Nictaux Sand Pit Expansion Project

Environmental Assessment Registration Document

4389818 Nova Scotia Limited

2 May 2025

→ The Power of Commitment

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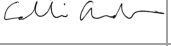
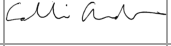
S4	C	Glen Merkley	Callie Andrews		Callie Andrews		02-05-2025

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Acronyms

Common Acronym	Expanded Use
ACCDC	Atlantic Canadian Conservation Data Centre
ACPF	Atlantic Coastal Plain Flora
Ag-Tech	Agricultural Technology
AMO	Abandoned Mine Opening
ANSMC	Association of Nova Scotia Mi'kmaq Chiefs
ARIA	Archaeological Resource Impact Assessment
BP	Before present
CFB	Canadian Forces Base
CLC	Community Liaison Committee
CLI	Canada Land Inventory
CMM	Confederacy of Mainland Mi'kmaq
COPD	Chronic Obstructive Pulmonary Disease
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EC	Environment Canada
ECCC	Environment and Climate Change Canada
ESC	Erosion and Sediment Control
FSC	Food, social and ceremonial
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
HA	Hectares
KM	Kilometer
KMKNO	Kwilmu'kw Maw-klusuaqn
LAA	Local Assessment Area
LOS	Level of Service
LUBs	Land Use By-laws
m	metre
masl	Metres above sea level
MBBA	Maritime Breeding Bird Atlas
MEKS	Mi'kmaq Ecological Knowledge Study
MK	Mi'kmaw Kina'matnewey
ML/ARD	Metal Leaching/Acid Rock Drainage
MPA	Municipal Planning Area
MPS	Municipal Planning Strategy

Common Acronym	Expanded Use
N/A	Not Applicable
NAICS	North American Industry Classification System
NB	New Brunswick
NS	Nova Scotia
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
NSDPW	NS Department of Public Works
NSECC	Nova Scotia Department of Environment and Climate Change
NSESA	Nova Scotia Endangered Species Act
NSNR	Nova Scotia Natural Resources
PA	Project Area
PEI	Prince Edward Island
PID	Property Identification Number
ppm	Parts per million
RAA	Regional Assessment Area
REAP	Valley Regional Entrepreneurial Acceleration Program
s	Second
SAR	Species at Risk
SARA	Species at Risk Act
SCC	Supreme Court of Canada
SMP	Special Management Practices
SOCI	Species of Conservation Interest
SPI	Statements of Provincial Interest
SPS	Secondary Planning Strategy
TSS	Total Suspended Sediment
UNSM	Union of Nova Scotia Mi'kmaq
VC	Valued Component
WAM	Wet Areas Mapping
WC	Watercourse

1. Introduction

1.1 Project Overview

4389818 Nova Scotia Limited proposes to develop the Nictaux Sand Pit Expansion Project (the Project), an expansion of the existing Trimper Sand and Gravel Pit located near Nictaux, Annapolis County, Nova Scotia (NS). The Minister of Environment and Climate Change has granted consent to transfer the existing environmental assessment (EA) approval dated April 20, 2012 for the Trimper Sand and Gravel Pit Expansion Project originally issued to Ivan H. Trimper Construction Ltd. to 4389818 Nova Scotia Limited. 4389818 Nova Scotia Limited is a numbered company wholly owned by the Shaw Group (Shaw). Shaw intends to expand the Project Area (PA) authorized by this EA approval to include extraction of a sand resource located on parcels with the following premises identification numbers (PIDs): 05291448, 05291455, 05286976, 05286984, 05310834, 05286968, 05194030, 05313853, 05059688, and 05058334.

This environmental assessment registration document (EARD) has been prepared to facilitate the Project's review as a Class I Undertaking in accordance with the Environmental Assessment Regulations under the *Environment Act*.

1.2 Proponent Information

The Shaw Group is one of Nova Scotia's founding companies operating continuously for over 164 years. Its focus has been on building Nova Scotia by converting local natural resources into building products that last generations. Shaw has operations throughout Nova Scotia and has earned a stellar reputation as a construction product innovator, caring employer, responsible operator and community builder.

The proponent and landowner containing the sand resource is 4389818 Nova Scotia Limited. It is wholly owned by The Shaw Group. The NS Registry of Joint Stocks information is provided in Appendix A. Proponent contact information is provided in Table 1.2-1.

Table 1.2-1 Proponent Information

Requested Information	Response
Name of the Proponent	The Shaw Group Limited
Proponent CEO	Dean Robertson
Proponent Contact	Stephen Warren, P.Geo.
Official Title	Land and Quality Manager
Mailing Address	P.O. Box 60, Shubenacadie, NS, B0N 1Y0
Street Address	9105 Highway 14, Shubenacadie, NS, B0N 2H0
Telephone Number	(902) 883-4290
Website	shawresources.ca

I, Dean Robertson hereby accept responsibility for the content of this Environmental Assessment Registration Document (EARD).

April 29, 2025

1.3 Environmental Assessment Study Team

This EARD was prepared by an experiences study team based in NS. GHD Limited (GHD) is the EA Lead for the Project, with support from Strum Consulting and Cultural Resource Management Group Limited. The EA Study Team is presented in Tables 1.3-1 and 1.3-2.

Table 1.3-1 GHD EA Study Team

Position	GHD Limited
Environmental Assessment Lead	Glen Merkley, P.Eng. 120 Western Parkway, Bedford, NS T: (902) 499-0321 E: **glen.merkley@ghd.com**
Senior Impact Assessment Specialist	Callie Andrews, M.Sc.
Senior Impact Assessment Specialist	Nancy Griffiths, MCIP
Senior Hydrogeologist	Alan Deal, P.Geo.
Intermediate Impact Assessment Specialist	Sadie Jacobs-Peters
Senior Transportation Engineer	Vanessa Skelton, P.Eng. (NS, ON)

Other consultants who contributed supporting information for the preparation of the EARD are included in Table 1.3-2, below.

Table 1.3-2 Consultants Providing Supporting Information

Consultant	Contributing Role
Strum Consulting	Valued Components: Wetlands, Fish and Fish Habitat, Terrestrial Environment Baseline data collection and reports: Flora and Fauna, Avian, Fish and Fish Habitat, Wetlands
Cultural Resource Management Group Limited	Archaeological Reconnaissance and Impact Assessment

1.4 Purpose of the Project

The Project will contribute to the natural resource sector of the economy and provide essential raw materials for the province's construction industry. The primary purpose of the proposed undertaking is to provide a source of high-quality sands, which is an essential ingredient for concrete, septic fields, and other uses in the housing, construction, and agriculture sectors in the local area and across Nova Scotia.

The Shaw Group has operated the Keddy sand facility in Coldbrook, Nova Scotia for the past 40 years. It currently provides sand products to the local market, including the majority of the sand used for construction projects in the Halifax Regional Municipality. The Project will replace this supply as the remaining sand resources at the Keddy facility are nearly depleted. This Project will provide direct and indirect rural employment for its workers and suppliers, as well as for the trades, transportation, and construction industries, as well as several other local spin-offs benefits. The Keddy facility has made a significant contribution to the local economy with employment of approximately 15 people (full time and seasonal) on an annual basis. Total economic activity at the Keddy facility including wages, taxes, operating expenses, sales, and capital expenditures is nearly $10 million annually. The Project is expected to have a similar ongoing economic impact in rural economic development in the Annapolis Valley for multiple decades.

1.5 Funding

The Project will be privately funded by Shaw and will not require any external funding from federal, provincial or municipal entities.

1.6 Regulatory Overview

The following section outlines the regulatory framework and the anticipated permitting requirements for the Project. The federal, provincial and local regulatory framework required for the EA process, the permits required for the construction, operation, and reclamation phases of the Project, are outlined in Table 1.6-1, below. An Industrial Approval (IA) amendment issued under the *Environment Act* must be obtained following receipt of EA approval. Pits and quarries are subject to the *Nova Scotia Pit and Quarry Guidelines*. All associated work programs must be carried out in compliance with such legislation as well as with additional legislation such as the *Occupational Health and Safety Act* (1996, c. 7, s. 1) and the Labour Standards Code of NS.

Table 1.6-1 Applicable Regulatory Framework

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Federal		
Fisheries Act	Any direct or indirect disturbance of fish or fish habitat requires authorization.	Fisheries and Oceans Canada (DFO)
Migratory Birds Convention Act – Migratory Birds Regulations	Activities such as clearing and grubbing have the potential to interact with migratory birds.	Environment and Climate Change Canada (ECCC)
Species at Risk Act (SARA)	Physical disturbance and/or destruction of species at risk (SAR) and/or habitats are prohibited.	DFO/ECCC
Canadian Environmental Protection Act (CEPA)	Pollution prevention measures are required to protect the environment and human health associated risks.	ECCC
Canada Wildlife Act and Regulations	Activities that have the potential to adversely affect wildlife are prohibited in National Wildlife Areas or Migratory Bird Sanctuaries.	ECCC Canadian Wildlife Services (CWS)
Provincial		
Environment Act – Activities Designation Regulations	Under Part 2: Construction (e), an IA is required for construction, operation or reclamation of a pit larger than 2 ha with ground disturbance or excavation for the purpose of removing aggregate without use of explosives. Under Division I – Water, a water approval, and/or notifications, is required for any water withdrawal or alteration of a watercourse, water resource or wetland.	Nova Scotia Department of Environment and Climate Change (NSECC)
Nova Scotia Endangered Species Act (NSESA) and Regulations	Killing, injuring, disturbing, taking and/or interfering with endangered or threatened species and/or their habitats are prohibited.	Nova Scotia Department of Natural Resources and Renewables (NSDNRR)
Wildlife Act and Regulations	Taking, hunting, killing or possessing protected wildlife species is prohibited.	NSDNRR
Nova Scotia Occupational Health and Safety Act (1996) and Regulations	Projects must operate under regulated labour standards.	Department of Labour, Skills and Immigration
Local		
Land Use By-law (LUB) for the East End Area of Annapolis County	Discussions with Annapolis County are on-going regarding how to accommodate the Project with regards to the municipal planning strategy and land use bylaws.	Municipality of the County of Annapolis

Legislation	Physical Activity and/or Trigger	Regulatory Authority
Nova Scotia Building Code Act and Regulations	Constructing or renovating buildings requires permitting and inspections at various development stages to ensure compliance. Modular or manufactured structures built to CSA A277 or CSA Z240 standards are exempt from the regulations as stated in Section 9(1).	Municipality of the County of Annapolis
Municipal Infrastructure Standards	Construction of infrastructure (e.g., roads, streets, sewage or water works) is subject to standards.	Municipality of the County of Annapolis

1.6.1 Environmental Assessment Requirements

A Class I EA is required under the *Environment Act* and *Environmental Assessment Regulations* (B.2.(c)) where the Project includes a pit larger than 4 hectares (ha) in area for extracting sand. This EARD was developed in accordance with the *Environmental Assessment Regulations* (s.9(1A)). Concordance with the EA requirements in the regulations are outlined in Table 1.6-2. Other provincial guidance documents that have been consulted in preparation of this EARD include:

– A Proponent's Guide to Environmental Assessment (NSE, 2001)
– Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia (NSE, 2009)
– Guide to Considering Climate Change in Environmental Assessment in Nova Scotia (NSE, 2011)
– Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSE, 2005)

Table 1.6-2 EARD Concordance Table with the Environmental Assessment Regulations

Environmental Assessment Regulations Requirement	EARD Section Reference
The name of the proposed undertaking	Section 1.1
The location of the proposed undertaking	Section 2.2
The name, address and identification of the proponent	Section 1.2
A list of contact persons for the proposed undertaking and their contact information	Section 1.2
The name and signature of the Chief Executive Officer or a person with signing authority, if the proponent is a corporation	Section 1.2
Details of the nature and sensitivity of the area surrounding the proposed undertaking	Section 5
The purpose and need for the proposed undertaking	Section 1.4
The proposed construction and operation schedules for the undertaking	Section 2.3
A description of the proposed undertaking	Section 2
Environmental baseline information	Section 5
A list of licences, certificates, permits, approvals and other forms of authorizations that will be required for the proposed undertaking	Section 1.6.2
All sources of public funding for the proposed undertaking	Section 1.5
All steps taken by the proponent to identify the concerns of the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	Section 3
A list of all concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking	Section 3

Table 1.6-2 EARD Concordance Table with the Environmental Assessment Regulations

Environmental Assessment Regulations Requirement	EARD Section Reference
All steps taken or proposed to be taken by the proponent to address concerns of the public and aboriginal people	Section 5

Under the Physical Activities Regulations: SOR/2019-285 of the federal *Impact Assessment Act*, designated projects indicate the following will require impact assessment:

"18 (f) a new stone quarry or sand or gravel pit with a production capacity of 3 500 000 t/year or more."

"19 The expansion of an existing mine, mill, quarry or sand or gravel pit in one of the following circumstances:

(f) in the case of an existing stone quarry or sand or gravel pit if the expansion would result in an increase in the area of mining operations of 50% or more and the total production capacity would be 3 500 000 t/year or more after the expansion."

The Project, which will extract approximately 590,000 tonnes per year, is not anticipated to require a federal Impact Assessment.

1.6.2 Other Approvals

Following release from the provincial EA process numerous permits, leases, and approvals are required for Project commencement. The notable approvals and permits required for the Project are:

– IA Amendment
– Water Withdrawal Permit

2. Project Description

2.1 Project Name

The name of the undertaking is the Nictaux Sand Pit Expansion Project.

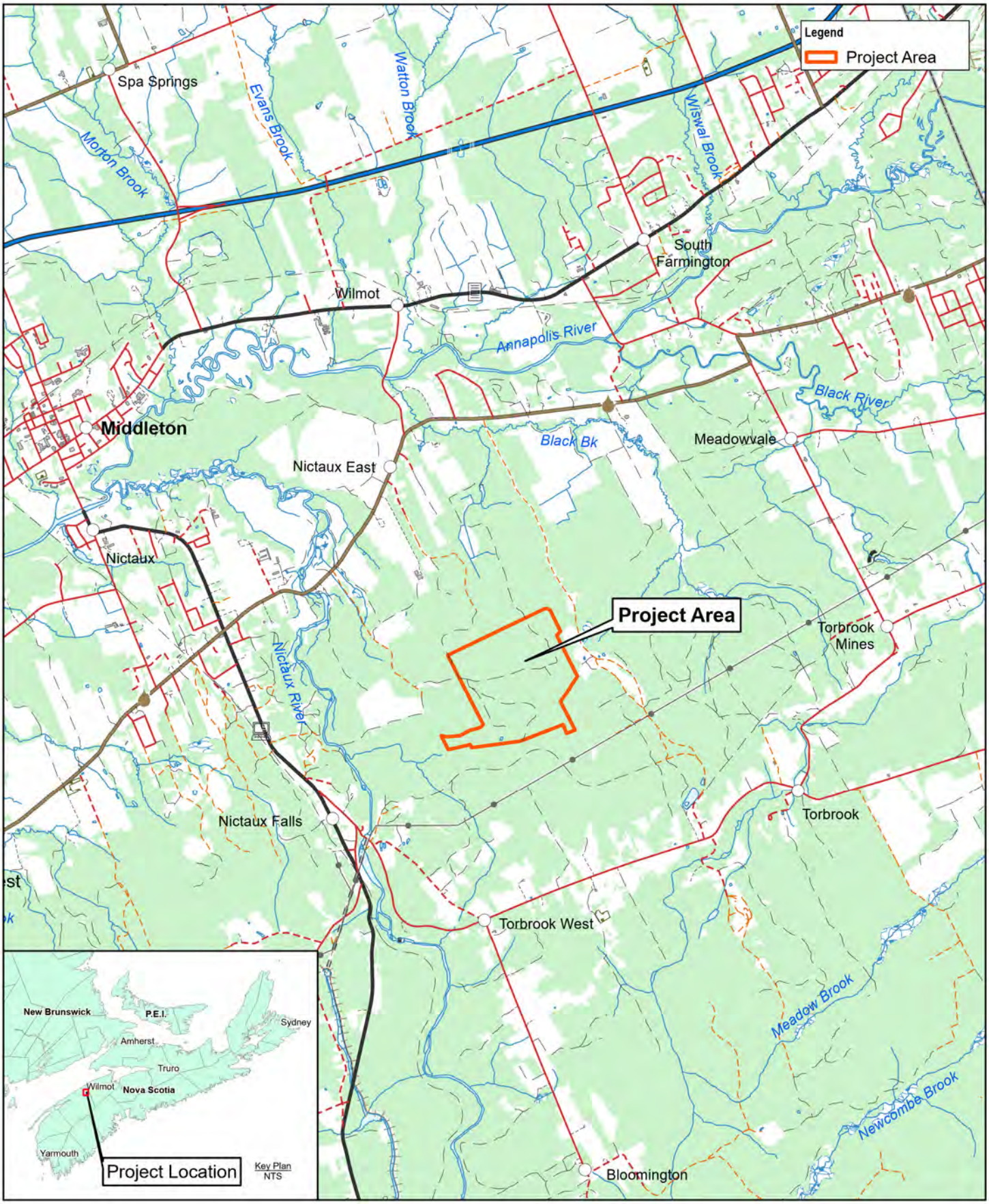
2.2 Project Location

The Project is located on South Mountain east of Nictaux River in Annapolis County within the Municipality of the County of Annapolis (Figure 2.2-1). The nearest communities are South Farmington to the north, Meadowvale, and Torbrook Mines to the east, Torbrook and Torbrook West to the south and Nictaux Falls and Nictaux to the west. The nearest regional service centre is Middleton, which is located northwest of the PA on Provincial Trunk Highway 1. The PA is bound by the existing sand pit to the east, agricultural land to the west, and by undeveloped forest land to the north, south, and east. The agricultural land located west of the PA is owned by Quality Concrete Inc., who hold an EA Approval for the development of a sand pit on the property.

The PA is centered at coordinates 4976394 m north, 341210 m east (Universal Transverse Mercator (UTM) Zone 20 NAD83) (44° 55' 23.7" N latitude and 65° 0' 43.3" W longitude) and is 110 ha in area.

The Project is situated on lands owned by Shaw and/or its subsidiaries. The land parcels include the following premises identification numbers (PIDs): 05291448, 05291455, 05286976, 05286984, 05310834, 05286968, 05194030, 05313853, 05059688 and 05058334 as illustrated in Figure 2.2-2. Topography within the PA ranges from approximately 30 metres above sea level (masl) in the northwest to 71 masl at the peak of an esker located in the southern portion of the PA. The Project will adhere to all setbacks and other requirements of the NSECC Pit and

Quarry Guidelines (1999) and as prescribed in existing and future Industrial Approvals (IAs) as granted by NSECC, including 30 metre (m) buffers between areas of disturbance and any wetlands and watercourses.



Paper Size ANSI A

0 500 1,000 1,500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

N

GHD

THE SHAW GROUP LIMITED
SOUTH FARMINGTON, ANNAPOLIS CO, NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

PROJECT LOCATION

Project No. 12584960
Revision No. -
Date Mar 06, 2025

FIGURE 2.2-1

Data source: GeoNOVA, GHD, Shaw . Created by: wilson2

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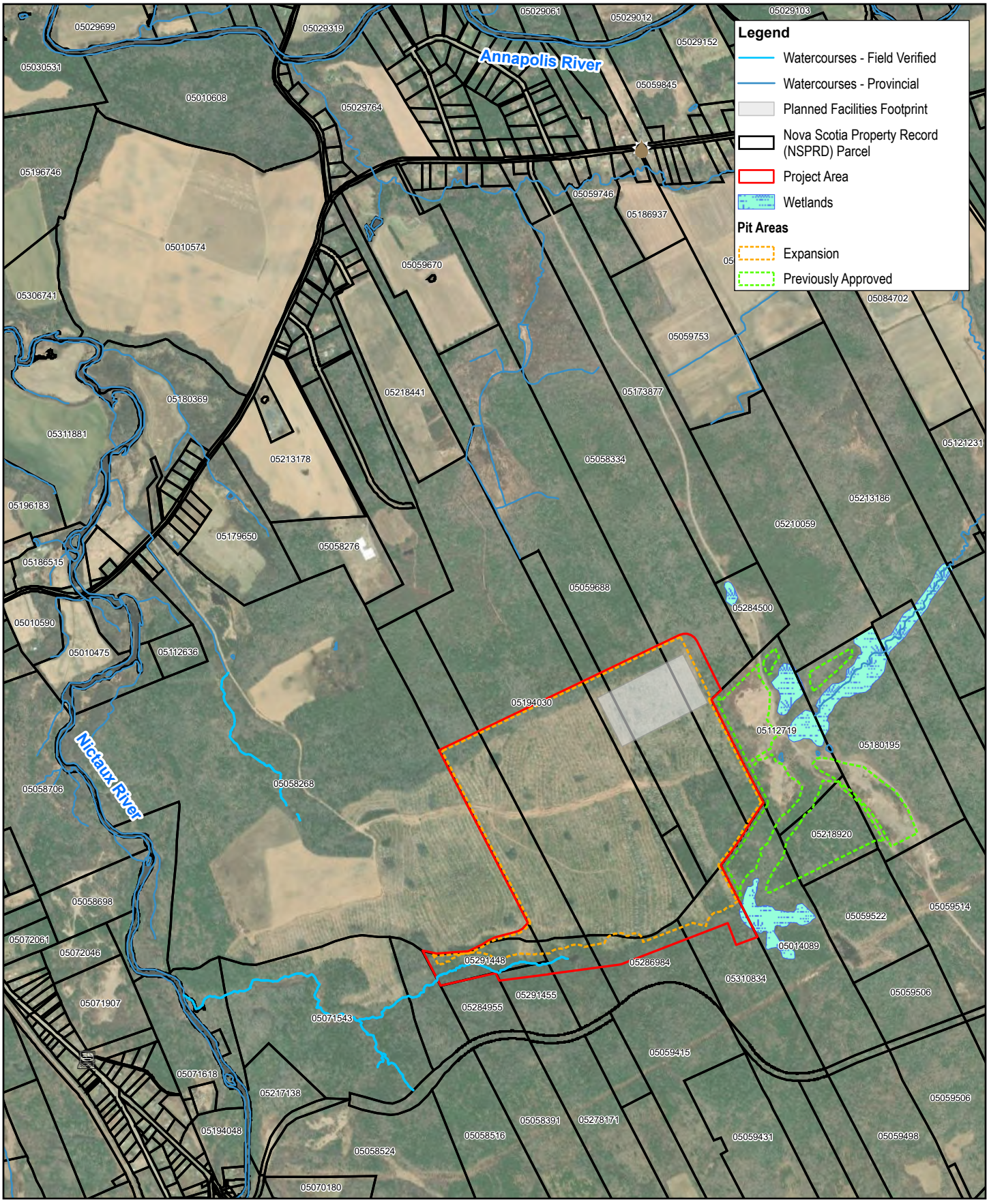
Print date: 06 Mar 2025 - 12:42



Scale 1:20,000

0 200 400 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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GHD

THE SHAW GROUP LIMITED
SOUTH FARMINGTON, ANNAPOLIS CO, NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

Project No. **12586970**
Revision No. **-**
Date **Mar 12, 2025**

PROJECT AREA

FIGURE 2.2-2

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Print date: 12 Mar 2025 - 11:15

Data source: NSECC, GeoNova World Imagery: Maxar; Province of Nova Scotia; GHD, 2024. Created by: mmize

The nearest residence is located approximately 980 m southwest of the PA. The nearest structure is an agricultural facility located approximately 850 m northwest of the PA. The number of residences located within 0.5 km, 1.0 km, 1.5 km, and 2.0 km of the PA is provided in Table 2.2-1, below.

Table 2.2-1 Distances from residences

Distance from PA (m)	Number of Residences
500	0
1000	1
1500	120
2000	274

2.3 Project Activities

Shaw intends to operate the Project for the purpose of extracting commercial sand at a rate of approximately 590,000 tonnes per year. For the purposes of this assessment, commercial sand is best described as medium- to coarse-grained sand with a gradation of particle sizes that maximizes the production yield of saleable products for use in the construction industry and other market sectors. The intent is to extract commercial sand and avoid areas that contain excessive amounts of fines (silt and clay sized particles). The existing sand pit will be expanded from the approved 26 ha to approximately 125 ha in size so that Shaw may continue to extract and supply aggregate to meet local and regional demand.

The Project schedule will be contingent on issuance of EA and IA approvals. Construction activities are anticipated to commence in 2026. The three phases planned for the Project and their estimated durations are as follows:

– Construction – approximately six months
– Operation – 30+ years depending on market demand
– Reclamation – one to three years, dependent on the monitoring duration and the success of reclamation activities

Project activities associated with each Project phase are detailed in the following sections.

2.3.1 Construction

The existing sand pit was in operation for approximately 25 years, and can be accessed via Freeman Street, south from Highway 201. This road will continue to be used for the expanded Project as the principal route for transporting sand to market. Additional access roads will be constructed on an as needed basis to access the expanded pit footprint.

