DILLON CONSULTING

COVERED BRIDGE POTATO CHIP COMPANY

Environmental Impact Assessment (EIA) Registration

Wastewater Treatment System Project, Waterville, New Brunswick

July 2023 – 22-4639

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July 13, 2023

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: Crystale Harty
Director, Environmental Impact Assessment Branch

Environmental Impact Assessment (EIA) Registration – Covered Bridge Potato Chip Company Wastewater Treatment System Project, Waterville, New Brunswick

On behalf of the Covered Bridge Potato Chip Company, Dillon Consulting Limited (Dillon) is pleased to submit this environmental impact assessment (EIA) registration document for the Covered Bridge Potato Chip Company's proposed Wastewater Treatment System Project (the Project) in Waterville, 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

Denis L. Marquis, M.Sc.E., P.Eng.
Associate, Project Manager

DLM:bjf:vrt

cc: Ryan Albright – CEO/Founder, Covered Bridge Potato Chip Company

Our file: 22-4639

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Acronyms and Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
AER	Alberta Energy Regulator
AES	Advanced Enviro-Septic®
AO	aesthetic objective
BOD	biological oxygen demand
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CO	carbon dioxide
CO	carbon monoxide
COD	chemical oxygen demand
CO_2	carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CH_4	methane
CWS	Canadian Wildlife Service
DO	dissolved oxygen
DWAs	deer wintering areas
EIA	environment impact assessment
ESA	Environmentally Sensitive Area
FAC	facultative
FACW	facultative wetland
FOG	fat, oil, and grease
ECCC	Environment and Climate Change Canada
Evoqua-MBR	Evoqua Membrane Bioreactor
GHG	greenhouse gases
GIS	geographical information systems
GPS	global positioning system
HMI	human-machine interface
H_2S	hydrogen sulphide
IA	impact assessment
IAA	*Impact Assessment Act*
IBA	Important Birds Areas
LIT	pressure transducer type level transmitter
LS	level switch
LSDs	Local Service District
MAC	maximum allowable concentration
MBBA	Maritime Breeding Bird Atlas
MBCA	*Migratory Birds Convention Act*
MBR	membrane bioreactor

MLSS	mixed liquor suspended solid
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NBDAA	New Brunswick Department of Aboriginal Affairs
NBDELG	New Brunswick Department of Environment and Local Government
NB SARA	New Brunswick *Species at Risk Act*
NGOs	non-governmental organizations
NH_3-N	ammonia nitrogen
OBL	obligate
O_3	ozone
OWLS	Online Well Log System
PDA	Project development area
PLC	programmable logic controller
PM	particulate matter (also known as total suspended particulate)
$PM_{2.5}$	particulate matter less than 2.5 microns
PNA	Protected Natural Area
RSC	Regional Service Commission
SAR	species at risk
SARA	*Species at Risk Act*
SCC	South Central Carleton
SMU	submerged membrane units
SO_2	sulphur dioxide
SOCC	species of conservation concern
TCH	Trans-Canada Highway
The Company	Covered Bridge Potato Chip Company
The Factory	Covered Bridge Potato Chip Company's Factory
The Project	Wastewater Treatment System Project
TKN	total Kjeldahl nitrogen
TMP	transmembrane pressure
TN	total nitrogen
TP	total phosphorus
TRC	Technical Review Committee
TRC	total residual chlorine
TSP	total suspended particulate
TSS	total suspended solids
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
VFD	variable frequency drive
VC	valued component

VSS	volatile suspended solids
WAS	waste activated sludge
WAWA	Watercourse and Wetland Alteration
WESP-AC	Wetland Ecosystem Services Protocol of Atlantic Canada
WMZ	Wildlife Management Zone
WWTP	wastewater treatment plant
WWTS	wastewater treatment system

1.0 Introduction

This document is an Environmental Impact Assessment (EIA) Registration document for the Wastewater Treatment System Project (the Project) proposed by the Covered Bridge Potato Chip Company (Covered Bridge Chips; the Company) in the community of Waterville within the town of Hartland, Carleton County, New Brunswick, Canada. The Company produces "kettle-style" potato chips for the retail market. The proposed Wastewater Treatment System (WWTS) consists of a 96 cubic metre (m^3) Evoqua membrane bioreactor (Evoqua-MBR) as the primary treatment system, and an Advanced Enviro-Septic® (AES) Wastewater Treatment System as the secondary treatment and treated effluent release system, to be located on the Covered Bridge Chips property in west-central New Brunswick.

The Project is an undertaking under item (m) of Schedule A of the New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (EIA Regulation) ["*(m) all waste disposal facilities or systems*"]. As such, the Project must be registered under Section 5(1) of the EIA Regulation, and at a minimum a determination review will be conducted. Following the EIA review and approval, other permits and approvals may 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 Covered Bridge Chips to provide information to 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 "Wastewater Treatment System Project". The proponent of the Project is the Covered Bridge Potato Chip Company. The Proponent's contact information is provided in **Table 1.1.1** below.

Table 1.1.1: Proponent Information

Proponent Information	
Name of Project:	Wastewater Treatment System Project
Name of Proponent:	Covered Bridge Potato Chip Company
Mailing Address of Proponent:	35 Alwright Court Waterville, NB E7P 0A5
Chief Executive Officer:	Mr. Ryan Albright
Principal Proponent Contact for the purposes of this EIA Registration:	Mr. Ryan Albright Chief Executive Officer/Founder Telephone: 506.375.2447 Mobile: 506.325.8205 Email: ryan@coveredbridgechips.com

Proponent Information	
Environmental Consultant that led the preparation of this EIA Registration:	Denis L. Marquis, M.Sc.E., P.Eng. Associate, Project Manager Dillon Consulting Limited 1149 Smythe Street, Suite 200 Fredericton, NB E3B 3H4 Telephone: 506.444.9717 ext. 5119 Mobile: 506.454.8846 Email: dmarquis@dillon.ca
Other contributors to the preparation of this EIA Registration:	Evoqua Water Technologies Fundy Engineering & Consulting Ltd.

1.2 About the Covered Bridge Potato Chip Company

The Covered Bridge Potato Chip Company's Factory (the Factory) is located in Waterville, Carleton County, in New Brunswick's "potato belt" and was founded in 2009. A family business since its inception, the Factory manufactures "kettle-style" potato chips for the retail market. Potatoes are delivered to the Factory, washed, sliced, deep fried, inspected, flavoured, and packaged for shipment to markets. All of the dark russet potatoes used to make the chips are grown locally by the Albright family.

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 Covered Bridge Potato Chip Company produces wastewater from the washing of potatoes and equipment used to manufacture potato chips. Currently, the wastewater produced by the Factory is stored in large tanks connected in series at the Factory, decanted by gravity sedimentation to separate grit (which settles to the bottom of the tanks) and oil and grease (which floats on top of the tank) before moving onto the next large tank for further settling. Following sedimentation and decanting in several successive tanks connected in series, the final decanted wastewater is stored in a final tank pending its shipment via tanker truck to an external third party facility for final treatment and release of treated effluent. Decanted oil and grease is stored in a 3,800 L (1,000 US gallon) sump/lift station located underneath the parking lot, and transported to markets for use as a biofuel.

Rising inflation including transportation costs as well as treatment costs are causing the current method of wastewater disposal by trucking it to an external facility to become economically unfeasible. In addition, with planned expansions to the Factory in the future, it will become even more expensive, and logistics will become more difficult, to continue to transport wastewater off-site for third party treatment. The Company also wishes to become less reliant on external parties as the Company grows and its business opportunity expands.

For several years, the Company has evaluated various options and has concluded that the most appropriate approach is to establish its own WWTS on-site. The WWTS will be a combination of an Evoqua Membrane Bioreactor (Evoqua-MBR) system for primary treatment and an Advanced Enviro-Septic® (AES) system for secondary treatment, installed on the property of the Factory, to treat and discharge all process wastewater produced by the Factory. This will also provide greater capacity for the Factory to expand in the future.

A new Maintenance Building has recently been constructed behind the main Factory Building. This Maintenance Building will provide space for administrative offices, laboratory, warehousing, and a shop area for carrying maintenance activities on equipment and machinery at the Factory. Although the property had been previously cleared some time ago (approximately 2016), the construction of the new Maintenance Building involved site levelling, grading, pouring of footings and foundations, building construction and finishing, and the construction of a short access road between the Factory Building and new Maintenance Building. Upon approval of the Project under the EIA Regulation and the receipt of all required permits, the new WWTS will be housed in a new expansion to the recently constructed Maintenance Building. Once the construction of this building expansion is completed, the Company will complete the installation of the WWTS as well as relocate the existing decanting tanks located in the main Factory Building to the WWTS Building in order to consolidate wastewater infrastructure in one location. This will also vacate space in the main Factory Building to allow for future process expansions.

The Project is proposed to include the following components and considerations:

- Installation of concrete foundations, and construction of the building expansion to the newly constructed Maintenance Building in order to house the WWTS;
- New pipe installation connecting the new WWTS to the existing sump/lift station (which will be repurposed to collect raw wastewater from the Factory and pumped to the WWTS for treatment);
- Relocation of the existing decanting tanks currently located in the main Factory Building to the WWTS area of the now expanded Maintenance Building, to consolidate wastewater decanting and treatment operations at the WWTS area;
- Installation and operation of an Evoqua-MBR wastewater treatment system as the primary treatment system; and
- Installation and operation of an Advanced Enviro-Septic® wastewater treatment system, as the secondary treatment and treated effluent release system (**Figure 1.3.1**).

1.3.2 Rationale and Need for the Project

For the past number of years, the Company has been transporting its wastewater from its Factory to an external third party facility to be treated. As this is proving to be a costly endeavour, and since the Company has plans to expand its Factory and thus its production in the future, the Company is planning to build its own wastewater treatment facility on-site. In addition, trucking the wastewater elsewhere was always meant to be a temporary solution until a more permanent solution could be implemented.

COVERED BRIDGE POTATO CHIP COMPANY EIA

FIGURE 1.3.1

LOCATION AND LAYOUT OF THE PROPOSED WASTEWATER TREATMENT SYSTEM (PROJECT DEVELOPMENT AREA)

- Street
- Highway
- Delineated Wetland
- Project Development Area
- Subject Property

SCALE 1:2,000

0 15 30 60 Meters

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: GM
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_LocationAndLayoutProposedWTS.mxd

Taking the above into consideration, the principal reasons for this Project are:

1. The current system of trucking production wastewater from the Factory to an external facility to be treated is expensive and impractical in the long-term;
2. The current system of trucking production wastewater from the Factory to an external facility will become more expensive with the planned future expansion of the Factory; and
3. The Company wishes to become more self-reliant in its operations.

1.3.3 Project Purpose

In consideration of the above, the purpose of the Project is to construct an on-site wastewater treatment system at the Covered Bridge Potato Chip Company Factory to allow for on-site treatment of process wastewater.

There are several other advantages to implementing the Project as described herein:

1. It will allow the Company to have control over the treatment of its own produced wastewater;
2. It will reduce the greenhouse gas emissions and thus the carbon footprint of the Company by removing the need for transporting wastewater off-site;
3. It will meet or exceed current treatment standards on a consistent basis; and
4. It will serve the Company's wastewater treatment requirement for a design period of approximately 50 years.

1.3.3.1 Alternatives to the Project

Alternatives to the Project include the null (do nothing) alternative as well as alternative treatment technologies.

The null (do nothing) alternative is not a feasible alternative as it does not achieve the Project purpose of constructing an on-site wastewater treatment system at the Factory to allow for on-site treatment of process wastewater.

As for alternative technologies, in arriving at the proposed WWTS concept, several alternatives have been evaluated. This included evaluating different mechanical biological treatment facilities. The Evoqua-MBR system was ultimately selected because it is a compact, pre-packaged system that provides effective wastewater treatment at an industry-competitive cost.

In addition, a surface discharge of treated effluent was considered but ultimately dismissed since there are no watercourses nearby within which to release treated effluent. The Company therefore retained Fundy Engineering & Consulting Ltd. (Fundy) to investigate subsurface disposal options for treated effluent. Fundy presented the Company with two options for the subsurface secondary treatment and treated effluent release system:

- High-Capacity Infiltrator Chambers; and
- The Advanced Enviro-Septic® (AES) Wastewater Treatment System (which was selected for this Project).

Also important to note is that waste from a potato production facility is high in fats and starches, thus it cannot be treated in a municipal wastewater treatment facility. Municipal wastewater has different characteristics than potato-processing waste; therefore, treating this waste in a nearby village or town with their municipal treatment system is not feasible. As previously mentioned, the wastewater is currently shipped to another external facility for treatment; however, this option is not economically feasible in the long-term.

1.4 Regulatory Context

The potential environmental regulatory frameworks that may apply to the Project at the federal, provincial, and local levels are discussed at a high level below.

1.4.1 Environmental Impact Assessment Legislation

1.4.1.1 New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act*

The New Brunswick *Environmental Impact Assessment Regulation – Clean Environment Act* (known herein as the EIA Regulation), administered by the NBDELG, and establishes the EIA process in New Brunswick. The EIA Regulation requires that all "undertakings" listed on Schedule A of the EIA Regulation (including their proposed construction, operation, modification, extension, abandonment, demolition, or rehabilitation) require registration at minimum. Schedule A of the EIA Regulation defines 24 categories of undertakings that may trigger the need for an EIA Registration, and the following category listed in Schedule A applies to the Project:

- "*(m) all waste disposal facilities or systems*"

The requirements for EIA review of an EIA Registration document are described in the document titled *A Guide to Environmental Impact Assessment in New Brunswick* (referred to herein as the "EIA Guide"; NBDELG 2018a).

1.4.1.2 Government of Canada's *Impact Assessment Act*

The Government of Canada enacted the *Impact Assessment Act* (IAA) in August 2019 to supersede the former *Canadian Environmental Assessment Act, 2012* (CEAA 2012) that was previously in force to govern federal environmental assessments in Canada. The IAA, as administered by the Impact Assessment Agency of Canada (the Agency), defines the federal impact assessment (IA) process for projects that encompass "Designated Physical Activities" and projects carried out on federal land.

Designated Physical Activities are those listed in the *Physical Activities Regulations* under the IAA, which includes 61 types of activities under 10 project categories.

Based on the *Physical Activities Regulations*, and the Project activities as they are currently conceived, the Project is not considered a Designated Physical Activity under the IAA. Further, no aspect of the Project will be carried out on federally-owned land; therefore, a federal IA under the IAA is not required for the Project.

1.4.2 Other Potential Federal, New Brunswick, and Local Legislation

In addition, the other potential provincial, federal, and local environmental permitting requirements that may apply to the Project 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 is required, since the Project involves a waste disposal system. 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.	An Approval under the *Water Quality Regulation* will likely be required as the Project is a "source" of contaminants to the environment (i.e., treated effluent).
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. Should further ground disturbance be required within 30 m of the on-site delineated wetlands (see **Section 4.5.3**), a WAWA permit may be required.
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* for the Factory is not believed to be required because, although the Project is considered a "source" of contaminants to the atmosphere (with respect to odour), there is no known precedent for Air Approvals to be issued to wastewater treatment facilities. The Minister of Environment and Climate Change may require such an approval, however, at their discretion.
Crown Lands and Forests Act	Land use, ownership, commercial and industrials activities permit application(s).	No.	The Project and its components are located completely on land owned by Covered Bridge Chips.

Legislation	Nature of Permit/Approval/ License/Authorization	Required for the Project?	Applicability/Relevance to the Project
Heritage Conservation Act	Archaeological Field Research Permit for carrying out archaeological investigations.	No.	The new wastewater treatment system will be constructed entirely on previously disturbed land, and not near any watercourses, so archaeological potential for the site is believed to be low. It is not anticipated that an Archaeological Impact Assessment will be required.
New Brunswick *Species at Risk Act* (NB SARA)	Permit for killing, taking, or possessing a species listed as Extirpated, Endangered, or Threatened under NB SARA. Permit to engage in an activity that would otherwise violate a prohibition on habitat designation made under NB SARA.	Not likely.	There are no species at risk believed to be located within the Project development area (PDA) of the Project.
Quarriable Substances Act	Permits for the extraction/ processing of minerals in the Province.	No.	Should the Project involve excavation at unapproved borrow sources on Crown land, a permit may be required before the commencement of that activity.
Federal			
Impact Assessment Act (IAA)	Impact Assessment (IA).	No.	A federal IA is not required as WWTSs are not listed under the *Physical Activities Regulations* and the Project is not located on federal land.
Fisheries Act	*Fisheries Act* Authorization and Offsetting Plan.	No.	There are no in-water works for the Project.
Canadian Navigable Waters Act	Permit Application.	No.	This Project does not involve any activities that will disrupt water navigation and related activities.
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-August 28 (nesting zone C3 for western New Brunswick) that may disturb or harass migratory birds, their eggs, their chicks, or their nests.
Local			
Regional Service Commission 12 (Western Valley RSC)	Possible other permits from the Regional Service Commission (i.e., building permit).	Yes.	Local bylaws and rural plans will apply to the Project (e.g., building, electrical, plumbing, zoning, water, etc.; see WVRSC [2022])

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 nine chapters, as follows:

- Chapter 1 provides an introduction to the Project, including proponent information, a Project overview, the purpose, rationale and 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. A Project schedule is also included;
- Chapter 3 provides a summary of environmental impact assessment scope and methods;
- Chapter 4 provides the assessment of potential interactions between the Project and the environment, on various valued components (VCs) that are of relevance and importance to this EIA registration, for each applicable Project phase;
- Chapter 5 provides an assessment of the potential effects of the environment on the Project;
- Chapter 6 provides a description of planned public, stakeholder, and Indigenous engagement activities in respect of the Project;
- Chapter 7 provides other information relevant to the EIA Registration to meet the requirements of the NBDELG's EIA Guide (NBDELG 2018a);
- Chapter 8 provides closing remarks; and
- Chapter 9 provides the references 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 proposed Project components as well as the activities that will be required to complete the Project, as currently conceived and based on the available information at the time of writing. Engineering design for the Project is underway, and is likely to evolve as Project planning and engineering design is completed.

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

- A brief description of the Project and its components as well as the general site of the Project;
- The activities that will be carried out during construction of the new wastewater treatment system (WWTS) and its subsequent operation;
- The planned Project schedule; and
- Project-related emissions and wastes.

2.1 Project Location

The Project is located near the Trans-Canada Highway (NB Route 2) in the community of Waterville, within the municipal boundary of the town of Hartland, Carleton County, New Brunswick. The town of Hartland is situated in west-central New Brunswick along the Wolastoq (Saint John River) (**Figure 2.1.1**). The Factory itself is identified as property identification (PID) No. 10259463.

Specifically, the new WWTS is to be constructed on the Covered Bridge Potato Chip Company property. The new WWTS will be situated entirely on the property owned by the Company, identified as PID No. 10279313, which covers an area of approximately 8.45 hectares (ha). The coordinates for the centre of the site of the proposed new WWTS are 46.2841°N and 67.5824°W, at an elevation of approximately 111 metres above mean sea level (m amsl). The land directly associated with the recently constructed Maintenance Building and area of the building expansion for the new WWTS covers an area of approximately 2,170 square metres (m^2), or approximately 0.22 ha.

2.1.1 Property Ownership

The subject property where the new WWTS is proposed to be built, as shown on **Figure 2.1.1**, is owned by the Covered Bridge Potato Chip Company. If authorization is received to construct the new WWTS at the Factory as proposed herein, no additional lands are required for the work.

COVERED BRIDGE POTATO CHIP COMPANY EIA

FIGURE 2.1.1

SUBJECT PROPERTY AND SURROUNDING AREA

- Street
- Highway
- Watercourse
- Waterbody
- Parcel Boundary
- Subject Property

SCALE 1:4,000

0 35 70 140 Meters

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: GM
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_SubjectPropertySurroundingArea.mxd

2.2 Description of Project Components

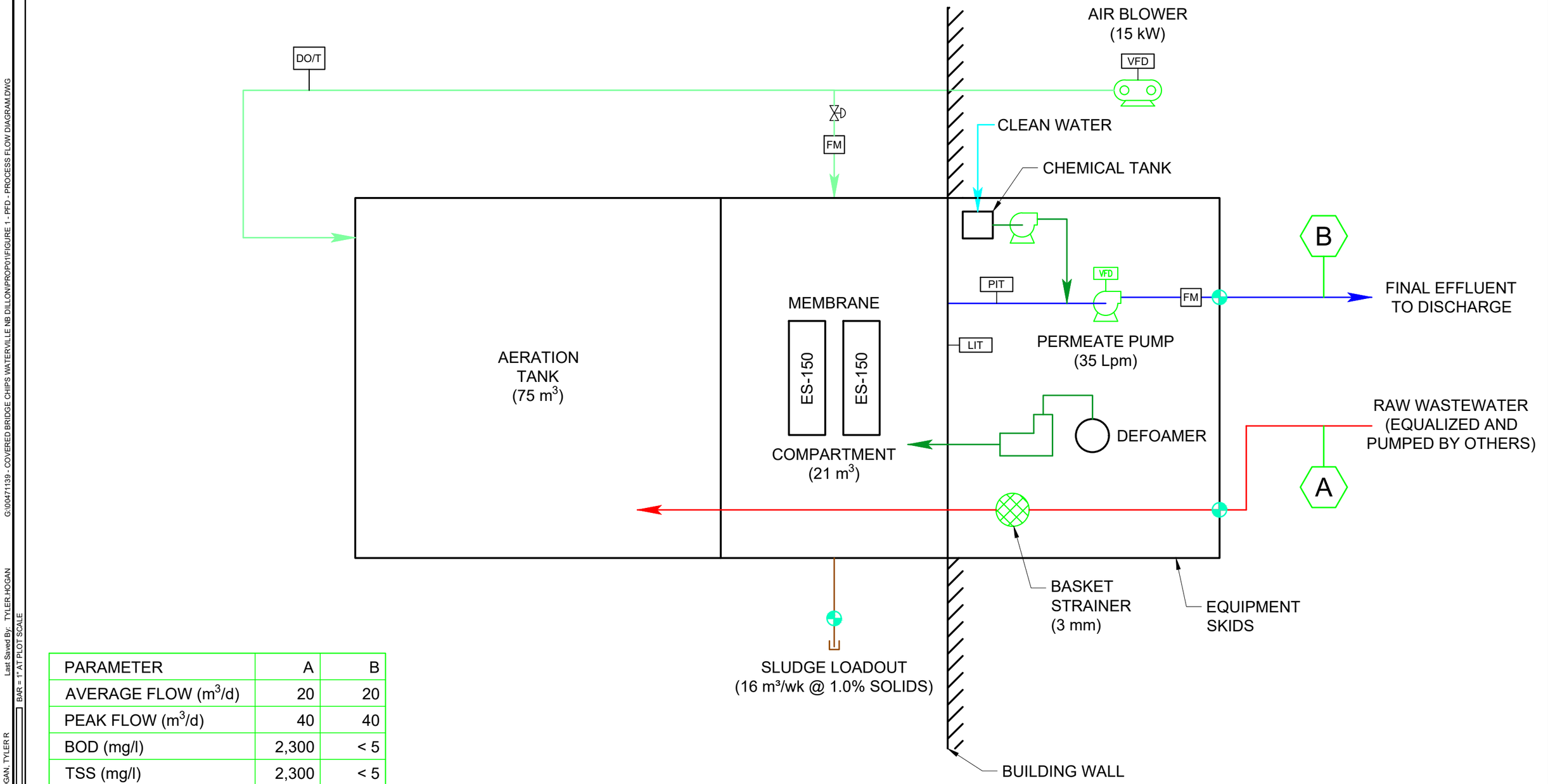
The current design of the Project includes the installation of an Evoqua Membrane Bioreactor (Evoqua-MBR) aerobic WWTS on the Factory property as the primary treatment system and the installation of an Advanced Enviro-Septic® (AES) WWTS as the secondary treatment and treated effluent release system. The following sections will describe the various components of both systems.

A conceptual process flow diagram of the proposed primary WWTS, as currently conceived, but subject to refinement as the design evolves, is shown in **Figure 2.2.1**. In general, the main system components include:

- A concrete foundation and building housing the WWTS, built as an expansion to the recently constructed Maintenance Building;
- A 96 cubic metre (m^3) pre-fabricated MBR tank;
- A bubble-diffused aeration system;
- Two Kubota ES150 submerged membrane units (SMUs);
- An aeration/scour system;
- A control panel including motor starters, variable frequency drives, and panel view; and
- Other equipment needed for the WWTS such as an influent basket strainer and defoamer pump (Evoqua 2022).

The secondary treatment and treated effluent release system, as currently conceived, is an Advanced Enviro-Septic® (AES) WWTS that replaces a typical leaching field commonly used for subsurface disposal and includes the following components:

- A perforated, corrugated 300 millimetre (mm) plastic pipe;
- Skimmer tabs, which extend into the pipe at each perforation point;
- A dense mat of coarse, randomly-oriented plastic fibres;
- Bio-Accelerator geo-textile fabric;
- Non-woven geo-textile fabric; and
- A bed of system sand (Fundy 2023).



PARAMETER	A	B
AVERAGE FLOW (m^3/d)	20	20
PEAK FLOW (m^3/d)	40	40
BOD (mg/l)	2,300	< 5
TSS (mg/l)	2,300	< 5

PRELIMINARY

- BATTERY LIMITS

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
.	.					
.	.					
.	.					
.	.					
.	.					
.	.					

DESIGNER	S.TAYLOR	DATE 2022-01-11
CHECKER		DATE
ENGINEER	D.BERTOL	DATE
MANAGER		DATE
REF:		
SCALE:		

TITLE: PROCESS FLOW DIAGRAM

CLIENT: COVERED BRIDGE POTATO CHIPS, WATERVILLE, NB

EVOQUA WATER TECHNOLOGIES
ADI SYSTEMS
370 WILSEY ROAD FREDERICTON, NB, CANADA
+1(506) 452-7307

PROJECT	CODE	DRAWING	SHEET	REV
1000044147		FIGURE 1	OF	

Date Plotted:18/11/2022 10:15 Plotted By: HOGAN, TYLER R STD:11X17_B 0616 Border.dwg BAR = 1" AT PLOT SCALE Last Saved By: TYLER.HOGAN G:\00471139 - COVERED BRIDGE CHIPS WATERVILLE NB DILLON\PROP01\FIGURE 1 - PFD - PROCESS FLOW DIAGRAM.DWG

2.2.1 Primary Treatment: Evoqua Membrane Bioreactor System

Raw process wastewater from the Factory will be pumped to the Evoqua-MBR system where a 3 mm basket strainer will screen the wastewater for solids prior to the wastewater entering the tank. The pre-fabricated Evoqua-MBR tank will be 96 m^3 with two compartments: one 75 m^3 pre-aeration compartment, and one 21 m^3 membrane compartment. After straining, the wastewater first enters the pre-aeration compartment where air will be supplied to the aeration system by an aeration blower for mixing and biological oxygen demand (BOD) removal (Evoqua 2022).

Mixed liquor will automatically overflow from the pre-aeration compartment into the membrane compartment. The membrane compartment consists of two Kubota ES150 SMUs to assist with final separation of solids and liquids as well as biomass retention. There is also an air blower for scouring the membrane – this mixes the contents in the membrane compartment and also cleans the membranes. Lastly, the permeate pump will pull permeate through the membranes which will be the final effluent with low BOD and total suspended solids (TSS) concentrations (Evoqua 2022).

Waste activated sludge (WAS) will have to be periodically removed from the system via a sludge loadout connection. As it is currently designed, 16 m^3/week of WAS will be generated by the system (Evoqua 2022). This sludge will require disposal at an appropriate facility that is approve to receive and dispose of biosolids.

Based on the current design of the WWTS, and taking into consideration the current BOD and TSS load of the process wastewater from the Factory, the Evoqua-MBR system is projected to produce effluent with < 5 milligrams per litre (mg/L) each of BOD and TSS (Evoqua 2022).

Key features of the Evoqua-MBR system include:

- Elimination of issues with gravity clarification systems;
- A long lifetime;
- Reduction or elimination of the need for disinfection;
- Low sludge yield; and
- Small footprint (Evoqua 2017).

The proprietary Evoqua-MBR system is a packaged system that is manufactured off-site and delivered to the site, installed, and commissioned with minimal assembly required. Further details on the Evoqua-MBR system are provided below, and a design brief (Evoqua 2022) are provided in **Appendix A.**

2.2.1.1 Modular MBR System

The MBR system includes a 96 m^3 pre-fabricated tank consisting of a 75 m^3 aeration compartment and a 21 m^3 membrane compartment. The tank consists of two ES 150 Kubota membrane cassettes in the membrane compartment and fine bubble diffuser aeration system in the aeration compartment.

2.2.1.2 Influent Basket Strainer

An influent basket strainer is installed for screening of the wastewater before discharging into the aeration compartment. The influent basket is installed to screen out any particles > 3 mm from entering the MBR tank. The Company is considering whether to have a single influent basket strainer, or to have two influent basket strainers (i.e., one operational and one in standby/cleaning mode at all times). A rotary sieve is also being investigated as an alternative.

The influent basket strainer has perforation sizes of 3 mm to remove debris from the wastewater. Daily inspection and cleaning of the basket strainer is required by the operator. Pressure gauges are installed on the inlet and outlet of the basket strainer to determine when the strainer needs to be cleaned. When the basket strainer discharge pressure exceeds a high value (to be determined on-site), the basket strainer needs to be cleaned immediately.

A bypass of the basket strainer is installed to allow for the cleaning of the basket strainer.

2.2.1.3 Aeration Compartment

A 75 m^3 aeration compartment is contained in the front section of the modular MBR tank. A fine-bubble diffused aeration system is included in this aeration compartment. The aeration compartment is separated from the membrane compartment by a partial baffle wall that extends from the top of the tank wall to near the bottom of the tank with weir openings near the bottom of the wall. This partial wall is to redirect flow coming from the aeration compartment back down toward the bottom of the cassette closest to the aeration compartment. Thus, the desired crossflow flow pattern is maintained in the membrane compartment. The bottom opening below the baffle allows mixed liquor to flow back and forth between the aeration and membrane compartments.

2.2.1.4 Aeration Blower

Mixing and aeration are completed via one aeration blower equipped with a variable frequency drive (VFD). The aeration blower will include a temperature switch (controlled by the programmable logic controller [PLC]). Blower speed will be controlled to maintain the dissolved oxygen (DO) concentration in the aeration compartment within a target range, as measured by the DO probe and transmitter. The speed of the aeration blower will vary to ensure a minimum (operator adjustable) DO concentration is met at all times.

2.2.1.5 Membrane Compartment

The 21 m^3 membrane compartment will house two Kubota ES-150 SMUs, complete with a dedicated air scour system. Each SMU includes 150 flat sheet membrane cartridges. The two membrane cassette units are connected to common header pipes for permeate and scour air.

2.2.1.6 Membrane Bioreactor (MBR) Level

A pressure transducer-type level transmitter (LIT) will be used to continuously measure the liquid level in the MBR system. Tank level will be displayed and trended at the human-machine interface (HMI). Low-low, low, high, and high-high tank level alarms will be signaled at the HMI. A low level in the membrane compartment, as measured by the level transmitter, will automatically initiate the "low load" condition for the membrane compartment, which prevents the membranes from becoming exposed in the case of a low level condition. During this condition, the permeate pump will shut off and the membrane scour will cycle ON/OFF according to the operator adjustable cycle time until the 'low load' condition is released.

A level switch (LS) is installed in the membrane compartment. This LS is used as back up for detecting liquid level in the membrane compartment. When the switch is not tipped up, the LS will automatically shut off the effluent permeate pump. The pump will restart once the switch is tipped up. The switch is to prevent the membranes from becoming exposed in case of a low level condition due to a problem with the LIT in the membrane compartment.

2.2.1.7 Permeate Control

The MBR tank will have a dedicated VFD-controlled permeate pump (35 L/min), permeate piping, transmembrane pressure transmitter, and permeate flow meter. Permeate (effluent) is extracted from the MBR tank through the membranes via the suction created by the duty permeate pump.

The permeate header will have a dedicated differential pressure transmitter installed on the suction side of the permeate pump (as close to the membranes as possible). The pressure readings are used to measure the static (permeate pump off) and dynamic (permeate pump on) pressures. The difference between static and dynamic pressures is called the transmembrane pressure (TMP). This TMP reading is important for judging the condition of the membranes and determining when membrane cleaning with chemical is necessary. The pressure transmitter must be installed directly on the permeate header before any pipe reductions, bends, etc. as head loss before the pressure transmitter result in errors when determining TMP. The self-priming feature of the permeate piping will ensure that gas-locking potential in the permeate piping is minimized.

A magnetic-type flow meter is located on the discharge side of the permeate pump to monitor the permeate flow rate from the MBR tank and for permeate pump speed control. The instantaneous flow meter readings will be displayed and trended at the HMI. Totalized daily flow for the current day and

previous seven days will be displayed at the HMI. The speed of the permeate pump will be adjusted automatically by the PLC to maintain the permeate flow rate setpoint. The permeate flow control loop includes the flow meter, permeate pump, and pump VFD.

The permeate pump will operate for nine minutes during a ten-minute cycle (providing a one-minute "relaxation" event). The permeate pump discharge piping will be designed such that there is no gravity flow through the membranes during a membrane 'relaxation' event. If required, siphon break/vent could be installed on the discharge side of the permeate pumps and to ensure that there is no gravity flow through the membranes during a "relaxation" event.

2.2.1.8 Air Scour and Diffuser Flushing

The membrane compartment will have a dedicated coarse-bubble air scour system in order to continuously clean the membrane surfaces. The blower will supply scour air to the membranes. During low load conditions, the scour blower will operate based on the operator adjustable cycle timer.

A flow meter and flow control valve will be used to control the air scour flow rate to the membrane compartment at an operator-adjustable setpoint. The setpoint will be within an allowable range of 180 m^3/hr to 270 m^3/hr.

The air blower will be used to supply air to the aeration and membrane compartments of the MBR system. Periodically, the PLC will check the DO probe reading against the DO setpoint range, and the aeration blower will adjust its speed to maintain the DO concentration within an operator adjustable range. When the blower adjusts its speed, the air scour control valve will modulate its position to maintain the air scour flow scour rate setpoint, as measured by the air scour flow meter.

A diffuser flush valve will be used for automatic back flushing the membrane unit coarse bubble diffusers to ensure there is no build-up of scale or blockages. Buildup of scale or blockages would create aeration problems and reduce efficiency.

When the normally-closed diffuser flush valve is opened, the air takes the path of least resistance and vents to the atmosphere through the open valve. The mixture of mixed liquor and scour air will discharge back into membrane compartment.

Once per day, the permeate pump will automatically turn off based on an operator adjustable time schedule from the HMI. The permeate pump will automatically turn off for four minutes. The automatic diffuser flush valve will open one minute after the permeate pump is turned off and will stay open for two minutes before closing again. One minute after the diffuser flush valve closes, the permeate pump will resume normal operation.

2.2.1.9 Waste Activated Sludge (WAS) Production and Removal

Waste activated sludge (WAS) will be removed from the MBR system in order to maintain the mixed liquor suspended solid (MLSS) concentration in the aeration tank and membrane compartment within a range of 8,000 to 15,000 mg/L. At design conditions, the estimated volume of WAS to be removed from the MBR tank is 16 m^3/week at 1.0% solids concentration.

2.2.1.10 Membrane Cartridge Clean System

The membrane cartridges in the MBR system will need to be periodically cleaned in-situ (manual procedure, as required) with dilute sodium hypochlorite solution (1% NaOCl) for removal of organic fouling of the membranes.

During a membrane cleaning event, the MBR tank needs to be taken out of service (i.e., no MBR tank influent, permeate, WAS, or scour) for a few hours (2 to 4 hours is typical) to accommodate the cleaning operation. When the MBR tank is taken out of service for cleaning, the permeate pump and scour for the MBR tank will be shut off, and manual valves for the MBR tank will be adjusted by the operator to allow for the cleaning to take place without flow into or out of the MBR tank.

During the membrane cleaning event, the membrane cassettes will be injected with cleaning chemical. To accomplish a membrane cleaning, approximately 900 L of membrane cleaning solution (1 % NaOCl) will be injected into the membrane cartridges using the membrane cleaning pump, which will be controlled locally by the operator. This corresponds to 75 L of 12% sodium hypochlorite (NaOCl) mixed with 825 L of potable water and then delivered to the permeate header of the MBR tank.

2.2.1.11 Defoamer Metering System

A defoamer metering system is available to supply defoaming chemical to the MBR system. Defoamer will be added as necessary to control foaming in the MBR system using the defoamer metering pump, which will be controlled locally by the operator. A non-silicon type defoamer must be used for dosing to the MBR system.

2.2.2 Secondary Treatment and Treated Effluent Release: Advanced Enviro-Septic® (AES) Wastewater Treatment System

As there are no watercourses nearby within which to discharge effluent from the primary treatment system, the WWTS requires a secondary treatment and treated effluent release system to discharge the wastewater into the ground via subsurface disposal.

The effluent from the primary treatment system still contains suspended solids (like fat, oil, and grease) which could overload bacteria, cut off the air required for aerobic bacterial activity, or clog the soil underlying the leaching field, interfering with the soil's ability to absorb liquids (Fundy 2023); therefore, the Company retained Fundy to design a secondary treatment and treated effluent release system.

At a high level, treated effluent from the primary treatment system will enter the Advanced Enviro-Septic® (AES) WWTS where it will be treated using a natural bacterial process. The Advanced Enviro-Septic® (AES) WWTS serves a similar function as normally performed by a conventional subsurface leaching field, with enhancements to improve its performance and minimize clogging by solids. The cooling of the effluent in the pipes, combined with the aerobic bacterial processes, allow suspended solids to separate from the effluent. The solids are retained in the 300 mm pipe (Fundy 2023).

Benefits of the AES® WWTS compared to traditional systems include:

- Adaptation to difficult or small sites – the AES® system uses 40 to 70% of the land area used for a traditional pipe and stone system;
- Easily and quickly installed;
- No mechanical equipment for the system – the system is self-sustaining and self-regulating;
- Lower cost than comparable level IV treatment systems;
- Eliminates septic mounds;
- Maintains a stable pH (7.0-8.5) providing ideal conditions for aerobic bacterial processes;
- Protects the underlying soils from clogging;
- Prevents leachate from surfacing; and
- Has a long system life.

The precise location of the AES® system on the property has not been finalized as yet. Further details on the AES® system are provided below, and a design brief (Fundy 2023) is provided in **Appendix B**.

2.2.2.1 Pump Lift Station

The first step of the secondary treatment system includes a lift station which receives the effluent from the primary treatment system, and disperses it into the pressure-dosed leaching field.

2.2.2.2 Plastic Piping

When the effluent enters the leaching field, it is further treated in the pipes where it is cooled. The cooling of the effluent assists in the separation of liquids and solids. The solids are retained inside the pipes, rather than sealing the underlying soil with solids as traditional systems do (Fundy 2023). The pipe also contains skimmer tabs and cooling ridges. The cooling ridges assists in cooling the effluent. Air flow, as well as continually fluctuating liquid levels within the pipes, increases bacterial activity in the membranes, which are described in the subsections below.

2.2.2.3 Plastic Fibre Mat

Outside of the plastic pipe, the system has a dense mat of coarse, randomly-oriented plastic fibres (Fundy 2023).

2.2.2.4 Bio-Accelerator Geo-Textile Fabric

This layer of geo-textile fabric partially covers the plastic fibres on the lower half of the pipes. It is located between the plastic pipe and the plastic fibre mat.

2.2.2.5 Non-Woven Geo-Textile Fabric

The outer-most layer of the system is non-woven geo-textile fabric whose function is twofold: to hold the other components in place, and provides a surface on which a biomat develops.

2.2.2.6 System Sand

The entire system is surrounded by a bed of system sand. The system sand assists the system by wicking liquid out of the pipes, and ensures that there is sufficient oxygen to support the bacteria populations which are required for the system to work.

2.3 Description of Project Phases and Activities

The following sections describe the Project activities associated with the construction and operation and maintenance phases of the Project. As decommissioning of the WWTS is not planned at this time, it will not be discussed further in this document. It is noted that the activities described below represent a simplified version of the complex engineering requirements and construction sequences being developed. The sequence of required activities may vary slightly from that described below as engineering refinements are made and as the EIA review and related permitting processes are conducted.

2.3.1 Construction Phase

As noted previously, a new Maintenance Building has recently been constructed behind the main Factory Building. This Maintenance Building will provide space for administrative offices, laboratory, warehousing, and a shop area for carrying maintenance activities on equipment and machinery at the Factory. Although the property had been previously cleared some time ago (approximately 2016), the construction of the new Maintenance Building involved site levelling, grading, pouring of footings and foundations, building construction and finishing, and the construction of a short access road between the Factory Building and new Maintenance Building. Upon approval of the Project under the EIA Regulation and the receipt of all required permits, the new WWTS will be housed in a new expansion to the recently constructed Maintenance Building. Once the construction of this building expansion is completed, the Company will complete the installation of the WWTS as well as relocate the existing decanting tanks located in the main Factory Building to the WWTS Building in order to consolidate wastewater infrastructure in one location. This will also vacate space in the main Factory Building to allow for future process expansions.

The activities to be carried out during the construction phase of the new WWTS are described conceptually below. Wastewater will continue to be shipped to an off-site treatment facility during the construction of the new facility.

2.3.1.1 Site Preparation and Grading

The land where the new WWTS will be installed was previously clear-cut and grubbed a number of years ago. Site preparation and grading activities for construction of the WWTP portion of the Maintenance Building has already been conducted as part of the recent construction activities associated with the new Maintenance Building. Therefore, limited site preparation or grading is required. The site is located at a high elevation and located at least 400 m from the closest watercourse, so it is not anticipated that erosion, sedimentation, or flooding will be of concern during site preparation.

2.3.1.2 Tank and Building Foundation Preparations

Tank and building foundations will then be constructed in preparation for the expansion of the recently constructed Maintenance Building in order to house the new WWTS. The foundations will be constructed using locally-sourced concrete from approved concrete ready-mix plants. There will not be a batch concrete plant on-site for this work. After the foundations have been constructed, infilling activities will occur to bring the surface elevation up to the foundation level.

2.3.1.3 Construction of the Expanded Maintenance Building to House the WWTS

Construction activities associated with the expansion of the recently constructed Maintenance Building in order to house the new Evoqua-MBR WWTS will be conducted following the completion of the associated foundations. Buildings will be constructed on-site rather that bringing in pre-built modular facilities, using conventional building materials such as structural steel, wood, and other common building materials.

2.3.1.4 Relocation of the Existing Decanting Tanks

As noted previously, currently, the wastewater produced by the Factory is stored in large tanks connected in series at the Factory, decanted by gravity sedimentation to separate grit (which settles to the bottom of the tanks) and oil and grease (which floats on top of the tank) before moving onto the next large tank for further settling. Following sedimentation and decanting in several successive tanks connected in series, the final decanted wastewater is stored in a final tank pending its shipment via tanker truck to an external third party facility for final treatment and release of treated effluent. Decanted oil and grease is stored in a 3,800 L (1,000 US gallon) sump/lift station located underneath the parking lot, and transported to markets for use as a biofuel.

Following completion of the expanded Maintenance Building to house the Evoqua-MBR WWTP, the existing decanting tanks that are used to gravity separate oil and grit from wastewater, currently located in the main Factory Building, will be relocated inside the WWTP Building in order to allow for that Factory space to be repurposed.

2.3.1.5 Repurposing of Sump/Lift Station, and Pipe Construction

The current sump/lift station located underneath the parking lot currently stores decanted oil from the gravity separation process for later transportation to markets for use as a biofuel.

Once the decanting tanks have been moved to the WWTS area, the sump/lift station will be repurposed to collect raw wastewater from the Factory pending its pumping to the WWTS for treatment. Decanted oil from the gravity separation process will no longer be stored in the sump/lift station but rather in one of the decanting tanks at the WWTS area.

An underground pipe connecting the sump/lift station to the WWTS will be installed to facilitate the pumping of raw wastewater to the WWTS for treatment.

2.3.1.6 Equipment Installation

Following construction of the WWTP Building, equipment installation will occur, including the pre-fabricated 96 m^3 Evoqua-MBR tank. All piping, mechanical, and electrical connections will be made following their installation, in preparation for commissioning.

2.3.1.7 Secondary Treatment and Treated Effluent Release System Construction and Installation

The Advanced Enviro-Septic® (AES) secondary treatment and treated effluent release system will be installed underground and connected to the Evoqua-MBR WWTP via underground pipe.

2.3.1.8 Final Grading, Levelling, and Revegetation

Following the completion of the above construction activities, the site will be graded and leveled to final grades, and inactive areas of the site will be covered with topsoil and seeded with native grasses and vegetation species.

2.3.1.9 Commissioning of the WWTS

The new WWTS will be commissioned following the completion of the construction phase, with all systems tested for performance and started up. Wastewater will begin to be pumped into the new system and the aerobic MBR process will proceed.

2.3.2 Operation Phase

Following commissioning, the new WWTS will begin normal operation to treat wastewater produced within the Factory. The estimated service life of the new WWTS is estimated to be 50 years, after which it will either be refurbished or replaced by other facilities. Routine inspections and preventative maintenance will be conducted throughout the operational phase to ensure optimal operation of the WWTS and ensure minimal interruptions to the treatment system.

2.3.2.1 Maintenance Requirements

Maintenance requirements for the Evoqua-MBR include:

- Daily inspection and cleaning of the basket strainer where influent enters the system;
- Membrane cartridges in the MBR system require periodic cleaning (the process design brief [PDB] assumes four times per year; Evoqua 2022) with a sodium hypochlorite solution; and
- Membranes will require replacement approximately every ten years.

The AES® system is passive and self-regulating and does not require maintenance or monitoring.

2.3.2.2 Monitoring Requirements

There will be a human-machine interface (HMI) associated with the WWTS that will be located on a computer and will be used to store data gathered from various monitoring probes within the plant. A visual inspection of the system will also be performed once per day (Evoqua 2017). In addition, laboratory analysis will be conducted biweekly for:

- Chemical oxygen demand (COD);
- Biological oxygen demand (BOD);
- Total suspended solids (TSS);
- Volatile suspended solids (VSS);
- pH;
- Temperature;
- Total Kjeldahl nitrogen (TKN);
- Ammonia nitrogen (NH_3-N);
- Total nitrogen (TN);
- Total phosphorus (TP);
- Fat, oil, and grease (FOG);
- Total residual chlorine (TRC); and
- Filterability (mL/min).

2.4 Project Schedule

The construction of Project is expected to span 2023 and 2024, subject to EIA approval and the receipt of required permits by that time. A conceptual Project schedule (subject to change) is shown in **Table** 2.4.1 below.

Table 2.4.1: Proposed Project Schedule

Activity	Proposed Schedule
Secondary Wastewater Treatment System Construction (leaching field)	Fall 2023
Site Preparation	Fall 2023
Tanks and Building Foundation Preparations	Fall 2023
Construction of WWTS Building	Fall 2023
Equipment Installation	Spring 2024
Final Grading, Levelling, and Revegetation	Spring 2024
Commissioning of the WWTS	Spring 2024
Operation of the WWTS	2024 onward

2.5 Emissions and Wastes

2.5.1 Air Contaminant Emissions

Emissions associated with fuel combustion in heavy equipment and vehicles, and dust associated with earth moving activities and travel on unpaved surfaces, will occur during the construction phase of the Project. Unpaved surfaces will be watered when necessary to suppress and control dust levels during construction. Project construction and operation is not anticipated to result in substantial emissions of air contaminants or greenhouse gases (GHG) to the environment. Airborne emissions are expected to be generally confined to the Project development area (PDA) and are not expected to result in measurable increases in the air quality conditions or to exceed provincial air quality standards. Some odours are possible during the operation of the system, but since the active portion of the incoming wastewater will be treated in an enclosed area in the headworks, exterior odours are not expected to be substantive during the operation phase.

