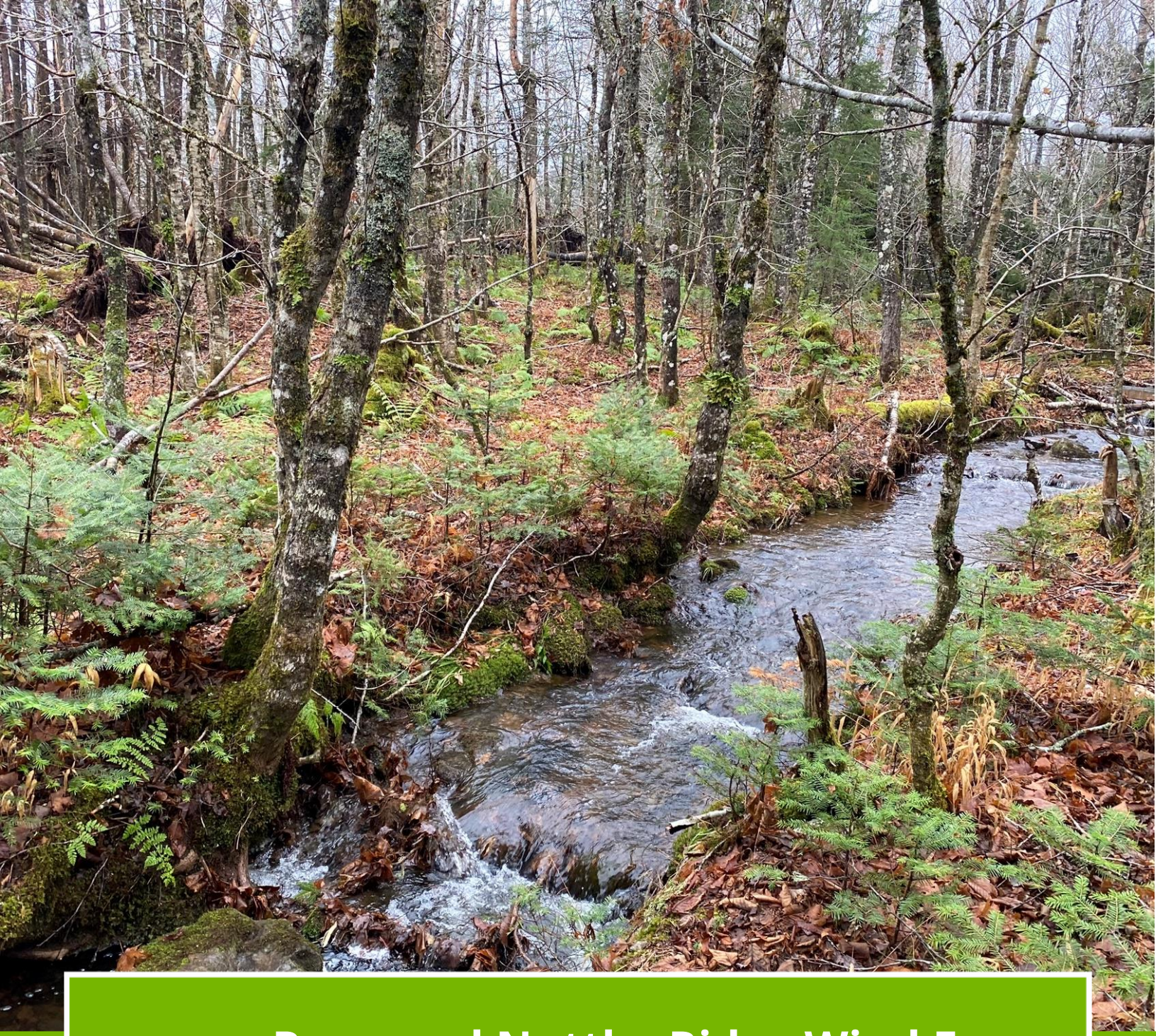
# APPENDIX E
# CBCL TECHNICAL SUMMARY REPORT - FISH AND FISH HABITAT, WATER QUALITY, AQUATICS, AND TURTLE HABITAT ASSESSMENTS



# Proposed Nuttby Ridge Wind Farm Technical Summary Report

## Fish and Fish Habitat, Water Quality, Aquatics, and Turtle Habitat Assessments

**FINAL Report**

CBCL

221265.01 • May 19 , 2023

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| 01 | FINAL | L. Hardwick | 19-May-2023 | M. Browne |
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Project No. 221265.01

May 19, 2023

Glenn Goudey
Manager, Environment – T&D
Nova Scotia Power
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*RE: Environmental Studies at Proposed Nuttby Ridge Wind Site – FINAL Aquatics Technical Summary Report*

Dear Glenn,

CBCL Limited is pleased to provide Nova Scotia Power Incorporated with the final Nuttby Ridge Aquatics Technical Summary Report. We trust this report meets your expectations, and we appreciate the opportunity to work with NSPI on this project.

Yours very truly,

CBCL Limited

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Project No.: 221265.01

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# Acronyms and Abbreviations

| | |
|---|---|
| % | Percent |
| ‰ | Per Thousand |
| °C | Degrees Celsius |
| > | Greater than |
| µg | Microgram |
| µg/cm | Micrograms per centimetre |
| AC CDC | Atlantic Canada Conservation Data Centre |
| $CaCO_3$ | Carbonate Hardness |
| CBCL | CBCL Limited |
| CCME | Canadian Council of Ministers of the Environment |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| cm | Centimetre |
| DFO | Department of Fisheries and Oceans Canada |
| E | East / Easting |
| EA | Environmental Assessment |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| GSGOL | Gaspe-Southern Gulf of St. Lawrence |
| IAAC | Impact Assessment Agency Canada |
| iBoF | Inner Bay of Fundy |
| L | Litre |
| m | Metre |
| mg | Milligram |
| mg/L | Milligrams per litre |
| mm | Millimetre |
| m/s | Velocity |
| mV | Millivolts |
| N | North / Northing |
| NS ECC | Nova Scotia Environment and Climate Change |
| NS DNRR | Nova Scotia Department of Natural Resources and Renewables |
| NSPI | Nova Scotia Power Inc. |
| NTU | Nephelometric Turbidity Unit |
| pH | Power of hydrogen |
| ppt | Parts Per Thousand |
| the Project | Nuttby Wind Project |
| RISC | British Columbia Resources Information Standards Committee |
| ROW | Right-of-Way |
| QA/QC | Quality Assurance / Quality Control |
| s | Second |
| SAR | Species at Risk |
| SARA | Species at Risk Act |

| | |
|---|---|
| SoCC | Species of Conservation Concern |
| TDS | Total Dissolved Solids |
| TOC | Total Organic Carbon |
| UTM | Universal Transverse Mercator |
| VEC | Valued Ecosystem Component |
| VES | Visual Encounter Survey |
| WC | Watercourse |

# 1 Introduction

## 1.1 Overview & Purpose

Nova Scotia Power Inc. (NSPI) is proposing to develop the Nuttby Ridge Wind Project (the Project) in Colchester County, Nova Scotia. CBCL Limited (CBCL) was contracted by NSPI to complete an assessment of watercourses and turtle habitat that could be affected by the proposed Nuttby Ridge Project as part of a preliminary environmental constraints analysis.

The objective of this technical data report is to provide baseline information on the existing conditions for the aquatic environment; specifically, fish and fish habitat, turtle habitat, and water quality. The data collected will be used to support further design and an environmental impact assessment of the Nuttby Ridge Project.

## 1.2 Study Area

The Nuttby Ridge Project is adjacent to the existing Nova Scotia Power Nuttby Mountain Wind Turbine Farm, which has been in operation since 2010. The Project is located within an active forestry and logging area in Colchester County, Nova Scotia, approximately 25 km north of Truro. The Project is in the general proximity of the communities of McCallum Settlement and Kavanaugh Mills, Nova Scotia. The approximate centre coordinates of the Project Area are at UTM 20 T 477585 m E and 5043494 m N. The Project Area is defined as the anticipated footprint for the proposed development; this includes areas of vegetation clearing, ground disturbance, and construction that will be required. At the time of completion of this report the detailed Project design had not been finalized and was subject to change. Any changes in the design or location of Project components may not be captured or accurately represented by the information presented in this report.

The Study Area (see Figure 1, Appendix A) for the aquatic environment was assessed in two components—a Preliminary Study Area and a Detailed Study Area—based on the anticipated Project Area plus an additional distance from the Project Area as described below:

- Preliminary Study Area for watercourse identification consisted of the area within a 150-m radius around each planned turbine site and 50 m on either side of the SW centreline of planned roads, substations, and laydown areas.

- Detailed Study Area for detailed assessment of watercourses consisted of the area within a 400 m zone of influence[1] for access road crossings (i.e., 100 m upstream of the crossing to 300 m downstream).

Preliminary watercourse identification surveys were carried out within the Study Area. Detailed assessments were conducted on watercourses deemed to be, or likely to be, fish-bearing as determined during the preliminary survey completed in summer and fall of 2022.

Surveys within the Study Area were implemented to collect watercourse and habitat information in the Project Area and to accommodate adjustment of the Project footprint during the design phase. In some cases, surveys extended beyond the Study Area, where deemed prudent by the assessors, to appropriately characterize the aquatic environment.

The Study Area for the Project, including the access road and proposed turbine locations, was divided into a grid pattern, using 20 quaternary watersheds of two main rivers: the Salmon River / Debert River and River John. Of these 20 quaternary watersheds, 12 were identified to be potentially affected by the proposed Project infrastructure or access roads. The grid pattern was overlayed on the map with the Project Study Area and was used during field assessments and data collection to systematically keep track of stream locations and to aid with communication between field teams.

## 1.3 Regulatory Setting

The Project is subject to the provincial EA process; however, the regulatory setting described in this report is specific to the regulatory regime for fish and fish habitat, and Wood Turtles and their habitat relevant to construction and operation of the Project. Some of the applicable legislation pertinent to fish and fish habitat, and Wood Turtles is outlined below.

### 1.3.1 Federal

#### 1.3.1.1 Fisheries Act

The federal *Fisheries Act* provides protection to fish and fish habitat in Canada and is administered by Fisheries and Oceans Canada (DFO). The *Fisheries Act* is applicable to permanent and seasonal fish habitat. Sections of the *Fisheries Act* that may be relevant to the construction and operation of the Project are as indicated below:

- Section 34(1). Deleterious substances
- Section 34.2(1). Establishment of codes of practice for protection of fish
- Section 34.3(1),(2),(4),(7). Protection of fish passage

[1] The zone of influence was determined to be the most likely extent of disturbance from construction of the Project with appropriate mitigation measures implemented.

- Section 34.4(1). Death of fish
- Section 35(1). Harmful alteration, disruption or destruction of fish habitat
- Section 35.2(1). Work in an ecologically significant area

DFO Codes of Practice and relevant guidance documents may be applicable to the implementation of the Project in order to protect fish and fish habitat. These would be implemented during the construction and operation phases of a project.

#### 1.3.1.2 Species at Risk Act

The federal *Species at Risk Act* (SARA) provides a governmental commitment to prevent wildlife species, including aquatic species, from becoming extinct and to secure the necessary actions for their recovery. The Act provides legal protection to wildlife species and conservation of their biological diversity. Sections of SARA that may be relevant to the construction and operation of the Nuttby II Project are, but not limited to, as presented below:

- Section 27. List of Wildlife Species at Risk
- Section 32. General Prohibitions on killing or harming species
- Section 33. General Prohibition on damaging or destroying a species' residence
- Section 56. Protection of Critical Habitat
- Section 73. Agreements and Permits
- Section 80. Emergency Orders to protect critical habitat of a specific wildlife species
- Section 85. Enforcement Measures

Should the Project require a permit to allow the disturbance of an aquatic species at risk, the *Fisheries Act* Authorization can act as a SARA permit, with DFO reviewing the provided information and issuing the permit.

### 1.3.2 Provincial

#### 1.3.2.1 Environment Act

Nova Scotia Environment and Climate Change (NS ECC) administers the provincial regulations for alterations to wetlands and watercourses including culvert installation and modifications through Watercourse Alteration Approval Applications or Notifications.

Designated activities that require an Approval or Notification are stated in the Activities Designation Regulations, under Section 66 of the provincial *Environment Act*. Applicable Project activities that may trigger an Approval or Notification are as per the following sections:

- Section 5A (2). Approval
  - Altering a watercourse, water resource, or wetland
- Section 5B (1). Notification
  - (a) Watercourse Alterations to improve fish habitat, unless exempt under Section 5D if all the following conditions are met:
    - (i) watercourse is altered for less than 15 m

- (ii) the work is done by hand or equipment
- (iii) the work occurs between June 1 and September 30.

- (b) Constructing or modifying a single culvert, or closed-bottom structure, for the purpose of a road, railbed, trail or footpath crossing, if:
  - (i) Culvert is less than 25 m in length
  - (ii) Watercourse slope is less than 8.0%
  - (iii) Watershed is 20 $km^2$ or less in area
  - (iv) work occurs between June 1 and September 30

- Section 5C. Qualifications for certain alterations
  - (1) Structure described in 5(B)(1)(b) to be installed in a watercourse with a slope of less than or equal to 0.5% must be sized by a Watercourse Alteration Sizer or professional engineer.
  - (2) Structure described in 5(B)(1)(b) to be installed in a watercourse with a slope between 0.5% and 8.0% must be designed by an engineer.
- Section 5D. Exemptions
  - (e) maintaining alterations or structures associated with activities designated in subsections 5A (1) and (2) and clauses 5B(1)(a) to (d), if works if work is done above the ordinary high-water mark.

Where the proposed works do not alter the bed or bank of a watercourse, no approval or notification from NS ECC is required.

#### 1.3.2.2 Endangered Species Act

The provincial *Endangered Species Act* (ESA) protects species in Nova Scotia that have been assessed and are at risk of extinction. The Act is applicable to all flora and fauna species in the province that require protection, including aquatic species such as fish and turtles, and ranks species in categories based on risk. Sections of the ESA that may be applicable to the Project during construction or operation are, but may not be limited to, as presented below:

- Section 12(1). Listing of Species at Risk
- Section 13(1). Prohibitions
- Section 14(1). Issuance of a permit
- Section 22(1). Contravention of the Act

Permitting requirements for the ESA are administered by the NS Department of Natural Resources and Renewables. Where works associated with the Project may impact a species at risk or its habitat, a permit may be required to allow the work to proceed, as described in Section 14 of the Act.

# 2 Methodology

The following section describes the methods used for the desktop and field data collection programs for the Project. Field surveys were limited in some areas by the extensive blowdowns caused by post-tropical storm Fiona.