The existing pit will be expanded westward in a progressive manner. The Project footprint has been harvested for commercial forestry purposes in the past with some degree of historical or ongoing forestry activities on adjacent lands. Topsoil and grubbing present within the expanded pit footprint will be removed via bulldozers and excavators and stockpiled for use in future reclamation activities. This process will be completed progressively to minimize the extent of disturbed soils at any one time. Surface water runoff generated during construction activities will be directed to a settling pond to remove suspended solids prior to discharge to the receiving environment.

2.3.2 Operation

During the operation phase, sand will be extracted from active working faces within the expanded pit via excavators and front-end loaders. The vertical extent of sand extraction will be dynamic and dependent on the depth and volume of useable sand within the PA. Based on exploration drilling completed to date for the Project, the depth of the pit will range from approximately 5 to 35 m below ground surface (mbgs). Shaw intends to extract sand from beneath the groundwater water table as established through baseline groundwater elevation monitoring. Any sand

extracted from beneath the water table will be removed via dredge; as such, the expanded pit will not require dewatering to facilitate sand extraction, minimizing the Project's impact on the surrounding aquifer.

All sand extracted for the Project will be processed on-site via screening, washing, and classifying for commercial sale. Processing equipment will include screens, conveyors, and crushers. All on-site equipment will be operated using electricity with the exception of mobile equipment (i.e., excavators, dozers, haul trucks), which will be diesel-fuelled. Following screening, washing, and classifying, sand products will be stockpiled and loaded onto trucks for transportation to market.

Further detail on Project activities proposed for the operation phase is provided in the following sections.

2.3.2.1 Water Management and Erosion and Sediment Control

Water management infrastructure constructed for the Project will include settling ponds, a water supply pond, a water clarifier, ditches, and silt management areas. The primary goal of water management infrastructure will be to prevent the release of sediment-laden runoff to surrounding watercourses and wetlands. All process water discharged to the receiving environment will be treated for total suspended solids (TSS) using settling ponds. Discharge from the settling ponds will be directed to the north, east, and west to maintain the drainage areas of adjacent watercourses to the extent practicable. Detailed design drawings for all water management infrastructure will be included in an updated surface water management plan submitted as part of the IA application following EA approval.

Erosion and sediment control measures will be established through the PA as needed. Silt fencing will be placed downgradient of the pit area prior to any ground disturbance, and disturbed areas of the PA will be graded toward the pit. Diversion ditches may also be constructed around the pit area as needed to divert 'clean' runoff away from the pit. Exposed soils will be managed to reduce the potential for erosion once they have reached final grade. All disturbed areas are to be seeded once they have reached final grade elevations. A detailed erosion and sediment control plan will be developed in accordance with the NSECC *Guide to Developing Erosion and Sediment Control Plans* and will be submitted as part of the IA application following EA approval.

All process water released to the receiving environment will meet water quality standards as established by IA conditions issued by NSECC. TSS is the primary contaminant of concern (COC) associated with process water effluent generated by a sand pit. Proposed water quality limits for TSS in the receiving environment are listed below:

– Clear flow: Maximum increase of 25 milligrams per litre (mg/L) from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
– High flow: Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

Freshwater requirements for the wash plant are proposed to be met by withdrawal from an on-site water supply pond. The pond will be constructed by excavating beneath the water table and will be recharged by inflows from the highly permeable sand and gravel aquifer present within the PA. Process water from the wash plant will flow through a water clarifier before being recycled back into the water supply pond.

With the exception of potential losses to evaporation and the water clarifier, all water withdrawn from the supply pond is planned to be recycled within this unconfined closed loop system. Shaw currently employ a similar process water supply system at their Keddy facility. Operations and environmental monitoring completed for the Keddy facility demonstrate consistent water elevations in supply ponds and monitoring wells, confirming the process water supply system is not depleting local groundwater. Considering the similar geological conditions and process proposed for the Project, water withdrawal is not anticipated to affect surrounding water users.

Water withdrawal demand for the Project is anticipated to exceed 23,000 litres per day (L/d) as established by Section 5A of the Activities Designation Regulations. Shaw will apply for a water withdrawal approval following EA registration.

2.3.2.2 Air and Noise Emissions

Equipment exhaust and dust will represent the majority of air emissions from the Project. Emissions produced will include carbon monoxide, carbon dioxide, oxides of nitrogen, sulphur dioxide, and dust. Emissions from the burning of hydrocarbons will be managed using clean burning, low-sulphur diesel fuel. All equipment will be properly maintained and inspected, and engine idling will be reduced when not in use to further decrease emissions from the PA.

Dust will be generated in the pit during all phases of Project development. Shaw will implement operational dust reduction methods (primarily through the application of water) to reduce potential fugitive dust emissions. Truck covers will be used to reduce the generation of dust during transportation of aggregate.

Noise emissions will result from extraction, processing, and transportation operations. The primary contributors to noise on-site will be heavy equipment such as crushers, excavators, loaders and trucks. Shaw will control operations and maintain equipment to ensure that noise levels are kept within required limits as established in the NS *Pit and Quarry Guidelines*. Noise levels will be monitored as required by the conditions of the IA and as directed by NSECC. Certain equipment noises associated with extraction activities may have a specific regulated safety requirement such as back-up beepers. Other methods (e.g., strobes) could be used as warning indicators if required with the appropriate agency approval.

2.3.2.3 Waste Management

Municipal solid waste produced by the Project will be removed by Shaw for disposal or picked up by an approved licensed contractor for appropriate reuse or disposal to a provincially approved waste disposal facility. On site sewage treatment will include the use of on-site septic. Portable toilets will also be used as required and will be maintained by Shaw or their subcontractors.

The Project will require the use and handling of petroleum, oil, and lubricant (POL) products such as fuel oil and lubricants on-site. A diesel storage tank will be installed within the PA for the purpose of fuelling mobile equipment. Fuel storage tanks exceeding 4000 L will be managed under the Nova Scotia Petroleum Management Regulations and will be registered with NSECC.

Any location where refuelling is taking place will be equipped with a spill kit and the operators will be trained in their use.

2.3.2.4 Transportation

The proposed haul route for the Project is as follows: trucks looking to access Highway 101 from the PA would turn left from Freeman Street into Route 201, make a westbound right-turn movement into Trunk 10, turn right into Trunk 1, make an eastbound left-turn movement into Victoria Road and a northbound right-turn movement to access Highway 101. As the Project is anticipated to be similar in scale to Shaw's existing Keddy facility in Coldbrook, NS, haul traffic recorded from Keddy was used as a proxy to estimate the number of trips generated by the Project. Haul traffic provided by Shaw for 2023 showed the highest average of daily loads occurred in May, with an average of 57 loads per day. Further information on the proposed haul route and the traffic impact assessment completed for the Project is provided in Section 5.9 and Appendix H.

2.3.3 Reclamation

Reclamation, the final phase of the Project, will return the PA to a condition that is consistent with the natural surroundings and community use. Progressive reclamation will occur during operation in stable areas that are no longer required for production with final reclamation (after the cessation of extraction and related activities), for any areas that are not reclaimed progressively.

The objective of reclamation is to produce a landscape that is safe, stable and compatible with the surrounding landscape and final land use. This is generally achieved by grading, contouring, capping with soil, revegetating, and

time. Progressive reclamation is understood as an integral part of project planning that keeps potential future land uses in mind.

Following sand extraction, the pit will be graded and contoured via bulldozers and excavators to ensure that they are stable and meet the legislated slope requirements. Ditches and drainage channels will be constructed as necessary to control run-off and prevent erosion of exposed soils. The reclaimed area will be seeded with an approved naturalization mix. Stockpiled grubbings and topsoil will be used to the extent possible to facilitate natural regrowth of native species.

It is anticipated that the reclamation will be completed within a one-to-three-year period from the end of the operation phase. A reclamation plan will be developed and submitted as part of the IA application. The reclamation plan will cover the following details:

– Site contouring and stabilization (for long term erosion control, to mitigate impacts of off-site drainage to adjacent lands / wetlands / or watercourses, and to blend with natural topography)
– Slope specifications which ensure a safe and stable site
– Use of overburden for revegetation purposes
– Use of native vegetation
– Specifications of any ponds, lake, or flooded pit features
– Removal of equipment

The reclamation plan will also outline the groundwater and surface water monitoring plan to ensure the erosion and sediment controls are effective during this phase of the Project.

2.4 Project Alternatives

Alternatives to an undertaking are defined as functionally different ways of achieving the same end.

The location of the proposed Project was initially selected based on available aggregate resources as delineated through considerable exploration effort by Shaw (i.e., drilling, testing, and planning). The Project is located in a rural area with limited development or residences in its immediate vicinity, and Shaw currently owns the land required for the pit expansion. Furthermore, the PA contains very favourable geologic conditions for the development of a sand pit; a large sand esker is present in the central and southern portions of the PA. The peak of the esker is approximately 30 m higher in elevation than the surrounding grade, providing a large volume of high-quality sand.

The extraction methods, infrastructure configuration, and processing options for a sand pit have standard and established practices and few alternatives exist. The planned process is to extract, screen, wash, and classify sand for commercial sale. Shaw currently operates other sand pits in the province and has considerable experience with the development, operations and environmental management of sand pits. The proposed methods of operation are based on industry best practices and are considered the best options available.

One alternative to the undertaking is a ‘do nothing’ alternative, in which no aggregate is extracted from this area. The ‘do-nothing’ alternative would result in a loss of essential raw materials for the province’s construction industry, as well as direct and indirect employment for Shaw’s employees and suppliers. The Keddy facility operated by Shaw in Coldbrook, NS currently provides approximately 80% of the sand used for construction projects in the Halifax Regional Municipality. The Project is intended to replace this supply of sand once the resources at the Keddy facility have been depleted.

2.5 Environmental Management

Given Shaw’s experience with sand extraction in Nova Scotia, various mitigation measures will be proactively incorporated into Project design to avoid, reduce, and/or control the effects of Project activities on the environment. Mitigation measures proposed for the Project will include the following, among others:

– A site-specific erosion and sediment control plan will be developed to outline control measures to be implemented around all disturbed areas.
– Disturbed areas of the PA will be progressively reclaimed to reduce generation of sediment-laden runoff.
– A spill response and contingency plan will be developed to address any accidental spills.
– Clearing of vegetation will occur outside the bird breeding window (April 15 – August 31) where possible. If this is not possible, nest sweeps will be completed by a qualified biologist prior to clearing. The proponent will work with the Nova Scotia Department of Natural Resources and Renewables and NSECC to develop nest sweep protocols.
– During dry periods, water and/or dust suppressants will be applied to the access road and haul roads as needed to mitigate dust emissions.
– Project vehicles will be required to comply with established speed limits to limit fugitive dust generation from vehicle travel on unpaved roads.
– Equipment, vehicles and haul trucks will be maintained in good working order and equipped with appropriate mufflers to reduce noise.

3. Consultation and Engagement

Consultation and engagement are key elements in the EA process in that they allow proponents to gather feedback from stakeholders, Rightsholders, regulators, and members of the public and to incorporate this information into the final Project design. Shaw acknowledges the importance and value of effective public and Indigenous engagement and envisions a long and mutually beneficial engagement program for the Project. GHD has worked closely with Shaw in identifying key stakeholders (public and regulators) and Rightsholders (Mi'kmaq) and developing an effective consultation and engagement approach for this Project. In addition to the consultation and engagement that has been completed to support the EARD, Shaw will continue to engage with those groups and key regulatory agencies to maintain ongoing communication regarding Project activities and progress should an EA Approval be granted.

3.1 Regulatory Engagement

Shaw and GHD met with representatives of the NSECC EA Branch and Inspection, Compliance and Enforcement (ICE) Division on April 23, 2024 to discuss the transfer of the existing EA approval for the Trimper Sand and Gravel Pit, and the registration of this EARD. Shaw subsequently provided a project description document to the NSECC EA Branch on September 3, 2024 for review and comment. The biophysical assessment methods and preliminary findings were shared with NSDNRR for review and comment.

As part of the archaeological assessment process, CRM provided a copy of the draft ARIA report the Nova Scotia Department of Communities, Culture, Tourism and Heritage (CCTH) for review and comment. No concerns were identified, and the report and associated archaeological mitigation measures were accepted by CCTH.

3.2 Notification to Community Officials

Information packages were provided to elected municipal, provincial, and federal representatives for the local area to inform them of the Project and to support their response to any inquiries and comments received from their constituents. The following representatives were contacted as part of this engagement:

– David Bowlby, Member of the Legislative Assembly (MLA) for Annapolis
– Chris McNeill, Chief Administrative Office (CAO) for the Municipality of the County of Annapolis

3.3 Mi’kmaq of Nova Scotia Engagement

Developing longstanding relationships with the Mi’kmaq of Nova Scotia throughout the life of the Project is important to Shaw. On October 15, 2024, a letter of introduction and a description of the Project was sent by mail to the following recipients:

– Chief Gerald B. Toney, Annapolis Valley First Nation
– Confederacy of Mainland Mi’kmaq
– Kwilmu’kw Maw-klusuaqn Negotiation Office (KMKNO)
– Nova Scotia Office of L’nu Affairs

KMKNO responded in writing on November 6, 2024 requesting documentation relevant to the Project be provided for review. No further correspondence has been received to date from Annapolis Valley First Nation, the Confederacy of Mainland Mi’kmaq, or the Nova Scotia Office of L’nu Affairs. A copy of all correspondence between Shaw and the individuals and organisations listed above is provided in Appendix B.

In recognition of past, present, and future Mi’kmaw ties to lands and waters in the vicinity of the PA, CRM Group contacted Kwilmu'kw Maw-klusuaqn's Archaeological Research Division (KMK-ARD) to request any available information pertaining to traditional or historical Mi'kmaw use of the PA. Ultimately, the information gained from this engagement expanded upon the results of the general background review described below, providing a better understanding of the cultural and archaeological importance of the PA. In response to CRM Group’s inquiry, KMK-ARD provided traditional Mi’kmaw land use information that was taken into consideration when preparing the archaeological assessment.

4. Environmental Assessment Methods

4.1 Approach and Guiding Principles

The approach and methods for the Nictaux Sand Pit Project (the Project) Environmental Assessment Registration Document (EARD) are based on current requirements of the NS *Environment Act* and *Environmental Assessment Regulations*, particularly for a Class I Undertaking, as well as direction from the most recent versions of the Guide to Preparing an EA Registration Document for Pit and Quarry Developments in Nova Scotia, A Proponent’s Guide to Environmental Assessment and the Proponent’s Guide: The Role of Proponents in Crown Consultation with the Mi’kmaq of Nova Scotia.

4.1.1 Planning Tool

An EA is a planning tool used to develop projects in a manner to avoid or mitigate possible negative environmental and socioeconomic effects and to maximize potential benefits. Use of the EA process encourages proponents to develop projects in the most sustainable manner, including identification of issues, review of alternatives and modification of project design to meet regulatory requirements, reduce disturbance to the environment and address stakeholder concerns and expectations.

4.1.2 Precautionary Approach

This EARD provides a detailed analysis of the environmental planning process for the Project. Shaw has applied a conservative (i.e., worst case scenario) approach to effects assessment through the following:

– Compiling detailed information about the existing environment to establish baseline conditions and identify potential issues.
– Preparing modelling and other analyses to provide conservative science-based effects predictions.

- Adopting mitigation measures to avoid, reduce or compensate, where appropriate, for Project effects on the environment and communities.
- Developing contingency plans to address worst-case scenario Project-related accidents and malfunctions.
- Designing follow-up and monitoring programs to facilitate effects management and verify Project-related effects predictions.
- Providing a description of other projects in the area to identify possible interactions with the Project and potential effects.

4.2 Scope of the Environmental Assessment

The Project is a sand pit, with associated construction, operation and reclamation phases. The Project is planned to commence construction in 2026, pending regulatory approvals.

4.3 Overview of Methods

The methodology used to conduct the EA and describe the potential effects of the Project was developed to meet the requirements of the NS *Environmental Assessment Regulations* under the NS *Environment Act*. It incorporates information and learnings derived from:

- Proposed Project components and activities
- Applicable municipal, provincial and federal regulations
- Applicable policies, guidance documents and guidelines
- Environmental and socioeconomic regulatory interests
- Knowledge of the biophysical and socioeconomic environments
- Engagement with the Mi'kmaq of Nova Scotia, stakeholders and public consultation for this Project
- Experience with other pit and quarry projects in NS
- Other legislative and regulatory requirements that apply to the Project

The following sections describe the general methodology used to conduct this environmental assessment (EA). This overview includes valued components (VC) selection, Project boundaries, determination of significance, baseline conditions, results of engagement, Project VC interactions, effects prediction, mitigation measures, identification and characterization of residual effects, monitoring and follow-up.

4.3.1 Valued Components Selection

The selection of VCs for this EARD was based on the consideration of the following:

- Technical aspects of the Project, including the nature and extent of Project activities
- Applicable federal, provincial and municipal legislation, including SOCI and SAR
- Regulatory guidance and requirements including discussions with representatives of NSECC, NSDNRR, DFO, ECCC and Transport Canada (TC)
- Concerns raised by stakeholders and the public
- Concerns raised by the Mi'kmaq of Nova Scotia
- Known physical, biophysical and socioeconomic conditions and characteristics
- A review of publicly available information including EAs of similar projects

Table 4.3-1 identifies the VCs based on these considerations and provides rationale for their selection.

Table 4.3-1 Selection of VCs

VC	Rationale for Inclusion
Air Quality and Light	Dust will be emitted from extraction operation, stockpiles, crushing and vehicle/machinery traffic on unpaved roadways throughout construction and operation. GHG emissions will result from vehicle use.
Noise	Project-related noise will result from construction and operation activities. Changes to ambient noise levels have the potential to adversely affect fauna and birds by influencing patterns of important life activities.
Geology, Soil, and Sediment	Soil and sediment contamination may increase potential for exposure for human health and ecological receptors. Soil erosion from Project activities may increase the potential for siltation of watercourses from surface water runoff.
Groundwater Resources	Changes to aquifers may limit groundwater or surface water recharge. Groundwater drawdown may adversely affect surface water quantity in adjacent watercourses and/or wetlands. Groundwater recharge is important for drilled and dug domestic wells.
Surface Water Resources	Sediment and contaminants may be conveyed through stormwater runoff into various water systems (i.e., rivers, lakes, oceans) and groundwater through recharge.
Wetlands	Wetlands may be affected by development or changes to groundwater and surface water.
Fish and Fish Habitat	Fish habitat, including surface water and wetlands, may be affected by development or by changes to groundwater and surface water.
Terrestrial Environment	Terrestrial habitat, fauna, flora, avifauna, SOCI, and SAR may be affected, either directly or indirectly, by Project activities.
Socioeconomic Conditions	The Project has the potential to provide benefits from direct, indirect and/or induced employment and procurement as well as tax revenue. Adverse Project effects may result from potential changes to air, light, noise, aesthetics, changes to availability of housing and goods or increased traffic experienced by local communities. Socioeconomic benefits and adverse effects may be most evident during construction.
Mi'kmaq of Nova Scotia	The Project could result in conflicts with traditional land and resource use activities.
Cultural and Heritage Resources	The Project may interact with cultural and heritage resources.

4.3.2 Project Boundaries

Boundaries established to define the scope or limits of the analyses of potential effects and encompass both the areas (spatial) and the times (temporal) in which it is reasonable to assume that effects from a project will interact with a VC. Boundaries may also be established that include possible political, social and economic constraints (administrative boundaries) and limitations (technical) when trying to predict or measure changes to a VC. Some or all assessment boundaries may vary between VCs based on Project Team expertise and experience with regulatory feedback from other projects. Where this occurs, rationale for the variations will be provided.

4.3.2.1 Temporal Boundaries

The temporal boundaries represent the duration over which Project activities interact with each VC. These include phases of a project (e.g., construction, operation, reclamation) and duration of specific project activities. Generally, temporal boundaries encompass all Project activities but may vary depending on the VC being considered.

4.3.2.2 Spatial Boundaries

Spatial boundaries represent anticipated geographic limits that will aid in defining the scale and range of interactions between Project activities and VCs. Establishing suitable spatial boundaries facilitates consideration of all important potential effects. The following spatial boundaries will be used for this EA and described in detail in each VC.

Project Area (PA)

The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following premises identification numbers (PIDs): 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.

Local Assessment Area (LAA)

The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. Generally, the LAA is limited to the area in which Project activities are likely to have indirect effects on VCs. However, the size of the LAA may vary depending on the VC, and biological and physical variables present.

Regional Assessment Area (RAA)

The RAA encompasses all Project and VC interactions including effects on GHG emissions and the socioeconomic environment. The RAA may vary in size depending on the VC being considered, and the physical, biological and socioeconomic variables present. Additional spatial boundaries may be used in certain VCs, where appropriate.

4.3.2.3 Administrative Boundaries

Administrative boundaries represent regulatory, public policy and/or economic limitations identified for the Project. An example of an administrative boundary would be if an available dataset does not have the same spatial boundaries as the selected VC. This could cause potential constraints to the assessment of effects.

4.3.2.4 Technical Boundaries

Technical boundaries represent limits of the Project Team's ability to assess a VC. The limitations to measure, assess and/or monitor effects of the Project may create gaps in knowledge and understanding related to key conclusions, therefore limiting the EA study team's ability to confidently predict potential effects of the Project on a VC. An example of a technical boundary is the difficulty associated with sampling certain reclusive species. Technical limitations may also be associated with modelling and possible margin of error in outputs.

4.3.3 Standards or Thresholds for Characterizing and Determining Significance of Effects

Criteria or established thresholds for determining the significance of predicted effects from Project activities may be based on regulations, standards, resource management objectives, scientific literature and/or ecological processes. These criteria or thresholds were developed through the following:

– Applicable regulatory documents, environmental standards, guidelines and/or objectives
– Consultation with appropriate regulatory agencies
– Information obtained in stakeholder consultation
– Available information on the status and characteristics of each VC
– Information regarding the outcomes from monitoring of previous projects

The resulting criteria are used to establish a threshold beyond which a predicted effect would be considered significant. Significance criteria have been defined quantitatively where possible, and qualitatively with supporting justifications where no standards exist. Significance criteria are defined in each VC in Section 5. Some or all threshold criteria may vary between VCs based on Project Team expertise and experience with regulatory feedback from other projects.

4.3.4 Baseline Conditions

Baseline conditions are presented for each physical, biophysical and socioeconomic VC to characterize the existing environment, to establish an understanding of the receiving environment, and to provide sufficient context to enable an understanding of how the Project may affect existing environmental conditions. Inclusion of existing conditions is limited to that which is necessary to assess the effects of the Project and support the development of mitigation measures, monitoring and follow-up programs. Descriptions of existing conditions consider the effects of past and current projects occurring within and outside of the PA.

Various methods are employed to obtain baseline conditions for each VC. Environmental field work specific to the Project has been ongoing since 2023 resulting in a comprehensive knowledge base of lands in and around the PA.

4.3.5 Project-Environment Interactions

Interactions between Project activities, and the VCs outlined in this EARD may either be direct or indirect. Direct interactions between the Project and VCs can logically be expected to be based on a good understanding of Project activities and existing physical, biophysical and socioeconomic conditions and characteristics. Indirect interactions typically require an active pathway between Project activities and the affected VCs. A pathway provides a link between a Project component or activity and VC and facilitates the interaction and potential effect.

As an example, a direct effect may be the potential loss of a wetland through clearing, grubbing and grading in preparation for construction. Clearing, grubbing, and grading may also decrease infiltration and therefore increase runoff, resulting in a potential indirect effect on surface water quality and quantity. Poor surface water quality and quantity may then affect fish and fish habitat; this is an example of a VC being both the receptor of an effect and the pathway for an effect.

To determine the potential direct and indirect interactions between Project activities and VCs, the EA study team conducted the following:

– Reviewed the anticipated components and activities required to construct, operate and close the Project.
– Selected those VCs that may have the potential to be directly or indirectly affected by Project activities through potential interactions.

Table 4.3-2 presents the anticipated Project components and activities and interactions with the VCs.