2.5.2 Hazardous Materials

Potentially hazardous materials used during the construction phase will include, but are not limited to, propane, diesel, gasoline, hydraulic fluids, motor oil, and grease and lubricants for heavy equipment and vehicle use. Cleaning and maintenance of vehicles and equipment, site inspections, and the monitoring and inventorying of materials will be conducted for environmental protection. All waste hazardous materials will be properly stored in enclosed areas and disposed of at approved facilities. Construction activities are thus not anticipated to result in substantive releases of hazardous materials into the environment. Sludge removed from the system will be removed from the site and transported to an approved third party authorized to accept biosolids.

Decanted oil and grease collected from the decanting tanks will continue to be shipped to third parties for use as a biofuel.

2.5.3 Sound Emissions

Sound emissions will occur during the construction phase of the Project, and would be limited to the use of heavy equipment and vehicles. These noises will be typical of an active construction site, and will be restricted to daytime. Furthermore, there are no residential sound receptors in the immediate area of the Project, and the Trans-Canada Highway as well as a large truck stop are located adjacent to the Project site so the area is already subject to the noise of 24-hour truck and vehicle traffic travelling at high speeds. For the operational period of the WWTF, the plant will be designed to contain noise within the buildings, to mitigate impacts to adjacent neighbors. Process blowers are typically the highest noise emitters, and acoustic enclosures will be provided to ensure occupational and environmental noise limits are met.

Throughout the construction phase as well as during operation of the WWTS, mitigation will be used wherever feasible to reduce the potential environmental interactions resulting from sound emissions. Neither the construction nor operation phase are anticipated to result in substantive emissions of sound into the environment.

2.5.4 Runoff

Erosion and runoff associated with construction activities is not anticipated to result in a substantive deposition of sediments into watercourses. This is partially because the PDA is located high on a hill, at least 400 m from the closest watercourse. Sedimentation and erosion control measures will be used as necessary to provide slope stability and to reduce and mitigate the potential for construction-related sediments to enter watercourses.

2.5.5 Treated Wastewater

The objective of the new WWTS is to enable the Company to treat wastewater to current discharge standards and to allow for future expansion of the Factory, which will in turn create more process wastewater. The anticipated design performance standards for the Evoqua-MBR primary wastewater treatment system for this Project are presented in **Table 2.5.1**.

Table 2.5.1: Effluent Design Basis (Evoqua 2022)

Parameter	Raw Wastewater	MBR Treated Effluent (Prior to Entry into the AES® Secondary Treatment System)
Flow, average. (m^3/d)	20	20
Flow, peak day (m^3/d)	40	40
BOD_5, average (mg/L)	2,300	< 5
BOD_5 load, average (kg/d)	46	-
BOD_5 load, peak (kg/d)	92	-
TSS, average (mg/L)	2,300	< 5
TSS load, average (kg/d)	46	-
TSS load, peak (kg/d)	92	-
Temperature (°C), average	-	18-35

Notes:
MBR = membrane bioreactor; BOD = biological oxygen demand; TSS = total suspended solids; mg/L = milligrams per litre; kg/d = kilograms per day

It is important to note that the treated wastewater characteristics identified in **Table 2.5.1** are those for the Evoqua-MBR system only; further residence time and treatment in the Advanced Enviro-Septic® (AES) secondary treatment system may further improve treated effluent quality.

2.5.6 Solid Waste

Solid wastes generated during the construction phase would include packaging materials, plastics, cardboard, wood, metals, and sediment runoff. Wherever possible, solid wastes will be re-used or recycled. Other materials will be properly disposed of at approved municipal landfills.

During the operation phase, solid waste generation includes WAS from the system, approximately 16 m^3/week. This biosolid waste shall be collected from the sludge loadout connection, and will be regularly transported for proper disposal off-site at approved facilities.

3.0 Environmental Assessment 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 and/or traditional knowledge), as well as design mitigation 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 (VC) are provided below.

3.1 Scope of the Assessment

As mentioned in **Section 1.4.1.1**, the 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 the EIA review of the Project. As described in **Section 1.4.1.2**, 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 wastewater treatment facilities are not listed as a designated project as defined in the *Physical Activities Regulations* of the Act.

The scope of the assessment for the Project assessed herein includes:

- The expansion of the recently constructed Maintenance Building in order to house the new WWTS and related tanks;
- The construction, operation, and maintenance of a new Evoqua-MBR WWTS constructed on PID No. 10279313, including a new underground pipe to connect the new WWTS to the existing sump/lift station connected to the Factory Building (**Figure 1.3.1**); and
- The construction, operation, and maintenance of a new and Advanced Enviro-Septic® (AES) secondary treatment and treated effluent system.

The following is not part of the scope of this EIA Registration:

- The construction of the Maintenance Building itself (since it has already been constructed);
- The ongoing operation of the Factory; and
- The eventual decommissioning of the Factory or the new WWTS at the end of their useful service life (since decommissioning and/or upgrading is not envisioned for several decades).

3.1.1 Selection of Valued Components

Valued components (VCs) are those components of the biophysical and socioeconomic environments that are of value or interest to regulatory agencies, the public, other stakeholders, and Indigenous people. VCs are typically selected for assessment on the basis of: regulatory issues, scientific concern, legislation, guidelines, policies, and requirements; input arising from consultation with regulatory agencies, the public, stakeholders groups, and First Nations; field reconnaissance; and professional judgment.

The VCs selected for this EIA Registration document, and the rationale for their selection in relation to the Project, are outlined in **Table 3.1.1**, below.

Table 3.1.1: 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, combustion gases, greenhouse gases, and potential odours related to Project activities during the construction and operation phases have the potential to interact with the atmospheric environment and nearby receptors.
Acoustic Environment	Noise and vibration related to Project activities during the construction and operation phases have the potential to interact with nearby receptors.
Groundwater	The Project has the potential to interact with groundwater on a localized basis via the subsurface disposal of treated wastewater.
Surface Water	The Project has the potential to interact with the quality or quantity of surface water.
Fish and Fish Habitat	Fish and fish habitat are protected by the federal *Fisheries Act*.
Vegetation and Wetlands	Physical alteration of the Project development area (PDA) during the construction phase has the potential to result in the loss of vegetation and/or wetlands.
Wildlife and Wildlife Habitat	Physical alteration of the PDA during the construction phase has the potential to result in the loss of wildlife habitat, and Project activities have the potential to interact with wildlife (e.g., sensory disturbance).
Socioeconomic Environment	The Project has the potential to interact with existing and future land uses, labour, and economy through the activities during the construction and operation phases that might result in the generation or reduction of employment and associated expenditures.
Heritage Resources	Heritage resources (e.g., archaeological, palaeontological, or built heritage resources) are protected under the New Brunswick *Heritage Conservation Act*. Limited earth moving activities within the PDA have the potential to result in the accidental discovery of previously unknown heritage resources that may be present.

Valued Component (VC)	Rationale for Selection of the VC
Traditional Land and Resource Use	Though traditional land use and resource gathering activities by Indigenous persons is not currently occurring at the site of the proposed WWTS, the Project is located in traditional Wolastoqey territory, and was likely used by Wolastoqey people for several millennia.
Effects of the Environment on the Project	Natural forces and other effects of the environment (such as climate change, extreme weather, and other natural hazards or risks) may pose a risk to the Project components and their longevity, or cause delays in the Project.

The following sections provide a description of the methods of desktop and/or field studies that were required to assess the VCs detailed in **Table 3.1.1**, based on professional judgment, the nature of the Project, knowledge of the Project area, and previous experience on projects of a similar nature. In addition, the methods employed for the analysis of environmental effects are discussed.

3.1.2 Spatial Boundaries

The spatial boundaries of the assessment, which represent the area in which a potential effect could occur, 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 the Project Development Area (PDA; **Figure 1.3.1**).

3.1.2.1 Project Development Area

The PDA is the area where physical alterations occur to enable the Project to be carried out (common for all VCs), as defined in **Section 2.1**. This includes:

- The footprint of the new Evoqua-MBR WWTS and related building to be attached to the new Maintenance Building, which is approximately 533 m^2;
- The linear footprint of the access road, which is approximately 823 m^2;
- The linear footprint of the ground disturbance for the underground line connecting the new WWTS to the existing sump/lift station), measuring approximately 397 m^2; and
- The footprint of the new Advanced Enviro-Septic® WWTS and leaching field, which is approximately 417 m^2.

In total, this constitutes a total PDA of 2,170 m^2 (or approximately 0.22 ha).

3.1.3 Temporal Boundaries

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

The temporal boundaries for the Project correspond to the timing of the Project phases as they were defined in the Project schedule in **Section 2.4**.

3.2 Environmental Impact Assessment Methods

This EIA Registration document was prepared based on a desktop level assessment with some limited field work for wetlands and vegetation. In general, this EIA Registration 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;
- 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 focused 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, 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 involves the following generalized steps:

- **Scope of VC** – This involved the scoping of the assessment for the VC, and includes a definition of the VC and a rationale for its selection and description of 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 the absence of the Project. 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 largely 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 as assessed. The evaluation also considers the effects of the environment on the Project.

- **Summary** – A summary of the assessment for the VC is provide, 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 that is recommended for each VC in order to confirm the predicted environmental effects.

4.0 Assessment of Environmental Interactions with the Project

The identification of potential interactions between the Project and the Valued Components (VCs) will be undertaken in consideration of the nature of the Project and its planned activities.

4.1 Project Interactions with the Environment

The potential interactions with the surrounding environment have been considered in terms of both the construction and operation phases of the Project.

The initial screening (i.e., Project interaction matrix) provided in **Table 4.1.1** below assists in determining if an interaction between the activities being carried out in construction or operation and maintenance of the wastewater treatment system (WWTS) 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 (**Section 2.0**) and the scope of the EIA (**Section 3.0**), the potential interactions between the Project and the environment are summarized in **Table 4.1.1** below.

Table 4.1.1: Project Interactions with Valued Components

Valued Component (VC)	Project Phases	
	Construction	Operation
Atmospheric Environment	✓	✓
Acoustic Environment	✓	
Surface Water		
Groundwater	✓	✓
Fish and Fish Habitat		
Vegetation and Wetlands	✓	
Wildlife and Wildlife Habitat	✓	
Socioeconomic Environment	✓	✓
Heritage Resources		
Traditional Land and Resource Use		

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 assessment of environmental interactions in **Sections 4.2** to **4.7** below.

The following VCs are not discussed further as it was determined that there is no interaction between the Project and the environment:

- **Surface Water:** there is no surface water within 400 m of the proposed PDA which is an unnamed stream that runs into the Little Presque Isle Stream (NBDELG 2022c), so the Project is not anticipated to interact with surface water in any way;
- **Fish and Fish Habitat**: the closest possible fish-bearing stream to the PDA is an unnamed stream approximately 400 m to the west which runs into the Little Presque Isle Stream (NBDELG 2022c), so the Project is not anticipated to interact with fish and fish habitat in any way;
- **Heritage Resources**: the Project footprint is located entirely on previously disturbed land within the property of the Factory, where the land has been previously clear-cut. No disturbance of previously undisturbed ground is expected to occur as part of the Project. Therefore, no heritage resources have the potential to be discovered/disturbed during Project activities for the construction and operation phases; and
- **Traditional Land and Resource Use**: the land of the PDA and the land surrounding the Project has been occupied by the Company since 2015. In addition, the land adjacent to the PDA includes other industrial land (i.e., Irving gas station, and Subway and Burger King restaurants) and the Trans-Canada Highway (TCH) to the east, and agricultural land to the south. Lastly, the closest watercourse (watercourses have higher traditional land and resource use potential) is located approximately 400 m to the west.

In consideration of the above, the Project is not expected to interact with the surface water, fish and fish habitat, heritage resources, and traditional land and resource VCs. These VCs are therefore not discussed further in this EIA Registration document.

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 site-specific and general mitigation and lead to unmitigated environmental effects.

4.2 Atmospheric Environment

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

4.2.1 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;
- **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** (GHGs), 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 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 construction 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.

The 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 construction activities. For the Project components and activities assessed herein, 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 in addition to fugitive particulate matter (dust) and potential odours. 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 New Brunswick Department of Environment and Local Government (NBDELG). Federally, the Canadian Ambient Air Quality Standards (CAAQS), developed by the CCME, provide additional ambient limits for nitrogen dioxide (NO_2), SO_2, fine particulate matter, and ozone (O_3). 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 4.2.1** below.

Table 4.2.1: Ambient Air Quality Standards in New Brunswick (NB Regulation 97-133, Schedule B)

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

4.2.2 Existing Conditions

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

4.2.2.1 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 Woodstock) are presented in **Table 4.2.2** below. Data at the Woodstock weather station are limited to temperature and precipitation; therefore, climate normals from the Fredericton (A) weather station are also presented in **Table 4.2.3** to capture additional parameters.

Table 4.2.2: Climate Normals, Woodstock, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals, Woodstock (1981 - 2010)													
Daily Average (°C)	-11.5	-9.5	-3.4	3.7	10.9	16.3	19.0	18.4	13.2	6.6	0.3	-7.0	4.8
Daily Maximum (°C)	-6.0	-3.3	2.2	9.4	17.6	22.9	25.3	24.7	19.4	12.0	4.4	-2.3	10.5
Daily Minimum (°C)	-17.0	-15.6	-8.9	-2.0	4.1	9.6	12.6	12.0	6.9	1.1	-3.9	-11.7	-1.1
Precipitation Normals, Woodstock (1981 - 2010)													
Rainfall (mm)	27.5	24.2	36.9	61.6	93.6	91.0	100.2	100.6	95.6	92.1	81.9	53.2	858.2
Snowfall (cm)	76.6	47.4	54.3	18.8	0.7	0.0	0.0	0.0	0.1	3.2	21.3	50.0	272.3
Precipitation (mm)	104.0	71.6	91.2	80.4	94.2	91.0	100.2	100.6	95.7	95.3	103.2	103.2	1130.6

Source: Canadian Climate Normals (ECCC 2022a)

Table 4.2.3: Climate Normals, Fredericton A, New Brunswick (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature Normals, Fredericton A (1981 - 2010)													
Daily Average (°C)	-9.4	-7.9	-2.4	4.5	11.1	16.2	19.3	18.4	13.6	7.5	1.5	-5.7	5.6
Daily Maximum (°C)	-3.8	-2.0	3.0	10.0	17.6	22.7	25.5	24.8	20.0	13.2	6.0	-0.7	11.4
Daily Minimum (°C)	-15.0	-13.7	-7.8	-1.0	4.6	9.7	13.0	12.1	7.1	1.6	-3.0	-10.7	-0.2
Precipitation Normals, Fredericton A (1981 - 2010)													
Rainfall (mm)	38.0	31.4	46.7	68.3	94.5	82.4	88.3	85.6	87.5	88.2	92.9	55.3	859.1
Snowfall (cm)	69.9	47.5	49.4	18.6	1.4	0.0	0.0	0.0	0.0	0.8	14.3	50.5	252.3
Precipitation (mm)	95.3	73.1	93.2	85.9	96.2	82.4	88.3	85.6	87.5	89.1	106.3	94.9	1077.7
Wind Normals, Fredericton A (1981 - 2010)													
Maximum Hourly Wind Speed (km/h)	64	80	64	72	64	64	48	53	65	64	67	60	N/A
Direction of Maximum Hourly Speed*	W	S	W	SE	NW	W	SW	W	SE	NE	NW	NE	N/A

Source: Canadian Climate Normals (ECCC 2022b)

Notes:

* indicates the direction from which the wind is blowing

N/A = not applicable

4.2.2.2 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 AV Nackawic's ambient air quality monitoring station at Nackawic (approximately 43 km southwest of the PDA) as the closest representative station to the Project; however, because the station is monitored by industry, this station is mainly to monitor contaminant levels arising from emissions from its specific industry and is not intended to represent general background air quality, so the NBDELG Fredericton monitoring station data will also be considered. The AV Nackawic station measures fine particulate matter and sulphur dioxide. The Fredericton station measures particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), and ground-level ozone (O_3).

The maximum measured concentrations from the AV Nackawic air quality monitoring station data for the respective averaging periods of each contaminant during 2021, as reported in the NBDELG's most recent ambient air quality monitoring report titled "2021 Air Quality Monitoring Results" (NBDELG 2022a) and its supplementary data report (NBDELG 2022b), are presented in **Table 4.2.4**. 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 4.2.4** below are interpolated from the graphs and should be considered approximate.

Table 4.2.4: Ambient Air Quality Monitoring Data – 2021 Maximums – AV Nackawic Air Quality Monitoring Station

Air Contaminant	Averaging Period	Maximum Ground-Level Concentration Recorded in 2021
Sulphur dioxide (SO_2)	1 hour	95 ppb (249 µg/m^3)
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hour	19 µg/m^3

The maximum measured concentrations from the Fredericton air quality monitoring station data for the respective averaging periods of each contaminant during 2021, as reported in the NBDELG's most recent ambient air quality monitoring report titled "2021 Air Quality Monitoring Results" (NBDELG 2022a) and its supplementary data report (NBDELG 2022b), are presented in **Table 4.2.5**. 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 4.2.5** below are interpolated from the graphs and should be considered approximate.

Table 4.2.5: Ambient Air Quality Monitoring Data – 2021 Maximums – Fredericton 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	24 µg/m^3
Nitrogen dioxide (NO_2)	1 hour	56 µg/m^3 (30 ppb)
Ground-level ozone (O_3)	1 hour	137 µg/m^3 (70 ppb)

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

NBDELG (2022a) identifies provincial "air zones" which assists the Department in managing air quality in these regions. The Central Air Zone, within which the Project 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 4.2.4** and **Table 4.2.5** above, the ambient air quality in the region of the PDA is generally good to very good.

4.2.2.3 Greenhouse Gases

Greenhouse gas (GHG) emissions in Canada totalled 672 megatonnes of carbon dioxide equivalents (Mt CO_2e) in 2020, as published in Canada's most recent annual report on GHG emissions (ECCC 2022c). Total GHGs for New Brunswick were 12.4 Mt CO_2e in 2020, whereas they were 16.1 Mt CO_2e in 1990 and 20.0 Mt CO_2e in 2005 (ECCC 2022c). Since 2005, New Brunswick has seen a 38% decrease in total GHG emissions.

4.2.2.4 Odour

Odour is not measured in the Waterville area. Odours that are most relevant to the Project include odours that are relevant to the treatment of the potato waste; therefore, no baseline information is available to characterize existing odour conditions.

4.2.3 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.

4.2.3.1 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 construction activities and from transport of materials to- and from-site could result in air contaminants that could disperse in the atmosphere to off-site receptors.
- During operation of the new WWTS, limited combustion gas emissions may be emitted by an emergency generator when it is operated during a power loss (an infrequent occurrence); and
- Emissions of fugitive dust from proposed unpaved access road and parking areas, earth moving activities, and from transport of materials to and from the site during construction activities could be generated and disperse in the atmosphere to off-site receptors.

4.2.3.2 Mitigation

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

- Maintain vehicles and equipment in proper working order according to emission and noise suppression standards;
- Shut down all motorized vehicles and equipment when not in use to minimize idling, thus reducing exhaust emissions;
- Utilize low-sulphur fuels in combustion engines;
- Monitor weather conditions (specifically wind), stabilization of soil stockpiles and bare slopes to minimize a potential increase in fine particulate matter;
- Limit the volume of stockpiled materials (such as excavated gravel) as well as the duration they are stockpiled;
- Stabilize exposed soil as soon as practical;
- Apply water over exposed soils or the newly constructed access road if dry or dusty weather conditions occur; and
- Constrain construction activities to daylight hours, Monday to Saturday, excluding holidays.

4.2.3.3 Characterization of Potential Interactions Following Mitigation

Although there are no industrial sources of air contaminant emissions in the Waterville area itself, and there are no large industrial sources located within the community of Waterville or town of Hartland, the area may still experience some periods of poor air quality on occasion arising from the transport of contaminants other industrial facilities in Grand Falls, St. Léonard, or Nackawic and beyond; however, the minor air contaminant emissions from the Project are not expected to exacerbate air quality in Waterville, although some short and infrequent periods of reduced dispersion are expected.

Construction activities have the potential to result in temporary changes to air quality due to dust from earth moving activities and emissions from combustion gases. The emission of air contaminants from construction activities will be limited to the periods when such activities are taking place, and effects are anticipated to be generally localized to the PDA and perhaps immediately adjacent to them; however, once the construction phase is complete, there are no residual effects to air quality associated with fugitive dust or combustion gas emissions expected from the Project.

There will be limited greenhouse gas emissions in the immediate vicinity of the PDA, from vehicles and equipment used during the construction and decommissioning phases, but these increased greenhouse gas emissions are expected to be negligible and not discernible on a provincial or national scale. The potato waste is currently being treated at a different location, and is transported there via truck, so, in theory, greenhouse gas emissions should be reduced during operation of the new WWTS, as treatment emissions will be about the same as currently but the wastewater will not be transported by truck any longer.

Although odour impacts can occur in areas surrounding wastewater treatment facilities, odours are not expected during construction, since there is no existing wastewater treatment system. Odour impacts during operation are also expected to be negligible given that raw wastewater and treatment facilities will be located indoors and treated wastewater will be released below the ground surface.

4.2.4 Summary

The effects of the Project activities on ambient air quality due to fugitive dust and emissions from equipment are expected to be temporary, intermittent, localized, and minimal, using standard mitigation as identified in **Section 4.2.3.2**. It is unlikely that Project-related emissions will exceed New Brunswick air quality standards or objectives during both the construction and operation phases.

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 the emissions are temporary.

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

4.3 Acoustic Environment

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

4.3.1 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 a nuisance are 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 activities to be carried out for the Project, substantive sources of vibration are not expected, and as such the discussion below shall be focused 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 established 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:

- 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).

4.3.2 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, a conservative estimate of noise levels between the nearest

residential buildings and anticipated construction activities was used, with the assumption being that Project-related interactions with the acoustic environment at other locations would be less.

As previously described in **Section 2.1,** the Project is located in the small community of Waterville, within the town of Hartland, in Carleton County, New Brunswick. Waterville is located upland of the western side of the Wolastoq (Saint John River) and the western side of the Trans-Canada Highway (TCH; NB Route 2). The nearest potential noise sensitive receptor to the Project is the Upper River Valley Hospital, located approximately 710 m from the closest point of the PDA, on the eastern side of the TCH. For the purpose of this assessment, a noise sensitive receptor is defined as a residential building, a nursing home, hospital, school, or daycare facility.

Since no baseline noise monitoring has been completed for the Project, the baseline noise levels assumed to be present at or near the Project 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 2022) and adjacent TCH, it was determined that the noise levels within the Project area would be expected to be typical of a quiet suburban, with estimated baseline sound levels of approximately 50 dBA (USEPA 1974; Health Canada 2017).

4.3.3 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.

4.3.3.1 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 primarily during construction of the new WWTS. The operation of the new WWTS is not expected to result in substantive sources of noise since all mechanical equipment will be located within an enclosed building, with little exterior activity occurring.

4.3.3.2 Mitigation

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

- Maintain, service, and inspect vehicles and equipment to ensure proper, working, and effective exhaust and muffler systems;
- Discuss and address and complaints related to noise due to Project activities with contractor(s) and the Town of Hartland;

- Communicate speed limits, designated vehicle routes, parking locations, no-idling policy, normal delivery hours, and use of engine breaks with driver(s) and contractor(s);
- Inform the contractor(s) to reduce the number of vehicles and construction equipment to only those that are necessary for Project completion;
- Constrain construction activities to daylight hours, Monday to Saturday, excluding holidays to limit noise emissions to the daytime; and
- Regularly discuss noise minimization with worker(s) and contractor(s).

4.3.3.3 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 the construction of the new WWTS have the potential to result in noise emissions with potential disturbance effects for humans or wildlife outside of the PDA. 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 noise sensitive receptor (the Upper River Valley Hospital, located approximately 710 m from the closest point of the PDA) was undertaken. The United States Department of Transportation's (USDOT) *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 typical heavy equipment used for civil construction projects, and the measured sound pressure levels (USDOT 2006) associated with them, is provided in **Table 4.3.1**.

Table 4.3.1: 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
Excavator	85	1
Dump Truck	84	1
Front End Loader	80	1
Concrete Mixer Truck	85	1
Flatbed Truck	84	1
Crane	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 noise sensitive receptor located 710 m away was 51.7 dBA, which is below the accepted criteria of 65 dBA and marginally above the assumed background value of 50 dBA. The actual Project activities for site preparation, WWTS and building construction with

the PDA will have a limited duration and frequency of operation, and not all equipment will be operated at the same time; thus the above model results are conservative since they assume all identified equipment is operating continuously and at the same time. For example, the flatbed truck and crane will be mostly be non-operational (parked on-site), and the excavator is not likely to be used at the same time as the concrete mixer truck. In addition, the receptor is located on the opposite side of the TCH, so the receptor is already subject to noise from traffic and transport trucks travelling at high speeds on the TCH.

4.3.4 Summary

During the construction of the new WWTS and associated site preparation and building construction, sources of noise are expected to be primarily related 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 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.

4.4 Groundwater

The potential environmental effects of the Project on groundwater are discussed in this section.

4.4.1 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, birds, animals, and plants also rely on the availability of water to live and flourish. Changes in the availability of water, both in the amount of water and the quality of water, may affect the lives of people and other living things.

Groundwater was selected as a VC based on the importance of the resource for humans and because of the potential for this resource to be affected by the Project through changes in groundwater quality or quantity as a result of the new WWTS and leaching field.

Groundwater consists of water that is contained within the ground and recharged through infiltration of precipitation or surface water, and is important to local ecosystems and private potable wells. In general, groundwater flows from recharge areas (i.e., areas of high elevation) to discharge areas (i.e., 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 quality of the water contained in aquifers varies depending on the geochemical composition of the material within which the water flows. 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 2022). 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 groundwater environment is considered a VC as it is an important part of the hydrologic cycle, is critical to the water balance, and is a contributing component to both ecological and human health.

4.4.2 Existing Conditions

The surficial geology of the PDA consists of rill wash consisting of mixed sand and stones. The area includes minor bedrock and basal till (Lee 1962). The bedrock geology of the area is made up of Silurian dark grey calcareous slate, buff and grey-green slate, and greywacke (Lee 1962). According to New Brunswick's soil mapping, the soil in the PDA is of the Caribou Soil Unit, which is a non-compact till (deposited from melting glaciers) with a low volume of coarse fragment content. The soil is relatively deep, with an average of 66-100+ centimetres (cm) of soil before a compact layer is reached (Colpitts et al. 1995).

From a recharge to groundwater perspective, the PDA is located at a topographic high between the Little Presque Isle Stream to the south and east and an unnamed tributary of the Little Presque Isle Stream to the west. To gain a better understanding of the known sources of groundwater in the area, a desktop review of the New Brunswick Online Well Log System (OWLS; NBDELG 2022d) search was completed by Dillon. For the review, a search radius of 2 km was selected. It should be noted that the radial search is property based, and the OWLS will return wells that are affiliated with any property in which a portion of the property falls within the search radius. Therefore, the wells discussed may be located beyond the 2 km search radius surrounding the subject property. Another important limitation of the OWLS database is that it includes only wells that were completed after 1994; thus, there may be other wells present in an area if they were existing prior to that year.

The OWLS query yielded results for 39 water wells near or within the 2 km radius surrounding the PDA (**Figure 4.1.1**). Several of the identified wells are located to the south of the Little Presque Isle Stream. Shallow groundwater likely flows toward the tributary to the north whereas regional deeper groundwater likely flows to the east/southeast. There are no wells to the north of the PDA, in the area that may have the greatest impact from the surface activities. The wells are included in the discussion below for completeness. Also of note: wells 7, 8, 11, and 26 are located the closest to the PDA (**Figure 4.4.1**). Available information regarding well construction details is outlined in **Table 4.4.1**.

COVERED BRIDGE POTATO CHIP COMPANY EIA

FIGURE 4.4.1

WELL LOCATIONS WITHIN APPROXIMATELY 2KM OF THE PDA (NBDELG 2022C)

- Wells
- Street
- Highway
- Watercourse
- Waterbody
- Subject Property

SCALE 1:18,000

0 0.25 0.5 1 Kilometers

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: BG
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_WellLocations_within2KmPDA.mxd

Table 4.4.1: Well Construction Details for 39 Wells within Approximately 2 km of the PDA (NBDELG 2022d)

Well Number	Well Identifier	Overall Well Depth (m)	Well Casing Diameter (cm)	Well Casing Depth (m)	Estimated Safe Yield (litres per minute)[1]
1	2914	60.96	15.24	6.1	31.85
2	3113	79.25	15.24	5.79	0
3	6863	32	15.24	5.79	45.5
4	13302	124.97	15.24	5.79	13.65
5	13302	124.97	15.24	5.79	13.65
6	13988	25.91	15.24	6.1	54.6
7	15587	86.87	15.24	12.19	45.5
8	15590	91.44	15.24	12.19	18.2
9	15594	60.96	15.24	12.19	45.5
10	15597	76.2	15.24	6.1	9.1
11	16067	19.81	-	-	113.75
12	16886	76.2	15.24	6.1	22.75
13	16887	77.72	15.24	25.6	31.85
14	16888	77.72	15.24	7.92	227.5
15	16889	68.58	15.24	6.1	22.75
16	16896	77.72	15.24	13.72	227.5
17	16901	35.05	15.24	6.1	18.2
18	16922	53.34	15.24	6.1	45.5
19	27898	76.2	15.24	19.81	104.65
20	27898	76.2	15.24	15.24	18.2
21	29486	38.1	15.24	6.1	136.5
22	29978	56.39	15.24	17.07	136.5
23	29978	56.39	15.24	17.07	136.5
24	33221	50.29	15.24	7.62	45.5
25	35604	22.86	15.24	5.79	136.5
26	36952	38.1	15.24	12.8	364
27	37197	42.67	15.24	21.34	136.5
28	37197	42.67	15.24	21.34	136.5
29	37197	42.67	15.24	21.34	136.5
30	37197	42.67	15.24	21.34	136.5
31	37197	42.67	15.24	21.34	136.5
32	37197	42.67	15.24	21.34	136.5
33	37302	76.2	15.24	7.92	31.85
34	37304	68.58	15.24	8.53	364
35	37308	68.58	20.32	12.19	409.5
36	40417	32	15.24	6.1	68.25

Well Number	Well Identifier	Overall Well Depth (m)	Well Casing Diameter (cm)	Well Casing Depth (m)	Estimated Safe Yield (litres per minute)[1]
37	44437	32	15.24	6.1	113.75
38	90502100	16.76	15.24	5.79	91
39	91383600	13.72	15.24	5.79	91

Notes:
The estimated safe yield is based upon the well driller's estimate at the time of well drilling and may not represent the long-term sustainability of the well.

Observed stratigraphy is recorded by the licensed well drillers during each well installation. Available information regarding observed stratigraphy is presented below in **Table 4.4.2**.

Table 4.4.2: Stratigraphy Information for the 39 Wells within Approximately 2 km of the Project (NBDELG 2022d)

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
1	2914	0	3.05	Brown topsoil
		3.05	53.34	Blue shale
		53.34	53.95	Brown shale
		53.95	60.96	Unknown
2	3113	0	3.66	Brown dirt
		3.66	79.25	Blue shale
3	6863	0	4.88	Brown clay
		4.88	32	Blue shale
4	13302	0	1.52	Brown topsoil
		1.52	124.97	Blue shale
5	13302	0	1.52	Brown topsoil
		1.52	124.97	Blue shale
6	13988	0	3.66	Brown topsoil
		3.66	19.81	Grey shale
		19.81	21.34	Brown shale
		21.34	25.91	Grey shale
7	15587	0	11.58	Brown topsoil
		11.58	46.02	Blue shale
		46.02	46.63	Brown shale
		46.63	82.3	Blue shale
		82.3	82.6	Brown shale
		82.6	86.87	Blue shale

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
8	15590	0	10.67	Brown topsoil
		10.67	45.72	Blue shale
		45.72	46.02	Brown shale
		46.02	91.44	Blue shale
9	15594	0	11.28	Brown topsoil
		11.28	16.76	Blue shale
		16.76	17.07	Brown shale
		17.07	45.72	Blue shale
		45.72	47.55	Brown shale
		47.55	60.96	Blue shale
10	15597	0	5.18	Brown topsoil
		5.18	53.34	Blue shale
		53.34	53.64	Brown shale
		53.64	76.2	Shale
11	16067	0	7.62	Brown Clay
		7.62	19.81	Blue shale
12	16886	0	3.66	Brown topsoil
		3.66	47.24	Blue shale
		47.24	48.77	Blue and white shale
		48.77	76.2	Blue shale
13	16887	0	25.6	Brown topsoil
		25.6	45.72	Blue shale
		45.72	46.33	Brown and white shale
		46.33	77.72	Blue shale
14	16888	0	7.92	Brown topsoil
		7.92	16.76	Brown shale
		16.76	19.81	Blue shale
		19.81	20.12	Brown shale
		20.12	60.96	Blue shale
		60.96	61.26	Brown shale
		61.26	77.72	Blue shale
15	16889	0	6.1	Brown topsoil
		6.1	12.19	Brown shale
		12.19	35.05	Blue shale
		35.05	35.36	Brown and white shale
		35.36	68.58	Blue shale

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
16	16896	0	7.92	Brown topsoil
		7.92	16.76	Brown shale
		16.76	19.81	Blue shale
		19.81	20.12	Brown shale
		20.12	60.96	Blue shale
		60.96	61.26	Brown shale
		61.26	77.72	Blue shale
17	16901	0	3.05	Brown topsoil
		3.05	13.41	Blue and brown shale
		13.41	13.72	Brown shale
		13.72	22.56	Blue shale
		22.56	22.86	Brown shale
		22.86	35.05	Blue shale
18	16922	0	3.66	Brown topsoil
		3.66	22.86	Blue shale
		22.86	23.16	Brown shale
		23.16	28.96	Blue shale
		28.96	29.26	Brown shale
		29.26	51.51	Blue shale
		51.51	53.34	Brown shale
19	27898	0	16.76	Brown gravel
		16.76	22.86	Grey shale
		22.86	23.77	White quartz
		23.77	35.36	Grey shale
		35.36	35.97	White quartz
		35.97	53.34	Grey shale
		53.34	54.56	White shale
		54.56	76.2	Grey shale
20	27898	0	10.67	Brown topsoil
		10.67	18.29	Grey shale
		18.29	18.9	White quartz
		18.9	48.77	Grey shale
		48.77	49.38	White quartz
		49.38	76.2	Grey shale

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
21	29486	0	1.83	Brown topsoil
		1.83	16.46	Grey shale
		16.46	17.07	Brown sandstone
		17.07	30.48	Grey shale
		30.48	32.92	Brown quartz
		32.92	38.1	Grey shale
22	29978	0	15.24	Brown clay, sand, and gravel
		15.24	45.72	Grey shale
		45.72	47.24	White quartz
		47.24	48.77	Grey shale
		48.77	51.82	Brown and white quartz
		51.82	56.39	Grey shale
23	29978	0	15.24	Brown clay, sand, and gravel
		15.24	45.72	Grey shale
		45.72	47.24	White quartz
		47.24	48.77	Grey shale
		48.77	51.82	Brown and white quartz
		51.82	56.39	Grey shale
24	33221	0	4.57	Brown clay and gravel
		4.57	50.29	Grey and white shale and quartz
25	35604	0	1.83	Brown clay
		1.83	22.86	Blue shale
26	36952	0	1.52	Brown gravel
		1.52	9.14	Brown clay
		9.14	11.58	Brown shale
		11.58	13.72	Grey shale
		13.72	14.63	Brown shale
		14.63	18.29	Grey shale
		18.29	19.51	Black and white shale
		19.51	22.86	Grey shale
		22.86	24.38	Brown clay and shale
		24.38	28.96	Grey shale
		28.96	32	Brown clay and shale
		32	38.1	Grey shale
27	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
28	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay
29	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay
30	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay
31	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay
32	37197	0	5.49	Grey sandstone
		5.49	19.81	Brown clay
		19.81	36.58	Grey sandstone
		36.58	42.67	Brown clay
33	37302	0	1.22	Brown fill
		1.22	4.88	Brown gravel
		4.88	5.49	Brown clay
		5.49	6.71	Brown shale
		6.71	51.82	Grey shale
		51.82	52.73	Brown and white quartz
		52.73	76.2	Grey shale
34	37304	0	1.22	Brown Fill
		1.22	7.32	Brown Clay
		7.32	10.97	Grey Shale
		10.97	11.28	Brown Clay
		11.28	13.72	Grey Shale
		13.72	14.33	White Quartz
		14.33	18.29	Grey Shale
		18.29	18.9	Brown Clay
		18.9	22.86	Grey Shale
		22.86	23.16	White Quartz
		23.16	25.91	Grey Shale
		25.91	26.52	Brown and white Quartz

Well Number	Well Identifier	Depth of Top of Zone (m bgs[1])	Depth of Bottom of Zone (m bgs[1])	Stratigraphy[2]
		26.52	36.58	Grey Shale
		36.58	37.8	White Quartz
		37.8	68.58	Grey Shale
35	37308	0	1.83	Brown Fill
		1.83	3.66	Brown Gravel
		3.66	7.32	Grey Clay
		7.32	18.29	Grey shale
		18.29	19.81	Brown Shale
		19.81	22.86	Grey Shale
		22.86	23.16	White Quartz
		23.16	48.77	Grey Shale
		48.77	49.07	White Quartz
		49.07	59.44	Grey Shale
		59.44	59.74	Brown Shale
		59.74	68.58	Grey Shale
36	40417	0	2.44	Brown Gravel
		2.44	15.24	Grey Shale
		15.24	15.85	Brown Clay
		15.85	22.86	Grey Shale
		22.86	23.16	White quartz
		23.16	32	Grey Shale
37	44437	0	2.44	Brown Fill
		2.44	9.14	Grey Shale
		9.14	9.75	White Quartz
		9.75	12.19	Grey Shale
		12.19	13.72	White quartz
		13.72	32	Grey Shale
38	90502100	0	1.83	Brown Topsoil
		1.83	10.67	Blue Shale
		10.67	16.76	Blue Shale
39	91383600	0	2.44	Brown gravel
		2.44	3.66	Brown shale
		3.66	13.72	Blue shale

Notes:

[1]m bgs – metres below ground surface

[2]The stratigraphy is based upon the observation of drill cutting made by the well driller at the time of drilling. The stratigraphy should be considered as a general description only and not an interpreted geologic unit.

Available information regarding water bearing zones observed during well construction is presented below in **Table 4.4.3**.

Table 4.4.3: Water Bearing Zones for 39 Wells Within Approximately 2 km of the PDA (NBDELG 2022d)

Well ID	Depth (m)	Rate[1] (litres/min)
1	There is no water-bearing fracture zone information for this well.	
2	78.64	364
3	12.5	9.1
	15.85	9.1
	25.91	27.3
4	30.48	4.55
	60.96	4.55
	114.3	4.55
5	30.48	4.55
	60.96	4.55
	114.3	4.55
6	19.81	54.6
7	46.02	13.65
	82.3	31.85
8	45.72	18.2
9	16.76	18.2
	45.72	27.3
10	53.34	9.1
11	13.72	113.75
12	47.24	22.75
13	There is no water-bearing fracture zone information for this well.	
14	15.24	136.5
	19.81	45.5
	60.96	45.5
15	9.14	4.55
	35.05	13.65
16	15.24	136.5
	19.81	45.5
	60.96	45.5
17	13.72	9.1
	22.86	9.1
18	51.51	36.4
	22.86	4.55
	28.96	4.55
19	22.86	68.25
	35.36	13.65
	53.34	22.75
20	48.77	68.25
	18.29	13.65
21	16.46	31.85
	30.48	104.65
22	45.72	45.5
	48.77	91
23	45.72	45.5
	48.77	91

Well ID	Depth (m)	Rate[1] (litres/min)
24	10.67	18.2
	24.38	9.1
	45.72	18.2
25	19.81	136.5
26	13.72	45.5
	18.29	91
	22.86	91
	28.96	136.5
27	36.58	136.5
28	36.58	136.5
29	36.58	136.5
30	36.58	136.5
31	36.58	136.5
32	36.58	136.5
33	51.82	31.85
34	22.86	45.5
	10.97	22.75
	13.72	68.25
	18.29	68.25
	25.91	91
	36.58	113.75
35	18.29	204.75
	22.86	91
	48.77	91
	59.44	22.75
36	15.24	45.5
	22.86	22.75
37	9.14	45.5
	12.19	68.25
38	10.97	91
39	10.67	91

Notes:

[1]The estimated water flow rate is a representation of the well driller's estimate of the yield of each water bearing fracture identified during the drilling of the well.

In accordance with the New Brunswick *Clean Water Act*, the OWLS database does not attribute reported water quality analytical data to its corresponding well. The OWLS search completed as part of this assessment yielded analytical data for nine samples. The reported analytical data are presented in **Table** 4.4.4. For reference, the data have been compared to the applicable Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ; Health Canada 2022).

Table 4.4.4: General Chemistry and Trace Metals for Nine Samples within Approximately 2 km of the PDA (NBDELG 2022d)

Parameter	Units	GCDWQ[1]		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
		AO[2]	MAC[3]									
Calcium	(mg/L)	-	-	-	143	-	-	0.18	74.8	85	39.1	79.1
Chloride	(mg/L)	250	-	-	298	-	-	1.47	133	18.7	1.3	13
Conductivity	(µS/cm)	-	-	-	1,330	-	-	316	842	503	287	547
Copper	(µg/L)	-	-	-	11	-	-	28	24	< 10	< 10	< 10
Fluoride	(mg/L)	-	1.5	-	< 0.1	-	-	0.853	< 0.1	0.17	< 0.1	< 0.1
Hardness	(mg/L)	-	-	-	461.2	-	-	< 0.67	240	258	153	290
Iron	(mg/L)	0.3	-	-	< 0.01	-	-	0.02	< 0.01	0.041	0.021	0.047
Magnesium	(mg/L)	-	-	-	25.3	-	-	< 0.1	12.9	11.1	13.5	22.3
Manganese	(mg/L)	0.02	0.12	-	< 0.005	-	-	0.11	< 0.005	0.007	< 0.005	< 0.005
Nitrate + Nitrite (as N)	(mg/L)	-	10[4]	-	5	-	-	< 0.05	0.67	6	0.13	12
pH	(pH)	7-10.5	-	-	7.48	-	-	8.65	7.8	7.73	8.05	7.89
Potassium	(mg/L)	-	-	-	0.856	-	-	< 0.1	1.2	0.7	0.5	2.6
Sodium	(mg/L)	200	-	-	93.4	-	-	78.9	77.1	12.9	3.03	3.84
Sulphate	(mg/L)	500	-	-	18.9	-	-	11.2	16.8	14	8.86	22.3
Total Alkalinity	(mg/L)	-	-	-	191	-	-	158	220	196	144	202
Total Dissolved Solids	(mg/L)	500	-	-	716.59	-	-	188.409	451.04	286.953	153.534	317.813
Turbidity	(NTU)	-	1		0.15	-	-	1.8	< 0.2	1.6	0.32	0.83
Bicarbonate	(mg/L)	-	-	-	191	-	-	151.4	218.7	195	142.4	200.5
Carbonate	(mg/L)	-	-	-	0	-	-	6.4	1.3	1	1.5	1.5
Hydroxide	(mg/L)	-	-	-	0	-	-	0.2	0	0	0.1	0
Total Anions	(EPM)	-	-	-	12.977	-	-	3.482	8.568	5.322	3.117	6.027
Total Cations	(EPM)	-	-	-	13.312	-	-	3.473	8.183	5.741	3.211	6.022
Conductivity	(µS/cm)	-	-	-	1,136.018	-	-	285.03	753.239	455.499	267.88	476.453
E.coli	Present/Absent		Ab	Pr		Ab	Ab	Ab	Ab	Pr	Ab	Ab
Total Coliforms	Present/Absent		Ab	Pr		Ab	Ab	Ab	Ab	Pr	Ab	Ab
Aluminum	(mg/L)	-	2.9	-	< 0.025	-	-	0.064	< 0.025	0.039	< 0.025	< 0.025
Antimony	(µg/L)	-	6	-	< 1	-	-	< 1	< 1	< 1	< 1	2
Arsenic	(µg/L)	-	10	-	< 1.5	-	-	< 1.5	< 1.5	< 1.5	< 1.5	1.7
Barium	(mg/L)	-	2	-	0.09	-	-	< 0.01	0.031	0.076	0.023	0.082
Boron	(mg/L)	-	5	-	0.015	-	-	0.124	< 0.01	0.057	< 0.01	0.01
Bromide	(mg/L)	-	-	-	< 0.1	-	-	< 0.1	< 0.1	< 0.1	< 0.1	0.12
Cadmium	(µg/L)	-	7	-	< 0.5	-	-	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Calcium	(mg/L)	-	-	-	143	-	-	0.18	74.8	85	39.1	79.1

Parameter	Units	GCDWQ[1]		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
		AO[2]	MAC[3]									
Chromium	(µg/L)	-	50	-	18	-	-	12	21	18	10	< 10
Copper	(µg/L)	-	2,000	-	11	-	-	28	24	< 10	< 10	< 10
Iron	(mg/L)	0.3	-	-	< 0.01	-	-	0.02	< 0.01	0.041	0.021	0.047
Lead	(µg/L)	-	5	-	1.56	-	-	2.3	< 1	< 1	2	< 1
Magnesium	(mg/L)	-	-	-	25.3	-	-	< 0.1	12.9	11.1	13.5	22.3
Manganese	(mg/L)	0.2	0.12	-	< 0.005	-	-	0.11	< 0.005	0.007	< 0.005	< 0.005
Potassium	(mg/L)	-	-	-	0.856	-	-	< 0.1	1.2	0.7	0.5	2.6
Selenium	(µg/L)	-	50	-	< 1.5	-	-	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Sodium	(mg/L)	200	-	-	93.4	-	-	78.9	77.1	12.9	3.03	3.84
Thallium	(µg/L)	-	-	-	< 1	-	-	< 1	< 1	< 1	< 1	< 1
Uranium	(µg/L)	-	20	-	< 0.5	-	-	0.5	< 0.5	< 0.5	0.6	< 0.5
Zinc	(µg/L)	5		-	231	-	-	260	7	< 5	< 5	< 5

Notes:

- Denotes not measured or no guideline
AB = absent
EPM = equivalents per million
PR = present
mg/L = milligrams per litre
µS/cm = microSiemens per centimetre

Based upon the results of the OWLS search and water chemistry review, the following assumptions have been made:

- The water quality analytical data indicate that nitrate + nitrite (as N) were above the Health Canada maximum allowable concentration (MAC) in Sample 9, and turbidity was above the Health Canada MAC in Samples 5 and 7.
- The water quality analytical data indicate that chloride was above the Health Canada aesthetic objective (AO) in Sample 2, and zinc was above the Health Canada AO in Samples 2, 5, and 6; and
- The presence of *E. coli* and total coliforms was detected in Samples 1 and 7.

4.4.3 Assessment of Potential Interactions between the Project and Groundwater

4.4.3.1 Potential Interactions

Though unlikely, the Project has the possibility to affect groundwater quality through the following:

- Contact with residual contaminants that may be present in treated effluent discharged from the Advanced Enviro-Septic® (AES) secondary wastewater treatment system; and
- Failure of the system that would warrant discharge of contaminants either biological, organic or inorganic.

On a day-to-day basis, and under normal operation, the effluent released into the environment will have undergone primary and secondary treatment, thereby treating effluent to well below normally accepted discharge standards for BOD and TSS (typically 20-25 mg/L for each of BOD and TSS); however, there is always the possibility of system failure (as an unplanned event).

4.4.3.2 Mitigation

Planned mitigation to minimize the potential effects of the Project on groundwater include the operation of the Evoqua MBR primary wastewater treatment system to treat effluent to less than 5 mg/L for each of TSS and BOD, followed by the release of treated effluent below ground surface in the Advanced Enviro-Septic® (AES) secondary wastewater treatment system. While the secondary treatment and treated effluent release system chosen for this site were selected primarily to provide a mechanism for sub-surface disposal of treated effluent, these are inherently designed to protect soil and groundwater from being contaminated by filtering out additional solids from the effluent prior to it being leached into the environment (Fundy 2023).

4.4.3.3 Characterization of Potential Interactions Following Mitigation

Interactions between the Project and groundwater resources during construction are not anticipated.

