1 of SARA or on the NB SARA. We also define "species of conservation concern" (abbreviated SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or are regionally rare or endangered by the Atlantic Canada Conservation Data Centre (AC CDC) (i.e., those species with AC CDC S-ranks of "extremely rare" [S1], "rare" [S2], or "uncommon" [S3]).

For the purpose of this EIA Registration document, the local assessment area (LAA) for fish and fish habitat includes the watercourses and water bodies located within 30 m of any well site, including the 30 m riparian buffer on each side of watercourses.

5.6.2 Existing Conditions

The Stoney Creek wellfield as well as the ancillary well locations south of Hillsborough and south of Memramcook are located within the Petitcodiac River watershed, whereas the ancillary well locations at Monteagle are located within the Canaan River watershed. There are at least 14 known fish species in the Petitcodiac River watershed. These include: alewife *(Alosa pseudoharengus)*, American eel *(Anguilla rostrata)*, American shad *(Alosa sapidissima)*, Atlantic salmon *(Salmo salar)*, Atlantic tomcod *(Microgadus tomcod)*, blueback herring *(Alosa aestivalis)*, brook trout *(Salvelinus fontinalis)*, brown bullhead *(Ameiurus nebulosus)*, chain pickerel *(Esox niger)*, rainbow smelt *(Osmerus mordax)*, smallmouth bass *(Micropterus dolomieu)*, striped bass *(Morone saxatilis)*, white perch *(Morone*

Americana), and white sucker (*Catostomus commersonii)* (NBDELG 2007). Due to their connection with the Petitcodiac River, the watercourses located in the area of the Stoney Creek wellfield and the ancillary well locations south of Hillsborough and south of Memramcook have the potential to support these fish species as well.

There are at least 12 known fish species in the Canaan River watershed, including landlocked Atlantic salmon, Atlantic sturgeon *(Acipenser oxyrinchus),* brook trout, burbot *(Lota lota),* chain pickerel, muskellunge *(Esox masquinongy),* rainbow smelt, shortnose sturgeon *(Acipenser brevirostrum),* smallmouth bass, striped bass, white perch, and yellow perch *(Perca flavescens)* (NBDELG 2007).

A report generated by the AC CDC (2022) indicated records of three aquatic species at risk or species of conservation concern within approximately 10 km of the Project area: Atlantic salmon, brook floater *(Alasmidonta varicose*), and lake trout *(Salvelinus namaycush).* The Atlantic salmon population that is thought to be present near the Project area are of the Inner Bay of Fundy (IBoF) population, and is listed as Endangered under Schedule 1 of SARA and on NB SARA. The brook floater is a freshwater mussel species that is listed as a species of Special Concern under Schedule 1 of SARA and on NB SARA. The lake trout was given a ranking of S3 (uncommon) by the AC CDC, and was not classified under either under SARA or NB SARA.

As part of a previous EIA registration completed by Dillon (Dillon 2011), several tributaries to the Petitcodiac River in the Stoney Creek wellfield were assessed. These were found to provide suitable brook trout habitat and the presence of brook trout was noted. The fish habitat in Stoney Creek was found to consist of a series of riffle/run/pool habitat with average depths of 0.2 m in the riffle habitat and 0.6 m in the pool habitat. Another nearby watercourse, Weldon Creek, supported sporadic stretches of good salmonid substrate approximately 5.5 km upstream of its confluence with the Petitcodiac River, according to a Fundy National Park salmon biologist (Flannagan, J., pers. comm., 2006). A survey of a tributary to Weldon Creek, Hiram Brook, was completed by Dillon in 2011, where it was found to consist primarily of a well shaded rubble/gravel stream approximately 3.0 to 5.0 m wide. This brook consists of a series of riffle/pool habitats with average depths of 0.2 m in the riffle habitat and 0.4 m in the pool habitat. Brook trout were also noted throughout the surveyed reach of this brook (Dillon 2011).

5.6.3 Assessment of Potential Interactions between the Project and Fish and Fish Habitat

The potential interactions between the Project and fish and fish habitat are assessed below.

5.6.3.1 Potential Interactions

Though no in-water work is required for the Project, temporary interactions with fish and fish habitat during decommissioning of the well sites may occur if conducted within 30 m of an unmapped watercourse that has not yet been detected through desktop review. As such, there is potential for runoff from the Project areas to reach unmapped waterways if appropriate mitigation measures are not in place.

Upgrades to access roads (i.e., vegetation management, limited grading, limited widening) have the potential to impact watercourses at crossing locations. Mitigation measures will be required where upgrades activities occur within 30 m of a watercourse that may cause potential interactions with fish and fish habitat.

5.6.3.2 Mitigation

The following general mitigation measures for the aquatic environment will be applied as part of the Project:

- No work is to be conducted within 30 m of a watercourse without first obtaining and complying with a watercourse and wetland alteration (WAWA) permit;
- Soil will not be stockpiled within 30 m of a watercourse;
- All chemicals and petroleum products will be managed in accordance with manufacturer's specifications and stored more than 30 m from a watercourse;
- Refueling equipment and vehicles will be conducted more than 30 m from a and where possible over an impermeable surface;
- All waste materials will be secured and/or stabilized until they can be transported off-site for disposal to prevent them from entering any aquatic habitat;
- Ground disturbance work will not be completed during significant storm events;
- Erosion and sediment control (ESC) structures will follow specifications as outlined in the WAWA technical guidelines and will be inspected weekly, as well as prior to heavy rainfall (>25 mm over 24 hours) events to ensure they are continuing to operate properly;
- Routine maintenance of ESC measures will be performed to address concerns identified during the inspections to ensure they are continuing to operate properly; and
- In the event of a significant ESC failure that results in non-compliance with a permit/approval, all work will be immediately stopped, and all available resources will immediately focus on mitigating the failure(s) in an effort to minimize negative impacts.

5.6.3.3 Characterization of Potential Interactions Following Mitigation

Construction activities have the potential to result in changes to fish and fish habitat without the proper mitigation employed. Although there are no mapped watercourses in the Project area, some well sites may be within 30 m of a currently unmapped watercourse that has not yet been detected. Currently, no Project activities will occur within 30 m of mapped watercourses, and the construction of water crossings is not required for the Project.

The largest potential risk to fish and fish habitat lies in the potential for sediment migration through runoff into local surface water features from exposed soils created during Project activities. Mitigation of this potential impact will therefore will be a high priority and will follow mitigation measures

described above, as well as any special conditions outlined in the specific conditions of approval outlined in WAWA permits acquired for Project activity if an unmapped watercourse is discovered within 30 m of Project activity. Materials required for mitigation efforts will be obtained and installed before the occurrence of soil disturbance when possible and extra/replacement materials will be obtained and available for replacement in the event of failure (see **Section 7.3.2** for more information associated with failure of erosion and sediment control structures). Special attention will also be given to the local weather forecast, and inspection of mitigation measures will be inspected before any rain events are predicted to address maintenance issues that may be required following mitigation. Upon completion of construction activities, final grades will be established and permanently stabilized with perennial and annual plants (i.e., hydroseed application) to mitigate future sedimentation inputs caused by runoff. See **Section 5.5** for more detailed information on mitigation of impacts to surface water.

With the implementation and proper maintenance of the planned mitigation indicated above (including obtaining a WAWA permit for any activity carried out within 30 m of a watercourse), interactions between the Project and fish and fish habitat are not anticipated to be substantive and are limited to the local environment temporarily. Additionally, there are no mapped watercourses within 30 m of Project activity, and the occurrence of interactions with unmapped watercourses is likely very low. Without these vectors for the transport of sediment toward the previously discussed watercourses in the Project area and proposed mitigation measures, the potential risks to fish and fish habitat as a result of Project activity are not considered to be substantive.

As is the case with many projects in close proximity to environmentally sensitive areas, however, unforeseen accidents, malfunctions, and unplanned events (such as spills) have potential to impact local watercourses. Due to the nature of the crude oil in the Stoney Creek and ancillary well locations, however, its viscous, waxy consistency compared to refined petroleum products make spills less mobile and therefore easier to contain, should unplanned events occur. Environmental interactions that may arise through accidents, malfunctions, and unplanned events are outlined in **Section 7.3.**

5.6.4 Summary

Based on a high level assessment, the potential fish and fish habitat interactions associated with decommissioning the oil and gas wells are temporary in nature. Given the above, and in light of the Project as currently planned and planned mitigation to reduce or eliminate negative environmental effects, the potential interactions between the Project and fish and fish habitat are not expected to be substantive. This conclusion will be re-evaluated once site specific information is gathered prior to decommissioning of individual well sites.

5.7 Vegetation and Wetlands

The potential interactions between the Project and vegetation and wetlands, including vegetation species at risk (SAR), are assessed in this section.

5.7.1 Scope of VC

Wetlands are defined as land where the water table is at, near, or above the land's surface, or land which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activities adapted to the wet environment (NBDNRE-NBDELG 2002; NTNB 2018).

Vegetation includes terrestrial and aquatic plant species (both vascular and non-vascular, such as mosses) as well as lichens.

Vegetation and wetlands was selected as a VC because they are valued in their relationship with water resources, wildlife and wildlife habitat, and other biological and physical components addressed as VCs in this EIA Registration document. In addition, SAR (including plants) are protected under federal and provincial legislation (pursuant to the federal *Species at Risk Act* [SARA] and the New Brunswick *Species at Risk Act* [NB SARA]), and SAR and other rare plant species are considered valued, including species of conservation concern (SOCC).

In this EIA Registration document, we define "species at risk" (SAR) as those species that are listed as "Extirpated", "Endangered", "Threatened", or "Special Concern" on Schedule 1 of the federal SARA or on the NB SARA. We also define "species of conservation concern" (SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as regionally rare or endangered by the AC CDC (i.e., those species with AC CDC S-ranks of extremely rare [S1], rare [S2], or uncommon [S3]).

New Brunswick's wetlands have been given specific protection pursuant to the New Brunswick *Clean Environment Act* and the *Clean Water Act*. The New Brunswick Department of Environment and Local Government (NBDELG) requires a permit for any alteration within 30 m of the banks of a watercourse or the delineated boundaries of a wetland. Wetlands often support rare or uncommon vegetation species assemblages, and the New Brunswick Wetlands Conservation Policy and regulatory processes are guided towards the goal of achieving no net loss of wetland function (NBDNRE-NBDELG 2002). In addition, wetlands are widely recognized as providing a host of ecosystem functions and benefits including, but not limited to: filtering out pollutants and heavy metals, mitigating flood events, and providing habitat to many SAR and sensitive species in New Brunswick such as the wood turtle (*Glyptemys insculpta*), Least Bittern (*Ixobrychus exilis*), and showy lady's-slipper (*Cypripedium reginae*), among others (NTNB 2018). Wetland compensation for alterations of a delineated wetland is often required as a condition of a watercourse and wetland alteration (WAWA) permit when a net loss of wetland function occurs, usually at a ratio of two units of wetland to be restored for every unit of wetland altered.

This VC covers the vegetation component of terrestrial and aquatic habitats, as well as wetlands including their habitat functions. It does not cover the wildlife (including wildlife SAR) that may be using the habitats, which is addressed in **Section 5.8 (Wildlife and Wildlife Habitat)**, nor does it address aquatic wildlife (including fish and aquatic SAR) which is addressed in **Section 5.6 (Fish and Fish Habitat)**.

As mentioned in **Section 2.3.2**, a well site-specific decommissioning plan will be prepared and submitted to the New Brunswick Department of Natural Resources and Energy Development (NBDNRED) for review and approval for each well that is to be decommissioned. As part of the well decommissioning process, there will be a desktop review for environmental constraints as well as biophysical surveys completed for each well and a supplemental report detailing the results of these surveys submitted to NBDELG and NBDNRED prior to proceeding with the well decommissioning process. Because these reports will be prepared for each well, this analysis provides a high-level overview of the wetlands and vegetation in the area based on desktop information, to be detailed more specifically in future supplemental reports for each well site.

The local assessment area (LAA) for vegetation and wetlands is defined as the footprint of each well site/pad where ground disturbance will be taking place plus a 30 m buffer surrounding each well site, including a 30 m buffer around any wetlands present in proximity of the well sites.

5.7.2 Existing Conditions

The information regarding the presence and characterization of wetlands and the characterization of vegetation communities within the well sites and surrounding areas was derived from several sources including existing databases and secondary information sources (i.e., desktop analysis).

The methods used during the desktop analysis, followed by the results of these analyses, are presented below.

5.7.2.1 Desktop Analysis Methods

Dillon reviewed readily-available information from reputable sources. The information was reviewed to evaluate the potential for vegetation SOCC and/or vegetation SAR within the general area of the Project. Dillon completed a review of the following sources and data lists for the purpose of characterizing existing conditions for this EIA Registration document:

- A custom AC CDC report (AC CDC 2022, refer to **Appendix A**);
- A previous AC CDC report (AC CDC 2011);
- Various NBDNRED and NBDELG publications;
- The federal SAR registry;
- The provincial SAR registry;
- Publicly-available Geographic Information Systems (GIS) map layers and databases;
- Previous studies (including the 2011 EIA Registration document [Dillon 2011]);
- High-resolution aerial photography; and
- GeoNB wetland and watercourse mapping.

5.7.2.2 Desktop Analysis Results – Wetlands

As part of a previous EIA Registration completed by Dillon in 2011 (Dillon 2011), the Stoney Creek wellfield area was assessed for wetlands, which are detailed below. Note that no known field surveys have been conducted at the ancillary well locations south of Hillsborough, south of Memramcook, or at Monteagle. Well site-specific field work will be conducted a year in advance of a specific well site planned to be decommissioned, to supplement the information below.

Stoney Creek Wellfield

Shrub Wetland: There is a shrub wetland located near the centre of the Stoney Creek wellfield area, approximately 1.2 km west of site A-89 (i.e., the main production facility; **Figure 5.7.1**). The wetland receives groundwater and surface water influences from the surrounding terrain. It is estimated to be 11 hectares (ha) in area and is the headwater for the watercourse that drains northwest into Stoney Creek. The wetland is open with vegetation that is approximately 1 m or less in height. The ground vegetation consists of rhodora (*Rhododendron canadense*), spirea, grasses, sedges, sphagnum, raspberry, and some scattered birch (*Betula* sp.) and willow (*Salix* sp.). There is an irregular open water channel near the centre of the wetland. The ground surrounding this open water is saturated. Toward the edge of the wetland, the vegetation shows a distinct transition from wetland grasses to shrubs.

Forested Wetland: There is a forested wetland located approximately 750 m southwest of site A-89 (i.e., the main production facility; **Figure 5.7.1**). This wetland is approximately 10 ha in size and drains into unnamed tributary #3 flowing to the southwest of the Stoney Creek wellfield and drains into the shrub wetland west of the wellfield. The forested wetland has been harvested in the last 20 years. Growth in 2011 consisted of grasses, sedges, and mosses along with various tree species including spruce (*Picea sp.*), alders (*Alnus sp.*), maple (*Acer sp.*), and aspen (*Populus sp.*) (Dillon 2011).

Bog Wetland: There is a bog wetland located approximately 1.2 km west of site A-89 (i.e., the main production facility) and is approximately 1.7 ha in size (**Figure 5.7.1**). This wetland drains in a southwest direction towards Hiram Brook. Growth in 2011 consisted of various species of grasses, sedges and mosses along with various tree species (i.e., spruce, maple; Dillon 2011).

Ancillary Well Locations

Based on desktop analysis, there are no mapped wetlands of concern at the Hillsborough or Memramcook ancillary well locations which could interact with the well sites (**Figure 5.7.1**); however, there is a well site located within a wetland at the Monteagle ancillary well location (**Figure 5.7.2**; see photo in **Section 2.2.5**).

STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

MAPPED WETLANDS IN THE AREA OF THE STONEY CREEK WELLFIELD AND ANCILLARY WELL LOCATIONS SOUTH OF HILLSBOROUGH AND SOUTH OF MEMRAMCOOK

FIGURE 5.7.1

- Oil and Gas Well
- Local Road
- Highway
- Waterbody
- Wetland (NBHN - NB ERD)

SCALE 1:50,000

0 0.5 1 2 Kilometers

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
DATA PROVIDED BY: DILLON CONSULTING LIMITED, SNB & NB DEPARTMENT OF NATURAL RESOURCES

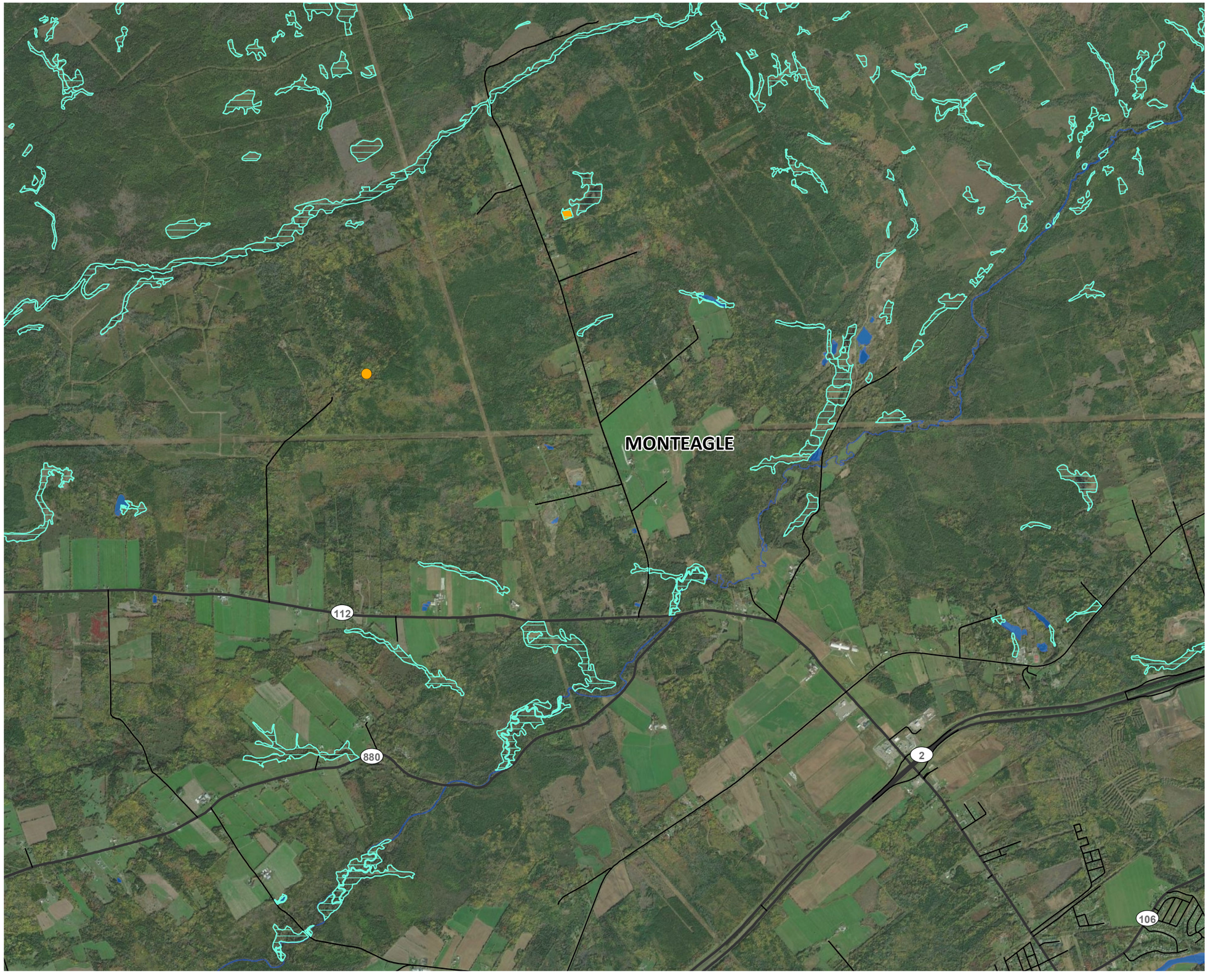
MAP CREATED BY: GM
MAP CHECKED BY: AS
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

DILLON CONSULTING

PROJECT: 21-2269

STATUS: FINAL

DATE: 2022-07-06



STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

MAPPED WETLANDS IN THE ANCILLARY WELL LOCATION AT MONTEAGLE
FIGURE 5.7.2

- Oil and Gas Well
- Local Road
- Highway
- Waterbody
- Wetland (NBHN - NB ERD)

SCALE 1:40,000
0 0.5 1 2 Kilometers

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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MAP CREATED BY: GM
MAP CHECKED BY: AS
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

DILLON CONSULTING

PROJECT: 21-2269
STATUS: FINAL
DATE: 2022-07-06

5.7.2.3 Desktop Analysis – Vegetation Communities

Based on a desktop analysis, the land within and around the well sites is predominantly forested with some residential areas. The residential properties are expected to contain ornamental tree, shrub, and herbaceous plant species.

A field reconnaissance of the Stoney Creek wellfield area was conducted in March 2006 to ground-truth the existing data and mapping and confirm/adjust vegetation community/habitat boundaries, as appropriate. A detailed vegetation survey was also conducted in June 2006 (**Appendix B**) and throughout the following five years while the facility was operating to identify dominant vegetation communities as well as investigate the potential to encounter species at risk as outlined by the AC CDC. (Note that well site-specific field surveys will also be completed prior to decommissioning individual well sites, with details of these surveys to be provided in supplemental reports.)

The area in the immediate vicinity of the two existing well pads at sites A-89 (main production facility) and I-88 (secondary production facility) (see **Section 2.2.2**) was historically forested but has been harvested within the last 18-20 years.

In 2006, the surrounding area encompassed within the 2 km radius of site A-89 consists of a mixture of hardwood and softwood tree species including: yellow birch (*Betula allegheniensis*), white birch (*Betula papyrifera*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*), sugar maple (*Acer saccharinum*), trembling aspen (*Populus tremuloides*), balsam fir (*Abies balsamea*), red spruce (*Picea rubens*), and Eastern hemlock (*Tsuga canadensis*), among others, with hardwood considered to be the dominant species.

In 2011, much of the area was a mixture of harvested and unharvested areas that were in various stages of regeneration. Much of the regeneration consisted of immature hardwood species, with an understory of softwood species. This developing vegetation is considered to be similar to what was on the site prior to harvesting. The unharvested zones are scattered throughout the area with some occurring along the watercourses or sections near the outer boundary of the 2 km radius (Dillon 2011).

Ground vegetation in 2006 was relatively consistent throughout the Stoney Creek wellfield area. Much of the vegetation noted for this area are species commonly found in forest habitats and included moss sp., *lycopodium* sp., ferns, grasses, raspberry (*Rubus pubescens*), blackberry (*Rubus allegheniensis*), and seedlings of both hardwood and softwood tree species. Leaf litter was abundant on the ground surface throughout the area, derived from the stocks of hardwood tree species within the 2 km radius. Refer to **Appendix B** for the 2006 Plant Survey Report, for a more complete list of vegetation species identified within the Stoney Creek wellfield during the 2006 field surveys (Dillon 2011).

In February 2022, a custom AC CDC report was obtained, listing historical observations of flora and fauna, including rare species, SOCC, and SAR within 13 km of the Stoney Creek wellfield (this includes the ancillary well locations south of Hillsborough and south of Memramcook, but not the Monteagle ancillary well location) (AC CDC 2022; refer to **Appendix A**).

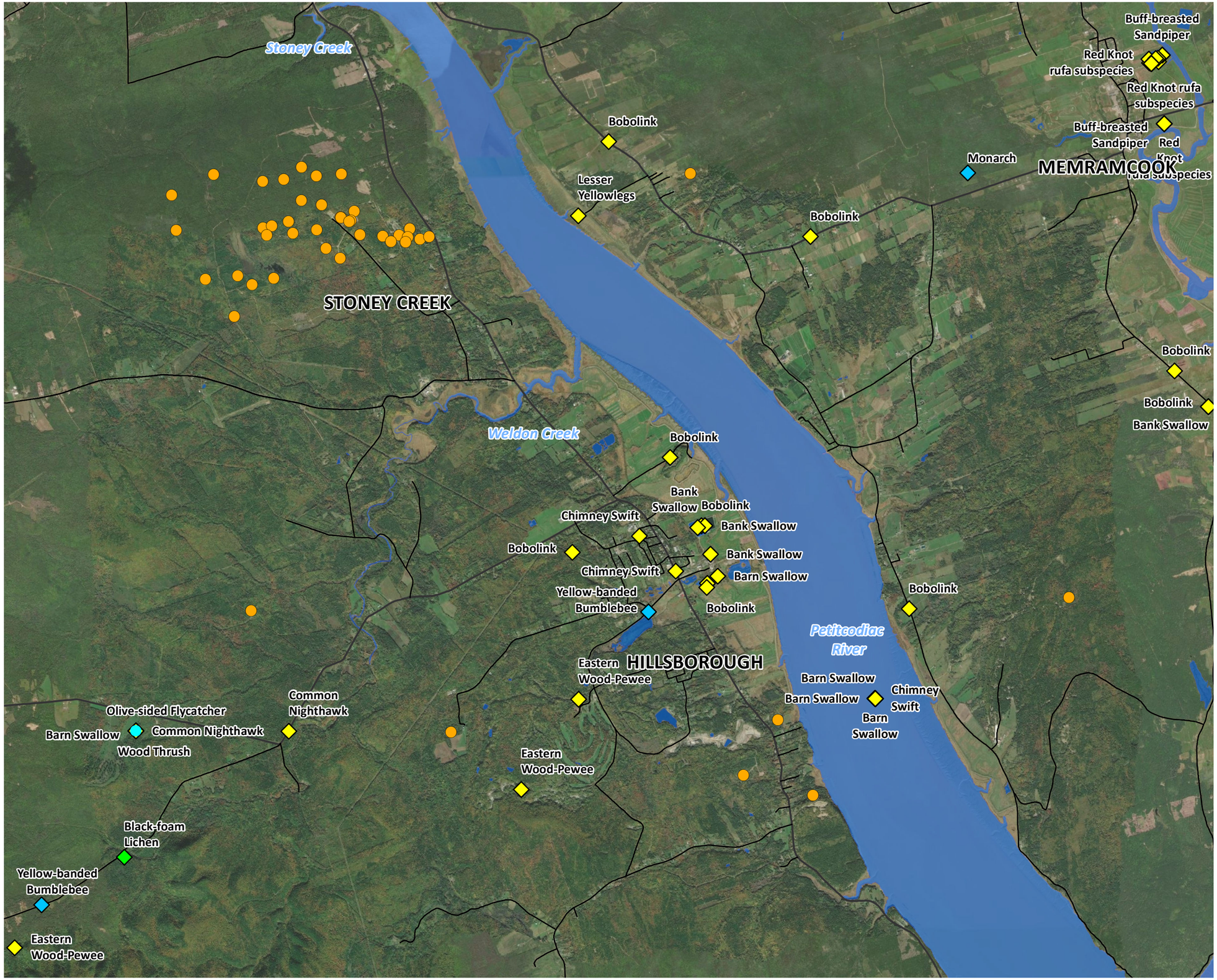
The AC CDC report (AC CDC 2022) included historical records of observations of one vascular plant SAR (black ash) within 13 km of the Stoney Creek wellfield. Black ash (*Fraxinus nigra*) is listed as Threatened by COSEWIC, but is not listed under SARA or NB SARA. In addition, the AC CDC report included historical observations of two non-vascular plant SAR. Eastern waterfan (*Peltigera hydrothyria*) and black-foam lichen (*Anzia colpodes*) are both listed as Threatened under SARA but neither are listed under NB SARA. **Table 5.7.1** and **Figure 5.7.3** outline the SAR and SOCC found in a 15 km radius from the Stoney Creek wellfield.

Table 5.7.1 Historical Observations of Vegetation SAR and SOCC within 13 Kilometres of the Stoney Creek Wellfield (AC CDC 2022)

Common Name	Scientific Name	COSEWIC Status	SARA Status	NB SARA Status	AC CDC S-Rank[1]
Non-Vascular Plants					
Eastern waterfan	*Peltigera hydrothyria*	Threatened	Threatened	-	S1
Black-foam lichen	*Anzia colpodes*	-	-	-	S1S2
A moss	*Thamnobryum alleghaniense*	-	-	-	S2
Membranous pelt lichen	*Peltigera membranacea*	-	-	-	S3
Shelter shingle lichen	*Vahliella leucophaea*	-	-	-	S3S4
Vascular Plants					
Black ash	*Fraxinus nigra*	Threatened	-	-	S4S5
Multi-rayed goldenrod	*Solidago multiradiata*	-	-	-	S1
Roland's sea-blite	*Suaeda rolandii*	-	-	-	S1
Fernald's serviceberry	*Amelanchier fernaldii*	-	-	-	S1
Entire-leaved mountain avens	*Dryas integrifolia*	-	-	-	S1
Blueberry willow	*Salix myrtillifolia*	-	-	-	S1
Soapberry	*Shepherdia canadensis*	-	-	-	S2
Small-flowered anemone	*Anemone parviflora*	-	-	-	S2
Eastern leatherwood	*Dirca palustris*	-	-	-	S2
Arching dewberry	*Rubus x recurvicaulis*	-	-	-	S2?
Bayberry willow	*Salix myricoides*	-	-	-	S2?
Pennsylvania blackberry	*Rubus pensilvanicus*	-	-	-	S2S3
Hyssop-leaved fleabane	*Erigeron hyssopifolius*	-	-	-	S3
Halberd-leaved tearthumb	*Persicaria arifolia*	-	-	-	S3
Sandbar willow	*Salix interior*	-	-	-	S3
River bulrush	*Bolboschoenus fluviatilis*	-	-	-	S3
Star duckweed	*Lemna trisulca*	-	-	-	S3
Dissected moonwort	*Sceptridium dissectum*	-	-	-	S3
Appalachian polypody	*Polypodium appalachianum*	-	-	-	S3
Creeping juniper	*Juniperus horizontalis*	-	-	-	S3S4
Spotted coralroot	*Corallorhiza maculata*	-	-	-	S3S4
Oakes pondweed	*Potamogeton oakesianus*	-	-	-	S3S4

Notes:

[1] AC CDC S-Ranks as follows- S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common, and apparently secure in province; S5: widespread, abundant, and demonstrably secure in province; S#S#: a numeric range rank used to indicate any range of uncertainty about the status of the species or community; B: breeding; N: nonbreeding; M: migrant; U: unrankable (AC CDC 2022).



STONEY CREEK OIL AND GAS WELLFIELD DECOMMISSIONING

MAPPED SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN IN THE AREA OF THE STONEY CREEK WELLFIELD AND ANCILLARY WELL LOCATIONS SOUTH OF HILLSBOROUGH AND SOUTH OF MEMRAMCOOK

FIGURE 5.7.3

- Invertebrate Species at Risk / Species of Conservation Concern
- Avian Species at Risk / Species of Conservation Concern
- Vegetation Species at Risk / Species of Conservation Concern
- Oil and Gas
- Local
- Highway
- Waterbody

SCALE 1:50,000

0 0.5 1 2 Kilometers

N W E S

MAP DRAWING INFORMATION:
CANVEC SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISS TOPO, OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
DATA PROVIDED BY: DILLON CONSULTING LIMITED, SNB & NB DEPARTMENT OF NATURAL RESOURCES

MAP CREATED BY: GM
MAP CHECKED BY: AS
MAP PROJECTION: NAD_1983_CSRS_New_Brunswick_Stereographic

DILLON CONSULTING

PROJECT: 21-2269
STATUS: FINAL
DATE: 2022-07-06

5.7.3 Assessment of Potential Interactions between the Project and Vegetation and Wetlands

The potential interactions between the Project and vegetation and wetlands are assessed below.

5.7.3.1 Potential Interactions

Based on a desktop review, the well at the Monteagle site that is located within a wetland will be the only place where physical work for decommissioning is required within a wetland. This will require a Watercourse and Wetland Alteration (WAWA) permit through the NBDELG. Any permanent wetland loss of wetland function associated with decommissioning this particular well may need compensation, in alignment with New Brunswick's Wetland Conservation Policy, which mandates a no net loss of wetland function associated with wetland alterations.

Though no work in wetlands is anticipated through the rest of the well sites, temporary interactions with wetlands are possible due to some well decommissioning or road maintenance activities being conducted within 30 m of a wetland. As such, there is potential for runoff from the well sites and roads to reach waterways if appropriate mitigation measures are not in place. Project activities also have the potential to alter natural drainage patterns and increase erosion into the watercourses and wetlands in the Stoney Creek wellfield. Activities conducted within 30 m of a wetland will require a WAWA permit.

During well decommissioning, it may be necessary to remove some immature vegetation along roadsides and around the well sites in order to access the wells with the service rig. Some limited grading and widening of access roads may also be required in order to access the well sites.

5.7.3.2 Mitigation

During the well decommissioning, surface reclamation, and site rehabilitation process, the following mitigation measures for vegetation and wetlands will be applied:

- No work is to be conducted within 30 m of a wetland without first obtaining and complying with a WAWA permit;
- Soil will not be stockpiled within 30 m of a wetland;
- All chemicals and petroleum products will be managed in accordance with manufacturer specifications and stored more than 30 m from a wetland;
- Refueling equipment and vehicles will be conducted more than 30 m from a wetland and where possible over an impermeable surface;
- All waste materials will be secured and/or stabilized until they can be transported off-site for disposal to prevent them from entering any aquatic habitat;
- Ground disturbance work will not be completed during significant storm events;
- The source of any new fill material will be approved and the material shall be inspected prior to use;

- Proper erosion and sediment control measures will be installed and checked regularly to confirm they are continuing to operate properly to minimize potential effects to wetlands;
- The area of disturbance of the Project will be limited to that which is absolutely necessary to achieve the Project purpose;
- Natural vegetation will be preserved when possible to maintain habitat, especially in riparian areas;
- Tree clearing and grubbing should be limited to that which is necessary to achieve the Project purpose; and
- During Project activities, efforts will be made to avoid the area where SOCC or SAR) is known to be present, or other management implemented upon discussion with applicable regulatory authorities.

5.7.3.3 Characterization of Potential Interactions Following Mitigation

Though there is little ground disturbance expected to accomplish the Project activities, aside from the well in Monteagle that is located within a wetland, the Project will be developed such that the area of disturbance within the individual well sites is minimized to that which is required to meet the Project objectives and avoids interactions with wetlands to the extent possible.

Based on the species known to be in the area, and the results of the vegetation surveys in 2006-2011, any trees or shrubs that need to be removed or brushed should not be SAR. Buffers will be maintained, where possible, around wetlands or known areas of plant SAR/SOCC, if identified, to minimize the loss of valued vegetation communities. If buffers cannot be maintained, additional mitigation will be developed in consultation with applicable regulatory authorities. In addition, updated biophysical surveys will be completed for each well site-specific decommissioning plan.

It is not anticipated that the Project activities will affect the black ash, Eastern waterfan, black-foam lichen, or other SOCC plants identified at or near the well sites, given that their presence is not known to be located near any wells that are to be decommissioned, subject to confirmation by the planned field surveys at each well site.

Applicable authorization (i.e., WAWA permits) will be secured with NBDELG prior to undertaking activities within 30 m of a wetland at any of the well sites. For heavy equipment mobilizing to the site, contractors will be required to properly clean equipment prior to mobilizing to the site so as to avoid the transfer of exotic or invasive plant species to the area. Given current knowledge as informed by the desktop analysis and previous vegetation surveys, the loss of SAR/SOCC vegetation is not anticipated as a direct result of the Project with the appropriate implementation of the mitigation measures presented.

Preventative erosion and sediment control measures during Project activities, especially during any road construction/improvement, are expected to prevent any sedimentation effects that could negatively affect vegetation communities and wetlands.

5.7.4 Summary

Based on the above, with planned mitigation, authorization, and properly installed environmental protection measures, and given the existing context of the well sites, which already have roads established and no SAR or SOCC that cannot be avoided, the potential interactions between the Project and vegetation and wetlands are not expected to be substantive.

Although there are large wetlands in the Stoney Creek wellfield area, roads are already established in the area to the wells, and the wells are already established.

Lastly, adaptive management measures will be implemented as necessary to address any changed to valued vegetation communities (e.g., SAR or SOCC) as they arise.

5.8 Wildlife and Wildlife Habitat

The potential interactions between the Project and wildlife (including species at risk and birds) and their habitats are assessed in this section.