Table 4.3-2 Interactions table

Physical Activities	Valued Components										
	Air Quality and Light	Noise	Geology, Soil, and Sediment	Groundwater Resources	Surface Water Resources	Wetlands	Fish and Fish Habitat	Terrestrial Environment	Socioeconomic Conditions	Mi' kmaq of Nova Scotia	Cultural and Heritage Resources
Construction											
Clearing, grubbing, and grading	X	X	X	X	X	X	X	X	X	X	X
Road construction	X	X	X	X	X	X	X	X	X	X	X
Water management	-	-	X	X	X	X	X	X	X	X	X
Operation											
Processing	X	X	X	X	X	X	X	X	X	X	X
Overburden management	X	X	X	X	X	X	X	X	X	X	X

Table 4.3-2 Interactions table

Physical Activities	Valued Components										
	Air Quality and Light	Noise	Geology, Soil, and Sediment	Groundwater Resources	Surface Water Resources	Wetlands	Fish and Fish Habitat	Terrestrial Environment	Socioeconomic Conditions	Mi' kmaq of Nova Scotia	Cultural and Heritage Resources
Water management	-	-	X	X	X	X	X	X	X	X	X
Road maintenance	X	X	X	X	X	X	X	X	X	X	-
Emissions and waste management	X	X	X	X	X	X	X	X	X	X	-
Transportation	X	X	-	-	X	X	X	X	X	X	-
Reclamation											
Demolition	X	X	-	-	-	-	-	X	X	X	X
Earthworks	X	X	X	X	X	X	X	X	X	X	X
Water management	-	-	X	X	X	X	X	X	X	X	X

4.3.6 Effects Prediction

Potential Project-related effects are changes to the physical, biophysical and/or socioeconomic environment resulting from Project activities. Interactions between VCs and Project activities described above form the basis of the effects assessment. Once interactions have been identified, effects on VCs resulting from the Project can be determined by evaluating predicted changes from existing conditions. The degree of scientific uncertainty related to the data and methods used to determine the potential effects is also documented, if applicable.

4.3.7 Mitigation Measures

A variety of regulations, guidelines and mitigation measures are typically available to avoid, reduce or compensate for adverse effects of Project activities. These range from standard industry best management practices for construction and operation, policies and practices communicated through training programs, management plans and/or engineering controls incorporated into the final Project design. Given Shaw's experience with sand pit development and operation in Nova Scotia, various mitigation measures were proactively incorporated into Project design to eliminate, reduce and/or control the effects of Project activities on the environment.

4.3.8 Monitoring and Follow-up

Monitoring programs will be implemented to ensure regulatory compliance, and details of the specific monitoring required for each VC are based on the potential effects identified. Follow-up is a process to verify the accuracy of predicted effects and determine the degree to which mitigation measures were successful in eliminating, reducing or controlling those effects. Follow-up programs, which will be carried out in conjunction with the proposed monitoring, will be used to determine if additional work or mitigation is required to address any adverse effect, should it be experienced.

4.3.9 Residual Effects and the Determination of Significance

Residual effects are effects to VCs that are predicted to remain even after implementation of mitigation measures. The process by which they are identified is as follows:

– Determining potential interactions between VCs and Project activities and effects of the interactions.
– Assessing effects of each mitigation strategy applied to the interactions.
– Characterizing the extent and nature of remaining residual effects after mitigation measures have been applied.

To identify if residual effects are significant or not, consideration of the magnitude, geographical extent, duration, frequency and reversibility is required. Table 4.3-3 provides a description of these effect characteristics and the varying degrees in which they can contribute to the significance of an effect. Where possible, criteria will be described quantitatively. When residual effects cannot be characterized quantitatively, they will be characterized qualitatively.

It should be noted that each of the criteria will also incorporate the social and ecological context, reflecting the importance of the environmental attribute or feature to ecosystem health and function as well as the influence of past and current human activity and the disturbance associated with that activity. Further, timing considerations will be noted in the evaluation of the residual environmental effects for each VC, where applicable or relevant. For example, if the VC has sensitive timings for life stages (i.e., breeding/spawning, migration), the VC section will provide a description of timing considerations as part of the evaluation.

Table 4.3-3 Characterization Criteria for Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The size or degree of the effects compared against baseline conditions or reference levels, and other applicable measurement parameters (i.e., standards, guidelines, objectives)	**Negligible (N)** – Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of documented/measured natural variation and below a threshold value **Low (L)** – Differing from the average value for the existing environment/baseline conditions, outside the range of documented/measured natural variation, and less than or equal to appropriate guideline or threshold value **Moderate (M)** – Differing from the existing environment/ baseline conditions and documented/measured natural variation, and marginally exceeding a guideline or threshold value **High (H)** – Differing from the existing environment/ baseline conditions and documented/measured natural variation, and exceeding a guideline or threshold value
Geographic Extent	The geographic area over or throughout which the effects are likely to be measurable	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA **RAA** – Occurs beyond the PA and LAA and within the RAA
Timing	Considers when the residual environmental effect is expected to occur. Timing considerations are noted in the evaluation of the residual environmental effect, where applicable or relevant.	**Not Applicable (N/A)** – seasonal aspects are unlikely to affect VC's (i.e., fisheries productivity). **Applicable (A)** – seasonal aspects may affect VC's (i.e., fish productivity).

Table 4.3-3 Characterization Criteria for Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The time period over which the effects are likely to last	**Short-Term (ST)** – effects are limited to occur from as little as one day to 12 months **Medium-Term (MT)** – effects can occur beyond 12 months and up to seven years **Long-Term (LT)** – effects extend beyond seven years **Permanent (P)** – valued component unlikely to recover to baseline conditions *Different timeframe definitions may be provided in each VC section depending on specific VC effects.*
Frequency	The rate of recurrence of the effects (or conditions causing the effect)	**Once (O)** – effects occur once **Sporadic (S)** – effects occur at irregular intervals throughout the Project **Regular (R)** – effects occur at regular intervals throughout the Project **Continuous (C)** – effects occur continuously throughout the Project
Reversibility	The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)	**Reversible (RE)** – VCs will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible (PR)** – mitigation cannot guarantee a return to baseline conditions **Irreversible (IR)** – effects to VCs are permanent and will not recover to baseline conditions

Along with the effects characteristics outlined in Table 4.3-2, the significance of residual effects is determined based on the standards or thresholds assigned to each VC. Rationale for the threshold determination and the residual effects characterization will be provided in each VC section to provide an understanding of how the EA study team determined the conclusions presented in the residual table for each VC.

5. Environmental Effects Assessment

5.1 Air Quality and Light

5.1.1 Rationale for Valued Component Selection

Total suspended particulates (TSP) include dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such heavy equipment and motorized vehicles, construction activity, fires, and natural wind. Air quality is provincially regulated by the NS Air Quality Regulations, under the Environment Act, which aims to protect the health of workers. Increased TSP, and changes to air quality may affect wildlife due to inhalation and/or ingestion. Air quality was selected as a VC, as the Project has the potential to result in changes to air quality through dust and particulate mobilization, vehicle and equipment emissions which has the possibility of causing effects to human and ecological health.

Light level limits are not directly regulated through provincial or federal regulations. Changes to ambient light levels (i.e., increases or changes to occurrence/timing) have the potential to adversely affect residential receptors, as it can be viewed as a nuisance. Changes to ambient light levels also have the potential to adversely affect fauna and birds. Light was selected as a VC, as the Project has the potential to result in changes to light conditions through vehicle and equipment operating within the PA, and introduction of artificial lighting for the safety and security of onsite activities which may adversely affect fauna and general public and human receptors

5.1.2 Baseline Program Methods

The Air Quality and Light VC includes information obtained through desktop research and analysis. Baseline site-specific data was not deemed necessary due to the rural nature of the PA and surrounding forested areas.

5.1.3 Baseline Condition

Meteorological conditions in NS are recorded through a network of 47 weather stations, which are owned and operated by ECCC. These stations have been collecting climatological data since 1981, measuring key parameters such as precipitation, relative humidity, temperature, wind speed, and wind direction. The Greenwood Air Force Base Weather Station (Station ID: 8202000; Coordinates: 44°59'00" N, 64°55'00" W; Elevation: 28 m), situated approximately 18 km from the PA, serves as a relevant reference point for climate data. Long-term climate normals for this station, covering the period from 1981 to 2010, are summarized in Table 5.1-1 (ECCC, 2024). Data from the Greenwood Air Force Base Weather Station indicate that mean temperatures in the region range from -5.5°C in winter to 19.7°C in summer.

Table 5.1-1 Climate Data 1981-2010 for Greenwood Weather Station

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°C)													
Daily Average	-5.5	-4.9	-0.7	5.3	11.2	16.2	19.7	18.9	14.5	8.7	4	-1.9	7.1
Standard Deviation	2.2	2.2	1.5	1.3	1.4	1.1	1.1	1.1	1.3	1.3	1.4	2.2	0.8
Daily Maximum	-0.6	0.3	4.3	10.6	17.4	22.4	25.8	25.1	20.6	14.2	8.3	2.6	12.6
Daily Minimum	-10.4	-10	-5.7	0	5	9.9	13.5	12.6	8.3	3.2	-0.5	-6.3	1.6
Record High	18.8	17.8	24.3	30.3	33.8	35	35.6	37.2	34.1	27.8	23	19.5	
Record Low	-28.9	-35.5	-27.2	-13.4	-7.2	-1.7	2.8	0.2	-4.4	-8.9	-16.2	-26.1	
Average Precipitation (mm) / Snow (cm) / Rainfall (mm)													
Rainfall (mm)	44.5	45.5	58.8	67.8	83.4	81	83.2	78.4	96.2	98.6	100.7	65.6	903.5
Snowfall (cm)	78.7	53	43.4	15.1	1.1	0	0	0	0	0.2	16.4	62.8	270.7
Precipitation (mm)	102.5	84.8	94.8	83.2	84.8	81	83.2	78.4	96.2	98.8	116.5	112.9	1117.1
Precipitation Days (≥ 0.2 mm)	19.5	15.4	15.3	14.3	13.9	13.7	11.2	10.4	11	13.5	15.8	18.9	172.8
Snow Days (≥ 0.2 mm)	16.7	12.9	10.4	4.6	0.47	0	0	0	0	0.17	4.1	12.5	61.8
Reference: ECCC (2024)													

Based on the Greenwood Station, the prevailing winds direction is in the southwest direction. The wind rose is presented in Figure 5.1-1, below.

Figure 5.1-1 Greenwood Air Force Base Weather Station Wind Rose - February 2024 to February 2025

The PA is located within the Western Air Quality Zone, administered by NSECC. Historical air quality data was obtained from a Nova Scotia ambient air quality monitoring station, which is also part of the National Air Pollution Surveillance Program, located in Kentville, NS (Latitude: 45.067284, Longitude: -64.477425, Network ID: 31101), approximately 60 km west of the PA. Hourly datasets for fine particulate matter of size 2.5 micrometre (µm) or less ($PM_{2.5}$) (NSECC, 2024a), nitrogen oxide (NO), nitrogen dioxide (NO_2), nitrogen oxides (NO_x) (NSECC, 2024c), and ozone (O_3)(NSECC, 2024b) from January 2018 to December 2023 were obtained publicly through the Nova Scotia's Open Data Portal. No total suspended particles (TSP) are recorded at this station. These datasets were subsequently averaged yearly in Table 5.1-2.

Table 5.1-2 Kentville historical air quality data

Year		2018	2019	2020	2021	2022	2023
PM 2.5	Min concentration (µm/m3)	0	0	0.1	0.1	0.1	0.2
	Max concentration (µm/m3)	32	24	66.2	51.5	35	40.3
	Mean concentration (µm/m3)	5.5	5.3	5.3	5.6	5.2	5.4
O3	Min concentration (ppb)	0.1	0.9	1.5	0.5	0.6	0.8
	Max concentration (ppb)	67.4	54.6	57	65.3	61.7	66.1
	Mean concentration (ppb)	30.6	30.3	28.5	27.9	28.9	29.9
NO	Min concentration (ppb)	0	0	0	0	0	0
	Max concentration (ppb)	12.1	13.7	16.3	15.1	24	16.6
	Mean concentration (ppb)	0.4	0.3	0.3	0.4	0.4	0.3
NO2	Min concentration (ppb)	0	0	0	0	0	0
	Max concentration (ppb)	20.3	12.3	17.4	12.1	15.7	12.6
	Mean concentration (ppb)	0.8	0.9	1	0.9	1	0.8
NOx	Min concentration (ppb)	0	0	0	0	0	0
	Max concentration (ppb)	31.8	21.5	29.3	24.9	33.6	27.9
	Mean concentration (ppb)	1.2	1.2	1.3	1.4	1.3	1.1

Kentville and the PA are both classified as rural areas and located within the Western Air Quality Zone, allowing for the derivation of similar conclusions regarding air quality baseline.

5.1.4 Effects Assessment Methods

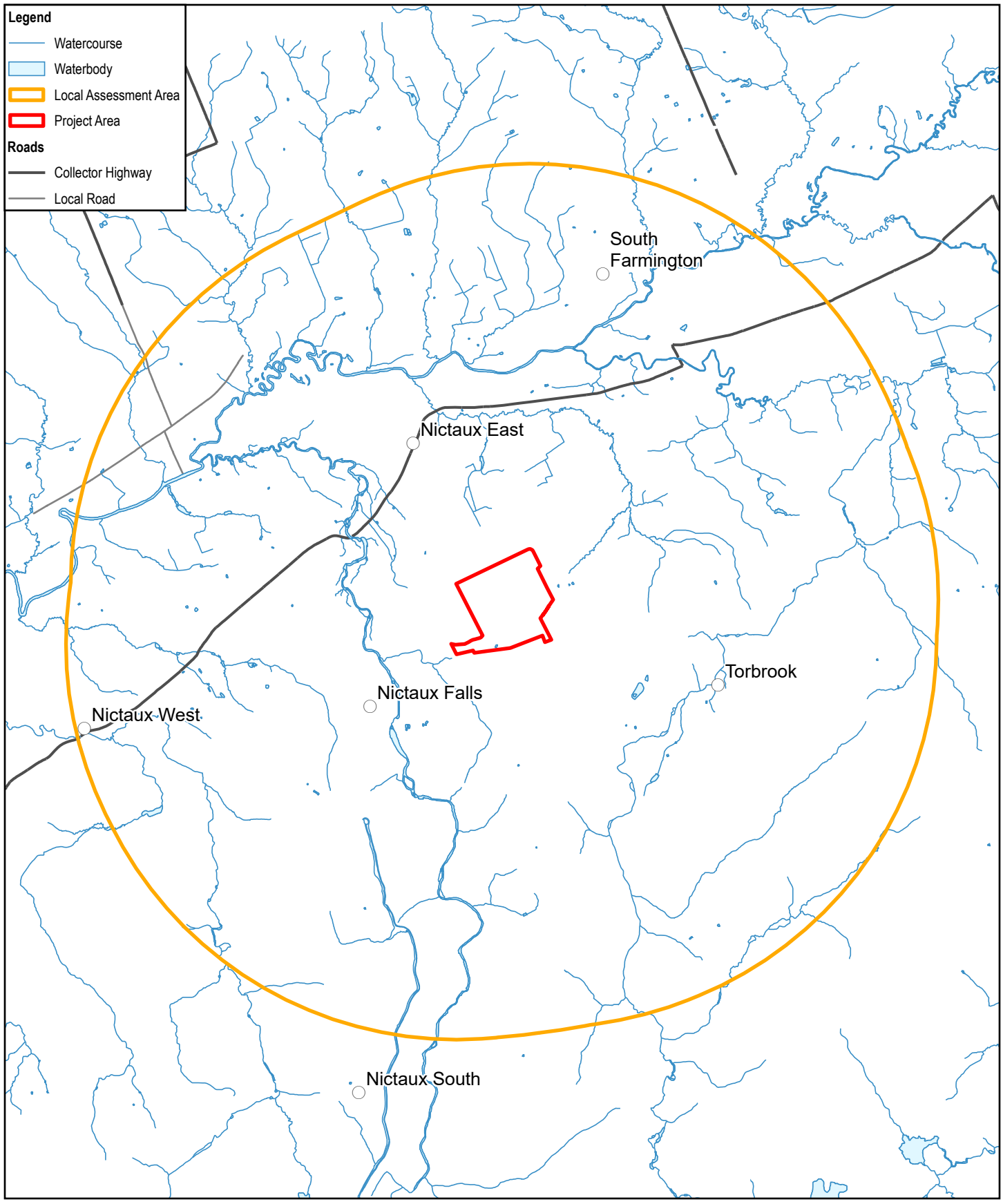
5.1.4.1 Boundaries

5.1.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on air quality and light are defined below and shown on Figure 5.1-2.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses includes adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. The LAA for air quality encompasses an area of 5 km from the PA in all directions to capture air quality and light impacts.

An RAA was not selected for Air Quality and Light where the LAA was deemed sufficient for the evaluation of effects.



Paper Size ANSI B

0 650 1,300 1,950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

Project No. **12584960**
Revision No. **-**
Date **Mar, 12 2025**

SPATIAL BOUNDARIES - AIR

FIGURE 5.1-2

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_003_SpatialBoundariesAir
Print date: 12 Mar 2025 - 09:25

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.1.4.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects of the Project includes the construction, operation, and reclamation phases.

5.1.4.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of air quality and light.

5.1.4.1.4 Administrative Boundaries

Ambient air quality is regulated by NSECC through the Air Quality Regulations made under Section 25 and 112 of the Environment Act.

Light level limits are not directly regulated through the provincial or federal regulatory regime.

5.1.4.2 Thresholds for Determination of Significance

Table 5.1-3 provides the definition of qualitative categories for assessment of residual effects on Air Quality and Light VC.

Table 5.1-3 Characterization Criteria for Environmental Effects on Air Quality and Light

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – minimal to no effect on air quality or light associated with Project activities within the PA. **L** – Potential for dust and pollutants emission or light within the perimeter of the PA with no negative effect to LAA. **M** – Potential for dust and pollutants emission or light within the perimeter of the PA with negative effect to LAA. **H** – Potential for dust and pollutants emission or light within the perimeter of the PA with negative effect beyond the LAA.
Geographic Extent	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **Applicable** – seasonal aspects may affect VCs
Duration	**ST** – Effects are limited to occur from as little as 1 day to 12 months **MT** – Effects can occur beyond 12 months and up to seven (7) years **LT** – Effects extend beyond 7 years **P** – Effects to air quality are unlikely to recover to baseline conditions
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals throughout the Project **R** – Effects occur at regular intervals throughout the Project **C** – Effects occur continuously through the Project
Reversibility	**R** – Air quality will recover to baseline conditions before or after Project activities have been completed. **PR -** Mitigation cannot guarantee a return to baseline conditions **IR** – Effects to air quality are permanent and will not recover to baseline conditions

A significant adverse effect to Air Quality and Light from the Project is defined as:

– An exceedance of the NS Air Quality Standards at a residential location outside of the PA boundary resulting from Project activity.

– Continuous nighttime light levels deemed as an annoyance or causing a disturbance as reported by nearby residential receptors

5.1.5 Project Interactions and Potential Effects

Potential Project interactions with Air Quality and Light are presented in Table 5.1-4.

Table 5.1-4 Project Activities and Air Quality Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction
Operation	Processing Overburden management Road maintenance Emissions and waste management Transportation
Reclamation	Demolition Earthworks

Fugitive dust may be created by during exposed dry soils, light and heavy vehicles traffic, heavy machinery during all the project phases activities listed in Table 5.1-3. Fugitive dust poses a risk to respiratory systems of both humans and wildlife, as the particles are small enough to be inhaled. Beyond respiratory concerns, significant amounts of dust may reduce vision, deposit on vegetation which is consumed by wildlife, and impact water chemistry and/or turbidity through deposition in waterbodies.

The nearest structure is an agricultural facility located approximately 850 m northwest of the PA. The nearest residential structure is located approximately 950 m to the southwest, downwind of the Project. Given the distance to the nearest residential receptor, mitigation to be implement (indicated in Table 5.1-5, below) and the area surrounding the PA consisting of primarily undeveloped forested areas (excluding the Quality Concrete property to the east), the dust and light generated by the Project are anticipated to be low during all phases of the Project.

5.1.6 Mitigation

Mitigation measures planned for the Project related to Air Quality and Light are provided in Table 5.1-5, below.

Table 5.1-5 Air Quality Mitigation Measures

Project Phase	Mitigation Measure
Construction, operation, reclamation	– Heavy and light vehicles speeds on unpaved surfaces will control to minimize dust – Use of properly sized machines and maintaining equipment using combustion engines – During dry periods, watering as a form of dust suppressant will be applied to the road network as needed to mitigate dust emissions. Watering may be repeated several times a day if required, depending on the conditions. Water used for dust suppression will be sourced from Project the settling pond and not sourced from natural waterbodies – Equipment, vehicles, and haul trucks will be maintained in good working order. To reduce emissions, idling times and cold starts will be limited, where practicable. – Limit disturbed areas to the extent practical. – Disturbed areas will be graded and/or scarified, covered with topsoil and overburden, where required, and seeded with native seed mix representative of natural conditions to promote natural plan colonization.

Table 5.1-5 Air Quality Mitigation Measures

Project Phase	Mitigation Measure
	– No unnecessary lighting will be used. – Lights will be placed as far from residential receptors as practical; lighting will be aimed inward to prevent light trespass beyond the PA.

5.1.7 Monitoring and Follow-up

Monitoring of particulate emission will be conducted in accordance with the IA, and as require by NSECC in accordance with the NS Pit and Quarry Guidelines and Nova Scotia Air Quality Regulations. Moreover, Shaw will fully adhere and comply with the most up to date regulations pertaining fugitive particulate emissions. Monitoring will include adequate reporting as required by provincial regulations.

5.1.8 Residual Effects and Significance Determination

The predicted residual effects (following mitigation) of the Project on Air Quality and Light are assessed to be adverse, but not significant. The overall residual effect of the Project on Air Quality and Light are assessed as not likely to have significant adverse effects after appropriate mitigation measures have been implemented as summarized in Section 5.1.6.

A significant adverse effect on the Air Quality and Light was defined in Section 5.1.4.2 as:

– An exceedance of the NS Air Quality Standards at a residential location outside of the PA boundary resulting from Project activity.
– Continuous nighttime light levels deemed as an annoyance or causing a disturbance as reported by nearby residential receptors

Residue effects on air quality and light are presented in Table 5.1-6, below.

Table 5.1-6 Residual Effects on air quality

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, operation and reclamation – air quality	Dust suppression, regular equipment maintenance, reduced speeds.	A	L The Project will likely result in the generation of fugitive dust.	LAA Fugitive dust primarily contained within the PA but with the potential in the LAA.	A	LT	S	R	Increased dust generation	Not significant
Construction, operation and reclamation – light	Minimize lighting required for safety activities at night, face lighting downwards, place lighting as far away from sensitive receptors as possible.	A	M The Project may generate light that is visible beyond the PA but not at levels that will cause a nuisance to residential receptors.	LAA	A	LT	R	R	Increased ambient light	Not significant
Legend (refer to Table 5.1-6 for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility R – Reversible IR – Irreversible PR – Partially Reversible				

5.2 Noise

5.2.1 Rationale for Valued Component Selection

Noise is defined as any unwanted sound which may be hazardous to health, interfere with speech and verbal communications or is otherwise disturbing, irritating, or annoying. Noise is provincially regulated via the *NS Workplace Health and Safety Regulations* and the NSECC Guidelines for Environmental Noise Measurement and Assessment (NSECC, 2023). Changes to noise levels (i.e., increases or changes to occurrence/timing) have the potential to cause a disturbance or nuisance to nearby residential receptors and the general public, as well as impact migration and behavioural patterns causing an adverse effect to wildlife.

Noise was selected as a VC as the Project will generate noise through all Project phases, through the operation of heavy equipment and vehicle traffic.

5.2.2 Baseline Program Methods

The Noise VC includes information obtained through desktop research and analysis. Baseline site-specific noise data was not deemed necessary due to the rural nature of the PA and surrounding forested areas.

5.2.3 Baseline Conditions

The PA is bound by the existing sand pit to the east, agricultural land to the west, and by undeveloped forest land to the north, south, and east. The agricultural land located west of the PA is owned by Quality Concrete Inc., who hold an EA Approval for the development of a sand pit on the property. The area surrounding the PA is considered rural for the purposes of the effects assessment on noise.

Noise is measured as sound pressure levels (SPL) in decibels (dB), with measurements typically "A-weighted" (dBA) to approximate how the human ear perceives sound across different frequencies. This weighting adjusts the measurements to align with the ear's sensitivity to various pitches. Generally, an increase in noise levels of 1 to 3 dBA is imperceptible to most people, while a change of 3 to 5 dBA is noticeable. An increase of 5 to 7 dBA is easily perceived, and a rise of 7 to 10 dBA is often perceived as a doubling of loudness (USEPA, 1974).

The decibel scale is logarithmic, therefore, doubling the number of identical noise sources results in a 3 dBA increase in overall sound levels, while a tenfold increase adds 10 dBA. Common sound levels provide useful context for understanding noise impacts as shown in Table 5.2-1. Extremely quiet environments, such as libraries or inactive residential areas, typically register approximately 35 dBA. Noticeable disturbances begin at approximately 70 to 80 dBA. For example, a tractor-trailer passing at a distance of 10 to 15 meters produces about 80 dBA, which is comparable to the sound of shouting at a distance of one meter.