During the operation phase of the Project, there is the potential for there to be effects to the groundwater through the presence of residual contaminants in treated effluent released from the secondary wastewater treatment system. The primary wastewater treatment system is designed to treat effluent to below 5 mg/L for both TSS and BOD, and secondary wastewater treatment system will offer further polishing of effluent beyond that of the primary system. With the use of this modern technology of WWTS and the proposed mitigation, there are not anticipated to be any substantive adverse interactions with groundwater resources. The three wells on and near the subject property should be at low risk from any surface activity if they were constructed with the best practice approach (i.e., minimum 20 feet of casing). There is always the opportunity for a system failure, which may result in discharge of contaminants from the system, either biological, organic or inorganic, though it is unlikely.

4.4.4 Summary

During the operation phase of the Project, treated wastewater will be released underground on the Covered Bridge property; however, following primary and secondary treatment of the wastewater, the discharge of the treated effluent is not anticipated to lead to substantive adverse interactions with groundwater resources.

4.5 Vegetation and Wetlands

The potential environmental effects of the Project on vegetation and wetlands are assessed in this section.

4.5.1 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 is included due to the potential for interactions with rare plants and Project activities, particularly species at risk (SAR) or species of conservation concern (SOCC).

In this EIA Registration document, we define SAR as those species that are listed as "Extirpated", "Endangered", "Threatened", or "Special Concern" on Schedule 1 of the federal *Species at Risk Act* (SARA) or on the New Brunswick *Species at Risk Act* (NB SARA). We also define 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]).

Vegetation and wetlands were selected as a valued component (VC) because of their relationship with water resources, wildlife and wildlife habitat, and other biological and physical components addressed as VCs in this EIA Registration. 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 in New Brunswick such as the wood turtle (*Glypemys insculpta*), least bittern (*Ixobrychus exilis*), and yellow rail (*Coturnicops noveboracensis*), among others (NTNB 2018). Project activities have the potential to cause adverse environmental effects through the physical alteration of wetland habitat as well as terrestrial and aquatic vegetation.

New Brunswick's wetlands have been given specific protection pursuant to the New Brunswick *Clean Environment Act* and the *Clean Environment Act*. The New Brunswick Department of Environment and Local Government (NBDELG) requires a permit for any alteration within 30 metres (m) of the banks of a watercourse or the delineated boundaries of a wetland.

4.5.2 Existing Conditions

4.5.2.1 Regional Setting

The information regarding the presence and characterization of wetlands and the characterization of vegetation communities within the PDA and surrounding subject property was derived from several sources including existing databases and secondary information sources (i.e., desktop analysis) as well as field surveys. The methods conducted during the desktop analysis and field surveys are presented below in the following sections.

The PDA is located within the Valley Lowlands Ecoregion and, more specifically, within the Meductic Ecodistrict, which is a low-lying area in the middle of the Saint John River valley (Zelazny 2007). The ecodistrict is characterized by the Wolastoq (Saint John River) and its many tributaries which flow into it within this ecodistrict. The ecodistrict has an average elevation of 159 metres above mean sea level (m amsl).

The original biota in the ecodistrict consisted of tolerant hardwood stands. The majority of the ecodistrict is covered with agricultural land uses now (Zelazny 2007). Undisturbed ridgetops in the area support species such as sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), ironwood (*Ostrya virginiana*), butternut (*Juglans cinerea*), and basswood (*Tilia americana*). Further downslope are mixed-wood forests of sugar maple, balsam fir (*Abies balsamea*) and beech. White spruce (*Picea glauca*) and tamarack (*Larix laricina*) stands in the ecodistrict characterize old fields. This ecodistrict has calcareous soils, a warm climate, and stands of tolerant hardwoods, leading to one of the richest ecodistricts for rare plants in the province (Zelazny 2007).

4.5.2.2 Desktop Analysis – Vegetation SAR and SOCC

Prior to completing the field surveys, Dillon reviewed readily-available information from reputable sources. The information was reviewed to evaluate the potential for vegetation SOCC and/or SAR within the general area of the Project and to assist in scoping/focussing efforts for the field surveys. Dillon completed a review of the following sources and data lists:

- A custom AC CDC report (AC CDC 2022a);
- Various NBDELG and New Brunswick Department of Natural Resources and Energy Development (NBDNRED) publications;
- The federal SARA registry;
- The provincial SARA registry;
- Publicly-available Geographic Information Systems (GIS) map layers and databases;
- High-resolution aerial photography; and
- GeoNB wetland and watercourse mapping.

A custom AC CDC report was obtained in August 2022 for a 5 km radius around the PDA (AC CDC 2022a). The report lists historical observations of species of flora and fauna, including rare species, SOCC, and SAR within and around the PDA (refer to **Appendix C**; shown on **Figure 4.5.1**. It should be noted that a historical observation of a SAR or SOCC documented in the AC CDC report does not necessarily imply that these species are or will be present in the PDA or area surrounding PDA, but rather that they were observed at some time in the past as having been present. The AC CDC report nonetheless provides useful information as to the types of species that might potentially be present in the PDA, which informs the field surveys for potential target species of interest.

Based on the review of the AC CDC report (AC CDC 2022a), there were 34 records of two vascular plant SAR, and 162 records of 45 vascular plant SOCC historically observed within a 5 km radius of the PDA, though none were known to be located within the PDA. The SAR plant species identified by the AC CDC as having been historically observed within 5 km of the Project site, as well as their habitat requirements and potential to occur within the region, are discussed in **Table 4.5.1** below. SOCC lists are provided in the AC CDC report in **Appendix C,** with further details provided in **Appendix D**.

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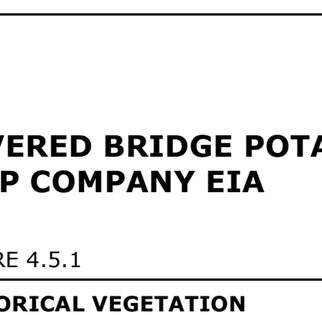
FIGURE 4.5.1

HISTORICAL VEGETATION OBSERVATIONS WITHIN 5KM OF THE PDA (AC CDC 2022A)

- Species At Risk Plant
- Species Of Conservation Concern Plant
- Street
- Highway
- Watercourse
- Waterbody
- Wetland (NBDELG 2022c)
- Subject Property



SCALE 1:30,000

0 0.25 0.5 1 Kilometers

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_HistoricalVegitation_within5kmPDA.mxd

Table 4.5.1: Historical Observations of Species at Risk Located within 5 km of the PDA (AC CDC 2022a)

Species	Status	Habitat	Potential to Occur in PDA
Butternut (*Juglans cinerea*)	**COSEWIC:** Endangered **SARA:** Endangered **NB SARA**: Endangered **AC CDC S-Rank:** S1	Butternut reaches its highest abundance in well-drained calcareous soils in floodplains, streambanks, terraces, riparian zones, and ravines. It is shade intolerant (COSEWIC 2017a).	None to low. The PDA is on a hilltop where it is unlikely a butternut population would be located. In addition, the PDA has already been clear-cut; but, there were no butternuts observed in the surrounding forest during field surveys.
Anticosti Aster (*Symphyotrichum anticostense*)	**COSEWIC:** Special Concern **SARA:** Special Concern **NB SARA**: Endangered **AC CDC S-Rank:** S3	Grows on open river shores within the annual flood zone. This plant is also strongly associated with calcareous sedimentary bedrock and surface minerals. It has capacity to grow on highly-disturbed sites (COSEWIC 2017b).	None to low. There are no watercourses within the PDA or near the subject property, where Anticosti aster prefers to grow. Local populations are found along the Saint John River.

Notes:

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 rank range used to indicate any range of uncertainty about the status of the species or community; B: breeding, N: non-breeding; M: migratory; SNA: not applicable – usually means an exotic species that is not a good target for conservation efforts. (AC CDC 2022b)

According to the New Brunswick Forest Inventory, (i.e., publicly-available GeoNB GIS database) the forest types on the subject property (PID No. 10279313) consist of typical New Brunswick forest types. According to the publicly-available forest layer from GeoNB (NBDNRED 2010), there are two forest types on the subject property including softwood forests consisting of balsam fir, with some Eastern white cedar (*Thuja occidentalis*) and black spruce (*Picea mariana*), as well as intolerant hardwood stands dominated by non-commercial species and poplar (*Populus spp.*) species. The stands on the subject property are a variety of ages, from new clear-cut, to mid-succession, to mature forest.

4.5.2.3 Wetland Determination, Delineation, and Functional Assessment

Vegetation and wetlands within and adjacent to the PDA were surveyed and assessed by Dillon biologists certified in wetland delineation and functional assessments on August 22, 2022 by Dillon's recognized wetland delineator Bethany Francis, B.Sc.(ENR), EPt. Following a desktop analysis, vegetation (including both wetland and upland vegetation communities, with a primary focus on vegetation SOCC and SAR) and wetlands were assessed by the implementation of the field methodologies described below.

Field Wetland Delineation

The field wetland determination and delineation methods used for this Project followed the *Protocol for Wetland Delineation in New* Brunswick (NBDELG 2021), which is based upon established protocols for wetland delineation, as outlined by the *US Army Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (USACE 2012). Wetland determination and delineation is focussed on establishing the wetland-upland edge, and is based on the presence of positive indicators for three parameters:

- Hydric soils;
- Hydrophytic vegetation; and
- Wetland hydrology.

A positive indicator must typically be present for all three parameters in order to definitely identify the boundary (edge) of a wetland. Sample points for these three parameters were established at representative locations within the wetlands.

Upon positive wetland determination (i.e., positive indicators identified for soils, hydrology and vegetation), a wetland edge condition was established based on the indicators identified at the three-parameter sample points. This edge condition was used to navigate around the perimeter of the wetland, which was in turn georeferenced with a handheld Geographical Positioning System (GPS) unit (3 to 5 m accuracy).

Hydric Soils

Hydric soil conditions are formed when an area is exposed to flooding or saturation for a sufficient length of time during the growing season such that an anaerobic (oxygen free) environment is formed in the soil. These anaerobic conditions may manifest themselves in a variety of ways, such as through the formation of redox features (reduction-oxidation), organic soils (i.e., peat), or formation of hydrogen sulphide (rotten egg odour), among many other indicators. Interpretation of soil profiles, their associated colour, texture and presence/absence of any hydric soil indicators provides the basis for judgement of whether or not any given soil is a hydric soil (USDA 2010).

Soil sampling was performed to a depth of approximately 50 cm (or to point of refusal) to identify conditions in both wetland and upland soils. Soil horizons were documented in terms of their texture, thickness, color (Munsell value/chroma/hue) and presence of hydric soil indicators (where applicable).

Hydric soil indicators were determined as per the document titled *Field Indicators of Hydric Soils in the United States* (USDA 2010). Wetland Delineation Data Sheets were used to record data collected in the field. The data sheets provide the detailed soil information for each sample point, as well as list the various possible hydric soil indicators.

Hydrophytic Vegetation

Hydrophytic vegetation arises in areas where saturation or inundation by water is of duration sufficient to exert a controlling influence on the plant community assemblage. In such areas, plant species which are adapted to high-moisture environments tend to dominate. In order for a given area to classify as a wetland, hydrophytic vegetation should account for the majority (> 50%) of the sample sites' total vegetation (Environmental Laboratory 1987).

For every plant species, there is a wetland indicator status, which may be interpreted as that species' estimated probability of occurring within a wetland (Environmental Laboratory 1987). If the majority of plant cover in the sample area is comprised of species with facultative (FAC), facultative wetland (FACW), or obligate (OBL) statuses, then the positive indicator for hydrophytic vegetation is met. Wetland indicator statuses for plant species were determined as per USDA Region 1 (Nova Scotia and New Brunswick) listings for interpreting USDA Wetland Indicator Statuses.

Species encountered at each of the sample locations were analysed at three strata (tree, shrub, and herbaceous) and were documented in terms of their percent (%) cover within a given plot size (10 m, 5 m, and 2 m radius, respectively) and their wetland indicator status (FAC, FACW, or OBL).

Wetland Hydrology

Both in the soil pits prepared and over the greater area of the wetland, observations were made concerning the presence of a hydrological regime, which would sustain wetland processes. Taken into consideration were: the site context, site location, and the micro-topography of the wetland area.

Primary hydrology indicators (of which at least one must be present) include surface water, high water table, saturation, sediment deposits, among many other others (Environmental Laboratory 1987). Secondary indicators (of which two are required, in the absence of a primary indicator) include surface soil cracks, drainage patterns and moss trim lines among others.

4.5.3 Wetland Delineation Results

During the field analysis conducted on August 22, 2022, two unmapped wetlands were identified, delineated, and functionally assessed (refer to **Figure 4.5.2**). The delineated wetlands are summarized in **Table 4.5.2**.

Table 4.5.2: Summary of Wetland Delineation Findings

Wetland Identifier	Wetland Type	Delineated Area (ha)	Area (ha) of Wetland to be Potentially Directly Affected by Project Activities
Wetland 1 (WL1)	Disturbed forested wetland	0.13	0
Wetland 2 (WL2)	Disturbed scirpus wetland	0.08	0

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FIGURE 4.5.2

WETLANDS WITHIN THE SUBJECT PROPERTY AND SURROUNDING AREA

- Upland
- Wetland
- Street
- Highway
- Watercourse
- Wetland 30m Buffer (NBDELG 2022c)
- Delineated Wetland (0.08 ha)
- Delineated Wetland (0.13 ha)
- Delineated Wetland 30 m Buffer (Dillon 2022)
- Wetland (NBDELG 2022c)
- Subject Property

SCALE 1:2,000

0 15 30 60 Meters

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_WetlandsWithinSubjectProperty.mxd

The following sections provide a summary of the wetland delineation results for the wetlands located within the subject property. There were no GeoNB mapped wetlands located within the PDA; the nearest mapped wetland is complex located on the adjacent property to the north of the PDA, along an unnamed stream that runs into the Little Presque Isle Stream. Wetland delineation data sheets are provided in **Appendix E**. Refer to **Figure 4.5.2** for approximate wetland field delineations. It is important to note that the field assessment was completed for only that wetlands that are present entirely within the PDA and for the portion of wetlands that are present on the PDA for wetlands that extend to other neighbouring properties, to avoid trespassing on privately-owned property. This is notable since Wetland 1 extends into and is hydrologically connected to a large wetland complex to the north.

Wetland 1 (WL1) – 0.13 m^2 Disturbed Forested Wetland

Based on the results of the field assessment, WL1 is characterized as a 0.13 ha disturbed forested wetland, which was likely a forested wetland prior to the development in the area. The wetland is located along the north-northeast portion of the Factory property, adjacent with, then running into the neighbouring property (i.e., Irving gas station and Subway and Burger King restaurants). The wetland is connected to a manmade ditch that runs between the Factory and the adjacent Irving Big Stop, and is likely hydrologically connected to/a part of the GeoNB mapped forested wetland located to the north of the subject property (**Figure 4.5.2**). There is no treed overstory. The shrub layer is dominated by Bebb's willow (*Salix bebbiana*). The understory herbaceous layer is dominated by bulrush (*Scirpus* spp.). The vegetation community identified at WL1 is comprised of greater than 50% wet adapted vegetation species based on their indicator status (i.e., obligate, facultative wet, facultative, facultative upland, upland; Environmental Laboratory 1987); therefore, this wetland is considered to have a "hydrophytic" or wet adapted vegetation community. There were no flora SAR or SOCC observed during desktop review or field delineations of this wetland. The wetland also had wet soil indicators in the form of a sandy redox layer. Hydrology indicators include surface water, saturation, and a high-water table.

Wetland 2 (WL2) – 0.08 m^2 Disturbed Scirpus Wetland

Based on the results of the field assessment, WL2 is characterized as a 0.08 ha disturbed *Scirpus* wetland, located within the cleared portion of the PDA. The wetland is not hydrologically connected to any streams or other wetlands (**Figure 4.5.2**), and it is characterized as seasonally drained during most of the warmer seasons. There is no treed overstory or shrub layer. The herbaceous layer is dominated by cottongrass bulrush (*Scirpus cyperinus*). The vegetation community identified at WL2 is comprised of greater than 50% wet adapted vegetation species based on their indicator status (i.e., obligate, facultative wet, facultative, facultative upland, upland; Environmental Laboratory 1987); therefore, this wetland is considered to have a "hydrophytic" or wet adapted vegetation community. There were no flora SAR or SOCC observed during desktop review or field delineations of this wetland. The wetland also had wet soil indicators in the form of a sandy gleyed matrix. Hydrology indicators include surface water, saturation, and aquatic fauna in the form of frogs using the surface water and bulrush cover.

Functional Assessment: Wetland Ecosystem Services Protocol for Atlantic Canada

The Wetland Ecosystem Services Protocol of Atlantic Canada (WESP-AC) represents a standardized approach to the way data is collected and interpreted to indirectly yield relative estimates of a wide variety of important wetland functions and their associated benefits. WESP-AC generates scores (0 to 10 scale) and ratings ("Lower", "Moderate", or "Higher") for a variety of wetland functions using visual assessments of weighted ecological indicators. The number of indicators that is applied to estimate a particular wetland function depends on which function is being assessed.

The indicators are then combined in a spreadsheet using logic-based, mathematical models to generate the score and rating for each wetland function and benefit (NBDELG 2018b). Together, they provide a profile of "what a wetland does."

For each function, the scores and ratings represent a particular wetland's standing relative to those in a statistical sample of non-tidal wetlands previously assessed for the province (98 for New Brunswick; NBDELG 2018b). **Table 4.5.3** provides a list of various functions, their definitions, and potential benefits.

Table 4.5.3: Benefits of Wetland Functions Scored by WESP-AC (NBDELG 2018b)

Function	Definition	Potential Benefits
Hydrologic Functions:		
Water Storage and Delay	The effectiveness for storing runoff or delaying the downslope movement of surface water for long or short periods.	Flood control, maintain ecological systems
Stream Flow Support	The effectiveness for contributing water to streams especially during the driest part of a growing season.	Support fish and other aquatic life
Water Quality Maintenance Functions:		
Water Cooling	The effectiveness for maintaining or reducing temperature of downslope waters.	Support cold water fish and other aquatic life
Sediment Retention and Stabilization	The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting excessive erosion, and stabilizing underlying sediments or soil	Maintain quality of receiving waters. Protect shoreline structures from erosion
Phosphorous Retention	The effectiveness for retaining phosphorus for long periods (> 1 growing season)	Maintain quality of receiving waters
Nitrate Removal and Retention	The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonium to nitrogen gas while generating little or no nitrous oxide (a potent greenhouse gas).	Maintain quality of receiving waters
Organic Nutrient Transport	The effectiveness for producing and subsequently exporting organic nutrients (mainly carbon), either particulate or dissolved.	Support food chains in receiving waters
Ecological (Habitat) Functions:		
Fish Habitat	The capacity to support an abundance and diversity of native fish (both anadromous and resident species)	Support recreational and ecological values
Aquatic Invertebrate Habitat	The capacity to support or contribute to an abundance or diversity of invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, clams, snails, water beetles, shrimp, aquatic worms, and others.	Support salmon and other aquatic life Maintain regional biodiversity

Function	Definition	Potential Benefits
Amphibian and Reptile Habitat	The capacity to support or contribute to an abundance or diversity of native frogs, toads, salamanders, and turtles.	Maintain regional biodiversity
Waterbird Feeding Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that migrate or winter but do not breed in the region.	Support hunting and ecological values Maintain regional biodiversity
Waterbird Nesting Habitat	The capacity to support or contribute to an abundance or diversity of waterbirds that nest in the region.	Maintain regional biodiversity
Songbird, Raptor, and Mammal Habitat	The capacity to support or contribute to an abundance or diversity of native songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water	Maintain regional biodiversity
Native Plant Habitat and Pollinator Habitat	The capacity to support or contribute to a diversity of native, hydrophytic, vascular plant species, communities, and/or functional groups, as well as the pollinating insects linked to them	Maintain regional biodiversity and food chains
Public Use and Recognition*	Prior designation of the wetland, by a natural resource or environmental agency, as some type of special protected area. Also, the potential and actual use of a wetland for low-intensity outdoor recreation, education, or research.	Commercial and social benefits of recreation. Protection of public investments

A WESP-AC functional assessment was performed on WL1 and WL2 by Dillon biologists on August 22, 2022, the results of which are presented below in **Table 4.5.4** and **Table 4.5.5**.

Overall, WL1 was rated as having a wetland condition of “Lower” and WL2 was rated as having a wetland condition of “Moderate.” Both wetlands rated as “Higher” for wetland stressors. Overall, functions were typically rated as “Lower” or “Moderate,” with only a few “Higher” ratings. Compared to the normalized function score, the normalized benefits score is calculated independently of the function score and describes the context in which the certain function is being performed and it is currently associated with current land uses. As defined by NBDELG (2018) in the manual for *Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC): Non-tidal Wetlands*, wetland ecosystem condition is the health and integrity of the wetland. For the purposes of WESP-AC, this is measured primarily by the wetlands vegetation, as that is the only meaningful indicator of wetland ecosystem health that can be assessed rapidly.

Table 4.5.4: Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC) Results for WL1

Wetland Functions or Other Attributes:	Function Score (Normalized)	Function Rating	Benefits Score (Normalized)	Benefits Rating
Water Storage and Delay (WS)	2.35	Lower	3.77	Moderate
Stream Flow Support (SFS)	1.20	Lower	0.00	Lower
Water Cooling (WC)	5.10	Moderate	1.44	Lower
Sediment Retention and Stabilization (SR)	1.92	Moderate	2.34	Lower
Phosphorus Retention (PR)	0.95	Lower	3.32	Moderate
Nitrate Removal and Retention (NR)	2.07	Lower	5.50	Moderate
Carbon Sequestration (CS)	0.85	Lower		
Organic Nutrient Export (OE)	3.05	Lower		
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower
Aquatic Invertebrate Habitat (INV)	2.19	Lower	4.53	Moderate
Amphibian and Turtle Habitat (AM)	7.61	Higher	3.35	Moderate
Waterbird Feeding Habitat (WBF)	6.09	Moderate	6.67	Moderate
Waterbird Nesting Habitat (WBN)	5.74	Higher	2.50	Moderate
Songbird, Raptor, and Mammal Habitat (SBM)	6.08	Moderate	2.50	Lower
Pollinator Habitat (POL)	6.93	Moderate	0.00	Lower
Native Plant Habitat (PH)	0.00	Lower	4.08	Moderate
Public Use and Recognition (PU)			3.39	Moderate
Wetland Sensitivity (Sens)			3.24	Moderate
Wetland Ecological Condition (EC)			0.00	Lower
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher
Summary Ratings for Grouped Functions:				
HYDROLOGIC Group (WS)	2.35	Lower	3.77	Moderate
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	1.76	Lower	4.61	Moderate
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	3.99	Moderate	3.26	Moderate
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	5.75	Moderate	4.59	Moderate
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	5.63	Moderate	3.14	Moderate
WETLAND CONDITION (EC)			0.00	Lower
WETLAND RISK (average of Sensitivity & Stressors)			6.62	Higher

Table 4.5.5: Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC) Results for WL2

Wetland Functions or Other Attributes:	Function Score (Normalized)	Function Rating	Benefits Score (Normalized)	Benefits Rating
Water Storage and Delay (WS)	6.29	Higher	3.77	Moderate
Stream Flow Support (SFS)	0.00	Lower	0.00	Lower
Water Cooling (WC)	2.38	Moderate	0.00	Lower
Sediment Retention and Stabilization (SR)	10.00	Higher	2.55	Lower
Phosphorus Retention (PR)	10.00	Higher	3.32	Moderate
Nitrate Removal and Retention (NR)	10.00	Higher	6.25	Moderate
Carbon Sequestration (CS)	1.55	Lower		
Organic Nutrient Export (OE)	0.49	Lower		
Anadromous Fish Habitat (FA)	0.00	Lower	0.00	Lower
Resident Fish Habitat (FR)	0.00	Lower	0.00	Lower
Aquatic Invertebrate Habitat (INV)	0.98	Lower	3.89	Moderate
Amphibian and Turtle Habitat (AM)	9.15	Higher	2.31	Moderate
Waterbird Feeding Habitat (WBF)	5.04	Moderate	6.67	Moderate
Waterbird Nesting Habitat (WBN)	4.61	Moderate	2.50	Moderate
Songbird, Raptor, and Mammal Habitat (SBM)	4.78	Moderate	2.50	Lower
Pollinator Habitat (POL)	3.47	Moderate	0.00	Lower
Native Plant Habitat (PH)	0.25	Lower	2.60	Moderate
Public Use and Recognition (PU)			3.31	Moderate
Wetland Sensitivity (Sens)			4.15	Moderate
Wetland Ecological Condition (EC)			3.49	Moderate
Wetland Stressors (STR) (higher score means more stress)			10.00	Higher
Summary Ratings for Grouped Functions:				
HYDROLOGIC Group (WS)	6.29	Higher	3.77	Moderate
WATER QUALITY SUPPORT Group (max+avg/2 of SR, PR, NR, CS)	8.94	Higher	5.14	Moderate
AQUATIC SUPPORT Group (max+avg/2 of SFS, INV, OE, WC)	1.67	Lower	2.59	Moderate
AQUATIC HABITAT Group (max+avg/2 of FA, FR, AM, WBF, WBN)	6.45	Higher	4.48	Moderate
TRANSITION HABITAT Group (max+avg/2 of SBM, PH, POL)	3.81	Lower	2.15	Moderate
WETLAND CONDITION (EC)			3.49	Moderate
WETLAND RISK (average of Sensitivity & Stressors)			7.07	Higher

4.5.3.2 Wetland and Upland Vegetation Communities

In addition to the characterization of wetland vegetation communities during wetland delineations, upland vascular vegetation communities were inventoried by a Dillon biologist skilled in the identification of common and rare plant species in New Brunswick. The vascular plant inventory for the PDA and the subject property was completed during site visit on August 22, 2022. Refer to the master plant species lists for the site provided in **Appendix F**.

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

The potential environmental effects of the Project on vegetation and wetlands are assessed in this section.

4.5.4.1 Potential Interactions

The Project is expected to interact with vegetation and wetlands throughout the construction phase. There is no anticipated direct wetland loss associated with the Project since they are all located outside footprint of the WWTS and related infrastructure within the PDA; however, construction activity may occur within the 30 m buffer for WL2, thereby requiring a WAWA permit.

The primary possible effects to wetlands includes indirect loss of wetland function for those wetlands adjacent to the PDA that could be subjected to sedimentation or changes in surface hydrology during Project activities such as site preparation and construction of infrastructure, access roads, and piping to connect the new WWTS to the existing storage tanks. As currently proposed, no wetlands overlap with the PDA; therefore, direct wetland impacts are not anticipated to the wetlands; however, the PDA extends into the 30 m buffer of WL2. For wetland data sheets, refer to **Appendix E**.

The primary possible effect to vegetation includes the direct loss of vegetation communities through site preparation and construction of infrastructure, access roads, and piping to connect the new WWTS to the existing storage tanks. There are no interactions expected between the Project and vegetation and wetlands during the operation phase.

4.5.4.2 Mitigation

Mitigation is identified in relation to the interactions or effects of the Project to vegetation and wetlands in an attempt to prevent the interaction from occurring, if possible, or to reduce the severity, magnitude, geographic extent, frequency, or duration of the interaction. Best management practices (based on industry guidelines and regulatory guidance documents) have been identified as appropriate mitigative strategies. In addition, several acts, codes, regulations, and guidelines may require appropriate actions to be conducted as mitigative measures prior to or during the interaction. The following mitigation will be implemented as part of the Project:

- Minimize the area to be disturbed by the Project to the extent possible while accomplishing the Project objectives;
- Reduce vegetation removal to that necessary to accomplish the Project objectives;
- Design surface water drainage to minimize changes in hydrological regimes on the subject property;
- Obtain a watercourse and wetland alteration (WAWA) permit from NBDELG prior to beginning work within 30 m of the wetlands adjacent to the PDA;
  - Construction activities comply with all conditions of the WAWA;
- Install proper erosion and sediment control (ESC) measures (i.e., check dams, silt fences) where appropriate to minimize potential effects to the adjacent wetland;
  - Check ESC measures regularly throughout Project activities and prior to and after any storm events to confirm they are continuing to operate properly;
  - Avoid stockpiling and soil within 30 m of the wetlands on the subject property;
- Properly clean all construction equipment prior to mobilizing to and from site (known invasive species on site) to avoid introduction and spread of invasive species;
- Properly label chemical storage containers and retain safety data sheets (SDS) on-site for chemicals stored on-site to reduce the likelihood for accidents or spills;
  - When necessary, employ secondary containment containers and spill prevention measures;
- Limit vegetation removal to outside of April 8-August 28 to avoid disturbing nesting birds;
  - Obtain relevant SAR permits, if necessary.

4.5.4.3 Characterization of Potential Interactions Following Mitigation

During construction activities, it is anticipated that there will be indirect loss or alterations to wetlands and wetland functions within the subject property.

WL1 is located on the property line between the subject property and the Irving Big Stop gas station located next door. The section of the wetland on the subject property is highly disturbed and the ecological function of the assessed area of the wetland is rated as “Lower”; however, the wetland is hydrologically connected to the large forested wetland complex north of the subject property. There are not anticipated to be any direct impacts to WL1, but there is the potential for indirect impacts to WL1 through sedimentation, alteration of hydrological regimes surrounding the wetland, and introduction of invasive plant species. Although there are anticipated potential impacts to WL1, they are expected to be low magnitude, short-term, and local in geographic extent.

WL2 is hydrologically independent of WL1 and is not connected to any watercourses, except for the possibility during heavy rain events and the spring freshet, where it might spill into WL1. It is likely seasonally drained during most summer months. In addition, WL1 may be a relatively new wetland or a newly disturbed wetland, following the clear-cutting and grubbing of the subject property several years ago. The ecological function of WL2 is rated as “Moderate”; however, the wetland is highly-disturbed. There are not anticipated to be any direct impacts to WL2, but there is the potential for indirect impacts to WL2 through sedimentation, alteration of hydrological regimes surrounding the wetland, and

introduction of invasive plant species. Although there are anticipated potential impacts to WL2, they are expected to be low magnitude, short-term, and local in geographic extent.

During construction, there is the possibility of interaction with vegetation within the PDA; however, the site was already cleared and grubbed several years ago. In addition, no SAR or SOCC were observed on-site by biologists during the August 2022 site visit. Lastly, there were no SAR or SOCC historically recorded by AC CDC within the PDA; therefore, impacts to vegetation within the PDA are expected to be restricted to the PDA, short-term, and negligible in magnitude.

4.5.5 Summary

During the construction phase of the Project, alterations to the PDA are required to complete the Project. These activities have the potential to result in direct vegetation removal, as well as indirect impacts to the wetlands on the subject property via sedimentation, invasive species spread, etc. With the above proposed mitigation measures, impacts to vegetation and wetlands as a result of Project activities are not expected to be substantive.

4.6 Wildlife and Wildlife Habitat

The potential environmental interactions between the Project and wildlife (including SAR and birds) and wildlife habitat are assessed in the subsections below.

4.6.1 Scope of VC

Wildlife and wildlife habitat includes wildlife (fauna) and the habitats that support wildlife species. This valued component (VC) is focused 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 PDA supports terrestrial wildlife and wildlife are important to the public for the biodiversity they support. Species at risk (SAR) and species of conservation concern (SOCC) are of particular focus in this assessment because they 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 are protected under the *Migratory Birds Convention Act* (MBCA).

The wildlife and wildlife habitat VC has connections to the vegetation and wetlands VC (**Section 4.5**) 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 4.5**.

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]).

4.6.2 Existing Conditions

Information regarding the use of the PDA by wildlife and presence and characterization of wildlife habitat was derived from several desktop information sources including existing databases and secondary information sources, as well as incidental recordings of wildlife species evidence recorded during wetland and vegetation surveys.

To provide information on potential occurrences of rare and endangered wildlife, and unique or sensitive wildlife habitats potentially existing within the PDA, a review of the following existing data and information sources was conducted:

- Listed species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC);
- Listed species under the federal SARA;
- Listed species under NB SARA; and
- Canada's General Status of Wild Species (CESCC 2022).

As part of the desktop assessment, a site-specific AC CDC report (AC CDC 2022a) was obtained for a 5 km radius from the Project location (refer to **Appendix C**). The report provided recorded historical observations of SAR/SOCC flora and fauna species, as well as identified environmentally sensitive or managed areas within 5 km of the PDA. Wildlife SOCC identified as Extremely Rare (S1), Rare (S2), or Uncommon (S3) are also identified.

Other available background information sources and mapping reviewed to identify and assess wildlife and wildlife habitat presence near the Project 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 (PNAs) and Wildlife Management Zones (WMZ).

Incidental observations conducted during wetland and vegetation survey efforts were used to collect information on the presence of wildlife within the PDA, with an emphasis on SAR/SOCC.

4.6.2.1 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 MBCA is the federal law which protects migratory birds in Canada (with similar legislation in the United States). The MBCA prohibits the killing, injuring, or harassing of migratory birds, their nests, or their young. Migratory birds that are protected under the MCBA 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 nests, 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.

According to the *General Status of Species in Canada* (CESCC 2021), there are 400 extant bird species known to occur in New Brunswick. Of the species that regularly occur in the province during at least part their lifecycle, 43 are considered “critically imperiled”, 29 are listed as “imperiled”, and 44 are listed as “vulnerable”.

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 PDA lies within Region 7 Carleton – Victoria in Square 19FM02: Jacksontown. During the MBBA period of 2006-2010, a total of 97 species of birds were recorded within Square 19FM02. Of these species, 24 were confirmed as breeding, 10 were probable breeders, and 63 were possible breeders. There were 11 SAR, 30 SOCC, and seven exotic species detected during the most recent MBBA period in this square (**Table 4.6.1**).

Table 4.6.1: Species at Risk, Species of Conservation Concern, and Exotic Species found in the MBBA Second Atlas (2006-2010; Stewart et al. 2015)

Species		
Bald Eagle	Northern Shoveler	Lincoln's Sparrow
Common Nighthawk	Black-crowned Night-heron	Scarlet Tanager
Chimney Swift	Red-shouldered Hawk	Rose-breasted Grosbeak
Olive-sided Flycatcher	Killdeer	Indigo Bunting
Eastern Wood-Pewee	Spotted Sandpiper	Brown-headed Cowbird
Bank Swallow	Solitary Sandpiper	Baltimore Oriole
Barn Swallow	Wilson's Snipe	Pine Grosbeak
Canada Warbler	Black-billed Cuckoo	Red Crossbill
Bobolink	American Three-toed Woodpecker	Pine Siskin
Rusty Blackbird	Black-backed Woodpecker	Ring-necked Pheasant
Evening Grosbeak	Boreal Chickadee	Rock Pigeon
Willow flycatcher	Northern Mockingbird	Yellow-billed Cuckoo
Great-crested Flycatcher	Brown Thrasher	European Starling
Eastern Kingbird	Cape May Warbler	Yellow-breasted Chat**
Warbling Vireo	Blackpoll Warbler	House Finch
Purple Martin	Cliff Swallow	House Sparrow

Notes:
Blue = SAR
White = SOCC
Green= Exotic
** = considered an accidental observation

Important Bird Areas

The nearest IBA is the Lower Saint John River (Sheffield/Jemseg) site (NB010). This IBA includes a 25 kilometre (km) stretch of the Wolastoq (Saint John River), extending from 5 km northeast of Oromocto to 25 km east of Oromocto, and includes the Portobello National Wildlife Area, Gilbert Island, French Lake, Big Timber Lake, Grand Lake Meadows, and the southern extent of Grand Lake (Birds Canada n.d.). The extensive spring flooding of the Saint John River has created Atlantic Canada's larger wetland complex here (Birds Canada n.d.). The Project is located over 85 km from the IBA, and there is no similar habitat present surrounding the Project.

AC CDC Data Review

A review of the AC CDC data as compiled in a site-specific report (AC CDC 2022a) indicated that there were 100 records of 33 vertebrate SAR or SOCC historically observed within 5 km of the PDA, all of these being avian species. Of these avian species, nine are considered SAR, and the remainder are considered SOCC. The nine avian SAR include one "location sensitive" bird species (Bald Eagle [*Haliaeetus leucocephalus*]) which intersects with the PDA (AC CDC 2022a). The SAR bird species identified by the AC CDC as having been historically observed within 5 km of the Project site, as well as their habitat requirements and potential to occur within the region, are discussed in **Table 4.6.2** below. The SAR bird species identified by the AC CDC as having been historically observed within 5 km of the PDA are also shown in **Figure 4.6.1**. SOCC lists are provided in the AC CDC report provided in **Appendix C**.

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 bird species covered under the MCBA are likely to breed. The Project is located in Nesting Zone C3, where most migratory birds breed from mid-April to late August each year (specifically April 8-August 28 for Nesting Zone C3; ECCC 2018); however, it is noted that some avian species nest outside of this window, including corvids, crossbills, owls, and waxwings.

Incidental observations of birds recorded during 2022 field surveys are listed below:

- American Crow – direct observation; and
- Osprey (*Pandion haliaetus*) – direct observation.

Table 4.6.2: Bird Species at Risk Historically Observed within 5 km of the PDA (AC CDC 2022a)

Species	Status	Breeding Habitat	Potential to Occur in PDA
Bald Eagle (*Haliaeetus leucocephalus*)	**COSEWIC:** Not at Risk **SARA:** Not listed NB SARA: Endangered AC CDC S-Rank: S4	Bald Eagles typically nest in large, tall conifers near or adjacent a body of water. They will often re-use nest sites year-after-year.	This species is most likely to be found nesting along the Saint John River, but there is no good nesting or foraging habitat for Bald Eagles within the PDA.
Olive-sided Flycatcher (*Contopus cooperi*)	**COSEWIC:** Special Concern **SARA:** Threatened (under consideration for status change) **NB SARA**: Threatened **AC CDC S-Rank:** S3B	Typically breeds in coniferous edges and open areas with perches (e.g., forest openings near waterbodies, wetlands and clear-cuts) (COSEWIC 2018a).	This species has the potential to nest/breed within the area surrounding the PDA as it contains a stand of coniferous forest with openings.
Barn Swallow (*Hirundo rustica*)	**COSEWIC:** Special Concern **SARA:** Threatened NB SARA: Threatened AC CDC S-Rank: S2B	Barn Swallows typically nest on human-made structures such as abandoned buildings or barns and forages in open areas (COSEWIC 2021a).	Species has the potential to be found within or near the PDA, nesting on human-made structures.
Eastern Wood-pewee (*Contopus virens*)	**COSEWIC:** Special Concern **SARA:** Special Concern **NB SARA**: Special Concern **AC CDC S-Rank:** S3B	Most often associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation. During migration, a variety of habitats are used, including forest edges and early successional clearings (COSEWIC 2012).	This species may nest and forage near the PDA along the edges of the forest.
Canada Warbler (*Cardellina canadensis*)	**COSEWIC:** Special Concern **SARA:** Threatened (under consideration for status change) **NB SARA:** Threatened AC CDC S-Rank: S3S4B	The Canada Warbler prefers wet, mixed deciduous and coniferous forests with a well-developed shrub layer for breeding, but also uses riparian shrub forest on slopes, as well as regenerating stands after a disturbance (COSEWIC 2020).	There are little to no wet or riparian forests within the PDA suitable for Canada Warbler; however, they may inhabit the wetland complex near the PDA.

Species	Status	Breeding Habitat	Potential to Occur in PDA
Bank Swallow (*Riparia riparia*)	COSEWIC: Threatened **SARA**: Threatened NB SARA: Pending AC CDC S-Rank: S2B	Bank Swallows breed in a variety of vertical habitats, both natural and artificial, including riverbanks, aggregate pits, road cuts, and soil stock piles (COSEWIC 2013).	Bank Swallows have the potential to nest within the banks of the Saint John River, but also within the substrate berms within the PDA adjacent to the parking areas, though these are not fine material and they are likely not steep enough to be preferred by Bank Swallow.
Yellow-breasted Chat (*Icteria virens*)	**COSEWIC:** Endangered **SARA:** Endangered **NB SARA:** Accidental AC CDC S-Rank: SNA	Though the Yellow-breasted Chat is listed as Endangered under SARA and COSEWIC, it is recognized as an accidental sighting in NB and is therefore not considered further in this assessment.	
Chimney Swift (*Chaetura pelagica*)	COSEWIC: Threatened **SARA**: Threatened NB SARA: Threatened AC CDC S-Rank: S2S3B, S2M	Historically, the Chimney Swift used mainly large hollow trees for nesting sites, but have adopted chimneys as preferred nesting sites. They are generally associated with urban and rural areas where chimneys are available for nesting and roosting. They are aerial insectivores and tend to concentrate near water where insects are abundant (COSEWIC 2018b).	Species has the potential to be found within or near the PDA, nesting on or within human-made structures.
Bobolink (*Dolichonyx oryzivorous*)	**COSEWIC:** Special Concern **SARA**: Threatened NB SARA: Threatened AC CDC S-Rank: S3B	Typically nest in lush meadows, open grasslands, and hayfields (COSEWIC 2010).	Unlikely to be found in the PDA as there is no meadow or grassland habitat.

Notes:

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 rank range used to indicate any range of uncertainty about the status of the species or community; B: breeding, N: non-breeding; M: migratory; SNA: not applicable – usually means an exotic species that is not a good target for conservation efforts. (AC CDC 2022b)

COVERED BRIDGE POTATO CHIP COMPANY EIA

FIGURE 4.6.1

HISTORICAL WILDLIFE OBSERVATIONS WITHIN 5KM OF THE PDA (AC CDC 2022A)

- Species At Risk Bird
- Species At Risk Invertebrate
- Species Of Conservation Concern Bird
- Species Of Conservation Concern Invertebrate
- Street
- Highway
- Watercourse
- Waterbody
- Wetland (NBDELG
- Subject Property

SCALE 1:34,000

0 0.250.5 1 Kilometers

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_HistoricalWildlife_within5kmPDA.mxd

4.6.2.2 Mammals (Including Bats)

Canada's *General Status of Wild Species* (CESCC 2022) reports that there are 54 extant species of mammals recognized to occur within New Brunswick, and an additional three which are presumed extinct. Of these 54 species, Canada lynx (*Lynx canadensis*) is listed as Endangered under NB SARA, Gaspé shrew (*Sorex gaspensis*) is listed as Special Concern under Schedule 3 of SARA, and three bat species are listed as Endangered under 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*).

A review of the AC CDC report (AC CDC 2022a) indicated that there have been no historical observations of any mammalian SAR or SOCC within 5 km of the PDA, and that no bat hibernacula have been reported to have been historically observed within 5 km of the PDA. The PDA does not provide suitable deer wintering habitat due to the limited amount of canopy cover throughout most of the property.

Incidental observations of mammals recorded during 2022 field surveys are listed below:

- Moose (*Alces alces*) – tracks; and
- White-tailed deer (*Odocoileus virginianus*) – tracks. Invertebrates

A review of the AC CDC data report (AC CDC 2022a) indicated that there were five records of four invertebrate SAR or SOCC historically observed within 5 km of the PDA. Of these species, two are considered SAR, and two are considered SOCC. The two SAR include one "location sensitive" beetle species (cobblestone tiger beetle; *Cicindela marginipennisi*) which has been found within 5 km of the PDA (AC CDC 2022a), as well as the monarch butterfly (*Danaus plexippus*). The two SAR invertebrate species identified by the AC CDC as having been historically observed within 5 km of the PDA, as well as their habitat requirements and potential to occur within the region, are discussed in **Table 4.6.3** below. SOCC lists are provided in the AC CDC report in **Appendix C**.

Table 4.6.3: Invertebrate Species at Risk Historically Observed within 5 km of the PDA (AC CDC 2022a)

Species	Status	Breeding Habitat	Potential to Occur in PDA?
Monarch (*Danaus plexippus*)	**COSEWIC:** Endangered **SARA:** Special Concern (under consideration for status change) **NB SARA**: Special Concern **AC CDC S-Rank:** S2S3B	Although adult monarchs typically breed in southern United States or Mexico, while they are in Canada, they feed solely on milkweed plants, and lay their eggs on the underside of milkweed leaves (COSEWIC 2016).	This species may nest within or near the Project footprint if milkweed plants are available. No milkweed plants were observed during August 2022 site visit, but there is potential for them to occur on the site.

Species	Status	Breeding Habitat	Potential to Occur in PDA?
Cobblestone tiger beetle (*Cicindela marginipennisi*)	**COSEWIC:** Special Concern **SARA:** Endangered (under consideration for status change) **NB SARA**: Endangered **AC CDC S-Rank:** S2S3	This species is endemic to New Brunswick and is limited to three isolated geographic populations in Grand Lake, Saint John River, and Southwest Miramichi River. The beetle prefers sparsely vegetated cobble and sand beaches (COSEWIC 2021b).	This species is limited to cobble and sand within rivers and lakes, and is not anticipated to be found within the PDA.

Notes:
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 rank range used to indicate any range of uncertainty about the status of the species or community; B: breeding, N: non-breeding; M: migratory; SNA: not applicable – usually means an exotic species that is not a good target for conservation efforts (AC CDC 2022b).

4.6.2.3 Herptiles

Canada's *General Status of Wild Species* database (CESCC 2022) reports that there are 7 reptile and 16 amphibian species known to occur in New Brunswick. Of these species, one (wood turtle [*Glyptemys insculpta*]) is considered to be At Risk, and one (dusky salamander [*Desmognathus fuscus*]) is considered to be Sensitive. Both SARA and NB SARA list the wood turtle as Threatened and the snapping turtle (*Chelydra serpentine*) as Special Concern, so they are considered SAR.

A review of the AC CDC report (AC CDC 2022a) indicated that there were no records of historical observations of wood turtle or snapping turtle within 5 km of the Project. A targeted field survey to identify if herptiles are present was not conducted as part of this assessment. Given that turtles generally favour waterbodies and watercourses, and there are none within 400 m of the PDA (**Figure** 4.6.2), it is not suitable habitat for snapping or wood turtles. If any are observed during Project phases and activities, work will be stopped and a mitigation plan will be developed.

4.6.2.4 Environmentally Sensitive Areas

The site-specific AC CDC report (AC CDC 2022a) report provides a list of environmentally-sensitive or managed areas within 5 km of the PDA. The report indicated that there are three biologically significant areas and one managed area within 5 km of the Project:

- Upper Becaguimec Island Environmentally Sensitive Area (ESA);
- Middle Becaguimec Island ESA;
- Somerville ESA; and
- Arthur Kyle Nature Preserve (refer to **Figure 4.6.3**; AC CDC 2022a).

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

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FIGURE 4.6.2

WATERCOURSES AND WATERBODIES IN THE VICINITY OF PDA

- Street
- Highway
- Watercourse
- Waterbody
- Wetland (NBDELG 2022c)
- Delineated Wetland
- Subject Property

SCALE 1:4,000

0 30 60 120 Meters

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

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PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

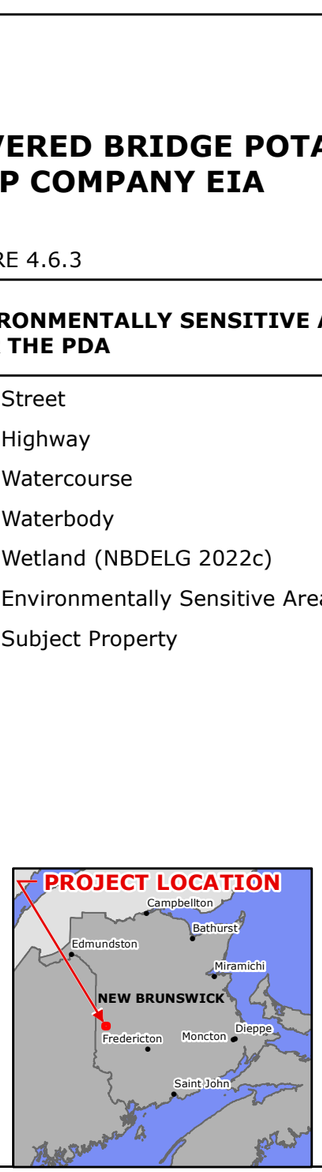
FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_WatercourseAndWaterbodies.mxd

COVERED BRIDGE POTATO CHIP COMPANY EIA

FIGURE 4.6.3

ENVIRONMENTALLY SENSITIVE AREAS NEAR THE PDA

- Street
- Highway
- Watercourse
- Waterbody
- Wetland (NBDELG 2022c)
- Environmentally Sensitive Area
- Subject Property



SCALE 1:15,000

0 125 250 500 Meters

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MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: JH
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
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Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_EnviromentallySensitiveAreas.mxd

There are no provincially identified deer wintering areas (DWAs) or protected natural areas (PNAs) within 5 km of the Project (NBDELG 2017). The PDA does not provide identified unique or limited habitat and is not located within a defined ESA or other provincially regulated or protected area.