5.8.1 Scope of VC

Wildlife and wildlife habitat includes wildlife (fauna) and the habitats that support wildlife species. This valued component (VC) is focussed on birds, mammals (including bats), invertebrates, and herptiles (i.e., reptiles and amphibians) within terrestrial components of their lifecycle, as well as the habitats that support them. Wildlife and wildlife habitat has been selected as a VC because, in general, the environment around the well sites, including the Petitcodiac River and Stoney Creek and its tributaries, support terrestrial wildlife and are important to the public for the biodiversity they support.

There is the potential for interactions between wildlife, its habitat, and proposed Project activities. Particular focus is placed on wildlife species at risk (SAR) and species of conservation concern (SOCC) as identified by provincial and federal regulatory agencies. SAR/SOCC are often susceptible to changes in the environment and are therefore useful indicators of ecosystem health and regional biodiversity.

Both provincial and federal legislation provides protection to designated bird, mammal, herptile, and other SAR. SAR are protected under the federal *Species at Risk Act* (SARA) and the New Brunswick *Species at Risk Act* (NB SARA). In addition, most bird species, specifically, are protected under the *Migratory Birds Convention Act* (MBCA).

In this EIA Registration document, we define “species at risk” (SAR) as those species that are listed as “Extirpated”, “Endangered”, “Threatened”, or “Special Concern” on Schedule 1 of the federal SARA or on the NB SARA. We also define “species of conservation concern” (SOCC) as those species that are not SAR but are listed in other parts of SARA, NB SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or as regionally rare or endangered by the Atlantic Canada Conservation Data Centre (AC CDC) (i.e., those species with AC CDC S-ranks of extremely rare [S1], rare [S2], or uncommon [S3]).

The wildlife and wildlife habitat VC has connections to the vegetation and wetlands VC (**Section 5.7**) because of its relationship with vegetation, hydrology, landforms, and soil components that are key components of wildlife habitat. Vegetation communities and wetlands (and plant SAR) which comprise habitat are discussed in **Section 5.7**. Aquatic wildlife/fish are considered in **Section 5.6**.

As mentioned in **Section 2.3.2**, a well site-specific decommissioning plan will be prepared and submitted to the New Brunswick Department of Natural Resources and Energy Development (NBDNRED) for review and approval for each well that is to be decommissioned. As part of the well decommissioning process, there will be a desktop review for environmental constraints as well as biophysical surveys submitted to the New Brunswick Department of Environment and Local Government (NBDELG) and NBDNRED prior to proceeding with the well decommissioning process. Because these reports will be prepared for each well, this analysis provides a high-level overview of the wildlife and wildlife habitat in the area based on desktop information, to be detailed more specifically in future supplemental reports for each well site.

The local assessment area (LAA) for wildlife and wildlife habitat is defined as the footprint of each well site/pad where ground disturbance will be taking place, plus a 100 m buffer surrounding each well site, in recognition of the potential for sensory disturbance to wildlife as a result of Project-related activities.

5.8.2 Existing Conditions

The information regarding the presence and characterization of wildlife and wildlife habitat in the area of the Stoney Creek Wellfield and the three ancillary well locations was derived from several desktop information sources including existing databases and secondary information sources, including an Atlantic Canada Conservation Data Centre (AC CDC) report, and supplemented by information from field studies conducted in 2006 as well as information from a previous EIA Registration document for the Stoney Creek wellfield (Dillon 2011).

5.8.2.1 Desktop Analysis Methods and Data Sources

Information regarding the use of the well sites and surrounding area by wildlife and presence of wildlife habitat was derived from several sources including existing databases and secondary information sources. To provide information on potential occurrences of rare and endangered wildlife, and unique or sensitive wildlife habitats potentially existing within or near well sites, a review of the following existing data and information sources was conducted:

- Previous background information from other similar assessments completed in the general area (e.g., 2006 Biophysical Surveys);
- Listed species by COSEWIC;
- Listed species under the federal SARA;
- Listed species under NB SARA; and
- Ranked species by the NBDNRED.

In addition, a site-specific AC CDC report (AC CDC 2022) was obtained (**Appendix A**). The report provided recorded historical observations of SAR/SOCC flora and fauna species, as well as identified environmentally sensitive or managed areas within a 13 kilometre radius of the Stoney Creek wellfield. The 13 km radius from the Stoney Creek wellfield includes the ancillary well locations south of Hillsborough and south of Memramcook, but does not include the Monteagle ancillary well locations. The AC CDC report also identifies wildlife SOCC identified as “extremely rare” (S1), “rare” (S2), or “uncommon” (S3).

Other available background information sources and mapping reviewed to identify and assess wildlife and wildlife habitat presence at and near the well sites included:

- Ecological Reserves in the Maritimes;
- Environmentally Sensitive Areas (ESAs) database;
- Atlas of Breeding Birds of the Maritime Provinces (MBBA);
- Important Bird Areas (IBAs) of Canada;
- Federally-designated migratory bird sanctuaries;
- Provincially-identified deer wintering areas (DWAs); and
- Identified Protected Natural Areas and Wildlife Management Zones (WMZ).

5.8.2.2 Desktop Analysis Results – Resident and Migratory Birds

The vast majority of bird species found in New Brunswick are migratory and either breed in the province during the summer months, or pass through it during the spring and fall migratory periods. Jurisdiction for many migratory birds is federal, since migratory birds cross both provincial and international boundaries. The *Migratory Birds Convention Act* (MBCA) is the federal law which protects migratory birds in Canada (with similar legislation in the United States). The Act prohibits killing, injuring, or harassing migratory birds, their nests, or their young. Migratory birds that are protected under the MBCA in Canada, and that are relevant to the Project include:

- Waterfowl (e.g., ducks and geese);
- Rails (e.g., coots, gallinules, sora, etc.);
- Shorebirds (e.g., plovers and sandpipers); and
- Songbirds (e.g., thrushes and warblers).

Furthermore, species listed pursuant to the federal SARA or the NB SARA are afforded further protection as harm, the destruction of their nest, eggs, or young is prohibited.

Birds not addressed under federal jurisdiction include grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays, and kingfishers. Most birds not included in this list are protected under provincial laws, most notably the New Brunswick *Fish and Wildlife Act*. The New Brunswick *Fish and Wildlife Act* protects all fish and wildlife species (including all vertebrate animals or

birds) from angling, hunting, trapping and other forms of intentional take, except under the authority of permits or licences. The Act also prohibits the disturbance, gathering or collection of the nests or eggs of any bird species, except under the authority of a permit. Under Section 4 of the Act, some wildlife and bird species (including American Crow [*Orvus brachyrhynchos*], Double-crested Cormorant [*Phalacrocorax auritus*], and European Starling [*Sturnus vulgaris*]) are considered a nuisance animal, and may be taken if they present a risk of injury to landowners or a risk of property damage, but this requires a separate permit.

NBDNRED's *General Status of Wild Species* (NBDNRED 2021) reports that there are 407 extant bird species known to occur in New Brunswick, of which 143 are considered accidental (NBDNRED 2021). Of the species that regularly occur in the province during at least part of their lifecycle, 12 species are listed as "At Risk", 12 are listed as "May be At Risk", and 45 are considered "Sensitive".

Maritimes Breeding Bird Atlas

The Maritime Breeding Bird Atlas (MBBA) database (Stewart et al. 2015) provides information on the presence of breeding bird species in counts conducted between 2006 and 2010. Within the MBBA Second Atlas, the well sites lie within Region #13, Petitcodiac.

The Stoney Creek wellfield falls in Square #20LR69. During the most recent MBBA period of 2006-2010, a total of 86 species were recorded within this square. Of these species, 24 were confirmed as breeding, 21 were probable breeders, and 41 were possible breeders. There were seven SAR detected during the most recent MBBA period in this square. These species included: Bald Eagle (*Haliaeetus leucocephalus*), Chimney Swift (*Chaetura pelagica*), Olive-sided Flycatcher (*Contopus cooperi*), Barn Swallow (*Hirundo rustica*), Eastern Wood-pewee (*Contopus virens*), Bank Swallow (Riparia riparia), and Bobolink (*Dolichonyx oryzivorus*).

The ancillary well locations south of Memramcook and south of Hillsborough fall within Square #20LR78. During the MBBA period of 2006-2010, a total of 100 species were recorded within this square. Of these species, 36 were confirmed as breeding, 23 were probable breeders, and 41 were possible breeders. There were 16 SAR detected during the most recent MBBA period in this square, including:

- Bald Eagle;
- Piping Plover (*Charadrius melodus melodus*);
- Short-eared Owl (*Asio flammeus*);
- Common Nighthawk (*Chordeiles minor*);
- Eastern Whip-poor-will (*Antrostomus vociferus*);
- Chimney Swift;
- Peregrine Falcon (*Falco peregrinus anatum/tundrius*);
- Olive-sided Flycatcher;
- Eastern Wood-pewee;
- Bank Swallow;
- Barn Swallow;
- Bicknell's Thrush (*Catharus bicknelli*);
- Wood Thrush (*Hylocichla mustelina*);
- Canada Warbler (*Wilsonia Canadensis*);
- Bobolink; and
- Eastern Meadowlark (*Sturnella magna*).

The Monteagle ancillary well location falls within Square #20LS30. During the MBBA period of 2006-2010, a total of 90 species were recorded within this square. Of these species, 37 were confirmed as breeding, 26 were probable breeders, and 27 were possible breeders. There were 15 SAR detected during the most recent MBBA period in this square, which are the same as listed above, with the exception of Peregrine Falcon.

Important Bird Areas (IBAs)

As reported by Bird Studies Canada (BSC), there are two IBAs in the vicinity of the Stoney Creek wellfield and the three ancillary well locations: The Shepody Bay West IBA in the Bay of Fundy (NB009) and the Dorchester Cape and Grand Anse IBA in the Bay of Fundy (NB038) (BSC 2020a; 2020b). The habitat in this area consists of intertidal mud flats, sand and gravel beaches, and a rocky cape in the Dorchester IBA (BSC 2020a; 2020b). With the high tides in the Bay of Fundy, it creates a large, open area for shorebirds to forage for invertebrates, in particular the mud shrimp (*Corophium volutator*). These areas are particularly important for shorebirds, including Semipalmated Sandpipers (*Calidris pusilla*) during their fall migration, Dunlin (*Calidris alpine*), and significant numbers of Semipalmated Plovers (*Charadrius semipalmatus*). Other species that use these areas for an important stopover during migration include Short-billed Dowitchers (*Limnodromus griseus*), Least Sandpipers (*Calidris minutilla*), White-rumped Sandpipers (*Calidris fuscicollis*), and Red Knots (*Calidris canutus rufa*), which are listed as Endangered pursuant to SARA, NB SARA, and COSEWIC (BSC 2020a; 2020b).

Breeding Bird Surveys (2006)

Environment and Climate Change Canada (ECCC), through its Canadian Wildlife Service (CWS), provides general avoidance information for migratory birds, including regional nesting periods during which most migratory birds covered under the MBCA are likely to breed.
The Stoney Creek wellfield and all three ancillary well locations are located in Nesting Zone C3, where most migratory birds breed from mid-April until late August each year (specifically April 12 - August 28) (ECCC 2020b); however, it is noted that some avian species nest outside of this period, including corvids, crossbills, owls, and waxwings.

A detailed breeding bird survey was conducted from June 29-30, 2006 in the Stoney Creek wellfield area (Dillon 2011). Approximately 18 point counts were conducted in the wellfield following a protocol used by ornithologists for the Maritimes Breeding Bird Atlas Project. At each of the 18 points, species observed or heard during a 5-minute period were recorded. Refer to **Appendix C** for the detailed 2006 Avian Survey Report. Note that no known field surveys have been conducted at ancillary well locations south of Hillsborough, south of Memramcook, or Monteagle. Well site-specific field work will be conducted a year in advance of a specific well site planned to be decommissioned, to supplement the information below.

During the survey in 2006, a Common Nighthawk (*Chordeiles minor*) was reported northwest of site A-89 (i.e., the main production facility) and a Canada Warbler (*Cardellina canadensis*) reported at various

locations along Dawson Road to the west of site A-89 (refer to **Section 2.2.2** and **Figure 2.2.1**) in addition to an Eastern Wood-pewee. These species were also noted in the 2022 AC CDC report (AC CDC 2022).

Common Nighthawks prefer open and partially open habitats for nesting. This includes areas such as sand dunes and beaches, logged and burned-over areas, clearings, rocky areas, prairies, pastures, and bogs (COSEWIC 2018). The species is also known to nest in settled areas that are open (COSEWIC 2018). Only one individual species was noted northwest of site A-89 (i.e., point count #6), which consisted at the time (2006) of recent clear-cut and minimal regeneration. Given that this species was noted in 2006, the habitat has changed and some regeneration has occurred which may have altered the Nighthawk's use of this area.

Canada Warblers are most commonly found breeding in wet, mixed deciduous-coniferous forests with a well-developed shrub layer (COSEWIC 2020), but the species also prefers riparian habitats, and those stands that are in the regeneration phase following a disturbance (COSEWIC 2020). This species was noted within a mature forest mixed in with cleared areas. During the 2006 survey, seven individuals at five stops (i.e., point counts #7, 9, 11, 12, and 17) were noted at various locations along Beech Hill Road. There was evidence at the time of the 2006 avian survey that some of these individuals were noted as breeding in the area.

The mid-canopy layer of clearings, and edges of deciduous and mixed forests is the preferred habitat of the Eastern Wood-pewee in Canada (COSEWIC 2012). It is most abundance in intermediate-aged forests (COSEWIC 2012). Due to harvesting history in the Project area, suitable Eastern Wood-pewee habitat is likely found at the Stoney Creek wellfield. During the 2006 avian survey, one Eastern Wood-pewee was found at point count #10.

During the 2006 field survey, there were visual sightings of Ruffed Grouse and Hairy Woodpecker within the northwestern sections of the Stoney Creek wellfield area. A dead bird was also noted in the northeast portion of the Stoney Creek wellfield area, near the gravel pit and was located on an access road that travels alongside the gravel pit. The carcass was in poor condition which made identification difficult. The bird had light-coloured plumage and feathered legs. Consultation with NBDNRED biologists suggested that the carcass may have been that of an immature Barred Owl.

A review of the AC CDC data as compiled in a site-specific report (AC CDC 2022) indicated that there were 17 avian SAR historically observed within 13 km of the Stoney Creek wellfield (including the ancillary well locations south of Hillsborough and south of Memramcook). In addition, there were 51 avian SOCC historically observed. **Table 5.8.1** shows the legal status of the 17 SAR identified in the 2022 AC CDC report, and **Figure 5.7.3** shows the location of avian SAR in relation to the well sites. For the full list of avian SOCC, refer to **Section 4.2** of the AC CDC report in **Appendix A**.

Table 5.8.1 Avian Species at Risk Historically Observed Within 13 Kilometres of the Stoney Creek Wellfield and Their Legal Status (AC CDC 2022)

Common Name	Scientific Name	COSEWIC Status	SARA Status	NB SARA Status	AC CDC S-Rank[1]
Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened	Threatened	S1B, S1M
Wood Thrush	*Hylocichla mustelina*	Threatened	Threatened	Threatened	S1S2B, S1S2M
Short-eared Owl	*Asio flammeus*	Threatened	Special Concern	Special Concern	S2B, S2M
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	Threatened	S2S3B, S2M
Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	Threatened	S3B, S3M
Olive-Sided Flycatcher	*Contopus cooperi*	Special Concern	Threatened	Threatened	S3B, S3M
Canada Warbler	*Cardellina canadensis*	Special Concern	Threatened	Threatened	S3B, S3M
Evening Grosbeak	*Coccothraustes vespertinus*	Special Concern	Special Concern	-	S3B, S3S4N, SUM
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened	Threatened	S3B, S4M
Red-necked phalarope	*Phalaropus lobatus*	Special Concern	Special Concern	-	S3M
Eastern wood-pewee	*Contopus virens*	Special Concern	Special Concern	Special Concern	S4B, S4M
Buff-breasted sandpiper	*Calidris subruficollis*	Special Concern	Special Concern	-	SNA
Red Knot rufa ssp.	*Calidris canutus rufa*	Endangered, Special Concern	Endangered	Endangered	S2M
Bald Eagle	*Haliaeetus leucocephalus*	Not at Risk	-	Endangered	S4
Peregrine Falcon	*Falco peregrinus pop. 1*	Not at Risk	Special Concern	Endangered	S1B, S3M
Barn Swallow	*Hirundo rustica*	Special Concern	Threatened	Threatened	S2B, S2M
Bank Swallow	*Riparia*	Threatened	Threatened	Pending	S2S3B, S2S3M

Notes:
[1] AC CDC S-Ranks as follows- S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common, and apparently secure in province; S5: widespread, abundant, and demonstrably secure in province; S#S#: a numeric range rank used to indicate any range of uncertainty about the status of the species or community; B: breeding; N: nonbreeding; M: migrant; U: unrankable (AC CDC 2022).

5.8.2.3 Desktop Analysis Results – Mammals (Including Bats)

NBDNRED's *General Status of Wild Species* (NBDNRED 2021) reports that there are 52 species of mammals known to occur within New Brunswick, and an additional seven which are extinct, extirpated, or unverified. Of these 52 species, Canada lynx (*Lynx canadensis*) is listed as Endangered under NB SARA, and three bat species are listed as Endangered under Schedule 1 of SARA, including the little brown bat (little myotis; *Myotis lucifugus*), Northern long-eared bat (Northern myotis; *Myotis septentrionalis*), and Eastern pipistrelle (tri-coloured bat; *Perimyotis subflavus*).

The AC CDC (2022) report indicated that there was a historical record of Eastern cougar (*Puma concolor couguar*) within 10 km of the Stoney Creek wellfield. The Eastern cougar is not listed under SARA or NB SARA, and is listed as Data Deficient under COSEWIC. According to COSEWIC (2021), the species was first designated as Endangered in 1978, and was reassessed in 1998 when it was moved to the Data Deficient category. In spite of many sightings in Eastern Canada in the past two decades, none are confirmed, and there are not enough data to evaluate the taxonomy of the species. Many of these sightings may be of escaped pets, and there may never have existed an Eastern subspecies of cougar (COSEWIC 2021). As of 2018, Maine moved Eastern Cougar from Endangered to Extirpated (USFWS 2018). According to the U.S. Fish and Wildlife Service (2018), the subspecies likely disappeared at least 70 years ago. Because the species in unconfirmed in New Brunswick, and due to the rural residential nature of the area, it is highly unlikely that the species would be present at any of the well sites.

According to the AC CDC (2022), two additional mammal SAR species have the potential to occur at the well sites. There have been three historical sightings of Canada lynx within 11 km of the Stoney Creek wellfield (AC CDC 2022). The Canada lynx (*Lynx canadensis*) is not listed on Schedule 1 of SARA; however, it is listed regionally Endangered under NB SARA and listed by the AC CDC as S1 (extremely rare) in New Brunswick. The Canada lynx is commonly associated with the boreal forest. It usually chooses areas that are beneficial to snowshoe hare (*Lepus americanus*), usually in forests where there is dense vegetation and shrubbery as lynx populations are heavily influenced by populations of snowshoe hare. Snowshoe hare are Canada lynx' primary food source, so as hare populations fluctuate, so do lynx populations (NBDNRED 2022). In the vicinity of the Stoney Creek wellfield, there are some pockets of habitat that would support the Canada lynx.

According to the AC CDC report (2022), bat hibernacula or bat species have historically been observed within 13 km of the Stoney Creek wellfield; however, bats are location sensitive species, so location data were not provided.

General wildlife observations were made at the Stoney Creek wellfield area during the field reconnaissance that was conducted from March 2006 to July 2006 to assess the type and quality of wildlife habitat in the general study area and the specific location of the main sites: A-89 (i.e., the main production facility)and I-88 (i.e., the secondary production facility). General information on wildlife species utilizing the Stoney Creek wellfield area was gathered through observations of evidence of occurrence (e.g., visual sighting, vocalization, tracks, scat, distinctive dens/nests, and feeding activities). Visual sightings, tracks, droppings (scat) and/or feeding activities were evident from moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), Eastern coyote (*Canis latrans*), snowshoe hare, amphibians, and smaller rodents such as mice, voles and chipmunks—species that are generally common in New Brunswick.

5.8.2.4 Desktop Analysis Results – Terrestrial Invertebrates

Lists of butterfly and odonate (dragonfly and damselfly) species in New Brunswick are maintained in the NBDNRED's *General Status of Wild Species* database (NBDNRED 2021). The database currently lists 80 butterfly and 131 odonate species known to occur in the province. Of these species, one (Maritime

Ringlet, Coenonympha *nipisiquit*, a butterfly) is an SAR listed as Endangered under SARA and NB SARA, 15 (4 butterflies and 11 odonates) are considered May be At Risk SOCCs, and 13 (one butterfly and 12 odonates) are considered Sensitive (neither SAR nor SOCC). The Cobblestone Tiger Beetle (*Cicindela marginipennis*), Maritime Ringlet, and Skillet Clubtail (*Gomphus ventricosus*, an odonate) are SAR that are listed as Endangered under SARA, while the Monarch Butterfly (*Danaus plexippus*) and Pygmy Snaketail (*Ophiogomphus howei*, an odonate) are considered to be SAR as they are listed as Special Concern under Schedule 1 of SARA.

The Skillet Clubtail, Cobblestone Tiger Beetle, and the Maritime Ringlet have very limited populations in New Brunswick that are not located in the immediate vicinity of the Petitcodiac River. The Cobblestone Tiger Beetle is endemic to only the Saint John River system and Grand Lake (Environment Canada 2013). The known distribution of the Saint John River populations are all located above the Mactaquac Dam, so they are not in the vicinity of the Stoney Creek wellfield or the three ancillary well locations (Environment Canada 2013). Similarly, the Skillet Clubtail is only known in the Maritimes from records along the Saint John River below the Mactaquac Dam so they are not expected to be found in the area of the Stoney Creek wellfield (ECCC 2021). Lastly, the Maritime Ringlet is restricted to areas directly around the Chaleur Bay in Northern New Brunswick and portions of the Gaspé region of Québec (COSEWIC 2009) and due to the Project's distance from the Chaleur Bay (approximately 215 km south), it is not expected to be present during decommissioning work.

A review of the AC CDC report (2022) indicated that three terrestrial invertebrate SAR have historically been observed in the Stoney Creek wellfield area and ancillary locations south of Hillsborough and south of Memramcook (**Table 5.8.2**; **Figure 5.7.3**).

Table 5.8.2 Terrestrial Invertebrates Historically Observed Within 13 Kilometres of the Stoney Creek Wellfield and Their Legal Status (AC CDC 2022)

Common Name	Scientific Name	COSEWIC Status	SARA Status	NB SARA Status	AC CDC S-Rank[1]
Gypsy Cuckoo bumblebee	*Bombus (Psythryus) bohemicus*	Endangered	Endangered	-	S1
Monarch	*Danaus plexippus*	Endangered	Special Concern	Special Concern	S3B, S3M
Yellow-banded bumblebee	*Bombus terricola*	Special Concern	Special Concern	-	S3?

Notes:

[1] AC CDC S-Ranks as follows- S1: extremely rare in province; S2: rare in province; S3: uncommon in province; S4: widespread, common, and apparently secure in province; S5: widespread, abundant, and demonstrably secure in province; S#S#: a numeric range rank used to indicate any range of uncertainty about the status of the species or community; B: breeding; N: nonbreeding; M: migrant; U: unrankable (AC CDC 2022).

5.8.2.5 Desktop Analysis Results – Herptiles

NBDNRED's *General Status of Wild Species* database (NBDNRED 2021) reports that there are seven reptile and 16 amphibian species known to occur in New Brunswick. Of these species, snapping turtle (*Chelydra serpentina*) is listed as Special Concern under NB SARA and SARA, and wood turtle (*Glyptemys insculpta*) is listed as Threatened under SARA and NB SARA. Eastern painted turtle is also listed as Special Concern under Schedule 1 of SARA, but is not listed provincially.

Wood turtles are generally associated with watercourses and their riparian habitats in forested area (ECCC 2020c). Individuals nest on sandy and gravelly riverbanks (ECCC 2020c) but will also make use of other features such as sand pits and road embankments near watercourses that provide a sandy or gravelly substrate. Snapping turtles generally inhabit ponds, sloughs, streams, rivers, and shallow bays that are characterized by slow moving water, aquatic vegetation, and soft, muddy bottoms (COSEWIC 2008). Both wood turtles and snapping turtles are known to overwinter in deep pools in larger rivers and deep ponds (ECCC 2020c; COSEWIC 2008).

According to the AC CDC report (2022), there have been historical sightings of wood turtle within 13 km of the Stoney Creek wellfield. Because these species are location sensitive, AC CDC was not able to provide the location of theses sightings.

It was also noted during the 2006 habitat surveys that Stoney Creek (located approximately 1 km north) and Hiram Brook (located approximately 1.5 km west) from site A-89 may have the potential to support wood turtle habitat. During the field survey, no wood turtles were noted in the Stoney Creek wellfield. Snapping turtles and Eastern painted turtles were not noted during field surveys or in the AC CDC report. If there are any turtles observed during the Project, a mitigation plan will be developed.

5.8.2.6 Desktop Analysis Results – Environmentally Sensitive Areas

The 2022 AC CDC report indicated that there are 32 managed areas within 13 km of the Stoney Creek wellfield (which includes the ancillary well locations south of Memramcook and south of Hillsborough), as well as 11 biologically significant sites (see **Map 3** in **Appendix A**). There are no provincially identified deer wintering areas (DWAs) or Protected Natural Areas (PNAs) at any of the well sites.

5.8.3 Assessment of Potential Interactions between the Project and Wildlife and Wildlife Habitat

As part of the desktop assessment, the habitat requirements of wildlife species identified as potentially occurring within and/or near the well sites were compared to the range of environmental conditions within the surrounding area to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within and near the well sites was determined through an interpretation of aerial photography, topographic, and geological mapping. In instances where appropriate habitat was present at a well site, mitigation was identified, and potential impacts were assessed.

5.8.3.1 Potential Interactions

Project activities such as heavy equipment operation have the potential to interact with wildlife and wildlife habitat. Potential interactions with wildlife or their habitats include direct mortality, habitat loss and fragmentation, and sensory disturbance. These potential interactions are discussed in this section.

Migratory Birds

The primary possible interactions with birds due to the Project include habitat loss, destruction of nests, direct mortality due to collision, and sensory disturbance. The Project may interact with birds and bird habitat in the following ways:

- Direct mortality via collision with equipment and materials during the Project activities;
- Activities may destroy or alter habitat for bird SAR or SOCC or migratory bird habitat;
- Sensory disturbances from Project activities may deter birds from migrating into and using the well sites; and
- Sensory disturbances from Project activities may result in the abandonment of nests or increased rates of predation and exposure of hatchings and eggs during temporary abandonment.

Mammals

The Project may interact with mammals and their habitat in the following ways:

- Brushing or removing vegetation, decommissioning of the wells with the service rig, and moving around the service rig could temporarily cause loss of immature vegetation that provide habitat for wildlife;
- Disturbance from vehicles and heavy equipment may cause wildlife avoidance or disruption of wildlife activities (such as breeding and/or feeding);
- Sensory disturbance from noise, vibration, dust, and fuel emissions may cause a disruption to wildlife species;
- Mobile equipment used during Project activities may cause direct injury or death of wildlife, particularly to small wildlife such as rodents and shrews, through collisions or destruction of dens and food sources;
- Wildlife could be attracted to the site for food or food scraps; and
- Medium and large-sized mammals are unlikely to suffer direct mortality from Project activities as they would likely avoid the area in response to human presence and noise; however, such avoidance or behaviour could result in changes to normal movements, migration patterns, and other life cycle processes.

Herptiles

The Project may interact with herptiles and their habitat through direct mortality via collision with various equipment required around the site at different phases of the Project. The Stoney Creek wellfield is surrounded by wood turtle habitat and the main threat to this endangered species is vehicle collision. In addition, any road improvement or enhancement work that is required near streams could affect wood turtle habitat.

5.8.3.2 Mitigation

The following mitigation measures are planned to reduce environmental effects on wildlife and wildlife habitat:

- The size of the footprint at all phases of work will be limited to that necessary to accomplish the Project purpose;
- Vegetation will be retained where possible to maintain wildlife habitat;
- Activities that may harm or harass migratory birds will be scheduled to the extent possible outside of the normal migratory bird breeding season (mid-April to mid-August) to ensure that nesting activity is not disturbed and that eggs and flightless young are not inadvertently harassed or destroyed. At a minimum, if complete avoidance of these activities during the specified timeframe is not feasible, nest searches will be undertaken by a qualified biologist and avoidance setbacks will be established around active nests. Nest searches will only be completed following consultation with CWS and turtle nest searches undertaken by a qualified biologist if preferential habitat is identified;
- If encountered, turtle nesting areas will not be disturbed during the late May to mid-July period;
- Existing infrastructure and previously disturbed areas (e.g., roads, parking areas) will be preferentially used where feasible to reduce ground disturbance;
- Machinery and equipment will be cleaned prior to entering the site to limit the potential spread of exotic or invasive plant species;
- Food and food waste will be stored and disposed of properly to avoid attracting wildlife;
- On-site workers will receive training and reference material that will help them identify bird species that could be attracted to habitats created by Project operations (e.g., Bank Swallow and Common Nighthawk). If workers encounter birds that they suspect may be nesting within or near a well site, a biologist will be contacted to determine whether nesting is occurring and to locate the nest. No flagging of the nest will occur to minimize chances of predation;
- If a species at risk is encountered, contact will be made to a Species at Risk biologist at NBDNRED at (506) 453-5873 to discuss immediate actions and future mitigation;
- To minimize disruptions with wildlife activity at night, the Project construction activities will be limited to daylight hours. If night work is required, approval will be required and lighting

requirements will meet ECCC standards to minimize the potential impacts to migratory birds and bats;

- Any nuisance wildlife as identified under the *Nuisance Wildlife Regulation* (97-141) of the New Brunswick *Fish and Wildlife Act* identified as disrupting Project-related activities may only be removed by a licensed Nuisance Wildlife Control Officer or a licensed trapper; and
- In the case of wildlife encounters, the following shall be implemented:
    - No attempt will be made by any worker at any well site to chase, catch, divert, follow or otherwise harass wildlife by vehicle or on foot, and
    - Equipment and vehicles will yield the right-of-way to wildlife.

5.8.3.3 Characterization of Potential Interactions Following Mitigation

Project activities should not result in the permanent loss of wildlife habitat, as this Project is a decommissioning Project and the well sites are already disturbed; however, it may interact with wildlife through sensory disturbances such as noise, vibration, or light, or by increased traffic at the well sites during the Project activities. Due to the nature of the well sites being mostly forested, the areas surrounding the well sites are likely to provide valued habitat to wildlife species; however, following decommissioning, wildlife will be able to return to the site and some wildlife habitat temporarily lost human activity will return to its pre-existing state, if not an improved state.

Project activities, such as the operation of heavy machinery are likely to result in such sensory disturbance that most wildlife will likely avoid the area while work is taking place, thereby limiting the potential for wildlife encounters, injury, or mortality of wildlife species. Suitable habitat in the vicinity of the well sites is abundant.

Furthermore, the well sites may provide habitat for some bird species, including SAR such as the Common Nighthawk, Bank Swallow, and the Olive-sided Flycatcher; however, impacts to these areas are expected to be negligible and no major clearing of land is anticipated during the Project activities (except for minor vegetation management to enable the drill rig to access the well sites). Previous field studies identified three SAR at the Stoney Creek wellfield (i.e., Common Nighthawk, Eastern Wood-pewee, and Canada Warbler); however, the well sites are situated in a larger surrounding area that offers ample natural habitat, such as forests and clearings as well as residential properties.

Project activities are likely to result in sensory disturbance to birds and thus most bird species are likely to avoid the areas during the work, thereby limiting the potential for injury or mortality of bird species.

The Stoney Creek wellfield is surrounded by habitat for wood turtles and snapping turtles. During prior field surveys, no turtles were noted. Due to the location of the watercourses relatively removed from the well sites, with care taken near streams there should be no impact to turtles or turtle habitat.

Given the fact that the area was already developed for oil and gas extraction, and has had further exploration in recent years, and the implementation of mitigation measures outlined in **Section 5.8.3.2**, substantive interactions between the Project and wildlife and wildlife habitats are not anticipated.

Updated biophysical surveys will also be completed as part of the well site-specific decommissioning plans.

Following the completion of the decommissioning of the oil and gas wells, wildlife habitat should improve overall in the area.

5.8.4 Summary

Assuming the proper and adequate application of the mitigation measures described above, including conducting any intrusive Project activities outside of the ECCC recommended timing window for the Project location to facilitate compliance with the MBCA, the potential interactions between the Project and wildlife and wildlife habitat are not expected to be substantive.

5.9 Socioeconomic Environment

The potential interactions between the Project and the socioeconomic environment are assessed in this section.

5.9.1 Scope of VC

The Project has the potential to interact with the socioeconomic environment, which includes land and resource use, employment, and the local economy. These potential interactions concern regulatory agencies, non-governmental organizations, and the general public because they can have a direct influence on the lives of those living and working in the vicinity of a project. The socioeconomic environment has therefore been selected as a valued component (VC) in recognition of these concerns and values of New Brunswickers.

The scope of the socioeconomic environment VC normally includes potential interactions of the Project with residential, agricultural, forestry, recreation, and transportation land uses; and the employment and economic conditions that may change as a result of the Project. However, the Project as described in **Section 2.0** of this EIA Registration document provide limited potential for interactions with the socioeconomic context of the area, particularly due to its rural setting and sparse local population as well as very limited employment and economic opportunity associated with the well decommissioning program.

The scope of this VC therefore includes potential interactions of the Project with residential, agricultural, forestry recreation, and transportation land uses. The scope of the assessment is based on applicable regulations and policies, anticipated issues and concerns, existing knowledge of the area, and anticipated potential interactions.

The local assessment area (LAA) for the socioeconomic environment is defined as the Hillsborough Parish Census Subdivision from Statistics Canada.

5.9.2 Existing Conditions

Existing socioeconomic conditions in the Project area are described in this section.

5.9.2.1 Demographic Overview

The Stoney Creek wellfield is mostly within the Hillsborough Parish Census Subdivision in the 2021 Census, the most recent Census for which some data is beginning to be publicly available at the time of writing. The population of this Census Subdivision in 2021 was 1,397, which is a 6.8% increase from 2016 population numbers (Statistics Canada 2022). The population of the area is above the provincial median age of 45.7, with a median age of 48.9 (Statistics Canada 2017). These data are in line with the province of New Brunswick's trends of aging populations.

5.9.2.2 Land and Resource Use

Since the early 1900's, the Stoney Creek area has been developed to facilitate the commercial production of oil and natural gas from the Stoney Creek wellfield. The land use of the area has been focussed primarily on oil and natural gas exploration and extraction, as well as other resource exploitation, including: quarrying, forestry operations, and agriculture use.

The Project area is on privately-owned land parcels. The majority of the land associated with the Stoney Creek wellfield and the ancillary well locations is forested and shows signs of current harvesting activities. The land is moderately isolated, largely undeveloped, and contains infrastructure from historical oil and natural gas production activities. The general development pattern of the Stoney Creek area is predominately rural with residential ribbon development along Provincial Route 114 and evidence of small scale agricultural uses to the west. There are also some residential properties along Beech Hill Road.

According to the Canadian Land Inventory (CLI) Database (Government of Canada 2021c), the land use in and around the location of the main production facility consists primarily of productive and non-productive woodland with small areas of agricultural use. The potential for agricultural land is low as it has been classified as having soils with moderately severe limitations that restrict the range of crops or require special conservation practices. There are no designated recreational lands or facilities in the Stoney Creek area or at the ancillary well locations.

5.9.2.3 Infrastructure and Services

The Project is mostly within the Hillsborough Local Service District. The Hillsborough Local Service District receives services from the Southeast Regional Service Commission. These services include solid waste and recycling collection, emergency and policing services, recreational services, and some infrastructure services. The residential and seasonal residential (camp lot) land uses are serviced by private, on-site wells and septic systems. Storm water is managed by road-side ditching systems. The transportation network in the immediate area is operated and maintained by the New Brunswick Department of Transportation and Infrastructure (NBDTI).