## 2.1 Desktop Review

Background reports, literature, available information from NSPI, and publicly available databases and information sources related to aquatic environment were reviewed prior to the start of the preliminary field survey. Available information was reviewed for the following within the Nuttby II Study Area:

- Known or mapped watercourses
- Locations of known spawning, overwintering, or important fish habitat
- Known species presence and distribution
- Occurrence or possible occurrence of turtle species, as well as their seasonal habitat requirements

As part of the environmental approval process for the original Nuttby Wind Farm, environmental baseline studies were conducted. Available information related to watercourses, fish, fish habitat, and fish species at risk known from the for the original Nuttby Wind Farm project study area was reviewed prior to the start of the preliminary site surveys and detailed field assessments. Additional information sources used include the following:

- Reptiles and Amphibians of the Atlantic Maritime Ecozone (McAlpine, 2010)
- Amphibians of Nova Scotia (Gilhen, 1984)
- Natural History of Nova Scotia (Davis and Browne, 1996)
- Nova Scotia Department of Natural Resources and Renewable (NS DNRR)'s Significant Species and Habitats database
- Atlantic Canada Conservation Data Centre (AC CDC) data request (AC CDC, 2023)
- ROM field guide to amphibians and reptiles of Ontario (MacCulloch, 2002)
- Records within the Nova Scotia Herpetofauna Atlas iNaturalist project
- Species at Risk in Nova Scotia: Identification and Information Guide (MTRI, 2008)
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports for turtle species in NS
- Personal knowledge of CBCL ecologists

Existing biophysical features within the proposed Study Area were mapped using available geospatial data.

## 2.2 Preliminary Survey

A preliminary survey of the proposed Project Right-of-Way (ROW) and access roads was conducted by CBCL biologists to identify and classify, watercourses within the study corridor that may be crossed by the Project. Additionally, identified watercourses were assessed to determine which of those are potential permanent and/or fish-bearing watercourses. Watercourses that were identified as possibly supporting fish habitat or possibly permanent were selected for additional detailed assessment.

The preliminary survey was conducted in the Preliminary Study Area by a minimum of two experienced field staff who travelled along the proposed Project corridor to classify and assess the known watercourses and to identify and classify field-identified watercourses not shown on existing maps.

## 2.3 Detailed Fish Habitat Assessment

The detailed assessment generally followed the assessment methods presented in the BC *Reconnaissance 1:20 000 Fish and Fish Habitat Inventory: Standards and Procedures* (BC MoE, 2001) and the Nova Scotia Fish Habitat Suitability Assessment (NS Adopt a Stream, 2018). The detailed assessment focussed on those watercourses that were deemed to be fish-bearing, potentially fish-bearing, or permanent in nature. Detailed assessments covered a 400 m area: 100 m upstream of the proposed watercourse crossing or Project interaction location (at intervals of 50 m) to 300 m downstream (at intervals of 100 m). The assessment locations represent areas that could be monitored throughout the construction and operations periods of the Project to provide comparisons to baseline (upstream) and impacted areas (downstream).

For the detailed fish habitat assessment, the selected watercourses were assessed for the following parameters:

- Channel width (m)
- Wetted width (m)
- Water depth (m)
- Pool depth (m)
- Bankfull depth (m)
- Water velocity (metres per second (m/s))
- Water quality (e.g., temperature ($^{o}$C), turbidity (NTU), pH, dissolved oxygen (mg/L))
- Channel characteristics and morphology (e.g., pattern, islands, confinement)
- Substrate type and percent (e.g., gravels, cobble (see Table 2.1))
- Instream cover (e.g., overhanging vegetation, undercut banks)
- Crown closure (percentage (%))

- Riparian vegetation
- Fish habitat type and quality (e.g., spawning, overwintering)
- Likelihood for fish presence (based on habitat, water quality, barriers, etc.)
- Barrier or other features (e.g., waterfalls, beaver dams, perched culverts)
- Photographs (upstream, downstream, right and left bank, important features)
- Incidental observations of other features, including flora or fauna
- UTM locations

Substrates were classified based on the Wentworth Scale (Wentworth, 1922) for habitat assessments as per Table 2.1 below.

**Table 2.1 Substrate sizes and classes (Wentworth Scale (Wentworth, 1922))**

| Substrate Type | Size |
|---|---|
| Fines (e.g., sand, silt) | < 2 mm |
| Small Gravel (e.g., pebbles) | 2 to 16 mm |
| Large Gravel (e.g., pebbles) | 17 to 64 mm |
| Cobble | 65 to 256 mm |
| Boulder | > 256 mm |
| Bedrock | Continuous slab (> 2m diameter) |

Watercourses were classified based on their likelihood for permanence as described in Table 2.2. Those watercourses with characteristics of another watercourse type, e.g., Intermittent with Ephemeral Characteristics, were described as such, but included with the leading watercourse type.

**Table 2.2 Watercourse Type Descriptions**

| Watercourse Type | Average Channel Width | Description |
|---|---|---|
| Large Permanent | > 5 m | • Defined channel<br>• Defined bed, banks, floodplain<br>• Year-round flows |
| Small Permanent | 2 to 5 m | • Defined channel<br>• Defined bed, banks, floodplain<br>• Year-round flows |
| Intermittent | < 2 m | • Defined channel<br>• Defined bed and banks<br>• Seasonal flows |
| Ephemeral | No defined channel or surface flow only | • No defined channel<br>• No defined bed or banks or floodplain<br>• Typically only contains water after rain events or snow melt |

Spawning, rearing, staging/holding and overwintering fish habitat in each watercourse was evaluated based on the characteristics described below.

- Spawning habitat quality was based on water flow and substrate (i.e., large and small gravels) and location of pools and or instream vegetation.
- Rearing habitat quality was based on instream cover type and abundance, water flow, and downstream habitat connectivity.
- Overwintering habitat quality was based on the presence or absence of deep pools or ponds (≥50 cm (minimum)), water quality, and the potential for year-round flow.

The potential for fish presence year-round was based on the results of water quality measurements (Section 2.4), habitat quality at the time of the assessment, the quality of overwintering and spring/summer habitat, and upstream/downstream connectivity of the watercourse to other watercourses.

## 2.4 Water Quality

### 2.4.1 In Situ Surface Water Quality Sampling

During the detailed watercourse assessments, *in situ* water quality parameters were measured at field sites using a handheld YSI Multimeter unit or a Horiba unit. The YSI Multimeter or Horiba units were calibrated prior to use in the field and maintained according to manufacturer specifications. Field locations chosen for surface water sampling were based on those identified for further assessment by the preliminary survey. The following water quality parameters were measured at each detailed assessment site:

- Temperature ($^{o}$C)
- pH
- Conductivity (µS / cm)
- Turbidity (Clear, Low, Moderate, Turbid)
- Total Dissolved Solids (mg / L)
- Oxidation Reduction Potential (mV)
- Dissolved Oxygen (mg / L and % Saturation)
- Salinity (‰)

Water quality parameters (i.e., temperature, pH, and dissolved oxygen) measured in the field were compared to the water quality limits[2] presented in Table 2.3 to provide a likelihood of fish presence.

[2] Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2017) and Brook Trout tolerance and optimal ranges for water quality (Raleigh, 1982)

**Table 2.3 Water Quality Limits for the Protection of Aquatic Life and Salmonids (CCME, 2017)**

| Water Quality Parameter | CCME Water Quality Guideline for the Protection of Aquatic Life (CCME 2017) | Brook Trout Tolerance and Optimum Range (Raleigh 1982) |
|---|---|---|
| pH | 6.5 to 9.0 | Tolerance: 4.0 to 9.5<br>Optimal: 6.5 to 8.0 |
| Temperature (°C) | N/A | Tolerance: 0.5 to 22<br>Optimal: 11.0 to 16.0 |
| Dissolved Oxygen (mg/L) | Cold water: 6.5 to 9.5 | Tolerance: ≥ 5.0<br>Optimal: ≥ 7.0 |

### 2.4.2 Laboratory Analysis

Surface water quality samples collected during the detailed watercourse assessments were set to the Bureau Veritas Laboratories in Bedford, NS for analysis. Bureau Veritas Laboratories is a Standards Council of Canada accredited laboratory.

Water quality sampling stations were chosen based on the preliminary survey and the locations of permanent watercourses. Surface water quality samples were collected in laboratory-supplied bottles. Nitrile gloves were used during sampling events and each of the four sample bottles were submerged in the flowing watercourse to collect samples. All sampling locations were collected upstream of existing anthropogenic structures (e.g., bridge, culvert) at a sufficient distance (i.e., greater than 10 m) to avoid direct influence in the sample matrix.

Analytical results were compared to the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (NSE Tier 1 EQS Freshwater) for Surface Water (Fresh Water Receptor Pathway) (NS ECC, 2021) and the CCME guidelines. Samples were analysed for the following water quality parameters:

- Carbonate, Bicarbonate and Hydroxide
- Alkalinity
- Chloride
- Colour
- Conductance – water
- Hardness (calculated as $CaCO_3$)
- Total Metals (30 metals analysed)
- Ion Balance (% Difference)
- Anion and Cation Sum
- Nitrogen Ammonia – water
- Nitrogen – Nitrate + Nitrite
- Nitrogen – Nitrite
- Nitrogen – Nitrate (as N)
- pH (1)
- Phosphorus – ortho
- Sat. pH and Langelier Index (@20°C)

- Sat. pH and Langelier Index (@4°C)
- Reactive Silica
- Sulphate
- Total Dissolved Solids (TDS calc)
- Organic Carbon – Total (TOC) (2)
- Turbidity

## 2.5 Aquatic Invertebrate Presence

The presence of aquatic invertebrates within assessed watercourses was determined through observations of invertebrates during selected examination of instream substrates. At each assessed watercourse at least three rocks within the channel were flipped over or lifted out of the water and examined for the presence of aquatic invertebrates or larvae. A record of invertebrate presence was recorded based on the prevalence of invertebrates in assessed areas and presented on a scale of none, trace (< 5%), low (5 to 20%), moderate (20 to 60%), and high (>60%) (i.e., number of locations where invertebrates were observed versus total number of areas sampled).

## 2.6 Assessment of Turtle Habitat

CBCL biologists evaluated the Nuttby II Study Area for the presence of suitable turtle habitat features within the identified watercourses intersecting the Project Area. Turtle habitat assessments were conducted during the detailed watercourse assessments, and generally covered a minimum of 50 m up- and down-stream of a planned crossing. In some instances, these distances varied, depending on access and watercourse conditions.

Survey details and environmental conditions such as temperature, cloud cover, wind speed and precipitation were recorded for each assessment site. Additionally, other environmental conditions, such as water temperature, pH, and flow conditions were also recorded. Stream characteristics were determined based on flow conditions (dry, low, mid, high, floodplain), water clarity (clear, tannic, turbid, zero visibility), velocity (flat, slow, moderate, fast, turbulent), and dominant substrate (silt, sand, gravel, cobble, boulder). Observations of aquatic and riparian vegetation were also documented.

CBCL evaluated various habitat features of the watercourses and surrounding riparian areas to determine habitat quality in terms of summer habitat, overwintering sites, nesting sites, and foraging potential for each possibly occurring turtle species. Table 2.4 outlines the environmental data assessed for each watercourse and defines habitat types for each of the three turtle species potentially occurring in this region of NS.

Turtle habitat requirements were compared against the general watercourse types to assess potential use of each watercourse by each turtle species. Table 2.5 summarizes the general

suitability of each watercourse category as habitat for the three turtle species. In general, watercourses that were determined to be likely fish-bearing were also considered suitable for turtles, particularly for wood turtles.

Incidental sightings of any turtles or evidence of such were also recorded by CBCL field staff during the vegetation inventory, wetland and watercourse reconnaissance, detailed wetland assessment, and detailed watercourse surveys conducted for the Nuttby II Project.

**Table 2.4 Definitions of likely suitable habitats for target turtle species in the Study Area**

| Turtle Habitat Type | Watercourse Assessment Criteria | Description of Suitable Habitats, by Species | | |
|---|---|---|---|---|
| | | Wood Turtle | Common Snapping Turtle | Eastern Painted Turtle |
| **Summering and Basking** | • Watercourse category/ size<br>• Water depth<br>• Flow conditions<br>• Water quality<br>• Water clarity<br>• Velocity<br>• Substrate type | Terrestrial woody and/ or grassy habitats adjacent to permanent watercourses with higher velocities and rocky substrates. | Waterbodies / permanent watercourses with lower velocities and soft sediments. | Waterbodies / permanent watercourses with lower velocities and soft sediments. |
| **Overwintering** | • Presence of deep pools, root masses of large trees, undercut banks, oxbows, large woody debris, log jams, and boulders<br>• Sediment type (soft vs. rocky)<br>• Apparent flow rate<br>• Water depth<br>• Sediment depth | Permanent watercourses or waterbodies with deep pools, root masses of large trees, undercut banks, oxbows, large woody debris, log jams, and boulders. | 1) Waterbodies / permanent watercourses with logs, sticks, or overhanging banks in small streams that flow continuously throughout the winter.<br>2) Submerged logs and stumps, sometimes silt-covered, within 5 m of lake shorelines.<br>3) Deep anoxic mud in marshy areas or beneath floating mats of vegetation in watercourse or waterbodies. | Waterbodies / permanent watercourses with shallow water depths (<0.5 m) and thick sediment layers (> 50 cm). |

| Turtle Habitat Type | Watercourse Assessment Criteria | Description of Suitable Habitats, by Species | | |
|---|---|---|---|---|
| | | Wood Turtle | Common Snapping Turtle | Eastern Painted Turtle |
| **Nesting** | • Presence of sand or sand-gravel areas (sand bars, cut banks along watercourse, areas of over-washed sand in open floodplains)<br>• Degree of canopy cover/ level of sun exposure<br>• Aspect/compass direction | Areas of sand or gravel-sand beaches, banks of streams, sidebars, over-washed areas, in-stream sand-gravel bars, or gravel pits, road shoulders, and decommissioned railway beds. | Sand and gravel banks along waterways, including artificial dam and railway embankments, muskrat houses, abandoned beaver lodges, road shoulders, fissures in rocky shorelines, sawdust heaps, and forest clearings. | Areas of sand, loam, clay, and/or gravel substrates usually within 1.2 km of their aquatic habitats, in areas of open canopy, sloped with southern exposure, such as the shorelines of lakes and wetlands, beaver dams, or sand dunes. |
| **Foraging** | • Availability of vegetative food sources in watercourse and adjacent riparian zone[3]. | Areas with abundant alder, willow, strawberry, blackberry, violets, mushrooms and grasses. | Areas with abundant aquatic or wetland vegetation, such as filamentous algae, duckweed, pondweed, cattail, sedge, and water lily. | Areas with abundant algae and aquatic plants, such as duckweed, pondweed, cattail, sedge, and water lily. |

[3] Assessment of potential invertebrate and vertebrate food sources was not considered feasible.