4.6.3 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 PDA were compared to the range of environmental conditions within the PDA to determine if suitable habitat was present for these taxa. Knowledge of the habitats present within the PDA was determined through an interpretation of aerial photography, topographic, and geological mapping and confirmed on-the-ground during field visits. In instances where appropriate habitat was present for a particular species, that taxon was considered to be potentially present at the PDA, mitigation was identified, and potential impacts were assessed.

4.6.3.1 Potential Interactions

Project activities such as heavy equipment operation have the potential to interact with wildlife and wildlife habitat during the construction phase of the Project. Potential interactions on wildlife or their habitats include direct mortality, habitat loss and fragmentation, and sensory disturbance. There are no impacts anticipated during the operation phase. The potential interactions are discussed in the following subsections.

Migratory Birds

The primary possible interactions with birds due to the Project activities 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 construction activities;
- Alteration of habitat for bird SAR or SOCC or migratory bird stopover sites;
- Sensory disturbances deterring birds from migrating into and using the PDA; and
- Sensory disturbances from Project resulting 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, temporarily causing loss of immature vegetation that provides habitat for wildlife;
- Disturbance from vehicles and heavy equipment causing wildlife avoidance or disruption of wildlife activities (such as breeding and/or feeding);

- Sensory disturbance from noise, vibration, dust, and fuel emissions may causing a disruption to wildlife species;
- Direct injury or death of wildlife, particularly to small wildlife such as rodents and shrews, through collisions or destruction of dens and food sources;
- 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 and Invertebrates

Although there is no suitable habitat for herptiles on the PDA, the Project may interact with herptiles and their habitat (in the unlikely event they are present) through direct mortality via collision with various equipment required around the site during the construction phase of the Project or loss of wetland habitat (area or function) within the PDA. Similar interactions are expected for invertebrates.

4.6.3.2 Mitigation

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

- Limit the size of the Project footprint at all phases of work to that necessary to accomplish the Project purpose;
- Retain vegetation where possible to maintain any local wildlife habitat, though the forest where the PDA is located has already been clear-cut;
- Schedule activities that may harm or harass migratory birds outside of the normal migratory bird breeding season (April 8-August 28) to the extent possible to ensure that nesting activity is not disturbed and that eggs and flightless young are not inadvertently harassed or destroyed;
    - Undertake nest searches by a qualified biologist and implement avoidance setbacks around active nests if complete avoidance of these activities during the specified timeframe is not feasible;
- Preferentially use existing infrastructure and previously disturbed areas (e.g., parking lots, clear-cut areas) where feasible to reduce ground disturbance;
- Clean machinery and equipment prior to entering the site to limit the potential spread of exotic or invasive plant species;
- Train on-site workers and provide reference material that will help them identify bird species that could be attracted to habitats created by Project activities such as Bank Swallow (*Riparia riparia*);
- Establish a plan to contact a biologist if workers encounter birds that they suspect may be nesting within the PDA, to determine whether nesting is occurring and to locate the nest;
- Avoid flagging of nests to minimize chances of predation;

- Contact a Species at Risk biologist at NBDNRED at (506) 453-5873 if a SAR is encountered, to discuss immediate actions and future mitigation;
- Limit the Project construction activities to daylight hours to minimize disruptions with wildlife activity at night;
  - 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;
- Contact a license Nuisance Wildlife Control Officer or a licensed trapper to remove any nuisance wildlife identified as disrupting Project-related activities, pursuant to the *Nuisance Wildlife Regulation* (97-141) of the New Brunswick *Fish and Wildlife Act*;
- Implement the following, in case of wildlife encounters:
  - No attempt will be made by any worker 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.

4.6.3.3 Characterization of Potential Interactions Following Mitigation

Project activities should not results in the significant loss of wildlife habitat, as this Project is to be completed on an already clear-cut site that has already been infilled; with the exception of the impact to the wetland habitats, which were discussed in **Section 4.5.3.2**. It may interact with wildlife through sensory disturbances such as noise, vibration, or light, or by increased heavy machinery in the PDA during the construction phase. There is already likely substantive noise emissions in the area from the adjacent four-lane Trans-Canada Highway, and agriculture and other businesses in the immediate area, so there is not expected to be a significant increase in noise levels interacting with wildlife compared to existing levels.

The PDA is located behind the Factory in a general area that includes the Trans-Canada Highway, a distillery, a gas station, two fast food restaurants, and agriculture (mainly potatoes). The land within the PDA has already been cleared and grubbed so there will be no to minimal removal of tree, shrub or herbaceous species for construction.

The land to the northwest of the PDA is forested with a large wetland complex where there are likely healthy populations of most New Brunswick forest species and is likely home to the moose and deer whose tracks were found during the field visit. These large mammals likely travel between the forested area and the agricultural fields south of the PDA, but the PDA itself does not provide food or shelter for these animals.

Northern leopard frogs were found using the wetland environment as habitat. With any indirect impacts to the wetland, the habitat will no longer be present for these species; however, Northern leopard frogs are considered secure in both Canada and New Brunswick, and there is ample wetland habitat in the vicinity of the Project, so this is not expected to be a significant impact.

Because the PDA has previously been clear-cut and infilled, and the implementation of the mitigation measures outlined in **Section 4.6.3.2**, substantive interactions between the Project and wildlife and wildlife habitat are not anticipated.

4.6.4 Summary

Assuming the proper and adequate implementation of the mitigation measure described in **Section 4.6.3.2**, the potential residual interactions between the Project and wildlife and wildlife habitat are not expected to be substantive.

4.7 Socioeconomic Environment

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

4.7.1 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, local businesses, non-governmental organizations (NGOs), 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 VC in recognition of these concerns and values of New Brunswick residents. The main components of the socioeconomic environment, in relation to this assessment, are defined as follows:

- **Land and Resource Use** refers to current and future uses of public and private land and resources. It includes uses such as industrial, commercial, and residential use, property ownership (including potential nuisance effects), and the use of land and resources for recreational purposes, among others; and
- **Employment and Economy** refers to the labour market and availability, employment, employment income, business income, and their aggregate influence on the local, regional, and provincial economies.

The scope of the socioeconomic environment VC includes potential interactions of the Project with residential, industrial, recreation, and transportation land uses; and the employment and economic conditions that may change as a result of the Project, including anticipated potential changes upon commissioning the new WWTS. 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.

4.7.2 Existing Conditions

Existing socioeconomic conditions within the local Project area are discussed in this section.

4.7.2.1 Resource and Land Use

Local Government Structure

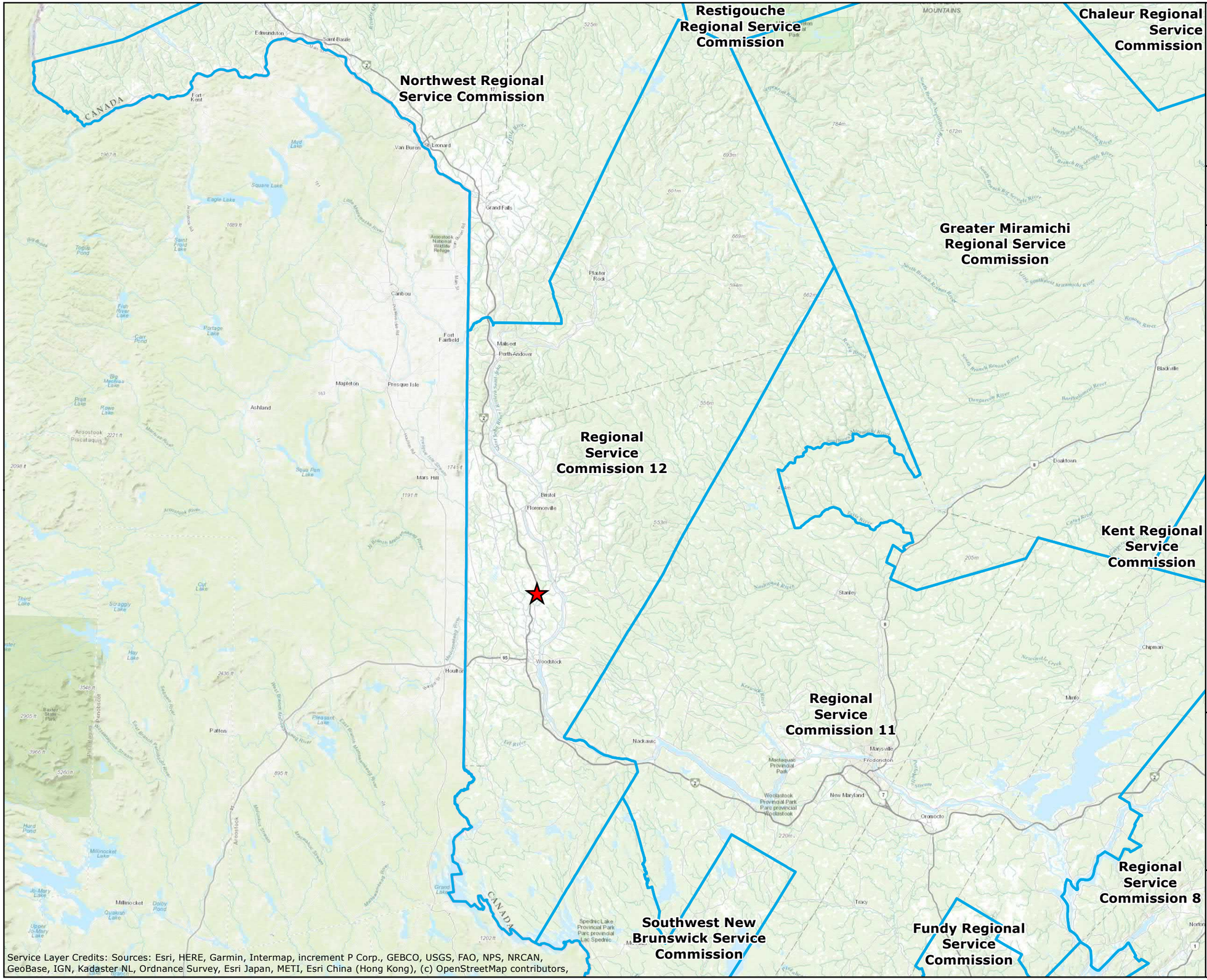
There are twelve service regions in New Brunswick directed by Regional Service Commissions (RSCs) formed under the New Brunswick *Community Planning Act* that are responsible for the delivery of local land use planning, solid waste management, and sports and recreation services. The RSCs govern 89 entities, which have been restructured from Local Service Districts (LSDs), which existed prior to the initiation of recent local governance reform.

The Province of New Brunswick completed local governance reform on January 1, 2023. The reforms sought to strategically restructure the province's local entities (i.e., cities, towns, villages, rural communities, and regional municipalities) to promote sustainable, vibrant communities which meet the current and future needs of New Brunswick residents. By restructuring the boundaries of existing entities, local governance reform was intended to ensure that all New Brunswick residents have access to local government representation and high-quality municipal services. This process involved restructuring 340 former entities into 89 entities, forming 77 local governments and 12 rural districts. Previously, New Brunswick had 208 entities with fewer than 1,000 people.

The PDA falls within the boundaries of the restructured town of Hartland. Hartland is located in the Western Valley Regional Service Commission (RSC 12; **Figure 4.7.1**), which is comprised of six entities. These include the Municipality of Lakeland Ridges, Woodstock, Hartland, District of Carleton North, Regional Community of Southern Victoria, and the District of Tobique Valley. Hartland has a hybrid council with one mayor, six councillors and three wards; the PDA is located in Ward 1. Municipal elections are held every four years in November, as directed by the New Brunswick *Municipal Elections Act*. The most recent municipal election took place in November 2022, which was the first election to take place under the local governance reform. The Municipal Council is supported by various departments including Public Works, Recreation, Police, Fire, and Tourism. Additional services are provided by the Western Valley Regional Services Commission.

Residential Land Use

Residential use within the area surrounding the PDA is minimal. There are residences along Estey Road, with the closest being 1.25 km from the PDA. Residences are also positioned along Wilmot Road, west of the Project site by roughly 2 km at the nearest point. The closest residences are along Route 590, 914 m from the PDA, located east across the Trans-Canada Highway. Residential uses are located in Waterville, and the community of Somerville, located approximately 1.4 km and 3 km from the PDA, respectively. The centre of Hartland, which has the largest and most dense collections of residences within the vicinity of the PDA, is located across the Wolastoq (Saint John River), approximately 4.5 km east.



Service Layer Credits: Sources: 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), (c) OpenStreetMap contributors,

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FIGURE 4.7.1

REGIONAL SERVICE COMMISSION 12

★ Project Location

▭ Regional Service Commission Boundary

SCALE 1:800,000

0 5 10 20 Kilometers

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY GEONB

MAP CREATED BY: RR
MAP CHECKED BY: GM
MAP PROJECTION: NAD 1983 CSRS New Brunswick Stereographic

DILLON CONSULTING

PROJECT: 22-4639
STATUS: DRAFT
DATE: 2023-05-30

FILE LOCATION: K:\2022\224639\Product\Client\20230123_CoverdBridge_EIA\224639_RegionalServiceCommission.mxd

Commercial Land Use

Commercial uses are the most common form of land use within area surrounding the PDA. Commercial uses include fast food, gas stations, hospitality uses, and storage. Immediately north of the PDA is a Burger King and Subway restaurant as well as an Irving gas station. Roughly 400 m north, along Alwright Court and accessed from the same highway interchange, is an automobile service station and the Moonshine Creek Distillery. Under the South Central Carleton Rural Plan, there are two types of Commercial Zones: Commercial 1 and Commercial and Light Industrial. The Somerville area contains a sparse mixture of commercial uses, including some retail, car repair shops, and industrial supply businesses.

The PDA is located on a parcel zoned Commercial and Light Industrial. The Plan promotes industrial development in appropriate areas to ensure compatible land uses:

"It is a policy to protect the natural environment and the residential and agricultural aspects of the Planning Area by managing the type and location of commercial and industrial development."

The South Central Carleton (SCC) Rural Plan discourages commercial and industrial uses that require a large amount of water that would discharge large amounts of wastewater in predominantly residential and agricultural areas. The text in the Plan is below:

"It is proposed that commercial and industrial uses that require large amounts of water for processing and which discharge large amounts of wastewater will be discouraged in predominately (sic) residential and agricultural areas."

It is noted that the Plan does not provide a definition of "large".

Under section "(b) Commercial and Industrial Uses", the SCC Rural Plan promotes economic growth and industrial development in appropriate areas. Policy in this section of the Plan also encourages land uses that provide employment opportunities and provide access to goods and services.

Institutional Land Use

The Upper River Valley Hospital is located across the Trans-Canada Highway, approximately 715 m from the PDA. The nearest school to the PDA is the Hartland Community School, located approximately 5.75 km from the PDA.

Industrial Land Use

The mixture of agricultural, industrial, and rural residential uses in the area are seamlessly integrated and consistent with the character of the region. The majority of land uses near the PDA are agricultural, or in the trucking or warehousing sector. Country Line Trucking is located 2.26 km west of the PDA, with a BF Mortensen Truck Repairs located nearby along Estey Road. Located 5 km east of the PDA, the centre of Hartland has several industrial developments, particularly within the former towns of Hartland and Somerville and along provincial highways. Several large food companies have production plants in the area, including Covered Bridge Chips, McCain Foods, and Old Dutch Food Ltd. Significantly, the town also has the headquarters of Day and Ross, a North American trucking company.

Recreation

Formal recreational uses are not present within the area immediately surrounding the PDA, but there are a number of recreation and community uses in the nearby communities. Closer to the PDA, residents or members of the public have the option of using the shoulders of rural roads, highways, or track roads for recreational purposes. Hartland's Recreation Department offers indoor and outdoor skating rinks, a swimming pool, a wading pool, a playground, a soccer field, and two baseball fields. As the landscape of the Municipality is very rural, there are many outdoor recreation opportunities which are both public and private. This includes day and overnight camps, adventure organizations, and trails including the Sentier NB Trail which begins in Pembrooke and travels along the Wolastoq (Saint John River) and the Tobique River to Plaster Rock. Many of these trails are all-season and used for walking, biking, and snowshoeing.

Integrated Mobility

The Trans-Canada Highway (New Brunswick Route 2) is the primary transportation route through Waterville, extending south to Woodstock and then east to Fredericton and continuing to the Nova Scotia border, and north to Edmundston and the provincial border with Québec. The provincial highway, Route 590 runs east of the PDA through the community of Waterville, and intersects with Route 130, approximately 1.4 km east of Covered Bridge Chips. There are also local roads where vehicle users access residences, nearby businesses, and light industrial uses. There are also dirt and track roads, some of which are on private agricultural land.

4.7.2.2 Demographic and Economic Overview

According to the Statistics Canada 2021 Census Profile for Wakefield Parish (Statistics Canada 2022), the total population was 2,722, down 1.6% from its population of 2,767 at the time of the 2016 Census (Statistics Canada 2017). The population density in 2021 was 13.9 persons per square kilometre, compared to 10.9 persons per square kilometer for the province. The age distribution of people living in Wakefield Parish for the 2021 Census indicates that the largest proportion of the population is in the 25 – 54 age range, followed by the 0 – 24 age range (**Table 4.7.1**). A population decline took place among all population age groups except for those who are 65+, which increased by 3.4%.

Table 4.7.1: Change in Population for Wakefield Parish between 2016 and 2021 (Statistics Canada 2017, 2022)

Age Group	2016 Census Year	% of Total	2021 Census Year	% of Total	Change 2016-2021
0-24	780	23.01%	720	21.30%	-60
55-64	445	13.13%	425	12.57%	-20
Total	3,390		3,380		

The Project is located in the Northwest Economic Region, which includes Carleton County, Victoria County, and Madawaska County. Beyond smaller and rural communities, the Northwest Economic Region is home to one city, Edmundston in Madawaska County, and two larger towns, Woodstock in Carleton County and Grand Falls in Victoria County.

Within Wakefield Parish, jobs are concentrated in transportation and warehousing, retail trade, manufacturing, construction, healthcare and social assistance, and agricultural and natural resource fields (**Figure 4.7.2** and **Figure 4.7.3**). Wakefield and surrounding parishes are known for their strong agricultural sectors. The nearby centre of Hartland has the headquarters for one of Canada's largest transportation companies, and has several trucking companies and manufacturing plants.

The median income in Wakefield Parish is $71,000, which is slightly higher than the provincial median income of $70,000 (Statistics Canada 2022). The median income is used because this measure of income is not influenced by a smaller number of extremely high or extremely lower incomes, and is understood to be a more accurate measure of incomes in a given community.

The majority of the population above the age of 25 has a post-secondary certificate, diploma, or degree. However, this percentage is at 47%, compared to 51% across New Brunswick. Wakefield Parish does have a higher population than New Brunswick with their highest level of education being their highest certificate, at 36% compared to 30% for the province.

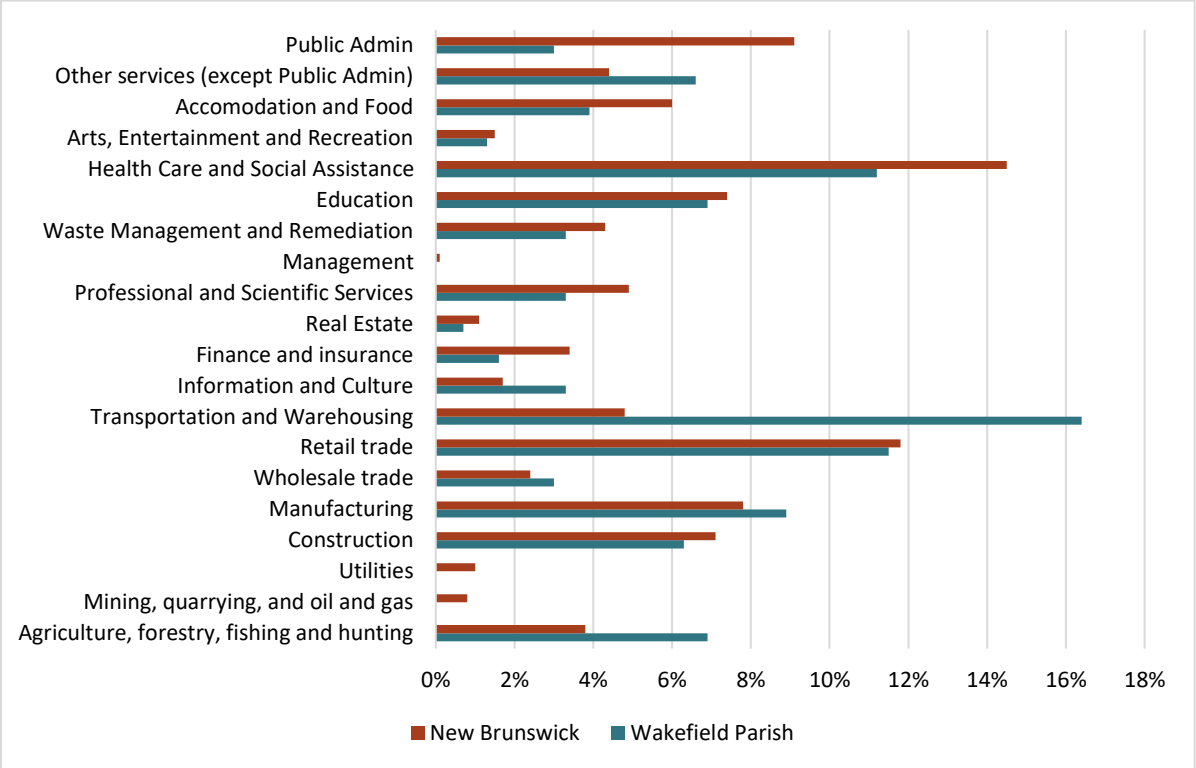

Figure 4.7.2: Industrial Sectors in Wakefield Parish compared to New Brunswick (Statistics Canada 2022)

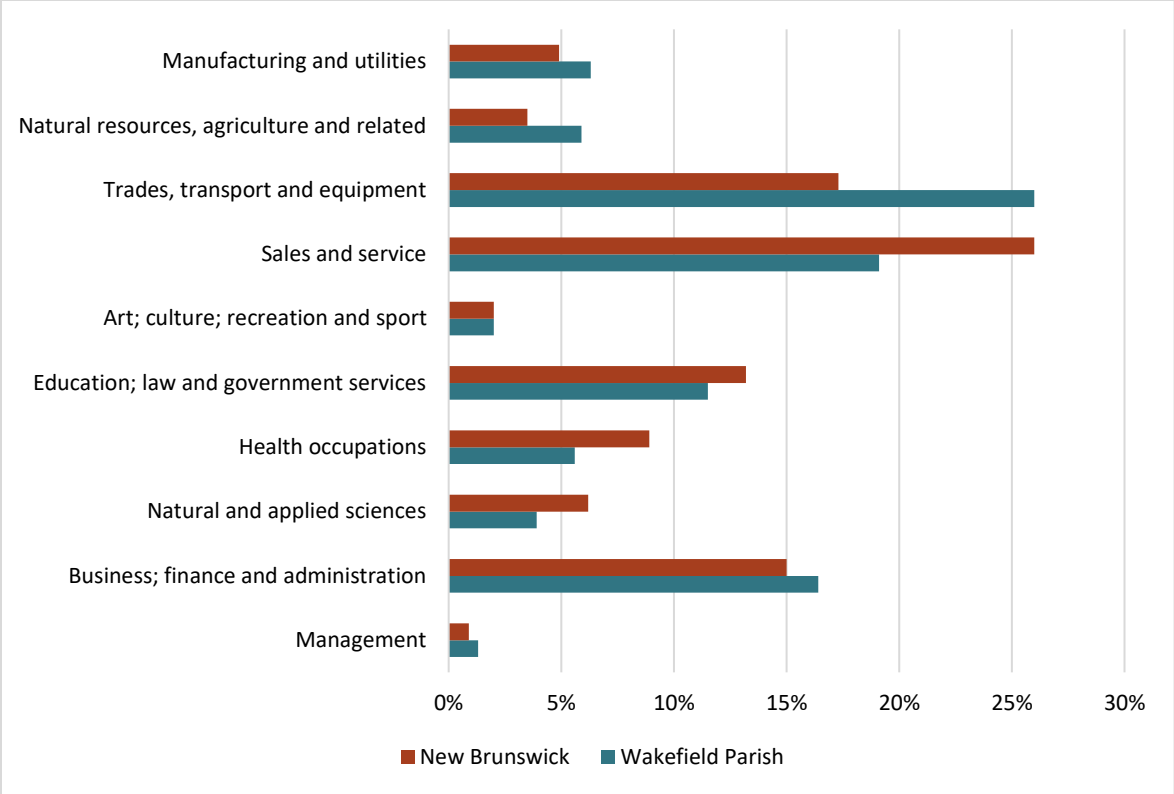

Figure 4.7.3: National Occupation Classification of Wakefield Parish compared to New Brunswick (Statistics Canada 2022)

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

4.7.3.1 Potential Interactions

The assessment of potential interactions between the Project and the socioeconomic environment in the absence of mitigation, as well as the proposed mitigation to be implemented as part of the Project, and the characterization of interactions following the implementation of mitigation, is presented below.

Interactions with Residential Land Use

Construction and operation of the Project are not likely to interact substantially with nearby residences. Residential land uses near the PDA are sparse, with the closest known residences located approximately 914 m from the PDA. With numerous agricultural and light industrial uses throughout the area, the construction and operation of the WWTS is not likely to interact significantly with residential uses. Additionally, noise from construction or operation is unlikely to be more disruptive than noise from automobiles traveling along the Trans-Canada Highway.

Interactions with Commercial Land Use

The expansion of the Hartland municipal boundaries is unlikely to change in a way that impacts the construction and operation of the new WWTS. With land use policy and zoning encouraging economic development within agricultural sectors, the process of Local Governance Reform is expected to encourage existing and future employment opportunities related to potato production and processing.

The flow of discharge from the WWTP will be an average of 20,000 litres per day (or approximately 13 litres per minute). This amount of wastewater would not reasonably be defined as "large", and is unlikely to have an adverse impact on surrounding land uses. The policy discouraging large amounts of wastewater is subjective, and the immediate surrounding land uses follow a rural development pattern, which is neither primarily residential nor agricultural, even though there is a significant amount of agricultural activity in the broader region.

The food services and hospitality establishments adjacent to the facility, Burger King, Subway, and Moonshine Distillery, may experience noises during the construction phase of the WWTS; however, the area is already experiencing traffic related noise as a result of the Trans-Canada Highway. Potential interactions also include dusty associated with earth moving activities and travel on unpaved surfaces. Odours experienced by neighbouring businesses are possible but not likely, as wastewater will be treated in an enclosed area.

Interactions with Institutional Land Use

The nearest institutional land use, the Upper River Valley Hospital, is located 715 m from the PDA, and unlikely to experience disruptive noise during the construction phase. For the operation phase of the WWTS, the plant will be designed to contain noise within the buildings, to mitigate impacts to adjacent neighbors.

Interactions with Industrial Land Use

With numerous industrial facilities in the region related to the agriculture and food processing field, the construction and operation of the WWTS are not expected to interact substantively with industrial land uses. With the facility's capacity to expand operations, this development has the potential to strengthen and enhance the food processing sector in an area that is already known as New Brunswick's "potato belt."

Interactions with Recreational Land Use

No interactions with recreational land uses are expected during the construction or operation phase.

Interactions with Integrated Mobility

There will be machinery and trucks present during the construction phase of the project. Without trucks transportation effluent from the Factory to an off-site facility, the on-site WWTS will reduce heavy vehicle traffic on the Trans-Canada Highway, nearby provincial highways, and adjacent local roads.

Interactions with Employment and Economy

As the WWTS will provide an opportunity for the factory to expand, there are potential job opportunities for both local residents and newcomers to the area. The Company may also be competing with employers in the food production sector throughout the region. Any challenges associated with recruiting employees can be mitigated through a number of measures and should be considered as minor.

4.7.3.2 Mitigation

The following mitigation measures are planned to reduce environmental effects on the socioeconomic environment:

- Engage nearby residents prior to and throughout the duration of the construction and operation phase to identify and address potential concerns;
- Ensure all vehicles and equipment are equipped with mufflers and maintained;
- Apply dust suppression to stockpiled soil during dry periods;
- Limit noise-intrusive work to daylight hours, Monday to Saturday and excluding holidays;
- Ensure truck drivers adhere to posted speed limits and warning signage and adjust driving to meet weather and road conditions (especially in residential and school areas);
- Obtain propter permitting should from the New Brunswick Department of Transportation and Infrastructure (NBDTI) if required for any oversized loads required on public roads for Project activities;
    - Follow best practices and permit conditions for oversized loads including special markings, and lead-and-follow vehicles;
- Use appropriate personal protective equipment (PPE) and follow industry safety procedures; and
- Prioritize local workers for any job openings that result from any future expansions in operations, and take standard measures to recruit workers if job vacancies present a challenge.

4.7.3.3 Characterization of Potential Interactions Following Mitigation

The construction of the Project may result in modest emissions of dust, air contaminants, and noise emissions that could cause a temporary nuisance to off-site receptors, thereby affecting residential land use; however, given the nature of the Project and in consideration of the mitigation to be employed, the Project is not expected to result in the undue emission of air contaminants (including dust) or noise at nearby commercial, residential, or institutional properties.

Interactions of the Project with traffic patterns, especially on residential roads, are not anticipated to cause any safety problems to residents with the appropriate mitigation measures applied, such as following speed limits. In addition, much of the construction will take place during the day. The operation of the WWTS will eliminate trips carrying plant discharge to off-site treatment plants, resulting in a potential decrease in transportation trucks in the Waterville/Hartland area.

With a new WWTS, there may be additional jobs associated with the operation of the Project. There may be a temporary positive interaction through employment and local expenditures as a result of the contracting of third-party companies to carry out the Project activities.

4.7.4 Summary

In summary, the Project is not expected to have any permanent negative interactions with the socioeconomic environment. Any impacts to the residents and businesses near the PDA are temporary in nature. No significant land use changes are anticipated within the community. There may be a potential rezoning depending on the amount of water that is discharged from the site, and depending on whether the WWTS can be categorized as Light Industrial according to the zoning of the PDA. The WWTS is supportable from a planning perspective given the importance of the agricultural and industrial sectors to the local economy.

A temporary infusion to the local economy is possible during construction and operation of the on-site WWTS. In consideration of the planned mitigation and best practices, the potential adverse interactions between the Project and the socioeconomic environment are not anticipated to be substantive, and no specific follow-up is proposed for the socioeconomic environment.

5.0 Effects of the Environment on the Project

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 execution of the Project or cause damage to infrastructure related to 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, the following environmental attributes have been selected for consideration in this assessment:

- Climate and climate change;
- Severe weather events, including wind, precipitation, floods, hail, electrical storms, and tornadoes; and
- Seismic activity.

5.1 Existing Conditions

5.1.1 Climate and Climate Change

Climate is defined as the statistical averages of precipitation, temperature, humidity, sunshine, wind velocity, and other phenomena such as fog, frost, and hail storms for a particular region and time period, generally taken over a 30-year period (NASA 2017). Climate change is an acknowledged change in climate that has been documented over two or more 30-year periods. According to the Intergovernmental Panel on Climate Change (IPCC), climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2014). The United National Framework Convention on Climate Change (UNFCCC) makes a distinction between climate change attributed to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability observed over comparable time periods (IPCC 2014).

The definition of climate change dictates the context in which the effects of those changes are discussed. It may not always be fitting to consider the effects of climate change projections on projects which will only take place over a relatively short period of time (e.g., weeks, months, a few years), and which will be initiated in the near future. In the case of this Project, while construction activities associated with the Project components will be of short duration, the new wastewater treatment system will continue operation for several decades, for approximately 50 years post-construction. As

such, this assessment should consider how climate change will influence all aspects of the Project both physically and financially, and how those effects could, in turn affect the environment.

The technical boundaries for the establishment of climate conditions include the spatial coverage of weather stations across New Brunswick, the number of parameters monitored at each station, and the temporal coverage of data collection at each station. Technical boundaries for the prediction of effects of climate change relate to the inherent uncertainty of global climate models in predicting future changes in climate parameters, and specifically their application of global-scale prediction algorithms to a relatively localized scale through "downscaling." Global climate models can provide relatively useful information for predicting and preparing for global and macro-level changes in climate, but their ability to pinpoint location-specific changes to climate on a localized level is limited.

5.1.1.1 Climate Normals

Current climate conditions are generally described by the most recent 30-year period for which Environment and Climate Change Canada (ECCC) has developed statistical summaries. These summaries are typically referred to as "climate normals." The closest weather station to the Project with available historical data is the Woodstock weather station, located within approximately 13 km of the PDA. The Woodstock weather station provides historical data for temperature and precipitation, among other variables. The most recent 30-year period for which climate normal data are available is for the period of 1981-2010. This period has been chosen as the most applicable period for summarizing current climate conditions for the Project (ECCC 2022a). As discussed in **Section 4.2.2.1**, data at the Woodstock weather station are limited to temperature and precipitation; therefore, climate normals from the Fredericton (A) weather were also observed to capture wind.

Monthly maximum hourly wind speed measured at the Fredericton A weather station during 1981-2010 ranged from 48-80 km/h. The dominant wind direction was reported as from the west during January, March, June, and August, and from the northeast in October and December, with the dominant wind direction being Southeast for April and September, south in February, southwest in July, and the northwest in May (ECCC 2022b). Maximum wind gusts for the same period ranged from 93-132 km/h (ECCC 2022b).

Precipitation at the Woodstock weather station, on average, was highest from November- January during the 1981-2010 period (ECCC 2022a). Based on precipitation data from the Woodstock weather station, from 1981-2010, the weather station recorded an average of 1,130.6 mm of precipitation annually, with 858.2 mm being rain and 272.3 cm being snowfall (as water equivalent). Extreme daily precipitation in the past century has ranged from 56.6 mm (January 2006) to 116.0 mm (August 1990). On average, there have been 7.2 days per year with rainfall greater than 25 mm and there are an average of 1.4 days per year with snowfall greater than 25 cm (ECCC 2022a).

The annual daily average temperature at the Woodstock weather station during the period of 1981-2010 was 4.8 °C, while the average daily maximum was 10.5 °C and the average daily minimum was -1.1 °C (ECCC 2022a). The extreme maximum temperature in the recorded history for the station was 39.4 °C recorded on August 18, 1935 and the extreme minimum temperature was -43.9 °C recorded on February 4, 1915 (ECCC 2022a).

5.1.2 Severe Weather Events

Extreme precipitation and storms can occur in New Brunswick throughout the year, but tend to be more common and severe throughout 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 forecast is 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 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 cities.

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).

In New Brunswick, river valleys and flood plains can pose a risk because of ice jams, harsh weather, and the floods of annual spring thaw. Flooding in New Brunswick is rather common, especially along the Saint John River (ECCC 2017a).

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 (ECCC 2017b). Tornadoes are rare in New Brunswick, but can occur. The closest tornado recorded by the Canadian National Tornado database of verified events between 1980 and 2009 was in 1983 in McNamee, NB, approximately 104 km east of the PDA (ECCC 2021).

5.1.3 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. As a whole, Eastern Canada is located in a stable continental region of the North American Plate, and has relatively low earthquake activity (NRCan 2021a). The PDA 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. 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 4.5-6.0 (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 Seismic Zone, is estimated to be magnitude 7.0, based on historical earthquake data and regional tectonics (Adams and Halchuk 2003).

Although not common, earthquakes are not unknown in the Waterville area of New Brunswick, and the closest earthquake recorded to the PDA was a magnitude 2.3 event in December 2010. There are records of 10 earthquakes with a magnitude of less than 2.0 within 50 km of the PDA, as well as 16 magnitude 2.0 events, and 1 magnitude 3.0 event, which was a magnitude 3.6 event 25 km southeast of Perth-Andover, NB in June 2006, approximately 35 km from the PDA (NRCan 2021b).

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

5.2 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 and flood events). The EIA has been carried out in parallel to preliminary design, and the results of the EIA have informed and are continuing to inform the design of the Project such that potential concerns are addressed and the potential for significant adverse effects of the environment on the Project are minimized.

5.2.1 Potential Interactions

5.2.1.1 Effects of Climate and Severe Weather on the Project

To assess the environmental effects of climate 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 Waterville 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 climate changes that could potentially have effects on the Project include:

- Increased frequency and magnitude of heavy precipitation events;
- Increased frequency of extreme storms accompanied by heavy and/or freezing precipitation; and
- Increased rates of 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, engineering, and design. 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 extreme weather;
- A reduction in visibility and an inability to maneuver heavy equipment;
- A loss of electricity to the wastewater treatment system; and
- Damage to heavy equipment and site infrastructure.

Extreme snowfall can also affect winter Project activities by causing delays in the movement of materials to and from the PDA, and resulting in additional effort for snow clearing and removal. This additional effort, however, would not substantially change the Project schedule. Extreme rainfall events could also potentially lead to erosion of the site.

5.2.1.2 Effects of Seismic Activity on the Project

The PDA is geographically situated within an identified seismic zone where historical earthquake activity has been identified (Northern Appalachian Seismic Zone). As previously discussed in **Section 6.1.3**, 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). Although the level of historical seismic activity near the PDA is considered to be low to moderate, past occurrence of seismic activity is not necessarily an indicator that a significant seismic event could or could not occur in the future.

Based on the low frequency and low magnitude 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.

5.2.2 Mitigation

Mitigation strategies for minimizing the likelihood of a significant effect of the environment on the Project are inherent in: the planning process being conduction, 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.

5.2.2.1 Mitigating Effects of Climate Change and Severe Weather on the Project

The mitigation measures that will be implemented to prevent the effects of climate change and severe weather include:

- Avoiding disruption of Project activities and delays to the Project by scheduling tasks that require precise and/or timely movements for periods when the weather conditions are favourable;
- Allowing the Project schedule to be flexible enough to include extreme precipitation events;
- Installation of erosion and sediment control (ESC) structures where and when appropriate to reduce site run-off from precipitation;

5.2.2.2 Mitigating Effects of Seismic Activity on the Project

The Project and related infrastructure will be designed to the applicable standard in consideration of the maximum credible earthquake magnitude for the region. The National Building Code of Canada provides for sufficient factors of safety to account for seismic activity in active seismic zones in Canada, and will form the basis of the design and construction of site infrastructure. The intent of these and other design standards is to maintain the integrity of the facilities based on the level of risk for an earthquake in the area of a magnitude up to the maximum credible earthquake. Therefore, seismicity is not considered to have the potential to substantively damage project infrastructure or components during all phases of the Project, due to planned design mitigation and the application of the National Building Code of Canada and other applicable guidelines.

5.2.3 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 working on the Project. Compliance with detailed design engineering completed for the Project will account for weather extremes and seismic activity through built-in factors of safety to prevent undue damage to

infrastructure from such events. Although it is possible for the PDA to experience extreme environmental conditions during the construction phase, a substantive delay is not anticipated.

Further, no substantial damages to Project infrastructure are anticipated as a result of natural environmental conditions due to the design and type of activities proposed; 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. Lastly, there are no watercourses within approximately 400 m of the PDA, so flooding is not anticipated to affect the Project during any phase.

5.3 Summary

For the construction phase of the Project, environmental consideration are inherent in the best management practices of the design and associated Project risk management. Equipment and materials that are able to withstand severe weather and other influences will be used. Environmental stressors, such as those that could arise as a result of severe weather, flooding, seismic events, or other factors would more than adequately be addressed by good engineering design, materials selection, best practices, and engineering foresight. The Project schedule will provide allowances so as to not adversely be affected by a potential delay caused by the 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.

6.0 Public Involvement

In accordance with the EIA Regulation, direct communication with stakeholders (local residents, elected officials, businesses, etc.) is required. In addition, the Province of New Brunswick has a duty to consult with First Nations if their decision-making regarding the EIA may affect Aboriginal and treaty rights. The planned approach to public and stakeholder notification in respect of the EIA review of the Project is described below. Evidence of a notification and a summary report detailing engagement efforts and comments received will be provided to the NBDELG within 60 days following registration of the Project.

6.1 Notification of Elected Officials

Following registration of the Project with NBDELG, relevant elected officials will be notified of the Project through direct communication (i.e., letter), as outlined in the *Guide to Environmental Impact Assessment in New Brunswick* (NBDELG 2018a). In addition, the EIA Registration document will be available to download from the NBDELG 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 a Company or Dillon representative who can be contacted for further information.

6.2 Notification of Potentially Affected Landowners

Following registration of the Project with NBDELG, potentially affected residents within 2 km of the PDA will be notified of the Project through direct communication (i.e., letter), as outlined in the *Guide to Environmental Impact Assessment in New Brunswick* (NBDELG 2018a). In addition, interested residents will be given the opportunity to review the EIA Registration document available to download on the NBDELG 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 a Company or Dillon representative who can be contacted for further information.

6.3 Indigenous Engagement

Given the limited nature of the Project on already disturbed commercial land as well as the lack of interactions with many VCs of concern to First Nations, Indigenous engagement is not currently planned as part of this Project. Should the New Brunswick Department of Aboriginal Affairs (NBDAA) determine that Indigenous engagement is required, the Company will comply with its directives.

7.0 Other Information

7.1 Project-Related Documents

This EIA Registration document includes other relevant documents as included in the appendices to this document.

Other than this EIA Registration document and the appended information, there are no additional Project-related documents that are publicly accessible.

7.2 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 by provincial or federal agencies. Refer to **Section 1.4** of this document for more information in this regard.

7.3 Funding

Funding for this Project is provided entirely by the Covered Bridge Potato Chip Company.

7.4 Signature

This document is submitted on behalf of Covered Bridge Potato Chip Company.

On behalf of the
Covered Bridge Potato Chip Company

July 11 /2023

Date of Signature

8.0 Closing

This report was prepared by Dillon Consulting Limited (Dillon) on behalf of the Covered Bridge Potato Chip Company. 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.

The material in the report reflects Dillon's best judgment in light of the information available to Dillon at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Please contact the undersigned if you have any questions or require additional information.

Sincerely,

DILLON CONSULTING LIMITED

Denis L. Marquis, M.Sc.E., P.Eng.
Associate, Project Manager

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Appendix A

Evoqua-MBR Process Design Brief (Evoqua 2022)

PROCESS DESIGN BRIEF

EVOQUA-MBR
WASTEWATER TREATMENT SYSTEM

Project: 1000044147

Date: November 18, 2022

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This design brief was prepared by Evoqua Technologies Canada Ltd. for Covered Bridge Potato Chips.

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ABBREVIATIONS

AOR	-	Actual Oxygen Requirement
BOD	-	Biochemical Oxygen Demand
cfm	-	Cubic Feet per Minute
COD	-	Chemical Oxygen Demand
DO	-	Dissolved Oxygen
EQ	-	Equalization
°C	-	Degrees Celsius
F:M	-	Food-to-Microorganism Ratio
FOG	-	Fat, Oil, and Grease
gpd	-	Gallons per Day
gpm	-	Gallons per Minute
HMI	-	Human-Machine Interface
HRT	-	Hydraulic Retention Time
kPa	-	Kilopascals
LIT	-	Level Transmitter
MBR	-	Membrane Bioreactor
mg/l	-	Milligrams per Liter
MGD	-	Million Gallons per Day
MLSS	-	Mixed Liquor Suspended Solids
MLVSS	-	Mixed Liquor Volatile Suspended Solids
OLR	-	Organic Loading Rate
PDM	-	Process Design Manual
PFD	-	Process Flow Diagram
PLC	-	Programmable Logic Controller
PVC	-	Polyvinyl Chloride
P&ID	-	Process and Instrumentation Diagram
RAS	-	Return Activated Sludge
RWW	-	Raw Wastewater
scfm	-	Standard Cubic Feet per Minute
SRT	-	Solids Retention Time

SS	-	Stainless Steel
TIN	-	Total Inorganic Nitrogen
TKN	-	Total Kjeldahl Nitrogen
TMP	-	Transmembrane Pressure
TN	-	Total Nitrogen
TP	-	Total Phosphorus
TRC	-	Total Residual Chlorine
TSS	-	Total Suspended Solids
VFD	-	Variable Frequency Drive
WAS	-	Waste Activated Sludge
WC	-	Water Column
WWTP	-	Wastewater Treatment Plant

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Project No.:	1000044147	Date:	2022-November-18
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1 INTRODUCTION

This Process Design Brief (PDB) is for an Evoqua membrane bioreactor (Evoqua-MBR) wastewater treatment system to treat process wastewater from the Covered Bridge Potato Chips plant in Waterville, NB.

1.1 Objectives of the Process Design Brief (PDB)

The primary objective of the PDB is to allow the process designers to communicate the following information to the detailed design team and other entities that may have an interest:

- Wastewater/sludge/effluent quantities and characteristics.
- Overview of the treatment plant components.
- Preliminary design information on Evoqua-supplied equipment.
- Process operations and controls strategy descriptions
- Process flow diagram and P&IDs
- General arrangement drawings for Evoqua's tank and equipment
- Preliminary motor list and power requirements
- Utility and chemical requirements
- Analysis of estimated annual operating cost (Refer to Appendix B)

1.2 Using the Process Design Brief

This PDB represents the process engineer's concept of how the treatment plant (and its individual components). This information presented in the PDB is subject to review during the detailed design phase.

2 WASTEWATER CHARACTERISTICS AND EFFLUENT QUALITY

Table 2.1 shows the design RWW characteristics, and projected MBR effluent quality from the new Evoqua-MBR wastewater treatment system at Covered Bridge Potato Chips.

Table 2.1 – Design RWW Characteristics, and Projected MBR Effluent Characteristics

Parameter	Raw Wastewater	MBR Effluent
Flow, avg. (m^3/d)	20	20
Flow, peak day (m^3/d)	40	40
BOD_5, avg. (mg/l)	2,300	< 5
BOD_5 load, avg. (kg/d)	46	---
BOD_5 load, peak (kg/d)	92	---
TSS, avg. (mg/l)	2,300	< 5
TSS load, avg. (kg/d)	46	---
TSS load, peak (kg/d)	92	---
Temperature (°C), avg.	---	18-35

3 FUNCTIONAL DESCRIPTION OF THE SYSTEM

3.1 General Overview

A process flow diagram (PFD) and process and instrumentation diagrams (P&IDs) for the wastewater treatment plant are shown in Appendix A.

The Evoqua-MBR system is an activated sludge technology in which a submerged physical membrane barrier is utilized to provide liquid/biosolids separation instead of gravity clarification. Excess biomass is wasted from the system periodically in order to maintain the mixed-liquor suspended solids (MLSS) concentration within the target range of 8,000 to 15,000 mg/l in the MBR system.

The MBR system is designed to ensure sufficient treatment by having adequate solids retention time (SRT), hydraulic retention time (HRT), aeration capacity, and a bioreactor pH near or slightly above neutral.

The average effluent BOD_5 and TSS concentrations from the new MBR system are expected to be consistently less than 5 mg/l and 5 mg/l, respectively.