Most of the well sites in the Stoney Creek wellfield can be accessed by one main road: Beech Hill Road, a two-lane rural road. Beech Hill Road connects to Highway 114, which follows the Petitcodiac River to the north and south. There is evidence of extensive ATV activity in many areas near the well sites.

5.9.3 Assessment of Potential Interactions between the Project and the Socioeconomic Environment

5.9.3.1 Potential Interactions

The Project has the potential to interact with the socioeconomic environment, which includes land use, employment, and the local economy. Without mitigation, the Project may result in environmental effects to the socioeconomic environment such as a temporary increase in noise from construction equipment. However, given that the Stoney Creek wellfield is inactive and the Project is intended to improve site conditions through reclamation of the well sites, interactions with the socioeconomic environment are generally expected to be positive from a land use perspective.

5.9.3.2 Mitigation

During the Project activities, the following general mitigation measures for the socioeconomic environment will be applied:

- Local residents will be notified of the Project, including planned activities and planned schedule. Refer to the Public Involvement section below;
- Adjacent residents will be re-notified immediately before the commencement of construction activities (i.e., when the contractor is retained and the schedule is finalized);
- Working hours for intrusive noise-producing activities will conform to a 7:00 a.m. to 7:00 p.m., Monday to Saturday (excluding holidays) schedule, to the extent possible;
- Truck drivers will adhere to posted speed limits and warning signage and adjust driving to meet weather and road conditions; and
- All necessary permits will be obtained and industry best practices will be followed for special moves or traffic interruptions on public roads.

5.9.3.3 Characterization of Potential Interactions Following Mitigation

The Project is not a typical development project, in that will not lead to any substantive changes in land use; the properties will remain rural private properties upon completion of the work. ATV use is evident in the areas surrounding the Project; recreational use of the well sites will be at the landowner's discretion.

The Project will interact with the socioeconomic environment in that the royalties that private landowners receive from oil production will cease. Furthermore, no additional long-term jobs will be generated in the community since the Project will be short-term contractual work.

The Project also has the potential to interact with the socioeconomic environment through temporary disturbance such as noise or dust; however, the Project will be temporary and is expected to result in minimal to no disruptions. With the implementation of the planned mitigation indicated above, interactions between the Project and the socioeconomic environment is not anticipated to be substantive.

5.9.4 Summary

It is anticipated that activities at the Project site may create temporary, short-term nuisance to some nearby residences along Highway 114. This may include increased traffic along local roads. Work at the Project site may also create a temporary increase in noise and light.

These possible interactions are limited and temporary and may be mitigated by scheduling intrusive activities to occur between 7:00 a.m. to 7:00 p.m., Monday to Friday and excluding holidays, and avoiding intrusive activities during the evening, overnight, weekends, and holidays. Overall, the potential interactions between the Project site and the socioeconomic setting are not expected to be substantive.

5.10 Heritage Resources

Heritage resources, both naturally occurring and human-made, are those resources related to the past that remain to inform present and future societies of that past. Heritage resources includes archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes). The integrity of heritage resources may be susceptible to ground-disturbing activities; therefore, Project activities related to surface or sub-surface ground disturbance have the potential for interaction with heritage resources, if and where they are present.

The potential environmental interactions between the Project and heritage resources, which includes archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes), are assessed in this section.

5.10.1 Scope of VC

Heritage resources has been selected as a valued component (VC) because of their importance to the people of New Brunswick. The preservation and management of heritage resources, particularly those resources that relate to the individual identities, community history, culture, or traditions of Indigenous peoples, is important to the people of New Brunswick.

Heritage resources are recognized and managed by provincial and federal regulatory agencies. In New Brunswick, heritage resources are protected under the New Brunswick *Heritage Conservation Act*, which is administered by the Archaeology and Heritage Branch (AHB) of the New Brunswick Department of Tourism, Heritage and Culture (NBDTHC), and are considered to be very important and highly valued by the people of New Brunswick (GNB 2020a). The *Heritage Conservation Act* outlines the Province's

ownership of all archaeological, palaeontological, and burial site heritage objects (GNB 2020a). Any such objects determined to be of Indigenous origin are specifically held "in trust" by the Government of New Brunswick on behalf of Indigenous people and their communities (GNB 2020a). The Act also protects locally or provincially designated heritage places.

The following definitions for selected heritage resources are derived from the provincial *Heritage Conservation Act*:

- Archaeological Object: "*an object which shows evidence of manufacture, alteration or use by humans that may provide information about past human activities and which meets any criteria set by regulation, and includes a sample collected from that object*".
- Archaeological Site: "*a place where evidence of past human activities, such as archaeological objects and features, is discovered on, buried or partially buried beneath the land, or submerged or partially submerged beneath the surface of a watercourse or permanent body of water*".
- Burial Ground: "*a place that has been used for the placement of human remains or burial objects, but does not include a cemetery regulated under the Cemetery Companies Act*".
- Burial Object: "*an object that is directly associated with the interment of a human, but does not include human remains*".
- Palaeontological Object: "*a work of nature consisting of or containing any remains, trace or imprint of a multicellular plant or animal or a stromatolite preserved in the Earth's crust since some past geologic time; does not include human remains*".
- Palaeontological Site: "*a place where evidence of palaeontological objects is discovered in rock or unconsolidated sediment, exposed at the surface, buried or partially buried beneath the land, or submerged or partially submerged beneath the surface of a watercourse or permanent body of water*".

Archaeological resources (i.e., burial objects or archaeological objects) tend to be found in surficial soils (normally in the layers above bedrock or glacial till), whereas palaeontological objects (i.e., fossils) tend to be found in certain types of bedrock that are conducive to fossil formation (e.g., sedimentary rock). The discovery of these resources can provide valuable information about the history of human activity or use in the distant past (in the case of archaeological objects), or natural history and evolution of wildlife and vegetation in earlier eras (in the case of palaeontological objects).

The Province of New Brunswick provides guidance for conducting heritage assessments under its "Guidelines and Procedures for Conducting Professional Archaeological Assessments in New Brunswick" (Archaeological Services 2012). The Guidelines consider the first 50 m away from a watercourse as well as 100 m from the confluence of watercourses to be of high archaeological potential; the next 30 m (from 51 m to 80 m from the watercourse) are considered to be of medium archaeological potential, and all other areas are generally considered to be of low archaeological potential (Archaeological Services 2012). Together, areas of high and medium archaeological potential are sometimes termed "elevated archaeological potential", for brevity. Under these guidelines, when substantive ground

disturbance is expected, a systematic Archaeological Impact Assessment (AIA) acceptable to the AHB must be undertaken to confirm whether archaeological resources are likely to be present.

The local assessment area (LAA) for heritage resources is limited to the footprint of each well site/pad where ground disturbance will be taking place.

5.10.2 Existing Conditions

Many of the well sites are located within a kilometre of the Petitcodiac River, which, like with all major watercourses, increases the potential for harbouring heritage resources (especially archaeological resources) since these waterways have been historically used by Indigenous peoples as "highways" of the past.

In addition to historical events, various environmental and factors such as glaciation, sea level fluctuation, topography, soil types, hydrology, and vegetation can influence settlement patterns and contributed to the archaeological potential of an area.

Existing conditions with respect to the overall historical context of the area, as well as, for archaeological resources, palaeontological resources, and built heritage resources, are discussed in this section.

5.10.2.1 Historical Background

The Acadians settled in some areas of what is now known as New Brunswick in the 1600s; in low lying areas such as those of southeastern New Brunswick, they built dykes to drain the marshes, creating some of the most fertile farmland in the North America. They also constructed the first dry dock in Canada at the confluence of the Aulac and La Coupe rivers, about 8 km from Cumberland Basin. In 1766, immigrants from Saxony via Pennsylvania moved onto the dyked and other lands around present-day Moncton. The Germans subsequently were joined by Planters from New England, as well as by Acadians returning from exile. By the 1860s, The Bend (later called Moncton) and Sackville had become centres of agriculture, shipbuilding, and education (Zelazny 2007).

The first drilling exploration for hydrocarbons in New Brunswick occurred in the Dover-St. Joseph region, on the opposite bank of the Petitcodiac River, near Stoney Creek in 1858. A number of shallow wells were drilled for the extraction of oil and gas. The wellfield area has been active in terms of resource extraction in some capacity since then, however exploration efforts have been abandoned (Foley 1989). Further information on the history of the Stoney Creek wellfield was provided in **Section 1.2**.

Based on a review of available literature, the following is a high-level summary of important historical information about the Stoney Creek Wellfield and the ancillary well locations and the surrounding lands.

- Historic Sites were not identified in the Stoney Creek wellfield or ancillary well pad locations following a review of the New Brunswick Department of Wellness, Culture and Sport - Historic Places website. A Historic Site, the Albert Mines site was identified in the community of Hillsborough (NBDWCS 2022).

- Historic places within the Stoney Creek wellfield or ancillary well pad locations were not identified following a review of the Canadian Register of Historic Places (Parks Canada 2022). According to the inventory of Canadian Register of Historic Places, the closest registered Historic Place to the Stoney Creek wellfield or ancillary well pad locations is located southeast of Memramcook, and is approximately 1.2 km southeast of the nearest well site.

5.10.2.2 Archaeological and Palaeontological Resources

A preliminary review found that the well sites were greater than 100 m of mapped watercourses (GeoNB 2022). Though no AIA was conducted for this EIA Registration, given the industrial history, disturbed condition, and distance from watercourses of over 100 m, the potential to encounter previously undiscovered archaeological resources at the well sites is believed to be very low. The Stoney Creek wellfield or ancillary well pad locations and are, therefore, generally considered to be of low archaeological potential.

The potential for paleontological resources to be present can vary based on the nature of bedrock and the geological history of the region. As discussed in **Section 3.1.5**, the bedrock geology in the Project area consists of carboniferous-aged terrestrial sediments (i.e., sedimentary rock). Although sedimentary rock is conducive to fossil presence, the Project is located in a region that would have been impacted by the most recent glacial period (i.e., the Wisconsin Glaciation) and would have been beneath the Laurentide Ice Sheet from approximately 18,000 years Before Present (BP) until approximately 16,000-15,000 BP when the ice retreated in Atlantic Canada (Fader 2005).

Given the high level nature of this EIA Registration document, an AIA was not considered for the entire Stoney Creek wellfield and ancillary well locations.

5.10.3 Assessment of Potential Interactions between the Project and Heritage Resources

This section details the assessment of the potential interactions between the Project and heritage resources. This will include characterizing the potential interactions between Project activities and heritage resources and identify key mitigation measures to reduce these interactions. The assessment will also include the characterization of any residual interactions that may exist after the implementation of mitigation measures. For this section, heritage resources include archaeological resources (e.g., artifacts, features, structures), palaeontological resources (e.g., fossils), and built heritage resources (e.g., historic buildings, complexes).

5.10.3.1 Potential Interactions

The Project has the potential to interact with heritage resources via accidental discovery of archaeological or palaeontological resources during soil excavation activities; however, it is unlikely that heritage resources will be encountered in the Project areas as this is located entirely on previously disturbed land. Project activities that include ground moving, such as excavation, have the potential to uncover previously undiscovered heritage resources. Without mitigation, environmental effects include

the potential permanent destruction of any previously undiscovered archaeological or palaeontological resources that might be present within the Project areas.

Overall the Stoney Creek wellfield and the ancillary well locations are anticipated to have a low potential for palaeontological resources due to the recent geological history, and previously disturbed nature of the area.

5.10.3.2 Mitigation

The following mitigation measures, through careful design and planning, are recommended to reduce the potential for adverse interactions with heritage resources:

- Minimize the extent of disturbance of the Project site by planning as small a disturbance area as possible;
- Planned avoidance of known areas of elevated archaeological potential, to the extent practical; and
- Contingency and emergency response procedures will be developed and implemented.

If any archaeological resources are accidentally identified at any point over the course of the Project, the following mitigation measures will be employed:

- Work in the area must cease immediately and the area secured;
- AHB must be contacted at (506) 453-2738 for further direction;
- Until a qualified archaeologist arrives at the site, no one shall disturb, move or re-bury any uncovered archaeological object; and
- Activities at the site may resume only when authorized by AHB and once mitigation measures have been completed.

Other contingency and emergency response procedures to be implemented in response to the accidental discovery of heritage resources will be documented and implemented as part of the Project. In addition to the above and in the event that evidence of burials or human remains are encountered:

- Contact and Inform the Lead Police Agency (RCMP or municipal police force) in accordance with AHB Guidelines (Archaeological Services 2012, pg. 57).

5.10.3.3 Characterization of Potential Interactions Following Mitigation

There are a variety of potential Project and heritage resource interactions that may persist beyond the implementation of proposed mitigation measures. These include the potential for discovering previously undiscovered (or unknown) archaeological or palaeontological objects. Archaeological resources could be found in the surficial soils (including topsoil and overburden). Any ground breaking, or earth moving activity has the potential to uncover previously undiscovered or unknown heritage resources.

The well sites are not considered to have high potential for harbouring heritage resources since most are upland and located more than 100 m from watercourses. The implementation of the other

mitigation measures (i.e., archaeological monitoring and archaeological contingency and emergency response planning) will reduce the likelihood of substantive interactions between the Project and archaeological resources following the implementation of mitigation methods. Consequently, the residual interactions between the Project and heritage resources are not anticipated to be substantive.

5.10.4 Summary

Based on a high level review (i.e., desktop assessment), the Project does not include areas that are considered to exhibit elevated potential for harbouring heritage resources. There is thus a low potential for interaction between the Project and heritage resources. The interactions will be associated with the clearing, grubbing and widening of access roads, preparation of laydown areas, and excavations to allow for decommissioning of the well sites.

Earth moving and ground breaking activities have the potential to interact with archaeological resources buried in the soil or subsurface bedrock of the Project site, if they are present. However, the development of appropriate mitigation in the event that any archaeological resources are present in areas identified for ground disturbing activities will reduce interactions with heritage resources. Therefore, the residual potential interactions between the Project and heritage resources are not expected to be substantive.

5.11 Traditional Land and Resource Use

The potential interactions between the Project and traditional land and resource use are assessed in this section.

The information presented in this section is intended to provide a high-level overview of traditional land and resource use in the general area of the Project. This will include traditional land and resource use at, or near, the well sites. The information and assessments provided below are derived from publicly-available literature and general knowledge and information relating to traditional land and resource use in the Stoney Creek and ancillary well locations. This information and preliminary assessment is not intended to supersede or prejudice the specific traditional land or resource use information or knowledge that may be shared by Indigenous communities. Rather, it is an attempt to provide information from general knowledge and secondary sources of information that is intended to complement the traditional knowledge that might become available from Indigenous people in this regard.

To date, a traditional land use and/or knowledge study has not been completed as part of the Project. However, ongoing consultation with the *Sigenigteoag* First Nations, Mi'gmawe'l Tplu'taqnn Incorporated (MTI, an umbrella organization representing eight of the nine Mi'kmaq communities in New Brunswick) and as well as other First Nations, may provide further opportunities for the First Nations to share additional traditional land and resource use information in the area.

5.11.1 Scope of VC

Traditional land and resource use refers to the activities undertaken by Indigenous peoples that were carried out dating back to pre-contact periods (GNB 2011). These activities may have included the building and settling of encampments, seasonal travel, hunting, fishing, trapping, gathering of food and medicines, practicing ceremonial traditions, and burial activities. Evidence of these traditional land and resource uses can be found in archaeological evidence (i.e., archaeological sites, burial sites, and associated objects) and through Indigenous traditional knowledge.

Traditional land and resource use has been selected as a valued component (VC) in order to:

- Acknowledge the lands and resources that have been used, and continue to be used, for traditional purposes by Indigenous persons;
- Assess the potential interactions between Project activities and traditional land and resource use as required under the New Brunswick EIA Regulation; and
- Assist ORLEN in providing information to the Government of New Brunswick in fulfilling its duty to consult with First Nation communities regarding the Project.

This section is intended to provide information about the potential interaction of Project activities on traditional land and resource use, and to identify appropriate mitigation measures to remove or reduce negative interactions. For the purposes of this EIA Registration document, Indigenous traditional activities practiced on Crown, publicly owned, or certain private lands will be considered.

The local assessment area (LAA) for traditional land and resource use is limited to the footprint of each well site/pad where ground disturbance will be taking place.

5.11.2 Existing Conditions

Based on a review of available literature, the following is a brief and high-level summary of traditional land and resource use in the Project area.

5.11.2.1 Historical Background

The Project lies within the traditional Mi'kmaq territory of *Sigenigteoag*. It intersects the main portage route between the Bay of Fundy and Gulf of St. Lawrence, and possessed multiple resources such as shellfish, waterfowl, seabirds, wild rice, and sweet grass. Although little is known about early native villages in the area, it likely supported many settlements over its several thousand years of aboriginal habitation (Zelazny 2007).

The Wabanaki Confederacy was an alliance between the Atlantic region's Indigenous nations, namely the Mi'kmaq, Wolastoqey (Maliseet), Peskotomuhkati (Passamaquoddy), and Penobscot Nations, which facilitated a peace treaty with the Mohawk Nations further to the west (GNB 2020b). Although the Wabanaki Confederacy Nations were largely nomadic people, their movements were largely focused around waterbodies.

The Petitcodiac River, known as *epetkutgoyek* by the Mi'kmaq (meaning "the river bends around in a bow"), including the tributaries that combine with it to discharge into the Shepody Bay and eventually into the Bay of Fundy, is a significant water feature in the region. The Petitcodiac River, as many others within New Brunswick, was used as a primary mode of transportation by, and a means of sustenance for, Indigenous peoples, particularly the Mi'kmaq peoples who have occupied the lands in New Brunswick for several millennia. The ancillary well locations near Monteagle, though a part of the Canaan River watershed and not the Petitcodiac River watershed, are still part of the same traditional territory.

5.11.2.2 First Nation Community Context

The entire province of New Brunswick is subject to the Peace and Friendship Treaties signed by the British with the Wolastoqey (Maliseet), Mi'kmaq, and Peskotomuhkati (Passamaquoddy) Nations in 1752 and renewed in specific agreements thereafter. New Brunswick's First Nations assert Aboriginal and treaty rights through these Peace and Friendship Treaties, and those rights are protected under Section 35(1) of the *Constitution Act, 1982*. In addition, the Supreme Court of Canada has held in several important decisions that the Crown (both federal and provincial) has a duty to consult with potentially affected First Nations in respect of decisions made by the Crown that might affect these Aboriginal or treaty rights, including those that might relate to their current use of the land and resources for traditional purposes. The Province of New Brunswick has a duty to consult policy which is administered by the New Brunswick Department of Aboriginal Affairs (GNB 2011).

Today, there are 15 officially recognized First Nations communities within the province of New Brunswick. They consist of six Wolastoqey Nation communities and nine Mi'kmaq Nation communities. Wolastoqey communities and their traditional territory are generally located along the Wolastoq (Saint John River) valley, while the Mi'kmaq communities are predominantly located along the northern and eastern coastal regions of the province. Though the Project is generally thought to be located in Mi'kmaq traditional territory, First Nations peoples migrated through the entirety of the lands in New Brunswick for millennia and as such, it is possible that other First Nations and peoples might have also used the lands and resources of this area as well.

The areas surrounding the Project may still be used by Indigenous people for traditional practices such as hunting, fishing, trapping, ceremonial, and gathering purposes. Within the well sites, hunting is not permitted and recreational fishing is restricted. It is more likely that hunting, fishing, ceremony, and gathering would also take place within other more natural areas, as these areas are more forested with less restrictions for access and use.

An Indigenous Knowledge (IK) study has not been completed for the Project; furthermore, specific and documented details on how and where traditional activities have been or are taking place may exist, but they are normally held confidential by First Nations. This knowledge is both valuable and private to the rights holders (land users), and as such there is an expectation that this knowledge should not be freely available for the purposes of development of traditional territories. As such, information presented within this section has been collected from reliable secondary sources. However, data collected for

other field disciplines (e.g., wildlife and wildlife habitats, vegetation and wetlands, fish and fish habitat, and heritage resources) will also be used to inform the availability of land and resources that could be used for traditional purposes within the well sites.

5.11.2.3 Indigenous Population Demographics

The 2016 Census (Statistics Canada 2017) is the latest Census available and it identified that approximately 4% of the New Brunswick population self-identifies as having an Indigenous or Aboriginal identity, or the equivalent of 29,385 persons. The total population of registered status First Nation band members in New Brunswick was 17,005, with a total of 9,805 residing on-reserve, as reported by Indigenous and Northern Affairs Canada (INAC 2022 and **Table 5.11.1**). It is noted that the totals from the Census and from Indigenous and Northern Affairs Canada may differ slightly.

Table 5.11.1 New Brunswick First Nation Total Registered Population and Registered Population On-Reserve

First Nation Community	2022 Registered Population	2022 On-reserve Population
Wolastoqey (Maliseet) First Nations in New Brunswick		
Oromocto First Nation	824	339
St. Mary's First Nation	2,087	899
Kingsclear First Nation	1,064	738
Woodstock First Nation	1,165	293
Tobique First Nation	2,588	1,589
Madawaska Maliseet First Nation	379	162
Wolastoqey First Nations Sub-total	**8,107**	**4,073**
Mi'kmaq First Nations in New Brunswick		
Eel River Bar First Nation	815	346
Pabineau First Nation	353	102
Esgenoopetitj First Nation	1,940	1,330
Metepenagiag First Nation	707	435
Eel Ground First Nation	1,083	580
Indian Island First Nation	213	111
Elsipogtog First Nation	3,524	2,714
Buctouche First Nation	124	79
Fort Folly First Nation	139	35
Mi'kmaq First Nations Sub-total	**8,898**	**5,732**
Total First Nation Population in New Brunswick	**17,005**	**9,805**

Source: INAC (2022)

The closest First Nation to the Project site is the Fort Folly First Nation, which is located approximately 17 km straight-line distance southeast of the approximate centre of the Stoney Creek wellfield.

5.11.3 Assessment of Potential Interactions between the Project and Traditional Land and Resource Use

The assessment of potential interaction between the Project and traditional land and resource use by Indigenous persons is provided in this section.

5.11.3.1 Potential Interactions

In general, potential interactions between the Project and traditional land and resource use are associated with any Project activity that could result in change in the amount of land or water available to Indigenous persons for practicing traditional activities that would restrict access to an area, or limit an area's use for traditional practices or Project activities. Project activities such as site access and well site preparation, well decommissioning, and surface reclamation and site rehabilitation may affect traditional land and resource use in the following ways.

- Currently, and during the Project, access to the Project site is and will be controlled for safety and security purposes to prevent injury to individuals. The access restrictions to the well pads will continue until all Project activities have been completed and the final site reclamation activities have been completed, at which time the landowner will determine the future use of the well sites.
- Prior to excavations, well pads will be cleared of vegetation, and accessed by existing roads, which may also need to be cleared of vegetation and widened to allow access for heavy equipment. A laydown area will be covered with suitable non-native gravel to protect the integrity of underlying soils, potentially affecting plants and wildlife that may have been used for food, medicinal, ceremonial use, or other traditional purpose. Outside the well sites, it is not expected that the Project activities will interact or affect plant or wildlife use for traditional purposes. It is expected that these disturbed areas will be reseeded or vegetated as part of site improvement and will naturally be repopulated over time, once the Project is completed.

5.11.3.2 Mitigation

It is important to note that traditional land and resource use is also connected to other VCs. The discussion of the potential interactions between the Project and other VCs (i.e. surface water; fish and fish habitat; vegetation and wetlands; wildlife and wildlife habitat; and, heritage resources), and their associated mitigation measures are applicable to this section. In addition, the following mitigation measures will be employed to avoid or reduce the potential environmental effects of the Project on traditional land and resource use at the well sites:

- Minimize the size of any areas of ground disturbance on the Project site to that which is necessary to accomplish the Project objectives while minimizing environmental disturbance to the extent possible;
- Maintain natural vegetation along watercourses and in wetlands (if present), as well as along the property boundaries, to minimize effects on natural resources and to provide a buffer for reducing effects of the Project that could cause sensory disturbance to wildlife (i.e., noise, dust);

- Conduct engagement with First Nations, if so desired, to exchange information and address question and concerns associated with the Project;
- Avoid known or identified archaeological sites, and follow the procedure if archaeological objects are accidently encountered as well as contacting and updating First Nations; and
- Wildlife and wildlife habitats within the Project site will be re-vegetated upon site improvement, which will partially restore habitat conditions in the Project site, over time.

5.11.3.3 Characterization of Potential Interactions Following Mitigation

The majority of interactions between the Project and traditional land and resource use can be considered temporary and can be mitigated effectively.

Ground disturbance during Project activities, though very limited in extent, may result in a temporary localized loss of vegetation and potential displacement of species used for traditional purposes due to altered habitats or sensory disturbance. Any areas of the Project site that are subjected to ground disturbance will be restored to ensure soil stability after the completion of the Project, as well as reseeding or re-vegetating these areas as part of restoration. Vegetation is anticipated to regrow naturally and other species are anticipated to return to these areas, over time.

It is anticipated that engagement with the Indigenous communities, if so desired, will provide opportunities for these indigenous groups to share information, ask questions, and discuss concerns about unanticipated interactions between the Project and traditional land and resource use.

5.11.4 Summary

The Project is not anticipated to result in a permanent loss of access by Indigenous communities to practice traditional land and resource use activities in the Stoney Creek Wellfield and ancillary well locations. In fact, the Project will improve conditions in the area by removing infrastructure that poses a risk for environmental contamination long-term.

The Project is anticipated to reduce access to the general area for safety purposes, which may limit ceremony, or gathering activities near the well sites (but not likely much of the surrounding area) until all Project activities have been completed. However, this restriction is anticipated to be temporary and only required until Project activities have been completed. There are no expected restrictions to traditional land or resource use in the remaining portions of the LAA during Project activities.

In light of the above, and in consideration of the Project planning and mitigation to be employed to reduce or minimize environmental impacts, the potential interactions between the Project and traditional land and resource use are not expected to be substantive.

6.0 Effects of the Environment on the Project

The effects of the environment on the Project are discussed in this section.

6.1 Scope of VC

Effects of the environment on the Project are those effects related to risks of natural hazards and influences of the natural environment that might affect the normal conduct of the Project or cause damage to infrastructure as part of it. Potential effects of the environment on any project are a function of project or infrastructure design in the context of its receiving environment, and ultimately how the project is affected by the natural environment. These effects may arise from physical conditions, land forms, and site characteristics or other attributes of the environment which may act on the project such that the project components, schedule, and/or costs could be substantively and adversely changed.

Based on the nature of the undertaking, and in consideration of the relatively short period of time during which the Project will be undertaken, the following environmental attributes have been selected for consideration in this assessment:

- severe weather events, including wind, precipitation, floods, hail, electrical storms, and tornadoes;
- seismic activity; and
- forest fires resulting from causes other than the Project.

Since the Project will be executed over a relatively short period of 5-6 years, consideration of long-term climate and climate change effects is not warranted.

6.2 Existing Conditions

6.2.1 Severe Weather Events

Extreme precipitation and storms can occur in New Brunswick throughout the year, but tend to be more common and severe during the winter. Winter storms generally bring high winds and a combination of snow and rain, especially in low lying areas.

Extreme rainfall events occur when 50 mm or more rain falls over a 24-hour period. ECCC issues a rainfall warning when this is forecast to occur. Extreme rainfall event data collected for three of New Brunswick's cities indicate that in the 2000s, Fredericton and Moncton had more extreme rainfall events than any other decade on record, while Saint John had the highest number of events during the 1960s. The trends were different in all three communities (GNB 2021).

Significant ice storms have affected New Brunswick twice in the past 10 years. The December 2013 ice storm saw the southern region hardest hit (Atlantic Security Group Inc. 2014); however, in January 2017, a significant ice storm affected eastern and northeastern New Brunswick extending from the Acadian

Peninsula to the New Brunswick-Nova Scotia border. According to NB Power, between 50 and 100 mm of ice built up on trees and power equipment in the Acadian Peninsula. Ice buildup led to significant damage to NB Power equipment and transmission/distribution infrastructure, as well as impassable roads, wide-spread power outages, and health emergencies (GNB 2017).

Electrical storms, or thunderstorms, which are more frequent in New Brunswick than the rest of Atlantic Canada, occur on average 10 to 20 times a year (NAV Canada 2001). Generally, only one of these storms (per year) is extreme enough to produce hail. Thunderstorms can produce extremes of rain, wind, hail, and lightning; however, most of these storms are relatively short-lived (GOC 2021a).

6.2.2 Seismicity

Seismic activity is dictated by the local geology of an area and the movement of tectonic plates comprising the Earth's crust. Natural Resources Canada monitors seismic activity throughout Canada and identifies areas of known seismic activity in order to document, record, and prepare for seismic events that may occur. The Project is located in the Northern Appalachians Seismic Zone, which includes most of New Brunswick and extends into central and western Nova Scotia, as well as the northeastern United States as far south as Boston, Massachusetts. Historical seismic data recorded throughout this zone has identified clusters of earthquake activity. In general, however, historical seismic activity is considered low (Natural Resources Canada 2022a). Earthquakes in New Brunswick generally cluster in three regions: the Central Highlands region (near Miramichi), the Moncton region, and the Passamaquoddy Bay region in the southwestern corner of the province.

The largest earthquake ever recorded in New Brunswick was a magnitude 5.7 (on the Richter scale) event on January 9, 1982, located in the north-central Miramichi Highlands. Aftershocks following this earthquake reached magnitude 5.1 and 5.4. Between 1855 and 1937, other moderate earthquakes in these three regions ranged from 4.5 to 6.0 (Basham and Adams 1984). There are records of one magnitude 5.0 earthquake in the Passamaquoddy Bay region, as well as three magnitude 4.0 earthquakes.

The maximum credible earthquake magnitude for the northern Appalachians region is estimated to be magnitude 7.0, based on historical earthquake data and regional tectonics (Adams and Halchuk 2003). It is noted that there is potential for large earthquakes of up to an estimated magnitude 7.5 along fault zones in the St. Lawrence River region. However, any such events in this region would be over 500 km from the Project, and, therefore, the amplitude of ground motions at the well sites would be expected to be low due to attenuation over a large distance.

Earthquakes are not unknown in southern New Brunswick, and several earthquakes have been recorded in the vicinity. A search of earthquake records within 50 km of the Stoney Creek area showed approximately 50 events from 1986 to 2021 ranging from magnitudes up to 3.6, the closest of these being approximately 5 km to the northwest, a magnitude 2.2 earthquake west of Pine Glen. The largest magnitude event recorded within 50 km of the Project was a magnitude 3.6 earthquake on April 24, 1988 located near Lower Turtle Creek, approximately 14 km west of the Stoney Creek wellfield (Natural Resources Canada 2021b).

In summary, a review of historical earthquake records and regional tectonics indicates that the Project is situated in a region of low to moderate seismicity.

6.2.3 Forest Fires

The Fire Weather Index is a component of the Canadian Forest Fire Weather Index System. The index provides a numeric rating of fire intensity, and is the general index of fire danger throughout the forested areas of Canada (Natural Resources Canada 2021c).

The mean Fire Weather Index in the Stoney Creek area for July (i.e., normally the driest month of the year), when risk of forest fire is typically greatest, is rated from 0 to 10, as shown in **Figure 6.2.1**, which includes the two lowest ratings on the scale of possible fire risk (the LAA extends across two indices: 0-5 and 5-10). This risk is based on Fire Weather Normals data, representing the average value of a fire weather code or index over the 30-year period from 1981 to 2010 (Natural Resources Canada 2021c).

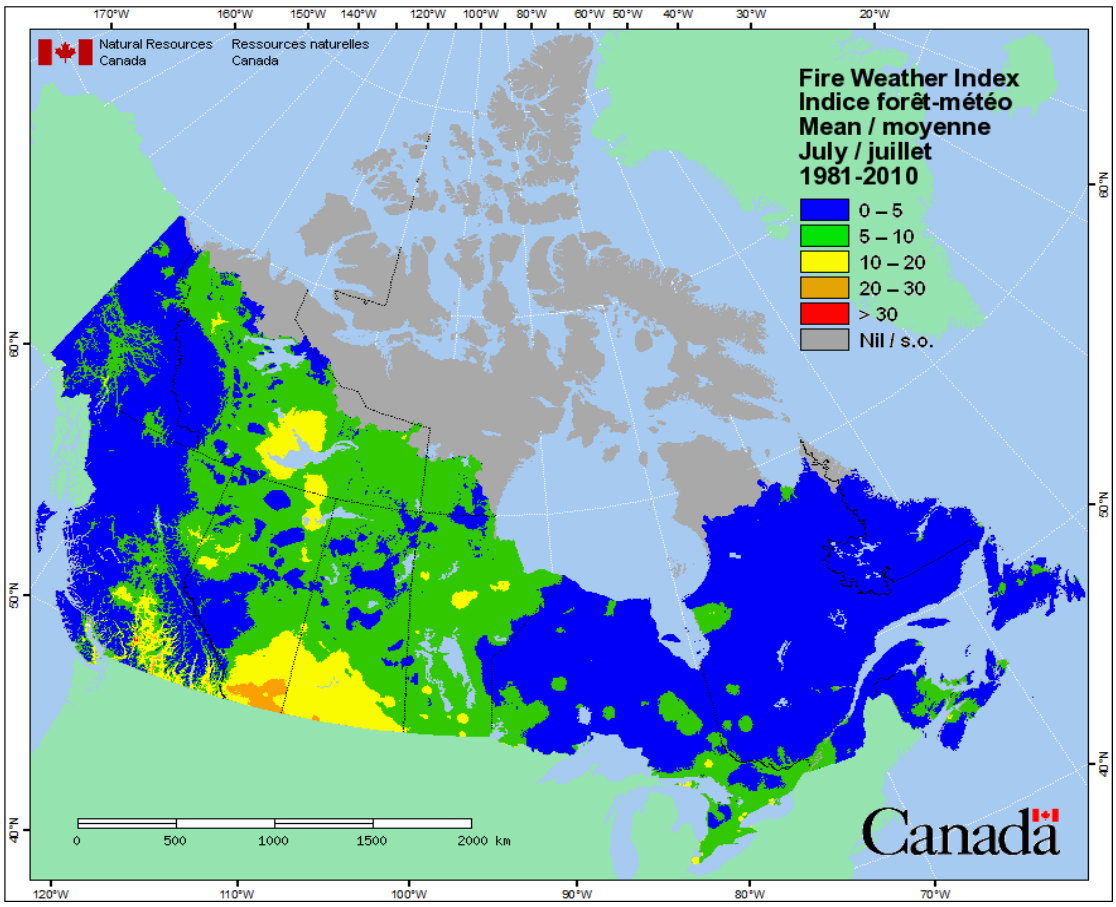


Figure 6.2.1 Natural Resources Canada Fire Weather Index

6.3 Assessment of Potential Interactions between the Environment and the Project

As a factor of safety and a matter of responsible engineering practice, the design and materials to be chosen for the Project will be selected so that the Project will withstand environmental stressors that could occur from various natural and environmental phenomena (e.g., extreme storms, forest fires).

6.3.1 Potential Interactions

6.3.1.1 Effects of Extreme Weather on the Project

To assess the environmental effects of extreme weather on the Project, current climate must be considered. Current climate conditions have been established by compiling relevant historical data and establishing a climatological background for the Stoney Creek area.

Recent climate trends (1981-2010 averages and extremes) have been assessed to determine the likelihood, and effect, of severe and extreme weather events on the Project so that they may be accounted for in both the engineering design, as well as timelines of various Project components. The most relevant extreme weather events that could potentially have effects on the Project include:

- heavy precipitation events; and
- extreme storms accompanied by heavy and/or freezing precipitation, thunderstorms, and strong winds; and increased incidence of flooding and erosion.

Each of these effects must be considered in terms of how they may adversely affect the Project if they are not accounted for in the planning and execution of the Project. The environmental attributes described have the potential to affect the Project in several ways, including but not limited to:

- Delays in carrying out Project activities as a result of severe weather;
- A reduction in visibility and an inability to manoeuvre heavy equipment;
- Changes to the ability of workers to access the work site; and
- Damage to heavy equipment and site infrastructure.

Extreme snowfall can also affect winter Project activities by causing delays in the movement of materials in and out of the well sites, and resulting in additional effort for snow clearing and removal. This additional effort, however, would not substantially change the Project schedule.