Table 5.2-1 Common Noise Levels Threshold

Noise Level(dBA)	Typical Noise Levels
140	Threshold of pain on the human ear
130	Jet Aircraft (65 m)
120	Thunder
110	Gas mower (1 m), nightclub music
100	Loud Street Noise
90	Noisy factory
80	Tractor -trailer travelling 70 km/hr (15 m), cocktail party

Table 5.2-1 Common Noise Levels Threshold

Noise Level(dBA)	Typical Noise Levels
70	Car travelling 70 km/hr (15 m), toilet flushing
60	Conversation
50	Private office
40	Light rain
30	Countryside at night, whisper
20	Recording studio
10	Rustle of leaves
0	Threshold of hearing
Reference: NRC (2012)	

Table 5.2-2 provides typical noise level ranges for heavy construction equipment measured at a distance of 15 meters, which may be representative of equipment used on-site. For stationary construction equipment, noise levels decrease by approximately 6 dBA with each doubling of the distance from the source.

Table 5.2-2 Typical Noise Levels (Heavy Equipment)

Type of Equipment	Noise Level Range (dBA)					
	15 m from Source	30 m from Source	60 m from Source	960 m from Source	1,920 m (1.92 km) from Source	3,840 m (3.84 km) from Source
Front Loaders	75-94	69-88	63-82	39-58	33-52	27-46
Backhoes	74-92	68-86	62-80	38-56	32-50	26-44
Trucks	85-95	79-89	73-83	49-59	43-53	37-47
Excavator	85-95	79-89	73-83	49-59	43-53	37-47
Reference: NRC (2012) and DOT (2006)						

5.2.4 Effects Assessment Methods

5.2.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical.

5.2.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on noise are defined below and shown on Figure 5.2-1.

– The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs.
– The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. For the purposes of determining effects on Noise, the LAA encompasses an area 1.5 km from the PA in all directions.

An RAA was not selected for Noise where the LAA was deemed sufficient for the evaluation of noise effects.

5.2.4.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects of the Project includes the construction, operation, and reclamation phases.

5.2.4.1.3 Technical Boundaries

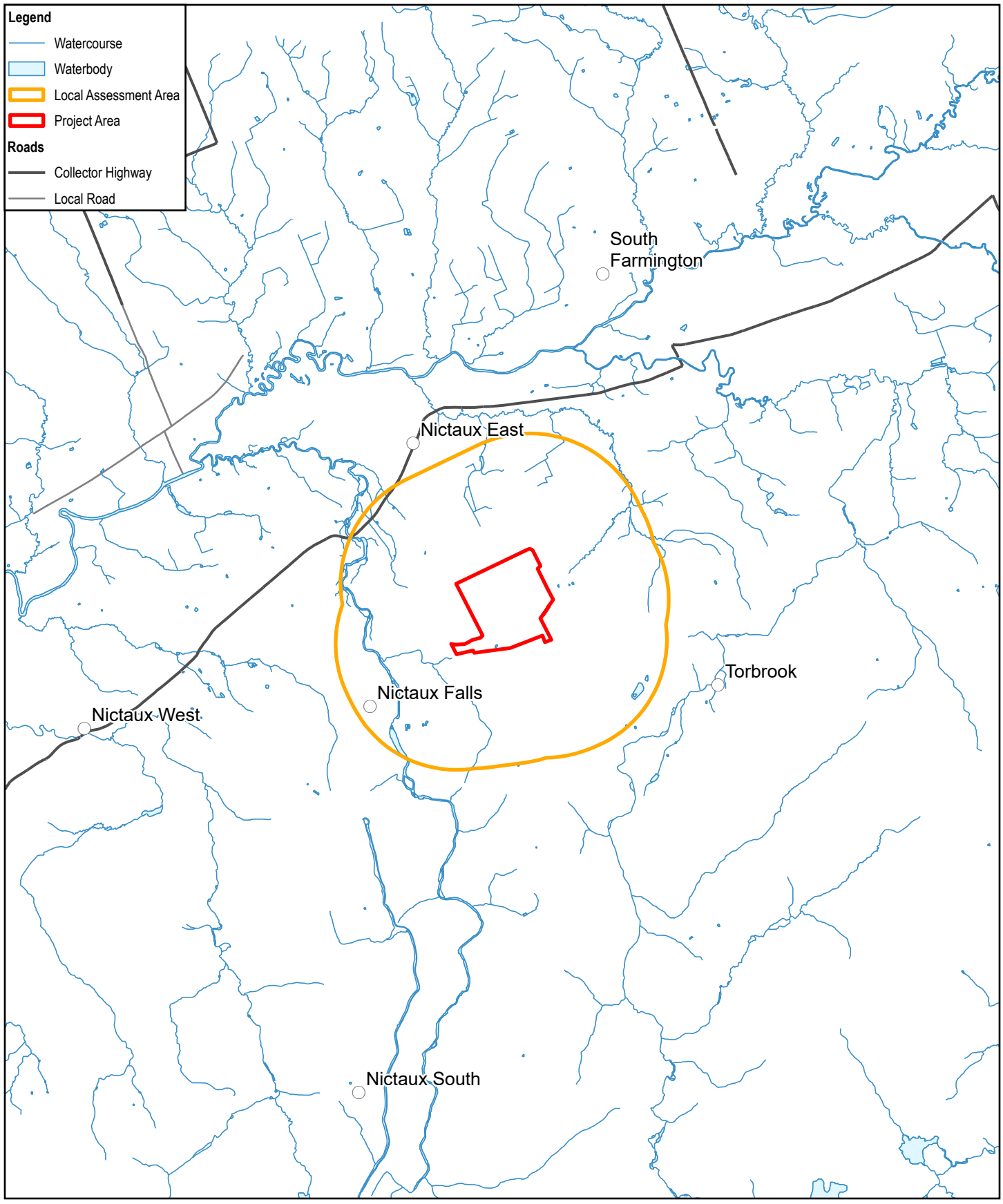
No technical boundaries were identified for the effects assessment of noise.

5.2.4.1.4 Administrative Boundaries

Guidelines enacted by NSECC (2023) identify noise limits based on acoustic environments as rural, urban residential, and industrial for any activities defined under Activities Designation Regulations made under Section 66 of the Environment Act (N.S. Reg. 329/2022) (NSECC, 2022). For the purposes of identifying noise level limits, the Project is generally considered to be located within a rural acoustic environment.

Table 5.2-3 Noise Guidelines and their respective limit range

Noise Guideline	Location	Time Period	Noise Limit
NSECC Guidelines for Environmental Noise Measurement and Assessment	Noise sensitive receptors	Day (07:00 – 19:00)	53 LA_{eq} dBA
		Evening (19:00 – 23:00)	48 LA_{eq} dBA
		Night (23:00 – 07:00)	40 LA_{eq} dBA
Reference: NSECC (2023)			



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0 650 1,300 1,950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

Project No. **12584960**
Revision No. **-**
Date **Mar, 12 2025**

SPATIAL BOUNDARIES - NOISE

FIGURE 5.2-1

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_004_SpatialBoundariesNoise
Print date: 12 Mar 2025 - 09:37

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.2.4.2 Thresholds for Determination of Significance

The characterization criteria applied to the noise effects assessment are detailed in Table 5.2-4, below.

Table 5.2-4 Characterization Criteria for Environmental Effects on Noise

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – minimal to no effect on noise associated with Project activities within the PA **L** – noise levels exceed background levels beyond the PA but comply with guidelines **M** – noise levels exceed guidelines beyond the PA but comply with guidelines at the nearest sensitive receptors (residences) **H** – noise levels exceed guidelines at residences
Geographic Extent	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**ST** – Effects are limited to occur from as little as 1 day to 12 months **MT** – Effects can occur beyond 12 months and up to seven (7) years **LT** – Effects extend beyond 7 years **P** – Effects to noise are unlikely to recover to baseline conditions
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals throughout the Project **R** – Effects occur at regular intervals throughout the Project **C** – Effects occur continuously through the Project
Reversibility	**R** – Noise will recover to baseline conditions before or after Project activities have been completed. **PR –** Mitigation cannot guarantee a return to baseline conditions **IR** – Effects to noise are permanent and will not recover to baseline conditions

A significant adverse effect to Noise from the Project is defined as:

– Repeated or sustained noise levels being emitted from Project activities that exceed NSECC Guidelines for Environmental Noise Measurement and Assessment (2023a) at residential receptors.

5.2.5 Project Interactions and Potential Effects

Potential Project interactions with noise are presented in Table 5.2-5.

Table 5.2-5 Project Activities and Noise Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction
Operation	Processing Overburden management Road maintenance Emissions and waste management
Reclamation	Demolition Earthworks

Noise impacts will result from heavy equipment and vehicle operations, and will occur during construction, operation and reclamation. The nearest structure to the Project is located approximately 760 m to the north which consists of an agricultural facility. Based on satellite imagery, the nearest residential structure is located approximately 950 m to the southwest. Given the distance to the nearest residential receptor, and the area surrounding the PA consisting of primarily undeveloped forested areas (excluding the Quality Concrete property to the east), the noise caused by Project will be low with the appropriate mitigation applied and is unlikely to impact the normal day to day life of residential properties. Recreational users may experience periodic elevated noise levels as a result of Project depending on distance from the PA.

5.2.6 Mitigation

Mitigation measures planned for the Project to ensure applicable noise guidelines are met are provided in Table 5.2-6, below.

Table 5.2-6 Noise Mitigation Measures

Project Phase	Mitigation Measure
Construction, Operation, and Reclamation	Use of properly sized equipment with reduced noise factor
	Control vehicle speeds to limit noise to a minimum
	Regular maintenance of vehicles and equipment to keep in good working condition.
	The location of the wash plant and other infrastructure will be selected to minimize noise generated for residential receptors.

5.2.7 Monitoring and Follow-up

A monitoring protocol will be implemented where Shaw will keep a clear line of communication through their Project Manager for noise complaints which will be recorded and evaluated in accordance with legislation and NSECC specific requirements. A sign will be always posted and be clearly visible indicating contact information in case of concerns. Noise monitoring will be conducted as required by NSECC.

5.2.8 Residual Effects and Significance Determination

The predicted residual effects (following mitigation) of the Project on Noise are assessed to be adverse, but not significant. The overall residual effect of the Project on Noise is assessed as not likely to have significant adverse effects after appropriate mitigation measures have been implemented as summarized in Section 5.2.6.

A significant adverse effect on the Noise VC was defined in as:

– Repeated or sustained noise levels being emitted from Project activities that exceed NSECC Guidelines for Environmental Noise Measurement and Assessment (2023a) at residential receptors.

Residual effects on noise are presented in Table 5.2-7, below.

Table 5.2-7 Residual Effects on Noise

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – clearing, grubbing and grading, road construction and water management.	Reduced speeds within the PA. Equipment and vehicle maintenance.	A	L Noise levels are not anticipated to exceed guidelines at residential receptors.	LAA	A	ST	R	R Noise will return to baseline conditions before or after Project activities have been completed	Increased ambient noise	Not significant
Operation – processing, overburden management, water management, road maintenance.	Location of Project infrastructure selected to minimize noise. Equipment and vehicle maintenance. Use of properly sized equipment with reduced noise factor	A	L Noise levels are not anticipated to exceed guidelines at residential receptors.	LAA	A	LT	R	R Noise will return to baseline conditions before or after Project activities have been completed	Increased ambient noise	Not significant
Reclamation – earthworks and revegetation.	Equipment and vehicle maintenance. Use of properly sized equipment with reduced noise factor	A	L Noise levels are not anticipated to exceed guidelines at residential receptors.	LAA	A	ST	R	R Noise will return to baseline conditions before or after Project activities have been completed	Increased ambient noise	Not significant

Legend (refer to Table 5.2-7 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	R – Reversible IR – Irreversible PR – Partially Reversible

5.3 Geology, Soil, and Sediment

5.3.1 Rationale for Valued Component Selection

Geology, soil, and sediment was selected as a VC due to the potential for sediment-laden runoff from Project activities and infrastructure to be transmitted into nearby watercourses and wetlands, as well as for fine particles to become airborne. Soil disturbance and sediment releases could increase the risk of contamination exposure to birds, wildlife, and fish through ingestion, and may negatively impact the water quality of local water bodies. Additionally, sediment releases, whether in water or the air, have the potential to be visible to stakeholders, including the general public.

5.3.2 Baseline Program Methods

As part of the baseline hydrogeological investigation completed by GHD, the characteristics of the overburden encountered during drilling were described and recorded. Baseline surface water monitoring and aquatic habitat surveys included the characterisation of sediment and substrate within watercourses within and surrounding the PA. Soil and sediment encountered during these programs were characterised according to their general composition, particle size, stratigraphy, and moisture content. In addition, a desktop review of publicly available bedrock and surficial geology mapping was completed to develop an understanding of baseline geological conditions within the PA.

5.3.3 Baseline Conditions

5.3.3.1.1 Bedrock Geology

The majority of the PA is underlain by mid to late Triassic sediments of the Wolfville Formation. The Formation is part of the Fundy Group, which is additionally comprised of the Scots Bay Formation, the North Mountain Formation, and the Blomidon Formation. The Wolfville Formation runs parallel to the basalt of the North Mountain Formation, which extends from Port Williams to Digby. The sediment of the Formation is described as being predominantly red and brown sandstones and conglomerates, deposited by fluvial activities. There are also smaller amounts of mudstones and aeolian sandstones documented (Fowell, 1995).

The Wolfville Formation has an unconformable contact along the southern PA boundary with the Kentville and White Rock Formations of the Rockville Notch Group, with the younger Kentville Formation having a conformable contact with the underlying older White Rock Formation. The Kentville Formation is comprised of interbedded slate and siltstones containing Late Silurian marine fossils, which indicate a warm, shallow marine depositional environment. The White Rock Formation is comprised of thick quartzite lenses contained within dark slate and siltstones (White, 2009).

The Project bedrock is overlain by thick glacial deposits. During the drilling programs conducted in spring 2024, boreholes were through the glacial deposits and did not encounter bedrock. Bedrock geology in the vicinity of the PA is presented on Figure 5.3-1.

5.3.3.1.2 Surficial Geology

As with the majority of Nova Scotia, the surficial geology at the PA is dominated by glacial deposits. An esker forms a sinuous ridge striking towards the west in the southern portion of the PA, with glacial outwash deposits in the northern portion. The esker and outwash sediments which would have been deposited during the last glacial event, which ended 10,000 years ago (Stea et al. 1992). The esker is composed of gravel, sand, and silt that would have been deposited in melted tunnels in historic glacial ice. The glacial outwash has a similar lithology, however it contains lesser silts and fines.

The 2024 drilling program is reflective of the expected glacial deposits, with high volumes of sand reported at all four boreholes. Fines, such as silt and clay, were reported at boreholes near the northern Project boundary. Coarser

deposits, including cobbles and granite boulders were reported at the southern property boundary, which would likely have been transported from the nearby South Mountain Batholith during a past glacial event.

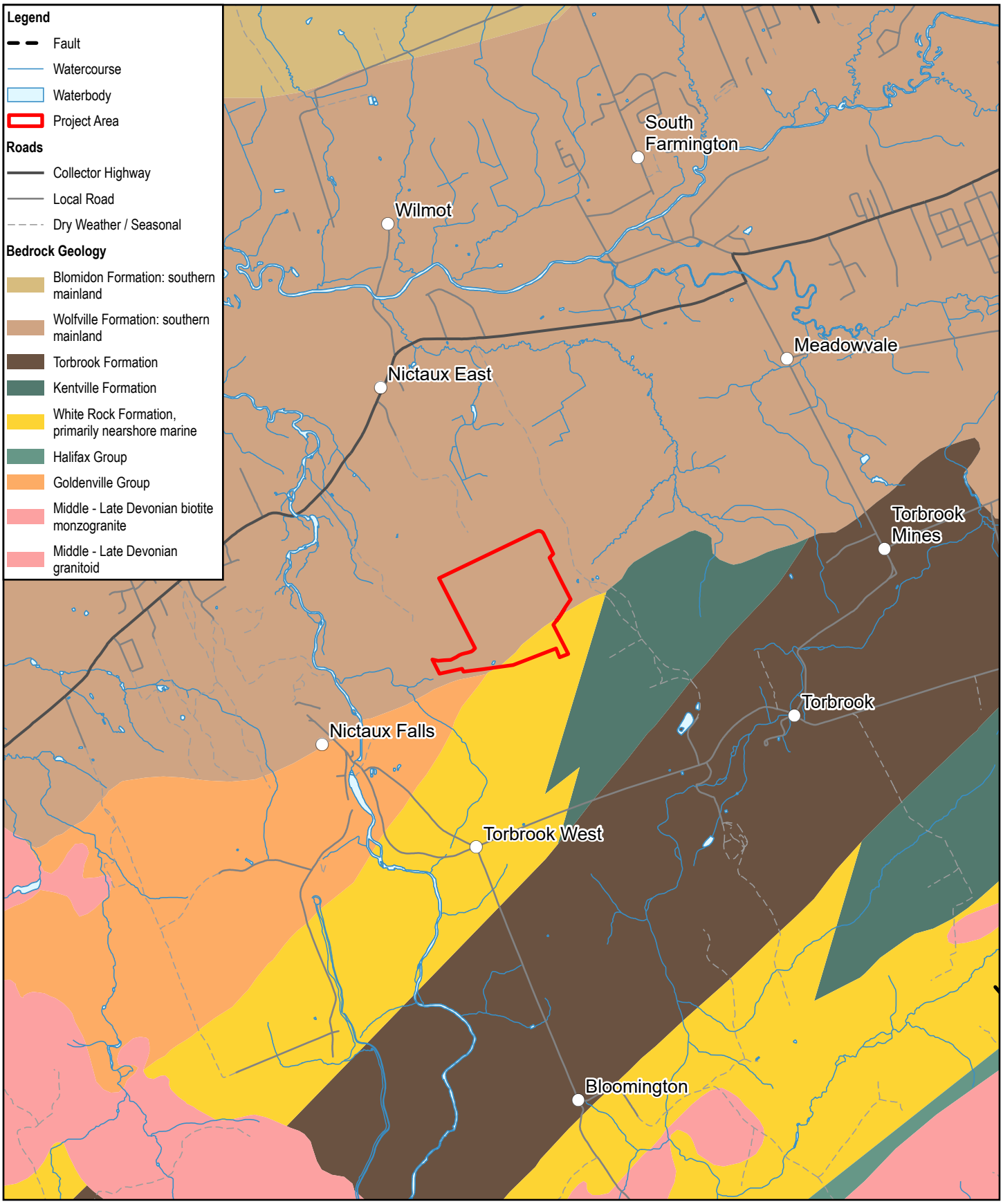
Between 1982 and 1985, the Mineral Resources Branch of NSDNRR conducted widescale till sampling and mapping over northern mainland NS with the intent of creating a georeferenced dataset of provincial till geochemistry (NSDNRR, 2006). Samples were collected at depths of 1 to 2 meters, and characterized by their sediment grain size, parent bedrock, and geochemical compositions. Of this dataset, sample T-79 393A shares the same bedrock and surficial geology features as the Project, and is geographically close to the PA. Geochemical analytical results for these samples, as provided by NSDNRR, are summarized in Table 5.3-1, below. Geochemical concentrations are measured in parts per million (ppm).

Table 5.3-1 Baseline Provincial Till Sampling Summary

Characteristic	Result
Sample ID	T-79 393A
Coordinates (UTM NAD 20)	348951.35, 4979574.8
Distance to PA (m)	7,250
Sample Depth (m)	2
Arsenic (ppm)	7
Barium (ppm)	0
Cadmium (ppm)	0.1
Calcium (ppm)	1900
Cobalt (ppm)	16
Copper (ppm)	32
Iron (ppm)	4.6
Lead (ppm)	18
Magnesium (ppm)	18800
Manganese (ppm)	970
Mercury (ppm)	0
Molybdenum (ppm)	1
Nickel (ppm)	30
Silver (ppm)	0.05
Tin (ppm)	10
Tungsten (ppm)	70
Uranium (ppm)	0.8
Zinc (ppm)	68

While till geochemistry may be influenced by local bedrock, it is typically predominantly sourced by parent material being removed and transported during glacial periods.

Surficial geology in the vicinity of the PA is presented on Figure 5.3-2.



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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NICTAUX SAND PIT EXPANSION PROJECT

Project No. **12584960**
Revision No. **-**
Date **Mar, 11 2025**

BEDROCK GEOLOGY

FIGURE 5.3-1

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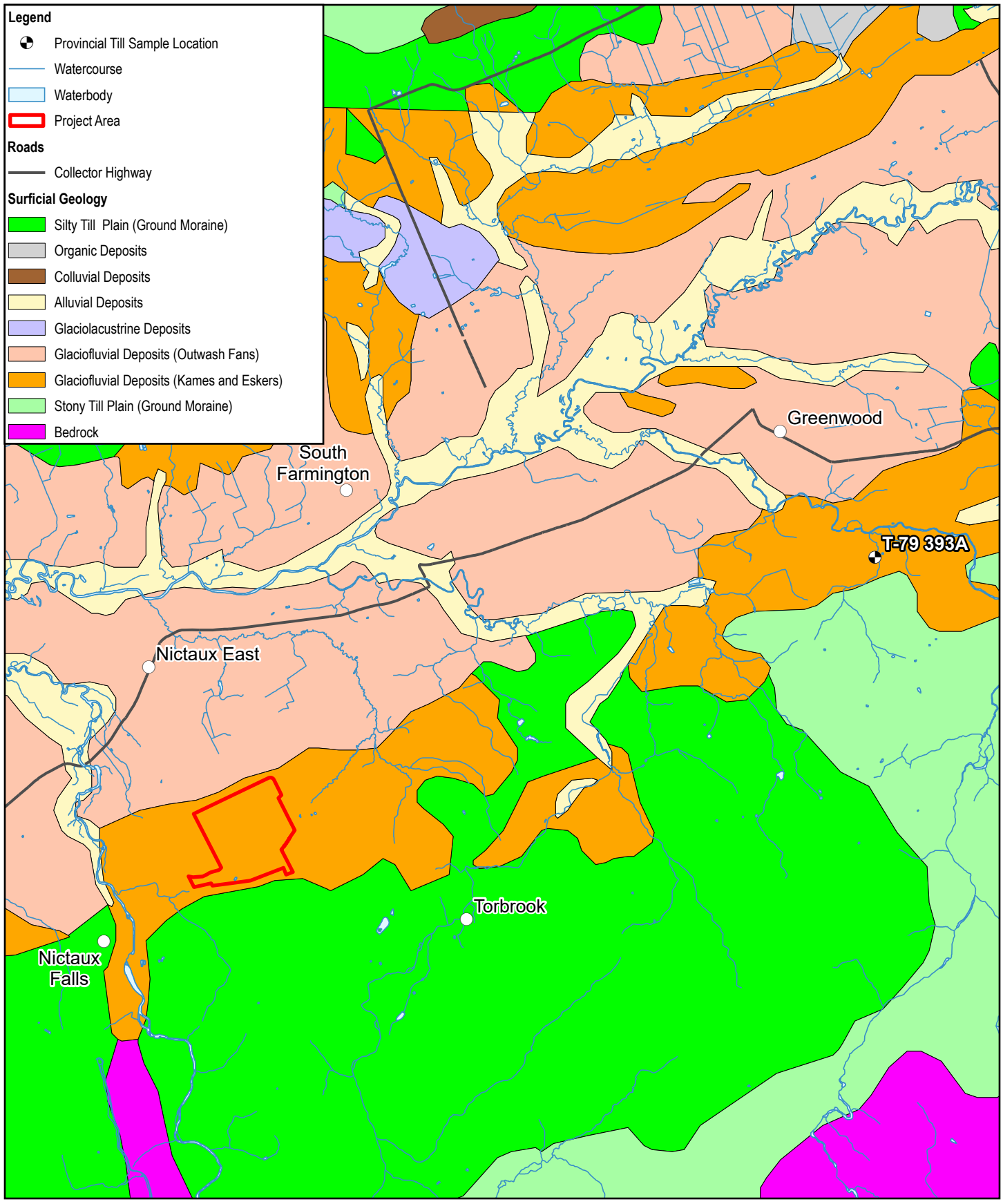
Attribution: GeoNova, GHD, DP ME 43, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 2000-1, Geological Map of the Province of Nova Scotia, Scale 1:500 000, Compiled by J. D. Keppie, 2000. Created by: mmize



Paper Size ANSI B

0 650 1,300 1,950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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SURFICIAL GEOLOGY

FIGURE 5.3-2

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Print date: 11 Mar 2025 - 14:19

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.3.3.1.3 Topography

The topography within the PA is dominated by the presence of the esker in the southern portion of PA. Elevation within the PA ranges from approximately 71 masl at the peak of the esker, to 30 masl at the northern boundary. Surface drainage occurs radially off the central high to streams and wetlands located off-site. General drainage occurs to the west, towards the adjacent Nictaux River. At a regional scale, the Project is located within the Annapolis Valley, which is banked by the North and South Mountains.