3.2 Evoqua-MBR System

The major components of the Evoqua-MBR system are as follows:

One 96 m^3 pre-fabricated MBR tank complete with:

- Fine bubble diffused aeration system in pre-aeration compartment (75 m^3)
- Two Kubota ES150 submerged membrane units (SMUs) in membrane compartment (21 m^3)
- Aeration/scour system, complete with aeration blower (15 kW), control valve and flow meter
- Level transmitter
- Equipment skids, including:
  - Influent basket strainer (3 mm perforations)
  - Permeate pump VFD (35 lpm) with transmembrane pressure transmitter and effluent flow meter
  - Defoamer pump
  - Membrane cleaning chemical tank and pump
- Control panel including motor starters, VFDs, and Panel View

3.3 Process Overview

The raw wastewater generated from the Covered Bridge Potato Chips plant will be equalized and pumped (by others) to the MBR system. The wastewater will be screened by a basket strainer (3 mm perforations) before entering the pre-fabricated tank. Air will be supplied by the aeration blower to the fine-bubble diffused aeration system in the aeration compartment for mixing and BOD removal.

Mixed liquor from the aeration compartment will overflow into the membrane compartment, which houses two Kubota ES150 SMUs used for final solids-liquid separation and biomass retention. Air for membrane scouring is also provided by the aeration blower, with scour air automatically controlled. The air scour serves to mix the

contents in the membrane compartment while continuously cleaning the membranes, which in turn reduces the rate of membrane fouling.

The permeate pump will extract permeate though the membranes to produce a high-quality effluent with low BOD/TSS concentrations, meeting the final discharge limits. Periodic membrane chemical cleanings can be performed to recover membrane performance.

Waste activated sludge (WAS) can be removed from the system via the sludge loadout connection for disposal, by others. At design conditions, 16 m^3/wk of WAS at 1.0% solids will be generated.

4 PROCESS, EQUIPMENT, INSTRUMENTATION, AND CONTROLS DESCRIPTION

4.1 Modular MBR System

The MBR system includes a 96 m^3 pre-fabricated tank with 75 m^3 aeration compartment and 21 m^3 membrane compartment. The tank consists of two (2) ES 150 Kubota membrane cassettes in the membrane compartment and fine bubble diffuser aeration system in the aeration compartment.

Please refer to the PFD and P&ID's in Appendix A for the following descriptions.

4.1.1 Influent Basket Strainer

An influent basket strainer is installed for screening of the wastewater before discharging into the aeration compartment. The influent basket is installed to screen out any particles >3 mm from entering the MBR tank.

The influent basket strainer has perforation sizes of 3 mm to remove debris from the wastewater. Daily inspection and cleaning of the basket strainer is required by the operator. Pressure gauges are installed on the inlet and outlet of the basket strainer to determine when the strainer needs to be cleaned. When the basket strainer discharge pressure exceeds a high value (to be determined on-site), the basket strainer needs to be cleaned immediately.

A bypass of the basket strainer is installed to allow for the cleaning of the basket strainer.

4.1.2 Aeration Compartment

A 75 m^3 aeration compartment is contained in the front section of the modular MBR tank. A fine-bubble diffused aeration system is included in this aeration compartment. The aeration compartment is separated from the membrane compartment by a partial baffle

wall that extends from the top of the tank wall to near the bottom of the tank with weir openings near the bottom of the wall. This partial wall is to redirect flow coming from the aeration compartment back down toward the bottom of the cassette closest to the aeration compartment. Thus, the desired crossflow flow pattern is maintained in the membrane compartment. The bottom opening below the baffle allows mixed liquor to flow back and forth between the aeration and membrane compartments.

4.1.3 Aeration Blower

Mixing and aeration are completed via one aeration blower equipped with a VFD. The aeration blower will include a temperature switch (controlled by the PLC). Blower speed will be controlled to maintain the DO concentration in the aeration compartment within a target range, as measured by the DO probe and transmitter. The speed of the aeration blower will vary to ensure a minimum (operator adjustable) DO concentration is met at all times.

4.1.4 Membrane Compartment

The 21 m^3 membrane compartment will house two (2) Kubota ES-150 submerged membrane units (SMU), complete with a dedicated air scour system. Each SMU includes 150 flat sheet membrane cartridges. The two membrane cassette units are connected to common header pipes for permeate and scour air.

4.1.5 MBR Level

A pressure transducer type level transmitter (LIT) will be used to continuously measure the liquid level in the MBR system. Tank level will be displayed and trended at the HMI.

Low-low, low, high, and high-high tank level alarms will be signaled at the HMI. A low level in the membrane compartment, as measured by the level transmitter, will automatically initiate the “low load” condition for the membrane compartment, which prevents the membranes from becoming exposed in the case of a low level condition. During this

condition, the permeate pump will shut off and the membrane scour will cycle ON/OFF according to the operator adjustable cycle time until the ‘low load’ condition is released.

A level switch (LS) is installed in the membrane compartment. This LS is used as back up for detecting liquid level in the membrane compartment. When the switch is not tipped up, the LS will automatically shut off the effluent permeate pump. The pump will restart once the switch is tipped up. The switch is to prevent the membranes from becoming exposed in case of a low level condition due to a problem with the LIT in the membrane compartment.

4.1.6 Permeate Control

The MBR tank will have a dedicated VFD-controlled permeate pump (35 lpm), permeate piping, TMP pressure transmitter, and permeate flow meter. Permeate (effluent) is extracted from the MBR tank through the membranes via the suction created by the duty permeate pump.

The permeate header will have a dedicated differential pressure transmitter installed on the suction side of the permeate pump (as close to the membranes as possible). The pressure readings are used to measure the static (permeate pump off) and dynamic (permeate pump on) pressures. The difference between static and dynamic pressures called the transmembrane pressure (TMP). This TMP reading is important for judging the condition of the membranes and determining when membrane cleaning with chemical is necessary. The pressure transmitter must be installed directly on the permeate header before any pipe reductions, bends, etc. as head loss before the pressure transmitter result in errors when determining TMP. The self-priming feature of the permeate piping will ensure that gas-locking potential in the permeate piping is minimized.

A magnetic-type flow meter is located on the discharge side of the permeate pump to monitor the permeate flow rate from the MBR tank and for permeate pump speed control. The instantaneous flow meter readings will be displayed and trended at the HMI. Totalized daily flow for the current day and previous 7 days will be displayed at the HMI. The speed

of the permeate pump will be adjusted automatically by the PLC to maintain the permeate flow rate setpoint. The permeate flow control loop includes the flow meter, permeate pump, and pump VFD.

The permeate pump will operate for 9 minutes during a 10 minute cycle (providing a one minute ‘relaxation’ event). The permeate pump discharge piping will be designed such that there is no gravity flow through the membranes during a membrane ‘relaxation’ event. If required, siphon break/vent could be installed on the discharge side of the permeate pumps and to ensure that there is no gravity flow through the membranes during a ‘relaxation’ event.

The permeate pump will shut off in any of the following scenarios:

- MBR tank level decreases below LL level alarm setpoint
- Permeate pump is in ‘relaxation’ event
- MBR tank is off-line (e.g. CIP event)
- Membrane scour blower is off
- Air supply is not detected by the air flow meter to the MBR tank.

4.1.7 Air Scour and Diffuser Flushing

The membrane compartment will have a dedicated coarse-bubble air scour system in order to continuously clean the membrane surfaces. The blower will supply scour air to the membranes. During low load conditions, the scour blower will operate based on the operator adjustable cycle timer.

A flow meter and flow control valve will be used to control the air scour flow rate to the membrane compartment at an operator-adjustable setpoint. The setpoint will be within an allowable range of 180 m^3/hr and 270 m^3/hr.

The air blower will be used to supply air to the aeration and membrane compartments of the MBR system. Periodically, the PLC will check the DO probe reading against the DO

setpoint range, and the aeration blower will adjust its speed to maintain the DO concentration within an operator adjustable range. When the blower adjusts its speed, the air scour control valve will modulate its position to maintain the air scour flow scour rate setpoint, as measured by the air scour flow meter.

A diffuser flush valve will be used for automatic back flushing the membrane unit coarse bubble diffusers to ensure there is no build-up of scale or blockages. Build up of scale or blockages would create aeration problems and reduce efficiency.

When the normally-closed diffuser flush valve is opened, the air takes the path of least resistance and vents to the atmosphere through the open valve. The mixture of mixed liquor and scour air will discharge back into membrane compartment.

Once per day, the permeate pump will automatically turn off based on an operator adjustable time schedule from the HMI. The permeate pump will automatically turn off for four minutes. The automatic diffuser flush valve will open one minute after the permeate pump is turned off and will stay open for two minutes before closing again. One minute after the diffuser flush valve closes, the permeate pump will resume normal operation.

4.1.8 WAS Production and Removal

Waste activated sludge (WAS) will be removed from the MBR system in order to maintain the MLSS concentration in the aeration tank and membrane compartment within a range of 8,000 to 15,000 mg/l. At design conditions, the estimated volume of WAS to be removed from the MBR tank is 16 m^3/wk at 1.0% solids concentration.

4.1.9 Membrane Cartridge Clean System

The membrane cartridges in the MBR system will need to be periodically cleaned in situ (manual procedure, as required) with dilute sodium hypochlorite solution (1% NaOCl) for removal of organic fouling of the membranes.

During a membrane cleaning event, the MBR tank needs to be taken out of service (i.e., no MBR tank influent, permeate, WAS, or scour) for a few hours (2 to 4 hours is typical) to accommodate the cleaning operation. When the MBR tank is taken out of service for cleaning, the permeate pump and scour for the MBR tank will be shut off, and manual valves for the MBR tank will be adjusted by the operator to allow for the cleaning to take place without flow into or out of the MBR tank.

During the membrane cleaning event, the membrane cassettes will be injected with cleaning chemical. To accomplish a membrane cleaning, approximately 900 L of membrane cleaning solution (1 % NaOCl) will be injected into the membrane cartridges using the membrane cleaning pump, which will be controlled locally by the operator. This corresponds to 75 L of 12% sodium hypochlorite (NaOCl) mixed with 825 L of potable water and then delivered to the permeate header of the MBR tank.

4.1.10 Defoamer Metering System

A defoamer metering system is available to supply defoaming chemical to the MBR system. Defoamer will be added as necessary to control foaming in the MBR system using the defoamer metering pump, which will be controlled locally by the operator. A non-silicon type defoamer must be used for dosing to the MBR system.

5 DESIGN CALCULATIONS

The wastewater characteristics upon which the design calculations are based are listed in Table 2.1. The calculations have been performed assuming the MBR system MLSS concentration may range between 8,000 and 15,000 mg/l.

5.1 Design F:M Ratio

For the MBR system designed to handle wastewater flow/load as listed in Table 2.1, the design F:M (BOD basis) at average and peak conditions, an average MLSS concentration of 10,000 mg/l in the aeration tank and membrane compartment and a mixed liquor volatility of 75%, is calculated as follows:

$$\text{F:M } (BOD_5)\text{, daily avg.} = \frac{46 \text{ kg BOD/d}}{[10{,}000 \text{ mg/l} \times (75\ m^3 + 21\ m^3)] \times 10^{-3} \times 0.75}$$

$$\textbf{F:M (BOD), daily avg.} = \mathbf{0.06}\ \frac{\textbf{kg BOD}_5}{\textbf{kg MLVSS} \cdot \textbf{d}}$$

$$\text{F:M } (BOD_5)\text{, peak day} = \frac{92 \text{ kg BOD/d}}{[10{,}000 \text{ mg/l} \times (75\ m^3 + 21\ m^3)] \times 10^{-3} \times 0.75}$$

$$\textbf{F:M (BOD), peak day} = \mathbf{0.}128\ \frac{\textbf{kg BOD}_5}{\textbf{kg MLVSS} \cdot \textbf{d}}$$

5.2 Design OLR

Assuming a wastewater BOD/COD ratio of 0.6, the MBR system design organic loading rate (OLR) at max weekly average and peak day conditions is calculated as:

$$\text{OLR, daily avg.} = \frac{46 \text{ kg BOD/d}}{96\ m^3}$$

OLR, daily avg. = 0.479 $\frac{\text{kg BOD}_5}{\text{m}^3 \cdot \text{d}}$

OLR, peak day = $\frac{92 \text{ kg BOD}_5/d}{96\ m^3}$

OLR, peak day = 0.96 $\frac{\text{kg BOD}_5}{\text{m}^3 \cdot \text{d}}$

5.3 Design SRT

Based on the dry mass of waste solids expected to be generated in the MBR system (see Section 5.4), the SRT for the MBR system at average design conditions is estimated as follows:

SRT = $\frac{10{,}000 \text{ mg/l} \times 96\ m^3 \times \frac{1\ kg}{10^6\ mg} \times 1000 \frac{L}{m^3}}{23\ kg\ TSS/d}$

SRT = 42 days

5.4 Estimated Waste Sludge Production

Assuming a net bios yield of 0.4 kg TSS produced per kg BOD_5 removed and 10% undigested influent solids, the dry weight of sludge generated at average design conditions corresponds to:

WAS, daily avg. = $(0.4 \text{ kg TSS/kg BOD}_5 \times 46 \text{ kg BOD/d}) + (0.1 \times 46 \text{ kg TSS/d})$

WAS, daily avg. = 23 kg/d

WAS, Peak day = $(0.4 \text{ kg TSS/kg BOD}_5 \times 92 \text{ kg BOD/d}) + (0..1 \times 92 \text{ kg TSS/d})$

WAS, Peak day = 46 kg/d

The estimated wet volume of sludge generated at average conditions corresponds to:

WAS, wet avg = $\frac{23\ \mathrm{kg}/d}{10\ \mathrm{kg}/m^3}$

WAS, wet avg = 2.3 m^3/d

WAS, wet avg = 16 m^3/wk

5.5 Design HRT

At average and peak day design conditions, the MBR system HRT is calculated as:

HRT, average = $\frac{96\ m^3}{20\ m^3/d}$

HRT, average = 4.8 days

HRT, peak day = $\frac{96\ m^3}{40\ m^3/d}$

HRT, peak day = 2.4 days

5.6 MBR System Membrane Flux Rate

5.6.1 Average Design Flux Rate

Number of cartridges:

= 150 cartridges x 2 cassettes

= 300 cartridges

Membrane surface area of one membrane cartridge:

= 0.8 m^2

Total membrane surface area:

= 300 cartridges x 0.8 m^2/cartridges

= 240 m^2

Average design (net) flux rate = 20 $m^3/d \div 240\ m^2$

Average design (net) flux rate = 0.083 $\frac{m^3}{m^2 \cdot d}$

Considering the 10% relax time (when there is no permeate flow), the average design instantaneous (gross) flux rate is:

Average design (gross) flux rate = $0.083\ m^3/m^2/d \div 0.90$

Average design (gross) flux rate = 0.093 $\frac{m^3}{m^2 \cdot d}$

5.6.2 Peak Design Flux Rate

Peak design (net) flux rate = $40\ m^3/d \div 240\ m^2$

Peak design (net) flux rate = 0.17 $\frac{m^3}{m^2 \cdot d}$

Considering the 10% relax time (when there is no permeate flow), the peak design instantaneous (gross) flux rate is:

Peak design (gross) flux rate = $0.17\ m^3/m^2/d \div 0.90$

Peak design (gross) flux rate = 0.19 $\frac{m^3}{m^2 \cdot d}$

5.7 Aeration Requirements for MBR System

The AOR for the MBR system at peak design conditions is calculated as follows:

Flow, peak = 40 m^3/d

BOD concentration, daily average = 2,300 mg/l

TKN concentration, daily average = 100 mg/l

Assume:

- 1.5 kg O_2/kg BOD_5 removed (BOD_5 oxidation and endogenous respiration)
- 4.6 kg O_2/kg TKN nitrified
- 1.25 peaking factor of AOR

AOR required at **peak** design conditions:

AOR, peak = 40 m^3 × $\frac{1000\ L}{m^3}$ $\frac{1\ kg}{10^6 mg}$ ×(1.5 × 2,300 mg/l BOD + 4.6 × 100 mg/l N)

AOR, peak = 156 kg O_2 / d

Peaking factor of 1.25 on top of peak AOR

AOR, peak = 156 kg O_2 / d × 1.25

AOR, peak = 196 kg O_2 / d

The aeration supplied via membrane scour to the membrane compartment is calculated as follows:

Minimum permissible air flow per ES150 cassette:

= 1.5m^3/min

Minimum scour air supplied:

= 2 cassettes/tank × 1.5 m^3/min/tank

= 3 m^3/min @ 0°C, 101.325 kPa

Maximum permissible air flow per ES150 cassette:

= 2.25 m^3/min

Maximum scour air supplied:

= 2 cassettes × 2.25 m^3/min/cassettes

= 4.5 m^3/min @ 0°C, 101.325 kPa
Water depth in membrane compartment = 2.6 m (3.5 m diffuser submergence)
Dissolving efficiency at 2.3 m = 3.9%
Alpha factor for 10,000 mg/l MLSS = 0.55

Minimum oxygen supplied via scour:
Scour air O_2 = 3 m^3/min × 1440 min/d × 0.277 kg/m^3 air × 0.039 × 0.55
Scour air O_2 = 26 kg O_2/d

Aeration and scour air in the membrane compartment is supplied by one VFD-controlled aeration blower and the coarse-bubble diffused aeration system. Aeration in the membrane compartment will be consistent and continuous, except during low flow/low load conditions when the air scour cycles ON/OFF on an operator-adjustable schedule, or during a membrane cleaning when the scour is shut OFF.

Membrane air scour will normally be controlled to meet the minimum scour requirements (i.e., 3 m^3/min). Membrane air scour may need to be increased if extra scour is required. During this condition, the air scour will be controlled at the max flow rate (4.5 m^3/min).

The design aeration required in the aeration compartment at peak design conditions is:
= Total AOR – actual oxygen provided via air scour
= 196 kg O_2/d – 26 kg O_2/d
= 170 kg O_2/d

The fine bubble diffused aeration system for the aeration compartment is to be sized for an AOR of 170 kg O_2/d, and the aeration blower is to be sized to supply air to the fine-bubble diffused aeration system plus the air scour for the membrane compartment.

5.8 Blower Conditions

The discharge pressure of the aeration blowers will depend on the dimensions of the aeration tank, elevation of the diffuser piping, and piping headlosses. The aeration blower discharge pressure can be calculated as:

Aeration blower discharge pressure =

[(Maximum liquid depth, ft – diffuser lateral height, ft) x 0.434 psi/ft] +
Head loss through diffuser piping + Head loss through blower piping

5.9 Laboratory Requirements

A new laboratory will be used for on-site testing. The following laboratory analyses will be routinely conducted (additional testing may be required, depending on local regulations):

- Chemical oxygen demand (COD)
- Biological oxygen demand (BOD_5)
- Total suspended solids (TSS)
- Volatile suspended solids (VSS)
- pH
- Temperature (°C / °F)
- Total Kjeldahl nitrogen (TKN)
- Ammonia nitrogen (NH_3-N)
- Total nitrogen (TN)
- Total phosphorus (TP)
- Fat, oil, and grease (FOG)
- Total residual chlorine (TRC)
- Filterability (ml/min)

Some analyses will be done by an outside laboratory, such as BOD.

5.10 Monitoring Requirements

The HMI used to monitor the system will be located on the control computer and be used to store data. This control computer should have secure internet access in order to allow easy access to the control system from outside the plant for required programming modifications and data transfer.

It is recommended that easily accessible manual sampling locations be available at the following locations:

- Wastewater influent line (manual sampling valve on the influent line)
- Aeration compartment
- Membrane compartment
- MBR permeate (manual sampling valve on discharge of permeate pump)

6 POWER

6.1 Power Supply

Power and communication wiring, conduit, and hardware will be required to accommodate the wastewater treatment system and to provide for the following new equipment:

- Aeration blower with VFD (1)
- MBR permeate pump (1)
- Defoamer pump (1)
- Chemical cleaning pump (1)
- Power supply for instrumentation, PLC, and control valves
- Communications wiring

A preliminary motor list and estimate of power requirements for the new MBR treatment system components are provided in Table 6.1 (detail designers to confirm final motor list).

Table 6.1 – Preliminary New Motor List and Estimate of Power Requirements

Motor	Power (kW)	
	Connected	Operating
Air Blower	15	10
Permeate Pump	0.75	0.5
Defoamer Pump	0.1	---
Cleaning Chemical Pump	0.3	---
Total	**16.15**	**10.5**

Electrical system is to be designed in accordance with NEC standards.

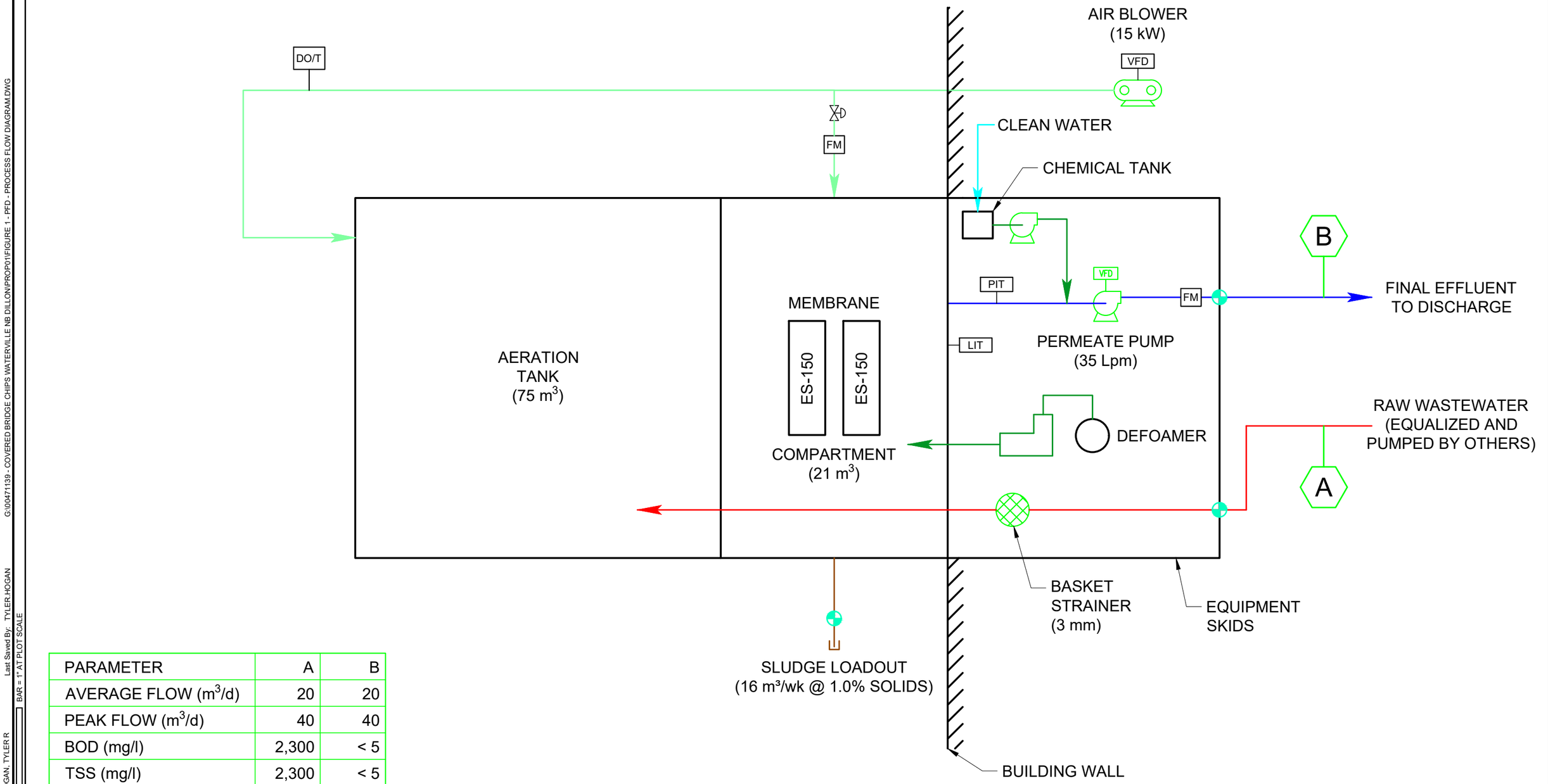
6.2 Control System

The PLC/PC hardware will monitor and control all analog and digital signals related to the treatment plant. The control program will provide user-friendly graphical screens to allow the operator to monitor the various treatment processes and equipment and make operating changes, if required. Features should include real-time trending of all on-line monitored parameters, easy to read graphical process screens, and automatic alarm functions and display.

The PC will also incorporate access via internet for troubleshooting and downloading process data by Evoqua. This feature allows the operator, process and/or electrical engineer to troubleshoot the system remotely, saving on both cost and time when resolving either process operating or control system problems.

APPENDIX A

PRELIMINARY DRAWINGS



PARAMETER	A	B
AVERAGE FLOW (m^3/d)	20	20
PEAK FLOW (m^3/d)	40	40
BOD (mg/l)	2,300	< 5
TSS (mg/l)	2,300	< 5

PRELIMINARY

- BATTERY LIMITS

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
.	.					
.	.					
.	.					
.	.					
.	.					
.	.					

DESIGNER	S.TAYLOR	DATE 2022-01-11
CHECKER		DATE
ENGINEER	D.BERTOL	DATE
MANAGER		DATE
REF:		
SCALE:		

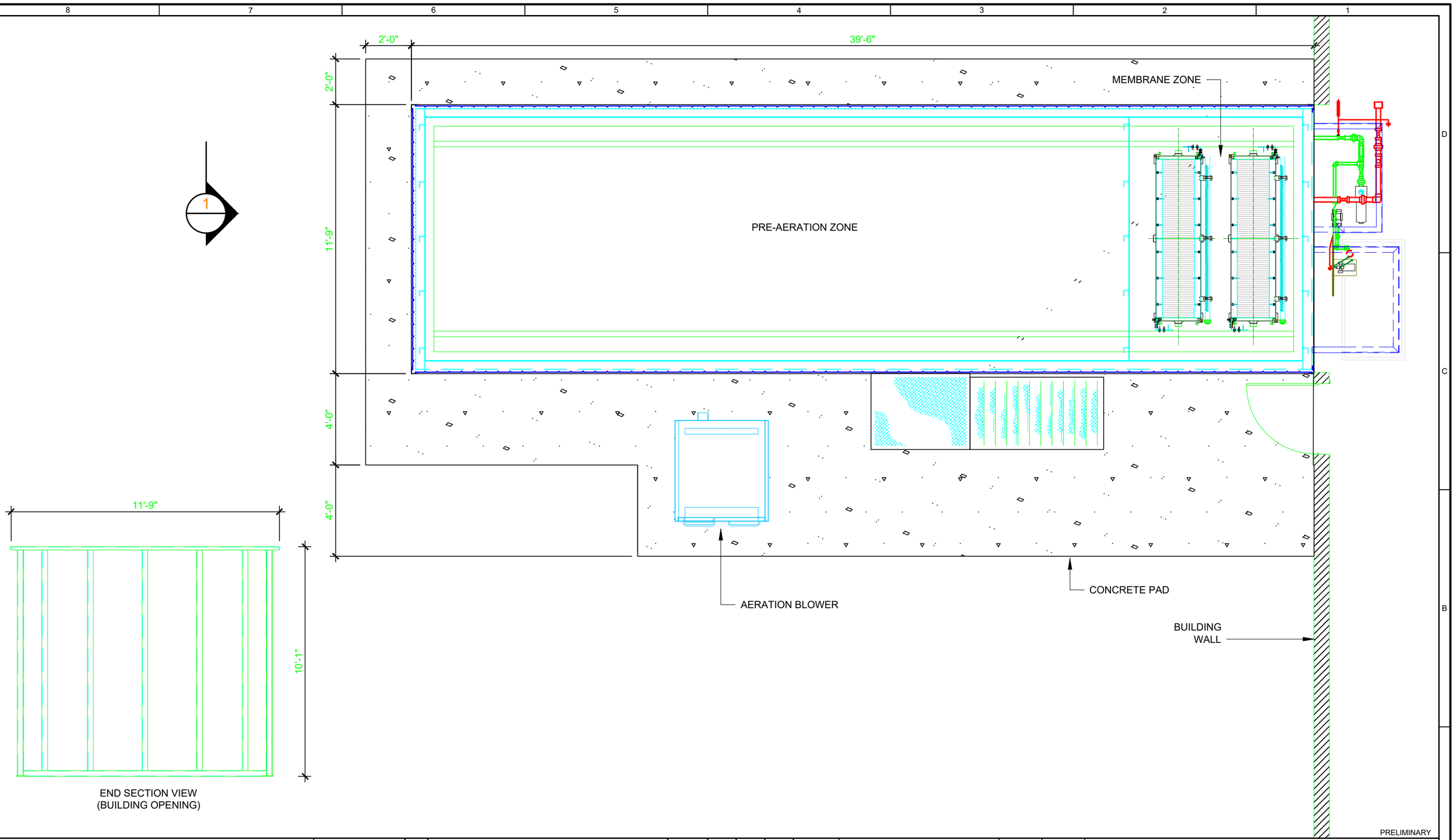
TITLE PROCESS FLOW DIAGRAM

CLIENT COVERED BRIDGE POTATO CHIPS, WATERVILLE, NB

evoqua WATER TECHNOLOGIES
ADI SYSTEMS
370 WILSEY ROAD FREDERICTON, NB, CANADA
+1(506) 452-7307

PROJECT	CODE	DRAWING	SHEET	REV
1000044147		FIGURE 1	OF	

Date Plotted:18/11/2022 10:15 Plotted By: HOGAN, TYLER R STD:11X17_B 0616 Border.dwg BAR = 1" AT PLOT SCALE Last Saved By: TYLER.HOGAN G:\00471139 - COVERED BRIDGE CHIPS WATERVILLE NB DILLON\PROP01\FIGURE 1 - PFD - PROCESS FLOW DIAGRAM.DWG



PRELIMINARY

- BATTERY LIMITS

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
.	.					
.	.					
.	.					
.	.					
.	.					
.	.					

DESIGNER	S.TAYLOR	DATE	2021-12-06
CHECKER		DATE	
ENGINEER	D.BERTOL	DATE	
MANAGER		DATE	
REF:			
SCALE:	1/4" = 1'-0"		

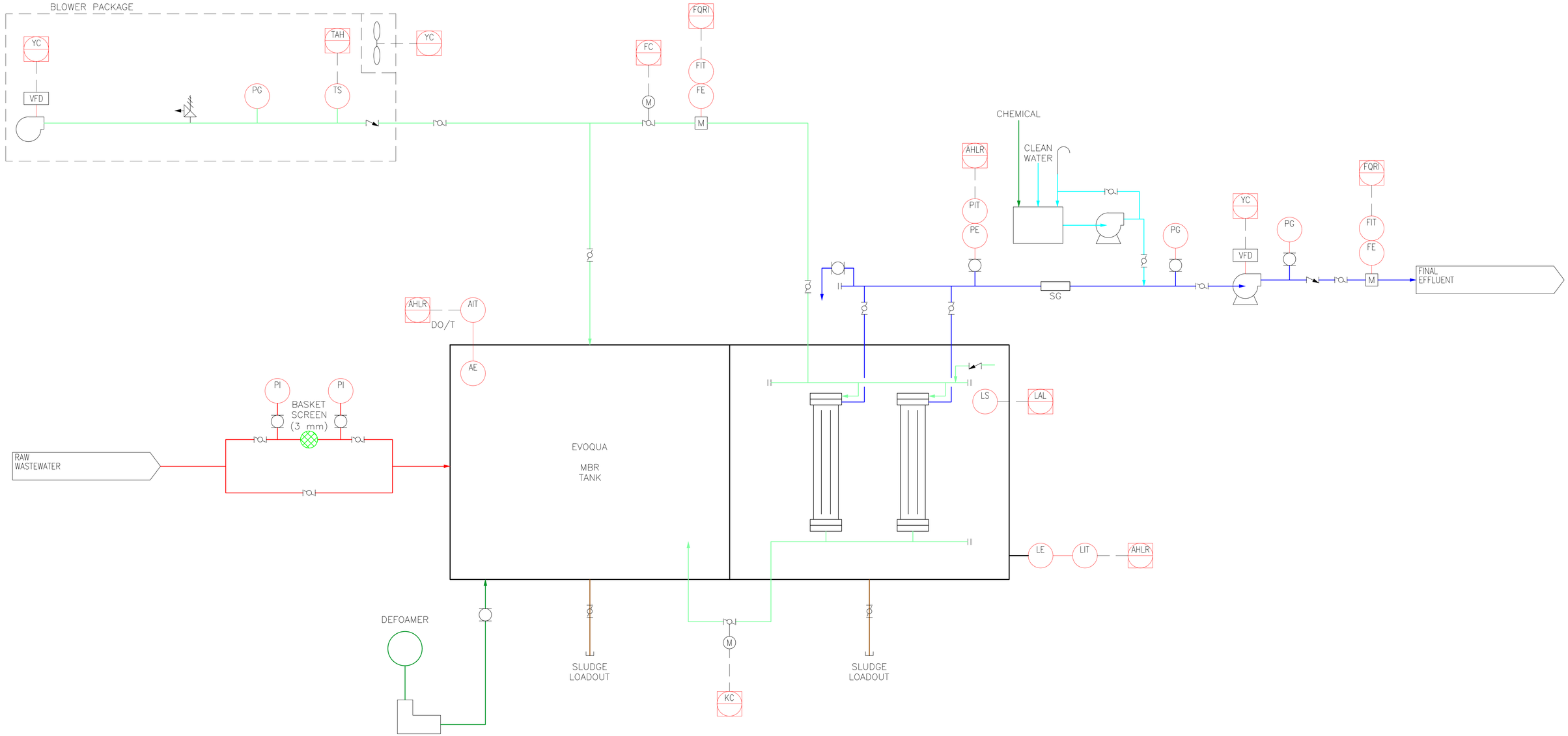
TITLE: PRELIMINARY LAYOUT

CLIENT: COVERED BRIDGE POTATO CHIPS, WATERVILLE, NB

EVOQUA WATER TECHNOLOGIES
ADI SYSTEMS
370 WILSEY ROAD FREDERICTON, NB, CANADA
+1(506) 452-7307

PROJECT	CODE	DRAWING	SHEET	REV
1000044147		FIGURE 2	OF	

Date Plotted:18/11/2022 10:33 Plotted By: HOGAN, TYLER R Last Saved By: JEFF.WHITE G:\00471139 - COVERED BRIDGE CHIPS WATERVILLE NB DILLON\PROP01\FIGURE 2A - PFD - PRELIMINARY LAYOUT.DWG
STD:11X17_B 0616 Border.dwg BAR = 1" AT PLOT SCALE



REV	DESCRIPTION	DATE	DWN	CKD	APPD	ECN

DWN BY: A.DESOUZ	DATE 2022-11-06
CKD BY: J.HO	DATE 2022-11-15
APPD BY: PENDING	DATE 2022-11-##
MGD BY: A.VANDEN	SCALE NOT TO SCALE
PART NUMBER	

TITLE
PIPING & INSTRUMENTATION DIAGRAM(S)
WASTEWATER TREATMENT SYSTEM
PID 12-3: PACKAGE MBR SYSTEM

CLIENT
COVERED BRIDGE POTATO CHIPS
WATERVILLE, NB

EVOQUA WATER TECHNOLOGIES
FREDERICTON NB CANADA
+1(506) 452-7307

PROJ/PROD NUMBER	CODE	FILE/DRAWING NUMBER	SHEET	REV
1000044147	D-DOS02	V113410212	1 OF 3	A

APPENDIX B

ESTIMATED ANNUAL OPERATING COSTS

Estimated Annual Operating Costs
(350 d/y Operation)

1. Labour $19,000
Assume one operator, 3 hr/d, 5 d/wk, $25/hr

2. Maintenance Allowance $10,000

3. Annual Allowance for Membrane Replacement $3,000
Based on estimated membrane lifetime of 10 years

4. Electrical (assuming $0.07/kW-h) $6,200

Motor	**Installed (kW)**	**Operating (kW)**
Air Blower	15	10
Permeate Pump	0.75	0.5
Defoamer Pump	0.1	---
Cleaning Chemical Pump	0.3	---
TOTAL	**16.15**	**10.5**

5. Chemicals
a) Laboratory, routine purchases, allowance $1,000
b) Allowance for defoamer, if required $1,000
c) Membrane cleanings chemical allowance:
Assume 4 cleanings per year at 75 liters per CIP. 300 liters per year of
12% sodium hypochlorite required for MBR CIPs at assumed cost of $0.80/kg, $300
- Clean water required for CIP 3300 liters per year.

6. Waste Activated Sludge Disposal
Estimated 1.6 m^3/week dewatered sludge disposal – allowance for transportation cost $1,000

TOTAL **$41,500**

Appendix B

Secondary Waste Water Treatment System Design Brief (Fundy 2023)

☎ 877.635.1566 ✉ fundy@fundyeng.com www.fundyeng.com

Bio-Resources | Building Systems | Environmental | Geotechnical | Project Management

COVERED BRIDGE POTATO CHIPS SECONDARY WASTE WATER DISPOSAL SYSTEM DESIGN BRIEF

Waterville, New Brunswick

March 2023

Prepared for:

Covered Bridge Potato Chip Company Inc.
Mike McCartney, Capital Project Manager
35 Alwright, Waterville, NB
E7P 0A5

Prepared by:

Fundy Engineering & Consulting Ltd.
27 Wellington Row
Saint John, NB
E2L 4S1

FUNDY Engineering

Serving Our Clients' Needs First

OFFICES IN SAINT JOHN AND CLYDE RIVER

Table of Contents

1 Introduction

High strength waste (HSW) presents a challenge for any type of onsite wastewater treatment system. Each facility type comes with its own unique wastewater characteristics as well as specific site and soil conditions for the design engineer and the operator to consider. It is critically important for the designer to gather sufficient information about the site conditions, the facility processes and the characteristics of the effluent that is to be treated. This will enable the design engineer and the treatment system vendor to identify certain distinct and potentially problematic conditions in the design and equipment selection process.

In general terms high strength waste has been defined as wastewater having greater than 200mg/l Biochemical Oxygen Demand (BOD) or Total Suspended Solids (TSS), however, there are constituents other than BOD and TSS such as pH, fats, oils & grease (FOG) or nitrogen that could potentially classify the effluent wastewater as “high Strength”. HSW has been loosely defined within the industry as anything greater than residential waste strength. Many standards and regulations base their soil loading rates upon residential strength waste. It is also important to note that soil loading rates can be reduced to account for HSW. Spreading the effluent over a larger footprint will provide better long-term performance.

Due to the variability in the creation of the high strength wastewater many health codes and regulations fail to completely address HSW. Therefore, the design engineer must review the costs and benefits of any additional treatment options or features with the Owner prior to presenting the treatment options available. There is no “one system fits” all solution. Each site and facility are different having its own unique conditions. At a minimum the design of the primary and secondary treatment systems must conform to provincial standards and regulations. The design decisions are ultimately the responsibility of the design engineer and the Owner. The primary objective is to provide a cost-effective treatment system that will perform well, satisfy the requirements of the provincial regulatory body and protect the public and environment.

2 High-Capacity Infiltrator Chambers

High-Capacity infiltrator chambers are hollow structures that attach end-to-end. They are installed in trenches or beds without gravel (except where local codes require the use of gravel). The entire bottom of the trench is open for unobstructed infiltration of water. The large storage volume within the hollow chambers accommodates peak flows of effluent from the facility. Infiltrator chambers also feature patented sidewall louvers that facilitates infiltration and allows for lateral leaching of effluent into the soil.

The High-Capacity Infiltrator Chamber H-20 offers maximum internal volume per linear foot for extra temporary storage capacity. The 10" louvered sidewalls facilitate infiltration and evaporation, while reducing fines in the system. The high-capacity chambers can achieve an H-20 load rating with 18" of compacted cover when installed per the manufacturer's installation requirements. Like conventional systems, the soil and site conditions must be approved prior to installation. A thorough site evaluation must be conducted to determine the proper sizing and siting of the system before installation.

2.1 System Advantages

The advantages of High-Capacity Infiltrator Chambers:

- Typically, the most cost-effective solution for larger systems
- Ease of installation
- Results in an overall field size reduction of 50% when compared to traditional pipe-in-stone trench design
- Most installers will have prior experience installing this system
- Latching mechanism allows for quick installation

3 Advanced Enviro-Septic (AES) Wastewater Treatment

The Advanced Enviro-Septic® (AES) Wastewater Treatment System utilizes a unique combination of components that work together to treat effluent and prevent suspended solids from sealing the underlying soil. Comprised of a patented corrugated, perforated plastic pipe with interior skimmer tabs and cooling ridges, the large-diameter pipe retains solids while the Bio-Accelerator® fabric, coarse fibers, and geo-textile fabric provide multiple bacterial surfaces to treat effluent prior to its contact with the receiving soils. The continual cycling of effluent

inside the pipe enhances bacterial growth. The AES system is completely passive, and yet provides increased aeration and a greater bacterial treatment area than traditional systems. The result is a system that is more efficient, lasts longer, and has virtually no negative environmental impact.

Sewage effluent that exits from a primary treatment system contains suspended solids that can cause traditional systems to fail prematurely. Solids can overload bacteria, cut off air required for aerobic bacterial activity, and/or clog the underlying soil, interfering with its ability to absorb liquid. By utilizing effective natural processes, the Advanced Enviro-Septic® System treats the primary system effluent in a manner that prevents solids from entering surrounding soils, increases system aeration, and provides a greater bacterial area (Biomat) than traditional systems.

The Advanced Enviro-Septic® pipe consists of:

- A 300 mm diameter, high-density plastic pipe which is corrugated and perforated. Skimmer tabs extend into the pipe at the point of each perforation.
- A dense mat of coarse, randomly oriented plastic fibres surrounds the outside of the pipe.
- The Bio-Accelerator geo-textile fabric layer partially covers the fibres on the lower half of the pipes. It is located between the pipe and the plastic fibres.
- The outer layer non-woven geo-textile fabric holds the other components in place and provides a protected surface on which a biomat develops.

The Advanced Enviro-Septic® pipes are surrounded by a bed of System Sand, which facilitates the process by wicking the liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria.

When effluent leaves the primary treatment system it still contains some suspended material, fat, oil & grease and other pollutants. The presence of these elements eventually causes clogging of traditional leaching fields. The Enviro-Septic® System facilitates the treatment of sewage effluent by using natural bacterial processes in a more efficient way. The cooling of the effluent in the pipes and the aerobic bacterial activity around the geo-textile allow for the separation of suspended solids, which are retained inside the pipes. The combination of air flow and continually fluctuating liquid levels in the pipes increases the effectiveness of bacterial activity in the membranes. These processes create a system with an interior balance, prolonging the system's lifespan and allowing the system to treat the wastewater effectively before it is dispersed into the environment.

3.1 System Advantages

The advantages of The Enviro-Septic® System.

- Eliminates “septic mounds” through sloping system installations
- Adapts to difficult sites
- Installs more easily and quickly than traditional systems
- Eliminates the need for expensive washed stone
- Adapts easily to both residential and commercial sites
- No mechanical equipment for treatment performance
- Allows for gravity discharge with often no requirement for pumps
- Lower cost than comparable level IV (tertiary) treatment systems

The system is installed within a bed or trench of specified System Sand which facilitates gas exchange and controlled infiltration into underlying soils. All systems include ventilation to assure aerobic conditions are maintained. In addition, the AES system maintains a stable pH in the range of 7.0 to 8.5, providing the ideal conditions for aerobic bacterial processes. AES provides treatment of wastewater prior to releasing it into the ground, reducing risks to public health, surface and ground waters, and the environment. Advanced Enviro-Septic™ protects the underlying soils from clogging--facilitating infiltration, preventing leachate from surfacing, and extending system life.

The AES system requires a fraction of the land area needed for a pipe and stone system (40 to 70% less depending on provincial regulations). Since the system does not rely on the underlying soils to treat wastewater and since the system prevents the bacterial surfaces and the underlying soil from clogging, it can be both smaller and closer to restrictive features. The Bio-Accelerator™ protects the soils and groundwater from contamination by filtering out additional solids from effluent, enhancing and accelerating treatment, facilitating quick start-up after periods of non-use, providing additional surface area for bacterial growth, promoting even distribution, and further protecting outer layers and the receiving surfaces so they remain permeable.

3.2 Minimum Site Requirements for an AES onsite system:

In order to be suitable for an AES onsite system, the site must have a minimum of 12 in. of unsaturated soil below the AES System and System Sand bed (either naturally occurring soil or suitable fill material). We require a minimum of 18 in. separation distance from the bottom of the AES pipes to the seasonal high-water table or restrictive layer; this 18 in. includes a minimum of 6 in. of System Sand installed directly below the pipes. Since an AES System can be 40 to 70% smaller than a conventional system, and since it does not require a replacement area, AES provides a realistic solution for small or odd-shaped lots that otherwise could not accommodate an onsite system.

3.3 How the AES treats wastewater:

The Advanced Enviro-Septic™ Wastewater Treatment System in essence creates a self-sustaining, self-regulating biological ecosystem which is highly effective at purifying effluent. The bacterial population within the system adjusts as it is exposed to cycling aerobic and anaerobic (wet and dry) conditions. The aerobic and anaerobic bacteria populations automatically adjust based on what they are “fed” and the amount of oxygen present in the system. A microscopic layer created by the waste-products of anaerobic bacterial activity referred to as the “Biomat” is responsible for treating the wastewater and regulating the rate at which fluid moves through the system. Slowing down the liquid enables the bacteria (both aerobic and anaerobic) the time it needs to digest the waste materials in the effluent. The aerobic bacteria digest the biomat, enhancing its permeability and preventing it from clogging. So while anaerobic bacteria are continually building the biomat, the aerobic bacteria are continually eating away at it, creating a natural balance that results in passive, effective, long-term wastewater treatment. The result is a healthy biomat that is not subject to clogging and which regulates the passage of fluid through the system. The AES system is designed to provide combined treatment and dispersal of wastewater that has received primary treatment. Effluent travels from the discharge of the primary treatment system to the AES treatment system by gravity or, if necessary, using a pump system to gain elevation. AES is a passive/non-mechanical treatment system that does not require electricity, pressure distribution, mechanical devices or replacement media. The AES system develops a multi-stage, permeable, self-regulating biomat that is highly effective at purifying wastewater and protects receiving soils from clogging.

4 Proposed Design

Based on the information available at this time, a preliminary schematic design has been prepared using the High-Capacity Infiltrator Chambers and the Advanced Enviro-septic Design (Appendix 3). The proposed design consists of a pump lift station receiving the effluent from the primary treatment system, and dispersing the effluent into a pressure dosed leaching field.

The schematic design has been prepared based on the expected daily flow rate from the primary treatment system, existing site conditions, ease of installation, cost effectiveness, and overall system reliability. The proposed disposal systems has been designed to ensure conformance with the New Brunswick Technical Guidelines for On-Site Sewage Disposal Systems.

5 Closing

We trust this schematic design debrief report is sufficient for your current needs. We would be pleased to provide additional information or clarification concerning the enclosed upon your request.

Darryl G. Ford, P.Eng., FEC
President/Building Systems Director, Fundy Engineering & Consulting Ltd.
Email: darryl.ford@fundyeng.com
Phone: 506.635.1566

Appendix I

The High-Capacity Infiltrator Chamber H-20 Specification Sheet

INFILTRATOR®
water technologies

The **High Capacity** Infiltrator Chamber H-20

High Capacity

The High Capacity Infiltrator Chamber H-20 offers maximum internal volume per linear foot for extra temporary storage capacity. The 10” louvered sidewalls facilitate infiltration and evapotransporation, while reducing fines in the system. The High Capacity H-20 chamber gets an H-20 load rating with 18” of compacted cover when installed per installation requirements.

Chamber Benefits:

- More temporary storage capacity
- Maximum internal volume per linear foot
- Easy assembly and installation with as few as two people, a backhoe and a pickup truck
- Inspection port option for easy access to leachfield with no site disruption
- **OVERALL REDUCED COST**

Tested and Proven with More than One Million Installed:

- Infiltrator is the number-one septic leachfield chamber system in the onsite industry.
- More than one million systems installed, with over 27 million units in-ground in all 50 states and 24 countries.
- Infiltrator’s established history of performance and reliability began in 1987.
- Field surveys show that Infiltrator chambers systems are more resistant to hydraulic failure than stone and pipe systems.
- Infiltrator is ISO 9001:2000 certified and is IAPMO and UPC approved.