**Table 2.5 General Suitability of Watercourse Types for Target Turtle Species, by Species and Habitat Requirements.**

| Species | Watercourse Category | | |
|---|---|---|---|
| | Ephemeral / Intermittent | Small Permanent | Large Permanent |
| **Wood Turtle** | • Unsuitable summering habitat<br>• Suitable foraging habitat<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Suitable foraging<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Suitable foraging habitat<br>• Possibly suitable for overwintering, depending on watercourse features<br>• Possibly suitable for nesting, if large gravel sidebars are present |
| **Eastern Painted Turtle** | • Unsuitable summering habitat<br>• Suitable foraging habitat<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Suitable foraging habitat<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Possibly suitable foraging habitat, depending on watercourse features<br>• Possibly suitable for overwintering, depending on watercourse features |
| **Common Snapping Turtle** | • Unsuitable summering habitat (though may be used by juveniles moving between waterbodies)<br>• Unsuitable for foraging<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Suitable foraging habitat<br>• Unsuitable for overwintering | • Possibly suitable summering habitat, depending on velocity and substrate<br>• Possibly suitable foraging habitat, depending on watercourse features<br>• Possibly suitable for overwintering, depending on watercourse features |

## 2.7 Survey Dates

All watercourse assessment work for the Project was conducted by CBCL biologists or environmental scientists between August and December 2022. Preliminary surveys were conducted between August and October 2022, while detailed watercourse assessments were conducted between late-October and mid-December 2022.

The typical survey methods for wood turtles in NS (Nova Scotia Department of Natural Resources and Renewables (NS DNRR)'s *2018 Wood Turtle Survey Protocol*) could not be used due to the survey timing, as that protocol requires that wood turtle encounter surveys be conducted in May or June. Therefore, the surveys effort for this Project focused on identifying possibly suitable habitat for individual turtle species. No turtle survey methods have been specified for Snapping Turtles or Eastern Painted Turtles, but the spring Wood Turtle survey method is generally considered sufficient for these species (Maureen Cameron-MacMillan, NS DNRR Regional Biologist, pers. comm, March 2023).

## 2.8 Data Management

CBCL organized the collected field data for the Project based on the watersheds and watercourses surveyed and assessed. Preliminary survey data was uploaded to the CBCL Project database and used to identify the watercourses where detailed habitat assessments and water quality analysis was required.

## 2.9 QA/QC

CBCL implemented a quality assurance and quality control (QA/QC) program to evaluate the precision and accuracy of data collected for the Project. The QA/QC program included the application of unique site identifiers, adherence to applicable field procedures, labelling and proper storage of all field samples, and delivery of samples to be analysed at the laboratory as per sample requirements. Chain of custody forms and laboratory QA/QC measures were followed.

Field data collection followed the protocols described in Section 2.3. Feld data were reviewed by an experienced fisheries biologist for accuracy prior to analysis and reporting.

During field work, the following QA/QC measures were undertaken:

- Use of laboratory supplied/prepared containers for samples.
- Use of disposable nitrile gloves when handling and collecting samples.
- Use of laboratory supplied storage coolers.
- Maintaining samples at a cool temperature in a secure location.
- Keeping samples under direct custody until delivery to the laboratory.
- Laboratory submission within required hold times.
- Implementation of field duplicate samples and travel blanks, as required.

# 3 Results

The results of the preliminary surveys and detailed assessments are provided in the following section. A total of 74 watercourses, drainages, and water features were identified and assessed during the Project field assessments. Watercourses and watersheds within the Study Area are shown on Figure 1, presented in Appendix A.

## 3.1 Watercourse Summary

Within the Project Area a total of 74 watercourses were identified during the initial mapping review and preliminary survey. Of the initially defined watercourses, 23 were determined to be fish-bearing or likely fish-bearing and subject to a detailed assessment, while the remaining 51 were determined to be non-fish-bearing. The majority of the watercourses assessed had either poor quality or no fish habitat, while those with fish habitat were usually moderate or poor-quality for all main habitat categories (e.g., spawning, foraging, etc.). Detailed fact sheets for the identified fish-bearing and non-fish-bearing watercourses are provided in Appendix B.

In general, the majority of the watercourses within the Project Area were small intermittent or ephemeral drainages, with little or no habitat present that would be suitable to support a population of fish. Only 18 watercourses were considered as permanent watercourses; all of which were small permanent watercourses. Many of the watercourses observed or assessed were anthropogenically influenced via previous wind turbine development, existing roads, or tree harvest areas, and had minimal natural fish habitat potential.

No large permanent watercourses were identified within the Study Area, as the larger primary watershed level streams (e.g., Salmon/Debert River) were downstream of the Study and Project Areas.

### 3.1.1 Fish Bearing

Preliminary watercourse assessments conducted within the Study Area were based on the existing mapped or known watercourses, including those previously identified as fish-bearing. Fish-bearing watercourses were categorized as such based on the biophysical characteristics observed and measured, water quality parameters, and observed fish presence and/or suitable fish habitat as presented in the Watercourse Mapbook (Figures

WC-A1 to WC-I1 in Appendix A). Watercourses located during initial mapping and preliminary surveys that were identified as permanent and fish-bearing or had the potential to be fish-bearing, were chosen for detailed watercourse assessments. Summary results for fish-bearing watercourses are provided in Table 3.1.

**Table 3.1 Fish Habitat Summary Information for Fish Bearing Watercourses**

| Watercourse ID | Quaternary Watershed ID | Watercourse Name | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Spawning | Rearing | Foraging | Migration | Overwintering | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-121a204 | 121a | Middle Branch North River | Small Permanent | 2.9 | 2.88 | 0.45 | 0.41 | | Cobble | Deep Pool | G | M | G | G | E | M | L |
| NR-WC-122f162 | 122f | West Branch North River - Tributary | Small Permanent | 1.78 | 1.53 | 0.29 | 0.16 | 0.39 | Gravel | Overhanging Vegetation | M | M | G | G | P | P | L |
| NR-WC-121b244 | 121b | Middle Branch North River - Tributary 1 | Small Permanent | 1.48 | 0.97 | 0.24 | 0.07 | 0.17 | Cobble | Large Woody Debris | M | P | M | P | P | P | L |
| NR-WC-122h34 | 122h | West Branch North River - Tributary 2 | Small Permanent | 1.48 | 0.97 | 0.24 | 0.07 | 0.17 | Cobble | Undercut Banks | P | P | M | P | P | P | L |
| NR-WC-122b81 | 122b | West Branch North River - Direct 1 | Small Permanent | | | | | | Cobble | Boulder | | P | | | M | | L |
| NR-WC-122h26 | 122h | West Branch North River - Tributary 2 | Small Permanent | 2.62 | 1.22 | 0.61 | 0.1 | 0.34 | Gravel | Overhanging Vegetation | P | P | M | M | P | M | L |
| NR-WC-122d34 | 122d | West Branch North River - Direct 1 | Small Permanent | 0.86 | 0.72 | 0.43 | 0.08 | 0.21 | Gravel | Overhanging Vegetation | P | P | M | M | P | P | M |
| NR-WC-122d113 | 122d | West Branch North River - Direct 1 | Small Permanent | 2.32 | 1.89 | 0.68 | 0.1 | 0.31 | Gravel | Large Woody Debris | P | P | M | M | P | M | H |
| NR-WC-122d111 | 122d | West Branch North River - Direct 1 | Intermittent | 2.74 | 2.36 | 0.53 | 0.09 | | Cobble | Instream Vegetation | M | P | M | | | P | M |
| NR-WC-122d101 | 122d | West Branch North River - Direct 1 | Intermittent | 2.25 | 2.13 | 0.48 | 0.1 | | Boulder | Small Woody Debris | M | P | M | M | P | N | M |
| NR-WC-122d116 | 122d | West Branch North River - Direct 1 | Small Permanent | 2.23 | 1.89 | 0.68 | 0.1 | 0.31 | Gravel | | M | P | M | M | P | P | H |
| NR-WC-200b473 | 200b | Cavanagh Brook | Intermittent | 4.57 | 3.73 | 0.58 | 0.2 | 0.37 | Cobble | Uprooted Tree Area | G | G | G | G | G | M | H |
| NR-WC-200b297 | 200b | Cavanagh Brook | Intermittent with Ephemeral Characteristics | 0.99 | 0.82 | 0.52 | 0.07 | 0.37 | Fines | Overhanging Vegetation | P | N | N | N | N | N | L |

| Watercourse ID | Quaternary Watershed ID | Watercourse Name | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Spawning | Rearing | Foraging | Migration | Overwintering | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-122b89 | 122b | West Branch North River - Direct 1 | Small Permanent with Intermittent Characteristics | 0.68 | 0.68 | 0.23 | | 0.13 | Organics | Small Woody Debris | M | P | G | G | G | M | H |
| NR-WC-122f157 | 122f | West Branch North River - Tributary | Small Permanent with Intermittent Characteristics | 1.91 | 1.87 | 0.5 | | 0.42 | Organics | Deep Pool | M | N | G | G | P | G | L |
| NR-WC-122f147 | 122f | West Branch North River - Tributary | Small Permanent with Intermittent Characteristics | 1.14 | 1.08 | 1.23 | | 0.19 | Organics | Undercut Banks | P | N | P | P | P | N | L |
| NR-WC-111a137 | 111a | Chiganois River - Tributary 1a | Small Permanent with Intermittent Characteristics | 1.29 | 1.07 | 0.38 | 0.13 | | Fines | Small Woody Debris | M | P | M | M | P | P | M |
| NR-WC-122a339 | 122a | | Small Permanent with Intermittent Characteristics | 1.48 | 1.33 | 0.4 | 0.11 | 0.34 | Fines | Small Woody Debris | P | P | M | M | P | P | M |
| NR-WC-122a374 | 122a | | Small Permanent with Intermittent Characteristics | 1.58 | 1.61 | 0.56 | | 0.24 | Fines | Undercut Banks | G | N | G | G | G | G | M |
| NR-WC-122a319 | 122a | | Small Permanent with Intermittent Characteristics | 1.24 | 1.25 | 0.27 | | 0.22 | Organics | Overhanging Vegetation | P | N | M | P | M | N | M |
| NR-WC-122a367 | 122a | | Small Permanent with Intermittent Characteristics | 1.22 | 1.32 | 0.6 | | 0.27 | Fines | Undercut Banks | G | G | G | G | G | M | M |

| Watercourse ID | Quaternary Watershed ID | Watercourse Name | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Spawning | Rearing | Foraging | Migration | Overwintering | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-122L26 | 122L | West Branch North River - Tributary 7 | Small Permanent with Intermittent Characteristics | 0.55 | 0.45 | 0.23 | 0.1 | | Cobble | | | | | | | | M |
| NR-WC-121a131 | 121a | Middle Branch North River | Ephemeral with Intermittent Characteristics | 0.75 | 0.75 | | 0.15 | | Gravel | Undercut Banks | P | N | P | P | P | P | L |

Notes: Excellent (E), Good (G), Moderate (M), Poor (P), Low (L), High (H), None (N); (BLANK – No Data Recorded)

### 3.1.2 Non-Fish-Bearing

Watercourses were identified as being non-fish-bearing drainages during the mapping review or preliminary field surveys if they displayed any of the following characteristics:

- Surface drainage only
- Not contained within a channel
- Had no evidence of scour
- Isolated roadside ditches
- Drainage features with no evidence of fish habitat
- Dry at the time of survey with no identified water input

These features were assessed based only on visible physical characteristics (e.g., substrates, channel size), unless sufficient water was present to allow for water quality measurements. No additional detailed survey was completed for these watercourses.

Of the 51 watercourses in the Study Area determined to be non-fish-bearing, 29 were ephemeral, nine were ephemeral with intermittent characteristics, and the remaining 13 were intermittent with ephemeral characteristics. Summary results for non-fish-bearing watercourses are provided in Table 3.2 and are visible on the Watercourse Mapbook (Figures WC-A1 to WC-I1, Appendix A).

**Table 3.2 Non-Fish Bearing Watercourses**

| Watercourse ID | Quaternary Watershed ID | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-200b115 | 200b | Ephemeral with Intermittent Characteristics | 0.2 | 0.03 | | | | Organics | N/A | None | None |
| NR-WC-200b80 | 200b | Ephemeral with Intermittent Characteristics | 2 | | | | | Organics | N/A | None | None |
| NR-WC-200b83 | 200b | Ephemeral with Intermittent Characteristics | 0.6 | | | | | | N/A | None | None |
| NR-WC-200b137 | 200b | Ephemeral | | | | | | | N/A | None | None |
| NR-WC-200b340 | 200b | Ephemeral | 1.2 | 1.1 | 0.2 | 0.1 | 0 | | N/A | None | None |
| NR-WC-121b167 | 121b | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-121b174 | 121b | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122L26 | 122L | Intermittent with Ephemeral Characteristics | 0.55 | 0.45 | 0.23 | 0.1 | 0 | Cobble | N/A | None | Low |
| NR-WC-200b239 | 220b | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-200b250 | 200b | Ephemeral with Intermittent Characteristics | 0.75 | 0.42 | 0 | 0.03 | 0 | | N/A | None | None |
| NR-WC-200b356 | 200b | Ephemeral with Intermittent Characteristics | 1.22 | 0 | 0 | 0 | 0 | | N/A | None | None |
| NR-WC-200b400 | 200b | Ephemeral | 1.06 | 0 | 0 | 0 | 0 | | N/A | None | None |
| NR-WC-122d32 | 122d | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-113a13 | 113a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122f8 | 122f | Intermittent with Ephemeral Characteristics | 0.86 | 0.36 | 0 | 0.4 | 0 | | N/A | None | None |
| NR-WC-122f41 | 122f | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122f44 | 122f | Ephemeral | 0.95 | 0.85 | 0 | 0.03 | 0 | | N/A | None | None |
| NR-WC-122f95 | 122f | Intermittent with Ephemeral Characteristics | 0 | 0 | 0 | 0 | 0.25 | | N/A | None | None |

| Watercourse ID | Quaternary Watershed ID | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-122f102 | 122f | Ephemeral | 0.8 | 0 | 0 | 0 | 0 | | N/A | None | None |
| NR-WC-122i39 | 122i | Ephemeral with Intermittent Characteristics | 0.69 | 0.4 | 0 | 0 | 0.05 | | N/A | None | None |
| NR-WC-122f116 | 122f | Intermittent with Ephemeral Characteristics | 1.01 | 0.49 | 0 | 0.04 | 0 | | N/A | None | None |
| NR-WC-121b89 | 121b | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122b27 | 122b | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122b68 | 122b | Ephemeral | 5.5 | 5.5 | 0 | 0 | 0 | | N/A | None | None |
| NR-WC-122h1 | 122h | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122i3 | 122i | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122j2 | 122j | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-121b19 | 121b | Ephemeral with Intermittent Characteristics | 0.81 | 0.29 | 0 | 0.01 | 0 | | N/A | None | None |
| NR-WC-122d11 | 122d | Ephemeral with Intermittent Characteristics | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122d18 | 122d | Intermittent with Ephemeral Characteristics | 1.5 | 1.35 | 0 | 0.09 | 0 | | N/A | None | None |
| NR-WC-122d19 | 122d | Intermittent with Ephemeral Characteristics | 1.9 | 0.8 | 0 | 0.09 | 0 | | N/A | None | None |
| NR-WC-122d22 | 122d | Intermittent with Ephemeral Characteristics | 0.6 | 0.4 | 0 | 0.03 | 0 | | N/A | None | None |
| NR-WC-122d27 | 122d | Intermittent with Ephemeral Characteristics | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122d30 | 122d | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122d32 | 122d | Ephemeral | 1.21 | 0.33 | 0 | 0.01 | 0 | | N/A | None | None |
| NR-WC-122d34 | 122d | Intermittent with Ephemeral Characteristics | 0.78 | 0.3 | 0 | 0.77 | 0 | | N/A | None | None |

| Watercourse ID | Quaternary Watershed ID | Watercourse Classification | Avg. Channel Width (m) | Avg. Wetted Width (m) | Avg. Bankfull Depth (m) | Avg. Water Depth (m) | Avg. Pool Depth (m) | Dominant Substrate | Dominant Instream Cover | Overall Habitat Quality | Potential for Fish Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NR-WC-122d35 | 122d | Ephemeral | 0.9 | 0 | 0 | 0 | 0 | | N/A | None | None |
| NR-WC-122d44 | 122d | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122d78 | 122d | Ephemeral | 0.14 | 0.07 | 0 | 0.01 | 0 | | N/A | None | None |
| NR-WC-122d82 | 122d | Ephemeral | 0.27 | 0.2 | 0 | 0.06 | 0 | | N/A | None | None |
| NR-WC-122d91 | 122d | Intermittent with Ephemeral Characteristics | 1.5 | 1.35 | 0 | 0.09 | 0 | | N/A | None | None |
| NR-WC-122d94 | 122d | Intermittent with Ephemeral Characteristics | 1 | 0.38 | 0 | 0.05 | 0 | Gravel | N/A | None | None |
| NR-WC-122d103 | 122d | Intermittent with Ephemeral Characteristics | 1.96 | 1.5 | 0 | 0.09 | 0 | | N/A | None | None |
| NR-WC-122d105 | 122d | Ephemeral with Intermittent Characteristics | | | | | | | N/A | None | None |
| NR-WC-122d123 | 122d | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-111a5 | 111a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-111a7 | 111a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122a21 | 122a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-122a69 | 122a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |
| NR-WC-111a137 | 111a | Intermittent with Ephemeral Characteristics | 0.45 | 0.35 | 0 | 0.09 | 0 | | N/A | None | None |
| NR-WC-122a20 | 122a | Ephemeral | N/A | N/A | N/A | N/A | N/A | | N/A | None | None |