5.3.3.1.4 Soils

Soils within the PA are mapped as part of the Canning Soil Series, which are defined as being very coarse, rapidly draining, and strongly acidic (MacDougall and Nowland, 1972). The Canning Soil Series is associated with soil types ST1 and ST15, both of which are associated with coarse textured, sandy, dry soils which have a poor ability to retain moisture and nutrients. Generally, soil types ST1 and ST15 have poor fertility and can be prone to drought. Where soil types are heavily influenced by parent rock material, the coarse sands of the local glacial till are likely a contributor to the rapid drainage characteristics of the Project soil.

Field data from the 2024 drilling program documents sand being present directly below the ground surface, which aligns with the provincial soil mapping data.

5.3.3.1.5 Palaeontology

While graptolite fossils have been documented in the White Rock Formation (White, 2009), graptolites are not considered to be of paleontological significance, and Project activities are not anticipated to contact the bedrock.

There is low potential of finding palaeontological features within the PA during Project activities.

5.3.3.1.6 Acid Rock Drainage

Metal Leaching and Acid Rock Drainage (ML/ARD) occurs when naturally occurring sulphide minerals in rock and overburden are exposed to oxygen and water, resulting in sulphide mineral oxidation. This reaction produces iron-oxides, sulphide minerals, and sulphuric acid which are released into contact water. The acidic runoff can mobilize metals including iron, arsenic, manganese, and copper from the surrounding bedrock, releasing them into the environment.

Sulphide-bearing minerals, such as pyrite, are commonly found in slates and shales. The Kentville Formation, present in the southern portion of the PA, additionally has a locality near New Minas, NS. While the locality near New Minas is documented to be rich with pyritic slate, the Kentville Formation found within the PA has not been found to contain pyrite.

Remediation for ML/ARD include chemical treatments such as lime dosing, and passive treatments which limit the extent of ML/ARD dispersion such as revegetation measures and sand coverage. The use of sand coverage reduces oxygen and water dispersion, therefore minimizing sulphide oxidation rates (Plaza et al, 2018).

Project development is limited to the glacial deposit overburden, which is composed of dense sands and gravels. The glacial deposits are not composed of sulphide bearing material and instead act as a buffer for potential ML/ARD generation. ML/ARD is not considered to be at risk of occurring at the Project.

5.3.4 Effects Assessment Methods

5.3.4.1 Boundaries

5.3.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on geology, soil, and sediment are defined below and are shown on Figure 5.3-3.

- The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
- The LAA encompasses the 1DC-3-EE tertiary watershed, and a portion of the 1DC-3-CC tertiary watershed. The 1DC-3-EE watershed drains directly to the Annapolis River, while the 1DC-3-CC contains the Nictaux River which then drains to the Annapolis River. Watersheds were selected as the LAA as watercourses are a potential receiving environment for sediment.
- The RAA encompasses the 1DC-3-DD, 1DC-3-EE, 1DC-3-FF, and 1DC-3-HH watersheds, and portions of the 1DC-3GG and 1DC-3-CC watersheds extending to the contact with the granitoid South Mountain Batholith. These watersheds encompass all bedrock types found in and directly adjacent to the Project and contains both the Nictaux and Annapolis Rivers.

As the Project has the potential to cause direct and indirect impacts to geology, soil, and sediment outside of the PA, the LAA is considered the most appropriate spatial boundary for this assessment.

5.3.4.1.2 Temporal Boundaries

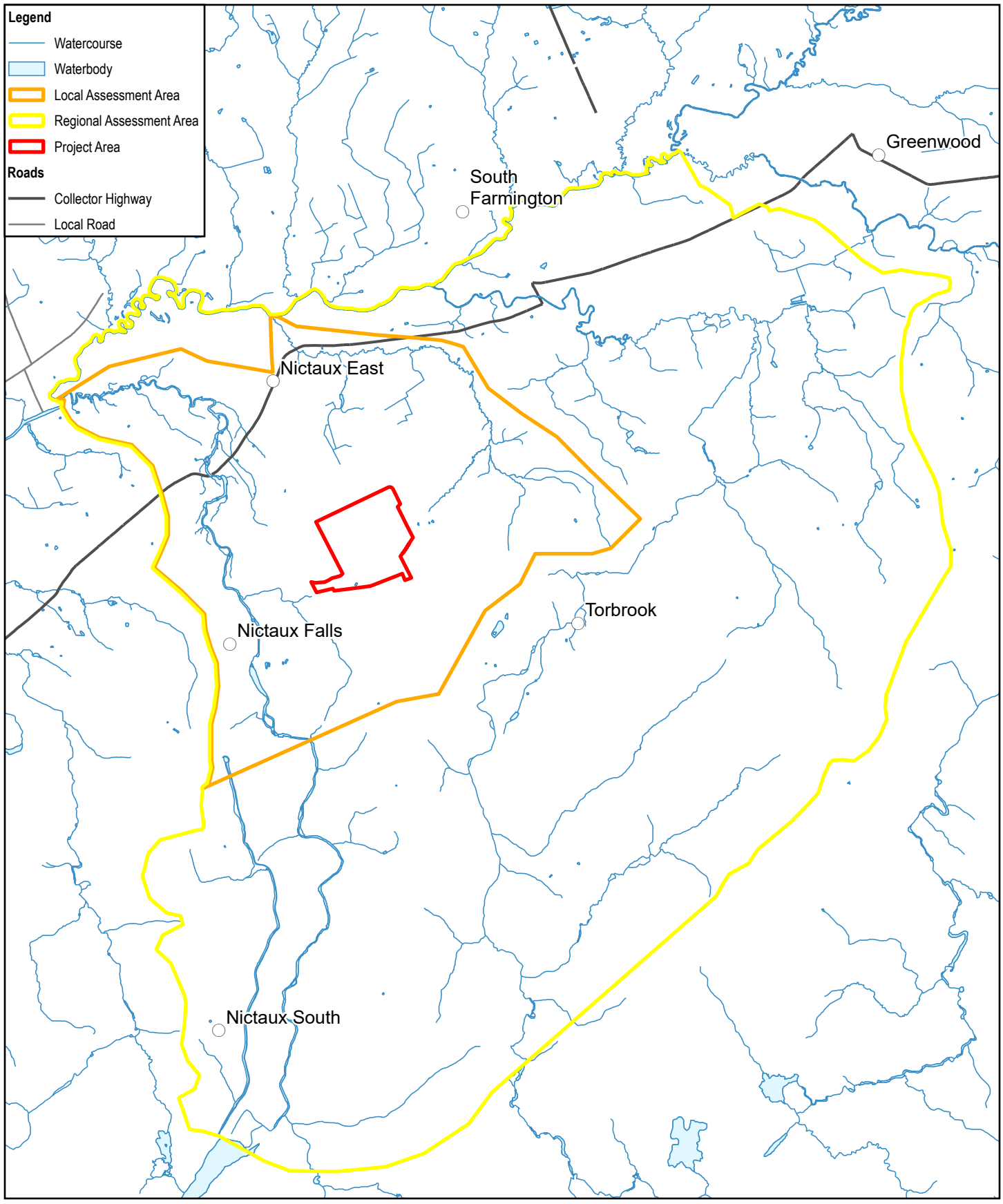
The temporal boundaries used for the assessment of effects of the Project includes the construction, operation, and reclamation phases.

5.3.4.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of geology, soil, and sediment.

5.3.4.1.4 Administrative Boundaries

There are no regulatory conditions regarding geology. Should ML/ARD monitoring be undertaken in the future, monitoring and sampling procedures will follow the criteria outlined in the *Sulphide Bearing Material Disposal Regulations.*



Paper Size ANSI B

0 650 1,300 1,950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

SPATIAL BOUNDARIES
GEOLOGY, SOIL, SEDIMENT

Project No. **12584960**
Revision No. **-**
Date **Mar, 11 2025**

FIGURE 5.3-3

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_007_SpatialBoundaries
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Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.3.4.2 Thresholds for Determination of Significance

There are no regulated or proposed thresholds for geology for the Project. The characterization criteria applied in the geology, soil and sediment quality effects assessment are detailed in Table 5.3-2, below.

Table 5.3-2 Characterization Criteria for Environmental Effects on Geology, Soil, and Sediment Quality

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – minimal sediment and erosion potential associated with Project activities within the PA **L** – potential for sediment and erosion within a small, isolated area of the PA **M** – potential for sediment and erosion within the PA, and the potential for sediment to enter a sensitive habitat (i.e. wetland or watercourse) **H** – potential for sediment and erosion within the PA with effects at the LAA
Geographic Extent	**PA** – Residual environmental effects from Project activities occur within the PA **LAA** – Residual environmental effects from Project activities occur beyond the PA within the LAA **RAA** – Residual environmental effects from Project activities occur beyond the PA and LAA within the RAA
Timing	**N/A** – seasonal aspects are unlikely to affect geology, soils, or sediments **A** – seasonal aspects may affect geology, soils, or sediments
Duration	**ST** – Effects are limited to occur from as little as 1 day to 12 months **MT** – Effects can occur beyond 12 months and up to 3 years **LT** – Effects extend beyond 3 years **P** – Effects to geology, soils, and sediment are unlikely to recover to baseline conditions
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals throughout the Project **R** – Effects occur at regular intervals throughout the Project **C** – Effects occur continuously through the Project
Reversibility	**R** – Geology, soils, or sediments will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to geology, soils, or sediments are permanent and will not recover to baseline conditions

A significant adverse effect to geology, soil, and sediment is defined as:

– A Project-related effect of high magnitude, potential for regional geographic extent and for medium to long term duration, occurring at any frequency, and is partially reversible to irreversible.

5.3.5 Project Interactions and Potential Effects

Potential Project interactions with geology, soil, and sediment are presented in Table 5.3-3, below.

Table 5.3-3 Project Activities and Geology, Soils, and Sediment Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management

Table 5.3-3 Project Activities and Geology, Soils, and Sediment Interactions

Project Phase	Relevant Project Activity
	Water management Road maintenance Emissions and waste management
Reclamation	Demolition Earthworks Water management

Given the coarse-grained nature of the sand deposits and subsequent high degree of till drainage, surface water runoff from rainfall events leaving the PA is anticipated to be minimal as precipitation will filtrate downwards through the substrate instead of exiting the PA. Furthermore, surface water runoff accumulated within the pit will be directed to settling ponds for removal of TSS prior to discharge to the environment. Therefore, erosion potential as a result of rain events is considered low.

ML/ARD is not expected to be an issue at this Project based on the restricted depth of Project activities and bedrock geochemistry.

No paleontological specimens or pre-historic remains have been reported on or near the PA and none are expected to be found. As such, potential impacts are expected to be negligible with the appropriate mitigation applied.

With appropriate mitigation measures implemented, Project related impacts related to geology, soil and sediment quality are anticipated to be negligible.

5.3.6 Mitigation

Project mitigation measures protective of geology, soil, and sediment are detailed in Table 5.3-4 below.

Table 5.3-4 Geology, Soil, and Sediment Mitigation Measures

Project Phase	Mitigation Measure
Construction	Minimize disturbed areas to the extent practical
	Erosion and sediment control measures will be established and detailed in an ESC Plan, completed, and submitted as part of the IA application.
	Disturbed areas will be monitored to ensure erosion and sediment control measures are maintained / effective and to identify if additional mitigation is required.
	Topsoil material will be separated and stockpiled separately during clearing and stripping activities. Material cleared will be stockpiled separately for use during progressive reclamation and reclamation activities
	Sediment control fences will be installed, as required, in areas (e.g., slopes and embankments) where organic material and till have the potential for erosion and siltation to occur. Sediment control fences will be inspected and maintained until the disturbed areas have stabilized and revegetation has occurred.
	Progressive reclamation practices will be enacted to minimize and stabilize disturbed areas.
Operation	Surfaces of stockpiles (i.e., organic, overburden, etc.) will be stabilized via vegetating or covering exposed surfaces if there are extended periods of time between use
	Precipitation runoff from stockpiles, and disturbed areas for Project activities will be collected and directed to associated water management infrastructure.
	Water management infrastructure will be designed to reduce erosion and sedimentation and will be inspected regularly to ensure it is maintained and functioning adequately.

Table 5.3-4 Geology, Soil, and Sediment Mitigation Measures

Project Phase	Mitigation Measure
	Mitigation measures outlined in the ESC Plan will be adhered to and maintained.

Progressive reclamation will restore the land for a use that is approved by various Proponents and regulators. Soil stockpiles will be allowed to naturally revegetate, aiding in reduction of dust generation and erosion potential. Stockpiled overburden will be stored at appropriate angles to ensure stability. Although acid generating bedrock is not anticipated to be contacted during Project operation, any interactions if encountered will be conducted in compliance with the *Sulphide Bearing Material Disposal Regulations*. Sedimentation and erosion control measures will be used to prevent erodible soils and materials from entering surface water bodies. A minimum thirty (30) metre (m) buffers will be maintained between areas of disturbance and any wetlands and watercourses.

5.3.7 Monitoring and Follow-up

The effectiveness of erosion and sediment control measures will be monitored as described in the ESC Plan, which will be developed and submitted as part of the IA application. Watercourse receptors will be monitored on a regular basis for TSS concentrations, as to identify potential sedimentation activities. Monitoring of surface water is further discussed in Section 5.5. Similarly, if requested by the NSECC, a Fugitive Dust Management Plan will be created and will detail the monitoring and management of airborne particulates, including sediments released by Project activities. Air quality is further discussed in Section 5.1. Results of monitoring programs will be provided to NSECC in annual environmental monitoring reports, as required by IA conditions.

5.3.8 Residual Effects and Significance Determination

Residual effects of the Project on geology, soil and sediment are anticipated to be adverse, but not significant. After appropriate mitigation measures have been implemented, the overall residual effect of the Project on geology, soil and sediment is assessed as not likely to have a significant adverse effect, as summarized in Table 5.3-5, below. A significant adverse effect on the geology, soil and sediment VC was defined in Section 5.3.4 as:

– A Project-related effect of high magnitude, potential for regional geographic extent and for medium to long term duration, occurring at any frequency, and is partially reversible to irreversible.

Residual effects resulting from sediment releases via waterbodies are further addressed in the Surface Water Resources VC (Section 5.5).

Table 5.3-5 Residual Effects on Geology, Soil, and Sediment

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, Operation, and Reclamation – Release of sediment laden runoff to sensitive receptors (watercourses and wetlands)	Water management infrastructure Erosion and sediment controls and inspections Ongoing revegetation reclamation of stockpiles	A	M	LAA	N/A	LT Potential for sediment releases during all phases of the Project	S	PR	Watercourse sedimentation	With the implementation of proper mitigations, effects are anticipated to not be significant
Construction, Operation, and Reclamation – Airborne mobilization of fine sediments	Erosion and sediment controls and inspections Fugitive dust management	A	M	LAA	N/A	LT Potential for airborne mobilization during all phases of the Project	S	PR	Reduced air quality	With the implementation of proper mitigations, effects are anticipated to not be significant
Legend (refer to Table 5.3-5 for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area		Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility R – Reversible IR – Irreversible PR – Partially Reversible			

5.4 Groundwater Resources

5.4.1 Rationale for Valued Component Selection

Groundwater resources were selected as a VC for its significance to ecological, and socioeconomic systems. Groundwater resources provide ecological value by supporting surface water flows and wetlands providing habitat for aquatic and terrestrial species that rely on accessible water sources for their survival. Socially and economically, groundwater resources can provide a source of water, potable or otherwise, to municipal, agricultural, industrial, and recreation sectors, among others. Groundwater quantity and/or quality may be changed due to the activities associated with Project construction, operation, and reclamation. Groundwater quality is provincially regulated via many legislative avenues within the NS *Environment Act* and several of its regulations. The regulations are protective of ecological receptors, as well as the health of the general public.

5.4.2 Baseline Program Methods

5.4.2.1 Desktop Review

GHD reviewed historical and recent data to develop an understanding of the regional and Project-specific hydrologic, geologic, and hydrogeologic conditions. Reviewed publicly available data included surficial and geologic mapping developed for NS, climate data, and the NS Well Logs Database (NSECC, nd). The Well Logs Database identified water supply wells and private wells located within or in the vicinity of the PA. The NS Well Logs Database also provided information on geologic conditions, groundwater elevations, and well yields.

5.4.2.2 Monitoring Well Installation

Logan Drilling and Geotechnical (Logan) was retained by GHD to drill and complete four boreholes as monitoring wells using a CME-75 track-mounted drill rig. The field investigation was conducted between March 19 and March 27, 2024, under the full-time supervision of qualified GHD field staff.

Logan advanced four boreholes to depths ranging from 9.10 metres below ground surface (mbgs) at MW-05 to 30.50 mbgs at MW-07, completing each as a monitoring well. Hollow stem and standard augers were used to drill through the overburden, which was characterized using split-spoon samplers. Wet rotary drilling methods were employed to advance the boreholes through bedrock, during which HQ 2.5” core samples were collected and logged by GHD staff.

Each monitoring well was constructed using a 50 mm diameter polyvinyl chloride (PVC) 20-slot screen, connected to a flush-threaded PVC riser. The annular space between the well screen and the borehole wall was backfilled with #2 silica sand to a height of 0.6 m above the well screen. This was followed by a seal of hydrated bentonite pellets approximately 1 m in thickness to prevent surface intrusion, and the remaining space was filled with silica sand to the ground surface. The top of each well was secured with a locking J-plug and protected by an above-ground protective cover.

Following installation, each monitoring well was developed and purged of at least three well volumes, or until the well ran dry. Additionally, Levelogger transducers (Solinst™) with built-in dataloggers were installed at a depth of 0.5-1.0 m above the bottom of each well to record water levels automatically at 15-minute intervals. A Barologger (Solinst™), installed near MW-05, was used to account for the effects of atmospheric pressure on water level data.

Well locations and available installation data are provided in Table 5.4-1, below. Locations of groundwater wells are additionally provided on Figure 5.4-1. Monitoring wells were positioned to provide spatial coverage surrounding the proposed pit areas and to allow monitoring of potential changes to groundwater quality and

quantity at locations between the pit and adjacent receptors, including domestic water wells, watercourses, and wetlands.

Table 5.4-1 Geology, Soil, and Sediment Mitigation Measures Monitoring Well Installation Details

Monitoring Well ID Monitoring Well ID	Coordinates		Recorded Drilled Depth (mbgs[1])	Screen Interval (mbgs)	Reference Elevation (masl[2])
	Northing (NAD 83 UTM Z20) (m)	Easting (NAD 83 UTM Z20) (m)			
MW-04	4975835.5	341233.9	10.70	2.40-10.90	49.224
MW-05	4976847	340796.3	9.10	2.10-9.10	31.944
MW-06	4976873.6	341523.1	9.10	2.10-9.10	36.203
MW-07	4976399.6	341496.5	30.50	6.10- 30.50	60.94

Notes
[1] mbgs – meters below ground surface
[2] masl – meters above sea-level

Five existing monitoring wells (MW-01, MW-02, MW-03, MW-08, and MW09) were previously installed by Ivan H. Trimper Construction Ltd. and Quality Concrete Inc. and were included in this monitoring program to provide a more fulsome understanding of baseline groundwater conditions in the PA.

The detailed methodology for monitoring well installation, development, hydraulic conductivity testing, monitoring, and sampling is presented the Hydrogeological Investigation Report in Appendix C. The methodology for hydraulic conductivity testing, groundwater elevation monitoring and sampling is briefly summarized in the sections that follow.

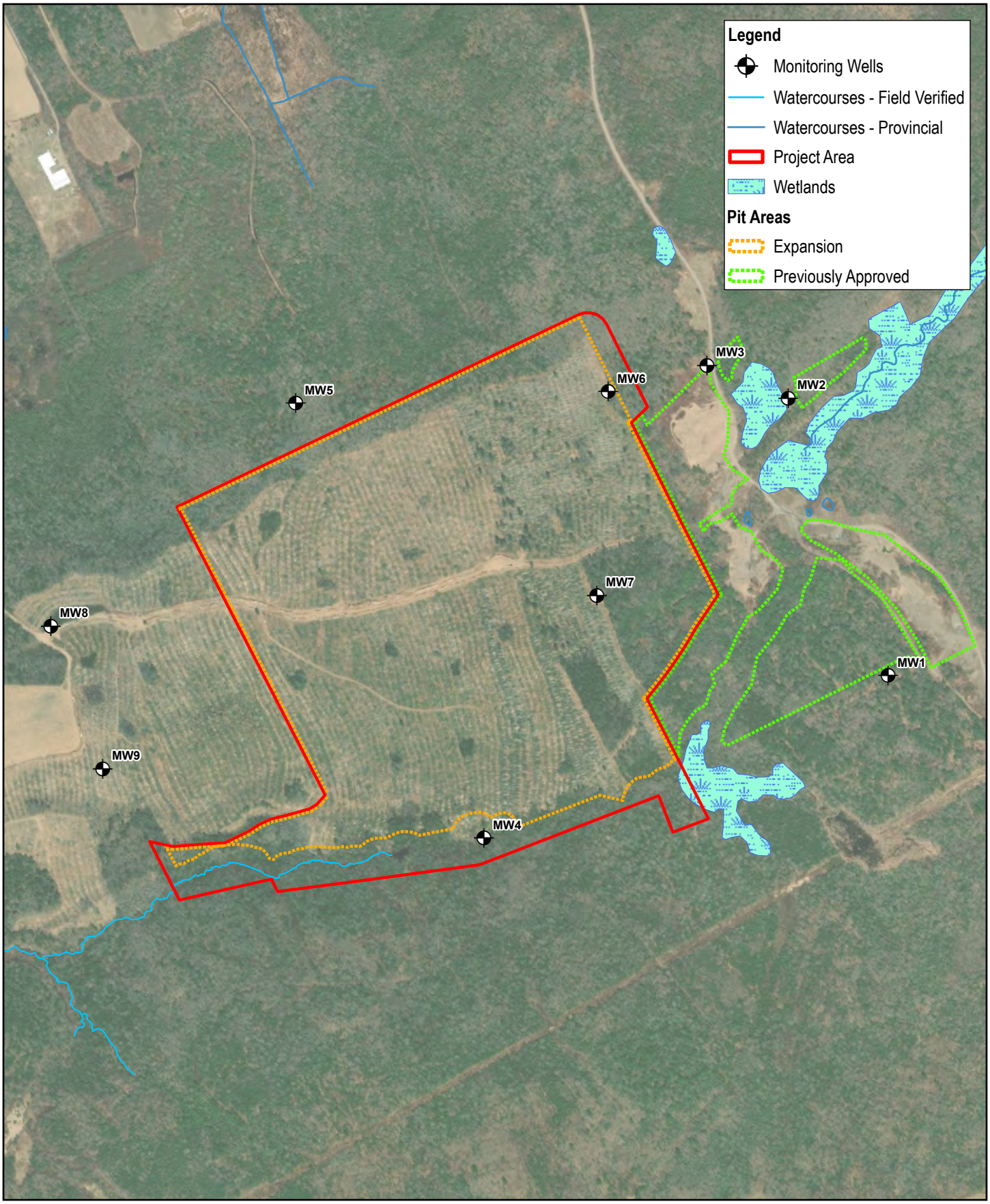
5.4.2.3 Hydraulic Conductivity Testing

Falling head and rising head slug tests were completed in monitoring well MW-05 on November 8, 2024. The tests were completed by inserting a solid slug into the well below the water level, causing an almost instantaneous rise in the water level in the well. The rate of the water level falling back to the static water level was recorded using a pressure transducer. The process was then repeated when the slug was removed, providing an instantaneous drop in the water level followed by a slower recovery period. Barometric pressure was simultaneously recorded using a SolinstTM Barologger datalogger. The purpose of the slug tests was to estimate hydraulic conductivities of the overburden and bedrock underlying the PA.

Continuous water level measurements, recorded at 1-second intervals using a pressure transducer, were analysed using the AQTESOLV© (v. 4.01) software. GHD used monitoring well/borehole specific data along with time-displacement data collected during the slug test with the Bouwer-Rice (1976) solution for unconfined and confined aquifers to estimate hydraulic conductivity values for each test.

5.4.2.4 Groundwater Elevation Monitoring

Static water levels were first collected manually when the newly constructed well was finished using an electric Solinist™, Model 101 P7 water level meter, by qualified GHD personnel. Static water level was then measured at every well in the monitoring program in the subsequent monitoring programs. Transducers (Solinst™ Levelogger with a built-in datalogger) were installed at Trimper's historic wells to continuously monitors water level at a similar frequency as the newly built wells.