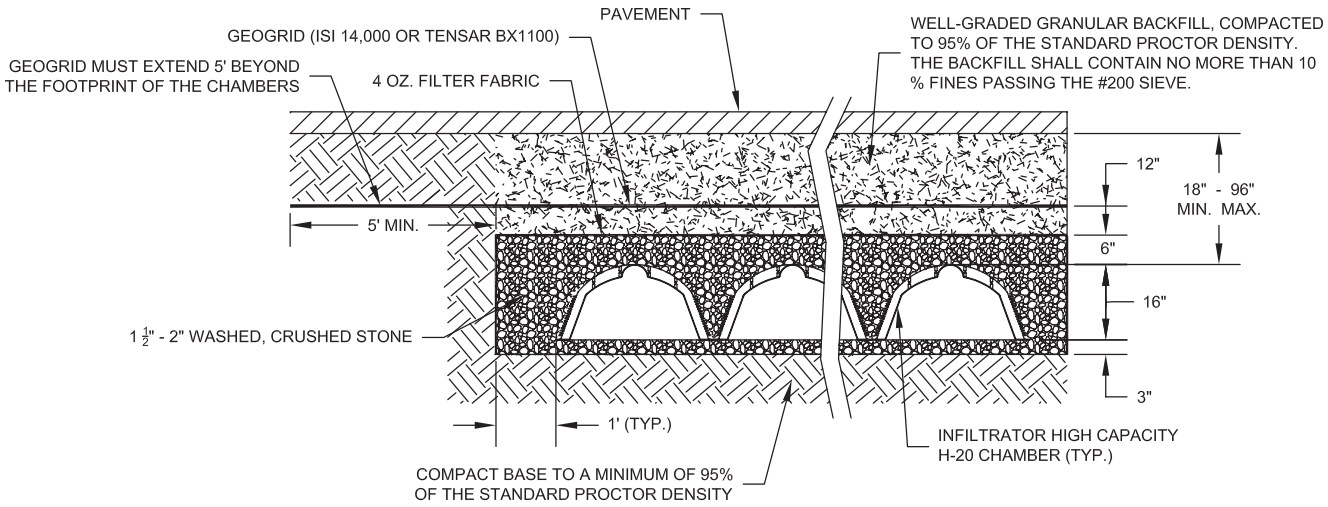
APPROVED in _____

Traffic Rated Series

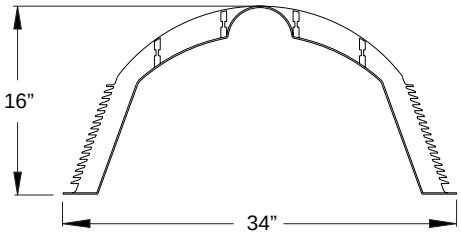
H-20 Load Rating with 18” of Compacted Cover

HIGH CAPACITY INFILTRATOR H-20 CHAMBER TYPICAL CROSS SECTION

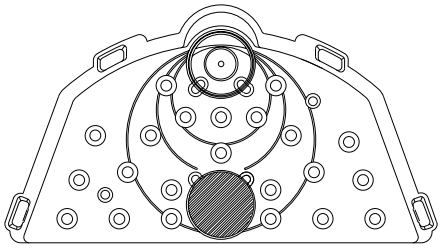
H-20 Traffic Rated Series



Chamber End View



PosiLock™ End Plate



Specifications	
Size	34"W x 75"L x 16"H
Storage Capacity	110 gal / 14.3 ft^3
Weight	38 lbs
Louvered Sidewall Height	10"

INFILTRATOR WATER TECHNOLOGIES STANDARD LIMITED WARRANTY

(a) The structural integrity of each chamber, endcap and other accessory manufactured by Infiltrator ("Units"), when installed and operated in a leachfield of an onsite septic system in accordance with Infiltrator's instructions, is warranted to the original purchaser ("Holder") against defective materials and workmanship for one year from the date that the septic permit is issued for the septic system containing the Units; provided, however, that if a septic permit is not required by applicable law, the warranty period will begin upon the date that installation of the septic system commences. To exercise its warranty rights, Holder must notify Infiltrator in writing at its Corporate Headquarters in Old Saybrook, Connecticut within fifteen (15) days of the alleged defect. Infiltrator will supply replacement Units for Units determined by Infiltrator to be covered by this Limited Warranty. Infiltrator's liability specifically excludes the cost of removal and/or installation of the Units.

(b)THE LIMITED WARRANTY AND REMEDIES IN SUBPARAGRAPH (a) ARE EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE UNITS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE

(c) This Limited Warranty shall be void if any part of the chamber system is manufactured by anyone other than Infiltrator. The Limited Warranty does not extend to incidental, consequential, special or indirect damages. Infiltrator shall not be liable for penalties or liquidated damages, including loss of production and profits, labor and materials, overhead costs, or other losses or expenses incurred by the Holder or any third party. Specifically excluded from Limited Warranty coverage are damage to the Units due to ordinary wear and tear, alteration, accident, misuse, abuse or neglect of the Units; the Units being subjected to vehicle traffic or other conditions which are not permitted by the installation instructions; failure to maintain the minimum ground covers set forth in the installation instructions; the placement of improper materials into the system containing the Units; failure of the Units or the septic system due to improper siting or improper sizing, excessive water usage, improper grease disposal, or improper operation; or any other event not caused by Infiltrator. This Limited Warranty shall be void if the Holder fails to comply with all of the terms set forth in this Limited Warranty. Further, in no event shall Infiltrator be responsible for any loss or damage to the Holder, the Units, or any third party resulting from installation or shipment, or from any product liability claims of Holder or any third party. For this Limited Warranty to apply, the Units must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Infiltrator's installation instructions.

(d) No representative of Infiltrator has the authority to change or extend this Limited Warranty. No warranty applies to any party other than the original Holder.

The above represents the Standard Limited Warranty offered by Infiltrator. A limited number of states and counties have different warranty requirements. Any purchaser of Units should contact Infiltrator's Corporate Headquarters in Old Saybrook, Connecticut, prior to such purchase, to obtain a copy of the applicable warranty, and should carefully read that warranty prior to the purchase of Units.

INFILTRATOR®
water technologies

4 Business Park Road
P.O. Box 768
Old Saybrook, CT 06475
860-577-7000 • Fax 860-577-7001
1-800-221-4436
www.infiltratorwater.com

C55 0713ISI

Contact Infiltrator Water Technologies' Technical Services Department for assistance at 1-800-221-4436

Appendix II

Case Studies

1. Berkshire East Project at Charlemont, MA
2. The Cottages at River Hill West Newbury, Mass
3. Victor Hernandez Building Elderly Housing, Aquadilla, Puerto Rico
4. Raven Rock State Park at Harnett County, NC

CASE STUDY

PROJECT NAME
Berkshire East
Charlemont, MA

SYSTEM SPECIFICATIONS
9,900 GPD subsurface AES combined treatment and dispersal system installed in two 4,743 sqft C33 sand beds at a Massachusetts four-season resort

INFILTRATOR PRODUCTS USED
6,000 linear foot Advanced Enviro-Septic® combined treatment and dispersal system

INSTALLATION DATE
Summer 2022

ENGINEER
Matthew Puntin, P.E.
SK Design Group, Inc.
Pittsfield, MA

CONTRACTOR
Clayton Davenport
CD Davenport Trucking, Inc.
Colrain, MA

INFILTRATOR
water technologies

4 Business Park Road, Old Saybrook, CT 06475
(800) 221-4436 • info@infiltratorwater.com

Advanced Enviro-Septic® Combined Treatment and Dispersal System Provides Reduced Footprint and Cost for Massachusetts Resort

OVERVIEW

Berkshire East is a four-season mountain resort located in Western Massachusetts. This resort features skiing, snowboarding, mountain biking, camping, white water rafting, zip lines, and a mountain coaster. The resort needed to replace an existing septic system serving the main lodge of the mountain that was deemed a failure. Plans for future development of the property required a new system sized to handle larger future flows.

SYSTEM DESIGN

The project engineer, Matthew Puntin, P.E. of SK Design Group, considered several options for the 9,900 GPD system including Infiltrator Chambers and conventional stone and pipe. He ultimately selected an Advanced Enviro-Septic® (AES) combined treatment and dispersal system because of the 25 percent footprint reduction as compared to chambers and the ability to install the system with the existing land contours. The footprint of a stone and pipe system would have had to be 50 percent larger than the selected AES system. In addition, the substantial reduction in footprint also reduced the construction cost.

The AES treatment system removes up to 99 percent of wastewater impurities without using any electricity or replacement media. Highly purified wastewater is released to the soil, recharging the groundwater, preventing soil and groundwater contamination. The 9,900 GPD AES system at Berkshire East includes 6,000 linear feet of AES pipe divided into two-5,000 GPD module beds. The total combined sand bed area for the system is 9,486 sqft with a soil loading rate of 1.233 GPD/sqft. The AES subsurface combined treatment and dispersal system solution enabled the engineer and contractor to accommodate the cross-slope on the site by installing the AES in a stepped configuration to slope the system and reduce the amount of fill needed for the project.

RESULTS

The smaller footprint required for the AES system, the ability to install with the natural contour of the site, and reduced fill and construction costs were all major benefits of choosing the AES system. In addition, the system is very low maintenance and will accommodate the future growth of the resort.

> ***"AES systems are low maintenance needing just annual inspections of the field, the distribution boxes, and the pump chamber. Key benefits are that AES slopes with the land, reduces the system footprint including mound height, and reduces project costs."*** *– Matthew Puntin, P.E., SK Design Group, Inc.*

CASE STUDY

PROJECT NAME
The Cottages at River Hill
West Newbury, Mass.

SYSTEM SPECIFICATIONS
9,240 GPD combined treatment and dispersal system for 30 single-family home residential community

PRODUCTS USED
Enviro-Septic® combined treatment and dispersal system

OWNER
Cottages at River Hill Community Management Assoc.

Combined Treatment and Dispersal System Enables Development of 30-home Residential Community in Massachusetts

OVERVIEW

The Cottages at River Hill project was developed as a residential "pocket community" of 30 single-family homes clustered to foster community connections, while leaving the majority of the property as an undeveloped, shared space with walking trails and community gardens to enhance the quality of life for the residents and greater community. Because there was no infrastructure available, developers needed an innovative onsite solution capable of handling a total design flow of 9,240 GPD from the 84 total bedrooms in the development.

CHALLENGE

The developers of this innovative project chose an Enviro-Septic® combined treatment and dispersal system from Infiltrator Water Technologies. Normally, an onsite wastewater system of this size in Massachusetts would require pressure distribution to facilitate dispersal of the effluent to the native soils. However, the performance track record of the Enviro-Septic wastewater treatment system enabled the project to proceed without pressure distribution.

SYSTEM DESIGN

Due to separation to seasonal high-water table requirements for new construction, the system was designed in an elevated mound configuration that included two beds for a total of 6,002 feet of Enviro-Septic pipe configured in 66 rows at 91 feet each. A portion of one of the beds (15 rows) slopes at 6 percent to allow the large field to blend in with the terrain and save on the cost of additional fill which would have been required for a level bed. Because of the secondary treatment performance of the system, the Enviro-Septic system is approved for a 40 percent reduction as compared to conventionally sized systems in Massachusetts. This enabled a much smaller footprint and subsequently much less disturbance to the natural areas of the property.

RESULT

Today, the Cottages at River Hill are fully occupied. The community management association reaps the value of a low-maintenance wastewater treatment system, and the residents enjoy the benefits of a tight-knit community along with the open spaces and natural vistas this type of development provides.

INFILTRATOR
water technologies

4 Business Park Road, Old Saybrook, CT 06475
(800) 221-4436 • info@infiltratorwater.com

CASE STUDY

PROJECT NAME
Victor Hernández Building Elderly Housing
Aquadilla, Puerto Rico

SYSTEM SPECIFICATIONS
6,000 GPD passive combined treatment and dispersal system for elderly housing facility

PRODUCTS USED
Advanced Enviro-Septic® (AES) combined treatment and dispersal system
Septic Maze™ septic tank insert

INSTALLATION DATE
2021

CONTRACTOR
Sani-Plant
Trujillo Alto, Puerto Rico

OWNER
City of Aquadilla, Puerto Rico

Combined Treatment and Dispersal Wastewater Treatment System Replaces Failed Conventional System at Elderly Home in Puerto Rico

OVERVIEW
The Victor Hernández Building Elderly Housing facility in Aquadilla, Puerto Rico had a failed onsite septic system in poor soils that needed to be pumped to a holding tank weekly. With a limited budget for operations and maintenance and wastewater constituents typical of a project of this type, the situation made clear the need for a better solution with technology that offered a higher level of treatment to protect and preserve the permeability of the soil.

CHALLENGE
Limited area available for a new system and ongoing maintenance expenses were both challenges that steered project designers toward a passive treatment system requiring minimal ongoing maintenance and associated costs. The small footprint of the system was compatible with the land available and was economical to install and maintain. Also, key to the system selection was the need for superior treatment of the building's wastewater due to challenging wastewater typical of these types of facilities.

SYSTEM DESIGN
Following thorough review of the project, Sani-Plant of Trujillo Alto, PR, selected a NSF 40 and BNQ Certified, Advanced Enviro-Septic® (AES) combined treatment and dispersal system. A 6,000 GPD system was designed with an additional septic tank that included a Presby Maze septic insert to increase the retention of the waste to allow greater efficiency in the primary treatment. Because of the AES system's rigorously tested capability for high level treatment, the system needed a treatment and dispersal footprint of only 5,609 ft^2 (39 ½ ft x 142 ft) with an application rate of 1.07 GDP/ft^2. Also, the project required only 2,600 feet of AES pipe in a butterfly configuration with eight serial sections. This saved the facility a significant amount of space. Additionally, by installing a passive CTD system with a proven record for exceeding required treatment levels and a reduced footprint, the Victor Hernández Building saved significant short and long-term costs.

RESULT
Victor Hernández Building saved significant short and long-term costs by installing a passive, small footprint system with a proven record for exceeding required treatment levels.

INFILTRATOR
water technologies

4 Business Park Road, Old Saybrook, CT 06475
(800) 221-4436 • info@infiltratorwater.com

CASE STUDY

PROJECT NAME
Raven Rock State Park
Harnett County, NC

SYSTEM SPECIFICATIONS
2,655 GPD onsite septic system with Infiltrator chambers for NC State RV Park expansion

INFILTRATOR PRODUCTS USED
840 Infiltrator Quick4® Plus Standard Chambers

INSTALLATION DATE
2020

ENGINEER
Robert Graham, PE
George Finch/Coney and Associates

INSTALLER
Stacy Creech
Creech's Plumbing

OWNER
NC State Parks

Infiltrator Quick4® Plus Standard Chamber System Enables Expansion of North Carolina State Park Wastewater Treatment System

OVERVIEW

Park officials in Harnett County, North Carolina wanted to expand Raven Rock State Park to include nine new campsites with five to six RV hookups and a bathhouse including showers and restrooms.

CHALLENGE

A remote location, the need for minimal site impact, and restricted funding all made the selection and installation of the large 2,655 GPD system challenging. Further, temperatures of 100 degrees and a threat of rain and unstable weather were a constant challenge. Park officials first considered a conventional stone and pipe drainfield system. Accessibility to the site and a lack of storage area for the stone required and the fall hurricane season timeframe made that impractical. The contractor, Creech's Plumbing, recommended modifying the design to utilize Quick4® Plus Standard Chambers from Infiltrator Water Technologies to alleviate transportation and storage issues. Chambers were delivered on one truck and easily stored in a cleared area and hand-carried to the installation site.

SYSTEM DESIGN

Wastewater from the camper hookups flows to the 6,000-gallon dual compartment septic tank via a 6-inch, 693-foot-long Schedule 40 PVC sewer pipe. Bathhouse wastewater gravity flows 799 feet via a 4-inch pipe to the septic tank and then to an 8,000-gallon field dose tank. Alternating on-demand 110 GPM pumps in the dose tank sends the effluent through a valve vault to a 14-tap manifold. The duplicative pumps ensure effluent flows to the two drainfields, even if one pump fails. When the campground is at full capacity, the two drainfields, each 120 feet long with 14 trenches on nine-foot centers and utilizing a total of 840 Infiltrator Quick4 Plus Standard Chambers, are both dosed twice daily. A slope of three percent allowed the use of a gravity flow system. To accommodate the potential for volatile weather, work was done in stages, inspected, and covered. Utilizing a hybrid positioning system on which all project team members were trained including Infiltrator representatives enabled the installation crew to increase productivity overall and complete the installation of both drainfields in one day, just beating a four-day rainstorm.

RESULT

The advanced GPS technology utilized took the information provided on survey's and site plans and translated it to an exact location on the ground saving time and adding installation accuracy. The system is monitored remotely by a licensed operator who also performs routine maintenance.

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Appendix III

Drawings

1. Site Layout – Option A
2. Details
3. Site Layout – Option B
4. Details

1 / M1 SITE LAYOUT – PUMP CHAMBER & DISPOSAL FIELD
SCALE: 1" = 1'-0"

CONSTRUCTION SCOPE OF WORK

THE CONTRACTOR SHALL PROVIDE ALL LABOUR, MATERIALS, TOOLS AND EQUIPMENT REQUIRED FOR THE INSTALLATION OF A NEW ON-SITE SEWAGE DISPOSAL SYSTEM AS SHOWN ON THE PLANS. THE WORK SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:

1. FURNISH AND INSTALL NEW PRE-ENGINEERED CONCRETE PUMP CHAMBER AS SHOWN.
   - 1.1. PRE ENGINEERED CONCRETE PUMP CHAMBER 10'L X 7'-7"W X 8'H
   - 1.2. BUTYL RUBBER MASTIC JOINT SEALANT FOR ALL SEAMS.
   - 1.3. SANITARY WHITE CORROSION LINER
   - 1.4. ALUMINUM TOP C/W LOCKABLE SAFE-HATCH BOLTED AND SEALED TO SHELL FLANGE
   - 1.5. TWO ANTI SWAY RINGS BOLTED TO THE SIDE OF THE TANK
   - 1.6. FRP PIPE INLET

PUMPS

- 1.1. QUANTITY 2
- 1.2. 75 GPM @ 25 FEET HEAD
- 1.3. 208V/1Ø/60HZ, 0.75 HP
- 1.4. LIFT CHAINS 9/32" S/S 316
- 1.5. 4 PUMP FLOATS: PUMP OFF, LEAD PUMP ON, LAG PUMP ON, HIGH LEVEL ALARM
- 1.6. STANDARD OF ACCEPTANCE: LIBERTY FL-70 OR APPROVED ALTERNATE

2. CONTROLS: DUPLEX CONTROL PANEL ELEMENTS SHALL INCLUDE A MAGNETIC MOTOR CONTACTOR, MAIN DISCONNECT, MOTOR STARTER, OVERLOAD PROTECTION, H-O-A SWITCH, VISUAL AND AUDIBLE ALARM, START/RUN CAPACITORS, START RELAY AND TERMINAL STRIP. ALL CONTROL ELEMENTS SHALL BE HOUSED IN A NEMA/EMAC 4X ENCLOSURE. CONTROL PANEL SHALL ALTERNATE PUMP OPERATION SO THAT EACH PUMP RECEIVES EQUAL RUN TIME.
   - a. POWER: THE INCOMING POWER SHALL BE 208V/1ø/60HZ SERVICE. A CIRCUIT BREAKER SHALL BE USED TO PROTECT FROM LINE FAULTS AND TO DISCONNECT THE PUMP FROM THE INCOMING POWER.
   - b. STANDARD OF ACCEPTANCE – LIBERTY AE SERIES DUPLEX PUMP CONTROLLER
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONDUITS, WIRING, FITTINGS, CONNECTIONS, ETC. FROM SUMP PUMP TO CONTROL PANEL AND BUILDING POWER TO PROVIDE A COMPLETELY OPERATIONAL SEWAGE LIFT STATION SYSTEM. ALL WIRING AND CONNECTIONS TO BE COMPLETED BY A LICENSED ELECTRICIAN.
6. FURNISH AND INSTALL NEW FORCE MAIN PIPING FROM PUMP TO THE DISPOSAL FIELD. FORCE MAIN WASTE PIPE SHALL BE PVC SDR-26 FORCE MAIN AND CONFORM TO CAN/CSA B137.3, "RIGID PVC PIPE FOR PRESSURE APPLICATIONS", ASTM D2241, "PVC PRESSURE RATED PIPE", AND LOCAL REGULATIONS. –PVC GASKETED FITTINGS SHALL CONFORM TO CSA B137.2, "PVC INJECTION MOULDED GASKETED FITTINGS FOR PRESSURE APPLICATIONS."
7. FURNISH NEW SOIL AND GRAVEL, BACKFILL – AS NECESSARY – AND GRADE.

2 / M1 KEY PLAN
SCALE: NTS

GENERAL NOTES

1. THE ON SITE WASTEWATER DISPOSAL SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS ON THESE DRAWINGS AND IN COMPLIANCE WITH THE NEW BRUNSWICK DEPARTMENT OF HEALTH REGULATIONS AND DEPARTMENT OF ENVIRONMENT.
2. THE PROPOSED AND FINAL INSTALLATION SHALL BE REVIEWED AND APPROVED BY THE LOCAL HEALTH INSPECTOR.
3. THE INSTALLER WILL PROVIDE TEST HOLES AND OBSERVATION WELLS AS REQUIRED, TO OBTAIN NECESSARY APPROVAL.
4. CONTRACTOR SHALL CONTACT ALL UTILITIES TO LOCATE ANY BURIED SERVICES/PIPELINES IN THE CONSTRUCTION AREA PRIOR TO DIGGING.
5. PIPING: ALL NEW GRAVITY PIPE AND FITTINGS SHALL BE GASKETED PVC DR-35 SEWER PIPE AND FITTINGS TO THE REQUIREMENTS OF CSA B182.1
6. COMPACTIONS ARE TO BE COMPACTED TO 95-100% STANDARD PROCTOR DENSITY OR TO MANUFACTURER'S RECOMMENDATIONS.
7. EFFLUENT PASSING THROUGH FILL MUST BE ABSORBED INTO NATURAL SOIL BENEATH THE FILL OR INTO THE SURROUNDING PERMEABLE SOIL WITHOUT PONDING OR BREAKOUT TO SURFACE.
8. IMPORTED FILLS MUST CONFORM TO THE STANDARDS FOR IMPORTED FILLS DETAILED IN THE NEW BRUNSWICK TECHNICAL GUIDELINES FOR ON-SITE SEWAGE DISPOSAL SYSTEMS, LATEST EDITION.
9. THE FINAL SYSTEM SHALL BE INSTALLED SUCH THAT IT IS NOT LESS THAN 1.2m ABOVE ANY LIMITING FACTORS (AS MEASURED FROM THE INVERT OF THE PIPE).
10. THE CONTRACTOR SHALL RETAIN THE SERVICES OF A CONSULTANT TO TEST IMPORTED FILLS, IF USED, TO ENSURE THEY ARE IN ACCORDANCE WITH THE SPECIFIED SOILS.
11. CONTRACTOR SHALL STRIP AND STOCKPILE ON SITE ALL TOPSOIL FROM CONSTRUCTION AREA.

FIELD SIZING CALCULATIONS

EXPECTED PEAK FLOW RATE FROM WASTE TREATMENT SYSTEM: 20,000 LPD

INFILTRATION RATE: 48 L/sq.M/D

AREA REQUIRED: 416.67 sq.M

NO. INFILTRATORS REQUIRED: 396
12 INFILTRATORS/ROW = 33 ROWS

WORKING CAPACITY OF PUMP: 8000L

DOSE VOLUME: 3828L

DOSE TIME: 15 MINUTES

DOSE FLOW: 73.4

NO. DOSES/DAY: 4.8

GENERAL NOTES

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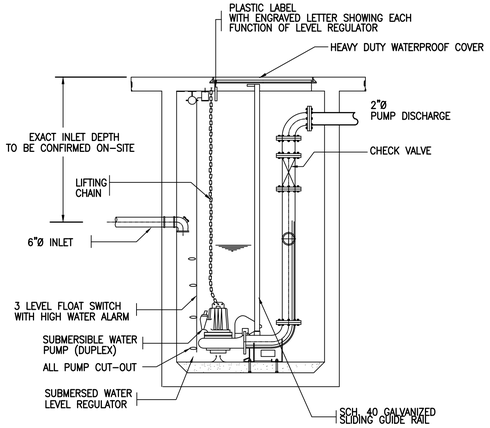
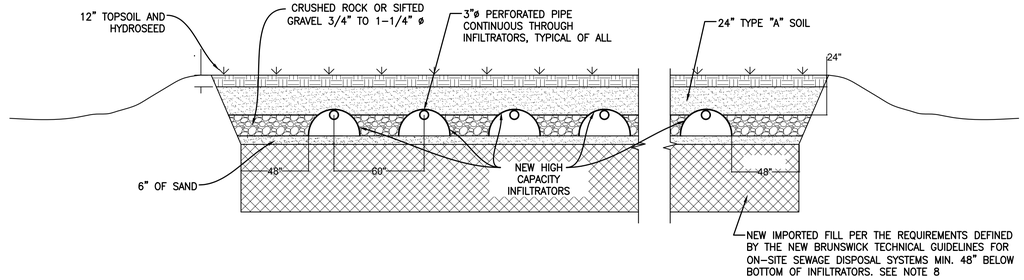
Project: ON-SITE WASTEWATER DISPOSAL DESIGN
COVERED BRIDGE
WATERVILLE, NB

Drawing: SITE LAYOUT – OPTION "A"

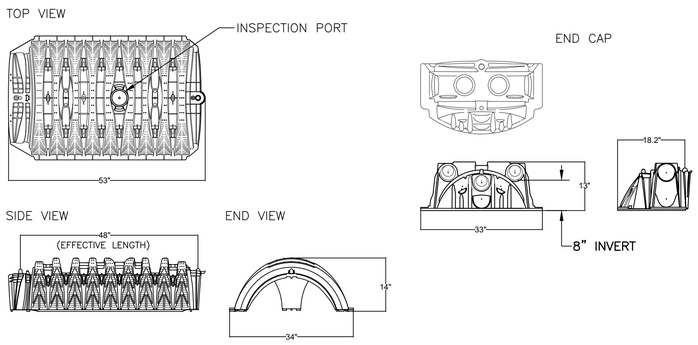
Designed	RSG	Project No. 16412	Rev. 0
Drawn	RSG	Sheet M1	
Date	FEB. 2023		
Scale	AS SHOWN		



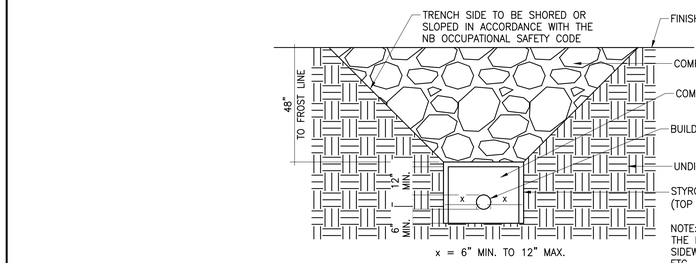
1 M2 PUMP CHAMBER DETAIL
SCALE: NTS



2 M2 RAISED MOUND DETAIL
SCALE: NTS

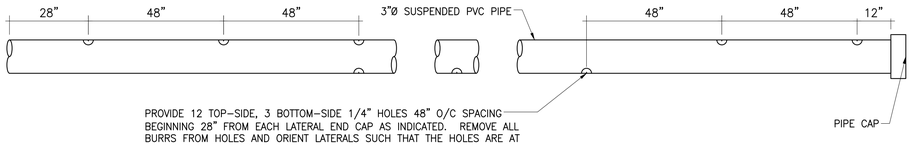


3 M2 INFILTRATOR DETAIL
SCALE: NTS



NOTE: CONTRACTOR IS RESPONSIBLE FOR THE RESTORATION OF ROADWAYS, CURBS, SIDEWALKS, DRIVEWAYS, LANDSCAPING, ETC. TO ORIGINAL CONFIGURATION.

4 M2 TRENCH DETAIL
SCALE: NTS



PROVIDE 12 TOP-SIDE, 3 BOTTOM-SIDE 1/4" HOLES 48" O/C SPACING BEGINNING 28" FROM EACH LATERAL END CAP AS INDICATED. REMOVE ALL BURRS FROM HOLES AND ORIENT LATERALS SUCH THAT THE HOLES ARE AT THE TOP OF THE PIPES AS SHOWN. THREE DRAIN HOLES IN EACH LATERAL SHALL BE DRILLED IN THE BOTTOM OF THE PIPE 122" FROM EACH END CAP AND CENTERED ON PIPE.

5 M2 SUSPENDED PIPE DETAIL
SCALE: NTS

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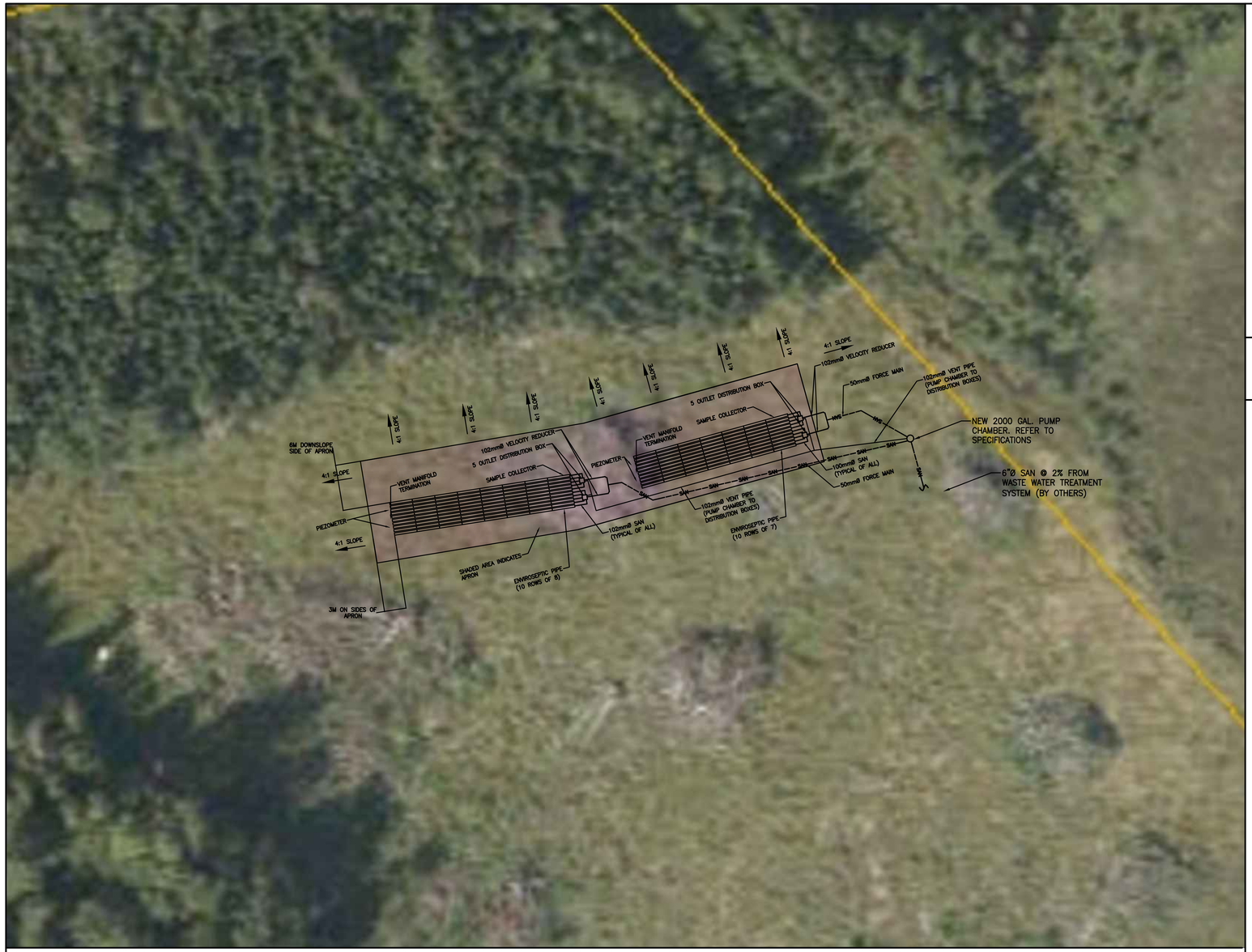
Project: ON-SITE WASTEWATER DISPOSAL DESIGN
COVERED BRIDGE
WATERVILLE, NB

Drawing: DETAILS

Designed	RSG	Project No. 16412	Rev. 0
Drawn	RSG	Sheet	M2
Date	FEB. 2023		
Scale	AS SHOWN		



1 / M3 SITE LAYOUT – PUMP CHAMBER & DISPOSAL FIELD
SCALE: 1" = 1'–0"

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   - 1.4. ALUMINUM TOP C/W LOCKABLE SAFE–HATCH BOLTED AND SEALED TO SHELL FLANGE
   - 1.5. TWO ANTI SWAY RINGS BOLTED TO THE SIDE OF THE TANK
   - 1.6. FRP PIPE INLET

PUMPS

- 1.1. QUANTITY 2
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- 1.3. 208V/1Ø/60HZ, 0.75 HP
- 1.4. LIFT CHAINS 9/32" S/S 316
- 1.5. 4 PUMP FLOATS: PUMP OFF, LEAD PUMP ON, LAG PUMP ON, HIGH LEVEL ALARM
- 1.6. STANDARD OF ACCEPTANCE: LIBERTY FL–70 OR APPROVED ALTERNATE

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2 / M3 KEY PLAN
SCALE: NTS

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11. CONTRACTOR SHALL STRIP AND STOCKPILE ON SITE ALL TOPSOIL FROM CONSTRUCTION AREA.

FIELD SIZING CALCULATIONS

EXPECTED PEAK FLOW RATE FROM WASTE TREATMENT SYSTEM: 20,000 LPD

INFILTRATION RATE: 48 L/sq.M/D

AREA REQUIRED: 416.67 sq.M

NO. PIPING SECTIONS: 150
PIPING LENGTH: 10 FEET

WORKING CAPACITY OF PUMP: 8000L

DOSE VOLUME: 3828L

DOSE TIME: 15 MINUTES

DOSE FLOW: 73.4

NO. DOSES/DAY: 4.8

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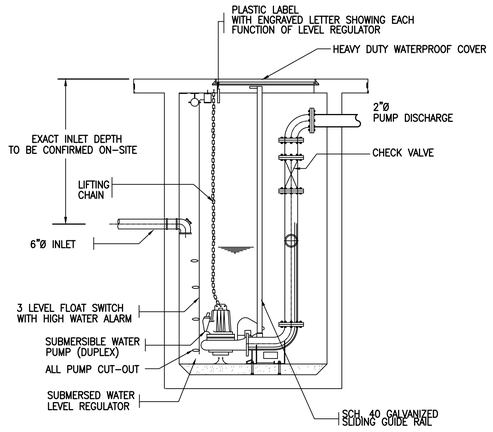
Project: ON–SITE WASTEWATER DISPOSAL DESIGN
COVERED BRIDGE
WATERVILLE, NB

Drawing: SITE LAYOUT – OPTION "B"

Designed	RSG	Project No. 16412	Rev. 0
Drawn	RSG	Sheet M3	
Date	FEB. 2023		
Scale	AS SHOWN		



1 M4 PUMP CHAMBER DETAIL
SCALE: NTS

Overview of Components and their Functions

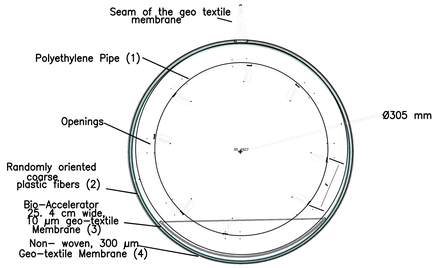
Advanced Enviro-Septic® pipe consists of:

- A 300 mm diameter, high-density plastic pipe which is corrugated and perforated. Skimmer tabs extend into the pipe at the point of each perforation.
- A dense mat of coarse, randomly oriented plastic fibres surrounds the outside of the pipe.
- The Bio-AcceleratorTM geo-textile fabric layer partially covers the fibres on the lower half of the pipes. It is located between the pipe and the plastic fibres.
- The outer layer non-woven geo-textile fabric holds the other components in place and provides a protected surface on which a biomat develops.

The Advanced Enviro-Septic® pipes are surrounded by a bed of System Sand, which facilitates the process by wicking the liquid out of the pipes and ensuring that the system receives sufficient oxygen to support a healthy population of bacteria.

Pipe Cross-Section

The following schematic presents the four components of the Advanced Enviro-Septic® pipe.



2 M4 ENVIROSEPTIC PIPE DETAIL
SCALE: NTS

GENERAL NOTES

THIS DRAWING IS PROVIDED TO REFLECT THE GENERAL EXTENT OF WORK AND AS SUCH DOES NOT NECESSARILY INDICATE THE ENTIRE SCOPE OF WORK. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH RELATED ARCHITECTURAL, STRUCTURAL, ELECTRICAL AND/OR MECHANICAL DRAWINGS/DETAILS, SPECIFICATIONS, TENDER AND/OR OTHER CONTRACT DOCUMENTS, AS APPLICABLE.

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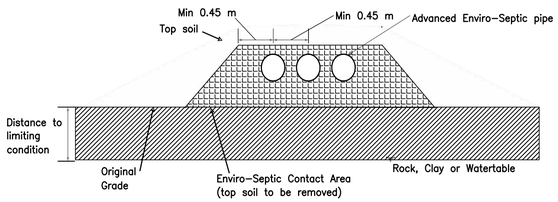
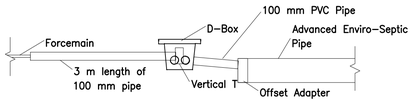


4 M4 PARTIAL CROSS SECTION OF RASIED MOUND
SCALE: NTS



5 M4 DISTRIBUTION BOX CROSS SECTION
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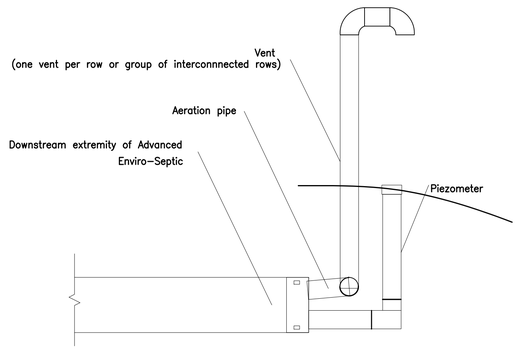

6 M4 VENT AND PIEZOMETER DETAIL
SCALE: NTS

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No.	REVISION/ISSUE	DATE
	ISSUED FOR REVIEW	MARCH 27, 2023

Stamp:

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fundy@fundyeng.com
www.fundyeng.com
Serving Our Clients' Needs First

Project: ON-SITE WASTEWATER DISPOSAL DESIGN COVERED BRIDGE WATERVILLE, NB

Drawing: DETAILS

Designed	RSG	Project No. 16412	Rev. 0
Drawn	RSG	Sheet	M4
Date	FEB. 2023		
Scale	AS SHOWN		

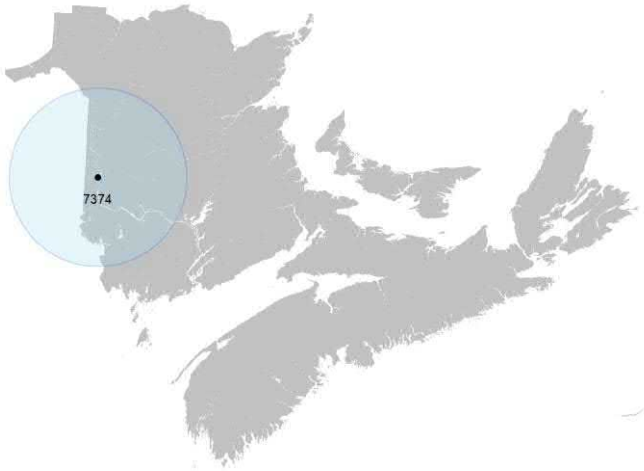
Appendix C

Atlantic Canada Conservation Data Centre (AC CDC) Report (AC CDC 2022a)

DATA REPORT 7374: Waterville, NB

Prepared 8 August 2022
by C. Robicheau, Conservation Data Analyst

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
WatervilleNB_7374ob.xls	Rare or legally-protected Flora and Fauna in your study area
WatervilleNB_7374ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
WatervilleNB_7374msa.xls	Managed and Biologically Significant Areas in your study area

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		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.

New Brunswick. For information about rare taxa, protected areas, game animals, deer yards, old growth forests, archeological sites, fish habitat etc., or to determine if location-sensitive species (section 4.3) occur near your study site, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

Nova Scotia. For information about Species at Risk or general questions about Nova Scotia location-sensitive species please contact the Biodiversity Program at biodiversity@novascotia.ca. For questions about protected areas, game animals, deer yards, old growth forests, archeological sites, fish habitat etc., or to determine if location-sensitive species (section 4.3) occur near your study site please contact a Regional Biologist:

DIGB, ANNA, KING	Emma Vost	(902) 670-8187	Emma.Vost@novascotia.ca
SHEL, YARM	Sian Wilson	(902) 930-2978	Sian.Wilson@novascotia.ca
QUEE, LUNE	Peter Kydd	(902) 523-0969	Peter.Kydd@novascotia.ca
HALI, HANT	Shavonne Meyer	(902) 893-0816	Shavonne.Meyer@novascotia.ca
Central Region	Jolene Laverty	(902) 324-8953	Jolene.Laverty@novascotia.ca
COLC, CUMB	Kimberly George	(902) 890-1046	Kimberly.George@novascotia.ca
ANTI, GUYS	Harrison Moore	(902) 497-4119	Harrison.Moore@novascotia.ca
INVE, VICT	Maureen Cameron-MacMillan	(902) 295-2554	Maureen.Cameron-MacMillan@novascotia.ca
CAPE, RICH, PICT	Elizabeth Walsh	(902) 563-3370	Elizabeth.Walsh@novascotia.ca

Prince Edward Island. For information about rare taxa, protected areas, game animals, fish habitat etc., please contact Garry Gregory, PEI Department of Environment, Energy and Climate Action: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

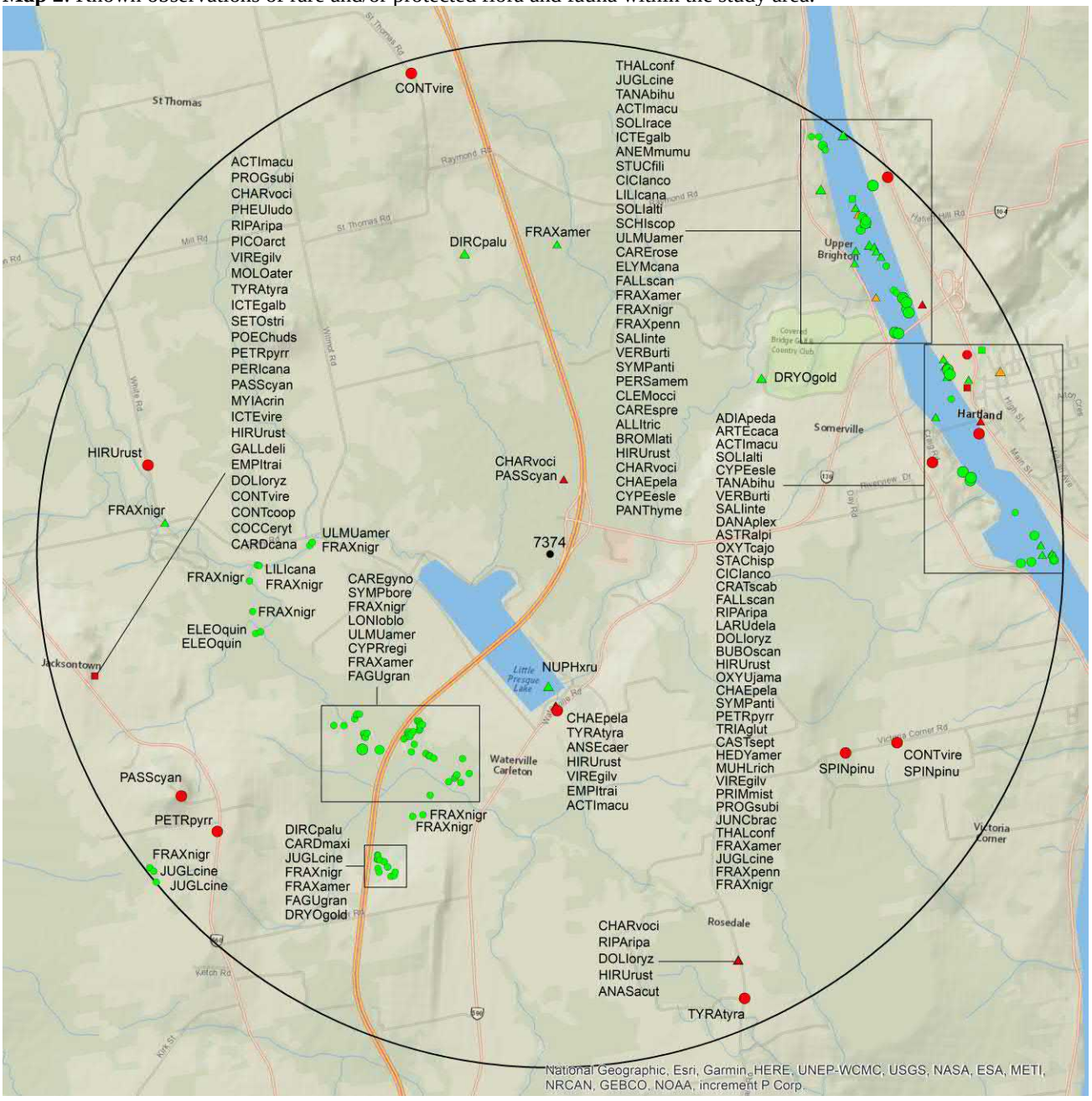
2.1 FLORA

The study area contains 196 records of 47 vascular and no records of nonvascular flora (Map 2 and attached: *ob.xls).

2.2 FAUNA

The study area contains 95 records of 32 vertebrate and 4 records of 3 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.