Notes: Good (G), Moderate (M), Poor (P), Low (L), High (H), Excellent (E), None (N); (BLANK – No Data Recorded); N/A – Parameter not measurable

## 3.2 Watercourse Preliminary Survey Summary

Watercourses identified during the initial mapping review as being potential drainages or watercourses were divided into 20 quaternary watersheds within the proposed Project area. The quaternary watersheds and identified watercourses are shown on Figure 1, Appendix A. All identified watercourses within the Study Area were visited during the preliminary survey to determine the likelihood for permanency, fish habitat, and fish presence.

While a total of 74 watercourses were identified during the preliminary survey, a large number of other depressions and surface drainages were noted, but not measured. These additional identified undefined drainages did not contain water, had no potential for fish habitat, did not have a defined channel, or were otherwise deemed unlikely to be part of the watershed drainage system, and therefore not assessed. A total of 23 watercourses were determined to be permanent, fish-bearing, or likely fish-bearing, and included in the detailed assessment phase of the baseline data collection.

## 3.3 Watercourse Detailed Assessment Summary

The results from the detailed assessments of the permanent fish-bearing watercourse are provided in the following sections, by quaternary watershed within the Project area.

All watercourses assessed as part of the detailed assessment are shown in the Watercourse Mapbook (Figures WC-A1 to WC-I1, Appendix A). Potentially fish-bearing watercourses were found in 10 of the 20 quaternary watersheds within the Study Area. All 10 of the quaternary watersheds with fish-bearing watercourses were tributaries of just two primary watersheds, the Salmon River / Debert River, which drains to the Bay of Fundy, and River John, which drains to the Northumberland Strait.

The 10 quaternary watersheds identified to have fish-bearing watercourses are labeled as follows:

1. Watershed 121a – Middle Branch North River
2. Watershed 121b – Middle Branch North River Tributary 1
3. Watershed 122h – West Branch North River Tributary 5
4. Watershed 122b – West Branch North River Direct Drainage 1
5. Watershed 122f – West Branch North River Tributary 3
6. Watershed 122d – West Branch North River Tributary
7. Watershed 122a – Coal Mine Brook
8. Watershed 111a – Chiganois River Tributary 1a

9. Watershed 122L – West Branch North River Tributary 9
10. Watershed 200b – Cavanagh Brook

A summary of data collected during detailed assessments for fish-bearing watercourses, by watershed, is provided in the following sections.

## 3.3.1 Watershed 121a – Middle Branch North River

Within Watershed 121a, nine watercourses were identified during the initial mapping review and preliminary survey in Project Study Area. Of these nine, only one watercourse was determined to be permanent and likely fish-bearing. Details on this watercourse are provided below.

### 3.3.1.1 NR-WC-121a204

Watercourse NR-WC0121a204, or the Middle Branch of the North River, is a small permanent watercourse that is a tributary to the North River. At the time of assessment, the watercourse was flowing north to south through a culvert located under an access road for the existing wind turbines. The average channel and wetted widths were 2.9 m and 2.88 m, respectively. The dominant substrates were cobbles and gravels with deep pool being the dominant cover available. Water quality was considered good and within recommended CCME guidelines for the protection of Aquatic Life (CCME, 2017). Water quality details are provided in Table 3.3 below.

Watercourse NR-WC0121a204 meandered irregularly along its assessed length, which was bounded by impassable barriers. A 4 m high waterfall was located approximately 80 m upstream from the existing road crossing and at the approximate location of the proposed access road for the Project. The plunge pool below the waterfall could provide good overwintering habitat, as it was greater than 0.5 m deep. An additional unobserved waterfall is known to exist on the watercourse approximately 1 km downstream of the existing road crossing. Mapping, as well as anecdotal information from a local forester, indicates that this waterfall exists downstream on the watercourse. This downstream waterfall was indicated to be taller than 4 m; however, no observations or measurements were taken since the location of the falls was significantly outside of the existing Study Area. Additionally, a cascade barrier was observed between approximately 150 m and 200 m downstream of centreline. The cascade (Photo 3-1) was approximately 6 m high and 20 m in length with a number of 1 to 1.5 m drops over boulders and large woody debris. Despite the known barriers downstream of the crossing suitable habitat and water quality for all life stages of fish was observed in the Study Area.

**Photo 3-1 Looking upstream from crossing at watercourse channel.**

All other watercourses (8 of 9) within this watershed had low potential for fish habitat, with minimal suitable substrates or cover to support various fish life stages. It was determined that the other watercourses assessed were non-fish-bearing tributaries to NR-WC-121a204 (Middle Branch North River).

### 3.3.2 Watershed 121b – Middle Branch North River Tributary 1

Seven watercourses within Watershed 121b were identified during the initial mapping review and preliminary survey as possibly permanent and fish-bearing. Of these seven, only one watercourse, NR-WC-121b244, was determined to be likely fish-bearing and assessed during the detailed assessment. Details on this watercourse are provided.

#### 3.3.2.1 NR-WC-121b244

Watercourse NR-WC-121b244 (tributary to the North River; Photo 3-2) was a small permanent watercourse that generally had poor conditions for fish. The average channel width was 1.48 m, with an average wetted width of 0.97 m. Water depth was on average less than 0.1 m with few deep pools. The dominant substrates were cobbles and gravels, with large and small woody debris providing the main form of cover. Riparian areas were

young mixed forest with stable banks. Water quality was suitable for fish (Table 3.3), with pH of 5.27 and dissolved oxygen of 10.9 mg/L. No barriers were observed within the Study Area. No fish were observed and, overall, the potential for fish in this section of the watercourse was determined to be low.

**Photo 3-2 Looking downstream, from crossing, at channel.**

Six of the seven (~86%) of the assessed watercourses in this watershed were determined to be non-fish-bearing and did not contain suitable fish habitat. These watercourses were mostly ephemeral with surface flows and fines or organics in the channel.

### 3.3.3 Watershed 122h – West Branch North River Tributary 5

Two watercourses were identified as possibly permanent and fish-bearing within this watershed during initial mapping review and preliminary surveys and were included in the detailed assessment phase. Key details from the assessments are provided below.

#### 3.3.3.1 NR-WC-122h34

Watercourse NR-WC-122h34 was a small permanent watercourse that had an average channel width of 1.48 m and an average wetted width of 0.97 (see Photo 3-3). Average

depth of the channel was less than 0.1 m. Dominant substrates were cobbles and gravels, with undercut banks being the dominant cover type observed. Overall likelihood for fish was determined to be low and fish habitat quality was poor, except for moderate quality rearing habitat. Water quality was suitable for fish (see Table 3.3), with a pH of 5.67 and dissolved oxygen of 7.78 mg/L.

**Photo 3-3 Looking downstream, from crossing at watercourse.**

#### 3.3.3.2 NR-WC-122h26

Watercourse NR-WC-122h26 was a small, unconfined, permanent watercourse with riffle-pool morphology (Photo 3-4). Average channel and wetted widths were 2.62 m and 1.22 m, respectively. Average channel and pool depths were 0.10 m and 0.34 m, respectively. Dominant substrates were gravels and fines, with overhanging vegetation as the dominant instream cover type. Watercourse banks were stable and vegetated with pole-sapling stage forest. Water quality was within acceptable limits for fish (see Table 3.3). Overall, habitat quality within the assessed watercourse was poor, despite moderate quality rearing, foraging, and overwintering habitat. The likelihood for fish presence was determined to be low. A perched culvert was noted at the centreline, where the watercourse crossed under an existing access road, which may limit or prevent fish access upstream.

**Photo 3-4 Looking upstream at the watercourse from the crossing location.**

### 3.3.4 Watershed 122b – West Branch North River Direct Drainage 1

Four watercourses were identified in this watershed for detailed assessment based on the preliminary survey and mapping review; however, only one watercourse, NR-WC-122b89, was determined to be permanent with the likelihood to be fish-bearing. The other watercourses, including NR-WC-122b81, were small, ephemeral, or intermittent, and had low or no likelihood for fish presence. These watercourses were visited but not assessed during the detailed assessment phase. Details on the fish-bearing watercourse are provided below.

#### 3.3.4.1 NR-WC-122b89

Watercourse NR-WC-122b89 was a small permanent watercourse with intermittent characteristics that appeared to have been formed due to the works for the existing wind turbine access road (see Photo 3-5). The watercourse had an average channel and wetted width of 0.68 m and an average pool depth of 0.13 m. Watercourse morphology was riffle-pool with unconfined irregular meandering. Dominant substrates were organics and fines, with small and large woody debris as the dominant instream cover types. Water quality was within acceptable ranges (see Table 3.3). A small stickleback was observed within the

watercourse at the proposed Project crossing centreline. Although fish-bearing, with moderate to good habitat for fish, the watercourse disappears 100 m upstream of the crossing location and after flowing through the culvert under the current access road, goes subsurface. The connectivity issues are considered a partial barrier to fish movement and access.

**Photo 3-5 Looking downstream at watercourse channel section.**

## 3.3.5 Watershed 122f – West Branch North River Tributary 3

Five watercourses were delineated in this watershed for detailed assessment during the initial mapping review and preliminary survey. During the detailed assessment, three of the five watercourses were assessed as likely to contain fish habitat and support fish; these watercourses are described below.

### 3.3.5.1 NR-WC-122f157

Watercourse NR-WC-122f157 was a small permanent watercourse with intermittent characteristics (see Photo 3-6). The watercourse meandered irregularly through an unconfined area with average channel and wetted widths of 1.91 m and 1.87 m, respectively. Average pool depth for the watercourse was 0.42, and overall, the

watercourse had good overwintering habitat due to the presence of deep pools greater than 0.5 m; however, migration habitat quality was poor due to beaver activity. No spawning habitat was observed within the assessed reach due to presence of beaver activity and organics in the channel. Dominant substrates were organics, with deep pools being the dominant type of cover present. Water quality was acceptable for fish (see Table 3.3). Beaver dams were observed at 300 m downstream of the proposed crossing location as well as at 50 m upstream. A culvert under the existing access road, at the proposed centreline, was plugged and likely would prevent fish passage.

**Photo 3-6 Looking upstream at beaver impacted area, near centreline.**

#### 3.3.5.2 NR-WC-122f147

Watercourse NR-WC-122f147 was a small permanent watercourse with intermittent characteristics (Photo 3-7). The watercourse was unconfined with an irregular meandering pattern. Average channel and wetted widths were 1.14 m and 1.08 m, respectively. Average pool depth was shallow at 0.19 m, which is insufficient for overwintering habitat. Dominant substrates were organics and fines, with undercut banks being the dominant cover type. Sections of the watercourse downstream of the centreline had more suitable habitat for fish compared to the upper watershed of this watercourse; however, overall fish habitat quality was considered poor and the likelihood for fish was low. Spawning habitat was

absent due to the presence of organics and fines. Water quality was within acceptable limits for fish, except for low dissolved oxygen of 4.47 mg/L (see Table 3.3).

**Photo 3-7 Looking upstream, near centreline.**

#### 3.3.5.3 NR-WC-122f162

Watercourse NR-WC-122f162 was a small permanent watercourse that was frequently confined along its assessed length (Photo 3-8). The morphology of the watercourse was run, with a sinuous pattern. Average channel and wetted widths were 1.78 m and 1.53 m, respectively. Average pool depth was 0.39 m. Dominant substrates were gravel and cobble, with overhanging vegetation as the dominant cover type. Overall habitat quality was considered as moderate, with low likelihood for fish presence. Good rearing and foraging habitat were observed in the watercourse; however, migration and overwintering habitat were both considered poor. Water quality was within acceptable limits for fish (see Table 3.3).

**Photo 3-8 Looking upstream, near centreline.**

## 3.3.6 Watershed 122d – West Branch North River Tributary 1

Five watercourses were identified during the preliminary survey for detailed assessment in this watershed. All five were found to be permanent and likely to contain fish habitat and thus detailed assessments were conducted for each watercourse.

### 3.3.6.1 NR-WC-122d116

Watercourse NR-WC-122d116, a tributary to the West Branch of the North River, was field identified as a small permanent watercourse with riffle pool morphology (Photo 3-9). Average channel and wetted widths were 2.32 m and 1.89 m, respectively. Average pool depth was 0.31 m. Dominant substrates were gravels and fines, with small woody debris, overhanging vegetation, and large woody debris as co-dominant habitat types. Overall fish habitat quality was moderate, with moderate rearing and foraging habitat, but poor spawning, migration, and overwintering habitat. Water quality was good and well within the acceptable ranges for fish (see Table 3.3).

**Photo 3-9 Looking upstream, near centreline.**

### 3.3.6.2 NR-WC-122d113

Watercourse NR-WC-122d113 (Unnamed Tributary to West Branch North River) was a small permanent riffle-pool watercourse (Photo 3-10). Average channel and wetted widths were 2.32 m and 1.89 m, respectively. Average pool depth was 0.31 m. The dominant instream substrate was gravels, with large woody debris being the dominant cover type. Water quality was good and within the acceptable range for fish (see Table 3.3). Overall, fish habitat quality in the assessed section of the watercourse was poor; however, rearing, foraging, and overwintering habitats were of moderate quality. The likelihood of fish presence was high; one fish, possibly a salmonid, was observed within the assessment area. No barriers to fish passage were noted.