Scale 1:12000

0 120 240 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

Project No. **12584960**
Revision No. **-**
Date **Mar 11, 2025**

MONITORING WELL LOCATIONS

FIGURE 5.4-1

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Data source: NSECC, GeoNova World Imagery: Maxar; Province of Nova Scotia; GHD, 2024. Created by: mmize

5.4.2.5 Groundwater Quality Sampling

GHD collected groundwater samples over three events through 2024. In August 2024, the groundwater monitoring program was expanded to include monitoring wells on the Trimper property. Two rounds of samples were collected from the wells on the Trimper property. Sampled wells and dates are provided in Table 5.4-2, below.

Table 5.4-2 2024 Baseline Groundwater Quality Sample Collection Schedule

Date	MW-01	MW-02	MW-03	MW-04	MW-05	MW-06	MW-07	MW-08	MW-09
March 21, 2024	-	-	-	X	X	-	-	-	-
March 27, 2024	-	-	-	-	-	X	X	-	-
August 28-29, 2024	X	X	X	X	X	X	Dry	X	X
October 30-31, 2024	X	X	X	X	X	Insufficient water volume	Dry	X	X

Note: - indicates monitoring well was not sampled as it was not yet added to the monitoring program

Prior to collecting groundwater samples, static water levels were measured in each monitoring well, and all wells were purged. GHD purged a minimum of three well volumes from each well while monitoring chemical parameters such as temperature, pH, conductivity, turbidity, and dissolved oxygen. These parameters were measured during purging until stabilization was achieved or until the well ran dry.

Before collecting groundwater samples, the water level in each well was allowed to recover to its approximate static level. Monitoring wells were developed using polyethylene Waterra tubing fitted with foot valves. Groundwater samples were subsequently collected using dedicated disposable bailers to minimize sediment accumulation in the sample bottles. Samples collected for dissolved metals analysis were filtered either in the field using a syringe with a 0.45-micrometre (µm) filter or with dedicated Waterra tubing and an in-line filter.

Groundwater samples were placed directly into new laboratory-supplied sample bottles and immediately transferred into coolers containing ice to maintain a temperature of <10°C. Samples were stored under cool conditions until delivery to Bureau Veritas Laboratory (BV Labs) in Bedford, Nova Scotia. The laboratory is accredited by the Standards Council of Canada and the Canadian Association for Laboratory Accreditation Inc. Analytical methods used during testing are referenced in the chain-of-custody (COC) records included in the Hydrogeological Investigation Report (Appendix C). All groundwater quality samples collected were analysed for general chemistry and dissolved metals.

5.4.3 Baseline Conditions

This section provides a summary of the existing or baseline conditions for groundwater resources (i.e., groundwater quantity and quality) based on a review of publicly available regional and Project-specific hydrologic, geologic, and hydrogeologic information and Project-specific hydrogeologic investigations. Detailed drilling, monitoring well installation details groundwater levels and groundwater quality monitoring results from the 2024 hydrogeologic investigations is presented in the Hydrogeological Investigation Report provided in Appendix C.

5.4.3.1 Hydrologic Conditions

The hydrologic conditions are affected by regional physiography, topography, and surface water features. Section 5.3.3 (Geology, Soils, and Sediment) provides a detailed description of the Project physiography and topography. Section 5.5 (Surface Water) provides a detailed description the Project surface water features. In general, the physiographic area containing the Project is characterized by gentle rolling hills and meandering

rivers contained within the wide historic river valley. Regional surface water drainage is predominantly to the northwest towards the Nictaux River and the Annapolis River. The Project is bisected by two unnamed tertiary watersheds (1DC-3-CC and 1DC-3-EE), both of which are contained within the Annapolis River secondary watershed.

5.4.3.2 Hydrogeologic Conditions

The hydrogeological regime within the PA can be characterized as two separate systems located within the overburden and bedrock layers. The degree of interaction between the two systems is highly dependent on the topography and local surficial and bedrock geology. Within overburden, groundwater movement is between the individual soil grains and moves under gradients controlled by topography. In the deeper bedrock aquifers, groundwater flow is dependent upon bedrock types, the degree to which fractures and voids within the strata are connected, and the hydraulic head differences between these openings.

Hydrogeologic characterization of NS Groundwater Regions (Kennedy, 2009) provides an indication of the bedrock groundwater regions based on dominant rock types and the chemistry of wells throughout the province. The Project overlies the boundaries of two separate bedrock groundwater regions – a sedimentary and a metamorphic groundwater region. Groundwater moves more readily through the looser sediment of the surficial glacial deposits than through bedrock. As a result, surficial aquifers occasionally form within surficial deposits, constrained by decreased porosity of the bedrock below. According to the provincial groundwater Atlas, the nearest surficial aquifer to the Project (surficial aquifer ID 49) is located approximately 1 km to the east.

Collected groundwater elevation measurements help provide an understanding of groundwater flow conditions within the PA. Groundwater elevations have been collected by GHD since 2024 at nine monitoring well locations. In 2024, the depth to groundwater ranged from 1.20 metres below top of riser (mbtr) (MW-04, March 20, 2024) to 25.546 mbtr (MW-07, March 20, 2024), with most of the static water levels ranging from approximately 3.0 – 6.0 mbtr. Monitoring wells MW-02 and MW-07 were both dry in October 2024, with MW-07 additionally being dry in August 2024. Groundwater elevations measured in 2024 are presented in Table 5.4-3.

Table 5.4-3 2024 Groundwater Elevation Data

Well ID	Date	Top of Casing Reference Elevation (masl)	Static Water Level (mbtr)	Groundwater Elevation (masl)
MW-01	28-Aug-24	52.03	3.732	48.298
	30-Oct-24		3.905	48.125
MW-02	28-Aug-24	30.40	3.691	26.709
	30-Oct-24		3.916	26.484
MW-03	28-Aug-24	31.49	4.269	27.221
	30-Oct-24		4.536	26.954
MW-04	26-Apr-24	50.145	2.334	47.811
	28-Aug-24		3.732	46.413
	30-Oct-24		4.368	45.777
MW-05	26-Apr-24	32.74	4.56	28.18
	28-Aug-24		5.426	27.314
	30-Oct-24		5.764	26.976

Table 5.4-3 2024 Groundwater Elevation Data

Well ID	Date	Top of Casing Reference Elevation (masl)	Static Water Level (mbtr)	Groundwater Elevation (masl)
MW-06	26-Apr-24	37.17	9.26	27.909
	28-Aug-24		9.875	27.294
	30-Oct-24		10.102	27.067
MW-07	27-Mar-24	61.66	25.546	36.116
	28-Aug-24		Dry	Dry
	30-Oct-24		Dry	Dry
MW-08	28-Aug-24	35.81	10.131	25.679
	30-Oct-24		10.566	25.244
MW-09	28-Aug-24	32.13	4.869	27.261
	30-Oct-24		5.427	26.703

Notes:
Groundwater Elevation = Reference Elevation - Static Water Level
masl - metres above sea level
mbtr - metres below top of riser

Based on the findings of the groundwater quality monitoring program, the groundwater table within the PA is influenced by local topography, with the highest groundwater elevation recorded adjacent to the esker in the south of the PA. This indicates that groundwater flows radially off the esker towards areas of lower topography, eventually feeding local surface water bodies and wetlands.

5.4.3.3 Hydraulic Conductivity

The results of the single well response tests were used to determine the hydraulic conductivity (K) for monitoring well MW-05. The hydraulic conductivity values, summarized below in Table 5, are consistent with silty sand and clean sand (Freeze and Cherry, 1979), which aligns with both the MW-05 borehole log stratigraphy and the understanding of local surficial geology. The results of the tests are presented in the Hydrogeological Investigation Report (Appendix C) and are summarized in Table 5.4-4.

Table 5.4-4 Single Well Response Test Data

Well	Falling Head	Rising Head	Geometric Mean
	(m/sec)	(m/sec)	(m/sec)
MW-05	4.0×10^{-5}	4.2×10^{-5}	4.1×10^{-5}

5.4.3.4 Groundwater Quality Results

GHD collected a total of 22 groundwater samples (including three field duplicates) from nine monitoring wells in the PA during baseline groundwater monitoring conducted in 2024.

The groundwater analytical results were compared to Health Canada Guidelines for Canadian Drinking Water Quality Guidelines (CDWQG) [Maximum Allowable Concentration (MAC) and Aesthetic Objective (AO)], NS Tier I Environmental Quality Standards (EQS); Potable Groundwater (Industrial, Coarse) and NS Pathway Specific Standards (PSS) for groundwater; groundwater discharge to surface water (0-10 m from a freshwater body). All parameters were within the applicable limits with the exception of those shown in Table 5.4-5, below.

Table 5.4-5 Groundwater Quality Exceedances

Well ID	Date	CDWQ; MAC	CDWQ; AO	NS Tier 1 EQS	NS Tier 2 PSS;
MW-01	August 29, 2024	Arsenic	--	Arsenic	--
	October 31, 2024	Arsenic	--	Arsenic	--
MW-02	August 29, 2024	--	pH Manganese	--	--
	October 31, 2024	--	pH Manganese	--	--
MW-03	August 29, 2024	--	pH	--	--
	October 31, 2024	--	pH	--	--
DUP-A (FD of MW-03)	October 31, 2024	--	pH	--	--
MW-04	March 21, 2024	--	pH	--	--
	August 29, 2024	Manganese	Manganese	--	--
	October 31, 2024	Manganese	Manganese	Cobalt Manganese	--
MW-05	March 21, 2024	--	pH Manganese	--	--
	August 29, 2024	--	pH Manganese	--	--
	October 31, 2024	--	pH Manganese	--	--
DUP-A (FD of MW-05)	March 21, 2024	--	pH Manganese	--	--
MW-06	March 27, 2024	Manganese	Colour Aluminum Iron	Aluminum Manganese	Aluminum Copper
	August 29, 2024	Manganese	Iron	Manganese	Aluminum Copper
MW-07	March 27, 2024	Manganese	Colour Aluminum Iron Manganese	Aluminum Manganese Molybdenum	Aluminum
MW-08	August 29, 2024	Manganese	Manganese	Manganese	--
	October 31, 2024	--	Manganese	--	--
DUP-A (FD of MW-08)	August 29, 2024	Manganese	Manganese	Manganese	--

Table 5.4-5 Groundwater Quality Exceedances

Well ID	Date	CDWQ; MAC	CDWQ; AO	NS Tier 1 EQS	NS Tier 2 PSS;
MW-09	August 29, 2024	--	--	--	--
	October 31, 2024	--	--	--	--

Notes:

-- denotes no exceedance

CDWQ: Guidelines for Canadian Drinking Water Quality

MAC: Maximum Allowable Concentrations

AO: Aesthetic Objectives

NS Tier 1 EQS: Nova Scotia Environment Tier 1 Environmental Quality Standards for potable groundwater

NS Tier 2 PSS: Nova Scotia Environment Pathway Specific Standards for groundwater discharge to surface water (0-10m from freshwater body)

Several monitoring wells, as summarised in Table 5.4-5, denote the presence of dissolved aluminum, arsenic, manganese, and iron which indicates that those metals are naturally occurring within overburden in the PA. Aluminum, arsenic, manganese, and iron are known to naturally occur in groundwater in Nova Scotia, as evidenced by groundwater chemistry maps published by NSDNRR.

Dissolved molybdenum was identified at MW-07 during the March sampling event at a concentration exceeding the NS Tier 1 EQS criterion. Molybdenum is additionally a common component of drill rod grease, utilized during the drilling process to maintain lubrication of drill rod threads. Molybdenum may have been identified in the MW-07 sample due to residual drill rod grease deposited during the March 2024 drilling program. Future groundwater sampling events will confirm whether molybdenum has a continued presence in groundwater samples collected at MW-07.

All data collected from the groundwater monitoring well network is considered baseline as no current extraction activity has occurred.

5.4.3.5 Potable Water Resources

The NS Well Logs Database identifies the locations of wells drilled or dug by licensed well drillers or contractors since the mid-1960s. The nearest water well identified in the database is a drilled agricultural well located approximately 850 m northwest of the PA, as shown on Figure 5.4-2. Six drinking water wells listed in the database are located within 1 km of the PA; five of these wells, however, do not have associated structures visible in satellite imagery. The NS Well Logs Database indicates these five wells were installed between 1979 and 1999, and as such their associated spatial data may not be accurate.

The nearest registered public drinking water supply location is approximately 2.2 km northeast of the PA, and the Middleton Wellfield Protection Area is located approximately 3.8 km northwest of the PA.

5.4.4 Effects Assessment Methods

5.4.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA and LAA.

5.4.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on groundwater resources are defined below and are shown on Figure 5.4-2.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses a 500 m buffer surrounding the PA.

As the Project has the potential to cause direct and indirect effects on groundwater quantity and quality outside of the PA, the LAA is considered the most appropriate spatial boundary for this assessment as groundwater impacts contained within the LAA will not impact residential well locations. An RAA has not been defined for this VC as the maximum extent of indirect impacts is expected to be within the LAA.

5.4.4.1.2 Temporal Boundaries

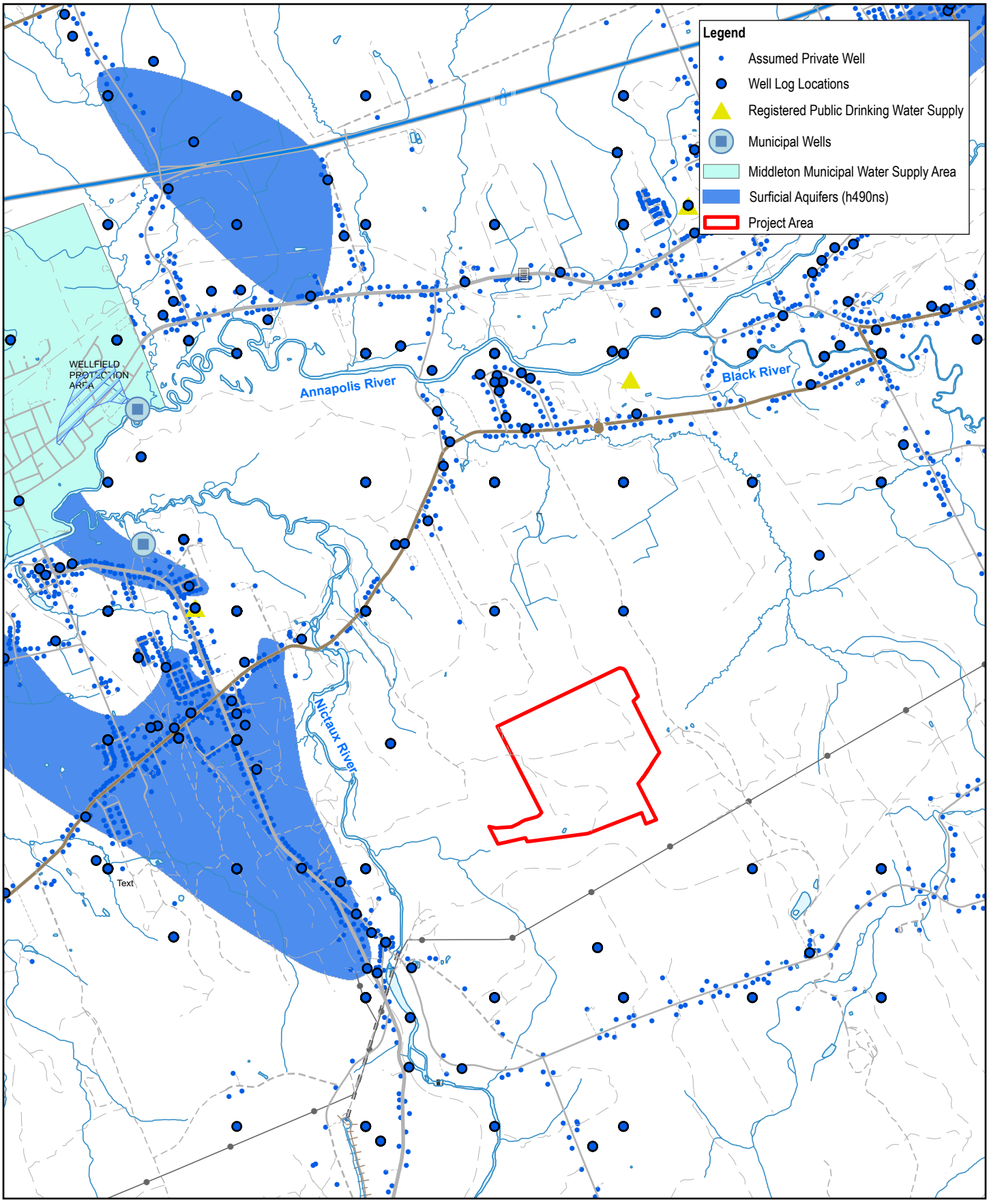
The temporal boundaries used for the assessment of effects of the Project includes the construction, operation, and reclamation phases.

5.4.4.1.3 Technical Boundaries

No technical boundaries are identified for the effects assessment of groundwater.

5.4.4.1.4 Administrative Boundaries

Groundwater quality with be compared against NS Tier 1 EQS for potable groundwater and CDWQ MAC and AO, herein referred to as Potable Criteria. Groundwater quality is also compared against the NS Tier II EQS for groundwater discharging to surface water (>10 m).



Paper Size ANSI A

0 0.4 0.8 1.2

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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NICTAUX SAND PIT EXPANSION PROJECT

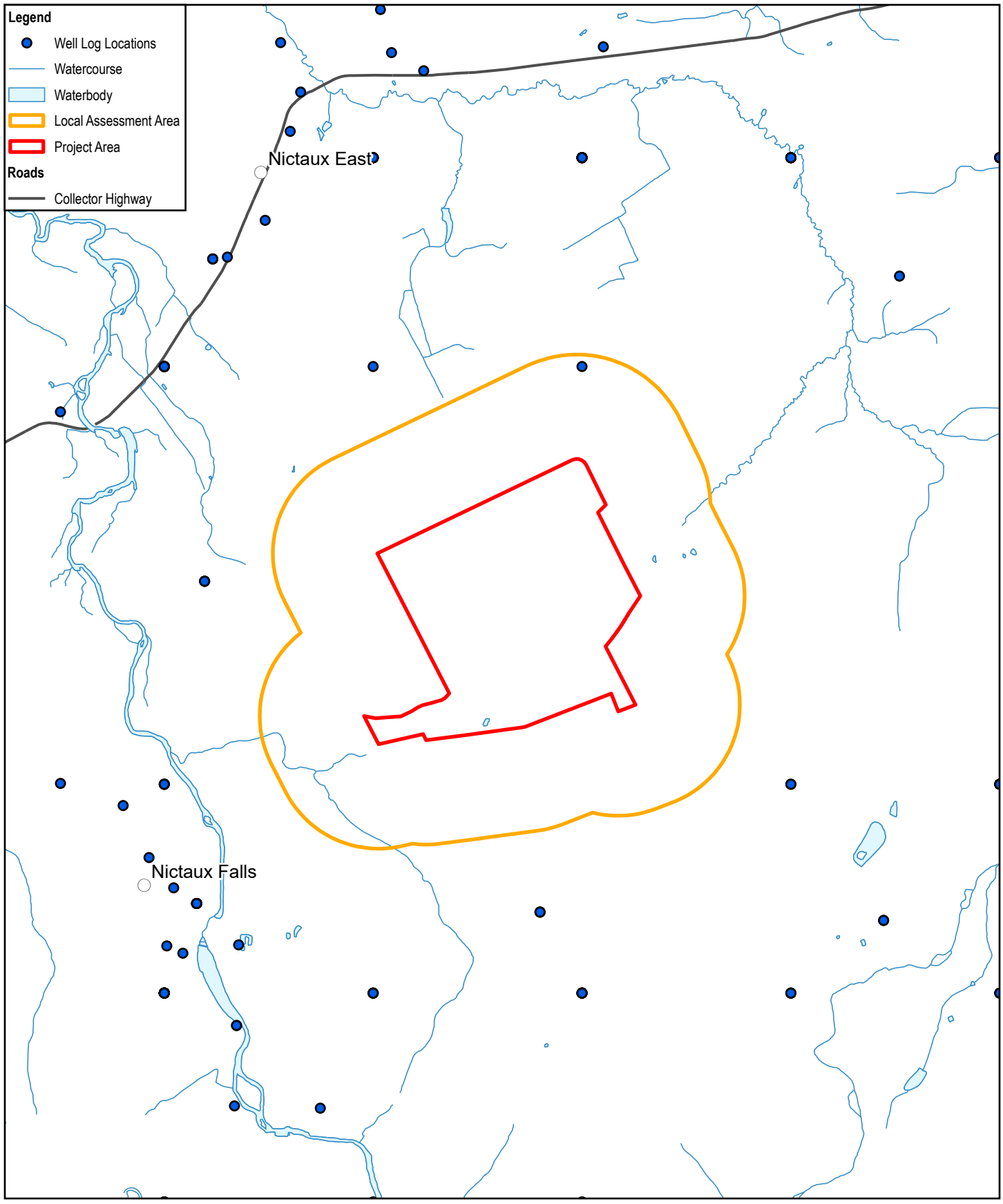
POTABLE WATER RESOURCES

Project No. **12584960**
Revision No. **-**
Date **Mar, 12 2025**

FIGURE 5.4-2

O:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_018_PotableWaterResources
Print date: 12 Mar 2025 - 09:12

Data source: NSDNRR Forestry, GeoNova GEOL/GEOL_hg_SurficialAquifers_h490ns_UT83: . Created by: mmize



Paper Size ANSI B

0 250 500 750

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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SPATIAL BOUNDARIES - GROUNDWATER

FIGURE 5.4-3

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_009_SpatialBoundariesGW
Print date: 12 Mar 2025 - 11:18

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.4.4.2 Thresholds for Determination of Significance

The characterization criteria applied in the groundwater effects assessment are defined in Tables 5.4-6 and 5.4-7, below.

Table 5.4-6 Characterization Criteria for Residual Effects on Groundwater Resources

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – No effects to groundwater quantity or quality predicted under normal operating conditions **L** – Predicted effects to groundwater quantity and quality are confined to the PA **M** – Predicted effects to groundwater quantity and quality are confined to the LAA **H** – Predicted effects to groundwater quantity and quality at the nearest residential water well
Geographic Extent	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**ST** – effects are limited to the construction phase or operation phase **MT** – effects occur in the construction phase and operation phase **LT** – effects occur in the construction phase and operation phase and persist in reclamation **P** – valued component unlikely to recover to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – groundwater quantity will recover to baseline conditions before or after Project activities have been completed. **PR** - mitigation cannot guarantee a return to baseline conditions **IR** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect to groundwater resource from the Project is defined as:

– A Project-related effect with a low magnitude, which occurs beyond the LAA, occurs sporadically or more frequently and is only partially reversible to irreversible.

5.4.5 Project Interactions and Potential Effects

Potential Project interactions with groundwater are presented in Table 5.4-8, below.

Table 5.4-7 Project Activities and Groundwater Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management Water management

Table 5.4-7 Project Activities and Groundwater Interactions

Project Phase	Relevant Project Activity
	Emissions and waste management
Reclamation	Demolition Earthworks Water management

5.4.5.1 Groundwater Quantity

Shaw intends to extract sand from beneath the current water table as established through baseline groundwater elevation monitoring. All sand extracted from beneath the water table will be removed via dredge. As such, sand extraction is not anticipated to result in groundwater drawdown as the pit area will not be dewatered. Following extraction, any pit areas extracted beneath the water table will be left as pit lakes into the reclamation phase, maintaining the adjacent water table elevation.

Freshwater requirements for the wash plant are proposed to be met by withdrawal from an on-site water supply pond. The pond will be constructed by excavating beneath the water table and will be recharged by inflows from the highly permeable sand and gravel aquifer present within the PA. Process water from the wash plant will flow through a water clarifier before being recycled back into the water supply pond.

With the exception of potential losses to evaporation and the water clarifier, all water withdrawn from the supply pond is planned to be recycled within this unconfined closed loop system. Shaw currently employ a similar process water supply system at their Keddy facility. Operations and environmental monitoring completed for the Keddy facility demonstrate consistent water elevations in supply ponds and monitoring wells, confirming the process water supply system is not depleting local groundwater. Considering the similar geological conditions and process proposed for the Project, water withdrawal is not anticipated to affect surrounding water users.

5.4.5.2 Groundwater Quality

There is potential for the Project to impact groundwater quality through precipitation leaching potential constituents of concern from stockpiles and spills of petroleum products as described in Section 7 (Accidents and Malfunctions). Leaching of potential constituents of concern is of greatest concern in the context of ML/ARD, as discussed in Section 5.3 (Geology, Soil, and Sediment). Project activities will be limited to the surficial geology and are not anticipated to contact the underlying sulphide-bearing bedrock. Therefore, acid production is not anticipated to occur at the Project and precipitation leaching through the stockpiles and recharging groundwater is anticipated to have similar constituent of concern concentrations to background.

Potential petroleum spills will be mitigated through the development handling methods to prevent and control leaks and spills and through the development of a Contingency Plan as described in Section 7.