RESOLUTION

- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- 3.0 within kilometers
- 2.7 within 500s of meters
- 2.0 within 100s of meters
- 1.7 within 10s of meters

HIGHER TAXON

- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

3.0 SPECIAL AREAS

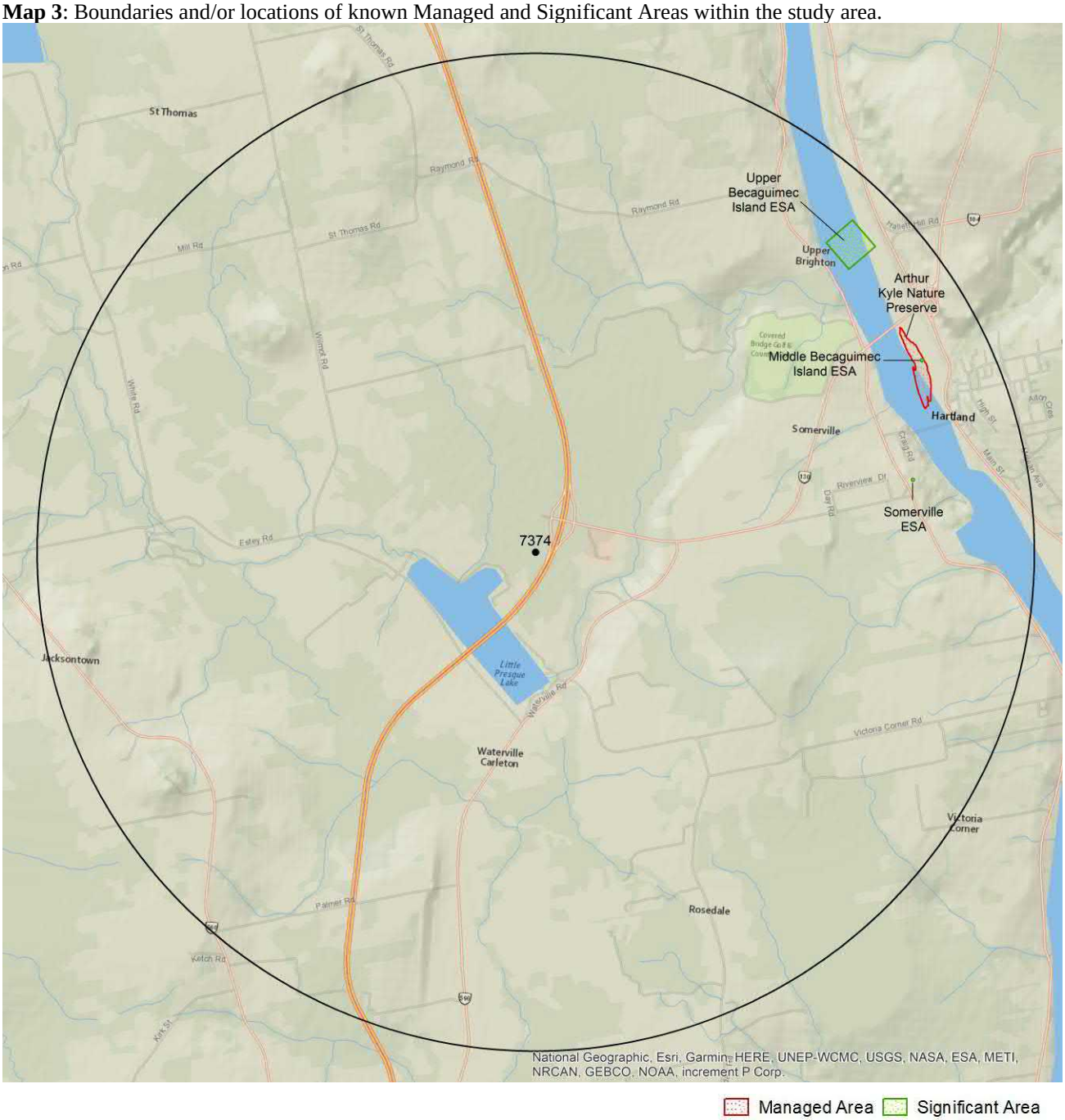
3.1 MANAGED AREAS

The GIS scan identified 1 managed area in the vicinity of the study area (Map 3 and attached file: *ma*.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified 3 biologically significant sites in the vicinity of the study area (Map 3 and attached file: *sa*.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)
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	16	3.4 ± 0.0
P	*Fraxinus nigra*	Black Ash	Threatened			S3S4	34	2.3 ± 0.0
P	*Symphyotrichum anticostense*	Anticosti Aster	Special Concern	Special Concern	Endangered	S3	18	4.0 ± 0.0
P	*Nuphar x rubrodisca*	Red-disk Yellow Pond-lily				S2	1	1.3 ± 1.0
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S2	1	4.3 ± 1.0
P	*Dirca palustris*	Eastern Leatherwood				S2S3	3	3.0 ± 1.0
P	*Verbena urticifolia*	White Vervain				S2S3	4	4.3 ± 0.0
P	*Allium tricoccum*	Wild Leek				S2S3	1	4.2 ± 0.0
P	*Elymus canadensis*	Canada Wild Rye				S2S3	2	4.5 ± 1.0
P	*Artemisia campestris ssp. caudata*	Tall Wormwood				S3	1	4.3 ± 0.0
P	*Solidago racemosa*	Racemose Goldenrod				S3	2	4.3 ± 0.0
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	5	4.2 ± 0.0
P	*Cardamine maxima*	Large Toothwort				S3	2	3.4 ± 0.0
P	*Lonicera oblongifolia*	Swamp Fly Honeysuckle				S3	1	2.3 ± 0.0
P	*Astragalus alpinus*	Alpine Milk-vetch				S3	1	4.3 ± 0.0
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S3	1	4.3 ± 0.0
P	*Fraxinus pennsylvanica*	Red Ash				S3	2	4.5 ± 5.0
P	*Primula mistassinica*	Mistassini Primrose				S3	1	4.2 ± 0.0
P	*Anemone multifida var. multifida*	Early Anemone				S3	1	4.5 ± 5.0
P	*Clematis occidentalis*	Purple Clematis				S3	4	4.0 ± 0.0
P	*Crataegus scabrida*	Rough Hawthorn				S3	1	4.3 ± 0.0
P	*Salix interior*	Sandbar Willow				S3	4	4.2 ± 0.0
P	*Castilleja septentrionalis*	Northeastern Paintbrush				S3	3	4.1 ± 0.0
P	*Carex gynocrates*	Northern Bog Sedge				S3	7	2.1 ± 0.0
P	*Carex rosea*	Rosy Sedge				S3	1	4.5 ± 5.0
P	*Carex sprengelii*	Longbeak Sedge				S3	3	4.2 ± 0.0
P	*Cyperus esculentus var. leptostachyus*	Perennial Yellow Nutsedge				S3	2	4.2 ± 0.0
P	*Juncus brachycephalus*	Small-Head Rush				S3	3	4.9 ± 0.0
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	17	2.1 ± 0.0
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	2	4.2 ± 0.0
P	*Muhlenbergia richardsonis*	Mat Muhly				S3	2	4.2 ± 0.0
P	*Schizachyrium scoparium*	Little Bluestem				S3	3	4.3 ± 0.0
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	2	4.7 ± 5.0
P	*Dryopteris goldieana*	Goldie's Woodfern				S3	2	2.7 ± 1.0
P	*Solidago altissima*	Tall Goldenrod				S3S4	4	4.3 ± 0.0
P	*Symphyotrichum boreale*	Boreal Aster				S3S4	9	2.1 ± 0.0
P	*Hedysarum americanum*	Alpine Hedysarum				S3S4	1	4.2 ± 0.0
P	*Fagus grandifolia*	American Beech				S3S4	3	2.4 ± 0.0
P	*Stachys hispida*	Smooth Hedge-Nettle				S3S4	3	4.3 ± 0.0
P	*Fraxinus americana*	White Ash				S3S4	7	2.2 ± 0.0
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	2	4.3 ± 0.0
P	*Thalictrum confine*	Northern Meadow-rue				S3S4	3	4.8 ± 0.0
P	*Ulmus americana*	White Elm				S3S4	3	2.3 ± 0.0
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3S4	2	2.9 ± 0.0
P	*Lilium canadense*	Canada Lily				S3S4	2	2.9 ± 0.0

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
P	*Triantha glutinosa*	Sticky False-Asphodel				S3S4	1	4.2 ± 0.0
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S3S4	3	4.2 ± 0.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Icteria virens*	Yellow-Breasted Chat	Endangered	Endangered		SNA	1	4.6 ± 7.0
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2B	3	4.4 ± 0.0
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	3	1.5 ± 0.0
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B	12	1.5 ± 0.0
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S3B	4	3.8 ± 0.0
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B	1	4.6 ± 7.0
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Threatened	S3B	7	4.4 ± 2.0
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Threatened	S3S4B	2	4.6 ± 7.0
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	1	4.4 ± 5.0
A	*Progne subis*	Purple Martin				S1B	3	3.8 ± 0.0
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	1	4.4 ± 0.0
A	*Empidonax traillii*	Willow Flycatcher				S1S2B	3	1.5 ± 0.0
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2B	4	4.2 ± 0.0
A	*Icterus galbula*	Baltimore Oriole				S2S3B	3	4.6 ± 7.0
A	*Larus delawarensis*	Ring-billed Gull				S2S3B,S4N,S5M	1	4.4 ± 5.0
A	*Picoides arcticus*	Black-backed Woodpecker				S3	1	4.6 ± 7.0
A	*Spinus pinus*	Pine Siskin				S3	2	3.5 ± 0.0
A	*Charadrius vociferus*	Killdeer				S3B	8	0.7 ± 0.0
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	1	4.6 ± 7.0
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	2	4.6 ± 7.0
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	2	4.6 ± 7.0
A	*Passerina cyanea*	Indigo Bunting				S3B	3	0.7 ± 0.0
A	*Molothrus ater*	Brown-headed Cowbird				S3B	2	4.6 ± 7.0
A	*Anas acuta*	Northern Pintail				S3B,S5M	1	4.4 ± 1.0
A	*Anser caerulescens*	Snow Goose				S3M	1	1.5 ± 0.0
A	*Perisoreus canadensis*	Canada Jay				S3S4	3	4.6 ± 7.0
A	*Poecile hudsonicus*	Boreal Chickadee				S3S4	2	4.6 ± 7.0
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	6	1.5 ± 0.0
A	*Vireo gilvus*	Warbling Vireo				S3S4B	4	1.5 ± 0.0
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S4M	6	1.5 ± 1.0
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	1	4.6 ± 7.0
A	*Setophaga striata*	Blackpoll Warbler				S3S4B,S5M	1	4.6 ± 7.0
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S2S3?B	1	4.7 ± 1.0
I	*Cicindela ancocisconensis*	Appalachian Tiger Beetle				S2	2	4.3 ± 0.0
I	*Pantala hymenaea*	Spot-Winged Glider				S3B	1	4.0 ± 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	No
Haliaeetus leucocephalus	**Bald Eagle**		**Endangered**	**YES**
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.	Special Concern	Endangered	No
Cicindela marginipennis	**Cobblestone Tiger Beetle**	**Endangered**	**Endangered**	**YES**
Coenonympha nipisiquit	Maritime Ringlet	Endangered	Endangered	No
Bat hibernaculum or bat species occurrence		[Endangered][1]	[Endangered][1]	No

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.

# recs	CITATION
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5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 12710 records of 124 vertebrate and 732 records of 61 invertebrate fauna; 11222 records of 295 vascular and 586 records of 120 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	13	14.9 ± 1.0	NB
A	*Myotis septentrionalis*	Northern Myotis	Endangered	Endangered	Endangered	S1	2	80.2 ± 1.0	NB
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered	Endangered	S2	432	28.8 ± 50.0	NB
A	*Melanerpes erythrocephalus*	Red-headed Woodpecker	Endangered	Threatened		SNA	1	93.0 ± 7.0	NB
A	*Empidonax virescens*	Acadian Flycatcher	Endangered	Endangered		SNA	2	79.5 ± 0.0	NB
A	*Icteria virens*	Yellow-Breasted Chat	Endangered	Endangered		SNA	1	4.6 ± 7.0	NB
A	*Salmo salar pop. 7*	Atlantic Salmon - Outer Bay of Fundy population	Endangered		Endangered	SNR	14	52.7 ± 0.0	NB
A	*Rangifer tarandus pop. 2*	Caribou - Atlantic-Gasp ├⌐sie population	Endangered	Endangered	Extirpated	SX	3	37.5 ± 1.0	NB
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened	Threatened	S1B	30	11.8 ± 7.0	NB
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened	Threatened	S1S2B	17	10.6 ± 0.0	NB
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened	Threatened	S1S2B	186	5.3 ± 7.0	NB
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Threatened	Threatened	Threatened	S2B	38	21.8 ± 0.0	NB
A	*Catharus bicknelli*	Bicknell's Thrush	Threatened	Threatened	Threatened	S2B	3	52.5 ± 7.0	NB
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2B	285	4.4 ± 0.0	NB
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2S3	868	8.2 ± 0.0	NB
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Threatened	S2S3B,S2M	293	1.5 ± 0.0	NB
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S3M	47	67.0 ± 0.0	NB
A	*Anguilla rostrata*	American Eel	Threatened		Threatened	S4N	12	47.9 ± 0.0	NB
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern population	Special Concern	Special Concern	Endangered	S1B,S1S2N,S2M	1	68.5 ± 0.0	NB
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Threatened	S2B	614	1.5 ± 0.0	NB
A	*Salmo salar pop. 12*	Atlantic Salmon - Gaspe - Southern Gulf of St. Lawrence population	Special Concern		Special Concern	S2S3	325	38.1 ± 0.0	NB
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Special Concern	S2S3B,S3M	218	11.7 ± 0.0	NB
A	*Bucephala islandica*	Barrow's Goldeneye	Special Concern	Special Concern	Special Concern	S2S3N,S3M	24	64.1 ± 1.0	NB
A	*Acipenser brevirostrum*	Shortnose Sturgeon	Special Concern	Special Concern	Special Concern	S3	1	67.6 ± 10.0	NB
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Special Concern	S3	25	10.6 ± 0.0	NB
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	S3B	457	3.8 ± 0.0	NB
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Threatened	Threatened	S3B	597	4.6 ± 7.0	NB
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Threatened	S3B	505	4.4 ± 2.0	NB
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern		S3B,S3S4N,SUM	213	5.9 ± 7.0	NB
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Threatened	Threatened	S3B,S4M	284	9.5 ± 7.0	NB
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern	Special Concern	S3N	3	13.7 ± 10.0	NB
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Threatened	S3S4B	1033	4.6 ± 7.0	NB
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	23	41.8 ± 0.0	NB
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk	Special Concern	Endangered	S1B,S3M	4	76.3 ± 5.0	NB
A	*Bubo scandiacus*	Snowy Owl	Not At Risk			S1N,S2S3M	5	4.4 ± 5.0	NB
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1S2B	13	29.7 ± 0.0	NB
A	*Buteo lineatus*	Red-shouldered Hawk	Not At Risk			S1S2B	28	12.1 ± 1.0	NB
A	*Sorex dispar*	Long-tailed Shrew	Not At Risk			S2	5	35.6 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Chlidonias niger*	Black Tern	Not At Risk			S2B	25	72.6 ± 0.0	NB
A	*Podiceps grisegena*	Red-necked Grebe	Not At Risk			S2N,S3M	3	14.9 ± 0.0	NB
A	*Desmognathus fuscus pop. 2*	Northern Dusky Salamander - Quebec / New Brunswick population	Not At Risk			S3	56	22.1 ± 0.0	NB
A	*Sterna hirundo*	Common Tern	Not At Risk			S3B,SUM	68	9.5 ± 7.0	NB
A	*Haliaeetus leucocephalus*	Bald Eagle	Not At Risk		Endangered	S4	409	4.4 ± 5.0	NB
A	*Lynx canadensis*	Canada Lynx	Not At Risk		Endangered	S4	46	35.9 ± 0.0	NB
A	*Canis lupus*	Grey Wolf	Not At Risk		Extirpated	SX	1	76.0 ± 1.0	NB
A	*Puma concolor pop. 1*	Cougar - Eastern population	Data Deficient		Endangered	SU	36	5.0 ± 1.0	NB
A	*Morone saxatilis*	Striped Bass	E,SC			S3S4B,S3S4N	7	66.5 ± 1.0	NB
A	*Thryothorus ludovicianus*	Carolina Wren				S1	35	13.8 ± 0.0	NB
A	*Salvelinus alpinus*	Arctic Char				S1	1	90.7 ± 1.0	NB
A	*Vireo flavifrons*	Yellow-throated Vireo				S1?B	5	82.1 ± 7.0	NB
A	*Tringa melanoleuca*	Greater Yellowlegs				S1?B,S4S5M	80	67.0 ± 0.0	NB
A	*Gallinula galeata*	Common Gallinule				S1B	10	40.3 ± 0.0	NB
A	*Grus canadensis*	Sandhill Crane				S1B	4	32.1 ± 0.0	NB
A	*Bartramia longicauda*	Upland Sandpiper				S1B	4	95.3 ± 7.0	NB
A	*Phalaropus tricolor*	Wilson's Phalarope				S1B	4	86.4 ± 7.0	NB
A	*Leucophaeus atricilla*	Laughing Gull				S1B	1	82.2 ± 1.0	NB
A	*Progne subis*	Purple Martin				S1B	141	3.8 ± 0.0	NB
A	*Oxyura jamaicensis*	Ruddy Duck				S1B,S2S3M	4	4.4 ± 0.0	NB
A	*Aythya affinis*	Lesser Scaup				S1B,S4M	33	13.7 ± 2.0	NB
A	*Eremophila alpestris*	Horned Lark				S1B,S4N,S5M	41	5.3 ± 7.0	NB
A	*Chroicocephalus ridibundus*	Black-headed Gull				S1N,S2M	2	76.6 ± 0.0	NB
A	*Branta bernicla*	Brant				S1N,S2S3M	1	98.2 ± 0.0	NB
A	*Calidris alba*	Sanderling				S1N,S3S4M	3	82.1 ± 0.0	NB
A	*Butorides virescens*	Green Heron				S1S2B	12	17.8 ± 7.0	NB
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1S2B	2	14.2 ± 1.0	NB
A	*Empidonax traillii*	Willow Flycatcher				S1S2B	47	1.5 ± 0.0	NB
A	*Stelgidopteryx serripennis*	Northern Rough-winged Swallow				S1S2B	14	14.1 ± 0.0	NB
A	*Troglodytes aedon*	House Wren				S1S2B	10	13.4 ± 1.0	NB
A	*Melanitta americana*	American Scoter				S1S2N,S3M	17	35.4 ± 2.0	NB
A	*Microtus chrotorrhinus*	Rock Vole				S2?	10	56.0 ± 1.0	NB
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2B	261	4.2 ± 0.0	NB
A	*Cistothorus palustris*	Marsh Wren				S2B	43	25.3 ± 0.0	NB
A	*Mimus polyglottos*	Northern Mockingbird				S2B	71	11.4 ± 7.0	NB
A	*Pooecetes gramineus*	Vesper Sparrow				S2B	33	7.7 ± 7.0	NB
A	*Mareca strepera*	Gadwall				S2B,S3M	3	18.4 ± 0.0	NB
A	*Tringa solitaria*	Solitary Sandpiper				S2B,S4S5M	63	11.4 ± 0.0	NB
A	*Pinicola enucleator*	Pine Grosbeak				S2B,S4S5N,S4S5M	59	5.3 ± 7.0	NB
A	*Phalacrocorax carbo*	Great Cormorant				S2N	2	66.4 ± 0.0	NB
A	*Larus hyperboreus*	Glaucous Gull				S2N	20	74.0 ± 50.0	NB
A	*Asio otus*	Long-eared Owl				S2S3	16	33.5 ± 0.0	NB
A	*Picoides dorsalis*	American Three-toed Woodpecker				S2S3	20	24.3 ± 7.0	NB
A	*Toxostoma rufum*	Brown Thrasher				S2S3B	83	12.3 ± 7.0	NB
A	*Icterus galbula*	Baltimore Oriole				S2S3B	139	4.6 ± 7.0	NB
A	*Somateria mollissima*	Common Eider				S2S3B,S2S3N,S4M	2	74.0 ± 199.0	NB
A	*Larus delawarensis*	Ring-billed Gull				S2S3B,S4N,S5M	78	4.4 ± 5.0	NB
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	1	85.3 ± 0.0	NB
A	*Calcarius lapponicus*	Lapland Longspur				S2S3N,SUM	2	9.7 ± 2.0	NB
A	*Larus marinus*	Great Black-backed Gull				S3	16	53.5 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Picoides arcticus*	Black-backed Woodpecker				S3	61	4.6 ± 7.0	NB
A	*Loxia curvirostra*	Red Crossbill				S3	56	13.8 ± 0.0	NB
A	*Spinus pinus*	Pine Siskin				S3	108	3.5 ± 0.0	NB
A	*Prosopium cylindraceum*	Round Whitefish				S3	5	55.6 ± 1.0	NB
A	*Salvelinus namaycush*	Lake Trout				S3	6	21.1 ± 0.0	NB
A	*Sorex maritimensis*	Maritime Shrew				S3	1	59.3 ± 1.0	NB
A	*Spatula clypeata*	Northern Shoveler				S3B	15	48.4 ± 0.0	NB
A	*Charadrius vociferus*	Killdeer				S3B	411	0.7 ± 0.0	NB
A	*Tringa semipalmata*	Willet				S3B	1	93.5 ± 0.0	NB
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	64	4.6 ± 7.0	NB
A	*Myiarchus crinitus*	Great Crested Flycatcher				S3B	173	4.6 ± 7.0	NB
A	*Piranga olivacea*	Scarlet Tanager				S3B	289	5.9 ± 7.0	NB
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	519	4.6 ± 7.0	NB
A	*Passerina cyanea*	Indigo Bunting				S3B	83	0.7 ± 0.0	NB
A	*Molothrus ater*	Brown-headed Cowbird				S3B	144	4.6 ± 7.0	NB
A	*Setophaga tigrina*	Cape May Warbler				S3B,S4S5M	118	12.0 ± 0.0	NB
A	*Mergus serrator*	Red-breasted Merganser				S3B,S4S5N,S5M	15	9.5 ± 7.0	NB
A	*Anas acuta*	Northern Pintail				S3B,S5M	6	4.4 ± 1.0	NB
A	*Anser caerulescens*	Snow Goose				S3M	4	1.5 ± 0.0	NB
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	6	7.0 ± 0.0	NB
A	*Calidris melanotos*	Pectoral Sandpiper				S3M	10	66.0 ± 0.0	NB
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	9	93.5 ± 0.0	NB
A	*Bucephala albeola*	Bufflehead				S3N	14	13.7 ± 10.0	NB
A	*Calidris maritima*	Purple Sandpiper				S3N	1	92.2 ± 1.0	NB
A	*Perisoreus canadensis*	Canada Jay				S3S4	203	4.6 ± 7.0	NB
A	*Poecile hudsonicus*	Boreal Chickadee				S3S4	173	4.6 ± 7.0	NB
A	*Eptesicus fuscus*	Big Brown Bat				S3S4	25	66.6 ± 1.0	NB
A	*Synaptomys cooperi*	Southern Bog Lemming				S3S4	2	64.6 ± 0.0	NB
A	*Tyrannus tyrannus*	Eastern Kingbird				S3S4B	384	1.5 ± 0.0	NB
A	*Vireo gilvus*	Warbling Vireo				S3S4B	134	1.5 ± 0.0	NB
A	*Actitis macularius*	Spotted Sandpiper				S3S4B,S4M	385	1.5 ± 1.0	NB
A	*Melospiza lincolnii*	Lincoln's Sparrow				S3S4B,S4M	197	7.7 ± 1.0	NB
A	*Gallinago delicata*	Wilson's Snipe				S3S4B,S5M	369	4.6 ± 7.0	NB
A	*Setophaga striata*	Blackpoll Warbler				S3S4B,S5M	41	4.6 ± 7.0	NB
A	*Pluvialis squatarola*	Black-bellied Plover				S3S4M	8	93.5 ± 0.0	NB
A	*Morus bassanus*	Northern Gannet				SHB	1	45.0 ± 0.0	NB
C	*Acer saccharum - Fraxinus americana / Gymnocarpium dryopteris - Deparia acrostichoides Forest*	Sugar Maple - White Ash / Common Oak Fern - Silvery Glade Fern Forest				S3	2	13.9 ± 0.0	NB
C	*Acer saccharum - Fraxinus americana / Polystichum acrostichoides Forest*	Sugar Maple - White Ash / Christmas Fern Forest				S3S4	1	52.3 ± 0.0	NB
I	*Bombus bohemicus*	Ashton Cuckoo Bumble Bee	Endangered	Endangered		S1	4	79.9 ± 5.0	NB
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Special Concern	S2S3?B	100	4.7 ± 1.0	NB
I	*Bombus affinis*	Rusty-patched Bumble Bee	Endangered	Endangered		SH	1	80.8 ± 5.0	NB
I	*Gomphurus ventricosus*	Skillet Clubtail	Special Concern	Endangered	Endangered	S2	53	79.6 ± 1.0	NB
I	*Cicindela marginipennis*	Cobblestone Tiger Beetle	Special Concern	Endangered	Endangered	S2S3	23	4.2 ± 0.0	NB
I	*Ophiogomphus howei*	Pygmy Snaketail	Special Concern	Special Concern	Special Concern	S2S3	4	77.6 ± 0.0	NB
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Special Concern	S3	5	77.6 ± 0.0	NB
I	*Lampsilis cariosa*	Yellow Lampmussel	Special Concern	Special Concern	Special Concern	S3	41	63.4 ± 1.0	NB
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern		S4	54	10.5 ± 0.0	NB
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern			SH	18	61.7 ± 2.0	NB
I	*Appalachina sayana sayana*	Spike-lip Crater Snail	Not At Risk			S3?	1	56.8 ± 0.0	NB
I	*Conotrachelus juglandis*	Butternut Curculio				S1	3	84.4 ± 0.0	NB
I	*Haematopota rara*	Shy Cleg				S1	1	79.7 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
I	*Tharsalea dorcas*	Dorcas Copper				S1	19	9.5 ± 7.0	NB
I	*Erora laeta*	Early Hairstreak				S1	11	42.3 ± 1.0	NB
I	*Somatochlora septentrionalis*	Muskeg Emerald				S1	4	56.0 ± 1.0	NB
I	*Polites origenes*	Crossline Skipper				S1?	2	67.9 ± 0.0	NB
I	*Icaricia saepiolus*	Greenish Blue				S1S2	7	75.8 ± 2.0	NB
I	*Cicindela ancocisconensis*	Appalachian Tiger Beetle				S2	3	4.3 ± 0.0	NB
I	*Encyclops caeruleus*	Cerulean Long-horned Beetle				S2	3	12.9 ± 0.0	NB
I	*Scaphinotus viduus*	Bereft Snail-eating Beetle				S2	1	93.2 ± 13.0	NB
I	*Brachyleptura circumdata*	Dark-shouldered Long-horned Beetle				S2	4	98.9 ± 0.0	NB
I	*Satyrium calanus*	Banded Hairstreak				S2	26	14.1 ± 0.0	NB
I	*Satyrium calanus falacer*	Falacer Hairstreak				S2	1	83.8 ± 1.0	NB
I	*Aeshna juncea*	Sedge Darner				S2	1	99.6 ± 0.0	NB
I	*Somatochlora brevicincta*	Quebec Emerald				S2	8	91.8 ± 0.0	NB
I	*Hybomitra frosti*	Frost's Horse Fly				S2S3	1	68.4 ± 0.0	NB
I	*Tabanus vivax*	Vivacious Horse Fly				S2S3	1	90.0 ± 0.0	NB
I	*Ophiogomphus colubrinus*	Boreal Snaketail				S2S3	36	76.5 ± 0.0	NB
I	*Elaphrus americanus*	Boreal Elaphrus Beetle				S3	1	99.2 ± 0.0	NB
I	*Semanotus terminatus*	Light Long-horned Beetle				S3	1	83.7 ± 0.0	NB
I	*Desmocerus palliatus*	Elderberry Borer				S3	2	79.8 ± 0.0	NB
I	*Agonum excavatum*	Excavated Harp Ground Beetle				S3	1	99.2 ± 0.0	NB
I	*Clivina americana*	America Pedunculate Ground Beetle				S3	1	99.2 ± 0.0	NB
I	*Tachys scitulus*	Handsome Riverbank Ground Beetle				S3	1	99.2 ± 0.0	NB
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	2	83.7 ± 0.0	NB
I	*Stenocorus vittiger*	Shrub Long-horned Beetle				S3	1	99.2 ± 0.0	NB
I	*Badister neopulchellus*	Red-black Spotted Beetle				S3	1	99.2 ± 0.0	NB
I	*Gonotropis dorsalis*	Birch Fungus Weevil				S3	1	83.7 ± 0.0	NB
I	*Ceruchus piceus*	Black Stag Beetle				S3	1	32.2 ± 0.0	NB
I	*Hesperia sassacus*	Indian Skipper				S3	14	9.5 ± 7.0	NB
I	*Euphyes bimacula*	Two-spotted Skipper				S3	11	25.7 ± 7.0	NB
I	*Papilio brevicauda gaspeensis*	Short-tailed Swallowtail				S3	3	66.1 ± 1.0	NB
I	*Satyrium acadica*	Acadian Hairstreak				S3	6	38.8 ± 7.0	NB
I	*Callophrys eryphon*	Western Pine Elfin				S3	1	94.0 ± 7.0	NB
I	*Argynnis aphrodite*	Aphrodite Fritillary				S3	15	42.0 ± 7.0	NB
I	*Boloria eunomia*	Bog Fritillary				S3	7	42.8 ± 1.0	NB
I	*Boloria bellona*	Meadow Fritillary				S3	50	12.8 ± 0.0	NB
I	*Nymphalis l-album*	Compton Tortoiseshell				S3	13	60.3 ± 2.0	NB
I	*Gomphurus vastus*	Cobra Clubtail				S3	58	54.0 ± 0.0	NB
I	*Ladona exusta*	White Corporal				S3	1	51.4 ± 0.0	NB
I	*Ischnura kellicotti*	Lilypad Forktail				S3	6	33.6 ± 0.0	NB
I	*Arigomphus furcifer*	Lilypad Clubtail				S3	3	80.2 ± 0.0	NB
I	*Alasmidonta undulata*	Triangle Floater				S3	11	33.3 ± 0.0	NB
I	*Atlanticoncha ochracea*	Tidewater Mucket				S3	53	14.8 ± 1.0	NB
I	*Striatura ferrea*	Black Striate Snail				S3	1	80.7 ± 1.0	NB
I	*Neohelix albolabris*	Whitelip Snail				S3	2	66.5 ± 0.0	NB
I	*Pantala hymenaea*	Spot-Winged Glider				S3B	3	4.0 ± 0.0	NB
I	*Bombus griseocollis*	Brown-belted Bumble Bee				S3S4	2	68.5 ± 0.0	NB
I	*Somatochlora forcipata*	Forcipate Emerald				S3S4	13	27.0 ± 0.0	NB
I	*Somatochlora tenebrosa*	Clamp-Tipped Emerald				S3S4	10	43.8 ± 0.0	NB
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened		S1?	43	76.3 ± 0.0	NB
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened		S1S2	3	65.1 ± 1.0	NB
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S2	114	37.1 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened		S2S3	9	29.0 ± 0.0	NB
N	*Aphanorrhegma serratum*	a Moss				S1	2	21.0 ± 0.0	NB
N	*Campylophyllum halleri*	Haller's Fine Wet Moss				S1	2	86.1 ± 1.0	NB
N	*Drepanocladus longifolius*	Long-leaved Hook Moss				S1	1	74.3 ± 1.0	NB
N	*Grimmia unicolor*	a Moss				S1	1	60.7 ± 1.0	NB
N	*Hypnum recurvatum*	Recurved Plait Moss				S1	3	86.1 ± 1.0	NB
N	*Leptogium hirsutum*	Jellyskin Lichen				S1	2	99.0 ± 0.0	NB
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S1?	1	14.8 ± 2.0	NB
N	*Ptychostomum pallens*	Pale Bryum				S1?	2	86.1 ± 1.0	NB
N	*Catoscopium nigritum*	Black Golf Club Moss				S1?	4	61.3 ± 0.0	NB
N	*Cinclidium stygium*	Sooty Cupola Moss				S1?	2	64.1 ± 0.0	NB
N	*Dichelyma falcatum*	a Moss				S1?	1	79.4 ± 10.0	NB
N	*Dicranum bonjeanii*	Bonjean's Broom Moss				S1?	2	81.1 ± 1.0	NB
N	*Entodon brevisetus*	a Moss				S1?	1	33.6 ± 1.0	NB
N	*Oxyrrhynchium hians*	Light Beaked Moss				S1?	2	10.0 ± 0.0	NB
N	*Paludella squarrosa*	Tufted Fen Moss				S1?	1	64.5 ± 0.0	NB
N	*Niphotrichum ericoides*	Dense Rock Moss				S1?	1	81.2 ± 3.0	NB
N	*Splachnum pensylvanicum*	Southern Dung Moss				S1?	1	57.2 ± 0.0	NB
N	*Splachnum sphaericum*	Round-fruited Dung Moss				S1?	1	84.8 ± 1.0	NB
N	*Timmia megapolitana*	Metropolitan Timmia Moss				S1?	3	74.5 ± 1.0	NB
N	*Enchylium tenax*	Soil Tarpaper Lichen				S1?	4	71.3 ± 0.0	NB
N	*Brachythecium acuminatum*	Acuminate Ragged Moss				S1S2	2	80.2 ± 10.0	NB
N	*Calliergon richardsonii*	Richardson's Spear Moss				S1S2	1	64.4 ± 0.0	NB
N	*Pseudocampylium radicale*	Long-stalked Fine Wet Moss				S1S2	3	71.8 ± 0.0	NB
N	*Ditrichum pallidum*	Pale Cow-hair Moss				S1S2	3	9.4 ± 1.0	NB
N	*Drummondia prorepens*	a Moss				S1S2	1	6.8 ± 1.0	NB
N	*Fissidens taxifolius*	Yew-leaved Pocket Moss				S1S2	5	15.4 ± 1.0	NB
N	*Grimmia longirostris*	a Moss				S1S2	1	86.1 ± 1.0	NB
N	*Oncophorus virens*	Green Spur Moss				S1S2	2	86.1 ± 1.0	NB
N	*Platydictya confervoides*	a Moss				S1S2	2	86.1 ± 1.0	NB
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S1S2	2	23.5 ± 1.0	NB
N	*Tomentypnum falcifolium*	Sickle-leaved Golden Moss				S1S2	1	68.3 ± 1.0	NB
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1S2	1	79.6 ± 1.0	NB
N	*Hamatocaulis vernicosus*	a Moss				S1S2	2	64.1 ± 0.0	NB
N	*Haplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2	7	36.1 ± 1.0	NB
N	*Porella pinnata*	Pinnate Scalewort				S1S3	1	92.9 ± 1.0	NB
N	*Cirriphyllum piliferum*	Hair-pointed Moss				S2	3	32.8 ± 1.0	NB
N	*Didymodon ferrugineus*	Rusty Beard Moss				S2	3	13.6 ± 0.0	NB
N	*Ditrichum flexicaule*	Flexible Cow-hair Moss				S2	6	86.1 ± 1.0	NB
N	*Anomodon tristis*	a Moss				S2	1	84.6 ± 1.0	NB
N	*Hygrohypnum bestii*	Best's Brook Moss				S2	1	86.1 ± 10.0	NB
N	*Hypnum pratense*	Meadow Plait Moss				S2	2	11.2 ± 1.0	NB
N	*Meesia triquetra*	Three-ranked Cold Moss				S2	2	43.7 ± 0.0	NB
N	*Physcomitrium immersum*	a Moss				S2	7	64.9 ± 0.0	NB
N	*Seligeria recurvata*	a Moss				S2	5	86.1 ± 1.0	NB
N	*Seligeria brevifolia*	a Moss				S2	1	13.3 ± 1.0	NB
N	*Thamnobryum alleghaniense*	a Moss				S2	2	29.1 ± 0.0	NB
N	*Tortula mucronifolia*	Mucronate Screw Moss				S2	3	86.1 ± 1.0	NB
N	*Zygodon viridissimus var. rupestris*	a moss				S2	2	62.4 ± 0.0	NB
N	*Anomobryum julaceum*	Slender Silver Moss				S2	2	80.2 ± 1.0	NB
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S2	2	59.2 ± 0.0	NB
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S2	3	10.0 ± 0.0	NB
N	*Nephroma laevigatum*	Mustard Kidney Lichen				S2	1	16.7 ± 0.0	NB
N	*Peltigera lepidophora*	Scaly Pelt Lichen				S2	1	87.8 ± 0.0	NB
N	*Anomodon minor*	Blunt-leaved Anomodon				S2?	2	12.8 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Ptychostomum pallescens*	Moss Tall Clustered Bryum				S2?	1	86.1 ± 1.0	NB
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S2?	1	62.7 ± 4.0	NB
N	*Schistostega pennata*	Luminous Moss				S2?	4	80.2 ± 1.0	NB
N	*Plagiomnium rostratum*	Long-beaked Leafy Moss				S2?	1	40.0 ± 1.0	NB
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2?	7	9.8 ± 0.0	NB
N	*Physcia subtilis*	Slender Rosette Lichen				S2?	1	72.5 ± 0.0	NB
N	*Ptychostomum cernuum*	Swamp Bryum				S2S3	2	86.1 ± 1.0	NB
N	*Calliergonella cuspidata*	Common Large Wetland Moss				S2S3	3	10.5 ± 0.0	NB
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2S3	3	75.3 ± 1.0	NB
N	*Didymodon rigidulus*	Rigid Screw Moss				S2S3	7	68.7 ± 8.0	NB
N	*Ephemerum serratum*	a Moss				S2S3	1	64.9 ± 0.0	NB
N	*Fissidens bushii*	Bush's Pocket Moss				S2S3	4	12.8 ± 1.0	NB
N	*Isopterygiopsis pulchella*	Neat Silk Moss				S2S3	1	11.7 ± 1.0	NB
N	*Orthotrichum elegans*	Showy Bristle Moss				S2S3	4	23.5 ± 12.0	NB
N	*Scorpidium scorpioides*	Hooked Scorpion Moss				S2S3	4	9.9 ± 1.0	NB
N	*Seligeria campylopoda*	a Moss				S2S3	3	13.6 ± 0.0	NB
N	*Sphagnum centrale*	Central Peat Moss				S2S3	1	64.0 ± 0.0	NB
N	*Taxiphyllum deplanatum*	Imbricate Yew-leaved Moss				S2S3	1	13.8 ± 0.0	NB
N	*Dendriscocaulon umhausense*	a lichen				S2S3	2	25.8 ± 0.0	NB
N	*Punctelia caseana*					S2S3	3	15.2 ± 0.0	NB
N	*Hypnum curvifolium*	Curved-leaved Plait Moss				S3	1	10.0 ± 0.0	NB
N	*Tortella fragilis*	Fragile Twisted Moss				S3	3	74.9 ± 0.0	NB
N	*Hymenostylium recurvirostrum*	Curve-beak Beardless Moss				S3	1	86.1 ± 1.0	NB
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	7	9.6 ± 0.0	NB
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	3	71.6 ± 0.0	NB
N	*Peltigera degenii*	Lustrous Pelt Lichen				S3	1	33.4 ± 0.0	NB
N	*Leptogium laceroides*	Short-bearded Jellyskin Lichen				S3	6	9.6 ± 0.0	NB
N	*Peltigera membranacea*	Membranous Pelt Lichen				S3	6	14.2 ± 0.0	NB
N	*Dicranella rufescens*	Red Forklet Moss				S3?	2	59.6 ± 4.0	NB
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3?	1	63.0 ± 0.0	NB
N	*Cystocoleus ebeneus*	Rockgossamer Lichen				S3?	1	17.8 ± 0.0	NB
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3?	4	63.6 ± 0.0	NB
N	*Anomodon rugelii*	Rugel's Anomodon Moss				S3S4	10	9.6 ± 0.0	NB
N	*Barbula convoluta*	Lesser Bird's-claw Beard Moss				S3S4	3	68.7 ± 8.0	NB
N	*Brachytheciastrum velutinum*	Velvet Ragged Moss				S3S4	3	7.5 ± 3.0	NB
N	*Calliergon giganteum*	Giant Spear Moss				S3S4	1	78.3 ± 3.0	NB
N	*Dicranella varia*	a Moss				S3S4	8	40.9 ± 2.0	NB
N	*Fissidens bryoides*	Lesser Pocket Moss				S3S4	3	13.8 ± 0.0	NB
N	*Elodium blandowii*	Blandow's Bog Moss				S3S4	3	11.7 ± 1.0	NB
N	*Isopterygiopsis muelleriana*	a Moss				S3S4	3	59.4 ± 3.0	NB
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	2	71.4 ± 0.0	NB
N	*Orthotrichum speciosum*	Showy Bristle Moss				S3S4	1	69.7 ± 0.0	NB
N	*Physcomitrium pyriforme*	Pear-shaped Urn Moss				S3S4	7	14.1 ± 1.0	NB
N	*Tomentypnum nitens*	Golden Fuzzy Fen Moss				S3S4	5	43.1 ± 3.0	NB
N	*Weissia controversa*	Green-Cushioned Weissia				S3S4	4	64.9 ± 0.0	NB
N	*Abietinella abietina*	Wiry Fern Moss				S3S4	6	71.4 ± 0.0	NB
N	*Trichostomum tenuirostre*	Acid-Soil Moss				S3S4	1	13.8 ± 0.0	NB
N	*Scorpidium revolvens*	Limprichtia Moss				S3S4	4	44.7 ± 0.0	NB
N	*Rauiella scita*	Smaller Fern Moss				S3S4	6	14.3 ± 0.0	NB
N	*Pannaria rubiginosa*	Brown-eyed Shingle Lichen				S3S4	22	9.4 ± 0.0	NB
N	*Pseudocyphellaria holarctica*	Yellow Specklebelly Lichen				S3S4	42	9.4 ± 0.0	NB
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	1	28.7 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Montanelia panniformis*	Shingled Camouflage Lichen				S3S4	1	17.8 ± 0.0	NB
N	*Nephroma parile*	Powdery Kidney Lichen				S3S4	5	16.8 ± 0.0	NB
N	*Nephroma resupinatum*	a lichen				S3S4	11	9.8 ± 0.0	NB
N	*Protopannaria pezizoides*	Brown-gray Moss-shingle Lichen				S3S4	6	62.8 ± 0.0	NB
N	*Usnea strigosa*	Bushy Beard Lichen				S3S4	1	16.8 ± 0.0	NB
N	*Fuscopannaria sorediata*	a Lichen				S3S4	4	60.6 ± 0.0	NB
N	*Pannaria conoplea*	Mealy-rimmed Shingle Lichen				S3S4	31	9.6 ± 0.0	NB
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	11	17.7 ± 0.0	NB
N	*Leucodon brachypus*	a Moss				SH	1	60.8 ± 10.0	NB
N	*Orthotrichum gymnostomum*	a Moss				SH	1	60.6 ± 10.0	NB
P	*Juglans cinerea*	Butternut	Endangered	Endangered	Endangered	S1	754	3.4 ± 0.0	NB
P	*Pedicularis furbishiae*	Furbish Lousewort	Endangered	Endangered	Endangered	S1	55	49.9 ± 1.0	NB
P	*Fraxinus nigra*	Black Ash	Threatened			S3S4	1062	2.3 ± 0.0	NB
P	*Isoetes prototypus*	Prototype Quillwort	Special Concern	Special Concern	Endangered	S1	22	75.2 ± 0.0	NB
P	*Symphyotrichum anticostense*	Anticosti Aster	Special Concern	Special Concern	Endangered	S3	84	4.0 ± 0.0	NB
P	*Pterospora andromedea*	Woodland Pinedrops			Endangered	S1	33	14.0 ± 0.0	NB
P	*Cryptotaenia canadensis*	Canada Honewort				S1	9	15.3 ± 1.0	NB
P	*Erigeron acris var. kamtschaticus*	Kamtchatka Fleabane				S1	1	85.9 ± 0.0	NB
P	*Helianthus decapetalus*	Ten-rayed Sunflower				S1	21	33.4 ± 0.0	NB
P	*Hieracium paniculatum*	Panicled Hawkweed				S1	2	78.6 ± 1.0	NB
P	*Andersonglossum boreale*	Northern Wild Comfrey				S1	16	10.1 ± 0.0	NB
P	*Cardamine concatenata*	Cut-leaved Toothwort				S1	17	8.9 ± 0.0	NB
P	*Draba cana*	Lance-leaved Draba				S1	10	74.4 ± 0.0	NB
P	*Chenopodiastrum simplex*	Maple-leaved Goosefoot				S1	7	58.8 ± 1.0	NB
P	*Blitum capitatum*	Strawberry-Blite				S1	8	11.6 ± 0.0	NB
P	*Hypericum virginicum*	Virginia St. John's-wort				S1	5	52.2 ± 0.0	NB
P	*Drosera anglica*	English Sundew				S1	6	43.8 ± 0.0	NB
P	*Drosera linearis*	Slender-Leaved Sundew				S1	10	43.7 ± 0.0	NB
P	*Vaccinium corymbosum*	Highbush Blueberry				S1	8	65.2 ± 0.0	NB
P	*Hylodesmum glutinosum*	Large Tick-trefoil				S1	8	13.4 ± 0.0	NB
P	*Oxytropis deflexa var. foliolosa*	Nodding Locoweed				S1	8	71.0 ± 0.0	NB
P	*Gentiana rubricaulis*	Purple-stemmed Gentian				S1	2	91.6 ± 0.0	NB
P	*Ribes cynosbati*	Prickly Gooseberry				S1	1	13.8 ± 0.0	NB
P	*Decodon verticillatus*	Swamp Loosestrife				S1	4	40.5 ± 1.0	NB
P	*Polygala verticillata*	Whorled Milkwort				S1	2	35.9 ± 0.0	NB
P	*Hepatica acutiloba*	Sharp-lobed Hepatica				S1	11	17.3 ± 0.0	NB
P	*Coptidium lapponicum*	Lapland Buttercup				S1	21	65.8 ± 1.0	NB
P	*Crataegus jonesiae*	Jones' Hawthorn				S1	3	79.5 ± 1.0	NB
P	*Rubus flagellaris*	Northern Dewberry				S1	1	79.5 ± 0.0	NB
P	*Galium brevipes*	Limestone Swamp Bedstraw				S1	5	17.5 ± 0.0	NB
P	*Agalinis tenuifolia*	Slender Agalinis				S1	9	78.0 ± 0.0	NB
P	*Pedicularis canadensis*	Canada Lousewort				S1	2	72.0 ± 0.0	NB
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S1	13	74.1 ± 0.0	NB
P	*Carex annectens*	Yellow-Fruited Sedge				S1	1	13.6 ± 0.0	NB
P	*Carex backii*	Rocky Mountain Sedge				S1	5	74.6 ± 0.0	NB
P	*Carex blanda*	Eastern Woodland Sedge				S1	1	13.4 ± 0.0	NB
P	*Carex scirpoidea*	Scirpuslike Sedge				S1	2	59.4 ± 1.0	NB
P	*Carex sterilis*	Sterile Sedge				S1	14	13.6 ± 0.0	NB
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	6	10.9 ± 0.0	NB
P	*Cyperus diandrus*	Low Flatsedge				S1	7	68.2 ± 0.0	NB
P	*Rhynchospora capillacea*	Slender Beakrush				S1	7	60.8 ± 1.0	NB
P	*Sisyrinchium angustifolium*	Narrow-leaved Blue-eyed-				S1	5	16.3 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
		grass							
P	*Juncus stygius ssp. americanus*	Moor Rush				S1	1	99.8 ± 10.0	NB
P	*Allium canadense*	Canada Garlic				S1	10	66.6 ± 0.0	NB
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S1	1	79.6 ± 0.0	NB
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	12	10.1 ± 0.0	NB
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S1	3	36.6 ± 0.0	NB
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S1	4	19.1 ± 4.0	NB
P	*Spiranthes casei*	Case's Ladies'-Tresses				S1	6	72.0 ± 0.0	NB
P	*Danthonia compressa*	Flattened Oat Grass				S1	4	36.0 ± 0.0	NB
P	*Dichanthelium xanthophysum*	Slender Panic Grass				S1	2	72.3 ± 0.0	NB
P	*Sporobolus compositus*	Rough Dropseed				S1	17	66.0 ± 0.0	NB
P	*Potamogeton friesii*	Fries' Pondweed				S1	2	76.7 ± 5.0	NB
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	14	13.9 ± 0.0	NB
P	*Dryopteris clintoniana*	Clinton's Wood Fern				S1	14	13.4 ± 0.0	NB
P	*Gymnocarpium robertianum*	Limestone Oak Fern				S1	1	85.4 ± 0.0	NB
P	*Huperzia selago*	Northern Firmoss				S1	1	94.6 ± 0.0	NB
P	*Botrychium lunaria*	Common Moonwort				S1	2	83.4 ± 0.0	NB
P	*Sceptridium oneidense*	Blunt-lobed Moonwort				S1	6	17.8 ± 0.0	NB
P	*Sceptridium rugulosum*	Rugulose Grapefern				S1	5	17.7 ± 0.0	NB
P	*Selaginella rupestris*	Rock Spikemoss				S1	7	66.2 ± 0.0	NB
P	*Polygonum aviculare ssp. neglectum*	Narrow-leaved Knotweed				S1?	5	15.0 ± 1.0	NB
P	*Galium trifidum ssp. subbiflorum*	Three-petaled Bedstraw				S1?	1	6.6 ± 1.0	NB
P	*Alisma subcordatum*	Southern Water Plantain				S1?	7	14.5 ± 1.0	NB
P	*Carex laxiflora*	Loose-Flowered Sedge				S1?	3	10.9 ± 0.0	NB
P	*Carex appalachica*	Appalachian Sedge				S1?	1	13.3 ± 0.0	NB
P	*Sisyrinchium mucronatum*	Michaux's Blue-eyed-grass				S1?	3	13.7 ± 0.0	NB
P	*Wolffia columbiana*	Columbian Watermeal				S1?	4	77.9 ± 0.0	NB
P	*Galium kamtschaticum*	Northern Wild Licorice				S1S2	6	26.5 ± 0.0	NB
P	*Galearis spectabilis*	Showy Orchis				S1S2	80	9.9 ± 0.0	NB
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S1S2	2	94.5 ± 5.0	NB
P	*Spiranthes cernua*	Nodding Ladies'-Tresses				S1S3	9	17.7 ± 0.0	NB
P	*Spiranthes arcisepala*	Appalachian Ladies'-tresses				S1S3	2	84.3 ± 0.0	NB
P	*Neottia bifolia*	Southern Twayblade			Endangered	S2	11	73.4 ± 0.0	NB
P	*Sanicula trifoliata*	Large-Fruited Sanicle				S2	25	5.1 ± 0.0	NB
P	*Sanicula odorata*	Clustered Sanicle				S2	33	6.2 ± 0.0	NB
P	*Hieracium robinsonii*	Robinson's Hawkweed				S2	2	69.6 ± 0.0	NB
P	*Betula minor*	Dwarf White Birch				S2	1	62.4 ± 0.0	NB
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2	1	97.6 ± 0.0	NB
P	*Viburnum dentatum var. lucidum*	Northern Arrow-Wood				S2	46	58.9 ± 10.0	NB
P	*Astragalus eucosmus*	Elegant Milk-vetch				S2	19	10.8 ± 5.0	NB
P	*Quercus macrocarpa*	Bur Oak				S2	14	44.4 ± 1.0	NB
P	*Nuphar x rubrodisca*	Red-disk Yellow Pond-lily				S2	9	1.3 ± 1.0	NB
P	*Polygaloides paucifolia*	Fringed Milkwort				S2	9	83.7 ± 0.0	NB
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S2	8	4.3 ± 1.0	NB
P	*Geum fragarioides*	Barren Strawberry				S2	27	33.5 ± 0.0	NB
P	*Micranthes virginiensis*	Early Saxifrage				S2	14	62.0 ± 5.0	NB
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S2	15	14.0 ± 0.0	NB
P	*Viola canadensis*	Canada Violet				S2	87	5.6 ± 50.0	NB
P	*Carex cephaloidea*	Thin-leaved Sedge				S2	35	12.9 ± 0.0	NB
P	*Carex albicans var.*	White-tinged Sedge				S2	4	69.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
	emmonsii								
P	*Galearis rotundifolia*	Small Round-leaved Orchid				S2	10	49.5 ± 100.0	NB
P	*Calypso bulbosa var. americana*	Calypso				S2	41	6.7 ± 0.0	NB
P	*Coeloglossum viride*	Long-bracted Frog Orchid				S2	10	23.9 ± 5.0	NB
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	39	10.0 ± 1.0	NB
P	*Platanthera huronensis*	Fragrant Green Orchid				S2	5	72.4 ± 0.0	NB
P	*Elymus hystrix*	Spreading Wild Rye				S2	51	10.8 ± 0.0	NB
P	*Festuca subverticillata*	Nodding Fescue				S2	35	12.9 ± 0.0	NB
P	*Botrychium minganense*	Mingan Moonwort				S2	7	72.6 ± 0.0	NB
P	*Coryphopteris simulata*	Bog Fern				S2	2	88.8 ± 0.0	NB
P	*Toxicodendron radicans var. radicans*	Eastern Poison Ivy				S2?	6	68.3 ± 1.0	NB
P	*Symphyotrichum novi-belgii var. crenifolium*	New York Aster				S2?	1	79.6 ± 1.0	NB
P	*Humulus lupulus var. lupuloides*	Common Hop				S2?	5	32.1 ± 0.0	NB
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2S3	15	5.7 ± 1.0	NB
P	*Symphyotrichum racemosum*	Small White Aster				S2S3	5	75.1 ± 0.0	NB
P	*Canadanthus modestus*	Great Northern Aster				S2S3	12	15.3 ± 0.0	NB
P	*Alnus serrulata*	Smooth Alder				S2S3	27	33.7 ± 1.0	NB
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2S3	10	58.2 ± 0.0	NB
P	*Gentiana linearis*	Narrow-Leaved Gentian				S2S3	10	79.4 ± 1.0	NB
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	2	43.2 ± 1.0	NB
P	*Aphyllon uniflorum*	One-flowered Broomrape				S2S3	5	13.1 ± 1.0	NB
P	*Polygala senega*	Seneca Snakeroot				S2S3	53	12.4 ± 0.0	NB
P	*Persicaria careyi*	Carey's Smartweed				S2S3	1	80.9 ± 1.0	NB
P	*Hepatica americana*	Round-lobed Hepatica				S2S3	65	10.4 ± 0.0	NB
P	*Ranunculus sceleratus*	Cursed Buttercup				S2S3	3	79.1 ± 0.0	NB
P	*Rosa acicularis ssp. sayi*	Prickly Rose				S2S3	34	64.9 ± 0.0	NB
P	*Cephalanthus occidentalis*	Common Buttonbush				S2S3	24	45.1 ± 0.0	NB
P	*Galium obtusum*	Blunt-leaved Bedstraw				S2S3	3	33.7 ± 1.0	NB
P	*Dirca palustris*	Eastern Leatherwood				S2S3	113	3.0 ± 1.0	NB
P	*Phryma leptostachya*	American Lopseed				S2S3	109	5.3 ± 1.0	NB
P	*Verbena urticifolia*	White Vervain				S2S3	38	4.3 ± 0.0	NB
P	*Viola novae-angliae*	New England Violet				S2S3	3	78.7 ± 10.0	NB
P	*Carex comosa*	Bearded Sedge				S2S3	8	6.9 ± 0.0	NB
P	*Carex rostrata*	Narrow-leaved Beaked Sedge				S2S3	11	7.1 ± 0.0	NB
P	*Scirpus atrovirens*	Dark-green Bulrush				S2S3	86	55.8 ± 0.0	NB
P	*Allium tricoccum*	Wild Leek				S2S3	20	4.2 ± 0.0	NB
P	*Corallorhiza maculata var. occidentalis*	Spotted Coralroot				S2S3	10	18.2 ± 1.0	NB
P	*Corallorhiza maculata var. maculata*	Spotted Coralroot				S2S3	5	13.3 ± 1.0	NB
P	*Elymus canadensis*	Canada Wild Rye				S2S3	26	4.5 ± 5.0	NB
P	*Piptatheropsis canadensis*	Canada Ricegrass				S2S3	4	78.3 ± 1.0	NB
P	*Poa glauca*	Glaucous Blue Grass				S2S3	2	61.1 ± 0.0	NB
P	*Piptatheropsis pungens*	Slender Ricegrass				S2S3	4	67.7 ± 0.0	NB
P	*Potamogeton vaseyi*	Vasey's Pondweed				S2S3	10	50.7 ± 0.0	NB
P	*Isoetes tuckermanii ssp. acadiensis*	Acadian Quillwort				S2S3	7	52.6 ± 0.0	NB
P	*Panax trifolius*	Dwarf Ginseng				S3	10	40.4 ± 1.0	NB
P	*Artemisia campestris ssp. caudata*	Tall Wormwood				S3	19	4.3 ± 0.0	NB
P	*Artemisia campestris*	Field Wormwood				S3	3	85.3 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Nabalus racemosus*	Glaucous Rattlesnakeroot				S3	13	29.3 ± 0.0	NB
P	*Solidago racemosa*	Racemose Goldenrod				S3	49	4.3 ± 0.0	NB
P	*Tanacetum bipinnatum ssp. huronense*	Lake Huron Tansy				S3	120	4.2 ± 0.0	NB
P	*Ionactis linariifolia*	Flax-leaved Aster				S3	31	75.8 ± 0.0	NB
P	*Pseudognaphalium macounii*	Macoun's Cudweed				S3	10	14.1 ± 0.0	NB
P	*Impatiens pallida*	Pale Jewelweed				S3	12	11.2 ± 0.0	NB
P	*Turritis glabra*	Tower Mustard				S3	14	13.6 ± 0.0	NB
P	*Arabis pycnocarpa*	Cream-flowered Rockcress				S3	17	5.8 ± 100.0	NB
P	*Cardamine maxima*	Large Toothwort				S3	112	3.4 ± 0.0	NB
P	*Boechera stricta*	Drummond's Rockcress				S3	9	15.3 ± 1.0	NB
P	*Stellaria longifolia*	Long-leaved Starwort				S3	7	15.5 ± 0.0	NB
P	*Cornus obliqua*	Silky Dogwood				S3	55	36.2 ± 0.0	NB
P	*Lonicera oblongifolia*	Swamp Fly Honeysuckle				S3	165	2.3 ± 0.0	NB
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S3	185	8.8 ± 0.0	NB
P	*Viburnum lentago*	Nannyberry				S3	64	13.6 ± 0.0	NB
P	*Shepherdia canadensis*	Soapberry				S3	17	56.8 ± 0.0	NB
P	*Astragalus alpinus*	Alpine Milk-vetch				S3	2	4.3 ± 0.0	NB
P	*Astragalus alpinus var. brunetianus*	Alpine Milk-Vetch				S3	26	8.9 ± 0.0	NB
P	*Oxytropis campestris var. johannensis*	Field Locoweed				S3	20	4.3 ± 0.0	NB
P	*Gentianella amarella ssp. acuta*	Northern Gentian				S3	8	17.6 ± 0.0	NB
P	*Geranium bicknellii*	Bicknell's Crane's-bill				S3	1	98.0 ± 1.0	NB
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S3	23	54.7 ± 0.0	NB
P	*Myriophyllum humile*	Low Water Milfoil				S3	14	51.7 ± 0.0	NB
P	*Proserpinaca palustris*	Marsh Mermaidweed				S3	27	61.2 ± 0.0	NB
P	*Fraxinus pennsylvanica*	Red Ash				S3	73	4.5 ± 5.0	NB
P	*Rumex occidentalis*	Western Dock				S3	1	82.6 ± 1.0	NB
P	*Podostemum ceratophyllum*	Horn-leaved Riverweed				S3	25	32.7 ± 1.0	NB
P	*Primula mistassinica*	Mistassini Primrose				S3	25	4.2 ± 0.0	NB
P	*Pyrola minor*	Lesser Pyrola				S3	3	55.1 ± 0.0	NB
P	*Anemone multifida*	Cut-leaved Anemone				S3	36	5.6 ± 0.0	NB
P	*Anemone multifida var. multifida*	Early Anemone				S3	7	4.5 ± 5.0	NB
P	*Clematis occidentalis*	Purple Clematis				S3	30	4.0 ± 0.0	NB
P	*Ranunculus flabellaris*	Yellow Water Buttercup				S3	6	63.9 ± 0.0	NB
P	*Amelanchier gaspensis*	Gasp ├⌐ Serviceberry				S3	1	13.4 ± 0.0	NB
P	*Amelanchier canadensis*	Canada Serviceberry				S3	8	76.0 ± 1.0	NB
P	*Crataegus scabrida*	Rough Hawthorn				S3	3	4.3 ± 0.0	NB
P	*Rubus occidentalis*	Black Raspberry				S3	151	9.4 ± 0.0	NB
P	*Salix candida*	Sage Willow				S3	34	8.7 ± 0.0	NB
P	*Salix myricoides*	Bayberry Willow				S3	58	7.7 ± 0.0	NB
P	*Salix nigra*	Black Willow				S3	8	63.7 ± 0.0	NB
P	*Salix interior*	Sandbar Willow				S3	139	4.2 ± 0.0	NB
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S3	9	58.3 ± 0.0	NB
P	*Castilleja septentrionalis*	Northeastern Paintbrush				S3	15	4.1 ± 0.0	NB
P	*Valeriana uliginosa*	Swamp Valerian				S3	74	5.8 ± 0.0	NB
P	*Viola adunca*	Hooked Violet				S3	8	33.8 ± 0.0	NB
P	*Symplocarpus foetidus*	Eastern Skunk Cabbage				S3	2	62.8 ± 0.0	NB
P	*Carex adusta*	Lesser Brown Sedge				S3	3	56.5 ± 1.0	NB
P	*Carex arcta*	Northern Clustered Sedge				S3	13	56.5 ± 0.0	NB
P	*Carex conoidea*	Field Sedge				S3	1	63.8 ± 1.0	NB
P	*Carex garberi*	Garber's Sedge				S3	13	56.9 ± 0.0	NB
P	*Carex granularis*	Limestone Meadow Sedge				S3	8	5.6 ± 0.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Carex gynocrates*	Northern Bog Sedge				S3	54	2.1 ± 0.0	NB
P	*Carex hirtifolia*	Pubescent Sedge				S3	78	8.6 ± 0.0	NB
P	*Carex livida*	Livid Sedge				S3	32	8.7 ± 0.0	NB
P	*Carex ormostachya*	Necklace Spike Sedge				S3	27	9.3 ± 1.0	NB
P	*Carex plantaginea*	Plantain-Leaved Sedge				S3	181	6.8 ± 0.0	NB
P	*Carex prairea*	Prairie Sedge				S3	42	8.6 ± 0.0	NB
P	*Carex rosea*	Rosy Sedge				S3	249	4.5 ± 5.0	NB
P	*Carex sprengelii*	Longbeak Sedge				S3	66	4.2 ± 0.0	NB
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S3	40	8.5 ± 0.0	NB
P	*Carex vaginata*	Sheathed Sedge				S3	19	8.3 ± 0.0	NB
P	*Cyperus esculentus var. leptostachyus*	Perennial Yellow Nutsedge				S3	45	4.2 ± 0.0	NB
P	*Cyperus squarrosus*	Awned Flatsedge				S3	2	83.5 ± 0.0	NB
P	*Eriophorum gracile*	Slender Cottongrass				S3	13	7.7 ± 0.0	NB
P	*Elodea nuttallii*	Nuttall's Waterweed				S3	12	52.6 ± 0.0	NB
P	*Juncus brachycephalus*	Small-Head Rush				S3	66	4.9 ± 0.0	NB
P	*Juncus vaseyi*	Vasey Rush				S3	8	64.0 ± 0.0	NB
P	*Cypripedium reginae*	Showy Lady's-Slipper				S3	148	2.1 ± 0.0	NB
P	*Goodyera oblongifolia*	Menzies' Rattlesnake-plantain				S3	3	65.8 ± 1.0	NB
P	*Neottia auriculata*	Auricled Twayblade				S3	9	68.3 ± 0.0	NB
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	13	36.7 ± 0.0	NB
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3	34	9.7 ± 0.0	NB
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S3	21	12.7 ± 0.0	NB
P	*Agrostis mertensii*	Northern Bent Grass				S3	2	47.4 ± 0.0	NB
P	*Bromus latiglumis*	Broad-Glumed Brome				S3	32	4.2 ± 0.0	NB
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S3	7	37.5 ± 0.0	NB
P	*Leersia virginica*	White Cut Grass				S3	13	67.2 ± 1.0	NB
P	*Muhlenbergia richardsonis*	Mat Muhly				S3	74	4.2 ± 0.0	NB
P	*Schizachyrium scoparium*	Little Bluestem				S3	32	4.3 ± 0.0	NB
P	*Zizania aquatica var. aquatica*	Eastern Wild Rice				S3	2	51.5 ± 0.0	NB
P	*Adiantum pedatum*	Northern Maidenhair Fern				S3	502	4.7 ± 5.0	NB
P	*Asplenium trichomanes*	Maidenhair Spleenwort				S3	5	67.1 ± 0.0	NB
P	*Anchistea virginica*	Virginia chain fern				S3	43	52.0 ± 0.0	NB
P	*Dryopteris goldieana*	Goldie's Woodfern				S3	343	2.7 ± 1.0	NB
P	*Woodsia alpina*	Alpine Cliff Fern				S3	16	60.3 ± 0.0	NB
P	*Woodsia glabella*	Smooth Cliff Fern				S3	4	60.4 ± 0.0	NB
P	*Isoetes tuckermanii ssp. tuckermanii*	Tuckerman's Quillwort				S3	8	65.2 ± 0.0	NB
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3	7	16.7 ± 5.0	NB
P	*Sceptridium dissectum*	Dissected Moonwort				S3	41	10.0 ± 0.0	NB
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S3	29	10.6 ± 0.0	NB
P	*Botrychium simplex*	Least Moonwort				S3	20	10.4 ± 0.0	NB
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S3	14	8.7 ± 0.0	NB
P	*Crataegus submollis*	Quebec Hawthorn				S3?	8	12.1 ± 1.0	NB
P	*Crataegus succulenta*	Fleshy Hawthorn				S3?	1	80.2 ± 5.0	NB
P	*Platanthera hookeri*	Hooker's Orchid				S3?	45	7.4 ± 0.0	NB
P	*Arnica lanceolata*	Lance-leaved Arnica				S3S4	26	57.7 ± 1.0	NB
P	*Solidago altissima*	Tall Goldenrod				S3S4	59	4.3 ± 0.0	NB
P	*Symphyotrichum boreale*	Boreal Aster				S3S4	158	2.1 ± 0.0	NB
P	*Betula pumila*	Bog Birch				S3S4	45	8.8 ± 0.0	NB
P	*Subularia aquatica ssp. americana*	American Water Awlwort				S3S4	13	64.4 ± 0.0	NB
P	*Lobelia cardinalis*	Cardinal Flower				S3S4	137	33.4 ± 0.0	NB
P	*Callitriche hermaphroditica*	Northern Water-starwort				S3S4	2	11.0 ± 0.0	NB
P	*Viburnum edule*	Squashberry				S3S4	17	40.6 ± 1.0	NB