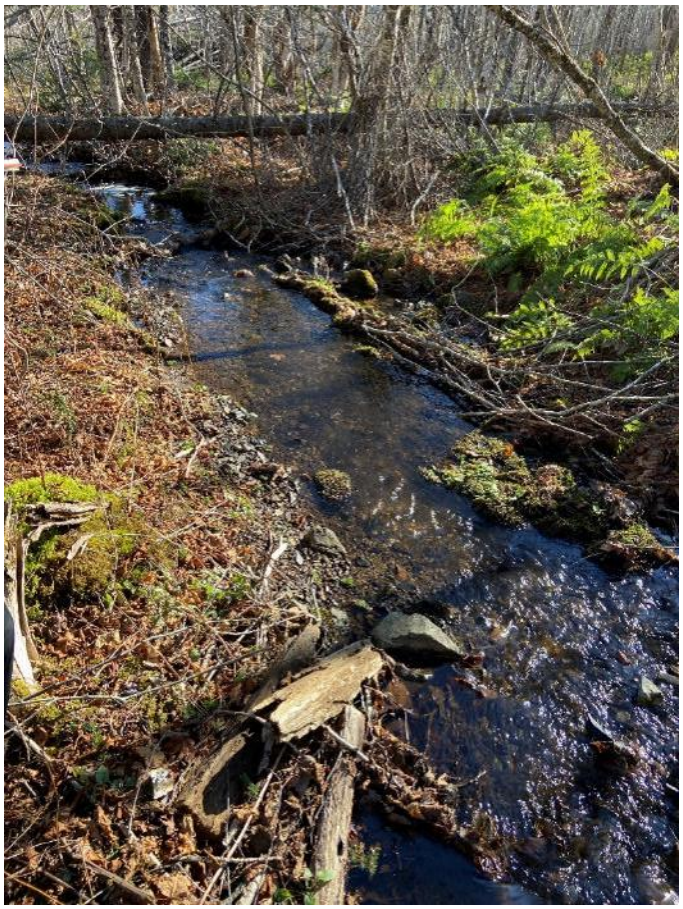

**Photo 3-10 Looking upstream, near centreline.**

#### 3.3.6.3 NR-WC-122d111

Watercourse NR-WC-122d111 (Unnamed Tributary 1 to West Branch North River) was an intermittent, unconfined, riffle-pool watercourse adjacent to an existing access road (Photo 3-11). The average channel and wetted widths were 2.74 m and 2.36 m, respectively. The watercourse was shallow with an average depth of 0.09 m. The dominant substrate type was cobble, followed by gravel; dominant cover was instream vegetation. No water quality samples were taken at this location; however, based on the proximity to NR-WC-122d113, similar water quality is probable. Overall, fish habitat quality in this watercourse was classified as moderate, but with pool spawning and overwintering habitat quality. Overall fish presence likelihood was moderate; one fish was observed, which was likely a Brook Trout. No permanent barriers to fish passage were noted.

**Photo 3-11 Looking upstream at channel, near centreline.**

#### 3.3.6.4 NR-WC-122d101

Watercourse NR-WC-122d101 (Unnamed Tributary to West Branch North River) was a shallow, intermittent, unconfined, riffle-pool watercourse that passed under the existing access road (Photo 3-12). Average channel and wetted widths were 2.25 m and 2.13 m, respectively. Dominant substrates were boulders, while dominant habitat types were small woody debris and boulders. Water quality was good and within the acceptable range for fish (see Table 3.3). Overall, habitat quality was moderate, despite poor spawning and migration habitat as well as an absence of overwintering habitat. Overall fish presence likelihood was moderate; one fish, likely a Brook Trout, was observed in the watercourse. No permanent barriers were observed within the assessed section; however, the culvert under the access road appeared to be blocked.

**Photo 3-12 Near centreline, looking at main channel.**

#### 3.3.6.5 NR-WC-122d34

Watercourse NR-WC-122d34 (Unnamed Tributary to West Branch North River) was a shallow, unconfined, small permanent, riffle-pool watercourse that flowed alongside the existing access road before going through a culvert under the road and flowing downstream through the forest (Photo 3-12). The average channel and wetted widths were 0.86 m and 0.72 m, respectively. Average pool depth was 0.21 m at mid-stage. Dominant instream substrates were gravels and fines, while the dominant cover type was overhanging vegetation, followed by a subdominant cover type of small woody debris. Water quality was good and within the acceptable range for fish (see Table 3.3). Overall, habitat quality for fish was determined to be poor, despite moderate rearing and foraging habitat observed in the assessed area. Overall likelihood for fish presence was moderate. No permanent barriers were observed; however, a blocked culvert under the access road was noted.

**Photo 3-13 Looking upstream at channel and riparian vegetation.**

## 3.3.7 Watershed 122a – Coal Mine Brook

Four permanent, likely fish-bearing watercourses were assessed in this watershed. Detailed habitat assessments were conducted on watercourses NR-WC-122a339, NR-WC-122a374, NR-WC-122a367, and NR-WC-122a319. The key details from these assessments are provided in the sections below.

### 3.3.7.1 NR-WC-122a339

Watercourse NR-WC-122a339 (downstream on Coal Mine Brook) was a small permanent, riffle-pool, watercourse with intermittent characteristics (Photo 3-14). The watercourse had a sinuous morphology and was occasionally confined within the assessed area. Average channel and wetted widths were 1.48 m and 1.33 m, respectively. Average channel and pool depths were 0.11 m and 0.34 m, respectively. Dominant substrates were fines, with subdominant boulders. The dominant instream cover type was small woody debris. Watercourse banks were stable and vegetated with mixed, mature forest, with mosses and ferns. Water quality was within acceptable limits for fish (see Table 3.3). Overall, habitat quality was poor within the assessed area, despite moderate habitat quality noted for rearing and foraging habitat. The likelihood for fish presence was moderate. No barriers were noted within the assessed area. Abundant blowdown and upturned tree roots, likely

from the post-tropical storm in fall 2022, were observed throughout the assessment area, including adjacent to and over the stream.

**Photo 3-14 Looking upstream at channel upstream of crossing location.**

### 3.3.7.2 NR-WC-122a374

Watercourse NR-WC-122a374 (upstream of NR-WC-122a339 – Coal Mine Brook) was a small permanent watercourse with intermittent characteristics (Photo 3-15). The watercourse morphology was run with regular meanders and was unconfined through the assessment area. The average channel and wetted widths were 1.58 m and 1.61 m, respectively. Dominant substrates were fines and organics, with undercut banks as the dominant habitat type. Shallow, stable banks with mixed mature forest were found in the riparian areas. Overall habitat quality was good, except for an absence of spawning habitat, due to the dominance of organics and fines. Although average pool depth was recorded as 0.24 m, overall overwintering habitat was considered as good. Water quality was within the acceptable range for fish (see Table 3.3). No barriers were observed within the assessed section of the watercourse, although a small boulder-dominated riffle-pool section was observed approximately 270 m downstream of the centreline.

**Photo 3-15 Looking upstream at centreline at a section of the watercourse that flowed through an existing wetland.**

#### 3.3.7.3 NR-WC-122a367

Watercourse NR-WC-122a367 was a small permanent watercourse with intermittent characteristics (Photo 3-16). The watercourse was located outside of the updated alignment but was within the originally proposed Study Area and, as such, it is included in this report. The watercourse had average channel and wetted widths of 1.22 m and 1.32 m, respectively, with an average pool depth of 0.27 m. The watercourse was unconfined with riffle-pool morphology and irregular meanders. Overall habitat quality was good, except for overwintering, which was considered as moderate due to few pools with a depth of 0.5 m or more. Fines were the dominant substrate, followed by gravels, and undercut banks were the dominant cover type. Banks were shallow and moderately stable, with mixed forest. Numerous upturned trees, likely a result of the post-tropical storm in the fall of 2022, with exposed rootballs were observed along the assessed watercourse. Water quality was within acceptable limits (see Table 3.3), although with a pH of 4.46, is on the lower end of the acceptable range for most fish species. Overall, the likelihood for fish presence was determined to be moderate. No barriers were observed within the assessed length of the watercourse.

**Photo 3-16 Looking downstream, near centreline, at upturned tree and root system.**

#### 3.3.7.4 NR-WC-122a319 – Coal Mine Brook

Watercourse NR-WC-122a319, Coal Mine Brook, was a small permanent watercourse with intermittent characteristics (Photo 3-17). The watercourse morphology was riffle-pool, sinuous, and unconfined within the assessment area. Dominant substrate type was organics, followed by fines, with overhanging vegetation as the dominant habitat type. The average channel and wetted widths were almost identical at 1.24 m and 1.25 m, respectively. Average pool depth was 0.22 m. Watercourse banks were moderately stable and vegetated with shrubs and grasses. Water quality was within acceptable limits (see Table 3.3). Overall habitat quality was evaluated as poor, with no spawning habitat observed; moderate quality rearing and migration habitat was present. Overall, likelihood for fish was moderate.

**Photo 3-17 Looking upstream at centreline channel and riparian vegetation.**

## 3.3.8 Watershed 111a – Chiganois River Tributary 1a

A single permanent, likely fish-bearing watercourse was identified in this watershed. Details from the assessment conducted on the watercourse are provided below.

### 3.3.8.1 NR-WC-111a137

Watercourse NR-WC-111a137 (Chiganois River Unnamed Tributary 1a) was a shallow, small permanent watercourse with intermittent characteristics (Photo 3-18). The watercourse was an occasionally confined, riffle-pool watercourse that had an irregular wandering (i.e., meandering) morphology. The average channel and wetted widths were 1.29 m and 1.07 m, respectively. The dominant substrate type was fines and the dominant instream cover was small woody debris. The banks were stable and vegetated with a mixed, mature forest. Water quality was within the acceptable range for fish (see Table 3.3). Overall, fish habitat quality was poor, except for moderate rearing and foraging habitat. The watercourse had a moderate likelihood for fish presence and no barriers were noted. Abundant blow-down was noted along the length of the assessed watercourse, likely from the post-tropical storm in fall 2022.

**Photo 3-18 Looking upstream at channel with downed trees and upturned tree roots.**

## 3.3.9 Watershed 122L – West Branch North River Tributary 9

A single watercourse that was possibly permanent and fish-bearing was identified in this watershed during the initial mapping review and preliminary survey. Watercourse NR-WC-122L26 was included for detailed assessments and the key details are provided below.

### 3.3.9.1 NR-WC-122L26

Watercourse NR-WC-122L26 (Unnamed Tributary 9 of the West Branch North River) was a shallow, small permanent, sinuous, riffle-pool watercourse with intermittent characteristics (Photo 3-19). The watercourse was frequently confined along the assessed length. Average channel and wetted widths were 0.55 m and 0.45 m, respectively. Average water depth was 0.10 m. Dominant substrates were cobbles and co-dominant instream cover types were undercut banks, small woody debris, and boulders. Watercourse banks were stable and vegetated with mature, mixed forest. Overall, likelihood for fish presence was assessed as moderate. Neither water quality measurements nor habitat quality assessments were completed for this watercourse.

**Photo 3-19 Downstream from centreline on NR-WC-122L26.**

## 3.3.10 Watershed 200b – Cavanagh Brook

Within the Cavanagh Brook quaternary watershed, two watercourses were identified during the preliminary survey as having the likelihood to be fish-bearing. Key details from the assessment of these two watercourses are provided below.

### 3.3.10.1 NR-WC-200b297

Watercourse NR-WC-200b297, Tributary to Cavanagh Brook, was a shallow, unconfined, intermittent watercourse with ephemeral characteristics (Photo 3-20). The watercourse was sinuous with run morphology. Average channel and wetted widths were 0.99 m and 0.82 m, respectively, with an average pool depth of 0.37 m. Dominant instream substrates were fines and gravels, with overhanging vegetation as the dominant instream cover type. Watercourse banks were stable and vegetated with mixed forest. Water quality was within the acceptable range for fish (see Table 3.3). Overall, fish habitat quality was classified as poor, with no noted habitat due to the ephemeral nature of parts of the stream, including a section that went into a roadside drainage feature. A waterfall was noted downstream as a complete barrier to fish passage within the assessed area of the watercourse.

**Photo 3-20 Looking upstream at channelized watercourse, near centreline.**

#### 3.3.10.2 NR-WC-200b473

Watercourse NR-WC-200b473 (Cavanagh Brook) was an unconfined, intermittent, riffle-pool watercourse (Photo 3-21). Average channel and wetted widths were 4.57 m and 3.73 m, respectively. Average channel and pool depths were 0.20 m and 0.37 m, respectively. Dominant substrates were cobbles and gravels, while the dominant instream cover type was uprooted tree area, followed by boulder and woody debris (small and large). Water quality was good and within the acceptable range for fish (see Table 3.3). Overall, fish habitat quality was classified as good, except for moderate overwintering habitat. Potential spawning redds were observed within the assessed section of watercourse, along with an observation of a fish, possibly Brook Trout. The likelihood for presence of fish was considered as high. A possible barrier was observed, as a boulder dominated cascade was present in the stream.

**Photo 3-21 Looking upstream at riffle and island, near centreline.**

## 3.4 Water Quality Analysis Summary

### 3.4.1 In Situ Surface Water Quality Sampling

Surface water quality was collected during the detailed assessments at the 23 likely fish-bearing watercourses in the Study Area. The water quality parameters that were measured were detailed in Section 2.4.1of this report. *In situ* measurements collected during the detailed assessments are provided by watercourse in Table 3.3.