Extreme snowfall contributing to unusual flooding during snowmelt and extreme rainfall events could also potentially lead to flooding and erosion. Heavy rain, snowfall and/or freezing rain events could also cause an interruption to services, such as communications or electricity.

Some effects, such as damage to infrastructure, can also result in consequential effects on the environment. These types of environmental effects are addressed as accidents, malfunctions, and unplanned events in **Section 7.0**.

6.3.1.2 Effects of Seismic Activity on the Project

The Project is geographically situated within an identified seismic zone where historical earthquake activity has been identified (Northern Appalachian Seismic Zone). There are historical records of one magnitude 5.7 earthquake in the Miramichi Highlands region (Natural Resources Canada 2021b). The maximum credible earthquake magnitude for the Northern Appalachians Seismic Zone is estimated to be magnitude 7.0, based on historical earthquake data and regional tectonics (Adams and Halchuk 2003). It is noted that there is potential for large earthquakes of up to an estimated magnitude 7.5 along fault zones in the St. Lawrence River region. Any such events in this region, however, would be over 500 km from the Project, and therefore, the amplitude of ground motions at the well sites would be low due to attenuation over a large distance.

Although the level of historical seismic activity near the Project is considered to be low to moderate, past occurrence of seismic activity in an area is not necessarily an indicator that a significant seismic event could or could not occur in the near future.

Based on the low frequency of recorded earthquakes in the region, and, therefore, low probability that a major seismic event would occur in the immediate vicinity of the Project during the Project's lifespan, major Project damage or interruption to activities due to earthquakes during any phase of the Project is considered to be low.

6.3.1.3 Effects of Forest Fires on the Project

With respect to the effects of forest fires on the Project, Project-related equipment and vehicles could be damaged by extreme heat. Failures of valves, gauges and fittings could result in leaks of petroleum hydrocarbons that could ignite if flames are nearby, compounding the health and safety risks from the fire.

Smoke generated by forest fires could adversely affect project personnel resulting from reduced air quality.

The Project is situated within a sparsely developed region in southern New Brunswick where forest fires are not uncommon.

Aerial imagery indicates that the forests surrounding the Stoney Creek area have been subject to varying degrees of harvest and silviculture either related to oil and gas extraction, or forest harvest practices. Fire behaviour normal mapping (Natural Resources Canada 2022c) indicates that the mean rate of spread of fire in the Project area is between one and three metres per minute. The rate of spread is based on several factors including fuel type, forest health, and crown base height. The mean rate of spread for the Project area is the second lowest on the scale used by Natural Resources Canada.

In the unlikely event that a forest fire encroaches on the well sites, New Brunswick has a forest fire control program in place to identify and control fires, minimizing the potential magnitude and extent of any forest fire, and their potential consequential effects on the Project. Local and provincial emergency response crews will provide for rapid detection and response to any identified fire threat. This includes

fires that could start within the Project site perimeter as well as fires approaching from outside the area (i.e., forest fires).

6.3.2 Mitigation

Mitigation strategies for minimizing the likelihood of a significant effect of the environment on the Project are inherent in: the planning process being conducted, the application of engineering design codes and standards, construction practices, and monitoring. To address these environmental effects, proactive design, planning, and maintenance are required in consideration of the potential normal and extreme conditions that might be encountered throughout the life of the Project.

6.3.2.1 Mitigating Effects of Extreme Weather on the Project

The following mitigation measures will be implemented to prevent effects of extreme weather on the Project.

- Disruption of Project activities and delays to the Project schedule will be avoided by scheduling weather dependent tasks for periods when the weather conditions are favourable. A disruption allowance will be considered in Project and operational scheduling.
- Extreme precipitation events are an expected work condition and the Project schedule allows for weather conditions typical for the southeastern New Brunswick region. Site water management features and erosion and sediment control structures will be in place early in the Project to manage potential increased site run-off from precipitation events that could occur.
- Erosion as a result of extreme precipitation and potential flooding is not anticipated to have a substantive adverse effect on the Project due to standard mitigation measures that will be implemented (e.g., management of site water, use of erosion and sedimentation control structures, and construction methods that stabilize erodible soils as early as possible after the ground has been disturbed). Following construction, exposed soils will be stabilized, roadways and laydown areas will use suitable gravel bases and/or sub-bases to prevent erosion, and exposed areas will be vegetated where possible to prevent surface erosion.

As described above, environmental stressors potentially associated with severe weather would be more than adequately addressed by engineering design, and careful equipment and materials selection for decommissioning Project-related infrastructure.

6.3.2.2 Mitigating Effects of Seismic Activity on the Project

Seismicity is not considered to have the potential to substantively damage Project components during all phases of the Project due generally low seismicity of the area.

6.3.2.3 Mitigating Effects of Forest Fires on the Project

Petroleum products and flammable substances that may be required by contractors decommissioning the well sites will be stored within secondary containment to reduce likelihood of spills and potential ignition.

Well heads are situated within well pads which are areas cleared of vegetation, this will act as a fire break, separating the individual sites from a potential forest fire.

Through integrated and coordinated emergency response capabilities at the local and provincial levels, personnel will mobilize away from the Project site if forest fires are affecting the local area, and will only return under clear and safe conditions, as determined by emergency response agencies in the province.

Project personnel will advise local and provincial fire response planners about potential hazards that firefighters could encounter at the well sites that are actively being decommissioned.

6.3.3 Characterization of Potential Interactions Following Mitigation

The potential effects of the environment on all Project phases will be considered in the planning and design of the Project and in the scheduling of Project activities to limit delays, prevent damage to infrastructure and the environment, and to maximize the safety of staff. Compliance with detailed design engineering completed for the Project will account for weather extremes, seismicity, and forest fire threats, through built-in factors of safety to prevent undue damage to infrastructure and equipment or schedule delays from such events or occurrences. Although it is possible, even likely, for the Project to experience extreme environmental conditions during its lifecycle, a substantive delay (e.g., a delay for more than one season) is not anticipated. Further, no substantial damages to Project infrastructure are anticipated as a result of natural environmental conditions due to the natures of activities proposed (i.e. decommissioning).

Therefore, the effects of the environment are not expected to adversely affect the Project in a manner that cannot be planned for or accommodated through design and other mitigation and adaptive management strategies. As a result, the effects of the environment on the Project are not expected to be substantive.

6.4 Summary

Environmental management is an inherent consideration in the best management practices of the design and associated Project risk management. Environmental stressors, such as those that could arise as a result of severe weather, seismic events, or other factors (e.g., fires), would more than adequately be addressed by good planning, materials selection, best practices, and scheduling foresight. The Project schedule will provide allowances so as to not adversely be affected by a potential delay caused by effects of the environment. While there is potential for natural forces to affect the Project, it is not likely to have a substantive effect due to planned mitigation and design.

7.0 Accidents, Malfunctions and Unplanned Events

This section identifies the potential accidents, malfunctions, and unplanned events that could occur as part of the Project. The assessment focuses on events that are considered credible, based on the Project description and the experience of the EIA team in assessing similar projects.

7.1 Approach

The general approach to assessing the potential environmental interactions of the selected potential accident, malfunction, or unplanned event scenarios involves the following:

- Describing the potential accident, malfunction, or unplanned event;
- Considering if the potential accident, malfunction, or unplanned event could occur during the life of the Project, and during which activity(ies);
- Determining with which valued component(s) (VCs) the potential accident, malfunction, or unplanned event may interact;
- Describing the Project planning, safeguards, and mitigation established or proposed to minimize the potential for such occurrences to happen;
- Considering the contingency or emergency response procedures applicable to the event; and
- In consideration of the above, assessing the potential interactions of accidents, malfunctions, and unplanned events on related VCs following mitigation.

Spatial and temporal boundaries for considering residual environmental effects of potential accidents, malfunctions, and unplanned events that may arise as a result of the Project are the same as those for each VC to which they apply, presented in **Section 4.2** of this document.

7.2 Description of Potential Credible Accidents, Malfunctions, and Unplanned Events

Based on the nature of the Project, general knowledge of the environment within which the Project is located, as well as the experience of the Proponent and the EIA team, the following credible accidents, malfunctions, and unplanned events have been selected for this assessment and are described in greater detail in the following sections:

Uncontrolled Release of Crude Oil or Gas from the Wellhead: A kick is defined as a flow of formation fluids into the wellbore, and a blow-out is the uncontrolled release of the fluid or gas gained through the kick. A blow-out could endanger personnel working at the site and result in contamination of the surrounding environment.

Failure of Erosion and Sediment Control Measure: Erosion and sediment control (ESC) measures prevent exposed soil from mobilizing and entering undisturbed areas as a result of rainfall or spring runoff. A failure of an ESC measure could result in mass wasting of soil or siltation of receiving watercourses.

Vehicle Accident: A vehicle accident is possible at the Project site or while Project-related vehicles are in transit on provincial roads. A vehicle accident includes a collision with other vehicles, pedestrians, wildlife, or structures/objects, and potentially cause damage to property or pose a risk to the health and safety of workers, the public, or wildlife. A fire or fuel spill could also occur as a consequence of a vehicle collision, compounding the initial effects by potentially threatening the atmospheric environment, the acoustic environment, surface water, groundwater, fish and fish habitat, and wildlife and wildlife habitat.

Accidental Release of a Hazardous Material: An accidental release of fuel used in vehicles or equipment on-site may occur during well decommissioning activities, refuelling of machinery or trucks as a result of human error or equipment malfunction, potentially affecting surface water, groundwater, fish and fish habitat, wildlife and wildlife habitat, vegetation, and wetlands.

Discovery of a Heritage Resource: Previously undiscovered archaeological resources (i.e., artifacts) could be uncovered during excavation as well as from other intrusive activities on the site. Based on the bedrock geology (i.e., sedimentary formations of the Cumberland Formations) underlying the Project site, there is potential that palaeontological resources (i.e., fossils) could be present in the bedrock.

7.3 Potential Interactions between Accidents, Malfunctions, and Unplanned Events and Related Valued Components

Based on the nature of the above credible events and the EIA team's knowledge of their potential to interact with the environment, the VCs with a reasonable potential to interact with these potential accidents, malfunctions, or unplanned events are identified in **Table 7.3.1**.

Table 7.3.1 Potential Interactions of Accidents, Malfunctions, and Unplanned Events with Valued Components

Accident, Malfunction, or Unplanned Event	Atmospheric Environment	Acoustic Environment	Groundwater	Surface Water	Fish and Fish Habitat	Vegetation and Wetlands	Wildlife and Wildlife Habitat	Socioeconomic Environment	Heritage Resources	Traditional Land and Resource Use
Uncontrolled Release of Crude Oil or Gas from the Wellhead	✓		✓	✓	✓	✓	✓	✓		✓
Failure of Erosion and Sediment Control Measure				✓	✓	✓	✓			✓
Vehicle Accident	✓	✓	✓	✓	✓		✓	✓		
Accidental Release of a Hazardous Material	✓		✓	✓	✓	✓	✓			✓
Discovery of a Heritage Resource									✓	

Legend: ✓ indicates a potential interaction

Those accidents, malfunctions, or unplanned events that may result in an interaction with a specific VC are identified with a checkmark in the table above, and are therefore carried for further assessment below.

Accidents, malfunctions, or unplanned events that are not identified with a checkmark in the table above are not expected to result in an interaction with a specific VC or VCs, and are thus not discussed further.

7.3.1 Uncontrolled Release of Crude Oil or Gas from the Wellhead

If a kick (the flow of formation fluids or gas into the wellbore) occurs, a blow-out or uncontrolled release of those fluids or gases could occur at the surface at the wellhead. The resulting release could affect the socioeconomic environment, the atmospheric environment, groundwater, surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and/or traditional land and resource use.

7.3.1.1 Mitigation

Key mitigation to prevent a kick or resulting blow-out include:

- Blow-out preventers (BOPs) connected to the wellhead to control potential releases directly from the wellhead;
- The rig crew will be trained in the operation of the BOP equipment;

- The driller will have a Well Service Blowout Prevention Certificate or equivalent in blow-out prevention and kick control procedures; and
- Blow-out prevention drills will be undertaken in accordance with industry standards.

7.3.1.2 Potential Interactions Following Mitigation

Kick monitoring and blow-out prevention procedures are a mandatory component of petroleum well drilling and servicing in Canada and most other jurisdictions where petroleum exploration and extraction occurs; as such are well regulated by the respective regulatory agencies.

With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a kick or blow-out with the atmospheric environment, surface water, groundwater, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resources during the Project are not anticipated to be substantive.

7.3.2 Failure of Erosion and Sediment Control Measure

Erosion and sediment control (ESC) measures prevent erosion of surface soils and the resulting surface runoff from directly entering surface water bodies. Failure of ESC measures could be a result of the measures being insufficient to manage a given runoff event (e.g., rainfall or spring runoff exceeding capacity) or the implementation was poorly constructed.

A failure of an ESC measure could primarily affect fish and fish habitat. The discharge of runoff containing sediment to watercourses during storm events or spring runoff could result in the degradation of adjacent surface water bodies, wetlands, and fish and fish habitat which those environments support. The effects on fish and fish habitat could include a temporary reduction in water quality due to increased sediment load. If the release were to occur during spawning periods, spawning beds could be negatively affected as sediment may cover the gravel beds and suffocate the eggs. Aquatic organisms may be adversely affected by a sediment release, potentially reducing the fish's food supply. Consequential environmental effects could result to surface water, vegetation and wetlands, and wildlife and wildlife habitat.

In addition, a failure of an ESC measure could affect traditional land and resource use as a consequential environmental effect. Indigenous communities that may practice traditional activities near the well sites could be affected if the fish and fish habitat affected by an ESC failure were being used for traditional purposes.

7.3.2.1 Mitigation

Key mitigation to prevent a failure of erosion or sediment control measures includes:

- Additional siltation and erosion prevention devices shall be on-site and readily deployable in the event of sudden/heavy precipitation and/or a runoff event;

- Construction of the ESC measures using quality materials and sound and proven construction practices in accordance with industry best practices;
- Periodic inspection and maintenance (as required) of the ESC measures, particularly following each precipitation event; and
- Contingency plans will be developed for extreme rainfall or spring runoff events including:
    - monitoring of surface runoff conditions during heavy rainfall/spring runoff and operational observations to evaluate the need for improvements in surface runoff control,
    - cover will be applied to highly erodible areas,
    - clean-out of check dams will be conducted, and
    - provision of a stockpile of sediment and erosion control materials.

Note that approaches will vary depending upon season, and the Site Manager shall indicate approaches for summer low flow periods, spring-fall high flow periods, and frozen ground high flow periods.

7.3.2.2 Potential Interactions Following Mitigation

The installation, maintenance, and monitoring of erosion and sediment control structures is a routine activity on construction sites and industrial operations, and is well understood by site managers and construction personnel. With daily visual monitoring of erosion and sediment control devices, conducting maintenance of them as necessary, periodically removing accumulated sediment, and active water management on-site, the risk of a failure of erosion and sediment control measures occurring is expected to be very low. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a failure of erosion and sedimentation control measures with surface water, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resources during all phases of the Project are not expected to be substantive.

7.3.3 Vehicle Accident

A vehicle accident could affect the socioeconomic environment, the atmospheric environment, the acoustic environment, groundwater, surface water, fish and fish habitat, and/or wildlife and wildlife habitat.

Vehicles will be active across the well sites for the entirety of the Project duration as well on provincial roads during mobilization and demobilization activities or moving to and from different parts of the wellfield. Vehicle collisions have the potential to pose a risk to human health and safety and other property such as Project infrastructure or private property. This could have an adverse effect on the socioeconomic environment.

Consequential environmental effects of a vehicle accident could occur on the atmospheric environment, as fires or fuel spills arising from a vehicle accident could result in a temporary and localized reduction in

air quality. The resulting noise from a vehicle accident as well as from emergency response vehicles could cause an interaction with the acoustic environment. Fuel spills resulting from a vehicle accident could adversely affect surface water, groundwater, or fish and fish habitat, as surface or groundwater resources may become contaminated by fuel, potentially threatening potable water supplies and fish and fish habitat. Finally, a vehicle accident could have a direct effect on wildlife in the event of vehicle-to-wildlife collision, and an indirect effect in the event of a fuel spill or fire resulting from a vehicle collision.

7.3.3.1 Mitigation

Key mitigation to prevent a vehicle accident includes:

- Establishment of a project site traffic management plan that provides guidance to workers, contractors and visitors for the safe flow of vehicles, equipment and pedestrians;
- Existing gravel roads within the wellfield will be upgraded where necessary to ensure they will accommodate vehicles and equipment planned for the Project;
- Select a preferred transportation route off-site to optimize safety by using roads that are designed to accommodate the vehicle weights that will be associated with the Project;
- Vehicles travelling to and from the Project site will adhere to posted speed limits, weight restrictions, and other traffic safety rules, and drivers will adjust their speed to conditions accordingly;
- Drivers will also heed wildlife warning signs and reduce speed in areas identified as posing a potential risk of wildlife collision;
- Pedestrian zones will be identified to allow workers access throughout the work area on foot; and
- A communications plan will be established to engage with local communities potentially affected by Project-related traffic.

7.3.3.2 Potential Interactions Following Mitigation

Though a vehicle accident may occur with any project, particular attention will be paid to conducting Project operations in a careful and safe manner so as to reduce the risk of a serious vehicle accident. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a vehicle accident with the socioeconomic environment, atmospheric environment, acoustic environment, surface water, groundwater, fish and fish habitat, and wildlife and wildlife habitat are not expected to be substantive.

7.3.4 Accidental Release of a Hazardous Material

The accidental release of a hazardous material through spills could affect primarily groundwater, surface water, and fish and fish habitat, with consequential environmental effects possible to the atmospheric

environment, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resource use.

As vehicles and mobile equipment used on-site will need to be refuelled for their continued operation, fuels will be brought on-site either by mobile tankers operated by approved refuelling contractors or for small equipment in approved fuel storage containers less than 40 L. Refuelling activities will be carried out in a designated area (at least 30 m away from watercourses or wetlands) using defined procedures to prevent the occurrence of a spill. Recovered crude oil and/or flowback water will be contained within the rig tank. On an as needed basis (i.e., the tank is full or needs to be moved to a new site) the rig tank will be emptied, cleaned and fluids transported to a licenced disposal facility.

An accidental spill of hydrocarbons or other substances may contaminate air, soils, or groundwater and, through runoff, contaminate watercourses. Contaminants may adversely affect both terrestrial and aquatic habitats and their species, including migratory birds. Loss of petroleum hydrocarbons, hazardous materials, or other substances may volatilize and adversely affect ambient air quality on a temporary and localized basis.

Chemical and fuel spills may enter a watercourse directly, potentially affecting water quality and fish and their habitat, with the extent of effects depending upon the nature of the material and the quantity released. The effects could range from a small localized spill, which is contained and remediated quickly, to a large release of a highly soluble material that affects the receiving watercourse. Possible negative effects to fish and fish habitat could include direct mortality of fish and aquatic organisms, degradation of surface water quality, and potential injury or death of wildlife in the event of exposure. If natural resources affected by a spill are used for traditional purposes by Indigenous persons, a consequential environmental effect of a spill could also occur to traditional land and resource use.

Effects on vegetation and wetlands from an accidental hazardous materials release include a physical harm or death of vegetation species, a reduction or loss of wetland function as a habitat for fish and wildlife, and accretion of contaminants in wetland sediments. Contaminants are less likely to move through a wetland system at the same rate as riparian systems due to the generally lower mobility of water and sediments. Contaminants may build up in the sediments and be released into the ecosystem over time, rather than being flushed out over a season as with a riparian system.

7.3.4.1 Mitigation

Key mitigation to prevent an accidental release of a hazardous material includes:

- Steel lines connect the wellhead/BOPs to the rig tank, pump and cement mixer. These steel lines (3-4” in diameter) are threaded together, and each connection is placed in a “drip pan” designed to collect fluids in the event the seal is not complete;
- Fuels will be brought on-site either by mobile tankers operated by approved refuelling contractors or in approved fuel storage containers less than 40 L. Refuelling activities will be carried out in a designated area (at least 30 m away from watercourses or wetlands) using defined procedures to prevent the occurrence of a spill. Recovered crude oil and/or flowback

water will be contained within the rig tank. On an as needed basis (i.e., the tank is full or needs to be moved to a new site) the rig tank will be emptied, cleaned and fluids transported to a licenced disposal facility. A Spill Contingency Plan will be developed for substances anticipated to be brought on-site during the decommissioning and reclamation activities;

- The majority of the well sites except four are located more than 30 m from a wetland and watercourse. When possible, fuelling operations will be conducted in designated areas located at a minimum distance of 30 m from wetlands, surface water bodies, or preferential pathways;
- Vehicle maintenance, including the changing of oil and lubricants, will not be permitted on-site;
- Releases potentially caused by motor vehicle accidents are addressed initially by local emergency response agencies and directed by the NBDELG. Subsequently, site contractors will contain the spill and remove contaminated soils and sediment for disposal;
- Emergency spill kits will be available on-site; and
- Small spills can typically be cleaned up effectively with minimal long-term impacts, and larger spills are not likely to occur based on limited quantities of hydrocarbons anticipated to be present on-site during decommissioning and reclamation.

7.3.4.2 Potential Interactions Following Mitigation

With no planned storage of liquid hazardous materials on-site and careful implementation of best practices during refuelling of equipment, the risk of spills resulting during decommissioning or reclamation activities for the Project is expected to be low. The risk of contamination from spills and leaks will be reduced further by preventive measures, contingency planning and spill response and mitigation. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of an accidental release of a hazardous material with the atmospheric environment, water resources, fish and fish habitat, vegetation and wetlands, wildlife and wildlife habitat, and traditional land and resource use during all phases of the Project are not expected to be substantive.

7.3.5 Discovery of a Heritage Resource

The discovery of a heritage resource would interact with the heritage resources VC.

Any ground breaking or earth moving activity has the potential to uncover previously undiscovered heritage resources. Archaeological resources (i.e., artifacts) tend to be found in surficial soils and when discovered, whereas palaeontological resources (i.e., fossils) tend to be found in bedrock. Little excavation is planned for the Project aside from a shallow (1-2 m) excavation at each wellhead—which is located in a previously disturbed area.

The discovery of these resources can provide valuable information about human activity or use in the distant past (in the case of artifacts), or the presence of wildlife and vegetation in earlier eras (in the case of fossils).

With respect to the Project, it is possible that previously undiscovered heritage resources in the form of artifacts could be found in the surficial soils (including topsoil and overburden) during the Project activities. Moreover, it is possible that fossils could be found in the sedimentary rock underlying the Project.

7.3.5.1 Mitigation

Key mitigation measures to minimize the potential for the discovery of a heritage resource include:

- Minimize the extent of disturbance of the Project site by planning as small a disturbance area as possible;
- Planned avoidance of known areas of elevated archaeological potential, to the extent practical; and
- Contingency and emergency response procedures will be developed and implemented.

In the event that an archaeological or cultural resource or artifact is discovered during the Project, the following procedure will be followed:

- Work will be immediately stopped, and the area will be marked to prevent further disturbance. An exclusion zone of 100 m surrounding the find will be established;
- The Site Manager will immediately contact the Archaeology and Heritage Branch (AHB) of the New Brunswick Department of Tourism, Heritage and Culture (NBDTHC) to notify them of the discovery and establish a mitigation plan;
- Notify affected First Nations of the discovery in a manner consistent with the directions of AHB;
- No additional work will be permitted at the site until approval has been received from the appropriate regulatory agency to resume the work;
- If bones or human remains are found, work in the area must cease, and the RCMP shall be immediately notified;
- No one shall disturb, move or conceal any uncovered human remains; and
- If the discovered resources are related to Indigenous culture, the New Brunswick Department of Aboriginal Affairs will be contacted to determine how best to proceed with respect to repatriation of the resources.

7.3.5.2 Potential Interactions Following Mitigation

The well pads and access roads have been the subject of extensive historic disturbance since the early 1900's and as such, if cultural resources were present in the topsoil or overburden, it is very likely that they would have been previously uncovered or destroyed. In addition, excavation associated with the Project will occur in previously disturbed areas at the individual wellheads, and will not extend below 2 m, thereby limiting interactions with potential undiscovered heritage resources. Palaeontological

resources are unlikely to be encountered as excavations will not advance to bedrock as a result of the Project.

Given that the Project will occur on historically disturbed land, and that excavations will be minimal and not reach bedrock, the potential to encounter previously undiscovered heritage resources during the Project is believed to be very low. With the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of a discovery of a heritage resource on heritage resources are not expected to be substantive.

7.3.6 Overall Summary

In light of the above, and with the implementation of mitigation measures, contingency and emergency response procedures, and best practices, the potential interactions of all credible accidents, malfunctions, or unplanned events on all VCs are not expected to be substantive.

8.0 Consultation and Engagement

In accordance with the EIA Regulation, direct communication with stakeholders (local residents, elected officials, businesses, etc.) is required. The planned approach to public and stakeholder notification as well as Indigenous consultation in respect of the EIA review of the Project is described in this section.

8.1 Overall Approach

As individual well pads are selected for decommissioning, residents within 500 m of the well pad areas will be made aware of the proposed decommissioning activities through direct written communications (i.e., letter). In addition, interested residents will be given the option to review the EIA document available to download on the NBDELG's website.

Direct written communication will include the following:

- Brief description of the proposed Project;
- Description of the Project location;
- Map showing the location of the Project components;
- Status of the Provincial Regulatory Approval process; and
- Contact information from an ORLEN or Dillon representative who can be contacted for further information.

Given that the Project activities will be conducted on privately owned land and will be occurring largely in isolated, forested areas away from residential properties, and since the Project is intended as an ecological restoration initiative aimed at minimizing potential environmental effects, a broad public, stakeholder, and Indigenous engagement program is not believed to be warranted for this limited scale Project. Engagement activities will be focused on consultation with the landowner and any immediate adjacent landowners within 500 m of a well site.

In the event that any questions or concerns are raised about the Project during the EIA review period, they will be documented, responded to, and reported to the NBDELG in a summary report on engagement efforts within 60 days of registration of the Project.

8.2 Future Activities

In accordance with the EIA Guide (NBDELG 2018), ORLEN will provide a summary report documenting the engagement efforts and feedback received during the first 45 days following submission of the EIA Registration document to the NBDELG. The report will be submitted to NBDELG for review within 60 days following registration of the Project, so that the information can be considered in the course of decision-making in respect of the Project.

9.0 Other Information

9.1 Project Related Documents

This EIA Registration document includes other relevant documents as **Appendices A** to **E** of this document. Other than this EIA Registration document and the appended information, there are currently no additional Project-related documents that are publicly accessible.

9.2 Approval of the Undertaking

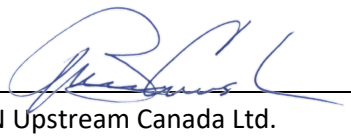
Following completion of the EIA review for the Project and the receipt of a Certificate of Determination, a number of other authorizations, approvals, permits, licenses, or leases may be required from provincial or federal agencies. Refer to **Section 1.4** of this document for more information in this regard.

9.3 Funding

This Project will be funded entirely by ORLEN, and does not involve the receipt of any funds, loans, loan guarantees, land transfers, or other types of financial support from any federal or provincial government department or agency.

9.4 Signature

This document is submitted on behalf of ORLEN Upstream Canada Limited.



ORLEN Upstream Canada Ltd.

July 7, 2022

Date of Signature

10.0 Closing

This report was prepared by Dillon Consulting Limited (Dillon) on behalf of ORLEN Upstream Canada Ltd. Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

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This report has been prepared by a team of Dillon professionals on behalf of ORLEN Upstream Canada Ltd.

Respectfully submitted,

DILLON CONSULTING LIMITED

Matt Hopps, P.Geo.
Associate, Project Manager

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Appendix A

2022 AC CDC Report

DATA REPORT 7158: Hillsborough, NB

Prepared 3 February 2022
by J. Pender, Data Manager

CONTENTS OF REPORT

Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
HillsboroughNB_7158ob.xls	Rare or legally-protected Flora and Fauna in your study area
HillsboroughNB_7158ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
HillsboroughNB_7158msa.xls	Managed and Biologically Significant Areas in your study area
HillsboroughNB_7158ff_py.xls	Rare Freshwater Fish in your study area (DFO database)

1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney
Senior Scientist / Executive Director
(506) 364-2658
sean.blaney@accdc.ca

Animals (Fauna)
John Klymko
Zoologist
(506) 364-2660
john.klymko@accdc.ca

Data Management, GIS
James Churchill
Conservation Data Analyst / Field Biologist
(902) 679-6146
james.churchill@accdc.ca

Billing
Jean Breau
Financial Manager / Executive Assistant
(506) 364-2657
jean.breau@accdc.ca

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

Western: Emma Vost
(902) 670-8187
Emma.Vost@novascotia.ca

Western: Sarah Spencer
(902) 541-0081
Sarah.Spencer@novascotia.ca

Central: Shavonne Meyer
(902) 893-0816
Shavonne.Meyer@novascotia.ca

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(902) 890-1046
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Eastern: Harrison Moore
(902) 497-4119
Harrison.Moore@novascotia.ca

Eastern: Maureen Cameron-MacMillan
(902) 295-2554
Maureen.Cameron-MacMillan@novascotia.ca

Eastern: Elizabeth Walsh
(902) 563-3370
Elizabeth.Walsh@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

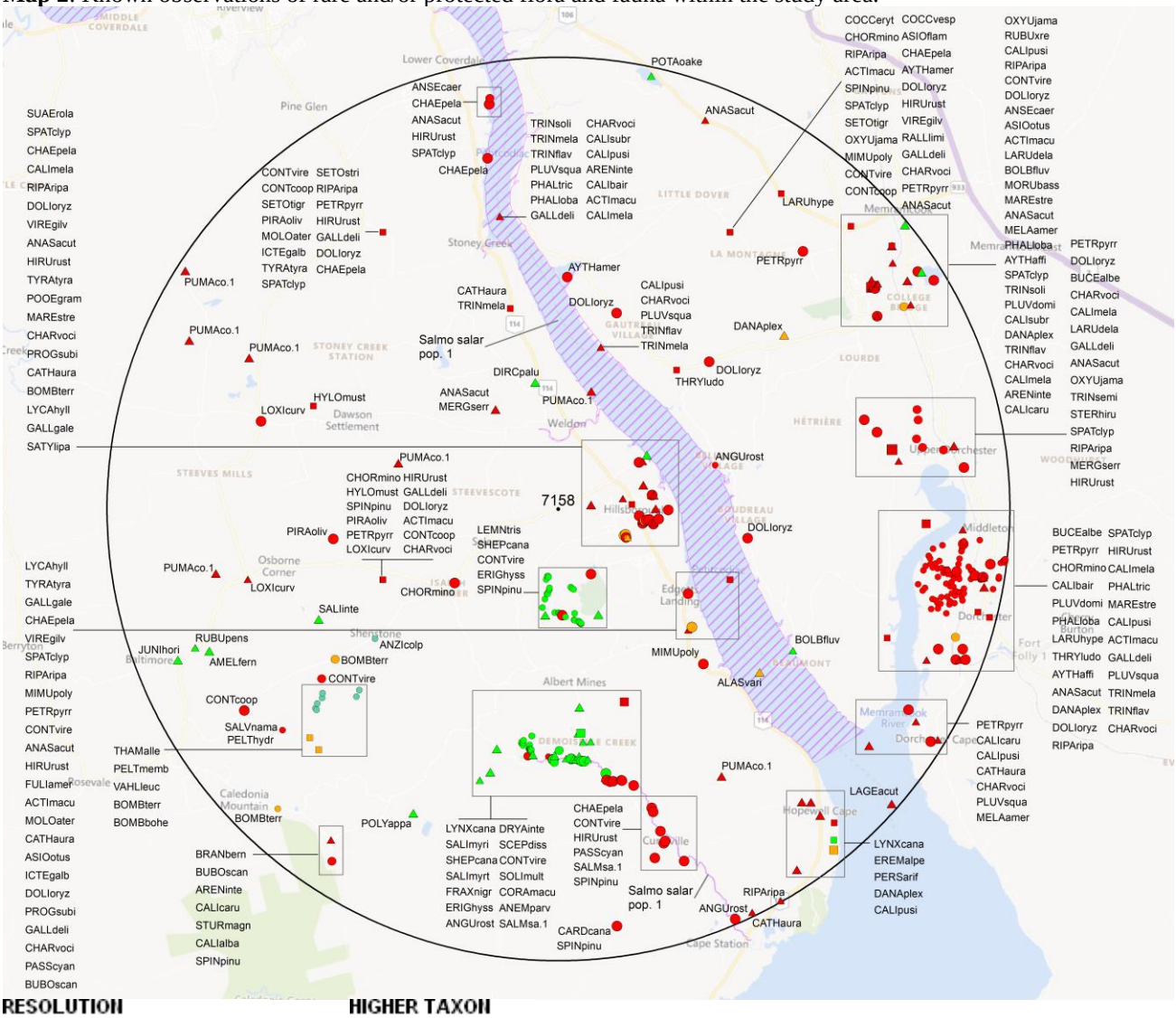
2.1 FLORA

The study area contains 152 records of 22 vascular, 9 records of 5 nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 686 records of 74 vertebrate, 16 records of 6 invertebrate fauna (Map 2 and attached data files - see 1.1 Data List). Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.