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Penthorum sedoides*	Ditch Stonecrop				S3S4	17	34.7 ± 1.0	NB
P	*Hedysarum americanum*	Alpine Hedysarum				S3S4	68	4.2 ± 0.0	NB
P	*Fagus grandifolia*	American Beech				S3S4	351	2.4 ± 0.0	NB
P	*Stachys hispida*	Smooth Hedge-Nettle				S3S4	60	4.3 ± 0.0	NB
P	*Stachys pilosa*	Hairy Hedge-Nettle				S3S4	38	61.8 ± 0.0	NB
P	*Utricularia radiata*	Little Floating Bladderwort				S3S4	62	50.4 ± 0.0	NB
P	*Utricularia gibba*	Humped Bladderwort				S3S4	18	51.3 ± 0.0	NB
P	*Fraxinus americana*	White Ash				S3S4	277	2.2 ± 0.0	NB
P	*Epilobium strictum*	Downy Willowherb				S3S4	58	8.4 ± 0.0	NB
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	17	4.3 ± 0.0	NB
P	*Littorella americana*	American Shoreweed				S3S4	28	51.4 ± 0.0	NB
P	*Thalictrum confine*	Northern Meadow-rue				S3S4	64	4.8 ± 0.0	NB
P	*Drymocallis arguta*	Tall Wood Beauty				S3S4	61	11.1 ± 5.0	NB
P	*Rosa palustris*	Swamp Rose				S3S4	147	12.2 ± 0.0	NB
P	*Rubus pensilvanicus*	Pennsylvania Blackberry				S3S4	7	37.9 ± 0.0	NB
P	*Galium boreale*	Northern Bedstraw				S3S4	15	10.8 ± 0.0	NB
P	*Galium labradoricum*	Labrador Bedstraw				S3S4	125	8.6 ± 0.0	NB
P	*Salix pedicellaris*	Bog Willow				S3S4	76	7.7 ± 0.0	NB
P	*Geocaulon lividum*	Northern Comandra				S3S4	6	41.8 ± 0.0	NB
P	*Parnassia glauca*	Fen Grass-of-Parnassus				S3S4	93	13.6 ± 1.0	NB
P	*Agalinis neoscotica*	Nova Scotia Agalinis				S3S4	1	76.8 ± 0.0	NB
P	*Ulmus americana*	White Elm				S3S4	226	2.3 ± 0.0	NB
P	*Boehmeria cylindrica*	Small-spike False-nettle				S3S4	21	13.5 ± 0.0	NB
P	*Carex capillaris*	Hairlike Sedge				S3S4	20	12.6 ± 0.0	NB
P	*Carex concinna*	Beautiful Sedge				S3S4	3	71.2 ± 0.0	NB
P	*Carex eburnea*	Bristle-leaved Sedge				S3S4	33	13.2 ± 0.0	NB
P	*Carex exilis*	Coastal Sedge				S3S4	48	8.2 ± 0.0	NB
P	*Carex haydenii*	Hayden's Sedge				S3S4	14	12.8 ± 1.0	NB
P	*Carex lupulina*	Hop Sedge				S3S4	17	33.0 ± 0.0	NB
P	*Carex tenera*	Tender Sedge				S3S4	31	15.3 ± 1.0	NB
P	*Carex wiegandii*	Wiegand's Sedge				S3S4	7	47.4 ± 0.0	NB
P	*Carex atratiformis*	Scabrous Black Sedge				S3S4	3	82.3 ± 0.0	NB
P	*Cladium mariscoides*	Smooth Twigrush				S3S4	91	8.7 ± 0.0	NB
P	*Cyperus dentatus*	Toothed Flatsedge				S3S4	31	54.7 ± 0.0	NB
P	*Eleocharis quinqueflora*	Few-flowered Spikerush				S3S4	36	2.9 ± 0.0	NB
P	*Rhynchospora capitellata*	Small-headed Beakrush				S3S4	25	57.8 ± 0.0	NB
P	*Trichophorum clintonii*	Clinton's Clubrush				S3S4	85	33.5 ± 0.0	NB
P	*Lilium canadense*	Canada Lily				S3S4	105	2.9 ± 0.0	NB
P	*Triantha glutinosa*	Sticky False-Asphodel				S3S4	126	4.2 ± 0.0	NB
P	*Corallorhiza maculata*	Spotted Coralroot				S3S4	13	9.1 ± 0.0	NB
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	23	6.3 ± 0.0	NB
P	*Neottia cordata*	Heart-leaved Twayblade				S3S4	43	6.5 ± 2.0	NB
P	*Platanthera obtusata*	Blunt-leaved Orchid				S3S4	34	6.5 ± 2.0	NB
P	*Calamagrostis stricta*	Slim-stemmed Reed Grass				S3S4	1	62.3 ± 0.0	NB
P	*Eragrostis pectinacea*	Tufted Love Grass				S3S4	13	59.9 ± 1.0	NB
P	*Stuckenia filiformis*	Thread-leaved Pondweed				S3S4	6	4.2 ± 0.0	NB
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3S4	13	10.3 ± 0.0	NB
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3S4	10	57.8 ± 0.0	NB
P	*Xyris montana*	Northern Yellow-Eyed-Grass				S3S4	2	53.5 ± 0.0	NB
P	*Cryptogramma stelleri*	Steller's Rockbrake				S3S4	4	60.2 ± 0.0	NB
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3S4	28	37.3 ± 0.0	NB
P	*Equisetum palustre*	Marsh Horsetail				S3S4	14	15.3 ± 1.0	NB
P	*Polypodium appalachianum*	Appalachian Polypody				S3S4	46	13.0 ± 0.0	NB
P	*Solidago ptarmicoides*	Upland White Goldenrod				SX	3	14.9 ± 10.0	NB
P	*Celastrus scandens*	Climbing Bittersweet				SX	4	15.8 ± 1.0	NB

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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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Appendix D

SAR and SOCC Descriptions

Species	Conservation Ranking	Habitat
Vegetation		
Butternut *Juglans cinerea*	**SARA:** Endangered **NB SARA:** Endangered **AC CDC:** S1	Preferential habitat for butternut includes moist, but well drained soil along riparian areas and in deciduous forests (COSEWIC 2017a).
Black Ash *Fraxinus nigra*	**SARA:** Threatened **AC CDC:** S3S4	Found mostly in swamps, floodplains, and fens, more commonly in alkaline sites (COSEWIC 2018a).
Anticosti Aster *Symphyotrichum anticostense*	**SARA:** Special Concern **NB SARA:** Endangered **AC CDC:** S3	The Anticosti aster is found along rivers and other wet areas such as shorelines, floodzones, and lakeshores with cobble, gravel, and sand in sparsely vegetated areas and as such may be found in the Project area as suitable habitat exists (COSEWIC 2017b).
Red-disk Yellow Pond-lily *Nuphar x rubrodisca*	**AC CDC:** S2	Grows in lakes, ponds, backwaters, and sluggish streams (Hinds 2000).
Long-root Smartweed *Persicaria amphibia var. emersa*	**AC CDC:** S2	Grows on very moist soil or as an emergent from water (Hinds 2000).
Eastern Leatherwood *Dirca palustris*	**AC CDC:** S2S3	Grows in very rich forests, either deciduous or mixedwood (Hinds 2000).
White Vervain *Verbena urticifolia*	**AC CDC:** S2S3	Grows in thickets and alluvial bottomlands (Hinds 2000).
Wild Leek *Allium tricoccum*	**AC CDC:** S2S3	Grows in alluvial bottomlands and in rich hardwood stands (Hinds 2000).
Canada Wild Rye *Elymus canadensis*	**AC CDC:** S2S3	Grows in sandy environments, such as river or stream banks or roadways (Hinds 2000).
Tall Wormwood *Artemisia campestris ssp. caudata*	**AC CDC:** S3	Grows on ledges, dry slopes, or sandy/gravelly shores (Hinds 2000).
Racemose Goldenrod *Solidago racemosa*	**AC CDC:** S3	Endemic in New Brunswick to the Wolastoq (Saint John) River, found growing on gravelly river strands (Hinds 2000).
Lake Huron Tansy *Tanacetum bipinnatum ssp. huronense*	**AC CDC:** S3	
Large Toothwort *Cardamine maxima*	**AC CDC:** S3	Deciduous woods and rich, calcareous, rocky slopes (Hinds 2000).
Swamp Fly Honeysuckle *Lonicera oblongifolia*	**AC CDC:** S3	Grows mostly in calcareous fens and swamps (Hinds 2000).
Alpine Milk-vetch *Astragalus alpinus*	**AC CDC:** S3	Grows on calcareous shores and ledges and gravel strands (Hinds 2000).
Field Locoweed *Oxytropis campestris var. johannensis*	**AC CDC:** S3	Gravelly river strands along the Restigouche and Wolastoq Rivers (Hinds 2000).
Red Ash *Fraxinus pennsylvanica*	**AC CDC:** S3	River banks and flood plains, mostly along the Wolastoq and St. Croix Rivers (Hinds 2000).
Mistassini Primrose *Primula mistassinica*	**AC CDC:** S3	Grows mostly on wet, calcareous ledges, slopes, and shores (Hinds 2000).
Early Anemone *Anemone multifida var. multifida*	**AC CDC:** S3	Gravel strands or large crevices near river shores (Hinds 2000).
Purple Clematis *Clematis occidentalis*	**AC CDC:** S3	Open woods, calcareous ledges, and rocky slopes (Hinds 2000).
Rough Hawthorn *Crataegus scabrida*	**AC CDC:** S3	Clearings and edge of woods, and rocky shores (Hinds 2000).
Sandbar Willow *Salix interior*	**AC CDC:** S3	Alluvial shores, beaches, and river bars (Hinds 2000).
Northeastern Paintbrush *Castilleja septentrionalis*	**AC CDC:** S3	
Northern Bog Sedge *Carex gynocrates*	**AC CDC:** S3	Calcareous sphagnum bogs and cedar swamps (Hinds 2000).
Rosy Sedge *Carex rosea*	**AC CDC:** S3	Rich forests (Hinds 2000).

Species	Conservation Ranking	Habitat
Longbeak Sedge *Carex sprengelii*	**AC CDC:** S3	Grows in lime-rich areas on banks, slopes, and alluvial bottomlands (Hinds 2000).
Perennial Yellow Nutsedge *Cyperus esculentus var. leptostachyus*	**AC CDC:** S3	Grows on sandy shores and sometimes in cultivated fields (Hinds 2000).
Small-head Rush *Juncus brachycephalus*	**AC CDC:** S3	Calcareous shores (Hinds 2000).
Showy Lady's Slipper *Cypripedium reginae*	**AC CDC:** S3	Calcareous bogs and fens, boggy meadows, and edges of cedar swamps (Hinds 2000).
Broad-glumed Brome *Bromus latiglumis*	**AC CDC:** S3	Grows in rich soils along the Restigouche and Wolastoq Rivers (Hinds 2000).
Mat Muhly *Muhlenbergia richardsonis*	**AC CDC:** S3	Rocky shores and gravelly river strands (Hinds 2000).
Little Bluestem Schizachyrium scoparium	**AC CDC:** S3	Rocky shores and gravelly river strands (Hinds 2000).
Northern Maidenhair Fern *Adiantum pedatum*	**AC CDC:** S3	Grows in rich hardwoods on neutral soils (Hinds 2000).
Goldie's Woodfern *Dryopteris goldiana*	**AC CDC:** S3	Grows in rich, shaded hardwoods on neutral soils (Hinds 2000).
Tall Goldenrod *Solidago altissima*	**AC CDC:** S3S4	Alluvial meadows and sandy fields (Hinds 2000).
Boreal Aster *Symphyotrichum boreale*	**AC CDC:** S3S4	Calcareous bogs, cedar swamps and shores (Hinds 2000).
Alpine Hedysarum *Hedysarum americanum*	**AC CDC:** S3S4	Calcareous ledges and rocky shores (Hinds 2000).
American Beech *Fagus grandifolia*	**AC CDC:** S3S4	Grows in matures forests – most of New Brunswick's individuals suffer from beech canker (Hinds 2000).
Smooth Hedge-nettle *Stachys hispida*	**AC CDC:** S3S4	Alluvial meadows, thickets, and along shores (Hinds 2000).
White Ash *Fraxinus americana*	**AC CDC:** S3S4	Rich hardwood stands (Hinds 2000).
Climbing False Buckwheat *Fallopia scandens*	**AC CDC:** S3S4	Alluvial meadows and thickets (Hinds 2000).
Northern Meadow-rue *Thalictrum confine*	**AC CDC:** S3S4	Alluvial meadows and calcareous shores (Hinds 2000).
White Elm *Ulmus americana*	**AC CDC:** S3S4	Grows in alluvial soils such as in flood plains, but also in rich, wet upland sites (Hinds 2000).
Few-flowered Spikerush *Eleocharis quinqueflora*	**AC CDC:** S3S4	Fens, ledges, and calcareous shores (Hinds 2000).
Canada Lily *Lilium canadense*	**AC CDC:** S3S4	Alluvial meadows and moist open woods (Hinds 2000).
Sticky False-asphodel *Triantha glutinosa*	**AC CDC:** S3S4	Mostly on calcareous ledges and shores (Hinds 2000).
Thread-leaved Pondweed *Stuckenia filiformis*	**AC CDC:** S3S4	Grows in brackish waters and in calcareous areas (Hinds 2000).
Birds		
Yellow-breasted Chat *Icteria virens*	**SARA:** Endangered **AC CDC:** SNA	Though the Yellow-breasted Chat is listed as Endangered under SARA and COSEWIC, it is recognized as an accidental sighting in NB.
Bank Swallow *Riparia riparia*	**SARA:** Threatened **AC CDC:** S2B	Bank Swallows prefer open habitats including: farmland, lake/river shorelines, grasslands, and wetlands. Nests in exposed earthen banks along shorelines and in artificial sites such as sand and gravel pits (COSEWIC 2013).
Chimney Swift *Chaetura pelagica*	**SARA:** Threatened **NB SARA:** Threatened **AC CDC:** S2S3B, S2M	Historically, the Chimney Swift used mainly large hollow trees for nesting sites but have adopted chimneys as preferred nesting sites. They are generally associated with urban and rural areas where chimneys are available for

Species	Conservation Ranking	Habitat
		nesting and roosting. Chimney swifts are aerial foragers and tend to concentrate near water where insects are abundant (COSEWIC 2007).
Barn Swallow *Hirundo rustica*	**SARA:** Special Concern **NB SARA:** Threatened **AC CDC:** S2B	Barn Swallows typically nest on human-made structures such as abandoned buildings or barns and forages in open areas (COSEWIC 2011).
Eastern Wood-pewee *Contopus virens*	**SARA:** Special Concern **NB SARA:** Special Concern **AC CDC:** S3B	Most often associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation. During migration, a variety of habitats are used, including forest edges and early successional clearings (COSEWIC 2012).
Olive-sided Flycatcher *Contopus cooperi*	**SARA:** Special Concern **NB SARA:** Threatened **AC CDC:** S3B	Typically breeds in coniferous edges and open areas with perches (e.g., forest openings near waterbodies, wetlands and clear-cuts; COSEWIC 2018b).
Bobolink *Dolichonyx oryzivorus*	**SARA:** Special Concern **NB SARA:** Threatened **AC CDC:** S3B	Typically nest in lush meadows, open grasslands, and hayfields (COSEWIC 2010).
Canada Warbler Cardellina canadensis	**SARA:** Special Concern **NB SARA:** Threatened **AC CDC:** S3S4B	The Canada Warbler prefers wet, mixed deciduous and coniferous forests with a well-developed shrub layer for breeding, but also uses riparian shrub forest on slopes, as well as regenerating stands after a disturbance (COSEWIC 2020).
Snowy Owl *Bubo scandiacus*	**AC CDC:** S1N,S2S3M	Typically only seen in New Brunswick during the winter, at the south and east of its range. Found in open areas and uses items like fence posts, power poles, and buildings to perch. Does not nest in NB (Burrows 2002).
Purple Martin *Progne subis*	**AC CDC:** S1B	Purple Martins prefer semi-open areas, including in urban areas such as gardens and fields and usually nest in human-made structures (Burrows 2002).
Ruddy Duck *Oxyura jamaicensis*	**AC CDC:** S1B,S2S3M	Breeds in shallow, muddy-bottom marshes with lots of emergent vegetation. Typically only seen in New Brunswick during migration (Burrows 2002).
Willow Flycatcher *Empidonax traillii*	**AC CDC:** S1S2B	Typically found within shrubby areas that include plants such as hawthorn (*Crataegus* spp.), apples (*Malus* spp.), red-osier dogwood (*Cornus sericea*), willow (*Salix* spp.) in riparian corridors or abandoned farmlands. Builds their nests within the crook of a shrub, 1-2m above-ground (Burrows 2002).
Cliff Swallow *Petrochelidon pyrrhonota*	**AC CDC:** S2B	Occasional nester in New Brunswick and common migrant. Typically nests under bridges, and on cliffs, buildings near watercourses (Burrows 2002).
Baltimore Oriole *Icterus galbula*	**AC CDC:** S2S3B	Prefers deciduous and mixed-wood forests – in particular riparian areas, as well as openings, shorelines, roads, orchards, gardens and parks (Burrows 2002).
Ring-billed Gull *Larus delawarensis*	**AC CDC:** S2S3B,S4N,S5M	Migrant and year-round species. Breeds in sparsely-vegetated islands, on beaches, breakwaters, and dredge-spoil areas. Prefers open areas during migration and in the winter (Burrow 2002).
Black-backed Woodpecker *Picoides arcticus*	**AC CDC:** S3	Coniferous forests, especially those with numerous standing dead trees (Burrows 2002).
Pine Siskin *Spinus pinus*	**AC CDC:** S3	Mostly found within coniferous and mixed-wood forests (Burrows 2002).
Killdeer *Charadrius vociferus*	**AC CDC:** S3B	A variety of habitats including any open habitat types, both urban and rural, at a distance from water (Burrows 2002).

Species	Conservation Ranking	Habitat
Black-billed Cuckoo *Coccyzus erythropthalmus*	**AC CDC:** S3B	Prefers dense areas such as thickets, shrubby areas, tangled riparian areas, and second-growth forests (Burrows 2002).
Great Crested Flycatcher *Myiarchus crinitus*	**AC CDC:** S3B	Mixed-wood and deciduous forests, usually near an edge or an opening (Burrows 2002).
Rose-breasted Grosbeak *Pheucticus ludovicianus*	**AC CDC:** S3B	Mixed and deciduous forests with shrubs and/or second growth during breeding; parks, gardens, and woodlots during migration (Burrows 2002).
Indigo Bunting *Passerina cyanea*	**AC CDC:** S3B	Deciduous forests and forest edges, as well as orchards, clearings, and shrubby fields (Burrows 2002).
Brown-headed Cowbird *Molothrus ater*	**AC CDC:** S3B	Open agricultural and residential areas (Burrows 2002).
Northern Pintail *Anas acuta*	**AC CDC:** S3B,S5M	Breeds in shallow wetlands, in fields, and the edges of lakes (Burrows 2002).
Snow Goose *Anser caerulescens*	**AC CDC:** S3M	Shallow wetlands, lakes, and fields (Burrows 2002).
Canada Jay *Perisoreus canadensis*	**AC CDC:** S3S4	Coniferous and mixed-wood forests, bogs and fens, as well as anthropogenic sites such as campgrounds and picnic areas (Burrows 2002).
Boreal Chickadee *Poecile hudsonicus*	**AC CDC:** S3S4	Breeds in spruce, pine, and fir forests, but spends the winter in coastal and suburban areas (Burrow 2002).
Eastern Kingbird *Tyrannus tyrannus*	**AC CDC:** S3S4B	Rural fields, clearings, open roadsides, old forest fires, and near residential areas (Burrows 2002).
Warbling Vireo *Vireo gilvus*	**AC CDC:** S3S4B	Deciduous forests and parks and gardens with deciduous trees. In migration – any kind of deciduous growth (Burrows 2002).
Spotted Sandpiper *Actitis macularius*	**AC CDC:** S3S4B,S4M	Any type of wet habitat: ranging from ditches to marshes to rivers, beaches and shores, wetlands, and occasionally cultivated fields (Burrows 2002).
Wilson's Snipe *Gallinago delicata*	**AC CDC:** S3S4B,S5M	Wet or grassy marshes.
Blackpoll Warbler Setophaga striata	**AC CDC:** S3S4B,S5M	Coniferous and mixed-wood scrub, open coniferous growth in bogs and fens, ridged riverbanks, and sparsely vegetated beach ridges (Burrows 2002).
Invertebrates		
Monarch *Danaus plexippus*	**SARA:** Endangered **NB SARA:** Special Concern **AC CDC:** S2S3?B	Milkweed plants, which grow in disturbed habitats. For overwintering monarchs require a cool, humid microclimate (COSEWIC 2016).
Appalachian Tiger Beetle *Cicindela ancocisconensis*	**AC CDC:** S2	Is a habitat specialist and prefers open sand or a matrix of sand and cobble along permanent streams or medium-sized rivers. Habitats may be grassy. Almost always found near water but adults may wander (Leonard and Bell 1999; Knisley and Schultz 1997).
Spot-winged Glider *Pantala hymenaea*	**AC CDC:** S3B	Shallow, temporary pools and puddles (University of Nebraska n.d.).

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COSEWIC (Committee on the Status of Endandered Wildlife in Canada). 2018b. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 52 pp.

COSEWIC (Committee on the Status of Endandered Wildlife in Canada). 2020. COSEWIC assessment and status report on the Canada Warbler *Cardellina canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 54 pp.

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Appendix E

Wetland Data Sheets

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site: Covered Bridge Chips Fac. Municipality/County: Waterville/Carleton Sampling Date: Aug. 22, 2022
Applicant/Owner: Covered Bridge Chips Sampling Point: Wetland1
Investigator(s): B. Gardine Affiliation: Dillon Consulting Ltd.
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): concave
Slope (%): Lat: 46.285365°N Long: 67.582365°W Datum: NAD83
Soil Map Unit Name/Type: canbau / non-compact till Wetland Type: disturbed - was likely forested wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No (If no, explain in Remarks.)
Are Vegetation ✓, Soil ✓, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No
Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No	**Is the Sampled Area within a Wetland?** Yes No
Hydric Soil Present?	Yes ✓ No	If yes, optional Wetland Site ID:
Wetland Hydrology Present?	Yes ✓ No	

Remarks: (Explain alternative procedures here or in a separate report.)
highly disturbed WL.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10m)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. Salix bebbiana	5	✓	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Sarpus	25	✓	FACW/OBL
2. Typha spp.	5		FAC
3. Carex pseudocyperus	2		OBL
4. Lycopus americanus	2		OBL
5.			
6.			
7.			
8.			
9.			
10.			
	34 = Total Cover		
Woody Vine Stratum (Plot size: 1m)			
1.			
2.			
	= Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	4	x 1 =	4
FACW species	25	x 2 =	50
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	39 (A)		84 (B)

Prevalence Index = B/A = 2.18

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
✓ Dominance Test is >50%
✓ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WET 1

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

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	5Y 4/2	100						
10-40+	5Y 5/2	97	5YR 5/8	3	C	M		

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ✓ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (cm): ___ not observed

Hydric Soil Present? Yes ✓ No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No ___ Depth (cm): 5 cm

Water Table Present? Yes ✓ No ___ Depth (cm): 0 cm

Saturation Present? (includes capillary fringe) Yes ✓ No ___ Depth (cm): ___

Wetland Hydrology Present? Yes ✓ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site: Covered Bridge Chips Fac. Municipality/County: Waterville / Carleton Sampling Date: Aug. 22, 2022
Applicant/Owner: Covered Bridge Chips Sampling Point: Upland 1
Investigator(s): B. Goodine Affiliation: Dillon Consulting Ltd.
Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): flat w/ hummocks
Slope (%): Lat: 46.285137°N Long: 67.582931°W Datum: NAD83
Soil Map Unit Name/Type: caribou/non-compact till Wetland Type: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ____
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	If yes, optional Wetland Site ID: ____

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 10m)			
1. Prunus spp	5		FAC
2. Abies balsamea	50	✓	FAC
3. Betula papyrifera	10		FACU
4. Acer rubrum	10		FAC
5.			
	75 = Total Cover		
Sapling/Shrub Stratum (Plot size: 5m)			
1. Abies balsamea	50	✓	FAC
2.			
3.			
4.			
5.			
	50 = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Trientalis borealis	5	✓	FAC
2. Dryopteris intermedia	5	✓	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ = Total Cover		

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)
Total Number of Dominant Species Across All Strata: ____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1	x 1 =	1
FACW species	1	x 2 =	1
FAC species	125	x 3 =	375
FACU species	10	x 4 =	40
UPL species	1	x 5 =	1
Column Totals:	135 (A)		415 (B)

Prevalence Index = B/A = 3.07

Hydrophytic Vegetation Indicators:
___ Rapid Test for Hydrophytic Vegetation
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: VP1

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

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-~~10~~5	organic matter/litter							
5-40+	7.5YR 6/6	100					gravelly/silty	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (cm): _____

Water Table Present? Yes _____ No _____ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site: Covered Bridge Chips Fac. Municipality/County: Waterville / Carleton Sampling Date: 22Aug. 2022

Applicant/Owner: Covered Bridge Chips Sampling Point: Wetland 2

Investigator(s): B. Goodine Affiliation: Dillon Consulting Limited

Landform (hillslope, terrace, etc.): man-made drainage Local relief (concave, convex, none): concave

Slope (%): _____ Lat: 46.284558°N Long: 67.582161°W Datum: NAD83

Soil Map Unit Name/Type: Canbou / non-compact till Wetland Type: /

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No _____	**Is the Sampled Area within a Wetland?** Yes ✓ No _____
Hydric Soil Present?	Yes ✓ No _____	If yes, optional Wetland Site ID: _____
Wetland Hydrology Present?	Yes ✓ No _____	

Remarks: (Explain alternative procedures here or in a separate report.)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: 1m)			
1. Scirpus cyperinus	90	✓	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	90	x 2 =	180
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		180 (B)

Prevalence Index = B/A = 2

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

✓ Dominance Test is >50%

✓ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Hydrophytic Vegetation Present? Yes ✓ No _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WL2

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

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0.5-0	organics							
0-40	Gley1 4/10Y	95	10R 6/8	5	C	M	gravelly w/ some crushed rock	
40+	2.5Y 4/3	100					possibly old ag. - clayey	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ✓ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____ none observed

Hydric Soil Present? Yes ✓ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ✓ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ✓ No _____ Depth (cm): 5-10cm

Water Table Present? Yes _____ No _____ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes ✓ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: frogs living in SW.

WETLAND DELINEATION DATA FORM – NEW BRUNSWICK

Project/Site: Covered Bridge Chips Fac. Municipality/County: Waterville/Carleton Sampling Date: 22 Aug, 2022

Applicant/Owner: Covered Bridge Chips Sampling Point: Upland2

Investigator(s): B. Goodine Affiliation: Dillon Consulting Ltd.

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none):

Slope (%): Lat: Long: Datum: NAD83

Soil Map Unit Name/Type: Canbou/non-compact till Wetland Type: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)

Are Vegetation, Soil, or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes No

Are Vegetation, Soil, or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ____	**Is the Sampled Area within a Wetland?** Yes ____ No ____
Hydric Soil Present?	Yes ____ No ____	If yes, optional Wetland Site ID: ____
Wetland Hydrology Present?	Yes ____ No ____	

Remarks: (Explain alternative procedures here or in a separate report.)

veg indicates WL, soil + hydrology indicate upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 10m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Abies balsamea	50	✓	FAC
2. Betula papyrifera	10		FACU
3. Populus tremuloides	10		FAC
4. Thuja occidentalis	10		FACW
5.			
	80	= Total Cover	

Sapling/Shrub Stratum (Plot size: 5m)			
1. Acer rubrum	3	✓	FAC
2.			
3.			
4.			
5.			
	3	= Total Cover	

Herb Stratum (Plot size: 1m)			
1. Aralia nudicaulis	10	✓	FAC
2. Maianthemum canddense	3		FAC
3. Acer rubrum	2		FAC
4. Oxalis montana	10	✓	FAC
5.			
6.			
7.			
8.			
9.			
10.			
	25	= Total Cover	

Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1	x 1 =	1
FACW species	10	x 2 =	20
FAC species	88	x 3 =	264
FACU species	10	x 4 =	40
UPL species	1	x 5 =	1
Column Totals:	108 (A)		324 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Hydrophytic Vegetation Present? Yes ____ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: VP2

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

Depth (cm)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	organic matter/ litter							
5-40+	2.5Y 5/4	100	none				gravelly/silty	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surfaces (S7)
- ___ Polyvalue Below Surface (S8)
- ___ Thin Dark Surface (S9)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ Coast Prairie Redox (A16)
- ___ 5 c Mucky Peat or Peat (S3)
- ___ Iron-Manganese Masses (F12)
- ___ Piedmont Floodplain Soils (F19)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (cm): _____

Hydric Soil Present? Yes _____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (cm): _____

Water Table Present? Yes _____ No _____ Depth (cm): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (cm): _____

Wetland Hydrology Present? Yes _____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix F

Master Plant List

Common Name	Scientific Name	S-Rank
Cattails	*Typha spp.*	S5/SNA
American Bugleweed	*lycopus americanus*	S5/SNA
Horsetails	*Equisetum spp.*	-
Cyperuslike Sedge	*Carex pseudocyperus*	S5
Bulrushes	*Scirpus spp.*	-
Bebb's Willow	*Salix bebbiana*	S5
Cherry	*Prunus spp.*	S5/SNA
Balsam Fir	*Abies balsamea*	S5
White birch	*Betula papyrifera*	S5
Red maple	*Acer rubrum*	S5
Northern Starflower	*Trientalis borealis*	S5
Evergreen Wood Fern	*Dryopteris intermedia*	S5
Common Woolly Bulrush	*Scirpus cyperinus*	S5
Trembling Aspen	*Populus tremuloides*	S5
Eastern White Cedar	*Thuja occidentalis*	S5
Wild Sarsaparilla	*Aralia nudicaulis*	S5
Wild Lily-of-the-Valley	*Maianthemum canadense*	S5
Common Wood Sorrel	*Oxalis montana*	S5
Arrow-leaved Tearthumb	*Persicaria sagittata*	s5
Canada Goldenrod	*Solidago canadensis*	S5
Tufted Vetch	*Vicia cracca*	SNA
Red Clover	*Trifolium pratense*	SNA
Common Dandelion	*Taraxacum officinale*	SNA
Common Timothy	*Phleum pratense*	SNA
Blackberry	*Rubus allegheniensis*	S5
Wild Strawberry	*Fragaria virginiana*	S5
Fireweed	*Chamaenerion angustifolium*	S5