**Table 3.3 In Situ Water Quality Measurements at Detailed Assessment Sites**

| Watercourse ID | Temperature (°C) | pH | Dissolved Oxygen | | Conductivity (µs/cm)^ | Salinity (ppt) | Total Dissolved Solids (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|
| | | | mg/L | % | | | | |
| NR-WC-121a204 | 4.7 | 6.06 | 12.37 | 100.4 | 26.6 | 0.01 | 17.5 | |
| NR-WC-122f162 | 5.39 | 5.27 | 10.9 | - | 25 | 0.01 | 16 | 3.3 |
| NR-WC-121b244 | 5.39 | 5.27 | 10.9 | - | 25 | 0.01 | 16 | 3.1 |
| NR-WC-122h34 | 2.6 | 5.67 | 7.78 | - | 27 | 0.01 | 17 | 4.4 |
| NR-WC-122b81 | 5.66 | 5.64 | 9.74 | - | 30 | 0.01 | 23 | 47 |
| NR-WC-122h26 | 1.66 | 5.68 | 8.2 | - | 30 | 0.01 | 19 | 3.7 |
| NR-WC-122d34 | 5.8 | 7.55 | 10.57 | 85.4 | 49.2 | 0.02 | 19 | - |
| NR-WC-122d113 | 7.5 | 7.57 | 12.59 | 106.1 | 35.4 | 0.02 | - | - |
| NR-WC-122d111 | - | - | - | - | - | - | - | - |
| NR-WC-122d101 | 7.8 | 6.11 | 10.39 | 89.1 | 30.4 | 0.02 | - | - |
| NR-WC-122d116 | 7.5 | 7.57 | 12.59 | 106.1 | 35.4 | 0.02 | - | - |
| NR-WC-200b473 | 5.9 | 7.76 | 11.35 | - | 30.3 | 0.03 | 19.5 | - |
| NR-WC-200b297 | 5.2 | 6.46 | 9.95 | 70 | 23.5 | 0.01 | 14.95 | - |
| NR-WC-122b89 | 7.4 | 5.8 | 9.9 | - | 25 | - | 16 | - |
| NR-WC-122f157 | 5.8 | 5.3 | 4.54 | - | 29 | - | 19 | 6.4 |
| NR-WC-122f147 | 7.1 | 5 | 4.47 | - | 20 | - | 18 | 3.4 |
| NR-WC-111a137 | 2.45 | 5.62 | 7.96 | - | 25 | 0.01 | 16 | 6.6 |
| NR-WC-122a339 | 1.86 | 5.72 | 8.73 | - | 32 | 0.01 | 21 | 2.7 |
| NR-WC-122a374 | 13.9 | 5.58 | 7.65 | 77 | 40.6 | - | 26.4 | - |
| NR-WC-122a319 | 14.5 | 5.54 | 6.47 | 65 | 33.7 | - | 21.9 | - |
| NR-WC-122a367 | 14 | 4.46 | 8.49 | 85.2 | 26.1 | - | 17 | - |
| NR-WC-122L26 | - | - | - | - | - | - | - | - |
| NR-WC-121a131 | 1.2 | 5.61 | 12.19 | 90.2 | 29.5 | 0.01 | 19.5 | - |

^ Some of the data for this parameter were converted to $\mu S \cdot cm^{-1}$ for consistency.

* Some of the data for this parameter were converted to mg/L from g/L for consistency.

Water quality measurements were used to inform fish habitat quality and likelihood of fish presence classifications at each watercourse. Water quality measurements for pH ranged between 4.46 (low) and 7.76 (high). Dissolved oxygen (mg/L) ranged between 4.47 (low) and 12.59 (high). Turbidity in fish bearing watercourses was not recorded for every site but was generally observed to be clear throughout the study area. All sites had low salinity of between 0.01 and 0.03 parts per thousand (ppt), along with low conductivity (< 50 μS/cm) and low total dissolved solids (TDS) of between approximately 15 and 26 mg/L.

### 3.4.2 Laboratory Analysis

CBCL collected surface water samples for laboratory analysis from a total of 13 sites, as per the parameters listed in Section 2.4.2, during the detailed watercourse assessments. The results are presented in table format by sampling location and parameter measurement in Appendix C. Several sampling locations exceeded the NSE Tier 1 EQS Freshwater and/or CCME guidelines as described below.

**Metals**

All samples exceeded the NSE Tier 1 EQS Freshwater and CCME guidelines for total aluminum.

Two samples (WQ-09 and WQ-11) exceeded the NSE Tier 1 EQS Freshwater for total zinc. Four samples (WQ-03, WQ-04, WQ-07, and WQ-10) exceeded the CCME guidelines for total zinc.

**Inorganics**

Seven samples (WQ-03, WQ-05, WQ-06, WQ-07, WQ-10, WQ-11, and WQ-12) are below the NSE Tier 1 EQS Freshwater and CCME guideline range for pH.

## 3.5 Aquatic Invertebrates

Aquatic invertebrates were investigated at the centreline / crossing location for each of the detailed watercourse assessment locations. The presence of aquatic invertebrates was noted throughout the detailed assessment area and varied in abundance from none or trace to abundant. Generally, aquatic invertebrates were present at most sites where there was good cobble and/or boulder substrates (Photo 3-22). Abundance of aquatic invertebrates was used in determining classification of fish habitat, including foraging habitat.

**Photo 3-22 Typical habitat with high abundance of aquatic invertebrates (Watercourse: NR-WC 121a204).**

## 3.6 Fish Species Identified

Fish capture studies were not completed as part of the baseline aquatic studies. Any observations of fish within the Study Area, as part of the preliminary survey or detailed assessment were recorded, identified if possible, and noted.

Fish were observed in at least four watercourses, in three quaternary watersheds, during the detailed assessments. At three locations the fish observed were likely salmonids, likely Brook Trout (*Salvelinus fontinalis*) young-of-the-year (YOY), while the fish species at the fourth was likely a stickleback (*Gasterosteus* sp.). Fish were observed in the following watercourses:

- NR-WC-200b473 (3 YOY Brook Trout; 1 Brook Trout; 1 YOY Salmon (possibly))
- NR-WC-122d101 (Brook Trout)
- NR-WC-122d111 (Brook Trout)
- NR-WC122b89 (Stickleback)

Spawning nests (redds) were identified in one watercourse (NR-WC-200b473), likely from spawning salmonids.

The likelihood for fish species presence in the area was determined from the background information review, as no fish capture studies were completed for the Project. Based on the available background information, the fish species that had the likelihood to be present in, or near, the Project Area are presented in Table 3.4. This is not a complete list, but based on known information about fish presence in, or near, the general area of the Project.

**Table 3.4 Fish Species Observed or Possibly Present in Project Area**

| Species Name | Scientific Name | Observed In Project Area |
|---|---|---|
| American eel | *Anguilla rostrata* | No |
| Atlantic Salmon | *Salmo salar* | Yes* |
| Brook Trout | *Salvelinus fontinalis* | Yes |
| Brown Bullhead | *Ameiurus nebulosus* | No |
| Gaspereau (Alewife) | *Alosa pseudoharengus* | No |
| Smallmouth Bass | *Micropterus dolomieu* | No |
| White Sucker | *Catostomus commersonii* | No |
| Lake Chub | *Couesius plumbeus* | No |
| Creek Chub | *Semotilus atromaculatus* | No |
| Common Shiner | *Luxilus cornutus* | No |
| Golden Shiner | *Notemigonus crysoleucas* | No |
| Threespine Stickleback | *Gasterosteus aculeatus* | Yes* |

Note: *Likely, but not a definitive identification

Brief descriptions of the species that were observed or are likely present in the Project area are provided below.

**Atlantic Salmon (*Salmo salar*)**

The Study Area is connected to both the Bay of Fundy and the Northumberland Strait through separate watersheds. As such, two populations of Atlantic Salmon could be present in, or near, the Project area. The Inner Bay of Fundy (iBoF) and the Gaspe-Southern Gulf of St. Lawrence (GSGOL) populations are connected to the Project area through the Salmon/Debert River (iBoF) and the River John (GSGOL) watersheds, respectively.

Atlantic salmon rear as young in freshwaters and then move into the marine environment to migrate and feed, returning only to spawn in their natal rivers when mature. Spawning occurs in fall in clean, cool, gravel- or cobble-dominated streams. Hatched young fry rear in riffles and pools in freshwater, growing into parr salmon. Parr can remain in the freshwater from one to six years (DFO, 2019).

**Brook Trout (*Salvelinus fontinalis*)**
Brook Trout is a freshwater char, a salmonid and a relative of the Atlantic Salmon. They are found in a variety of watercourse types, but prefer cold, clear waters with sections of good flow, and cover. They are, however, found in a wide range of habitats, including beaver ponds, as they are more tolerant of less-than-optimal conditions compared to other salmonids (Raleigh, 1982). They are known to tolerate a pH as low as 4.0. Brook Trout are carnivorous and opportunistic feeders and will eat a variety of other smaller fish, insects, invertebrates, and small vertebrates. Brook Trout are found in many areas of Nova Scotia since they are often stocked in lakes for sport fisheries. Despite this, they are listed as S3 in Nova Scotia and vulnerable by the AC CDC.

**Threespine Stickleback (*Gasterosteus aculeatus*)**
In Nova Scotia there are four species of stickleback, with multiple ecotypes endemic to various regions of the province. Threespine Stickleback is a small marine and freshwater species found throughout the province and is resilient to a wide range of water quality parameters, such as salinity, temperature, pH, and dissolved oxygen; more so than many salmonids (Jordan and Garside, 1972; Glippa et al., 2017; Mottola et al., 2022). Generally, they are found in slower moving water with vegetation and/or abundant cover. Within the freshwater environment they are found in ditches, lakes, and ponds as well as streams and rivers. Their diet is typically composed of invertebrates, but will feed opportunistically on available food sources, including eggs and young of other sticklebacks. They spawn by building a nest (male) and luring a female(s) to lay eggs. This typically occurs around April or May in shallow waters with fines and available vegetation for cover and nest building.

## 3.7 Fish Species at Risk

The only known fish species at risk near, or with potential access to watercourses that connect to, the Project Area are provided in Table 3.5, none of which were observed during the preliminary or detailed field assessments.

**Table 3.5 Fish Species at Risk in Proximity to the Project Area**

| Common Name | Species Name | COSEWIC / SARA/ NS ESA | NS S-Rank | Nearest AC CDC Record (km) |
|---|---|---|---|---|
| Atlantic Salmon iBoF Pop. DU1[4] | *Salmo salar* | Endangered – Schedule 1 | S1 | 9.9 ± 0.0 |
| Atlantic Salmon Gaspe – S. Gulf | *Salmo salar* | Special Concern | S1 | 11.3 ± 50.0 |

[4] DFO 2010.

| Common Name | Species Name | COSEWIC / SARA/ NS ESA | NS S-Rank | Nearest AC CDC Record (km) |
|---|---|---|---|---|
| St. Lawrence Pop. DU12[5] | | | | |
| American Eel[6] | *Anguilla rostrata* | Threatened | S3N (Non-Breeding Pop.) | 15.4 ± 0.0 |
| Alewife (Gaspereau) | *Alosa pseudoharengus* | Vulnerable | S3B | 26.4 ± 0.0 |

Although Brook Trout has been listed as Vulnerable (S3) in Nova Scotia it is not considered a species at risk federally (AC CDC, 2023).

## 3.8 Turtle Habitat Assessment Results

Results of the desktop review and habitat assessment for turtles are described in the following subsections.

### 3.8.1 Desktop Review

Nova Scotia is home to four species of freshwater turtles, all of which are now considered a species at risk under SARA and/or the NS ESA or a species of conservation concern. Of these four, three have distribution ranges within Nova Scotia that encompass the Nuttby II Study Area (Table 3.6). Turtle species expected to occur in the Study Area are similar to those encountered throughout much of the Nova Scotia Uplands (Zone 128 in McAlpine, 2010). No turtle species were reported within 5 km by the AC CDC (AC CDC, 2023), though the three species listed in McAlpine (2010) were reported within 100 km by the AC CDC. The Nova Scotia Herpetofauna Atlas iNaturalist project did not have any records for any turtle species within the Nuttby II Study Area. Species and occurrence records are listed in Table 3.6.

[5] GoC 2021
[6] COSEWIC 2012

**Table 3.6 Turtle Species Reported in Cobequid County, NS (McAlpine, 2010; AC CDC, 2023).**

| Common Name | Species Name | COSEWIC / SARA/ NS ESA | NS S-Rank | Nearest AC CDC Record (km) |
|---|---|---|---|---|
| Wood Turtle | *Glyptemys insculpta* | T/T/T | S2 | 11.4 ± 1.0 |
| Snapping Turtle | *Chelydra serpentina* | SC/SC/V | S3 | 15.8 ± 0.0 |
| Eastern Painted Turtle | *Chrysemys picta picta* | SC/SC/- | S4 | 17.8 ± 5.0 |

*- = No Status*
*T= Threatened – A species likely to become endangered if limiting factors are not reversed.*
*V= Vulnerable – a species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.*
*SC- Special Concern - A species that has characteristics that make it particularly sensitive to human activities or natural events[7].*

General descriptions of each species and their habitat requirements are provided in the following subsections.

### 3.8.1.1 Wood Turtle (*Glyptemys insculpta*)

The Wood Turtle (*Glyptemys insculpta*) is a medium-sized turtle with an adult carapace length of up to 25 cm (COSEWIC, 2007). Occurring only in eastern North America, Wood Turtles are patchily distributed within the Canadian provinces: Nova Scotia, New Brunswick, southern and eastern Québec, and south-central Ontario (COSEWIC, 2007). Within Nova Scotia, the number of adult individuals has been estimated to be 2,000-7,000; however, on a local scale, populations typically consist of less than 100 individuals (Environment Canada, 2016). Wood turtles have been reported in 31 watersheds throughout Nova Scotia (MacGregor and Elderkin, 2003), with concentrations in Guysborough and Annapolis Counties (Mersey Tobeatic Research Institute, 2008). Table 3.7 provides a summary of their known seasonal habitat requirements.

**Table 3.7 Habitat Requirements of Wood Turtles in Eastern Canada (COSEWIC, 2007).**

| Habitat Type | Description |
|---|---|
| **Summering and Basking Habitat (Active Season):** | • Wood Turtles are semiaquatic and considerably more terrestrial than other turtle species in NS.<br>• Strongly associated with permanent meandering rivers and streams with moderate current and sand or gravel substrates.<br>• During spring, summer, and early fall, wood turtles use riparian habitats and upland forests surrounding their home rivers.<br>• Forest mosaics and open-canopy areas are the most commonly used/ preferred terrestrial habitats. |

[7] Nova Scotia Dept. of Natural Resources and Renewables. 2021. Nova Scotia Endangered Species Act. Available at: https://novascotia.ca/natr/wildlife/biodiversity/legislation_nsesa.asp

| Habitat Type | Description |
|---|---|
| | • May disperse up to several hundred metres from a watercourse and several kilometres up or downstream from overwintering sites.<br>• May bask on large boulders, and fallen logs along rivers, especially early in the season when temperatures are cooler. |
| **Nesting Habitat:** | • Nesting occurs in June and July<br>• Natural nesting habitat consists of sand or gravel-sand beaches or banks of streams that receive moderate to intense exposure to sun.<br>• Females lay a single clutch of eggs annually in areas containing loose substrate (i.e., sand and small to large gravel), such as sidebars, over-washed areas, and in-stream sand-gravel bars.<br>• May nest in open anthropogenic sites such as gravel pits, road shoulders, and decommissioned railway beds.<br>• Hatchlings emerge in fall and move to water. |
| **Overwintering Habitat** | • Overwinter underwater in streams, rivers, and occasionally ponds.<br>• May use deep pools (>0.5 m), or under root masses of large trees, undercut or overhanging banks, oxbows, large woody debris, log jams, or boulders as suitable overwintering sites. |
| **Foraging Habitat & Diet** | • Forage in terrestrial or wetland habitats within close proximity to their river/stream, such as bogs, marshy pastures, oxbows, beaver ponds, shrubby cover, meadows, coniferous forests, mixed forests, hay and agricultural fields and pastures.<br>• Dietary plants include strawberries, blackberries, hawthorne, cinquefoil, violets, algae, moss, willow, algae, and mushrooms, as well as alder leaves and grasses.<br>• Protein sources include molluscs, insects, tadpoles, earthworms, newborn mice, and possibly eggs (MacGregor and Elderkin, 2003, COSEWIC, 2007). |

#### 3.8.1.2 Common Snapping Turtle (*Chelydra serpentina*)

The Common Snapping Turtle (*Chelydra serpentina*) is a well-known, large freshwater turtle with a distinctive keeled carapace which has been reported to reach 50 cm in length. Snapping Turtles occur throughout the United States and Canada east of the Rocky Mountains. In the Maritimes, the Common Snapping Turtle occurs throughout mainland Nova Scotia (Scott, 2002) and has recently been confirmed to have a population on Cape Breton Island (Power and Gilhen, 2018).