3.0 SPECIAL AREAS

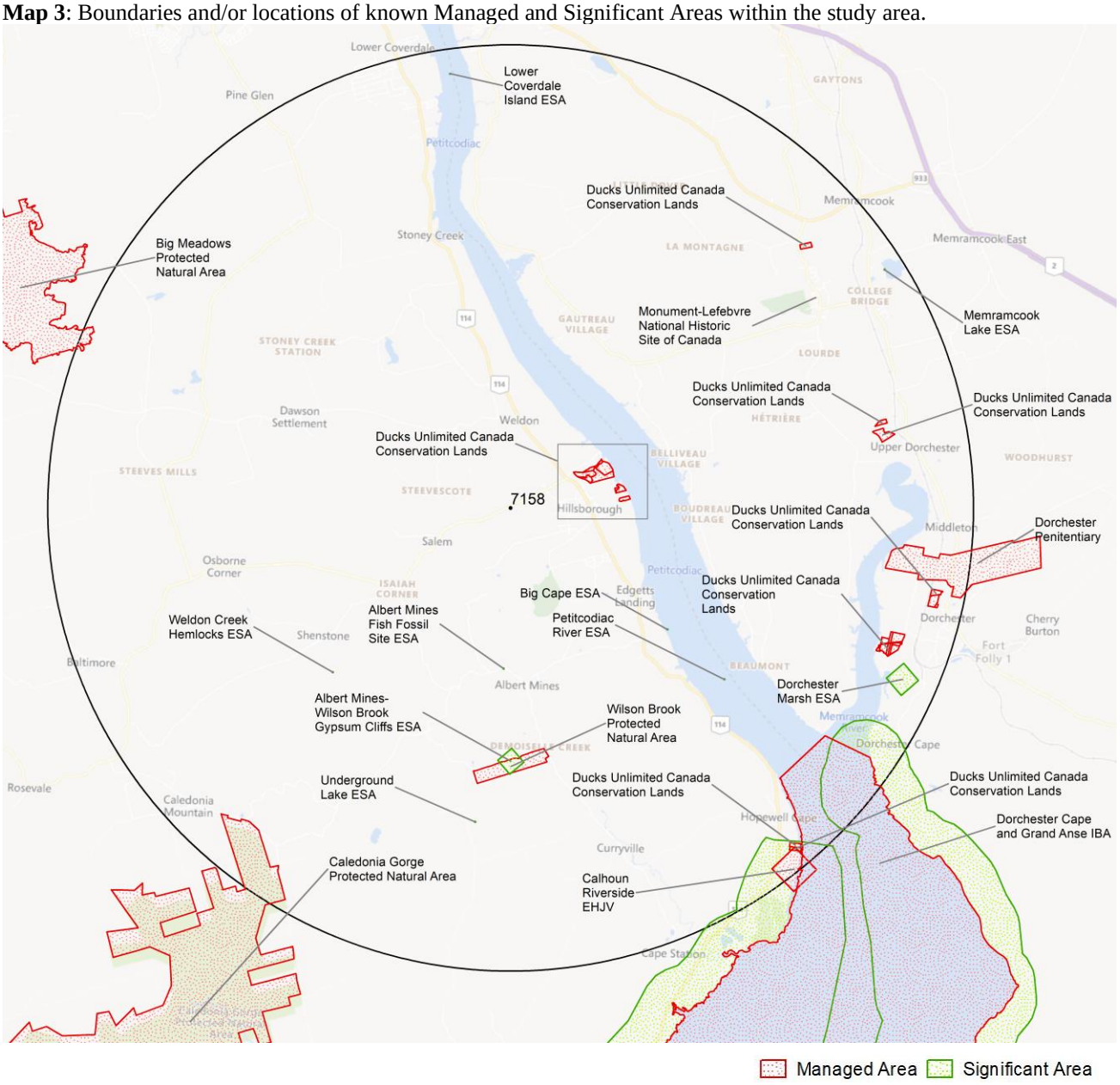
3.1 MANAGED AREAS

The GIS scan identified 32 managed areas in the vicinity of the study area (Map 3 and attached file: *msa.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified 11 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *msa.xls).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened		S1	1	10.2 ± 0.0
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened		S1S2	1	6.5 ± 0.0
N	*Thamnobryum alleghaniense*	a Moss				S2	1	7.7 ± 0.0
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	2	8.6 ± 0.0
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	4	7.9 ± 0.0
P	*Fraxinus nigra*	Black Ash	Threatened			S4S5	2	7.0 ± 0.0
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S1	19	6.6 ± 0.0
P	*Suaeda rolandii*	Roland's Sea-Blite				S1	1	3.0 ± 1.0
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S1	1	10.9 ± 1.0
P	*Dryas integrifolia*	Entire-leaved Mountain Avens				S1	15	5.7 ± 3.0
P	*Salix myrtillifolia*	Blueberry Willow				S1	25	6.5 ± 0.0
P	*Shepherdia canadensis*	Soapberry				S2	42	2.0 ± 0.0
P	*Anemone parviflora*	Small-flowered Anemone				S2	9	6.8 ± 0.0
P	*Dirca palustris*	Eastern Leatherwood				S2	1	3.7 ± 1.0
P	*Rubus x recurvicaulis*	arching dewberry				S2?	1	12.9 ± 1.0
P	*Salix myricoides*	Bayberry Willow				S2?	1	6.5 ± 1.0
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S2S3	1	11.2 ± 0.0
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	19	3.1 ± 1.0
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S3	2	12.4 ± 10.0
P	*Salix interior*	Sandbar Willow				S3	1	7.6 ± 1.0
P	*Bolboschoenus fluviatilis*	River Bulrush				S3	4	12.5 ± 1.0
P	*Lemna trisulca*	Star Duckweed				S3	1	2.0 ± 0.0
P	*Sceptridium dissectum*	Dissected Moonwort				S3	1	7.1 ± 1.0
P	*Polypodium appalachianum*	Appalachian Polypody				S3	1	9.7 ± 1.0
P	*Juniperus horizontalis*	Creeping Juniper				S3S4	1	11.8 ± 1.0
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	2	6.5 ± 10.0
P	*Potamogeton oakesianus*	Oakes' Pondweed				S3S4	2	12.7 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered	Endangered	S2	10	7.9 ± 0.0
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B,S1M	1	11.6 ± 0.0
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	2	5.4 ± 7.0
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern	Special Concern	S2B,S2M	1	9.4 ± 7.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	12	1.9 ± 0.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2S3B,S2S3M	43	11.1 ± 1.0
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	96	1.0 ± 0.0
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S4	8	12.9 ± 0.0
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S4M	45	11.5 ± 0.0
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B,S2M	23	10.0 ± 0.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B,S3M	6	10.7 ± 0.0
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Threatened	S3B,S3M	1	12.1 ± 0.0
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	2	9.4 ± 7.0
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	6	11.7 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S3M	4	11.1 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	12	10.4 ± 0.0
A	*Calidris subruficollis*	Buff-breasted Sandpiper	Special Concern	Special Concern		SNA	4	10.7 ± 0.0
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	2	11.6 ± 0.0
A	*Fulica americana*	American Coot	Not At Risk			S1S2B,S1S2M	2	5.4 ± 7.0
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	3	11.0 ± 1.0
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	1	9.8 ± 48.0
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4	1	12.8 ± 1.0
A	*Puma concolor pop. 1*	Eastern Cougar	Data Deficient		Endangered	SNA	7	10.0 ± 1.0
A	*Calidris canutus rufa*	Red Knot rufa subspecies	E,SC	Endangered	Endangered	S2M	6	10.7 ± 0.0
A	*Thryothorus ludovicianus*	Carolina Wren				S1	2	12.4 ± 5.0
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S5M	40	11.5 ± 0.0
A	*Aythya americana*	Redhead				S1B,S1M	4	6.7 ± 0.0
A	*Gallinula galeata*	Common Gallinule				S1B,S1M	4	2.1 ± 0.0
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B,S1M	7	10.2 ± 5.0
A	*Progne subis*	Purple Martin				S1B,S1M	2	2.5 ± 0.0
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	19	11.1 ± 0.0
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	8	11.1 ± 0.0
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	1	12.0 ± 7.0
A	*Branta bernicla*	Brant				S1N,S2S3M	1	11.6 ± 0.0
A	*Calidris bairdii*	Baird's Sandpiper				S1S2M	3	12.4 ± 0.0
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	3	5.4 ± 7.0
A	*Pooecetes gramineus*	Vesper Sparrow				S2B,S2M	1	2.5 ± 1.0
A	*Mareca strepera*	Gadwall				S2B,S3M	7	11.1 ± 44.0
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	3	10.7 ± 0.0
A	*Anser caerulescens*	Snow Goose				S2M	2	12.0 ± 0.0
A	*Larus hyperboreus*	Glaucous Gull				S2N,S2M	2	11.1 ± 5.0
A	*Asio otus*	Long-eared Owl				S2S3	3	12.4 ± 0.0
A	*Spatula clypeata*	Northern Shoveler				S2S3B,S2S3M	30	1.0 ± 0.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	29	10.2 ± 0.0
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	7	10.7 ± 0.0
A	*Loxia curvirostra*	Red Crossbill				S3	4	5.4 ± 7.0
A	*Spinus pinus*	Pine Siskin				S3	7	10.8 ± 0.0
A	*Salvelinus namaycush*	Lake Trout				S3	1	10.2 ± 0.0
A	*Cathartes aura*	Turkey Vulture				S3B,S3M	7	12.6 ± 0.0
A	*Rallus limicola*	Virginia Rail				S3B,S3M	1	9.4 ± 7.0
A	*Charadrius vociferus*	Killdeer				S3B,S3M	26	10.5 ± 0.0
A	*Tringa semipalmata*	Willet				S3B,S3M	1	9.8 ± 48.0
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B,S3M	5	9.4 ± 7.0
A	*Vireo gilvus*	Warbling Vireo				S3B,S3M	4	3.2 ± 0.0
A	*Piranga olivacea*	Scarlet Tanager				S3B,S3M	3	5.4 ± 7.0
A	*Passerina cyanea*	Indigo Bunting				S3B,S3M	3	10.1 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	2	5.4 ± 7.0
A	*Icterus galbula*	Baltimore Oriole				S3B,S3M	2	5.4 ± 7.0
A	*Setophaga tigrina*	Cape May Warbler				S3B,S4S5M	3	9.4 ± 7.0
A	*Anas acuta*	Northern Pintail				S3B,S5M	28	1.0 ± 0.0
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5M,S4S5N	2	3.4 ± 1.0
A	*Arenaria interpres*	Ruddy Turnstone				S3M	4	10.7 ± 0.0
A	*Melanitta americana*	Black Scoter				S3M,S1S2N	2	11.1 ± 0.0
A	*Bucephala albeola*	Bufflehead				S3M,S2N	2	10.6 ± 10.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	6	2.5 ± 1.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	15	11.2 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	13	11.5 ± 0.0
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	2	10.6 ± 0.0
A	*Setophaga striata*	Blackpoll Warbler				S3S4B,S5M	1	9.4 ± 7.0
A	*Pluvialis squatarola*	Black-bellied Plover				S3S4M	9	11.5 ± 0.0
A	*Calidris pusilla*	Semipalmated Sandpiper				S3S4M	35	10.2 ± 5.0
A	*Calidris melanotos*	Pectoral Sandpiper				S3S4M	20	1.0 ± 0.0
A	*Calidris alba*	Sanderling				S3S4M,S1N	1	11.6 ± 0.0
A	*Morus bassanus*	Northern Gannet				SHB,S5M	1	11.1 ± 44.0
I	*Bombus (Psithyrus) bohemicus*	Gypsy Cuckoo Bumble Bee	Endangered	Endangered		S1	1	9.8 ± 5.0
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	4	11.5 ± 0.0
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Special Concern	S2	1	7.5 ± 1.0
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern	Special Concern		S3?	5	11.8 ± 0.0
I	*Lycaena hyllus*	Bronze Copper				S3	4	2.0 ± 0.0
I	*Satyrium liparops*	Striped Hairstreak				S3S4	1	2.2 ± 0.0

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with "YES".

New Brunswick

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Chrysemys picta picta	Eastern Painted Turtle	Special Concern		No
Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	No
Glyptemys insculpta	**Wood Turtle**	**Threatened**	**Threatened**	**YES**
Haliaeetus leucocephalus	**Bald Eagle**		**Endangered**	**YES**
Falco peregrinus pop. 1	**Peregrine Falcon - anatum/tundrius pop.**	**Special Concern**	**Endangered**	**YES**
Cicindela marginipennis	Cobblestone Tiger Beetle	Endangered	Endangered	No
Coenonympha nipisiquit	Maritime Ringlet	Endangered	Endangered	No
Bat hibernaculum or bat species occurrence		**[Endangered][1]**	**[Endangered][1]**	**YES**

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NB Species at Risk Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 56950 records of 143 vertebrate and 1473 records of 78 invertebrate fauna; 7452 records of 316 vascular, 2356 records of 203 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including “location-sensitive” species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	69	2.2 ± 1.0	NB
A	*Myotis septentrionalis*	Northern Long-eared Myotis	Endangered	Endangered	Endangered	S1	14	2.2 ± 1.0	NB
A	*Perimyotis subflavus*	Eastern Pipistrelle	Endangered	Endangered	Endangered	S1	20	2.8 ± 0.0	NB
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1?B,S1?M	1	76.8 ± 0.0	NS
A	*Charadrius melodus melodus*	Piping Plover melodus ssp	Endangered	Endangered	Endangered	S1B,S1M	795	14.1 ± 3.0	NB
A	*Dermochelys coriacea (Atlantic pop.)*	Leatherback Sea Turtle - Atlantic pop.	Endangered	Endangered	Endangered	S1S2N	2	45.8 ± 1.0	NB
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy pop.	Endangered	Endangered	Endangered	S2	654	7.9 ± 0.0	NB
A	*Salmo salar pop. 7*	Atlantic Salmon - Outer Bay of Fundy pop.	Endangered		Endangered	SNR	399	21.8 ± 0.0	NB
A	*Rangifer tarandus pop. 2*	Woodland Caribou (Atlantic-Gasp├⌐sie pop.)	Endangered	Endangered	Extirpated	SX	2	47.1 ± 1.0	NB
A	*Lanius ludovicianus*	Loggerhead Shrike	Endangered	Endangered		SXB,SXM	1	25.7 ± 0.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B,S1M	50	11.6 ± 0.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B,S1S2M	19	17.3 ± 0.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B,S1S2M	91	5.4 ± 7.0	NB
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern	Special Concern	S2B,S2M	50	9.4 ± 7.0	NB
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S2B,S2M	18	16.3 ± 7.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Threatened	Threatened	S2B,S2M	10	26.6 ± 2.0	NB
A	*Oceanodroma leucorhoa*	Leach's Storm-Petrel	Threatened			S2B,SUM	1	40.3 ± 0.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	598	9.8 ± 10.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	312	1.9 ± 0.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2S3B,S2S3M	2219	2.7 ± 4.0	NB
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened		Threatened	S3	5	29.3 ± 1.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Threatened	S3B,S3M	2228	1.0 ± 0.0	NB
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S3S4M	385	19.1 ± 0.0	NB
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S4	7014	4.7 ± 0.0	NB
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S4M	1683	4.8 ± 0.0	NB
A	*Coturnicops noveboracensis*	Yellow Rail	Special Concern	Special Concern	Special Concern	S1?B,SUM	5	14.1 ± 3.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	S1B,S1S2N,S2M	7	41.8 ± 0.0	NB
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B,S2M	1546	2.9 ± 0.0	NB
A	*Bucephala islandica (Eastern pop.)*	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	S2M,S2N	111	18.3 ± 119.0	NB
A	*Salmo salar pop. 12*	Atlantic Salmon - Gaspe - Southern Gulf of St Lawrence pop.	Special Concern		Special Concern	S2S3	15	47.7 ± 1.0	NS
A	*Balaenoptera physalus*	Fin Whale	Special Concern	Special Concern		S2S3	1	35.5 ± 1.0	NB
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	26	17.7 ± 1.0	NB
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S3B,S3M	107	13.6 ± 0.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B,S3M	556	5.4 ± 7.0	NB
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Threatened	S3B,S3M	764	12.1 ± 0.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	382	9.4 ± 7.0	NB
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	262	3.7 ± 0.0	NB
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S3M	23	8.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Phocoena phocoena*	Harbour Porpoise	Special Concern		Spec.Concern	S4	4	13.8 ± 0.0	NB
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern			S4	106	50.9 ± 0.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S4B,S4M	879	2.1 ± 0.0	NB
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern	Special Concern	S4N,S4M	54	24.5 ± 1.0	NB
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S1?	5	50.8 ± 0.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Endangered	S1B,S3M	401	5.4 ± 7.0	NB
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	50	5.1 ± 0.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B,S1S2M	10	17.4 ± 0.0	NB
A	*Fulica americana*	American Coot	Not At Risk			S1S2B,S1S2M	64	5.4 ± 7.0	NB
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S1S2B,SUM	10	30.3 ± 0.0	NB
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk			S2	6	15.5 ± 1.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk			S2B,S2M	23	18.8 ± 0.0	NB
A	*Chlidonias niger*	Black Tern	Not At Risk			S2B,S2M	188	22.8 ± 0.0	NB
A	*Lynx canadensis*	Canadian Lynx	Not At Risk		Endangered	S3	15	5.9 ± 10.0	NB
A	*Desmognathus fuscus - Quebec / New Brunswick population*	Northern Dusky Salamander - Quebec / New Brunswick population	Not At Risk			S3	1	45.0 ± 0.0	NB
A	*Megaptera novaeangliae*	Humpback Whale (NW Atlantic pop.)	Not At Risk			S3	3	85.1 ± 0.0	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	489	9.8 ± 48.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S3M,S2N	56	23.1 ± 5.0	NB
A	*Lagenorhynchus acutus*	Atlantic White-sided Dolphin	Not At Risk			S3S4	3	12.8 ± 1.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S4	1600	1.0 ± 0.0	NB
A	*Canis lupus*	Gray Wolf	Not At Risk		Extirpated	SX	2	68.1 ± 1.0	NB
A	*Puma concolor pop. 1*	Eastern Cougar	Data Deficient		Endangered	SNA	117	3.5 ± 1.0	NB
A	*Calidris canutus rufa*	Red Knot rufa subspecies	E,SC	Endangered	Endangered	S2M	661	10.7 ± 0.0	NB
A	*Morone saxatilis*	Striped Bass	E,SC			S3	8638	29.3 ± 0.0	NB
A	*Thryothorus ludovicianus*	Carolina Wren				S1	10	5.3 ± 5.0	NB
A	*Salvelinus alpinus*	Arctic Char				S1	3	60.4 ± 1.0	NB
A	*Vireo flavifrons*	Yellow-throated Vireo				S1?B,S1?M	4	20.6 ± 0.0	NB
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S5M	2551	4.8 ± 0.0	NB
A	*Aythya americana*	Redhead				S1B,S1M	10	6.7 ± 0.0	NB
A	*Gallinula galeata*	Common Gallinule				S1B,S1M	53	2.1 ± 0.0	NB
A	*Antigone canadensis*	Sandhill Crane				S1B,S1M	20	28.3 ± 0.0	NB
A	*Bartramia longicauda*	Upland Sandpiper				S1B,S1M	56	18.6 ± 7.0	NB
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B,S1M	34	8.6 ± 0.0	NB
A	*Leucophaeus atricilla*	Laughing Gull				S1B,S1M	10	19.0 ± 1.0	NB
A	*Progne subis*	Purple Martin				S1B,S1M	125	2.5 ± 0.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	110	9.4 ± 7.0	NB
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	169	11.1 ± 44.0	NB
A	*Aythya marila*	Greater Scaup				S1B,S4M,S2N	11	24.5 ± 1.0	NB
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	71	12.0 ± 7.0	NB
A	*Sterna paradisaea*	Arctic Tern				S1B,SUM	14	24.1 ± 0.0	NB
A	*Fratercula arctica*	Atlantic Puffin				S1B,SUN,SUM	3	43.3 ± 11.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S1N,S2M	17	19.8 ± 0.0	NB
A	*Branta bernicla*	Brant				S1N,S2S3M	37	11.6 ± 0.0	NB
A	*Butorides virescens*	Green Heron				S1S2B,S1S2M	8	20.5 ± 7.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B,S1S2M	5	14.1 ± 3.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B,S1S2M	92	16.2 ± 0.0	NB
A	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				S1S2B,S1S2M	5	16.2 ± 0.0	NB
A	*Troglodytes aedon*	House Wren				S1S2B,S1S2M	12	16.0 ± 0.0	NB
A	*Rissa tridactyla*	Black-legged Kittiwake				S1S2B,S4N,S5M	4	54.4 ± 0.0	NB
A	*Calidris bairdii*	Baird's Sandpiper				S1S2M	55	8.6 ± 0.0	NB
A	*Cistothorus palustris*	Marsh Wren				S2B,S2M	82	19.5 ± 0.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S2B,S2M	158	5.4 ± 7.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2B,S2M	31	22.6 ± 7.0	NB

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A	*Pooecetes gramineus*	Vesper Sparrow				S2B,S2M	131	2.5 ± 1.0	NB
A	*Mareca strepera*	Gadwall				S2B,S3M	350	2.5 ± 1.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2B,S4S5N,S4S5M	49	17.7 ± 0.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S5M	218	8.6 ± 0.0	NB
A	*Anser caerulescens*	Snow Goose				S2M	25	12.0 ± 0.0	NB
A	*Phalacrocorax carbo*	Great Cormorant				S2N,S2M	50	14.1 ± 3.0	NB
A	*Somateria spectabilis*	King Eider				S2N,S2M	5	37.0 ± 0.0	NB
A	*Larus hyperboreus*	Glaucous Gull				S2N,S2M	93	11.1 ± 5.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	23	5.4 ± 7.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S2S3	16	36.5 ± 7.0	NB
A	*Spatula clypeata*	Northern Shoveler				S2S3B,S2S3M	474	1.0 ± 0.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S2S3B,S2S3M	67	13.0 ± 7.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B,S2S3M	594	5.4 ± 7.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	237	10.7 ± 0.0	NB
A	*Calcarius lapponicus*	Lapland Longspur				S2S3N,SUM	41	23.9 ± 5.0	NB
A	*Cepphus grylle*	Black Guillemot				S3	76	21.3 ± 5.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	154	5.4 ± 7.0	NB
A	*Spinus pinus*	Pine Siskin				S3	463	3.4 ± 0.0	NB
A	*Salvelinus namaycush*	Lake Trout				S3	1	10.2 ± 0.0	NB
A	*Sorex maritimensis*	Maritime Shrew				S3	114	29.2 ± 1.0	NB
A	*Eptesicus fuscus*	Big Brown Bat				S3	11	14.8 ± 0.0	NB
A	*Cathartes aura*	Turkey Vulture				S3B,S3M	213	2.5 ± 1.0	NB
A	*Rallus limicola*	Virginia Rail				S3B,S3M	349	9.4 ± 7.0	NB
A	*Charadrius vociferus*	Killdeer				S3B,S3M	1034	2.5 ± 1.0	NB
A	*Tringa semipalmata*	Willet				S3B,S3M	1168	9.8 ± 48.0	NB
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B,S3M	127	9.4 ± 7.0	NB
A	*Vireo gilvus*	Warbling Vireo				S3B,S3M	101	3.2 ± 0.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3B,S3M	70	5.4 ± 7.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B,S3M	52	4.5 ± 0.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B,S3M	308	5.4 ± 7.0	NB
A	*Icterus galbula*	Baltimore Oriole				S3B,S3M	140	5.4 ± 7.0	NB
A	*Somateria mollissima*	Common Eider				S3B,S4M,S3N	230	13.5 ± 80.0	NB
A	*Setophaga tigrina*	Cape May Warbler				S3B,S4S5M	311	9.4 ± 7.0	NB
A	*Anas acuta*	Northern Pintail				S3B,S5M	159	1.0 ± 0.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S5M,S4S5N	251	3.4 ± 1.0	NB
A	*Arenaria interpres*	Ruddy Turnstone				S3M	905	8.6 ± 0.0	NB
A	*Phalaropus fulicarius*	Red Phalarope				S3M	3	22.4 ± 0.0	NB
A	*Melanitta americana*	Black Scoter				S3M,S1S2N	261	11.1 ± 0.0	NB
A	*Bucephala albeola*	Bufflehead				S3M,S2N	123	9.8 ± 48.0	NB
A	*Calidris maritima*	Purple Sandpiper				S3M,S3N	107	19.1 ± 0.0	NB
A	*Uria lomvia*	Thick-billed Murre				S3N,S3M	3	53.7 ± 0.0	NS
A	*Synaptomys cooperi*	Southern Bog Lemming				S3S4	84	22.3 ± 1.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B,S3S4M	614	2.5 ± 1.0	NB
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S5M	953	5.4 ± 7.0	NB
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	1286	5.4 ± 7.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S3S4B,S5M	417	10.6 ± 0.0	NB
A	*Setophaga striata*	Blackpoll Warbler				S3S4B,S5M	61	9.4 ± 7.0	NB
A	*Pluvialis squatarola*	Black-bellied Plover				S3S4M	2048	4.8 ± 0.0	NB
A	*Calidris pusilla*	Semipalmated Sandpiper				S3S4M	2609	4.8 ± 0.0	NB
A	*Calidris melanotos*	Pectoral Sandpiper				S3S4M	509	1.0 ± 0.0	NB
A	*Calidris alba*	Sanderling				S3S4M,S1N	1519	11.6 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB,S5M	153	11.1 ± 44.0	NB
I	*Bombus (Psithyrus) bohemicus*	Gypsy Cuckoo Bumble Bee	Endangered	Endangered		S1	10	9.8 ± 5.0	NB
I	*Gomphus ventricosus*	Skillet Clubtail	Endangered	Endangered	Endangered	S1S2	2	68.2 ± 0.0	NB
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S3B,S3M	350	8.2 ± 2.0	NB
I	*Ophiogomphus howei*	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2	1	97.0 ± 0.0	NB

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I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Special Concern	S2	38	7.5 ± 1.0	NB
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S2	22	76.5 ± 0.0	NB
I	*Bombus terricola*	Yellow-banded Bumblebee	Special Concern	Special Concern		S3?	160	2.1 ± 0.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern			SH	29	13.6 ± 1.0	NB
I	*Appalachina sayana*	Spike-lip Crater	Not At Risk			S3?	1	97.2 ± 1.0	NB
I	*Erora laeta*	Early Hairstreak				S1	1	30.0 ± 1.0	NB
I	*Leucorrhinia patricia*	Canada Whiteface				S1	7	99.6 ± 1.0	NB
I	*Plebejus saepiolus*	Greenish Blue				S1S2	2	35.9 ± 7.0	NB
I	*Cicindela ancocisconensis*	Appalachian Tiger Beetle				S2	1	91.6 ± 0.0	NB
I	*Satyrium calanus*	Banded Hairstreak				S2	35	94.2 ± 2.0	NS
I	*Strymon melinus*	Grey Hairstreak				S2	5	39.9 ± 2.0	NB
I	*Somatochlora brevicincta*	Quebec Emerald				S2	2	40.1 ± 0.0	NB
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S2	8	38.2 ± 0.0	NS
I	*Ladona exusta*	White Corporal				S2	2	86.5 ± 0.0	NB
I	*Ischnura posita*	Fragile Forktail				S2	6	24.1 ± 0.0	NB
I	*Callophrys henrici*	Henry's Elfin				S2S3	18	30.4 ± 0.0	NB
I	*Psyrassa unicolor*	a Longhorned Beetle				S3	1	51.8 ± 0.0	NB
I	*Elaphrus americanus*	a Ground Beetle				S3	1	25.3 ± 0.0	NB
I	*Agonum crenistriatum*	a Ground Beetle				S3	1	21.0 ± 1.0	NB
I	*Agonum consimile*	a Ground Beetle				S3	1	21.0 ± 1.0	NB
I	*Lachnocrepis parallela*	a Ground Beetle				S3	1	21.4 ± 0.0	NB
I	*Dyschirius setosus*	a Ground Beetle				S3	3	21.4 ± 0.0	NB
I	*Harpalus fulvilabris*	a Ground Beetle				S3	1	24.6 ± 0.0	NB
I	*Olisthopus parmatus*	a Ground Beetle				S3	1	44.2 ± 0.0	NB
I	*Amara pallipes*	a Ground Beetle				S3	2	21.0 ± 1.0	NB
I	*Carabus maeander*	a Ground Beetle				S3	1	21.0 ± 1.0	NB
I	*Carabus serratus*	a Ground Beetle				S3	1	17.2 ± 1.0	NB
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	13	19.6 ± 0.0	NB
I	*Xylotrechus undulatus*	a Longhorned Beetle				S3	2	13.6 ± 1.0	NB
I	*Calathus gregarius*	a Ground Beetle				S3	1	44.5 ± 1.0	NB
I	*Gonioctena americana*	a Leaf Beetle				S3	1	22.2 ± 0.0	NB
I	*Naemia seriata*	a Ladybird beetle				S3	22	14.1 ± 0.0	NB
I	*Beckerus appressus*	A Click Beetle				S3	1	47.1 ± 0.0	NB
I	*Saperda lateralis*	a Longhorned Beetle				S3	1	45.6 ± 0.0	NS
I	*Trachysida aspera*	a Longhorned Beetle				S3	1	30.5 ± 0.0	NB
I	*Dicerca caudata*	Tailed Jewel Borer				S3	1	50.0 ± 0.0	NB
I	*Enoclerus muttkowskii*	a Checkered Beetle				S3	2	24.2 ± 0.0	NB
I	*Hesperia sassacus*	Indian Skipper				S3	3	44.3 ± 0.0	NB
I	*Euphyes bimacula*	Two-spotted Skipper				S3	15	24.9 ± 1.0	NB
I	*Papilio brevicauda bretonensis*	Short-tailed Swallowtail				S3	12	61.5 ± 0.0	NB
I	*Lycaena hyllus*	Bronze Copper				S3	168	2.0 ± 0.0	NB
I	*Lycaena dospassosi*	Salt Marsh Copper				S3	124	36.4 ± 0.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	18	18.7 ± 7.0	NB
I	*Callophrys polios*	Hoary Elfin				S3	17	31.0 ± 0.0	NB
I	*Plebejus idas*	Northern Blue				S3	6	52.0 ± 0.0	NS
I	*Plebejus idas empetri*	Crowberry Blue				S3	21	19.2 ± 7.0	NB
I	*Speyeria aphrodite*	Aphrodite Fritillary				S3	26	18.5 ± 0.0	NB
I	*Boloria bellona*	Meadow Fritillary				S3	1	98.6 ± 0.0	NB
I	*Boloria chariclea*	Arctic Fritillary				S3	9	15.1 ± 7.0	NB
I	*Polygonia satyrus*	Satyr Comma				S3	2	16.7 ± 5.0	NB
I	*Polygonia gracilis*	Hoary Comma				S3	2	96.5 ± 15.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	10	19.6 ± 0.0	NB
I	*Gomphus vastus*	Cobra Clubtail				S3	1	99.7 ± 0.0	NB
I	*Gomphus abbreviatus*	Spine-crowned Clubtail				S3	7	75.8 ± 0.0	NB
I	*Gomphaeschna furcillata*	Harlequin Darner				S3	3	40.2 ± 0.0	NB
I	*Dorocordulia lepida*	Petite Emerald				S3	5	55.7 ± 1.0	NB
I	*Somatochlora cingulata*	Lake Emerald				S3	4	41.6 ± 1.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3	8	42.7 ± 1.0	NB

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I	*Williamsonia fletcheri*	Ebony Boghaunter				S3	20	25.9 ± 2.0	NB
I	*Lestes eurinus*	Amber-Winged Spreadwing				S3	28	19.6 ± 0.0	NB
I	*Lestes vigilax*	Swamp Spreadwing				S3	1	91.9 ± 0.0	NS
I	*Enallagma geminatum*	Skimming Bluet				S3	5	97.0 ± 0.0	NB
I	*Enallagma signatum*	Orange Bluet				S3	5	23.9 ± 0.0	NB
I	*Stylurus scudderi*	Zebra Clubtail				S3	13	22.6 ± 0.0	NB
I	*Alasmidonta undulata*	Triangle Floater				S3	52	28.5 ± 1.0	NB
I	*Leptodea ochracea*	Tidewater Mucket				S3	53	23.7 ± 1.0	NB
I	*Neohelix albolabris*	Whitelip				S3	1	88.6 ± 0.0	NB
I	*Pantala hymenaea*	Spot-Winged Glider				S3B,S3M	5	40.4 ± 1.0	NS
I	*Collops vittatus*	Banded Soft-winged Flower Beetle				S3S4	1	40.7 ± 3.0	NB
I	*Hemicrepidius memnonius*	a Click Beetle				S3S4	3	51.8 ± 0.0	NB
I	*Bolitophagus corticola*	a Darkling Beetle				S3S4	1	51.8 ± 0.0	NB
I	*Satyrium liparops*	Striped Hairstreak				S3S4	44	2.2 ± 0.0	NB
I	*Satyrium liparops strigosum*	Striped Hairstreak				S3S4	3	20.0 ± 0.0	NB
I	*Cupido comyntas*	Eastern Tailed Blue				S3S4	17	21.2 ± 0.0	NB
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	SH	2	52.4 ± 1.0	NB
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	SH	2	63.0 ± 0.0	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened		S1	794	10.2 ± 0.0	NB
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened		S1?	4	26.4 ± 1.0	NB
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened		S1S2	16	6.5 ± 0.0	NB
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S2	10	74.2 ± 0.0	NB
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Special Concern	S1	15	59.8 ± 1.0	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	13	43.9 ± 0.0	NB
N	*Aloina rigida*	Aloe-Like Rigid Screw Moss				S1	3	23.0 ± 0.0	NB
N	*Arrhenopterum heterostichum*	One-sided Groove Moss				S1	1	77.8 ± 1.0	NS
N	*Dicranoweisia crispula*	Mountain Thatch Moss				S1	1	42.4 ± 0.0	NB
N	*Didymodon rigidulus var. gracilis*	a moss				S1	1	49.7 ± 1.0	NB
N	*Syntrichia ruralis*	a Moss				S1	1	65.2 ± 0.0	NB
N	*Enchylium tenax*	Soil Tarpaper Lichen				S1	2	79.2 ± 0.0	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S1	16	62.9 ± 0.0	NS
N	*Cladonia straminea*	Reptilian Pixie-cup Lichen				S1	5	36.5 ± 1.0	NB
N	*Ephebe perspinulosa*	Thread Lichen				S1	1	81.3 ± 1.0	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S1	1	36.5 ± 1.0	NB
N	*Peltigera collina*	Tree Pelt Lichen				S1	1	92.5 ± 0.0	NS
N	*Peltigera malacea*	Veinless Pelt Lichen				S1	1	49.4 ± 1.0	NB
N	*Bryoria bicolor*	Electrified Horsehair Lichen				S1	1	49.4 ± 1.0	NB
N	*Hygrobiella laxifolia*	Lax Notchwort				S1?	1	51.1 ± 1.0	NB
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S1?	1	87.4 ± 5.0	NS
N	*Bartramia ithyphylla*	Straight-leaved Apple Moss				S1?	2	43.2 ± 1.0	NB
N	*Ptychostomum pallens*	Pale Bryum				S1?	1	82.3 ± 0.0	NS
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1?	1	78.0 ± 0.0	NS
N	*Dicranum condensatum*	Condensed Broom Moss				S1?	2	42.5 ± 0.0	NB
N	*Entodon brevisetus*	a Moss				S1?	1	69.1 ± 10.0	NB
N	*Oxyrrhynchium hians*	Light Beaked Moss				S1?	1	66.6 ± 0.0	NB
N	*Homomallium adnatum*	Adnate Hairy-gray Moss				S1?	3	47.1 ± 1.0	NB
N	*Plagiothecium latebricola*	Alder Silk Moss				S1?	3	49.0 ± 1.0	NB
N	*Rhytidium rugosum*	Wrinkle-leaved Moss				S1?	2	49.6 ± 1.0	NB
N	*Seligeria recurvata*	a Moss				S1?	3	46.7 ± 15.0	NB
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1?	3	76.0 ± 1.0	NS
N	*Heterodermia squamulosa*	Scaly Fringe Lichen				S1?	75	63.1 ± 1.0	NS
N	*Cephaloziella spinigera*	Spiny Threadwort				S1S2	2	70.7 ± 0.0	NB
N	*Odontoschisma francisci*	Holt's Notchwort				S1S2	4	34.2 ± 0.0	NB
N	*Harpanthus flotovianus*	Great Mountain Flapwort				S1S2	2	37.9 ± 1.0	NB
N	*Jungermannia obovata*	Egg Flapwort				S1S2	1	44.1 ± 0.0	NB