In summary, after the implementation of applicable mitigation measures, significant impacts to groundwater quality are not anticipated beyond the LAA nor at identified residential water well locations.

5.4.6 Mitigation

Proposed mitigation measures for groundwater quantity and quality are presented in Table 5.4-8, below.

Table 5.4-8 Groundwater Mitigation Measures

Project Phase	Mitigation Measure
Construction and Operation	All sand extracted from beneath the water table will be removed via dredge and will not require the pit to be dewatered.

Project Phase	Mitigation Measure
	A Contingency Plan will include information on incident prevention, response procedures, and response training in the case of accidental spills.
	Disposal and handling of waste oils and hazardous waste will be as recommended by the suppliers and/or manufacturers in compliance with federal and provincial regulations.
	Fuel will be obtained from a licensed contractor who will be required to comply with federal and provincial regulations.
	Petroleum products (hydrocarbons) will be handled in such a way as to prevent and control leaks and spills. At all times, hydrocarbon absorbents will be kept on the premises where the storage or use of oil products occurs.
	A maintenance schedule will be developed and implemented to provide for regular maintenance and inspection of Project mine water management infrastructure.
	Progressive reclamation practices will be employed to minimize disturbed areas.
Reclamation	All pit areas extracted beneath the water table will be left as pit lakes into the reclamation phase, maintaining the adjacent water table elevation.

Shaw will maintain a complaints line to allow area residents to report any issues with their wells including changes in water quantity and quality. Shaw will investigate all complaints and will be responsible for replacement of impacted wells if it is determined that the impacts were a result of Project activities.

5.4.7 Monitoring and Follow-up

A Groundwater Monitoring Plan will be developed for the Project and submitted as part of the IA application. The plan will include proposed measures to monitor potential changes groundwater quality and quantity as a result of Project activities. The existing monitoring network consists of nine monitoring wells providing spatial coverage in all directions from proposed pit areas. The results of groundwater monitoring will be used to inform adaptive water management practices to mitigate any adverse impacts that may result from the Project.

Effective water management requires a clear understanding of the interaction between groundwater and surface water. A Surface Water Monitoring Plan will also be developed for the Project and will be coordinated with groundwater monitoring, with both monitoring plans designed to complement each other.

5.4.8 Residual Effects and Significance Determination

The predicted residual environmental effects of the Project on groundwater resources are assessed to be adverse, but not significant. Following the implementation of appropriate mitigation measures, the overall residual effect of the Project on groundwater is assessed as not likely to have significant adverse effects.

A significant adverse effect on the Groundwater Resources VC was defined in Section 5.4.4.2 as:

– A Project-related effect with a high magnitude, of potential regional geographic extent and of medium to long term duration, occurring at any frequency and being only partially reversible to irreversible.

Residual effects to groundwater resources are summarized in Table 5.4-9 and are further addressed in Section 5.5 (Surface Water Resources), Section 5.6 (Wetlands) and Section 5.7 (Fish and Fish Habitat) related to the impact of groundwater on the Surface Water Resources, Wetlands, and Fish and Fish Habitat VCs.

Table 5.4-9 Residual Effects on Groundwater Resources

Project -VC Interaction	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction/Operation There is a potential for spills of petroleum products associated with the use of machinery and handling/storage of petroleum products	Contingency plans, including spill prevention and response, training, outline of roles and responsibilities, clean-up equipment and materials, and contact and reporting procedures, will be implemented.	A	N Mitigation measures will contain and reduce the potential impact of a spill; however, there is potential for limited exceedance of Potable Criteria.	PA	N/A	MT	S	RE The source of potential impacts will be removed and any remaining COCs will naturally degrade over time.	A spill of hazardous material could potentially result in elevated COC concentrations in groundwater.	Not significant Impacts will not extend beyond the LAA, duration is MT, may occur sporadically, and the impact is reversible.
Operation Project activities will reduce groundwater elevations, thereby reducing available groundwater for potable use and for discharge to surface water bodies.	All sand extracted from beneath the water table will be removed via dredge and will not require the pit to be dewatered.	A	M Groundwater drawdown associated with water withdrawal is anticipated to be confined to the LAA.	LAA	N/A	MT	C	R	Reduction in groundwater quantity.	Not Significant Groundwater drawdown is not anticipated to affect surrounding water users.
Operation Precipitation falling on uncovered stockpiles may leach COCs from the piles which then may infiltrate into groundwater impacting groundwater quality	Runoff and groundwater seepage will be collected, with water pumped to the settling pond prior to discharge.	A	N COC concentrations in groundwater beneath the stockpiles is anticipated to be within the range of background concentrations and acidic drainage is not expected to occur	PA	N/A	MT	C	R	None	Not significant
Reclamation Precipitation falling on uncovered stockpiles may leach COCs from the piles which then may infiltrate into groundwater impacting groundwater quality	Reclamation of the stockpiles will reduce infiltration of precipitation and leaching of COCs to groundwater.	A	N COC concentrations in groundwater beneath the stockpiles is anticipated to be within the range of background concentrations and acidic drainage is not expected to occur	PA	N/A	LT	C	R	None	Not significant

Legend (refer to Table 4.3-2 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	R – Reversible IR – Irreversible PR – Partially Reversible

5.5 Surface Water Resources

5.5.1 Rationale for Valued Component Selection

Surface water resources was selected as a VC for its significance to hydrological, ecological, and socioeconomic systems. Surface water provides ecological value in providing habitat for aquatic species, and terrestrial species rely on accessible water sources for their survival. Socially and economically, surface water resources are essential to municipal, agricultural, industrial, and recreational sectors, among others.

Surface water quality and quantity are provincially regulated through the NS *Environment Act* and several of its regulations. The regulations help protect ecological components, as well as the health of the public. During various Project activities there is also a potential for impacts to surface water resources to indirectly impact other VCs including wetlands and fish and fish habitat.

5.5.2 Baseline Program Methods

Baseline surface water quality and quantity monitoring program methodologies are discussed below. Further detail on the baseline surface water monitoring program is provided in the Baseline Surface Water Monitoring Report in Appendix D.

5.5.2.1 Watercourse Identification and Characterization

Watercourse identification was completed by Strum across the PA in accordance with NS standards for identification of watercourses and wetlands. Identified watercourse are discussed in further detail in Section 5.7. During the field evaluations, Strum used NSECC guidance on watercourse determinations to identify watercourses (NSECC, 2015). The following parameters were used to define watercourses:

– Presence of a mineral soil channel.
– Presence of sand, gravel and/or cobbles evident in a continuous pattern over a continuous length with little to no vegetation.
– Indication that water has flowed in a path or channel for a length of time and rate sufficient to erode a channel or pathway.
– Presence of pools, riffles or rapids.
– Presence of aquatic animals, insects or fish.
– Presence of aquatic plants.

According to guidance provided by NSECC, any surface feature that meets two of the criteria above is defined provincially as a regulated watercourse. The inlet and outlet of each system were verified in field. Any identified watercourses were flagged in the field with blue flagging tape and mapped using a Garmin GPSMAP 64s unit (capable of sub-5m accuracy). All features were characterized through detailed fish habitat assessments.

Open water features were identified as components of linear watercourses (e.g., ponds) that were more accurately represented graphically by polygon files rather than lines. From a regulatory perspective, open water features are defined as watercourses by the Environment Act. Features referred to as open water habitats were typically less than 2 m depth, <8 ha in size, and had less than 50% vegetative cover following guidance from the Army Corps of Engineers wetland delineation manual (Environmental Laboratory, 1987).

5.5.2.2 Surface Water Quality

The baseline surface water monitoring program was established in 2024 and included five water quality sampling locations. A summary of each sampling location including the date each station was established is provided in Table 5.5-1. Surface water monitoring locations are also shown on Figure 5.5-1.

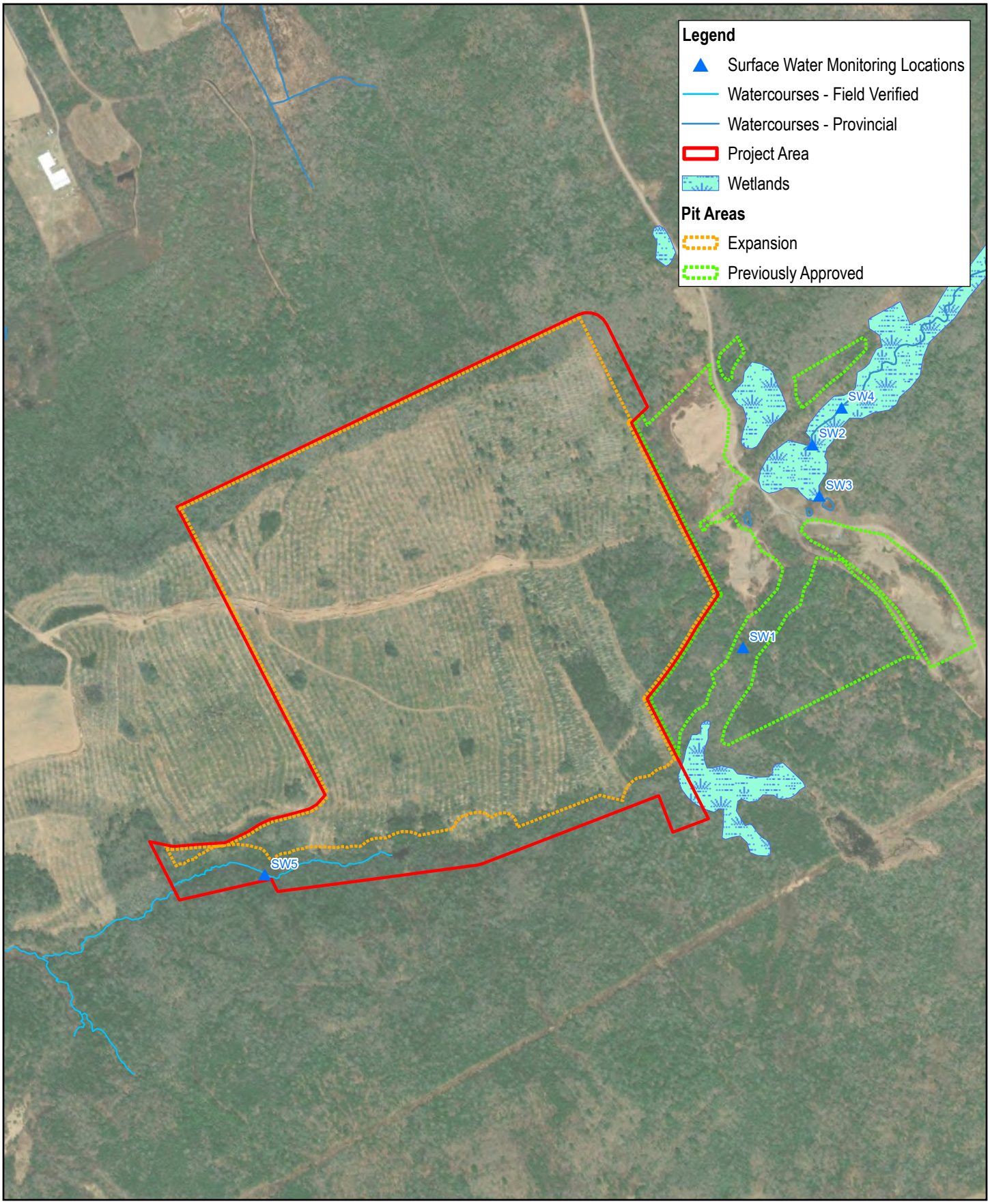
Table 5.5-1 Baseline Surface Water Monitoring Locations

Station	Coordinates (UTM 20N)		Date Established	Watercourse
	Northing	Easting		
SW-1	4976275	341836	August 29, 2024	Bald Hill Brook
SW-2	4976748	341996	August 29, 2024	Bald Hill Brook
SW-3	4976622	342016	August 29, 2024	Bald Hill Brook
SW-4	4976970	342198	October 31, 2024	Bald Hill Brook
SW-5	4975726	340523	April 26, 2024	Watercourse 1 (WC-1)

Surface water samples were collected on a quarterly basis via grab sampling, which was conducted by dipping the sample container directly into the stream to collect surface water, unless the sample bottles contained preservatives. If the bottle contained preservatives, sterile unpreserved bottles were used to collect the sample and transfer the surface water to the preserved sample container. Samples were collected below the surface with the sample bottles completely submerged, preventing floating surface debris from entering the sample bottles and contaminating the sample. Field measurements of pH, conductivity, dissolved oxygen, and temperature were collected at each location using a handheld multiparameter meter (i.e., Horiba U-52).

Samples were transferred to coolers with ice immediately after they were collected and maintained in cool storage until delivery to BV in Bedford, NS. COC forms were filled out with the sample ID, and date / time of sample collection, and were signed by field staff before being relinquished to the receiving laboratory. The surface water samples were submitted for analysis of general chemistry, total metals, and TSS.

Quality assurance / quality control (QA/QC) protocols included the collection of field duplicate samples at a frequency of 10% of samples collected. The results of the QA/QC sampling were used to evaluate the reliability of the sampling and analysis methods. One surface water field duplicate was collected during the August and October field monitoring programs.



Scale 1:12000

0 120 240 360

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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BASELINE SURFACE WATER MONITORING LOCATIONS

Project No. **12584960**
Revision No. **-**
Date **Mar 11, 2025**

FIGURE 5.5-1

O:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_010_BaselineSWStations
Print date: 11 Mar 2025 - 14:30

Data source: NSECC, GeoNova World Imagery: Maxar; Province of Nova Scotia; GHD, 2024. Created by: mmize

5.5.2.3 Surface Water Quantity

Discrete water levels and discrete velocity measurements were monitored at all locations. Discrete velocity measurements were collected using either a handheld Marsh McBirney Flo-Mate 2000 or a HACH FH950 velocity meter. A transect was established at each monitoring location perpendicular to the direction of flow. The width of the stream was divided into intervals where velocity readings and water depth were measured. Velocities were measured at 60% of the depth below the water surface. A total flow was then calculated by computing the product of area and velocity using an average of the mean and mid flow calculation methods.

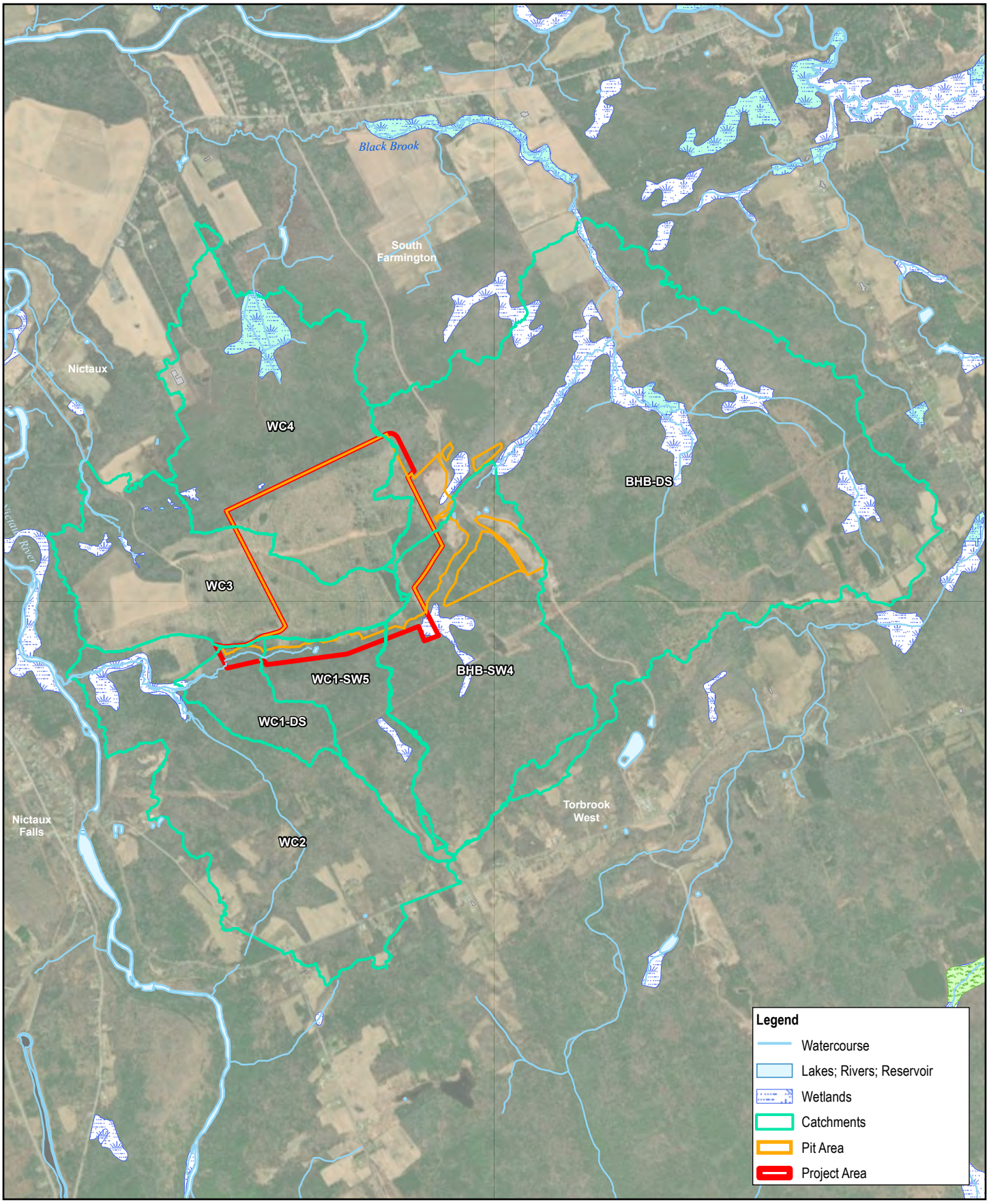
Staff gauges were installed at each monitoring location during their initial installation date (refer to Table 5.5-1) and were used for discrete surface water level measurements. In addition, continuous water level data was collected at 15-minute intervals using a Solinst® Levelogger installed at SW-5 from April 26, 2024 to November 8, 2024. The logger was downloaded during each surface water monitoring event, and compensated for barometric pressure, which was collected on-site using a Baro-Diver installed near groundwater well MW-05. Continuous surface water levels were corrected using the discrete water levels collected during the monitoring event.

5.5.3 Baseline Conditions

5.5.3.1 Watershed Characteristics

The PA is situated entirely within the Annapolis Royal secondary watershed (1DC-1), which is contained within the Annapolis Royal primary watershed (1DC). The PA is divided between two tertiary watersheds: 1DC-3-CC in the west and 1DC-3-EE in the east. The primary drainage feature of watershed 1DC-3-CC is the Nictaux River, which flows in a general north-westerly direction and drains to the Annapolis River just south of the Town of Middleton. The primary drainage feature of watershed 1DC-3-EE is Black Brook, which also drains to the Annapolis River.

Baseline catchments delineated as part of the water balance analysis are presented on Figure 5.5-2.



Paper Size ANSI A

0 300 600 900

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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Project No. **12584960**
Revision No. **-**
Date **Mar 13, 2025**

BASELINE CATCHMENTS

FIGURE 5.5-2

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Print date: 13 Mar 2025 - 16:00

Data source: GeoNOVA, GHD, Shaw World Imagery: Earthstar Geographics. Created by: kmundinger

5.5.3.2 Watercourses

One field identified watercourse, WC1, and one waterbody, Open Water A, were delineated and characterized within the PA. Two additional watercourses, WC2 and WC3, were identified to the southwest and northwest of the PA, respectively. Field delineated watercourses are summarized below:

– WC1 originates from Open Water A, travels through WL1, and continues west beyond the PA before draining into WC2 (a tributary to the Nictaux River). Direct connectivity to the Nictaux River was field verified.
– Open Water A is a waterbody that is present within WL1 and is the upstream headwater/extent of WC1. The open water is situated along the southern boundary of the PA.
– WC2 originates southwest of the PA. It flows north towards WC1, which drains into WC2, then flows west, eventually flowing into Nictaux River. WC2 was delineated and connectivity to the Nictaux River was field verified during the detailed habitat assessment.
– WC3 originates in a wetland in the northwest portion of the Aquatic Study Area. WC3 flows north, eventually joining Nictaux River. WC3 was delineated within the extent of the Aquatic Study Area during the detailed habitat assessment.

Further detail on field identified watercourses is provided in the Biophysical Baseline Report provided in Appendix F, and in Section 6.7.

5.5.3.3 Regional Climate

GHD obtained water budget data from Environment and Climate Change Canada's (ECCC) Meteorological Service of Canada (MSC) in support of the water balance analysis, provided in Appendix E. The water budget data includes monthly timeseries of temperature, precipitation, rainfall, snowmelt, potential evapotranspiration (PET), and actual evapotranspiration (AET), which are used to calculate the soil storage surplus for the selected soil water holding capacity following the Thornthwaite and Mather water balance methodology. The calculated surplus values were also obtained from ECCC.

The water balance surplus was estimated by ECCC using the most recent version of the water balance model developed by Meteorological Service of Canada (MSC, see Johnstone and Louie, 2008). The MSC's water balance method accounts for snow accumulation and melt (degree day method of USACE, 1956), potential evapotranspiration (Thornthwaite and Mather, 1955), soil storage, actual evapotranspiration, and moisture deficit and surplus. The MSC program calculates a 'water surplus' as the final product, which is the total water available in a given month to run off as surface overland flow and/or infiltrate to the ground and recharge the groundwater table. The MSC water balance model uses continuous daily precipitation and air temperature data. The use of daily data allows for more accurate modelling of snowmelt and snow storage, which are of particular importance in a cold weather/winter climate (Johnstone and Louie, 1983).

The completed time series of monthly water budget data between 1943 and 2021 was provided for the Greenwood A station (Climate ID: 8202000), which is located approximately 9 kilometers northeast of the PA. Average climate data collected from the Greenwood A station is presented in Table 5.5-2.

Table 5.5-2 Climate Data

Parameter	January	February	March	April	May	June	July	August	September	October	November	December
Temperature (°C)	-5.1	-5.0	-0.8	5.0	11.0	16.0	19.6	18.8	14.4	8.9	4.0	-1.9

Parameter	January	February	March	April	May	June	July	August	September	October	November	December
Precipitation (millimetres (mm))	109.9	89.5	86.4	80.3	79.9	80.1	79.0	85.4	91.1	96.8	115.5	118.4
AET (mm/d)	2.3	2.1	7.7	27.9	69.0	102.1	109.8	87.9	69.8	40.3	17.1	4.9

5.5.3.4 Surface Water Quantity Results

Stream flow measurements taken at station SW-5 in 2024 ranged from 0 litres per second (L/s) (i.e., dry) on August 28, 2024 to 0.70 L/s on April 26, 2024. One flow monitoring event was conducted at SW-4 in 2024, on October 31, 2024, resulting in a calculated flow of 2.20 L/s. Discrete surface water flow monitoring results are presented below in Table 5.5-3.

Table 5.5-3 Manual Water Levels and Flow Recordings

Station	Date	Flow (L/s)	Staff Gauge Reading (m)	Water Level Elevation (masl)
SW-4	31-Oct-24	2.20	0.09	26.86
SW-5	26-Apr-24	0.70	0.255	43.66
	28-Aug-24	Not measured; dry		
	30-Oct-24	0.00	0.140	43.55

A hydrograph of continuous elevation collected from the Solinst® Levelogger installed at SW-5 is provided in Appendix D. Monitored continuous water levels indicate this watercourse is ephemeral, with dry conditions observed during the summer and fall months and higher water levels during the spring freshet and following rainfall events. While typically there would be an increase in precipitation during fall months, central NS experienced varying degrees of drought from September through December (Canadian Drought Monitor, 2024).

5.5.3.5 Surface Water Quality Results

Surface water quality samples were collected on April 26, August 29, and October 31, 2024. Surface water quality results were compared to the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (WQGs) for the Protection of Fresh Water Aquatic Life (FWAL) and the Nova Scotia Tier 1 EQS for Surface Water.

Table 5.5-4, below, details the quality sampling schedule for all monitoring locations in 2024.

Table 5.5-4 2024 Water Quality Sampling Schedule

	SW-1	SW-2	SW-3	SW-4	SW-5
April 26, 2024	Not sampled; not added to monitoring program until August 2024				Sampled
August 29, 2024	Sampled	Sampled (Duplicate collected)	Not sampled; dry	Not sampled; not yet added to monitoring program	Not sampled; dry

	SW-1	SW-2	SW-3	SW-4	SW-5
October 31, 2024	Sampled	Sampled	Sampled (Duplicate collected)	Sampled	Not sampled, stagnant water

Laboratory analytical certificates and tabulated results for baseline sampling events are provided in Appendix D.

SW-1

– Total aluminum concentrations exceeded the NS Tier 1 EQS during the August and October monitoring events, but were less than the CCME FWAL criterion, which is variable dependent on pH.