This species' long lifespan, slow maturity, and low rate of reproduction result in snapping turtles being particularly vulnerable to threats (COSEWIC, 2008). Some populations appear to be declining and local populations are very sensitive to increased adult mortality

(Environment Canada, 2016). Table 3.8 provides a summary of the known seasonal habitat requirements in eastern Canada.

**Table 3.8 Habitat Requirements of Snapping Turtles in Eastern Canada (COSEWIC, 2008).**

| Habitat Type | Description |
|---|---|
| **Summering and Basking Habitat (Active Season):** | • Slow-moving water with a soft mud bottom and dense aquatic vegetation.<br>• Established populations are most often located in ponds, sloughs, shallow bays or river edges and slow streams, or areas combining several types of wetland habitat (Harding,1997).<br>• While they generally only go on land to nest or move to a larger water body, Snapping Turtles may bask on offshore logs and rocks, depending on environmental temperature (Obbard and Brooks, 1979; Brown et al., 1990). |
| **Nesting Habitat:** | • Nesting takes place in June and July.<br>• Females generally nest on sand and gravel banks along waterways, including artificial dam and railway embankments, but muskrat houses, abandoned beaver lodges, road shoulders, fissures in rocky shorelines, sawdust heaps, freshly dug soil, gardens, lawns and forest clearings have all been selected as nest sites with unknown success (Obbard and Brooks, 1980; Ernst et al., 1994; Congdon et al., 2008).<br>• Hatchlings emerge in fall, move to water, and bury themselves under leaf litter or debris. |
| **Overwintering Habitat** | • Three types of hibernacula have been documented for adult Snapping Turtles in Ontario (Brown and Brooks, 1994):<br>○ ***Stream sites*** - turtles bury themselves beneath logs, sticks, or overhanging banks in small streams that flow continuously throughout the winter<br>○ ***Lakeshore sites*** - turtles wedge beneath or beside submerged logs and stumps, sometimes covered in silt, within 5 m of the shoreline<br>○ ***Muddy sites*** - turtles are buried in deep anoxic mud in marshy areas or beneath floating mats of vegetation |
| **Foraging Habitat & Diet** | • Diet is more plant than protein-based, though they will scavenge recently dead animals.<br>• May eat water shield (*Brasenia schreberi* spp.), filamentous algae (*Spirogyra* spp.), duckweed (*Lemna* spp.), pondweed (Potamogeton and *Elodea* spp.), cattail (*Typha*), sedge (*Carex* spp.) and water lily (*Nymphaea* spp.).<br>• Protein sources include invertebrates, fish, frogs, reptiles (including snakes and smaller turtles), unwary birds, and small mammals (Bergeron et al., 2007). |

| Habitat Type | Description |
|---|---|
| | • Young Snapping Turtles actively forage for food, whereas older individuals tend to be ambush predators. |

### 3.8.1.3 Eastern Painted Turtle (*Chrysemys picta picta*)

The Painted Turtle (*Chrysemys picta*) is a well-known, relatively colourful, small to medium-sized freshwater turtle. It is the most widespread native turtle in North America. In eastern North America, the Eastern Painted Turtle (subspecies *picta)* occurs in New Brunswick, and mainland Nova Scotia, extending south to the Atlantic coastal states east of the Appalachian Mountains. This species is subject to a suite of continuing threats, including habitat loss and road mortality, which are unlikely to diminish in the future. Although data on declines of this species are limited (particularly in Nova Scotia where overall life history knowledge s rather limited) the slow life history of turtles increases vulnerability and constrains population resilience to these threats (COSEWIC, 2018). The Eastern Painted Turtle is currently ranked as Special Concern under both COSEWIC and SARA but is not listed under the NS ESA. The AC CDC ranks the Eastern Painted Turtle as S4 in Nova Scotia.

Table 3.9 provides a summary of the known seasonal habitat requirements of Eastern Painted Turtles in Nova Scotia, some of which has been extrapolated from eastern Canadian areas within its range due to lack of local data.

**Table 3.9 Habitat Requirements of Eastern Painted Turtles in Eastern Canada (COSEWIC, 2018).**

| Habitat Type | Description |
|---|---|
| **Summering and Basking Habitat (Active Season)** | • Prefers slow moving, relatively shallow and well-vegetated wetlands (e.g., swamps, marshes, ponds, fens, bogs, and oxbows) and water bodies (e.g., lakes, rivers, creeks, and streams) with abundant basking sites and organic substrates which support emergent plant species (COSEWIC, 2018).<br>• Juveniles prefer shallower water, perhaps for foraging and the avoidance of aquatic predators, transitioning to deeper water as they grow larger (Congdon et al., 1992).<br>• Often associated with submergent aquatic plants including *Nuphar, Nymphaea, Potamogeton,* and *Pontederia* spp. (Bleakney, 1958; Gilhen, 1984), which offer cover and feeding opportunities (Moldowan et al., 2015).<br>• Adults may spend half the year submerged in wetlands with very low dissolved oxygen.<br>• Bask frequently on sunny fallen trees, logs, lily tubers, and rocks in water bodies or along shorelines, often in groups. |

| Habitat Type | Description |
|---|---|
| **Nesting Habitat** | • Nesting occurs in May to June.<br>• Nest in areas of open canopy, often with southern exposure, such as the shorelines of lakes and wetlands, beaver dams, and sand dunes (Ernst and Lovich, 2009; Gillingwater and Piraino pers. comm., 2015; Litzgus pers. comm., 2015).<br>• Eggs are laid in sandy-loamy and/or gravel substrates usually within 1,200 m of their aquatic habitats (COSEWIC, 2018).<br>• Females appear to prefer sloped nest sites, although the degree of canopy and ground vegetation coverage varies widely (Schwarzkopf and Brooks, 1987).<br>• Preferred nesting substrate is sand, loam, clay, and/or gravel (Christens and Bider, 1987; Ernst and Lovich, 2009; Riley et al., 2014).<br>• Hatchlings generally emerge in fall and move to water. |
| **Overwintering Habitat** | • Overwinter in shallow water (<0.5) with deep sediment (Taylor and Nol, 1989; COSEWIC, 2018).<br>• Hatchlings are known to overwinter within the nest elsewhere in Canada. |
| **Foraging Habitat & Diet** | • Consume a wide variety of invertebrate and vertebrate prey, as well as algae, and aquatic vascular plant species.<br>• Diet changes as they mature, with young turtles eating more protein and adults relying more on vegetation. |

## 3.8.2 Field Surveys

As discussed in depth in Section 3.3, a total of 23 watercourses were assessed in detail as part of the watercourse assessment task. The distribution by size category (large permanent, small permanent, intermittent, and ephemeral) is provided in Table 3.10.

**Table 3.10 Nuttby II Study Area Watercourses, by Category**

| Watercourse Category | Number in Project Area |
|---|---|
| Ephemeral / Ephemeral with Intermittent Characteristics | 39 |
| Intermittent / Intermittent with Ephemeral Characteristics | 17 |
| Small Permanent / Small Permanent with Intermittent Characteristics | 18 |
| **Total** | **74** |

*Not including the large permanent West Branch North River

Of the 74 water courses assessed, 56 were ephemeral or intermittent watercourses that were deemed too small to be suitable aquatic habitat for turtles, though the occasional use of some of these features by turtles (particularly juvenile Common Snapping Turtles) moving between waterbodies cannot be ruled out.

The remaining 18 watercourses were all small or large permanent watercourses. These are summarized in Table 3.11 and depicted on Figure 3 in Appendix A.

**Table 3.11 Permanent Watercourses within the Nuttby II Study Area.**

| Watercourse Type | Label |
|---|---|
| Small Permanent | NR-WC-121a204 |
| | NR-WC-122f162 |
| | NR-WC-121b244 |
| | NR-WC-122h34 |
| | NR-WC-122b81 |
| | NR-WC-122h26 |
| | NR-WC-122d34 |
| | NR-WC-122d113 |
| | NR-WC-122d116 |
| Small Permanent with Intermittent Characteristics | NR-WC-122b89 |
| | NR-WC-122f157 |
| | NR-WC-122f147 |
| | NR-WC-111a137 |
| | NR-WC-122a339 |
| | NR-WC-122a374 |
| | NR-WC-122a319 |
| | NR-WC-122a367 |
| | NR-WC-122L26 |

#### 3.8.2.1 Wood Turtle Habitat

A total of ten watercourse(s) within the Nuttby II Project Area are considered to support likely suitable habitat for Wood Turtles as follows:

- Large Permanent
  - NR-WC-121a204
  - West Branch North River (not assessed)
- Small Permanent
  - NR-WC-122f162
  - NR-WC-121b244
  - NR-WC-122h34
  - NR-WC-122b81
  - NR-WC-122h26
  - NR-WC-122d34
  - NR-WC-122d113
  - NR-WC-122d116

Much of this can be considered potential summering (foraging and basking) habitat. Foraging may occur in these watercourses in late spring and fall, just after and prior to hibernation. Summer foraging for this species is primarily terrestrial, and considerable riparian habitat along these watercourses likely serves as potential foraging habitat, as Wood Turtles are quite terrestrial and active during the summer months. It is unlikely that hibernating habitat is present within these watercourses, as they are generally quite shallow. Nesting habitat is unlikely to be present, as large gravel sidebars were not observed within these watercourses.

West Branch North River is a large permanent watercourse within the Study Area. It crosses the Project Area at one location near the southernmost portion of the Study Area. It was not assessed as part of the fish habitat assessment since it is known fish habitat. However, this watercourse is probably the most likely watercourse within the Study Area to support Wood Turtle foraging habitat, and it may support hibernating habitat in some areas along its length.

Photographs of these watercourses within the Project Area, with the exception of West Branch North River, are provided in the Fish Habitat Assessment Fact Sheets for each watercourse in Appendix B. Figure 3 In Appendix A depicts large and small permanent watercourses within the Nuttby II Project Area that may provide suitable habitat for Wood Turtles.

#### 3.8.2.2 Eastern Painted Turtle Habitat

None of the watercourses intersecting the Project Area were deemed suitable habitat for summering, overwintering, or foraging for Eastern Painted Turtles, as this species generally prefers larger slow-moving watercourses or waterbodies with soft substrates and abundant aquatic vegetation which are not present within the Project Area. It is possible that some suitable nesting habitat may be present along the gravel roads or other disturbed areas within the Study Area, but without suitable summer habitat to support adult Eastern Painted Turtles, it is unlikely that they are utilizing these habitats.

#### 3.8.2.3 Common Snapping Turtle Potential Habitat

None of the watercourses intersecting the Project Area were deemed suitable habitat for summering, overwintering, or foraging for Common Snapping Turtle, as this species generally prefers larger slow-moving watercourses or waterbodies with soft substrates and abundant aquatic vegetation, which are not present within the Project Area.

It is possible that some suitable nesting habitat may be present along the gravel roads or other disturbed areas within the Study Area, but without suitable summer habitat to support adult Common Snapping Turtles, it is unlikely that they are utilizing these areas for nesting purposes. Juvenile Common Snapping Turtles could occasionally utilize habitats within watercourses classified as small permanent, or small permanent with intermittent

characteristics, within the Nuttby II Project Area for summering purposes. However, the near lack of suitable adult habitat decreases this possibility considerably.

Figure 3 In Appendix A depicts watercourses classified as small permanent, or small permanent with intermittent characteristics, within the Nuttby II Project Area which may provide occasional suitable habitat for juvenile Common Snapping Turtles. Photographs of these watercourses within the Project Area, with the exception of West Branch North River, are provided in the Fish Habitat Assessment Fact Sheets provided for each watercourse in Appendix B.

### 3.8.3 Incidental Reports

No incidental reports of turtle sightings were recorded by CBCL field staff during any of the vegetation inventory activities, wetland and watercourse reconnaissance, detailed wetland assessment, or detailed watercourse surveys conducted for the Nuttby II Project between August and December 2022.

# 4 Limitations of Study

## 4.1 Fish Habitat and Water Quality Assessments

The baseline data collection for the majority of the watercourses assessed was completed during a period of relatively dry weather in the fall of 2022. Weather conditions can have direct effects on habitat quality and availability in watercourses. Periods of low precipitation can create seasonal barriers and affect water quality. The fall of 2022 had lower than average rainfall from June to December (with the exception of September), which would have likely contributed to lower water levels in watercourses and wetlands in the Project Area (ECCC, 2023). As such, the lower water levels may have also impacted habitat quality in watercourses, and the permanent watercourses with shallow depths and few deep pools may not have resembled their typical seasonal habitat. Water quality measurements were dependent on complete submersion of the probe into flowing water. Where this was not possible, including deep but stagnant water, the readings obtained will not necessarily be representative of the actual conditions of the site.

Additionally, the timing of some of the detailed assessments overlapped with late winter snowfall, changing the ability of the assessors to distinguish smaller ephemeral or intermittent watercourses, as well as the riparian habitats associated with the watercourses.

To assess the likelihood for fish presence within watercourses, assessments should be conducted during multiple seasons, along with fish sampling. Since neither of these conditions were met, the streams where fish were not observed cannot conclusively eliminate fish presence without the presence of an impassible barrier. These locations may require additional assessment and sampling to meet the requirements of future permitting.

Access to the upstream or downstream sections on a number of watercourses in the Study Area was limited in many areas due to the effects from post-tropical storm Fiona in the fall of 2022. The storm topped many trees in riparian areas or through areas of typical access to the watercourses, creating barriers that were impassible in some cases. A variety of causes led to the abundance of downed trees, with some watercourse assessment

locations being inaccessible due to access or safety concerns. These trees will continue to create access issues unless removed.

## 4.2 Turtle Habitat Assessments

As with the fish habitat assessment, access to the upstream or downstream sections of a number of watercourses was limited in many areas due to the effects of post-tropical storm Fiona in the fall of 2022. This limited the ability to survey some watercourse sections for potential turtle presence.

The turtle habitat assessment occurred in fall of 2022 and was limited to identifying areas of suitable habitat for the three turtle species, and not confirmation of presence. To fully assess the likelihood for turtle presence within watercourses, targeted turtle surveys should be conducted in identified areas of potentially suitable aquatic turtle habitat during the appropriate season. The preferred timing window for Visual Encounter Survey (VES) for Wood Turtles in Nova Scotia is late April to late May (McLean, 2018) when air temperatures are above 9°C, and the weather is generally sunny. For construction projects, NS DNRR recommends Wood Turtle VES in May, prior to leaf emergence, and another immediately prior to the commencement of site clearing and construction activities (Laverty, Pers comm, 2020). No turtle survey methods have been specified for Snapping Turtles or Eastern Painted Turtles by NS DNRR, but the spring Wood Turtle survey method is generally considered sufficient for these species (Cameron-MacMillan, pers. comm, 2023).