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N	*Pallavicinia lyellii*	Lyell's Ribbonwort				S1S2	1	69.1 ± 1.0	NB
N	*Radula tenax*	Tenacious Scalewort				S1S2	1	44.1 ± 0.0	NB
N	*Reboulia hemisphaerica*	Purple-margined Liverwort				S1S2	1	49.8 ± 0.0	NB
N	*Brachythecium acuminatum*	Acuminate Ragged Moss				S1S2	4	45.3 ± 2.0	NB
N	*Ptychostomum salinum*	Saltmarsh Bryum				S1S2	1	49.0 ± 1.0	NB
N	*Pseudocampylium radicale*	Long-stalked Fine Wet Moss				S1S2	1	96.1 ± 3.0	NS
N	*Tortula obtusifolia*	a Moss				S1S2	1	91.2 ± 0.0	NB
N	*Distichium inclinatum*	Inclined Iris Moss				S1S2	5	49.7 ± 1.0	NB
N	*Ditrichum pallidum*	Pale Cow-hair Moss				S1S2	1	60.3 ± 1.0	NB
N	*Hygrohypnum bestii*	Best's Brook Moss				S1S2	5	41.9 ± 1.0	NB
N	*Timmia norvegica*	a moss				S1S2	3	49.9 ± 0.0	NB
N	*Timmia norvegica var. excurrens*	a moss				S1S2	1	49.9 ± 0.0	NB
N	*Tortella humilis*	Small Crisp Moss				S1S2	7	44.3 ± 1.0	NB
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1S2	2	14.7 ± 1.0	NB
N	*Umbilicaria vellea*	Grizzled Rocktripe Lichen				S1S2	1	49.4 ± 1.0	NB
N	*Pilophorus cereolus*	Powdered Matchstick Lichen				S1S2	2	16.1 ± 5.0	NB
N	*Peltigera scabrosa*	Greater Toad Pelt Lichen				S1S2	4	35.1 ± 1.0	NB
N	*Tritomaria scitula*	Mountain Notchwort				S1S3	1	40.3 ± 1.0	NB
N	*Amphidium mougeotii*	a Moss				S2	13	40.4 ± 0.0	NB
N	*Anomodon viticulosus*	a Moss				S2	3	50.3 ± 10.0	NB
N	*Cirriphyllum piliferum*	Hair-pointed Moss				S2	4	39.6 ± 1.0	NB
N	*Dicranella palustris*	Drooping-Leaved Fork Moss				S2	9	37.9 ± 1.0	NB
N	*Didymodon ferrugineus*	Rusty Beard Moss				S2	1	49.5 ± 0.0	NB
N	*Anomodon tristis*	a Moss				S2	10	44.4 ± 10.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S2	2	95.7 ± 0.0	PE
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2	8	41.6 ± 1.0	NB
N	*Isothecium myosuroides*	Slender Mouse-tail Moss				S2	4	68.8 ± 3.0	NS
N	*Meesia triquetra*	Three-ranked Cold Moss				S2	1	99.8 ± 100.0	NB
N	*Orthotrichum speciosum*	Showy Bristle Moss				S2	5	82.4 ± 0.0	PE
N	*Physcomitrium immersum*	a Moss				S2	1	88.4 ± 0.0	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2	4	46.7 ± 15.0	NB
N	*Pohlia elongata*	Long-necked Nodding Moss				S2	10	42.9 ± 0.0	NB
N	*Seligeria calcarea*	Chalk Brittle Moss				S2	2	37.9 ± 0.0	NB
N	*Sphagnum centrale*	Central Peat Moss				S2	8	38.1 ± 1.0	NB
N	*Sphagnum flexuosum*	Flexuous Peatmoss				S2	3	41.5 ± 0.0	NB
N	*Tayloria serrata*	Serrate Trumpet Moss				S2	7	21.4 ± 100.0	NB
N	*Tetrodontium brownianum*	Little Georgia				S2	8	42.4 ± 0.0	NB
N	*Thamnobryum alleghaniense*	a Moss				S2	28	7.7 ± 0.0	NB
N	*Tortula mucronifolia*	Mucronate Screw Moss				S2	1	76.8 ± 3.0	NS
N	*Ulota phyllantha*	a Moss				S2	4	49.9 ± 0.0	NB
N	*Anomobryum julaceum*	Slender Silver Moss				S2	4	49.7 ± 1.0	NB
N	*Cladonia macrophylla*	Fig-leaved Lichen				S2	3	42.5 ± 1.0	NB
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S2	1	88.8 ± 0.0	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S2	23	26.4 ± 0.0	NB
N	*Nephroma laevigatum*	Mustard Kidney Lichen				S2	34	47.8 ± 0.0	NS
N	*Anacamptodon splachnoides*	a Moss				S2?	2	68.3 ± 3.0	NS
N	*Andreaea rothii*	a Moss				S2?	5	40.2 ± 1.0	NB
N	*Anomodon minor*	Blunt-leaved Anomodon Moss				S2?	1	50.6 ± 1.0	NB
N	*Ptychostomum pallescens*	Tall Clustered Bryum				S2?	1	90.1 ± 100.0	NB
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S2?	1	69.1 ± 3.0	NB
N	*Hygrohypnum montanum*	a Moss				S2?	2	41.2 ± 1.0	NB
N	*Schistostega pennata*	Luminous Moss				S2?	1	91.3 ± 100.0	NB
N	*Seligeria diversifolia*	a Moss				S2?	1	83.8 ± 0.0	NB
N	*Sphagnum angermanicum*	a Peatmoss				S2?	1	69.9 ± 10.0	NB
N	*Trichodon cylindricus*	Cylindric Hairy-teeth Moss				S2?	3	46.7 ± 15.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	6	49.2 ± 0.0	NB
N	*Ramalina labiosorediata*	Chalky Ramalina Lichen				S2?	1	46.4 ± 1.0	NB

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N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2?	14	82.4 ± 0.0	PE
N	*Imshaugia placorodia*	Eyed Starburst Lichen				S2?	1	90.1 ± 0.0	PE
N	*Nephroma arcticum*	Arctic Kidney Lichen				S2?	2	48.0 ± 1.0	NB
N	*Ptychostomum cernuum*	Swamp Bryum				S2S3	1	49.9 ± 0.0	NB
N	*Buxbaumia aphylla*	Brown Shield Moss				S2S3	4	96.1 ± 3.0	NS
N	*Calliergonella cuspidata*	Common Large Wetland Moss				S2S3	6	55.8 ± 5.0	NB
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2S3	3	46.1 ± 0.0	NB
N	*Palustriella falcata*	a Moss				S2S3	2	50.4 ± 0.0	NB
N	*Didymodon rigidulus*	Rigid Screw Moss				S2S3	8	45.3 ± 2.0	NB
N	*Ephemerum serratum*	a Moss				S2S3	6	64.0 ± 0.0	NB
N	*Neckera complanata*	a Moss				S2S3	4	79.9 ± 2.0	NS
N	*Orthotrichum elegans*	Showy Bristle Moss				S2S3	3	31.5 ± 0.0	NB
N	*Pohlia proligera*	Cottony Nodding Moss				S2S3	6	45.2 ± 0.0	NB
N	*Codriophorus fascicularis*	Clustered Rock Moss				S2S3	3	42.4 ± 0.0	NB
N	*Racomitrium affine*	a Moss				S2S3	1	38.8 ± 1.0	NB
N	*Saelania glaucescens*	Blue Dew Moss				S2S3	2	42.4 ± 0.0	NB
N	*Sphagnum subfulvum*	a Peatmoss				S2S3	2	94.2 ± 0.0	PE
N	*Taxiphyllum deplanatum*	Imbricate Yew-leaved Moss				S2S3	2	44.3 ± 1.0	NB
N	*Zygodon viridissimus*	a Moss				S2S3	4	44.3 ± 1.0	NB
N	*Schistidium agassizii*	Elf Bloom Moss				S2S3	3	38.8 ± 1.0	NB
N	*Loeskeobryum brevirostre*	a Moss				S2S3	19	40.4 ± 0.0	NB
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2S3	7	38.1 ± 0.0	NB
N	*Cetrariella delisei*	Snowbed Icelandmoss Lichen				S2S3	2	60.9 ± 0.0	NB
N	*Cladonia acuminata*	Scantily Clad Pixie Lichen				S2S3	2	49.4 ± 1.0	NB
N	*Cladonia ramulosa*	Bran Lichen				S2S3	4	44.8 ± 1.0	NB
N	*Cladonia sulphurina*	Greater Sulphur-cup Lichen				S2S3	5	34.3 ± 1.0	NB
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	2	53.8 ± 1.0	NB
N	*Sphaerophorus globosus*	Northern Coral Lichen				S2S3	13	35.8 ± 0.0	NB
N	*Hypnum curvifolium*	Curved-leaved Plait Moss				S3	20	40.4 ± 0.0	NB
N	*Tortella fragilis*	Fragile Twisted Moss				S3	1	49.9 ± 0.0	NB
N	*Schistidium maritimum*	a Moss				S3	5	45.2 ± 0.0	NB
N	*Hymenostylium recurvirostre*	Hymenostylium Moss				S3	9	50.3 ± 1.0	NB
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	5	63.1 ± 3.0	NS
N	*Solorina saccata*	Woodland Owl Lichen				S3	6	49.4 ± 1.0	NB
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S3	2	83.6 ± 0.0	PE
N	*Normandina pulchella*	Rimmed Elf-ear Lichen				S3	25	44.8 ± 1.0	NB
N	*Cladonia farinacea*	Farinose Pixie Lichen				S3	5	41.9 ± 1.0	NB
N	*Hypotrachyna catawbiensis*	Powder-tipped Antler Lichen				S3	17	49.4 ± 0.0	NB
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	6	49.4 ± 1.0	NB
N	*Nephroma bellum*	Naked Kidney Lichen				S3	6	41.7 ± 1.0	NB
N	*Peltigera degenii*	Lustrous Pelt Lichen				S3	3	45.5 ± 1.0	NB
N	*Usnea strigosa*	Bushy Beard Lichen				S3	42	19.3 ± 0.0	NB
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S3	9	26.1 ± 0.0	NB
N	*Leptogium laceroides*	Short-bearded Jellyskin Lichen				S3	14	39.0 ± 1.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	28	8.6 ± 0.0	NB
N	*Cladonia botrytes*	Wooden Soldiers Lichen				S3	3	62.0 ± 0.0	NB
N	*Cladonia carneola*	Crowned Pixie-cup Lichen				S3	2	43.2 ± 0.0	NB
N	*Cladonia deformis*	Lesser Sulphur-cup Lichen				S3	10	42.5 ± 1.0	NB
N	*Aulacomnium androgynum*	Little Groove Moss				S3?	8	46.7 ± 15.0	NB
N	*Ptychostomum inclinatum*	Blunt-tooth Thread Moss				S3?	1	70.2 ± 3.0	NS
N	*Dicranella rufescens*	Red Forklet Moss				S3?	1	49.9 ± 0.0	NB
N	*Rhytidiadelphus loreus*	Lanky Moss				S3?	4	49.7 ± 1.0	NB
N	*Sphagnum lescurii*	a Peatmoss				S3?	9	39.7 ± 1.0	NB
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3?	13	50.3 ± 0.0	NS
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3?	5	53.3 ± 0.0	NS

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N	*Stereocaulon subcoralloides*	Coralloid Foam Lichen				S3?	1	46.4 ± 1.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	2	78.1 ± 0.0	NS
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3S4	1	71.9 ± 15.0	NB
N	*Brachytheciastrum velutinum*	Velvet Ragged Moss				S3S4	9	47.3 ± 1.0	NB
N	*Calliergon giganteum*	Giant Spear Moss				S3S4	2	90.7 ± 0.0	PE
N	*Dicranella cerviculata*	a Moss				S3S4	4	38.8 ± 0.0	NS
N	*Dicranella varia*	a Moss				S3S4	4	82.4 ± 0.0	PE
N	*Dicranum majus*	Greater Broom Moss				S3S4	23	38.1 ± 0.0	NB
N	*Dicranum leioneuron*	a Dicranum Moss				S3S4	2	30.4 ± 0.0	NB
N	*Encalypta ciliata*	Fringed Extinguisher Moss				S3S4	3	49.5 ± 0.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	7	45.2 ± 0.0	NB
N	*Elodium blandowii*	Blandow's Bog Moss				S3S4	2	84.4 ± 0.0	PE
N	*Heterocladium dimorphum*	Dimorphous Tangle Moss				S3S4	7	31.5 ± 0.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	25	38.1 ± 0.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	2	49.9 ± 0.0	NB
N	*Physcomitrium pyriforme*	Pear-shaped Urn Moss				S3S4	7	19.9 ± 0.0	NB
N	*Pogonatum dentatum*	Mountain Hair Moss				S3S4	4	38.8 ± 0.0	NS
N	*Sphagnum compactum*	Compact Peat Moss				S3S4	5	19.4 ± 0.0	NB
N	*Sphagnum quinquefarium*	Five-ranked Peat Moss				S3S4	2	31.5 ± 0.0	NB
N	*Sphagnum torreyanum*	a Peatmoss				S3S4	2	65.1 ± 0.0	NB
N	*Sphagnum austinii*	Austin's Peat Moss				S3S4	1	40.7 ± 0.0	NS
N	*Sphagnum contortum*	Twisted Peat Moss				S3S4	4	84.8 ± 0.0	NB
N	*Tetraphis geniculata*	Geniculate Four-tooth Moss				S3S4	17	38.8 ± 1.0	NB
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3S4	1	60.3 ± 0.0	NS
N	*Weissia controversa*	Green-Cushioned Weissia				S3S4	3	50.3 ± 1.0	NB
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	3	49.9 ± 0.0	NB
N	*Trichostomum tenuirostre*	Acid-Soil Moss				S3S4	7	42.4 ± 0.0	NB
N	*Rauiella scita*	Smaller Fern Moss				S3S4	1	99.0 ± 0.0	NB
N	*Pannaria rubiginosa*	Brown-eyed Shingle Lichen				S3S4	21	45.1 ± 0.0	NS
N	*Pseudocyphellaria holarctica*	Yellow Specklebelly Lichen				S3S4	92	18.8 ± 0.0	NB
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S3S4	13	35.1 ± 1.0	NB
N	*Hypogymnia vittata*	Slender Monk's Hood Lichen				S3S4	31	35.1 ± 1.0	NB
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	16	82.5 ± 0.0	PE
N	*Montanelia panniformis*	Shingled Camouflage Lichen				S3S4	5	37.3 ± 1.0	NB
N	*Cladonia floerkeana*	Gritty British Soldiers Lichen				S3S4	4	48.1 ± 1.0	NB
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	18	7.9 ± 0.0	NB
N	*Xylopsora friesii*	a Lichen				S3S4	1	49.4 ± 1.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	20	27.5 ± 0.0	NB
N	*Protopannaria pezizoides*	Brown-gray Moss-shingle Lichen				S3S4	31	14.4 ± 0.0	NB
N	*Usnea subrubicunda*	Reddish Beard Lichen				S3S4	2	61.4 ± 3.0	NS
N	*Stereocaulon paschale*	Easter Foam Lichen				S3S4	2	26.8 ± 1.0	NB
N	*Pannaria conoplea*	Mealy-rimmed Shingle Lichen				S3S4	38	48.1 ± 0.0	NB
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	6	42.7 ± 0.0	NB
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	82	19.0 ± 0.0	NB
N	*Peltigera neopolydactyla*	Undulating Pelt Lichen				S3S4	10	36.5 ± 1.0	NB
N	*Cladonia cariosa*	Lesser Ribbed Pixie Lichen				S3S4	4	23.6 ± 0.0	NB
N	*Hypocenomyce scalaris*	Common Clam Lichen				S3S4	1	46.4 ± 1.0	NB
N	*Dermatocarpon luridum*	Brookside Stippleback Lichen				S3S4	134	26.7 ± 0.0	NB
N	*Leucodon brachypus*	a Moss				SH	12	39.5 ± 1.0	NB
N	*Splachnum luteum*	Yellow Collar Moss				SH	1	90.1 ± 100.0	NB
N	*Thelia hirtella*	a Moss				SH	1	99.8 ± 100.0	NB
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				SH	3	73.8 ± 10.0	NB
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	45	49.8 ± 1.0	NB

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P	*Symphyotrichum laurentianum*	Gulf of St Lawrence Aster	Threatened	Threatened	Endangered	S1	7	95.4 ± 0.0	NB
P	*Fraxinus nigra*	Black Ash	Threatened			S4S5	568	7.0 ± 0.0	NB
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Endangered	S2	13	72.7 ± 0.0	NS
P	*Lechea maritima var. subcylindrica*	Beach Pinweed	Special Concern	Special Concern	Special Concern	S2	708	60.0 ± 0.0	NB
P	*Symphyotrichum subulatum (Bathurst pop)*	Bathurst Aster - Bathurst pop.	Not At Risk		Endangered	S2	20	79.6 ± 0.0	NB
P	*Cryptotaenia canadensis*	Canada Honewort				S1	1	68.9 ± 1.0	NB
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S1	5	98.4 ± 0.0	NS
P	*Antennaria howellii ssp. petaloidea*	Pussy-Toes				S1	2	79.4 ± 0.0	NS
P	*Bidens discoidea*	Swamp Beggarticks				S1	1	97.0 ± 0.0	NB
P	*Pseudognaphalium obtusifolium*	Eastern Cudweed				S1	8	37.6 ± 1.0	NB
P	*Hieracium paniculatum*	Panicled Hawkweed				S1	13	79.0 ± 0.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S1	12	37.3 ± 0.0	NB
P	*Solidago multiradiata*	Multi-rayed Goldenrod				S1	19	6.6 ± 0.0	NB
P	*Symphyotrichum subulatum (non-Bathurst pop)*	Annual Saltmarsh Aster				S1	12	70.6 ± 0.0	NB
P	*Andersonglossum boreale*	Northern Wild Comfrey				S1	2	95.5 ± 0.0	NS
P	*Barbarea orthoceras*	American Yellow Rocket				S1	1	79.6 ± 1.0	NB
P	*Cardamine parviflora*	Small-flowered Bittercress				S1	11	70.6 ± 0.0	NS
P	*Draba arabisans*	Rock Whitlow-Grass				S1	39	37.0 ± 0.0	NB
P	*Draba glabella*	Rock Whitlow-Grass				S1	8	49.6 ± 0.0	NB
P	*Stellaria crassifolia*	Fleshy Stitchwort				S1	3	35.4 ± 5.0	NB
P	*Chenopodiastrum simplex*	Maple-leaved Goosefoot				S1	6	28.9 ± 1.0	NB
P	*Blitum capitatum*	Strawberry-Blite				S1	1	92.9 ± 1.0	NB
P	*Suaeda rolandii*	Roland's Sea-Blite				S1	14	3.0 ± 1.0	NB
P	*Hypericum virginicum*	Virginia St. John's-wort				S1	2	44.7 ± 0.0	NS
P	*Corema conradii*	Broom Crowberry				S1	7	91.8 ± 0.0	NS
P	*Vaccinium boreale*	Northern Blueberry				S1	5	27.2 ± 1.0	NB
P	*Vaccinium corymbosum*	Highbush Blueberry				S1	1	38.5 ± 0.0	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S1	3	61.0 ± 0.0	NB
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S1	2	92.2 ± 7.0	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S1	2	52.7 ± 5.0	NS
P	*Polygonum douglasii*	Douglas Knotweed				S1	1	64.4 ± 0.0	NB
P	*Lysimachia quadrifolia*	Whorled Yellow Loosestrife				S1	4	96.4 ± 0.0	NB
P	*Primula laurentiana*	Laurentian Primrose				S1	61	44.9 ± 3.0	NB
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S1	2	10.9 ± 1.0	NB
P	*Crataegus jonesiae*	Jones' Hawthorn				S1	1	90.9 ± 1.0	NB
P	*Dryas integrifolia*	Entire-leaved Mountain Avens				S1	15	5.7 ± 3.0	NB
P	*Potentilla canadensis*	Canada Cinquefoil				S1	1	97.5 ± 0.0	NB
P	*Rubus flagellaris*	Northern Dewberry				S1	3	62.9 ± 0.0	NS
P	*Geum fragarioides*	Barren Strawberry				S1	1	24.8 ± 1.0	NB
P	*Salix myrtillifolia*	Blueberry Willow				S1	25	6.5 ± 0.0	NB
P	*Saxifraga paniculata ssp. laestadii*	Laestadius' Saxifrage				S1	43	49.0 ± 0.0	NB
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S1	23	27.6 ± 0.0	NB
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S1	7	74.6 ± 2.0	NS
P	*Carex annectens*	Yellow-Fruited Sedge				S1	3	37.5 ± 0.0	NB
P	*Carex atlantica ssp. atlantica*	Atlantic Sedge				S1	8	39.1 ± 0.0	NS
P	*Carex backii*	Rocky Mountain Sedge				S1	3	28.4 ± 0.0	NB
P	*Carex merritt-fernaldii*	Merritt Fernald's Sedge				S1	1	28.9 ± 0.0	NB
P	*Carex scirpoidea*	Scirpuslike Sedge				S1	6	66.4 ± 0.0	NB
P	*Carex sterilis*	Sterile Sedge				S1	1	50.9 ± 2.0	NB
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	11	70.1 ± 5.0	NB
P	*Scirpus pendulus*	Hanging Bulrush				S1	9	41.9 ± 0.0	NS
P	*Sisyrinchium angustifolium*	Narrow-leaved Blue-eyed-grass				S1	5	47.3 ± 5.0	NS
P	*Juncus greenei*	Greene's Rush				S1	9	30.6 ± 0.0	NB

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P	*Juncus stygius ssp. americanus*	Moor Rush				S1	16	37.6 ± 5.0	NB
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S1	13	29.9 ± 0.0	NB
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	7	70.3 ± 0.0	NS
P	*Malaxis monophyllos*	White Adder's-mouth				S1	1	49.4 ± 0.0	NB
P	*Platanthera flava*	Southern Rein-Orchid				S1	1	49.4 ± 0.0	NB
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1	3	97.5 ± 0.0	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S1	15	17.1 ± 0.0	NB
P	*Bromus pubescens*	Hairy Wood Brome Grass				S1	1	99.6 ± 0.0	NB
P	*Calamagrostis stricta ssp. inexpansa*	Slim-stemmed Reed Grass				S1	2	33.4 ± 1.0	NB
P	*Cinna arundinacea*	Sweet Wood Reed Grass				S1	4	95.0 ± 0.0	NS
P	*Danthonia compressa*	Flattened Oat Grass				S1	24	18.6 ± 0.0	NB
P	*Festuca subverticillata*	Nodding Fescue				S1	12	63.1 ± 0.0	NS
P	*Potamogeton friesii*	Fries' Pondweed				S1	15	23.1 ± 0.0	NB
P	*Potamogeton strictifolius*	Straight-leaved Pondweed				S1	1	99.2 ± 2.0	NB
P	*Cystopteris laurentiana*	Laurentian Bladder Fern				S1	1	64.4 ± 1.0	NB
P	*Dryopteris filix-mas ssp. brittonii*	Britton's Male Fern				S1	2	16.6 ± 1.0	NB
P	*Huperzia selago*	Northern Firmoss				S1	1	79.1 ± 1.0	NS
P	*Schizaea pusilla*	Little Curlygrass Fern				S1	9	45.2 ± 0.0	NB
P	*Cuscuta campestris*	Field Dodder				S1?	1	96.0 ± 2.0	NS
P	*Polygonum aviculare ssp. neglectum*	Narrow-leaved Knotweed				S1?	4	48.3 ± 1.0	NB
P	*Carex laxiflora*	Loose-Flowered Sedge				S1?	2	79.0 ± 7.0	NS
P	*Selaginella rupestris*	Rock Spikemoss				S1S2	9	57.9 ± 1.0	NB
P	*Coryphopteris simulata*	Bog Fern				S1S2	8	58.2 ± 0.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S1S3	6	39.4 ± 0.0	NB
P	*Eriophorum russeolum ssp. albidum*	Smooth-fruited Russet Cottongrass				S1S3	10	32.1 ± 1.0	NB
P	*Spiranthes arcisepala*	Appalachian Ladies'-tresses				S1S3	7	22.6 ± 0.0	NB
P	*Spiranthes incurva*	Sphinx Ladies'-tresses				S1S3	1	23.9 ± 0.0	NB
P	*Neottia bifolia*	Southern Twayblade			Endangered	S2	25	29.9 ± 0.0	NB
P	*Osmorhiza depauperata*	Blunt Sweet Cicely				S2	1	96.0 ± 5.0	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2	17	50.5 ± 1.0	NS
P	*Sanicula odorata*	Clustered Sanicle				S2	4	95.4 ± 2.0	NS
P	*Ionactis linariifolia*	Flax-leaved Aster				S2	1	94.0 ± 5.0	NB
P	*Symphyotrichum racemosum*	Small White Aster				S2	3	94.3 ± 0.0	NB
P	*Pseudognaphalium macounii*	Macoun's Cudweed				S2	44	38.0 ± 5.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S2	11	59.9 ± 0.0	NS
P	*Boechera stricta*	Drummond's Rockcress				S2	22	28.2 ± 0.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S2	10	44.6 ± 0.0	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S2	8	34.6 ± 1.0	NB
P	*Oxybasis rubra*	Red Goosefoot				S2	9	43.8 ± 0.0	NB
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2	4	58.2 ± 0.0	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S2	7	33.9 ± 0.0	NB
P	*Viburnum lentago*	Nannyberry				S2	1	45.0 ± 0.0	NB
P	*Viburnum recognitum*	Northern Arrow-Wood				S2	1	18.0 ± 0.0	NB
P	*Shepherdia canadensis*	Soapberry				S2	43	2.0 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S2	26	69.4 ± 1.0	NS
P	*Quercus macrocarpa*	Bur Oak				S2	4	72.1 ± 0.0	NB
P	*Gentiana linearis*	Narrow-Leaved Gentian				S2	1	73.9 ± 50.0	NB
P	*Myriophyllum humile*	Low Water Milfoil				S2	1	45.0 ± 1.0	NB
P	*Proserpinaca palustris*	Marsh Mermaidweed				S2	3	92.0 ± 1.0	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2	16	58.1 ± 1.0	NS
P	*Nuphar x rubrodisca*	Red-disk Yellow Pond-lily				S2	19	25.4 ± 0.0	NB
P	*Aphyllon uniflorum*	One-flowered Broomrape				S2	1	76.0 ± 0.0	NS
P	*Polygaloides paucifolia*	Fringed Milkwort				S2	8	73.1 ± 1.0	NB
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S2	9	94.1 ± 0.0	NB
P	*Persicaria careyi*	Carey's Smartweed				S2	4	51.4 ± 2.0	NB

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P	*Anemone parviflora*	Small-flowered Anemone				S2	9	6.8 ± 0.0	NB
P	*Hepatica americana*	Round-lobed Hepatica				S2	12	86.5 ± 1.0	NB
P	*Ranunculus flabellaris*	Yellow Water Buttercup				S2	1	36.5 ± 0.0	NB
P	*Crataegus scabrida*	Rough Hawthorn				S2	6	37.9 ± 0.0	NB
P	*Crataegus succulenta*	Fleshy Hawthorn				S2	2	80.2 ± 0.0	PE
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S2	2	36.8 ± 0.0	NS
P	*Euphrasia randii*	Rand's Eyebright				S2	8	51.8 ± 0.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S2	2	64.4 ± 1.0	NB
P	*Dirca palustris*	Eastern Leatherwood				S2	1	3.7 ± 1.0	NB
P	*Sagittaria montevidensis ssp. spongiosa*	Spongy Arrowhead				S2	67	70.4 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S2	128	40.3 ± 1.0	NS
P	*Carex comosa*	Bearded Sedge				S2	8	34.1 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S2	11	37.5 ± 0.0	NB
P	*Carex gynocrates*	Northern Bog Sedge				S2	1	64.4 ± 1.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S2	15	34.1 ± 0.0	NB
P	*Carex livida*	Livid Sedge				S2	9	40.4 ± 0.0	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S2	3	51.2 ± 0.0	NB
P	*Carex prairea*	Prairie Sedge				S2	2	88.6 ± 1.0	NS
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S2	3	46.7 ± 0.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S2	2	73.5 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S2	9	40.6 ± 10.0	NB
P	*Carex albicans var. emmonsii*	White-tinged Sedge				S2	7	23.4 ± 0.0	NB
P	*Cyperus squarrosus*	Awned Flatsedge				S2	3	96.0 ± 0.0	NS
P	*Eriophorum gracile*	Slender Cottongrass				S2	52	29.3 ± 0.0	NB
P	*Blysmopsis rufa*	Red Bulrush				S2	32	80.5 ± 0.0	PE
P	*Juncus vaseyi*	Vasey Rush				S2	12	21.2 ± 0.0	NB
P	*Allium tricoccum*	Wild Leek				S2	65	35.9 ± 0.0	NB
P	*Galearis rotundifolia*	Small Round-leaved Orchid				S2	3	77.9 ± 0.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	3	38.3 ± 5.0	NB
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2	18	16.2 ± 10.0	NB
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	5	49.2 ± 0.0	NB
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S2	2	91.2 ± 0.0	PE
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2	7	38.9 ± 1.0	NB
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S2	18	17.7 ± 0.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S2	3	76.0 ± 0.0	NB
P	*Elymus canadensis*	Canada Wild Rye				S2	1	27.4 ± 1.0	NB
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2	4	38.8 ± 10.0	NB
P	*Puccinellia phryganodes ssp. neoarctica*	Creeping Alkali Grass				S2	2	34.7 ± 0.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S2	24	46.6 ± 0.0	NB
P	*Puccinellia nutkaensis*	Alaska Alkaligrass				S2	1	38.5 ± 1.0	NB
P	*Schizachyrium scoparium*	Little Bluestem				S2	10	95.2 ± 0.0	NB
P	*Zizania aquatica var. aquatica*	Eastern Wild Rice				S2	6	69.5 ± 0.0	NS
P	*Piptatheropsis pungens*	Slender Ricegrass				S2	5	28.2 ± 0.0	NB
P	*Potamogeton vaseyi*	Vasey's Pondweed				S2	1	76.3 ± 0.0	PE
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S2	25	25.1 ± 0.0	NB
P	*Anchistea virginica*	Virginia chain fern				S2	25	42.4 ± 0.0	NS
P	*Woodsia alpina*	Alpine Cliff Fern				S2	5	37.8 ± 0.0	NB
P	*Diphasiastrum sitchense*	Sitka Ground-cedar				S2	5	15.6 ± 0.0	NB
P	*Selaginella selaginoides*	Low Spikemoss				S2	8	46.6 ± 0.0	NB
P	*Toxicodendron radicans var. radicans*	Eastern Poison Ivy				S2?	6	57.7 ± 5.0	NB
P	*Symphyotrichum novi-belgii var. crenifolium*	New York Aster				S2?	5	34.5 ± 1.0	NB
P	*Humulus lupulus var. lupuloides*	Common Hop				S2?	1	77.7 ± 5.0	NB
P	*Crataegus macrosperma*	Big-Fruit Hawthorn				S2?	3	16.0 ± 0.0	NB
P	*Rubus x recurvicaulis*	arching dewberry				S2?	5	12.9 ± 1.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2?	7	52.0 ± 10.0	NB
P	*Salix myricoides*	Bayberry Willow				S2?	1	6.5 ± 1.0	NB

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P	*Carex vacillans*	Estuarine Sedge				S2?	4	31.5 ± 7.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2?	4	46.4 ± 0.0	NB
P	*Solidago altissima*	Tall Goldenrod				S2S3	3	22.7 ± 0.0	NB
P	*Callitriche hermaphroditica*	Northern Water-starwort				S2S3	8	20.6 ± 0.0	NB
P	*Elatine americana*	American Waterwort				S2S3	7	33.3 ± 0.0	NB
P	*Bartonia paniculata*	Branched Bartonia				S2S3	2	38.2 ± 0.0	NS
P	*Bartonia paniculata ssp. iodandra*	Branched Bartonia				S2S3	22	42.7 ± 0.0	NB
P	*Geranium robertianum*	Herb Robert				S2S3	96	30.4 ± 0.0	NB
P	*Myriophyllum quitense*	Andean Water Milfoil				S2S3	2	99.2 ± 0.0	NB
P	*Epilobium coloratum*	Purple-veined Willowherb				S2S3	26	19.9 ± 0.0	NB
P	*Rumex persicarioides*	Peach-leaved Dock				S2S3	2	19.0 ± 1.0	NB
P	*Rumex pallidus*	Seabeach Dock				S2S3	6	59.4 ± 0.0	NS
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S2S3	32	11.2 ± 0.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S2S3	14	38.3 ± 0.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S2S3	9	21.6 ± 10.0	NB
P	*Scirpus atrovirens*	Dark-green Bulrush				S2S3	2	78.7 ± 0.0	PE
P	*Corallorhiza maculata var. occidentalis*	Spotted Coralroot				S2S3	13	16.2 ± 10.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	4	49.9 ± 0.0	NB
P	*Neottia auriculata*	Auricled Twayblade				S2S3	1	50.3 ± 0.0	NB
P	*Spiranthes cernua*	Nodding Ladies'-Tresses				S2S3	23	17.6 ± 0.0	NB
P	*Eragrostis pectinacea*	Tufted Love Grass				S2S3	8	21.7 ± 1.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S2S3	2	44.6 ± 1.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S2S3	12	38.5 ± 0.0	NS
P	*Isoetes tuckermanii ssp. acadiensis*	Acadian Quillwort				S2S3	1	97.6 ± 1.0	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	5	35.2 ± 1.0	NB
P	*Panax trifolius*	Dwarf Ginseng				S3	43	26.6 ± 0.0	NB
P	*Artemisia campestris ssp. caudata*	Tall Wormwood				S3	12	33.3 ± 0.0	NB
P	*Artemisia campestris*	Field Wormwood				S3	4	51.8 ± 0.0	NB
P	*Bidens hyperborea*	Estuary Beggarticks				S3	33	51.9 ± 1.0	NB
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3	101	3.1 ± 1.0	NB
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S3	9	94.8 ± 0.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3	14	38.2 ± 0.0	NB
P	*Betula pumila*	Bog Birch				S3	84	40.3 ± 0.0	NB
P	*Turritis glabra*	Tower Mustard				S3	1	62.7 ± 0.0	NB
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S3	13	28.5 ± 1.0	NB
P	*Cardamine maxima*	Large Toothwort				S3	22	62.8 ± 0.0	NB
P	*Subularia aquatica ssp. americana*	American Water Awlwort				S3	2	46.4 ± 0.0	NB
P	*Stellaria humifusa*	Saltmarsh Starwort				S3	17	23.2 ± 0.0	NB
P	*Ceratophyllum echinatum*	Prickly Hornwort				S3	38	22.5 ± 0.0	NB
P	*Hudsonia tomentosa*	Woolly Beach-heath				S3	175	44.6 ± 0.0	NB
P	*Cornus obliqua*	Silky Dogwood				S3	49	42.6 ± 0.0	NB
P	*Crassula aquatica*	Water Pygmyweed				S3	3	73.4 ± 0.0	NB
P	*Rhodiola rosea*	Roseroot				S3	96	36.4 ± 0.0	NB
P	*Penthorum sedoides*	Ditch Stonecrop				S3	31	31.9 ± 0.0	NB
P	*Elatine minima*	Small Waterwort				S3	2	46.7 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	29	24.5 ± 5.0	NB
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S3	9	26.6 ± 0.0	NB
P	*Myriophyllum heterophyllum*	Variable-leaved Water Milfoil				S3	7	94.8 ± 0.0	NB
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	14	25.8 ± 0.0	NB
P	*Teucrium canadense*	Canada Germander				S3	83	40.5 ± 0.0	NB
P	*Nuphar microphylla*	Small Yellow Pond-lily				S3	8	20.5 ± 0.0	NB
P	*Epilobium hornemannii*	Hornemann's Willowherb				S3	4	48.8 ± 1.0	NB
P	*Epilobium hornemannii ssp. hornemannii*	Hornemann's Willowherb				S3	1	49.1 ± 0.0	NB
P	*Epilobium strictum*	Downy Willowherb				S3	33	29.6 ± 0.0	NB
P	*Polygala sanguinea*	Blood Milkwort				S3	42	13.2 ± 0.0	NB
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S3	134	12.4 ± 5.0	NB
P	*Persicaria punctata*	Dotted Smartweed				S3	16	23.1 ± 1.0	NB
P	*Fallopia scandens*	Climbing False Buckwheat				S3	68	30.6 ± 0.0	NB