# 5 Mitigation Measures

## 5.1 Industry Standard Mitigation Measures

Works that occur within or near water are required to prevent or minimize adverse effects to the existing instream and riparian habitat, unless applicable permits, approvals, notices, or authorizations are acquired.

Industry standard mitigation measures are those that are known to be effective at controlling adverse effects of low or moderate risk works, including construction works. These measures are used where the effects to the environment, from the works, are known to have low or moderate risk, to the applicable environmental aspect or area, and are relatively straightforward to implement and maintain. These may include measures that place limits or boundaries (e.g., spatial, temporal, or physical) on activities, measures that remove or relocate potential effects to less sensitive areas, or measures that recommend additional equipment or methods in order to carry out the works according to the applicable regulations.

Example industry standard mitigation measures and best management practices (BMPs) that are applicable to the Project and the aquatic environment may include the following:

- Spill prevention, spill response measures and equipment
  - Refueling equipment > 30 m away from any waterbody, wetland, or watercourse
  - Using biodegradable fluids in all equipment used near water
  - Spill kits in all machines and larger spill kit on site
  - All petroleum-based products on site are stored away from water
  - Machinery is clean and free of leaks prior to use on site
  - Drip trays are placed under all parked machinery when not in use
- Erosion and Sediment Control (ESC)
  - An ESC Plan (ESCP) will be required for all instream works where ground disturbance occurs. The ESCP will be designed by a qualified professional (e.g., Engineer, CPESC)
  - Implement appropriate measures near water or wetlands to prevent sedimentation
- Staging of construction activities
  - Clearing and construction works to be staged to minimize adverse effects, including erosion and sedimentation, during the Project works
- Work Windows (Temporal)
  - Adhere to applicable working windows to protect existing flora and fauna in the riparian and instream habitats

- Instream construction in fish-bearing watercourses between June 1 and September 30, unless otherwise authorized.

Throughout the Project lifecycle, mitigation measures should be implemented to reduce the potential environmental effects to turtles. The mitigation measures that have been selected include, but are not limited to, the following:

- Wood Turtle VES should be conducted in May prior to leaves emerging and again immediately prior to site preparation and construction activities in areas identified as suitable turtle habitat (for any species).
- Onsite monitoring for turtles should be conducted during site preparation and construction activities in areas identified as suitable turtle habitat.
- Permanent and temporary road and water crossings should be planned in advance to help prevent turtle mortality and protect water quality.
- Known sensitive Wood Turtle habitat sites (e.g., suitable nesting areas) should be identified and avoided when building new roads and water crossings.
- The amount of road that parallels a watercourse should be minimized.
- If a turtle or nest is encountered during construction activities, work should cease, and the local Regional Biologist contacted for direction.

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## 6.2 Personal Communications

Jolene Laverty, NS DNRR Regional Biologist, 2020.

Maureen Cameron-MacMillan, NS DNRR Regional Biologist, March 2023.

# 7 Closure

This Aquatic Technical Report has been prepared for the sole benefit of Nova Scotia Power Inc. and may not be relied upon, in whole or in part, by any other entity or person without the express written consent of CBCL Limited and NSPI.

Any use of this report by a third party, or any reliance on decisions made based on it, are the responsibility of such third parties. CBCL Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this report.

The conclusions presented in this report represent the best judgement of the assessors based on the observed site conditions at the time of assessment. Due to the nature of the assessment area and assessment, the assessors cannot warrant against undiscovered environmental conditions or liabilities.

Should additional information become available, CBCL Limited requests that this information be brought to our attention so that we may re-assess the conclusions presented herein. Any changes to the Project alignment may result in a requirement to replicate or supplement the field program to capture any new information.

Prepared by:
Michael Browne, M.Sc., R.P.Bio.
Senior Fisheries Scientist
E-Mail: mbrowne@cbcl.ca
Direct: 902-421-7241 x2756

Reviewed by:
Loretta Hardwick, M.Sc., B.Sc.H.
Senior Environmental Scientist

# APPENDIX A

## Watercourse Location Maps


**KEY MAP**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | A1 | | | | |
| | | B1 | B2 | | | |
| | | C1 | C2 | | | |
| D1 | D2 | D3 | D4 | D5 | | |
| E1 | E2 | E3 | E4 | E5 | E6 | |
| F1 | | | | | | |
| G1 | G2 | G3 | | | | |
| H1 | | | | | | |
| I1 | | | | | | |

Nuttby

**LEGEND**

- Fish Observation (CBCL 2022)
- Beaver Dam (CBCL 2022)
- Waterfall (CBCL 2022)
- Quatenary Watersheds
- Preliminary Assessment Area
- Study Area (Phase 4)
- Predicted Water Flowpath (CBCL 2022)
- Fish Bearing Watercourse (CBCL 2022)
- Potential Fish Bearing Watercourse (CBCL 2022
- Non-Fish Bearing Watercourse (CBCL 2022)

Assessed Watercourses (CBCL 2022)

- Large Permanent
- Small Permanent
- Small Permanent with Intermittent Characteristics
- Intermittent
- Intermittent with Ephemeral Characteristics
- Ephemeral with Intermittent Characteristics
- Ephemeral
- Provincially Mapped Watercourse

Nova Scotia POWER An Emera Company

CBCL

# NSPI NUTTBY II NEW WIND

## WATERCOURSE CLASSIFICATION AND FIELD RESULTS

| | | |
|---|---|---|
| DATE: 2023-03-30 | PROJ N°: 221265.01 | FIGURE: **WC-A1** |
| DRAWN BY: NH | CHECKED BY: MB | APPROVED: LH |

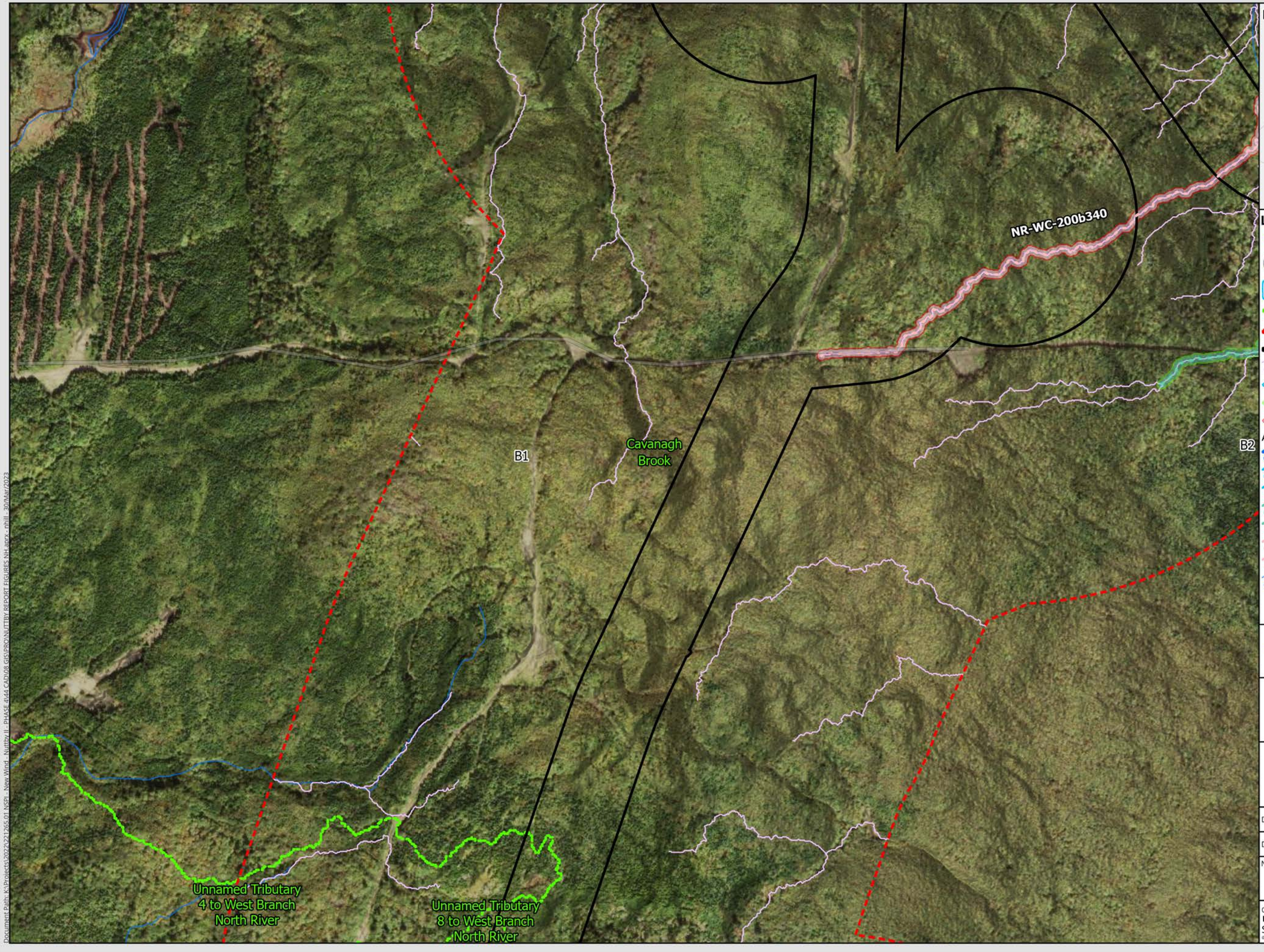
NOTES:

0 55 110 220 m

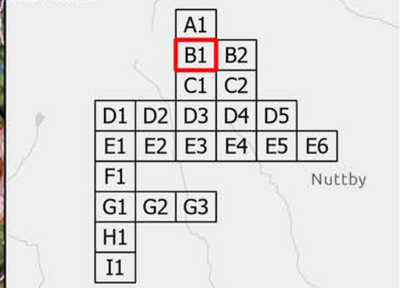
SCALE:1:4,200 @ 11 X 17

Coordinate System: NAD 1983 UTM Zone 20N
Units: Meter

Document Path: K:\Projects\2022\221265.01 NSPI - New Wind - Nuttby II - PHASE 4\44 CAD\08 GIS\PRO\NUTTBY REPORT FIGURES NH.aprx - nhill - 30/Mar/2023




**KEY MAP**




**LEGEND**

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Nova Scotia POWER An Emera Company

CBCL

# NSPI NUTTBY II NEW WIND

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| | | |
|---|---|---|
| DATE: 2023-03-30 | PROJ N°: 221265.01 | FIGURE: **WC-B1** |
| DRAWN BY: NH | CHECKED BY: MB | APPROVED: LH |

NOTES:

0 55 110 220 m

SCALE:1:4,200 @ 11 X 17

Coordinate System: NAD 1983 UTM Zone 20N
Units: Meter

Document Path: K:\Projects\2022\221265.01 NSPI - New Wind - Nuttby II - PHASE 4\44 CAD\08 GIS\PRO\NUTTBY REPORT FIGURES NH.aprx - nhill - 30/Mar/2023

NR-WC-200b297
NR-WC-200b137
NR-WC-200b473
Cavanagh Brook
Old Nuttby Rd
Baileys Brook
Cavanagh Brook
Cavanagh Brook
Old Nuttby Rd
Old Nuttby Rd
B1
B2

## KEY MAP

| | | | | | | |
|---|---|---|---|---|---|---|
| | | A1 | | | | |
| | | B1 | B2 | | | |
| | | C1 | C2 | | | |
| D1 | D2 | D3 | D4 | D5 | | |
| E1 | E2 | E3 | E4 | E5 | E6 | |
| F1 | | | | | | |
| G1 | G2 | G3 | | | | |
| H1 | | | | | | |
| I1 | | | | | | |

Nuttby

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# NSPI NUTTBY II NEW WIND

## WATERCOURSE CLASSIFICATION AND FIELD RESULTS

| | | |
|---|---|---|
| DATE: 2023-03-30 | PROJ N°: 221265.01 | FIGURE: **WC-B2** |
| DRAWN BY: NH | CHECKED BY: MB | APPROVED: LH |

NOTES:

0 55 110 220 m

SCALE:1:4,200 @ 11 X 17

Coordinate System: NAD 1983 UTM Zone 20N
Units: Meter

Document Path: K:\Projects\2022\221265.01 NSPI - New Wind - Nuttby II - PHASE 4\v4 CAD\08 GIS\PRO\NUTTBY REPORT FIGURES NH.aprx - nhill - 30/Mar/2023

Unnamed Tributary 4 to West Branch North River

Cavanagh Brook

C1

C2

Unnamed Tributary 8 to West Branch North River

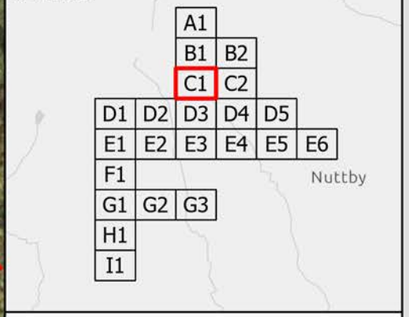
Unnamed Tributary 9 to West Branch North River

Unnamed Tributary to Middle Branch North River

D3

Document Path: K:\Projects\2022\221265.01 NSPI - New Wind - Nuttby II - PHASE 4\44 CAD\08 GIS\PROJ\NUTTBY REPORT FIGURES NH.aprx - nhill - 30/Mar/2023

## KEY MAP

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Nova Scotia POWER An Emera Company

CBCL

# NSPI NUTTBY II NEW WIND

## WATERCOURSE CLASSIFICATION AND FIELD RESULTS

| | | |
|---|---|---|
| DATE: 2023-03-30 | PROJ N°: 221265.01 | FIGURE: **WC-C1** |
| DRAWN BY: NH | CHECKED BY: MB | APPROVED: LH |

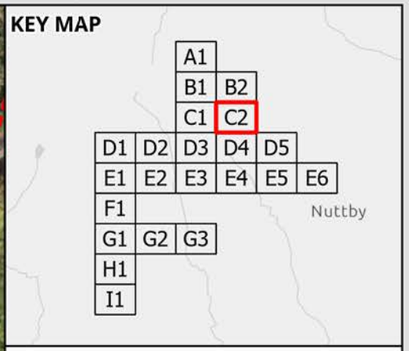
NOTES:

0 55 110 220 m

SCALE:1:4,200 @ 11 X 17

Coordinate System: NAD 1983 UTM Zone 20N
Units: Meter


**KEY MAP**

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CBCL

# NSPI NUTTBY II NEW WIND

## WATERCOURSE CLASSIFICATION AND FIELD RESULTS

| | | |
|---|---|---|
| DATE: 2023-03-30 | PROJ N°: 221265.01 | FIGURE: **WC-C2** |
| DRAWN BY: NH | CHECKED BY: MB | APPROVED: LH |

NOTES:

0 55 110 220 m

SCALE:1:4,200 @ 11 X 17

Coordinate System: NAD 1983 UTM Zone 20N
Units: Meter

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