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P	*Littorella americana*	American Shoreweed				S3	1	99.5 ± 1.0	NB
P	*Samolus parviflorus*	Seaside Brookweed				S3	106	32.0 ± 0.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	7	37.9 ± 1.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	15	27.8 ± 0.0	NB
P	*Ranunculus gmelinii*	Gmelin's Water Buttercup				S3	51	25.9 ± 0.0	NB
P	*Amelanchier canadensis*	Canada Serviceberry				S3	18	15.7 ± 1.0	NB
P	*Rosa palustris*	Swamp Rose				S3	8	33.7 ± 0.0	NB
P	*Rubus occidentalis*	Black Raspberry				S3	4	14.3 ± 0.0	NB
P	*Sanguisorba canadensis*	Canada Burnet				S3	19	42.2 ± 0.0	NB
P	*Galium boreale*	Northern Bedstraw				S3	11	46.1 ± 0.0	NB
P	*Salix nigra*	Black Willow				S3	23	65.0 ± 0.0	NB
P	*Salix pedicellaris*	Bog Willow				S3	53	27.2 ± 0.0	NB
P	*Salix interior*	Sandbar Willow				S3	1	7.6 ± 1.0	NB
P	*Comandra umbellata*	Bastard's Toadflax				S3	38	38.3 ± 0.0	NB
P	*Limosella australis*	Southern Mudwort				S3	70	37.6 ± 0.0	NB
P	*Pilea pumila*	Dwarf Clearweed				S3	67	23.1 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	7	28.7 ± 0.0	NB
P	*Viola nephrophylla*	Northern Bog Violet				S3	14	39.5 ± 0.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	6	24.7 ± 20.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3	20	40.6 ± 0.0	NS
P	*Carex chordorrhiza*	Creeping Sedge				S3	73	26.2 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	10	37.5 ± 0.0	NB
P	*Carex eburnea*	Bristle-leaved Sedge				S3	17	21.4 ± 100.0	NB
P	*Carex exilis*	Coastal Sedge				S3	6	41.9 ± 0.0	NS
P	*Carex garberi*	Garber's Sedge				S3	1	43.5 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3	18	25.5 ± 0.0	NB
P	*Carex lupulina*	Hop Sedge				S3	24	31.9 ± 0.0	NB
P	*Carex michauxiana*	Michaux's Sedge				S3	17	20.5 ± 1.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	6	37.2 ± 1.0	NB
P	*Carex rosea*	Rosy Sedge				S3	33	59.8 ± 0.0	NB
P	*Carex tenera*	Tender Sedge				S3	25	15.8 ± 0.0	NB
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	30	37.8 ± 0.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3	159	13.2 ± 0.0	NB
P	*Carex recta*	Estuary Sedge				S3	14	22.7 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3	3	63.6 ± 0.0	NS
P	*Cyperus dentatus*	Toothed Flatsedge				S3	47	75.7 ± 1.0	NB
P	*Cyperus esculentus var. leptostachyus*	Perennial Yellow Nutsedge				S3	11	49.3 ± 0.0	NB
P	*Eleocharis intermedia*	Matted Spikerush				S3	1	53.6 ± 0.0	NB
P	*Rhynchospora capitellata*	Small-headed Beakrush				S3	3	65.1 ± 0.0	NB
P	*Rhynchospora fusca*	Brown Beakrush				S3	12	40.5 ± 0.0	NS
P	*Trichophorum clintonii*	Clinton's Clubrush				S3	25	48.1 ± 0.0	NB
P	*Bolboschoenus fluviatilis*	River Bulrush				S3	6	7.9 ± 0.0	NB
P	*Schoenoplectus torreyi*	Torrey's Bulrush				S3	5	25.8 ± 0.0	NB
P	*Lemna trisulca*	Star Duckweed				S3	23	2.0 ± 0.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	37	29.9 ± 0.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3	23	17.2 ± 0.0	NB
P	*Platanthera blephariglottis*	White Fringed Orchid				S3	354	15.6 ± 0.0	NB
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	68	20.5 ± 0.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	26	30.4 ± 0.0	NB
P	*Calamagrostis pickeringii*	Pickering's Reed Grass				S3	32	43.1 ± 0.0	NB
P	*Dichanthelium depauperatum*	Starved Panic Grass				S3	6	59.2 ± 0.0	NS
P	*Heteranthera dubia*	Water Stargrass				S3	1	97.6 ± 0.0	NB
P	*Potamogeton obtusifolius*	Blunt-leaved Pondweed				S3	36	23.6 ± 0.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	8	88.0 ± 1.0	NS
P	*Xyris montana*	Northern Yellow-Eyed-Grass				S3	136	21.9 ± 0.0	NB
P	*Zannichellia palustris*	Horned Pondweed				S3	43	24.2 ± 0.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	2	86.5 ± 1.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3	2	82.0 ± 0.0	NS

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P	*Asplenium viride*	Green Spleenwort				S3	19	28.5 ± 1.0	NB
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3	73	35.8 ± 0.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	68	36.1 ± 0.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3	1	95.4 ± 5.0	NS
P	*Isoetes tuckermanii ssp. tuckermanii*	Tuckerman's Quillwort				S3	5	42.7 ± 0.0	NB
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3	16	15.0 ± 0.0	NB
P	*Huperzia appressa*	Mountain Firmoss				S3	50	49.5 ± 0.0	NB
P	*Sceptridium dissectum*	Dissected Moonwort				S3	10	7.1 ± 1.0	NB
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S3	22	17.8 ± 0.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	7	24.7 ± 0.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3	34	9.7 ± 1.0	NB
P	*Crataegus submollis*	Quebec Hawthorn				S3?	5	83.2 ± 7.0	NS
P	*Mertensia maritima*	Sea Lungwort				S3S4	12	22.9 ± 0.0	NB
P	*Lobelia kalmii*	Brook Lobelia				S3S4	1	98.9 ± 10.0	NB
P	*Suaeda calceoliformis*	Horned Sea-blite				S3S4	35	19.4 ± 0.0	NB
P	*Myriophyllum sibiricum*	Siberian Water Milfoil				S3S4	6	36.3 ± 0.0	NS
P	*Utricularia gibba*	Humped Bladderwort				S3S4	4	39.6 ± 0.0	NB
P	*Rumex fueginus*	Tierra del Fuego Dock				S3S4	73	16.0 ± 0.0	NB
P	*Rubus chamaemorus*	Cloudberry				S3S4	33	28.5 ± 0.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3S4	33	18.4 ± 0.0	NB
P	*Juniperus horizontalis*	Creeping Juniper				S3S4	11	11.8 ± 1.0	NB
P	*Cladium mariscoides*	Smooth Twigrush				S3S4	8	31.6 ± 0.0	NB
P	*Eriophorum russeolum*	Russet Cottongrass				S3S4	280	18.2 ± 0.0	NB
P	*Eriophorum russeolum ssp. russeolum*	Russet Cottongrass				S3S4	44	21.6 ± 0.0	NB
P	*Triglochin gaspensis*	Gasp ├⌐ Arrowgrass				S3S4	63	24.0 ± 1.0	NB
P	*Spirodela polyrhiza*	Great Duckweed				S3S4	19	24.4 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	35	6.5 ± 10.0	NB
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S3S4	26	23.2 ± 2.0	NB
P	*Calamagrostis stricta ssp. stricta*	Slim-stemmed Reed Grass				S3S4	15	30.2 ± 0.0	NB
P	*Distichlis spicata*	Salt Grass				S3S4	90	34.1 ± 5.0	NB
P	*Potamogeton oakesianus*	Oakes' Pondweed				S3S4	14	12.7 ± 0.0	NB
P	*Montia fontana*	Water Blinks				SH	4	34.3 ± 1.0	NB
P	*Brachyelytrum erectum*	Bearded Shorthusk				SH	2	44.5 ± 0.0	NS
P	*Agalinis maritima*	Saltmarsh Agalinis				SX	2	90.6 ± 50.0	NB
P	*Carex swanii*	Swan's Sedge				SX	1	91.6 ± 2.0	NS

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The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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1	MacAuley, M. 2020. Email to Sean Blaney regarding Agalinis paupercula var. parviflora at Malagash Station, NS. pers. comm., 2 records.
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1	McLellan, N. 2013. Discovery of extensive Nuphar lutea ssp. rubrodisca population at Tyne Valley. Ducks Unlimited, 1 record.
1	Mersey Tobetic Research Institute. 2021. 2020 Monarch records from the MTRI monitoring program. Mersey Tobetic Research Institute, 72 records.
1	Miller, D.G. 2013. Peregrine Falcon nesting information from birdingnewbrunswick.ca. birdingnewbrunswick.ca.
1	Mills, E. Connell Herbarium Specimens, 1957-2009. University New Brunswick, Fredericton. 2012.
1	Mills, Elizabeth and Bishop, Gart. 2020. Cuscuta cephalanthi record, Grand-Barachois, NB. Chapman-Lam, Colin J. (ed.) pers. comm., 1.
1	Neily, T.H. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
1	Newell, R. E., MacKinnon, C. M. & Kennedy, A. C. 2006. Botanical Survey of Boot Island National Wildlife Area, Nova Scotia, 2004. Canadian Wildlife Service, Atlantic Region, Technical Report Series Number 450. 3 recs.
1	Nova Scotia Nature Trust. 2013. Nova Scotia Nature Trust 2013 Species records. Nova Scotia Nature Trust, 95 recs.
1	Novak, Pam. 2017. Email to John Klymko regarding Chelydra serpentina record.
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1	Sollows, M.C,. 2009. NBM Science Collections databases: Coccinellid & Cerambycid Beetles. New Brunswick Museum, Saint John NB, download Feb. 2009, 569 recs.
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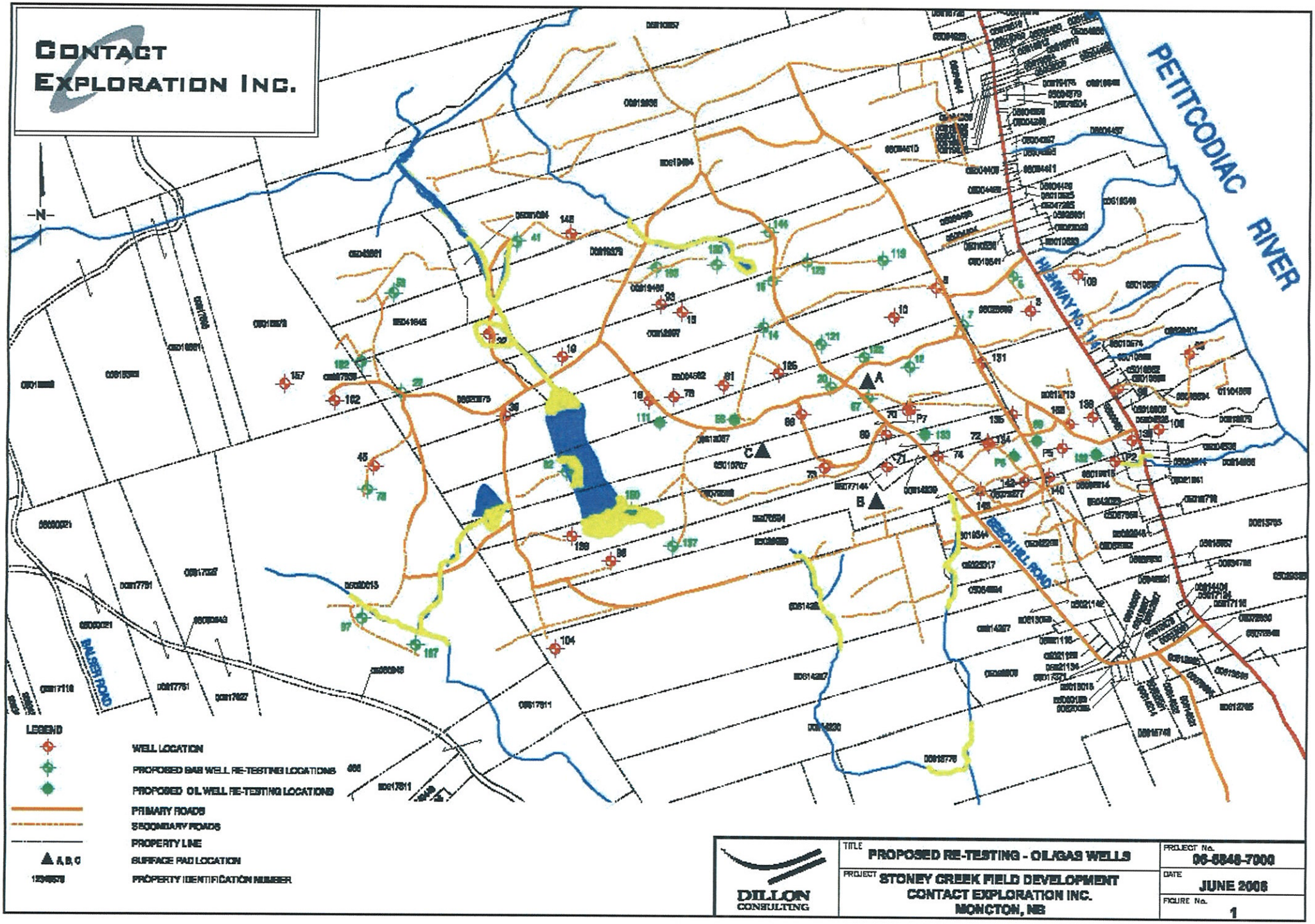
1	Wilson, G. 2013. 2013 Snapping Turtle email report, Wentworth, NS. Pers. comm.
1	Wissink, R. 2000. Four-toed Salamander Survey results, 2000. Fundy National Park, Internal Documents, 1 rec.
1	Young, A.D., Titman, R.D. 1986. Costs and benefits to Red-breasted Mergansers nesting in tern and gull colonies. Can. J. Zool., 64: 2339-2343.
1	Zahavich, J. 2017. Canada Warbler and Olive-sided Flycatcher records 2017. Island Nature Trust, 14 recs.

Appendix B

2006 Vegetation Surveys


CONTACT EXPLORATION INC.
N
PETITCODIAC RIVER
HIGHWAY No. 114
BEECH HILL ROAD
BALSER ROAD
LEGEND
WELL LOCATION
PROPOSED GAS WELL RE-TESTING LOCATIONS
PROPOSED OIL WELL RE-TESTING LOCATIONS
PRIMARY ROADS
SECONDARY ROADS
PROPERTY LINE
A, B, C
SURFACE PAD LOCATION
PROPERTY IDENTIFICATION NUMBER
DILLON CONSULTING
TITLE
PROPOSED RE-TESTING - OIL/GAS WELLS
PROJECT
STONEY CREEK FIELD DEVELOPMENT
CONTACT EXPLORATION INC.
MONCTON, NB
PROJECT No.
06-5848-7000
DATE
JUNE 2006
FIGURE No.
1

Stoney Creek Vascular Plant Survey

Date of Survey: 28-29-June-06

Botanist: Tom Neily

Species Lists

Roadside (Waypoint 441 – Waypoint 442)

Common Name	Binomial	Status (ACCDC)
Eastern Hemlock	*Tsuga canadensis*	S5
Yellow Birch	*Betula allegheniensis*	S5
Balsam Fir	*Abies balsamea*	S5
Paper Birch	*Betula papyrifera*	S5
Willow	*Salix sp*	not a species at risk
Speckled Alder	*Alnus incana*	S5
Trembling Aspen	*Populus tremuloides*	S5
Eastern White Pine	*Pinus strobus*	S5
Sugar Maple	*Acer saccharum*	S5
Striped Maple (Moosewood)	*Acer pensylvanicum*	S5
Red Raspberry	*Rubus idaeus*	S5
Vetch	*Viccia sp*	not a species at risk
Ox-eye Daisy	*Chrysanthemum leucanthemum*	SE

Small Stream (Waypoint 449)

Common Name	Binomial	Status (ACCDC)
Wild Strawberry	*Fragaria vesca*	S5
Indian Hemp	*Apocynum cannabium*	S5
Speckled Alder	*Alnus incana*	S5
Eastern Hemlock	*Tsuga canadensis*	S5
Red Maple	*Acer rubrum*	S5
Balsam Fir	*Abies balsamea*	S5
Interrupted Fern	*Osmunda claytoniana*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Wood Aster	*Aster acuminatus*	S5
Bunchberry	*Cornus canadensis*	S5
Sensitive Fern	*Onoclea sensibilis*	S5
Paper Birch	*Betula papyrifera*	S5
Yellow Birch	*Betula allegheniensis*	S5
Clintonia	*Clintonia borealis*	S5
Grass	*Brachyelytrum erectum*	S5
Lady Fern	*athyrium Filix-femina*	S5
Sedge	*Carex crinitum*	S%

Common Name	Binomial	Status (ACCDC)
Striped Maple	*Acer pensylvanicum*	S5
Tall Buttercup	*Ranunculus acris*	SE
Wood Horsetail	*Equisetum sylvaticum*	S5
New York Fern	*Thelypteris noveboracensis*	S5
Sedge	*Carex intumescens*	S5
Starflower	*Trientalis borealis*	S5
Sweet Coltsfoot	*Petasites frigidus*	S5
Lion's-paw	*Prenanthes trifolilata*	S5
Painted Trillium	*Trillium undulatum*	S5
Prince's-pine	*Chimaphila umbellata*	S5
Violet	*Viola sp*	not a species at risk
Bedstraw	*Galium sp*	not a species at risk
Small Enchanter's Nightshade	*Circaea alpina*	S5
Wild-lily-of-the-valley	*Maianthemum canadense*	S5
Bracken	*Pteridium aquilinum*	S5

Clearcut/Roadside (Waypoint 452)

Common Name	Binomial	Status (ACCDC)
Black Cherry	*Prunus serotina*	S5
Paper Birch	*Betula papyrifera*	S5
Red Maple	*Acer rubrum*	S5
Hawkweed	*Hieracium sp*	not a species at risk
Balsam Fir	*Abies balsamea*	S5
Red Spruce	*Picea rubens*	S5
Bracken	*Pteridium aquilinum*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Pink Lady's Slipper	*Cypripedium acaule*	S5
Wild Lily-of-the-valley	*Maianthemum canadense*	S5
Osmunda claytoniana	*Interrupted Fern*	S5
Lowbush Blueberry	*Vaccinium angustifolium*	S5
Moosewood	*Acer pensylvanicum*	S5
Lambkill	*Kalmia angustifolium*	S5
Red Raspberry	*Rubus idaeus*	S5
Wood Aster	*Aster acuminatus*	S5
Sedge	*Carex crinitum*	S5
Veronica	*Veronica officinalis*	SE
Bristly Sarsaparilla	*Aralia hispidula*	S5
New York Fern	*Dennstaedia punctilobula*	S5
Willow	*Salix sp*	not a species at risk
Common Blackberry	*Rubus allegheniensis*	S5
Soft Rush	*Juncus effusus*	S5
American Beech	*Fagus grandifolia*	S5
Meadowsweet	*Spiraea alba*	S5

Common Name	Binomial	Status (ACCDC)
Vetch	*Viccia sp*	not a species at risk
Five-fingered Cinquefoil	*Potentilla simplex*	S5
Tall Buttercup	*Ranunculus acris*	SE
Wire Birch	*Betula populifolia*	S5
Ox-eye Daisy	*Chrysanthemum leucanthemum*	SE
Common Plaintain	*Plantago major*	SE
Heal-all	*Prunella vulgaris*	SE
Sedge	*Carex retrorsa*	S5
Yarrow	*Acillea millefolium*	S5
Grass-leaved Goldenrod	*Euthamnia graminifolia*	S5
Sugar Maple	*Acer saccharum*	S5
Trembling Aspen	*Populus tremuloides*	S5
Ground-pine	*Lycopodium obscurum*	S5
Running-pine	*Lycopodium clavatum*	S5
Starflower	*Trientalis borealis*	S5
Lion's-paw	*Prenanthes trifolilata*	S5
Violet	*Viola sp*	not a species at risk
Large-toothed Aspen	*Populus grandidentata*	S5
Daisy Fleabane	*Erigeron strigosus*	S5
Large-leaved Aster	*Aster macrophyllus*	S5
Northern Bush Honeysuckle	*Diervilla lonicera*	S5
Rhodora	*Rhododendron canadense*	S5
Everlasting	*Antennaria neglecta*	S5
Rough Cinquefoil	*Potentilla norvegica*	S5
Low Hop Clover	*Trifolim campestre*	SE
Bulrush	*Scirpus atrovirens*	S5
Evening Primrose	*Oenothera biennis*	S5
St. John's-wort	*Hypericum canadense*	S5

Large Wetland (Waypoints 453 – 456)

Common Name	Binomial	Status (ACCDC)
Swamp-Ragwort	*Senecio Robbinsii*	S4
Sweet Gale	*Myrica gale*	S5
Meadowsweet	*Spiraea alba*	S5
Red Maple	*Acer rubrum*	S5
Willow	*Salix sp*	not a species at risk
Mountain Fly-honeysuckle	*Lonicera caerulea*	S5
Loosestrife	*Lysimachia terrestris*	S5
Sedge	*Carex radiata*	S5
Blue-flag	*Iris versicolor*	S5
Boneset	*Eupatorium perfoliatum*	S5
Cow-Lily	*Nuphar variegatum*	S5

Common Name	Binomial	Status (ACCDC)
Steeplebush	*Spiraea tomentosum*	S5
Sedge	*Carex echinata*	S5
Sedge	*Carex lurida*	S5
Sedge	*Carex lasiocarpa*	S5
Marsh St.John's-wort	*Triadenum virginicum*	S5
Leather-leaf	*Chamaedaphne calyculata*	S5
Larch	*Larix laricina*	S5
Jack Pine	*Pinus banksiana*	S5
Rose	*Rosa sp*	not a species at risk
Red Spruce	*Picea rubens*	S5
Red Maple	*Acer rubrum*	S5
Teaberry	*Gaultheria procumbens*	S5
Bunchberry	*Cornus canadensis*	S5
Lowbush Blueberry	*Vaccinium angustifolium*	S5
Twinflower	*Linnaea borealis*	S5
Interrupted Fern	*Osmunda claytoniana*	S5
Serviceberry	*Amelanchier sp*	not a species at risk
Beaked Hazelnut	*Corylus cornuta*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Wild Lily-of-the-valley	*Maianthemum canadense*	S5
Clintonia	*Clintonia borealis*	S5
Grass	*Brachyelytrum erectum*	S5
Bracken	*Pteridium aquilinum*	S5
Northern Lady Fern	*Anthyrium felix-femina*	S5
Wood Fern	*Dryopteris carthusiana*	S5
Aster	*Aster sp*	not a species at risk
Oak Fern	*Gymnocarpium dryopteris*	S5
Mountain Ash	*Sorbus americana*	S5
Rattlesnake Grass	*Glyceria canadensis*	S5
Water Horehound	*Lycopus americana*	S5
Crested Shield Fern	*Dryopteris cristata*	S5
Wood Horsetail	*Equisetum sylvaticum*	S5
Sedge	*Carex intumescens*	S5
Skunk Currant	*Ribes glandulosum*	S5
Meadow-rue	*Thalictrum pubescens*	S5

Stream (Waypoint 458)

Common Name	Binomial	Status (ACCDC)
Yellow Birch	*Betula allegheniensis*	S5
White Spruce	*Picea glauca*	S5
Fly-honeysuckle	*Lonicera canadensis*	S5
Interrupted Fern	*Osmunda claytoniana*	S5
Dwarf Raspberry	*Rubus pubescens*	S5

Common Name	Binomial	Status (ACCDC)
Starflower	*Trientalis borealis*	S5
Sensitive Fern	*Onoclea sensibilis*	S5
Meadow-rue	*Thalictrum pubescens*	S5
New York Fern	*Thelypteris noveboracensis*	S5
Partridgeberry	*Mitchella repens*	S5
Red Maple	*Acer rubrum*	S5
Epilobium sp	*Willow Herb*	not a species at risk
Rattlesnake Grass	*Glyceria canadensis*	S5
Black Ash	*Fraxinus nigra*	S5
Rough Cinquefoil	*Potentilla norvegica*	S5
Water-avens	*Geum macrophylla*	S5
Sedge	*Carex crinitum*	S5
Beaked Hazelnut	*Corylus cornuta*	S5
Alternate-leaved Dogwood	*Cornus alternifolia*	S5
Ground-hemlock	*Taxus canadensis*	S5
Mountain Maple	*Acer spicatum*	S5
Hobblebush	*Viburnum pensylvanicum*	S5
Wood Sorrel	*Oxalis montana*	S5
Shinleaf	*Pyrola asarifolia*	S5
Oak Fern	*Gymnocarpium dryopteris*	S5
Beech Fern	*Phegopteris connectilis*	S5
Eastern Hemlock	*Tsuga canadensis*	S5
Sugar Maple	*Acer saccharum*	S5

Black Spruce Bog (Waypoint 459)

Common Name	Binomial	Status (ACCDC)
Black Spruce	*Picea mariana*	S5
False Holly	*Nemopanthus mucronata*	S5
Rhodora	*Rhododendron canadense*	S5
Lambkill	*Kalmia angustifolia*	S5
Bunchberry	*Cornus Canadensis*	S5
Lowbush Blueberry	*Vaccinium angustifolium*	S5
Red Maple	*Acer rubrum*	S5
Wild Raisin	*Viburnum nudum*	S5
Creeping Snowberry	*Gaultheria hispidula*	S5
Huckleberry	*Gaylusaccia baccata*	S5
Sedge	*Carex trisperma*	S5
Cotton-grass	*Eriophorum angustifolium*	S5
Bog Huckleberry	*Gaylusaccia dumosa*	S5
Larch	*Larix laricina*	S5
Serviceberry	*Amelanchier sp*	not a species at risk
Blue Flag	*Iris versicolor*	S%
Wire Birch	*Betula populifolia*	S5

Common Name	Binomial	Status (ACCDC)
Bracken	*Pteridium aquilinum*	S5

Tributary From Marsh (Waypoints 460-462)

Common Name	Binomial	Status (ACCDC)
Willow	*Salix sp*	not a species at risk
Black Cherry	*Prunus serotina*	S5
Bracken	*Pteridium aquilinum*	S5
Wire Birch	*Betula populifolia*	S5
Red Spruce	*Picea rubens*	S5
Balsam Fir	*Abies balsamea*	S5
Speckled Alder	*Alnus incana*	S5
Red Maple	*Acer rubrum*	S5
Large-leaved Aster	*Aster macrophylla*	S5
Clintonia	*Clintonia borealis*	S5
Moosewood	*Acer pensylvanicum*	S5
Starflower	*Trientalis borealis*	S5
Wild Lily-of-the-valley	*Maianthemum canadense*	S5
Rosy Twisted-stalk	*Streptopus roseus*	S5
Interrupted Fern	*Osmunda claytoniana*	S5
Sedge	*Carex intumescens*	S5
Ground-hemlock	*Taxus canadensis*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Hobblebush	*Viburnum pensylvanicum*	S5
Lowbush Blueberry	*Vaccinium angustifoilum*	S5
Sensitive Fern	*Onoclea sensibilis*	S5
American Beech	*Fagus grandifolia*	S5
Red Raspberry	*Rubus idaeus*	S5
Sedge	*Carex crinitum*	S5
Rattlesnake Grass	*Glyceria canadensis*	S5
Sugar Maple	*Acer saccharum*	S5
Red-berried Elder	*Sambucus racemosa*	S5
Wild Raisin	*Viburnum nudum*	S5
Crow-foot	*Diphasiastrum digitatum*	S5
Yellow Birch	*Betula allegheniensis*	S5
Bunchberry	*Cornus canadensis*	S5
Grass	*Brachyelytrum erectum*	S5
New York Fern	*Thelyptris noveboracensis*	S5
Beaked Hazelnut	*Corylus cornuta*	S5
Eastern White Pine	*Pinus strobus*	S5
Wood Aster	*Aster acuminatus*	S5
Wood Sorrel	*Oxalis montana*	S5
Painted Trillium	*Trillium undulatum*	S5
Running-pine	*Lycopodium clavatum*	S5

Common Name	Binomial	Status (ACCDC)
Wood Fern	*Dryopteris spinulosa*	S5
Fly-honeysuckle	*Lonicera canadensis*	S5
One-flowered Wintergreen	*Moneses uniflora*	S5
Lion's-paw	*Prenanthes trifolilata*	S5
Goldthread	*Coptis trifolia*	S5
Water Horehound	*Lycopus americana*	S5
Dwarf Raspberry	*Rubus pubescens*	S5
Violet	*Viola sp*	not a species at risk
Moosewood	*Acer pensylvanicum*	S5
Ground-pine	*Lycopodium obscurum*	S5
Sweet Coltsfoot	*Petasites frigidus*	S4S5
Meadow-rue	*Thalictrum pubescens*	S5
Oak Fern	*Gymnocarpium dryopteris*	S5
Pink Lady's-slipper	*Cypripedium acaule*	S5
Blue Flag	*Iris versicolor*	S5
Joe-pye-weed	*Eupatorium maculatum*	S5
Small Enchanter's Nightshade	*Circaea alpina*	S5
Broad-leaved Cat-tail	*Typha latifolia*	S5
Prince's Pine	*Chamaphylla umbellata*	S5
Sedge	*Carex sp*	not a species at risk
Indian Cucumber Root	*Medeola virginiana*	S5
Rosy Twisted Stalk	*Streptopus roseus*	S5

Stream (Waypoint 463)

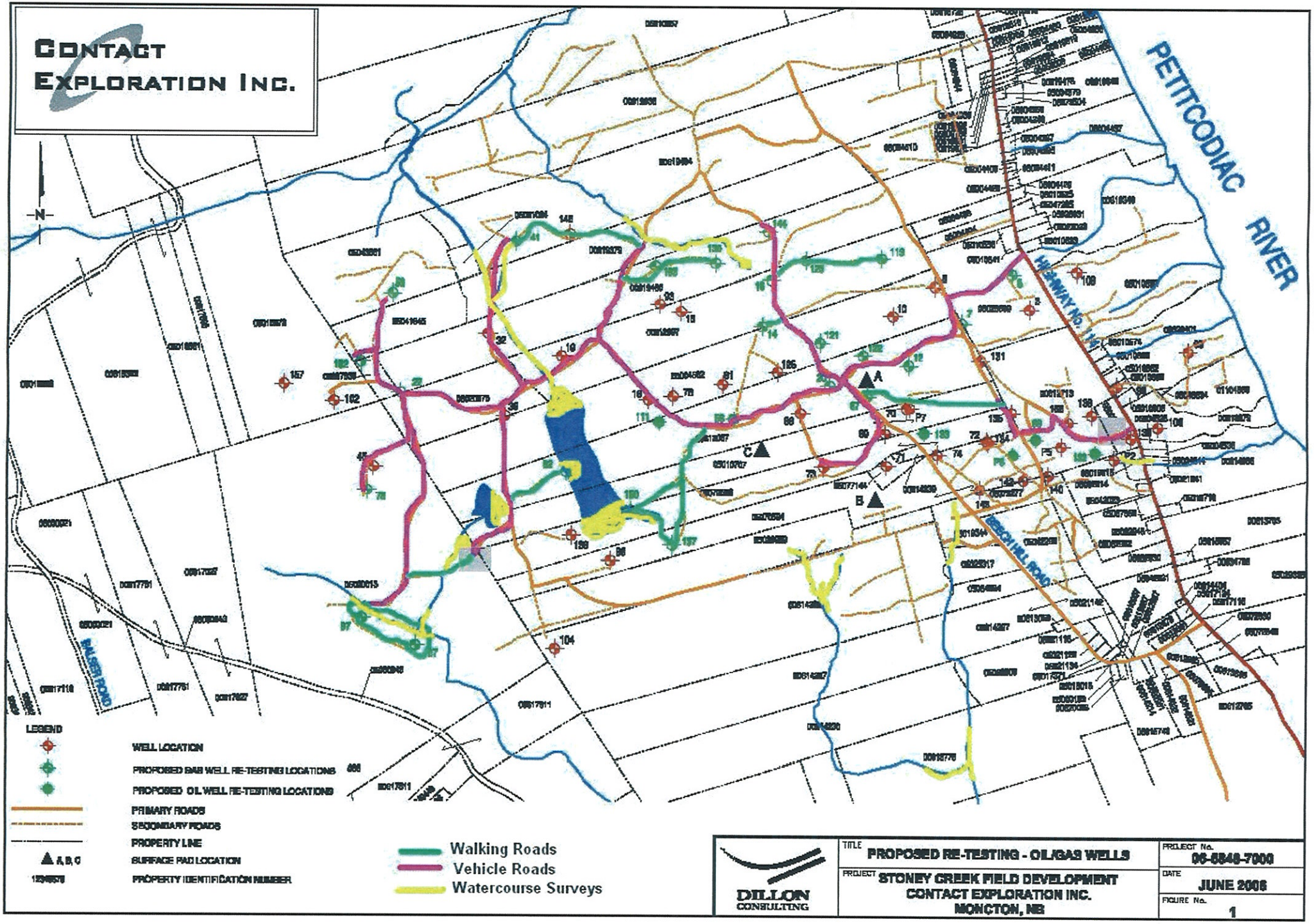
Common Name	Binomial	Status (ACCDC)
Mountain Maple	*Acer spicatum*	S5
Yellow Birch	*Betula allegheniensis*	S5
Eastern Hemlock	*Tsuga canadensis*	S5
Ground-hemlock	*Taxus canadensis*	S5
Evergreen Wood Fern	*Dryopteris intermedia*	S5
Christmas Fern	*Polystichum acrostichoides*	S5
Balsam Fir	*Abies balsamea*	S5
Oak Fern	*Gymnocarpium dryopteris*	S5
Moosewood	*Acer pensylvanicum*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Jewelweed	*Impatiens capensis*	S5
Thyme-leaved Speedwell	*Veronica serpyllifolia*	SE
Hobblebush	*Viburnum pensylvanicum*	S5
Common Speedwell	*Veronica officinalis*	SE
Clintonia	*Clintonia borealis*	S5
Fly-honeysuckle	*Lonicera canadensis*	S5
Sugar Maple	*Acer saccharum*	S5

Common Name	Binomial	Status (ACCDC)
American Beech	*Fagus grandifolia*	S5
Rattlesnake Grass	*Glyceria canadensis*	S5
Sensitive Fern	*Onoclea sensibilis*	S5
Alternate-leaved Dogwood	*Cornus alternifolia*	S5
Witch Hazel	*Hamamelis virginiana*	S5
Forget-me-not	*Myosotis scorpioides*	SE
Beaked Hazelnut	*Corylus cornuta*	S5
Speckled Alder	*Alnus incana*	S5

Tom Neily
04-July-06

Appendix C

2006 Avian Survey Report


CONTACT EXPLORATION INC.
PETITCODIAC RIVER
HIGHWAY No. 114
BEECH HILL ROAD
BAILEY ROAD
N
LEGEND
WELL LOCATION
PROPOSED GAS WELL RE-TESTING LOCATIONS
PROPOSED OIL WELL RE-TESTING LOCATIONS
PRIMARY ROADS
SECONDARY ROADS
PROPERTY LINE
A, B, C SURFACE PAD LOCATION
PROPERTY IDENTIFICATION NUMBER
Walking Roads
Vehicle Roads
Watercourse Surveys
DILLON CONSULTING
TITLE
PROPOSED RE-TESTING - OIL/GAS WELLS
PROJECT
STONEY CREEK FIELD DEVELOPMENT
CONTACT EXPLORATION INC.
MONCTON, NB
PROJECT No.
06-6846-7000
DATE
JUNE 2006
FIGURE No.
1

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Stuart Tingley

Avian Survey at Stoney Creek

Albert County, New Brunswick

Conducted for Dillon Consulting, Fredericton, NB, June 28 - July 1, 2006

SPECIES ACCOUNTS

For each species observed in the study area during the observation period (June 28 -July 1, 2006), the data is summarized below using the following abbreviations:
MSAPC = Main Study Area Point Count Survey condcuted on June 29 (X : Y; where X is the number of point counts, out of a total of 18, on which the species was recorded and Y is the total number of individuals recorded on the 18 point counts).
WRS = Walking route survey conducted on June 30 with total number of each species recorded over the course of the route.
R114PC = Route 114 Point Count Survey conducted on June 30 (X : Y; where X is the number of point counts, out of a total of 8, on which the species was recorded and Y is the total number of individuals recorded on the 8 point counts).
MISC = Miscellaneous observations.

DOUBLE-CRESTED CORMORANT

Comments: Incidental species observed in small numbers flying over the study site only; probably commuting from their nesting colony on Grindstone Island to the Riverview causeway where large numbers congregate to feed.

AMERICAN BLACK DUCK

Comments: The only sighting was of one in flight at Weldon Creek on June 28; this species could breed at the wetland in the Main Study Area, although none were observed.

TURKEY VULTURE

Comments: One was observed soaring over the ridge on the south side of Weldon Creek on June 28. Increasingly regular in Albert County in recent years, this species probably breeds in some of the more rugged, mountainous areas of the county.

BALD EAGLE

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 1
MISC - adult circling over Beech Hill Rd. on June 30.
Comments: There are two active Bald Eagle nests within a few kilometers of the Main Study Area. One is located in a large white pine across Weldon Creek from the 'Weldon Park' at Route 114, just south of the study area. This nest had two large young in it when it was checked on the morning of June 29 and there was an adult perched in the nest tree on the morning of June 30. The second nest is located at Stoney Creek. I was unable to locate the nest on three attempts June 28-30. The DNR office in Dieppe has promised me an update on the status of this nest in the next few days.

NORTHERN HARRIER

MSACP - 1 : 1
WRS - 0
R114PC - 0 : 0
MISC - agitated female calling and circling overhead at south end of wetland on June 29.
Comments: The behaviour of this bird suggested that it was nesting somewhere in the south end of the wetland in the Main Study Area.

SHARP-SHINNED HAWK

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 1
MISC - a male flying low down narrow woodland road leading to wetland on June 29.
Comments: Two sightings of this species at this time of the year would strongly suggest that there is a nest or two in the Main Study Area.

BROAD-WINGED HAWK

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - an adult was calling and circling overthe north end of the wetland on June 29; an adult was calling and circling over Beech Hill Road on June 30.
Comments: It would seem likely that there is at least one nest of this species near the Main Study Area.

MERLIN

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 2
MISC - two adults calling and performing a food pass on southeast side of Weldon Creek bridge on June 30; one adult calling at same location onJune 29.
Comments: It seems very likely that there is an active nest of this species in the woodlot just southeast of the Weldon Creek bridge.

WILSON'S SNIPE

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - one was heard vocalizing over the wetland in the Main Study Area on the evening of July 1.
Comments: It seems likely that this species breeds in the Main Study Area wetland in small numbers.

HERRING GULL

Comments: An incidental species seen flying over the Main Study Area in small numbers.

GREAT BLACK-BACKED GULL

Comments: An incidental species seen flying over the Main Study Area in small numbers.

MOURNING DOVE

MSACP - 0 : 0
WRS - 1
R114PC - 1 : 1
MISC - small numbers observed along Route 114 and Beech Hill Road.
Comments: This species no doubt breeds in low numbers in nearby populated areas; it was surprising to have one calling in a clearcut adjacent to the main drilling site on June 30.

BARRED OWL

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - one bird responded briefly in the distance (to the west) to a tape of this species being played near Point Count #9 on the evening of July 1.
Comments: There is suitable habitat in the Main Study Area to possibly support a breeding pair of Barred Owls, although the bird that I heard on July 1 sounded to be a kilometer or so to the northwest. This was the only owl that I heard during my evening owl survey.

COMMON NIGHTHAWK

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - one nighthawk was calling over a clearcut near Point Count #8 at dusk on July 1.
Comments: It's quite possible that this nighthawk was nesting nearby, although they wander widely in search of food.

RUBY-THROATED HUMMINGBIRD

MSACP - 1 : 1
WRS - 0
R114PC - 0 : 0
MISC -
Comments: Only one sighting, in suitable breeding habitat.

YELLOW-BELLIED SAPSUCKER

MSACP - 4 : 4
WRS - 2
R114PC - 0 : 0
MISC -
Comments: Probably breeds in low numbers in Main Study Area.

DOWNY WOODPECKER

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 1
MISC -
Comments: Not recorded in Main Study Area; only sighting was in a populated area on Route 114.

NORTHERN FLICKER

MSACP - 6 : 7
WRS - 2
R114PC - 1 : 1
MISC - several other sightings along Route 114, Beech Hill Road and Fownes Road.
Comments: Several pairs probably breed in the Main Study Area.

PILEATED WOODPECKER

MSACP - 1 : 1
WRS - 1
R114PC - 0 : 0
MISC -
Comments: It seems very likely that there is a breeding pair of Pileated Woodpeckers in the forested area just east of the north end of the wetland. An agitated male was calling and drumming agressively here on the morning of June 30.

EASTERN WOOD-PEWEE

MSACP - 1 : 1
WRS - 1
R114PC - 0 : 0
MISC -
Comments: One male on territory in the Main Study Area.

YELLOW-BELLIED FLYCATCHER

MSACP - 1 : 1
WRS - 1
R114PC - 0 : 0
MISC -
Comments: Probably one breeding pair in suitable habitat near Point Count #7.

ALDER FLYCATCHER

MSACP - 2 : 2
WRS - 1
R114PC - 3 : 3
MISC - also recorded along Fownes and Dawson Roads.
Comments: A few breeding pairs in Main Study Area.

LEAST FLYCATCHER

MSACP - 0 : 0
WRS - 2
R114PC - 0 : 0
MISC -
Comments: Apparently a pair on territory in suitable habitat just east of north end of wetland.

BLUE JAY

MSACP - 2 : 2
WRS - 3
R114PC - 1 : 1
MISC - also recorded on Beech Hill and Dawson Roads.
Comments: Distraction behaviour noted in Main Study Area strongly suggestive of flying young in area.

AMERICAN CROW

Comments: Recorded in all populated areas surrounding the Main Study Area but not in the Main Study Area.

COMMON RAVEN

MSACP - 2 : 2
WRS - 0
R114PC - 3 : 8
MISC -
Comments: Numerous along Route 114 but only a couple of birds noted at Main Study Area. Probably nest nearby.

BLACK-CAPPED CHICKADEE

MSACP - 1 : 2
WRS - 4
R114PC - 3 : 4
MISC - also recorded along Beech Hill, Fownes and Dawson Roads.
Comments: Adults seen carrying food at one location in MSA confirms breeding.

RED-BREASTED NUTHATCH

MSACP - 1 : 1
WRS - 0
R114PC - 0 : 0
MISC -
Comments: Just one sighting, a bird calling in the MSA, in suitable breeding habitat.

BROWN CREEPER

MSACP - 2 : 2
WRS - 1
R114PC -
MISC -
Comments: Calling males in suitable habitat in MSA; probably breeding.

WINTER WREN

MSACP - 3 : 3
WRS - 3
R114PC - 1 : 1
MISC -
Comments: Several males singing in suitable breeding habitat in MSA; probably breeding.

GOLDEN-CROWNED KINGLET

MSACP - 1 : 1
WRS - 1
R114PC - 0 : 0
MISC -
Comments: One or two birds present in suitable breeding habitat in MSA; probably breeds.

RUBY-CROWNED KINGLET

MSACP - 1 : 1
WRS -
R114PC - 1 : 1
MISC -
Comments: Just one male heard singing in MSA; this early migrant may have already stopped singing but probably breeds on MSA.

VEERY

MSACP - 0 : 0
WRS - 0
R114PC - 2 : 2
MISC -
Comments: Two birds singing along Route 114 on June 30; not recorded on MSA.

SWAINSON'S THRUSH

MSACP - 8 : 11
WRS - 10
R114PC - 0 : 0
MISC - also recorded along Beech Hill Road and Fownes Road.
Comments: A common breeding bird in forested areas of the MSA.

HERMIT THRUSH

MSACP - 5 : 7
WRS - 2
R114PC - 0 : 0
MISC - also recorded along Beech Hill Road.
Comments: Probably several breeding pairs in forested areas of MSA.

AMERICAN ROBIN

MSACP - 8 : 14
WRS - 18
R114PC - 7 : 25
MISC - recorded pretty much everywhere.
Comments: A common breeding bird of the more open areas of the MSA. Several birds seen carrying food.

CEDAR WAXWING

MSACP - 6 : 30
WRS - 15
R114PC - 5 : 13
MISC - small numbers recorded pretty much everywhere.
Comments: Small groups of Cedar Waxwings were commonly seen in flight throughout the area. This species tends to nest rather late in the summer so territories may not yet be established. Will probably be a pretty common breeding species in the MSA.

EUROPEAN STARLING

MSACP - 0 : 0
WRS - 0
R114PC - 2 : 3
MISC - up to 15 noted daily along populated areas of Route 114.
Comments: A common breeding species in populated areas. Not recorded at the MSA.

BLUE-HEADED VIREO

MSACP - 6 : 6
WRS - 1
R114PC - 2 : 2
MISC - also recorded along Fownes Road.
Comments: Several singing males in forested areas of MSA. Probably several pairs breeding.

RED-EYED VIREO

MSACP - 9 : 16
WRS - 4
R114PC - 6 : 12
MISC - recorded pretty much everywhere.
Comments: A common breeding species throughout the MSA.

TENNESSEE WARBLER

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - a male singing at the old field (Point Count #15) on the afternoon of June 29.
Comments: This warbler was formerly a very common breeder in this part of New Brunswick during the spruce budworm years but is now quite uncommon.

NASHVILLE WARBLER

MSACP - 9 : 13
WRS - 2
R114PC - 0 : 0
MISC - also recorded along Beech Hill and Fownes Roads and along Route 114.
Comments: Probably a fairly common breeder of forested and semi-open areas of the MSA. Adult seen carrying food, confirming breeding in MSA.

NORTHERN PARULA

MSACP - 6 : 6
WRS - 8
R114PC - 4 : 4
MISC - also recorded along Beech Hill and Dawson Roads.
Comments: Probably a fairly common breeder of forested areas of MSA. Agitated adults carrying food noted at two locations in MSA, confirming breeding.

CHESTNUT-SIDED WARBLER

MSACP - 4 : 8
WRS - 4
R114PC - 1 : 2
MISC - also recorded along Beech Hill Road, Fownes Road and Dawson Road.
Comments: Probably a fairly common breeder of semi-open areas of MSA. One adult noted carrying food, confirming breeding in MSA.

MAGNOLIA WARBLER

MSACP - 5 : 8
WRS - 18
R114PC - 3 : 3
MISC - also recorded on Beech Hill, Fownes and Dawson Roads.
Comments: A common breeding species of forested areas of MSA; adults observed carrying food; distraction display observed.

BLACK-THROATED BLUE WARBLER

MSACP - 2 : 2
WRS - 1 : 1
R114PC - 0 : 0
MISC -
Comments: Probably 2 or 3 breeding pairs in forested areas of MSA; one distressed female carrying food near Point Count #11 on June 30 confirms breeding.

YELLOW-RUMPED WARBLER

MSACP - 1 : 1
WRS - 3
R114PC - 1 : 2
MISC -
Comments: Probably commoner than this survey would indicate as this species arrives early and stops singing earlier in the season than other warblers. Fledged juveniles being fed out of nest noted near Point Count #7 on June 30 confirms breeding.

BLACK-THROATED GREEN WARBLER

MSACP - 5 : 7
WRS - 5
R114PC - 0 : 0
MISC - also recorded along Fownes Road.
Comments: Probably several breeding pairs in forested areas of MSA. Agitated behaviour of a pair near Point Count #16 on June 30 strongly suggestive of breeding.

BLACKBURNIAN WARBLER

MSACP - 2 : 2
WRS - 0
R114PC - 0 : 0
MISC - also recorded along Fownes Road.
Comments: Two singing males in areas of somewhat mature forest in MSA. Probably breeds.

PALM WARBLER
MSACP - 1 : 2
WRS - 1
R114PC - 0 : 0
MISC -
Comments: All sightings were near small 'bog' west of wetland and in trees at edge of wetland. Agitated adult male carrying food near bog on June 28 confirms breeding.

BAY-BREASTED WARBLER
MSACP - 0 : 0
WRS - 2
R114PC - 0 : 0
MISC -
Comments: Two males were singing and on territory in quite mature softwood between Point Counts #6 and 7 on June 30. Probably breeds.

BLACK-AND-WHITE WARBLER
MSACP - 8 : 8
WRS - 8
R114PC - 2 : 2
MISC -
Comments: A fairly commonbreeding species of forested areas of MSA; adult female carrying food near Point Count #9 on June 30 confirms breeding.

AMERICAN REDSTART
MSACP - 2 : 3
WRS - 1
R114PC - 1 : 1
MISC - also recorded on Dawson Road and along Route 114.
Comments: Probably just a few breeding pairs in MSA.

OVENBIRD
MSACP - 9 : 16
WRS - 11
R114PC - 2 : 2
MISC - also recorded along Fownes Road, Beech Hill Road and Dawson Road
Comments: A very common breeding species of forested areas of MSA.

MOURNING WARBLER
MSACP - 2 : 2
WRS - 0
R114PC - 0 : 0
MISC -
Comments: Two singing males in suitable breeding habitat (regenerating clearcuts) on the Point Count survey on June 29.

COMMON YELLOWTHROAT

MSACP - 6 : 6
WRS - 5
R114PC - 3 : 4
MISC - also recorded along Dawson Road, Fownes Road and Beech Hill Road
Comments: A fairly common breeding species of the clearcuts in the MSA.

CANADA WARBLER

MSACP - 5 : 5
WRS - 7
R114PC - 0 : 0
MISC - also recorded along Dawson Road.
Comments: A fairly common breeding species of forested areas of MSA. Agitated adults carrying food at two locations in MSA on June 28 and 30 confirms breeding.

ROSE-BREASTED GROSBEAK

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 1
MISC - also recorded along Dawson Road.
Comments: Recorded along Route 114 and at Dawson Road; not recorded in MSA.

CHIPPING SPARROW

MSACP - 1 : 1
WRS - 0
R114PC - 5 : 5
MISC - also recorded along Fownes and Dawson Roads.
Comments: A common breeding species of populated areas along Route 114 and adjacent roads. The only sighting in the MSA was at Point Count #1 which was near a residence on Beech Hill Road.

SAVANNAH SPARROW

MSACP - 0 : 0
WRS - 0
R114PC - 0 : 0
MISC - recorded singing in salt marsh at Weldon Creek and in fields along Route 114.
Comments: Does not occur in MSA as there is no suitable habitat.

NELSON'S SHARP-TAILED SPARROW

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 2
MISC - small numbers (up to 6) recorded daily June 28-30 singing in salt marsh at Weldon Creek.
Comments: While fairly common in the salt marsh at the Weldon Creek bridge on Route 114, this species does not occur in the MSA.

SONG SPARROW

MSACP - 0 : 0
WRS - 0
R114PC - 5 : 8
MISC - recorded in all populated areas.
Comments: A common breeding species in populated areas along Route 114 and adjacent roads. Not recorded in MSA.

LINCOLN'S SPARROW

MSACP - 1 : 2
WRS - 0
R114PC - 0 : 0
MISC -
Comments: There is suitable breeding habitat for this species adjacent to the old field / bog area west of the wetland in the MSA. This is where two males were heard singing on Point Count #15 on June 29.

SWAMP SPARROW

MSACP - 1 : 1
WRS - 0
R114PC - 1 : 2
MISC -
Comments: Probably a fairly common breeding species around the edge of the Weldon Creek salt marsh. In the MSA, the only record was of one singing at the edge of the wetland on Point Count #14 on June 29.

WHITE-THROATED SPARROW

MSACP - 11 : 23
WRS - 16
R114PC - 4 : 4
MISC - also recorded along Beech Hill, Fownes and Dawson Roads.
Comments: Perhaps the most numerous breeding bird in the MSA, occurring in clearcuts, semi-open forest and even quite mature forest. Several adults were seen carrying food, confirming breeding.

DARK-EYED JUNCO

MSACP - 4 : 4
WRS - 3
R114PC - 2 : 2
MISC - also recorded along Beech Hill and Fownes Roads.
Comments: Probably a fairly common breeder in most forested areas of MSA.

RED-WINGED BLACKBIRD

MSACP - 0 : 0
WRS - 0
R114PC - 1 : 3
MISC -
Comments: This species breeds in small numbers in the Weldon Creek salt marsh and possibly also along Route 114; not recorded in MSA.

COMMON GRACKLE

MSACP - 0 : 0
WRS - 0
R114PC - 3 : 4
MISC - also recorded along Beech Hill Road and Dawson Road.
Comments: Fairly common breeder around populated areas of Route 114 and adjacent roads; not recorded in MSA.

PURPLE FINCH

MSACP - 2 : 2
WRS - 2
R114PC - 2 : 2
MISC -
Comments: A few birds singing in forested areas of MSA suggest it is a fairly common breeder.

AMERICAN GOLDFINCH

MSACP - 2 : 2
WRS - 0
R114PC - 3 : 7
MISC - also recorded along Beech Hill Road and Dawson Road.
Comments: A common breeding species in populated areas of Route 114 and adjacent roads. In MSA only recorded in clearcut near top of Beech Hill Road. A late breeder, they may just have been wandering birds.

EVENING GROSBEAK

MSACP - 1 : 1
WRS - 3
R114PC - 0 : 0
MISC -
Comments: A few noted in flight over the southwestern section of the MSA. Could possibly breed but more likely just wandering.

DISCUSSION OF HABITAT

There doesn't appear to be any critical habitat for birds in the immediate Main Study Area. Extensive second-growth forest intermixed with recent and older clearcuts is pretty typical of much of inland Albert County. The pond / meadow wetland located in the western section of the Main Study Area is somewhat unique for Albert County, although very few wetland birds were noted. The most significant avian sighting in that area was an agitated female Northern Harrier that appeared to be nesting in the meadow at the south end of the wetland. A single Wilson's Snipe was also heard here on the evening of July 1 and probably indicates that this species breeds here in low numbers. Surprisingly, no waterfowl were recorded at the wetland, although it would seem suitable for several species of ducks and probably also for American Bittern. More study of this wetland is needed to determine its' use by waterbirds. I expect that this wetland also hosts some interesting dragonflies and damselflies.

OTHER FAUNA OBSERVED

Lepidoptera (Butterflies)

CANADIAN TIGER SWALLOWTAIL *Papilio canadensis* G5, N5, S5 - up to 10 noted daily June 28-30 in woodland and clearcuts; most were quite worn.

CLOUDED SULPHUR *Colias philodice* G5, N5, S5 - two were noted around clearing at main drill site on June 28.

PINK-EDGED SULPHUR *Colias interior* G5, N5, S5 - up to 20 noted daily June 28-30; in clearcuts and especially in 'peatland' just west of wetland; many were 'puddling' on damp roadside soil in the peatland area.

HARVESTER *Feniseca tarquinius* G4, N4, S4 - 4-5 were observed perching at eye-level in roadside alders along narrow woodland road leading to the wetland on June 29.

SUMMER AZURE *Celastrina neglecta* G5, N5, SU - up to 10 noted daily along roadsides in both forested and clearcut areas June 28-30.

SILVERY BLUE *Glaucopsyche lygdamus* G5T4, S5 - several rather worn individuals in the old field west of wetland on June 29.

GREAT SPANGLED FRITILLARY *Speyeria cybele* G5, S5 - one fresh-looking individual in clearcut near main drilling site on June 28.

ATLANTIS FRITILLARY *Speyeria atlantis* G5, N5, S5 - up to 10 noted daily in woodland roadsides June 28-30.

SILVER-BORDERED FRITILLARY *Boloria selene* G5T4Q, S5 - one very worn individual along roadside at pond area of wetland on June 29.

HARRIS'S CHECKERSPOT *Chlosyne harrisii* G4, N3N4, S4 - one very fresh individual along roadside near clearcut / forest interface on June 30.

NORTHERN CRESCENT *Phyciodes cocyta* G5, N5, S5 - up to 5 noted daily along forest roadsides June 28-30.

RED ADMIRAL *Vanessa atalanta* G5, SZB - one somewhat worn individual along roadside near pond area of wetland on June 29.

WHITE ADMIRAL *Limenitis arthemis* G5, N5, S5 - up to 10 noted daily June 28-30, mainly in forested areas.

VICEROY *Limenitis archippus* G5, N5, S5 - 1-5 rather fresh individuals noted daily June 28-30; most were in peatland area west of wetland.

NORTHERN PEARLY-EYE *Enodia anthedon* G5, N5, S5 - around 5 fresh individuals noted along narrow woodland road leading to wetland on June 29.

EYED BROWN *Satyrodes eurydice* G5, N5, S4 - up to 10 noted daily June 28-30 along roadside and meadow area near wetland.

LITTLE WOOD SATYR *Megisto cymela* G5, N5, S5 - three widely scattered individuals noted in forested areas June 29-30.

DREAMY DUSKYWING *Erynnis icelus* G5, N5, S5 - up to 5 noted daily June 28-30, mainly in clearcut areas. Most were very worn but a couple were rather fresh.

EUROPEAN SKIPPER *Thymelicus lineola* G5, NE, SE - common in most roadside areas with Vetch sp. (Viccia sp.) and especially common in old field west of wetland. Hundreds....

TAWNY-EDGED SKIPPER *Polites themistocles* G5, N5, S5 - singles along roadsides on June 29 and 30.

LONG DASH *Polites mystic* G5, N5, S5 - 2-5 noted daily June 28-30 along roadsides in both wooded and clearcut areas.

HOBOMOK SKIPPER *Poanes hobomok* G5, N5, S5 - 2 very worn individuals noted in clearcut on June 28 and a fresher individual in wooded area on June 30.

DUN SKIPPER *Euphyes vestris* G5T5, S5 - single fresh individuals in clearcuts on June 28 and 30.

COMMON ROADSIDE-SKIPPER *Amblyscirtes vialis* G5, N5, S3 - a single fairly worn individual noted along roadside in clearcut near main drilling site on June 28.

Odonata (Dragonflies and Damselflies)

EBONY JEWELWING *Calopteryx maculata* G5, N5, S5 - a wandering male in woodland on June 29; several territorial males along the small brook draining the wetland on June 30.

EMERALD SPREADWING *Lestes dryas* G5, N5, S3 - a freshly emerged male near a wet roadside ditch on June 29.

MARSH BLUET *Enallagma ebrium* G5, N5, S5 - abundant and breeding at pond and along channel of wetland, June 28-30.

EASTERN FORKTAIL *Ischnura verticalis* G5, N5, S5 - common at pond section of wetland, June 28-30.

AURORA DAMSEL *Chromagrion conditum* G5, N5, S3 - fairly common around perimeter of pond section of wetland; up to 10 tandem pairs plus several single males noted daily including females ovipositing on submergent vegetation.

BEAVERPOND CLUBTAIL *Gomphus borealis* G4, N3, S3 - fairly common at pond section of wetland; up to 10 noted daily June 28-30; males and females perching on dirt road adjacent to pond and several males perching on rocks at water's edge.

CANADA DARNER *Aeshna canadensis* G5, N5, S5 - a single adult male was noted patrolling the pond section of the wetland on June 28 and 29.

AMERICAN EMERALD *Cordulia shurtleffii* G5, N5, S5 - several males noted daily June 28-30 patrolling the edge of the pond and along the canal of the wetland.

BEAVERPOND BASKETTAIL *Epitheca canis* G5, N5, S4 - 2 males noted patrolling edge of pond area of wetland on June 28; one male noted along woodland road leading to wetland on June 29.

HUDSONIAN WHITEFACE *Leucorrhinia hudsonica* G5, N5, S4 - a wandering female noted in woodland on June 28; 3 males and 1 female noted perching on dirt road adjacent to pond area of wetland on June 30.

RED-WAISTED WHITEFACE *Leucorrhinia proxima* G5, N5, S5 - abundant daily June 28-30 around perimeter of pond area and along canal of wetland.

FOUR-SPOTTED SKIMMER *Libellula quadrimaculata* G5, N5, S5 - up to 10 rather worn adults noted daily June 28-30 around pond area and along canal of wetland; a few also noted perching along woodland roads away from water.

COMMON WHITETAIL *Plathemis lydia* G5, N5, S4 - a single female perching on woodland road away from water on June 28; an adult male and female noted around pond area of wetland on June 29.

CHALK-FRONTED CORPORAL *Ladona julia* G5, N5, S5 - several wandering males and females noted daily June 28-30 perching on woodland roads away from water; up to 30 noted daily June 28-30 around pond area and along canal of wetland.

OTHER INSECTS NOTED

Two species of tiger beetles were noted in the Main Study Area : **SIX-SPOTTED TIGER BEETLES** *Cicindela sexguttata* (G5, N5, S5) were noted daily in small numbers along roads in forested areas. A single **TWELVE-SPOTTED TIGER BEETLE** *Cicindela duodecimguttata* (G5, N5, S5) was noted along a sandy road near a clearcut / forest interface near Point Count #9 on June 30.

SAY'S CICADA *Okanagana rimosa* were commonly heard throughout the MSA once the air temperature reached 23 or 24 C. The **VIRGINIA CTENUCHA** Ctenucha virginica, a beautiful day-flying moth, was very conspicuous in the old field west of the wetland in the MSA.

REPTILES AND AMPHIBIANS

The pond at the north end of the wetland has many BULLFROGS ***Rana catesbeiana*** **(G5, N5, S5) and** GREEN FROGS ***Rana clamitans*** **(G5, N5, S5). A single** AMERICAN TOAD ***Bufo americanus*** **(G5, N5, S5) was noted crossing the road near the wetland outlet. A dead** RED-BELLIED SNAKE ***Storeria occipitomaculata*** **(G5, N5, S5), apparently run over by a car, was noted near the wetland outlet on June 30.**

Table 1: Birds recorded during 18 Point Counts in Main Study Area on morning of June 29/06.

Species \ Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Stops:Total
Northern Harrier														1					1 : 1
Ruby-throated Hummingbird				1			1												2 : 2
Yellow-bellied Sapsucker							1	1			1	1							4 : 4
Northern Flicker			1						2			1	1	1				1	6 : 7
Pileated Woodpecker							1												1 : 1
Eastern Wood-Pewee										1									1 : 1
Yellow-bellied Flycatcher								1											1 : 1
Alder Flycatcher					1									1					2 : 2
Blue Jay									1								1		2 : 2
Common Raven			1					1											2 : 2
Black-capped Chickadee								2											1 : 2
Red-breasted Nuthatch																1			1 : 1
Brown Creeper										1	1								2 : 2
Winter Wren								1	1							1			3 : 3
Golden-crowned Kinglet										1									1 : 1
Ruby-crowned Kinglet													1						1 : 1
Swainson's Thrush			2		1		1	1	2	1							2	1	8 : 11
Hermit Thrush									2				1	2	1		1		5 : 7
American Robin		1				1	1		2	1			2		2			4	8 : 14
Cedar Waxwing											7			8	3	5	2	5	6 : 30
Blue-headed Vireo				1	1		1					1		1		1			6 : 6
Red-eyed Vireo	2		5				2	1		2			1	1		1	1		9 : 16
Nashville Warbler	1					1		1	2		1	2		1	3			1	9 : 13
Northern Parula			1	1		1		1		1							1		6 : 6
Chestnut-sided Warbler		2			2	2											2		4 : 8
Magnolia Warbler					1				2				2		2		1		5 : 8
Black-throated Blue Warbler	1						1												2 : 2
Yellow-rumped Warbler						1													1 : 1
Black-throated Green Warbler			1	2			1					2	1						5 : 7
Blackburnian Warbler			1				1												2 : 2
Palm Warbler															2				1 : 2
Black-and-white Warbler								1	1		1	1			1	1	1	1	8 : 8

Table 1 (cont'd)

Species \ Stop #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Stops:Total
American Redstart	1		2																2 : 3
Ovenbird			1	2	1	2	2			2	1	2				3			9 : 16
Mourning Warbler		1			1														2 : 2
Common Yellowthroat					1				1					1	1		1	1	6 : 6
Canada Warbler							1		1		1	1					1		5 : 5
Chipping Sparrow	1																		1 : 1
Lincoln's Sparrow															2				1 : 2
Swamp Sparrow														1					1 : 1
White-throated Sparrow		3			2	2		1	2			1	2	2	3		3	2	11 : 23
Dark-eyed Junco			1						1	1	1								4 : 4
Purple Finch							1				1								2 : 2
American Goldfinch																	1	1	2 : 2
Evening Grosbeak																		1	1 : 1
TOTAL SPECIES 45	5	4	10	5	9	7	12	11	13	9	9	9	8	11	10	7	13	10	

Table 2: Birds recorded on 8 Point Counts along Route 114 between Stoney Creek and Weldon Creek on morning of June 30/06.

Species \ Stop #	1	2	3	4	5	6	7	8	# of Stops : Total
Bald Eagle								1	**1 : 1**
Sharp-shinned Hawk								1	**1 : 1**
Merlin								2	**1 : 2**
Mourning Dove	1								**1 : 1**
Downy Woodpecker						1			**1 : 1**
Northern Flicker							1		**1 : 1**
Alder Flycatcher				1		1	1		**3 : 3**
Blue Jay	1								**1 : 1**
American Crow	2		1		2	1	2	5	**6 : 13**
Common Raven	3	4			1				**3 : 8**
Black-capped Chickadee			1	1			2		**3 : 4**
Winter Wren				1					**1 : 1**
Ruby-crowned Kinglet		1							**1 : 1**
Veery	1						1		**2 : 2**
American Robin	5	5	3	3	3		3	3	**7 : 25**
Cedar Waxwing		2	1	6		3		1	**5 : 13**
European Starling			2				1		**2 : 3**
Blue-headed Vireo			1	1					**2 : 2**
Red-eyed Vireo	2	2	2	2	2	2			**6 : 12**
Northern Parula	1	1				1	1		**4 : 4**
Chestnut-sided Warbler						2			**1 : 2**
Magnolia Warbler				1	1	1			**3 : 3**
Yellow-rumped Warbler		2							**1 : 2**
Black-and-white Warbler		1			1				**2 : 2**
American Redstart						1			**1 : 1**
Ovenbird			1	1					**2 : 2**
Common Yellowthroat	1					1	2		**3 : 4**
Rose-breasted Grosbeak					1				**1 : 1**
Chipping Sparrow	1		1		1	1		1	**5 : 5**
Nelson's Sharp-tailed Sparrow								2	**1 : 2**
Song Sparrow	2		1	3			1	1	**5 : 8**
Swamp Sparrow								2	**1 : 2**
White-throated Sparrow	1	1				1	1		**4 : 4**
Dark-eyed Junco		1				1			**2 : 2**
Red-winged Blackbird								3	**1 : 3**
Common Grackle		1			1	2			**3 : 4**
Purple Finch		1			1				**2 : 2**
American Goldfinch	2			2		3			**3 : 7**
TOTAL SPECIES : 39	**13**	**12**	**10**	**11**	**10**	**15**	**11**	**11**	

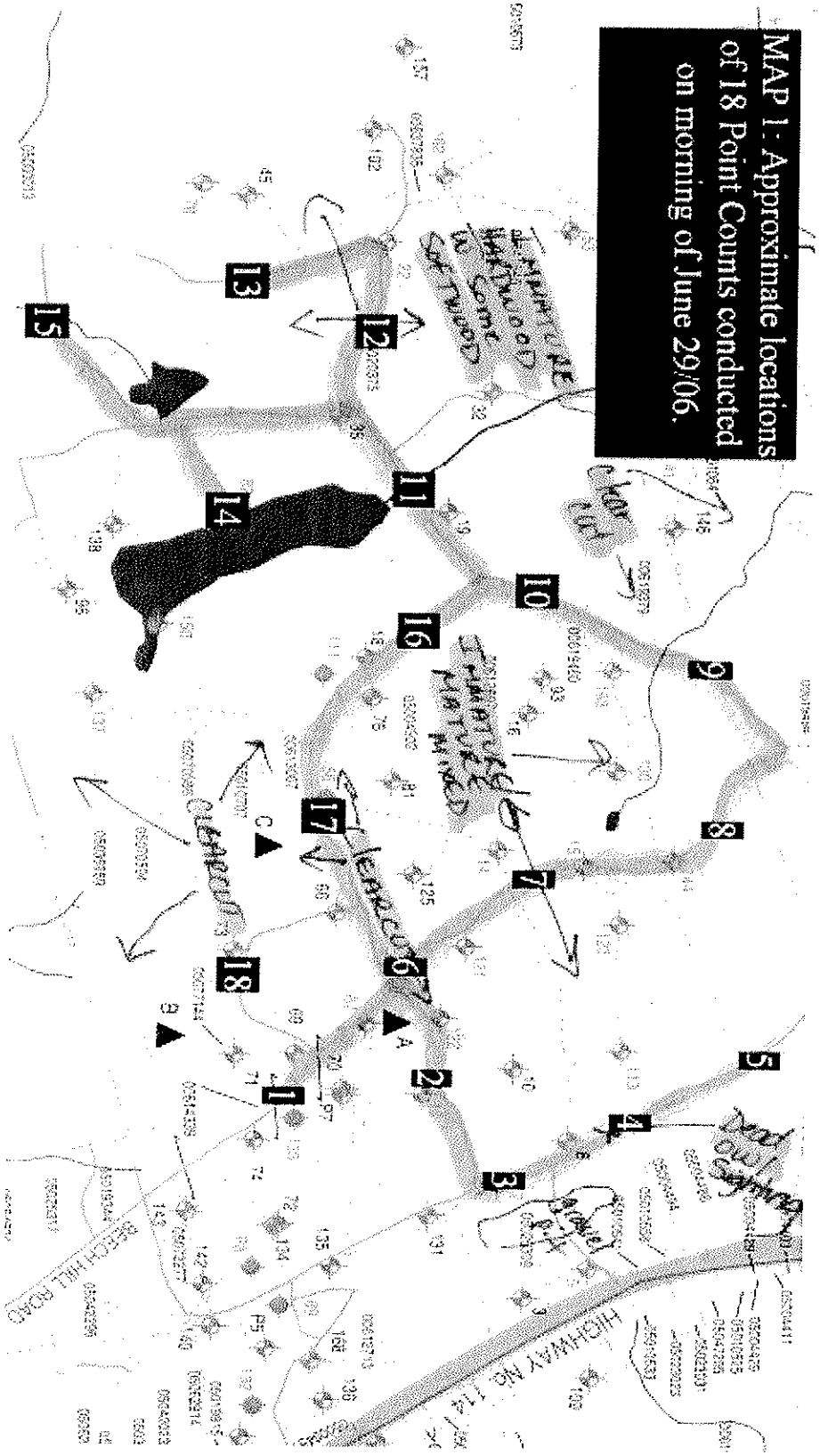
Table 3: Birds observed on walking route (encompassing Point Counts #6-13, 16 and 17) on morning of June 30/06.

Species	Total Individuals Recorded
Mourning Dove	1
Yellow-bellied Sapsucker	2
Northern Flicker	2
Pileated Woodpecker	1
Eastern Wood-Pewee	1
Yellow-bellied Flycatcher	1
Alder Flycatcher	1
Least Flycatcher	2
Blue Jay	3
Black-capped Chickadee	4
Brown Creeper	1
Winter Wren	3
Golden-crowned Kinglet	1
Swainson's Thrush	10
Hermit Thrush	2
American Robin	18
Cedar Waxwing	15
Blue-headed Vireo	1
Red-eyed Vireo	4
Nashville Warbler	2
Northern Parula	8
Chestnut-sided Warbler	4
Magnolia Warbler	18
Black-throated Blue Warbler	1
Yellow-rumped Warbler	3
Black-throated Green Warbler	5
Palm Warbler	1
Bay-breasted Warbler	2
Black-and-white Warbler	8
American Redstart	1
Ovenbird	11
Common Yellowthroat	5
Canada Warbler	7
White-throated Sparrow	16
Dark-eyed Junco	3
Purple Finch	2
Evening Grosbeak	3
TOTAL SPECIES: 39	

APPENDIX 1: UTM co-ordinates of 18 Point Counts in Main Study Area on morning of June 29/06.

1. *20 T 368223, 5091552*
2. *20 T 368296, 5091952*
3. *20 T 368437, 5092168*
4. *20 T 368275, 5092505*
5. *20 T 367991, 5092881*
6. *20 T 367782, 5091995*
7. *20 T 367621, 5092317*
8. *20 T 367428, 5092621*
9. *20 T 367065, 5092626*
10. *20 T 366853, 5092187*
11. *20 T 366530, 5091851*
12. *20 T 366167, 5091681*
13. *20 T 365885, 5091692*
14. *20 T 366658, 5091385*
15. *20 T 366239, 5091040*
16. *20 T 366932, 5091830*
17. *20 T 367353, 5091577*
18. *20 T 367904, 5091412*

Map 1 : Approximate location of 18 Point Counts in Main Study Area surveyed for birds on morning of June 29, 2006



OBSERVATION EFFORT AND DATES

Bird observations were recorded during the period June 28 - July 1, 2006 as follows:

June 28, 0815 - 1400 h.: Scouting of study area and miscellaneous observations at Weldon Creek, Beech Hill Road and throughout the Main Study Area.
Weather: partly cloudy, very humid, wind SW 10-40 kph, temperature 22-26C.

June 29, 0545 - 0950 h.: Conducted 18 Point Counts, following protocol used by Maritimes Breeding Bird Atlas Project, at Main Study Area. At each of 18 points, all species observed or heard during a 5-minute period were recorded (**See Table 1**), as was location (**See Map 1 and Appendix 1**).
1045 - 1415 h.: Miscellaneous observations at Weldon Creek, along Route 114 north to Stoney Creek, Beech Hill Road, and in the vicinity of the wetland and old field in the southwestern section of the Main Study Area.
Weather: mostly cloudy, humid, wind SW 15-40 kph, temperature 19-26C.

June 30, 0545 - 0700 h.: Conducted 8 Point Counts along Route 114 between Stoney Creek and Weldon Creek (**See Table 2**).
0715 - 0750 h.: Miscellaneous observations along Fownes Road and start of Dawson Road.
0755 - 1030 h.: Walked survey route encompassing Point Count stops #6-13, 16, 17 (**See Table 3**)
2130 - 2200 h.: Attempted evening owl survey but aborted due to high winds.
Weather: mostly cloudy, humid, wind SW 10-25 kph (am) increasing to SW 30-50 kph (pm), temperature 20-24C.

July 1, 2130 - 2300 h.: Conducted evening owl survey at three stops in Main Study Area following protocol used by the New Brunswick Nocturnal Owl Survey sponsored by Bird Studies Canada.
Weather: mostly cloudy, wind W 15 kph, temperature 18C.