SW-2

– Total aluminum concentrations were above the NS Tier 1 EQS guidelines during the August and October monitoring events. Total aluminum also exceeded the variable CCME FWAL criterion during the August monitoring event.
– Total iron concentrations were above the CCME FWAL and the NS Tier 1 EQS guidelines during the August and October monitoring events.
– SW-DUP, a field duplicate of the August SW-2 quality sample, also had CCME FWAL and NS Tier 1 exceedances of both total aluminum and total iron concentrations.

SW-3

– Total aluminum concentrations were above the CCME FWAL and NS Tier 1 EQS guidelines during the October monitoring event.
– Total iron concentrations were above the CCME FWAL guidelines and the NS Tier 1 EQS guidelines during the October monitoring event.
– SW-DUP, a field duplicate of the October SW-3 quality sample, also had CCME FWAL and NS Tier 1 exceedances of total aluminum concentrations.

SW-4

– Total aluminum concentrations were above the CCME FWAL and NS Tier 1 EQS guidelines during the October monitoring event.

SW-5

– Total aluminum concentrations were above the NS Tier 1 EQS guidelines during the April monitoring event.

5.5.4 Effects Assessment Methods

5.5.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA and LAA. An RAA is not considered necessary for surface water resources as all impacts will be contained within the LAA.

5.5.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on surface water resources are defined below and are shown on Figure 5.5-3.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses the 1DC-3-EE tertiary watershed, and a portion of the 1DC-3-CC tertiary watershed. The 1DC-3-EE watershed drains directly to the Annapolis River, while the 1DC-3-CC contains the Nictaux River which then drains to the Annapolis River.
– The RAA encompasses the 1DC-3-DD, 1DC-3-EE, 1DC-3-FF, and 1DC-3-HH watersheds, and portions of the 1DC-3GG and 1DC-3-CC watersheds extending to the contact with the granitoid South Mountain Batholith. These watersheds encompass all bedrock types found in and directly adjacent to the Project and contains both the Nictaux and Annapolis Rivers.

As the Project has the potential to cause direct and indirect impacts to surface water resources outside of the PA, the LAA is considered the most appropriate spatial boundary for this assessment.

5.5.4.1.2 Temporal Boundaries

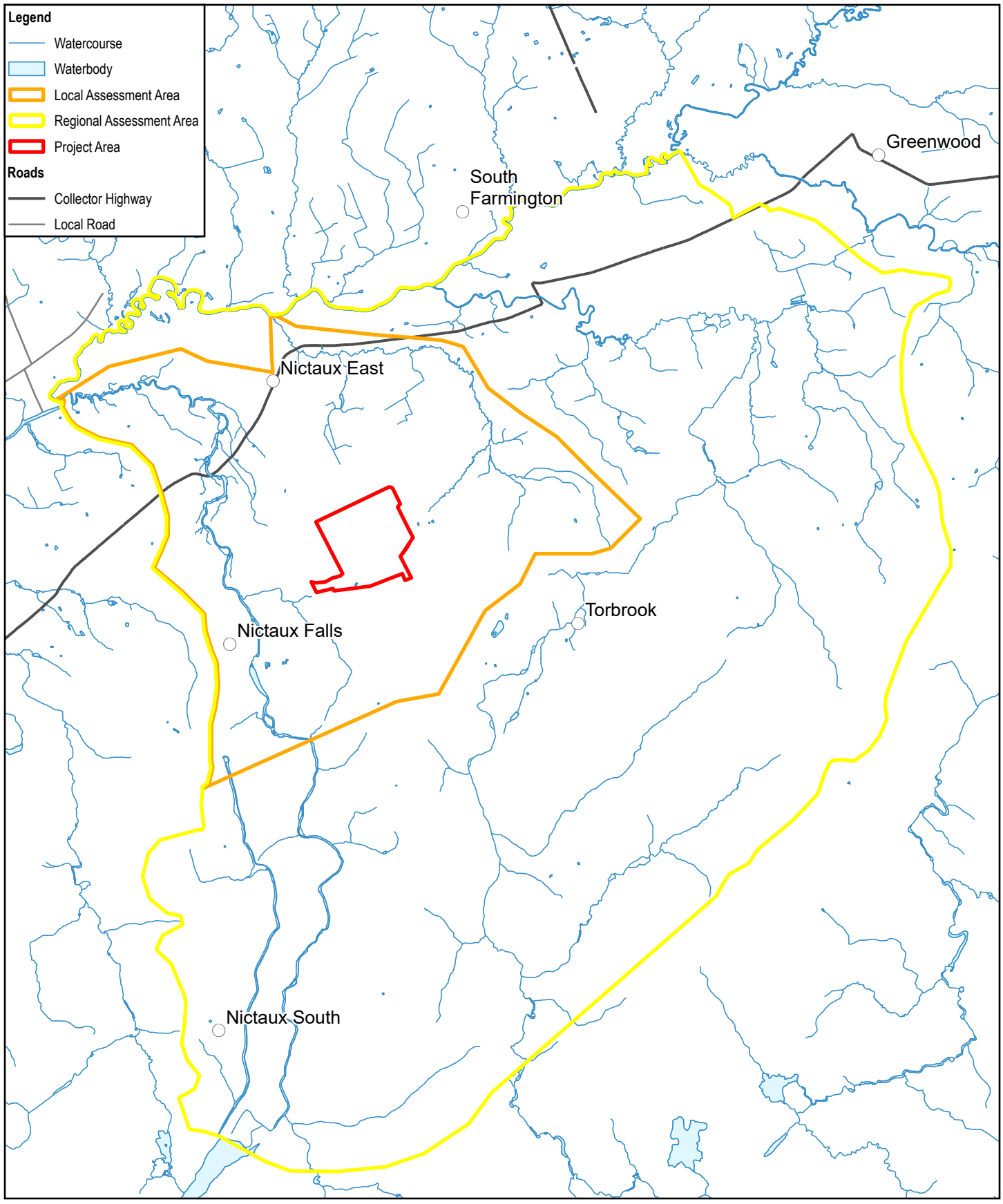
The temporal boundaries used for the assessment of effects of the Project includes the construction, operation, and reclamation phases.

5.5.4.1.3 Technical Boundaries

No technical boundaries were identified for the effects assessment of surface water resources.

5.5.4.1.4 Administrative Boundaries

Surface water quality results recorded for the Project will be compared against the CCME WQGs for Protection of Freshwater Aquatic Life and the NS Tier 1 EQS for Surface Water.



Paper Size ANSI B

0 650 1,300 1,950

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

N

GHD

THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

SPATIAL BOUNDARIES - SURFACE WATER

Project No. **12584960**
Revision No. **-**
Date **Mar, 11 2025**

FIGURE 5.5-3

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_012_SpatialBoundariesSW
Print date: 11 Mar 2025 - 14:24

Attribution: GeoNova, GHD, DP ME 36, Version 2, 2006. Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, Scale 1:500 000, by R. R. Stea, H. Conley and Y. Brown, 1992. Created by: mmize

5.5.4.2 Water Balance Analysis

The water balance analysis completed for this Project is a preliminary assessment the predicted effects on surrounding watercourses under three scenarios: baseline conditions, operating conditions, and reclamation conditions. Baseline conditions consider the site topography prior to development. Operating conditions consider the PA at full development of the proposed extraction area. Reclamation conditions are representative of the PA after revegetation of disturbed areas. As such, these represent the “post closure” condition as some degree of progressive reclamation will occur during site development.

A 1-m digital elevation model (DEM) collected from the Nova Scotia Data Locator – Elevation Explorer website was used to delineate the baseline catchments (Nova Scotia, 2022). Catchment delineations for the watercourses were produced using the watershed delineation tool within PCSWMM, a hydrologic modelling software.

A monthly water balance assessment was performed for all delineated catchments following the methodology developed by Thornthwaite and Mather (1957). The methodology calculates water surplus depths from soil storage, where rainfall and snowmelt are added, and PET is subtracted from the soil storage on a monthly basis. Further detail on the methods used in the water balance analysis are provided in Appendix E.

5.5.4.3 Thresholds for Determination of Significance

The characterization criteria applied in the surface water effects assessment are defined in Table5.5-5 below.

Table 5.5-5 Characterization Criteria for Residual Effects on Surface Water

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – Change in predicted average annual discharge is within 1% of baseline conditions **L** – Change in predicted average annual discharge is greater than 1% but less than 5% of baseline conditions **M** – Change in predicted average monthly discharge is greater than 5% but less than 10% of baseline conditions **H** – Change in predicted average monthly discharge is greater than 10% of baseline conditions
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – direct and indirect effects from Project activities are restricted to the LAA
Timing	**N/A** — seasonal aspects are unlikely to affect VCs **A** — seasonal aspects may affect VCs
Duration	**ST** – effects are limited to the construction phase or operation phase **MT** – effects occur in the construction phase and operation phase **LT** – effects occur in the construction phase and operation phase and persist in reclamation **P** – valued component unlikely to recover to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – Surface water quantity will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect to surface water from the Project is defined as:

– An unmitigated or uncompensated, Project-related effect with high magnitude, extending to the LAA and of medium to long term duration, occurring continuously throughout the Project and is irreversible.

5.5.5 Project Interactions and Potential Effects

Potential Project interactions with surface water resources are presented in Table 5.5-6 below.

Table 5.5-6 Surface Water Project Interaction

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management
Reclamation	Earthworks Water management

5.5.5.1 Water Balance Results

The results of the water balance analysis completed for operating and reclamation conditions is presented in Table 5.5-7 and Table 5.5-8, respectively. The tables display the percentage change in area and runoff from baseline conditions to operating, and reclamation conditions, respectively. Negative values represent a decrease in the parameter value when compared to baseline conditions, and positive values represent an increase in the parameter value when compared to baseline conditions. Settling pond overflow will be discharged to Bald Hill Brook, WC3, and WC4 under operation and reclamation conditions to maintain pre-development flow conditions to the extent practicable.

Although the water balance analysis was completed using a monthly timestep, the results provided below are summarized on an annual basis for discussion purposes. Water balance results summarized on a monthly basis are provided in Appendix E.

Table 5.5-7 Operating Conditions Comparison to Baseline Conditions

Watershed	% Area Change	% Streamflow Change
WC1-DS	-0.78%	-0.78%
WC2	-0.24%	-0.95%
WC3	2.46%	-0.26%
WC4	-0.89%	-4.31%
BHB-DS	-0.17%	2.13%
BHB-SW4	6.83%	8.27%
WC1-SW5	-0.17%	0.55%

Under operating conditions, marginal decreases in streamflow are anticipated at WC1-SW5, WC1-DS, WC2, WC3, and WC4. These predicted flow reductions are due to either loss of catchment area or increases in pervious area as a result of pit expansion. An increase in streamflow of 8.27% is predicted at assessment point BHB-SW4 due to an increase in its catchment area following pit expansion.

Table 5.5-8 Reclamation Conditions Comparison to Baseline Conditions

Watershed	% Area Change	% Streamflow Change
WC1-DS	-0.78%	-0.78%
WC2	-0.24%	-0.56%
WC3	2.46%	-0.07%
WC4	-0.89%	-3.76%
BHB-DS	-0.17%	0.96%
BHB-SW4	6.83%	7.53%
WC1-SW5	-0.17%	0.19%

Predicted streamflow volumes under reclamation conditions are similar to those predicted for operation conditions; marginal changes are the result of changes to land cover following site reclamation. Under reclamation conditions, marginal decreases in streamflow are anticipated at WC1-DS, WC2, WC3, and WC4. These predicted flow reductions are due to either loss of catchment area or changes to land cover. An increase in streamflow of 7.53% is predicted at assessment point BHB-SW4 due to an increase in its catchment area following pit expansion.

The results of the water balance are discussed in further detail in Section 5.7 and Appendix E.

5.5.6 Mitigation

Project mitigation measures protective of surface water resources are detailed in Table 5.5-9, below.

Table 5.5-9 Surface Water Mitigation Measures

Project Activity	Mitigation Measure
Construction	Road and site grading will be directed away from wetlands and watercourses, where possible.
	Ditching around stockpiles will collect all run-off for treatment of TSS prior to discharge.
	Sediment control fences will be installed in areas (e.g., slopes and embankments) where organic materials and till are exposed to potential erosion and siltation. Sediment control fences will be inspected and maintained until the disturbed areas have stabilized and revegetation has occurred.
	All ditching will be designed to reduce erosion and sedimentation through use of rock check dams, silt fences, plunge pools, and grading as appropriate.
Operation	Erosion and sediment control measures will be established around all disturbed areas.
	Disturbed areas will be monitored to ensure erosion and sediment control measures are maintained/effective and to identify if additional mitigation is required.
	All process effluent will be treated for TSS via settling ponds prior to discharge to the receiving environment.
	All surface water discharges from settling ponds to the receiving environment will be sampled as per requirements listed in the IA to ensure water quality conforms to applicable regulations and guidelines.
	Stockpile surfaces will be stabilized during extended periods between usage by means of vegetating or covering exposed surfaces.
	A Contingency Plan will include information on incident prevention, response procedures, and response training in the case of accidental spills.
	A maintenance schedule will be developed and implemented to provide for regular maintenance and inspection of Project mine water management infrastructure.

Table 5.5-9 Surface Water Mitigation Measures

Project Activity	Mitigation Measure
	Spill kits will be available in the vehicles and machinery circulating in the PA and at various places throughout the PA to facilitate the management of accidental spills. Spill kits will include a quantity of sufficient absorbent materials as well as watertight containers intended to collect petroleum products and other hazardous residual materials.
	Petroleum products (hydrocarbons) will be handled in such a way as to prevent and control leaks and spills. Hydrocarbon absorbents will be kept at all times on the premises of storage or use of oil products.
	Disposal and handling of waste oils and hazardous waste will be as recommended by the suppliers and/or manufacturers in compliance with federal and provincial regulations.
	Fuel will be obtained from a licensed contractor who will be required to comply with federal and provincial regulations.
	Settling pond overflow will be discharged to Bald Hill Brook, WC3, and WC4 under operation and reclamation conditions to maintain pre-development flow conditions to the extent practicable.
Reclamation	Pit areas extracted beneath the water table will either be left as pit lakes or will be filled in with silts and clays generated from the washing process.

5.5.7 Monitoring and Follow-up

A Surface Water Monitoring Plan will be developed for the Project and submitted as part of the IA application. The plan will include proposed measures to validate the predicted impacts to surface water quantity and quality and the efficacy of planned mitigation measures. The results of surface water monitoring will be used to inform adaptive water management practices to mitigate any adverse impacts that may result from the Project.

Effective water management requires a clear understanding of the interaction between groundwater and surface water. A Groundwater Monitoring Plan will also be developed for the Project and will be coordinated with surface water monitoring, with both monitoring plans designed to complement each other.

5.5.8 Residual Effects and Significance Determination

The predicted residual environmental effects of the Project on surface water resources are assessed to be adverse, but not significant. The overall residual effect of the Project on surface water is assessed as not likely to have significant adverse effects after appropriate mitigation measures have been implemented as summarized in Table 5.5-10.

A significant adverse effect to the Surface Water Resources (quantity and quality) VC was defined in Section 5.5.4.3 as:

– An unmitigated or uncompensated, Project-related effect for surface water quantity with high magnitude, extend to the LAA and of medium to long term duration, occur at continuously throughout the Project and are irreversible.
– A Project-related effect for surface water quality with a high magnitude, extends to the LAA and of medium to long term duration, occur at regular frequency and are only partially reversible to irreversible.

Residual effects to surface water resources are summarized in Table 5.5-10 and are further addressed in Sections 5.6 (Wetlands) and 5.7 (Fish and Fish Habitat).

Table 5.5-10 Residual Effects on Surface Water Resources

Component	Project Interactions	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
				Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Surface Water Quality	Construction – Clearing, grubbing, and grading	Erosion and sediment controls	A	L Erosion and sediment controls are expected to minimize impacts to receiving waterbodies	PA	A	MT	C	PR	Change in water quality	Not significant
	Operation and Reclamation – Process water effluent discharge into the receiving environment	TSS removal via settling ponds	A	L Erosion and sediment controls are expected to minimize impacts to receiving waterbodies	LAA	A	LT	C	PR	Change in water quality	Not significant
Surface Water Quantity	Operation and Reclamation – streamflow changes in adjacent watercourses	Flow mitigation via settling pond discharge to surrounding watercourses	A	M Predicted changes to average monthly discharge are greater than 5% but less than 10% of baseline conditions	LAA	A	P	C	IR	Changes to streamflow volumes	Not significant

Legend (refer to Tables 5.5-5 and 5.5-6 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	R – Reversible IR – Irreversible PR – Partially Reversible

5.6 Wetlands

5.6.1 Rationale for Valued Component Selection

Wetlands provide several important ecological functions and value, such as habitat for aquatic and terrestrial flora and fauna (including priority species), managing water storage and flow, and improving water quality.

In Nova Scotia, wetlands are protected under the Activities Designation Regulations of the *Environment Act* and the Wetland Conservation Policy (NSECC, 2019). The *Environment Act* defines a wetland as: *"*Land referred to as a marsh, swamp, fen, or bog that either periodically or permanently has water table at, near, or above the land surface or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation, and biological activities adapted to wet conditions*"* (Nova Scotia, 1995).

Nova Scotia's Wetland Conservation Policy (NSECC, 2019). applies to all freshwater and certain tidal wetlands with the objectives to prevent net loss of wetland area or function, promote wetland protection and net gain, and enhance impact mitigation efforts. Under this policy and the *Environment Act*, approvals are required to alter wetlands, with certain exceptions (e.g., wetlands with area <100 m^2, specific linear developments). The policy also provides a mechanism for the province to designate Wetlands of Special Significance (WSS), which may include wetlands known to support at-risk species.

5.6.2 Baseline Program Methods

A desktop review of available topographic maps, provincial databases, and aerial photography was completed to aid in the determination and assessment of wetland habitat in the PA using the following resources:

– NSECC Wetland Inventory Database (NSNR, 2021)
– NSTDB watercourse layer (version dated December 18, 2020)
– NSECC WSS (NSECC, June 2020)
– Provincial flow accumulation data set (version dated May 2007)
– Wet Areas Mapping (WAM) database (version dated December 2007)
– LiDAR data

Wetland delineation was completed by Strum within the PA to identify wetland habitat from June 20 to June 23, 2023 in accordance with the Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987).

The following parameters were used to define wetlands:

– Presence of hydrophytic (water loving) vegetation
– Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season
– Presence of hydric soils

Wetland boundaries were delineated, and vegetation, hydrology, and soils data were recorded. Wetland functional assessments were completed for each wetland identified within the PA using the WESP-AC wetland evaluation technique within the growing season (June to September). When appropriate, dedicated field surveys were conducted to assess the suitability of wetland habitat for wetland-specific species, especially those considered to be SAR or SOCI. Species-specific methodologies are presented in the Baseline Biophysical Report provided in Appendix F.

5.6.3 Baseline Conditions

Two wetlands are present within the PA, totalling 4.8 ha, which represents 4.4% of the total PA. Both wetlands are mixed wood treed swamps and are 3.97 ha and 0.85 ha. Details on each delineated wetland are provided in the Biophysical Baseline Report (Appendix F).

The dominant tree species within WL1 and WL2 include red maple (*Acer rubrum*), white ash (*Fraxinus americana*), black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*). Both wetlands have a notable shrub layer of speckled alder (*Alnus incana*) and white birch (*Betula papyrifera*). The soil type identified in both wetlands was histosol.

WL1 has outflow (WC1) and a small open water feature (Open Water A). WL2 is isolated (no defined outflow or throughflow). Both wetlands are located along the southern boundary of the PA and continue outside the boundary.

Wetland function assessments were completed for each wetland within the PA using the WESP-AC wetland evaluation technique detailed in the Biophysical Baseline Report (Appendix F). Scores ranged from higher to lower for both wetlands. WL1 scored higher in function for the aquatic support and transitional habitat groups and higher in benefits for the water quality group, as it is associated with a watercourse and open water feature, providing a unique range of functions and benefits. WL2 scored lower to moderate in aquatic support, aquatic habitat and transitional habitat groups because it is an isolated wetland offering less habitat variety and overall aquatic support. No functional WSS were identified through the WESP-AC assessments.

Neither of the wetlands are proposed WSS based on the results of the field surveys.

Within the PA, surface water drains in both northerly and westerly directions. Northern flow is directed towards an unnamed tributary to the Annapolis River (herein referred to as WC4), while western flow drains to the Nictaux River. A small amount of surface flow is generated eastward, which is directed toward Bald Hill Brook, which is an Annapolis River tributary. The WC4, Bald Hill Brook, and the Nictaux River drain into the Annapolis River, which is situated approximately 3 km north of the PA. A natural ravine in the south of the PA causes surface water to drain and collect at its base. All surface water originating from the PA is eventually directed north towards the Annapolis River which flows into the Annapolis Basin and eventually the Bay of Fundy.

Baseline conditions are shown on Figure 5.6-1.

Shaw Middleton Sand Pit Project, Middleton, NS

Wetland Impacts

WC3
WC1
WC2
WL 1
WL 2

0 200 400 600 800 m

N

Project Area
Project Footprint
Aquatic Study Area
Field Assessed Watercourse
Field Delineated Open Water
Field Delineated Wetlands

Utilities (line)

Existing Transmission Lines

Transportation

Road
Unpaved Road

Water Features

Mapped Stream
Mapped Lakes and Rivers
Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, ISA Canada, CNWI, HERE, Garmin, USGS

Date:	2025-03-11	Project #:	24-10016
Scale:	1:10,000	Drawing #:	**5.6-1**
Drawn By:	K. Wallace		
Checked By:	S. Allain		

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5.6.4 Effects Assessment Methods

5.6.4.1 Boundaries

The boundaries used to define the environmental effects assessment include spatial boundaries, temporal boundaries, technical boundaries, and administrative boundaries. Spatial boundaries were defined based on where the effects of the Project on wetlands are expected to extend to. Temporal boundaries are based on when Project activities will take place and the duration of those activities. Technical boundaries are the limitations of the effects assessment based on technical aspects (i.e., modelling limitations), and administrative boundaries include the NS Wetland Conservation Policy (NSECC, 2019), the *Environment Act*, and the NS Activities Designation Regulations.

5.6.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on wetlands are defined below and shown on Figure 5.6-2.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses the Annapolis River tertiary watersheds (1DC-3-CC and 1DC-3-EE). These are the two tertiary watersheds that are expected to be impacted.

An RAA has not been defined for this VC as the maximum extent of indirect impacts is expected to be within the LAA.

5.6.4.1.2 Temporal Boundaries

The temporal boundaries for the wetland effects assessment are defined by the construction, operation, and reclamation phase of the Project.

5.6.4.1.3 Technical Boundaries

Technical boundaries for the wetland effects assessment are limited by the wetland model developed for the effects assessment. Wetlands modelled at the LAA scale were provided by NSECC and have not been field verified nor assessed. Due to available GIS inputs and model variables, wetlands within the LAA may be conservatively over or under predicted.

5.6.4.1.4 Administrative Boundaries

Administrative boundaries for the protection and conservation of wetland habitat in NS include the NS Wetland Conservation Policy (NSECC, 2019), the NS Environment Act, and the NS Activities Designation Regulations.

Shaw Middleton Sand Pit Project, Middleton, NS

Wetland Spatial Boundaries

South Farmington

Nictaux

Torbrook Mines

Torbrook

Torbrook West

Nictaux Falls

N

0 0.5 1 1.5 2 km

Project Area

Project Footprint

LAA

Utilities (line)

Existing Pipeline

Existing Transmission Lines

Transportation

Road

Unpaved Road

Water Features

Mapped Stream

Mapped Lakes and Rivers

Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCGC, ISA Canada, CNWI, HERE, Garmin, USGS

Date: 2025-03-11	Project #: 24-10016
Scale: 1:25,000	Drawing #: **5.6-2**
Drawn By: K. Wallace	
Checked By: S. Allain	

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5.6.4.2 Thresholds for Determination of Significance

Table 5.6-1 presents the characterization criteria for effects to wetlands.

Table 5.6-1 Characterization Criteria for Environmental Effects to Wetlands

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – a loss of <1% of wetland habitat of modelled or field delineated wetlands in the LAA, and no direct or indirect impact to identified potential WSS. **L** – a loss of up to 5% of wetland habitat of modeled or field delineated wetlands in the LAA, and no direct or indirect impacts to identified potential WSS. **M** – a loss of up to 10% of wetland habitat of modeled or field delineated wetlands in the LAA, including direct or indirect impacts to identified potential WSS. **H** – a loss of >10% of wetland habitat of modeled or field delineated wetlands in the LAA, including direct or indirect impacts to identified potential WSS
Geographic Extent	**PA** – direct and indirect effects occur within the PA **LAA –** Residual effects extend into the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months. **MT** – effects can occur beyond 12 months and up to 3 years. **LT** – effects extend beyond 3 years. **P** – valued component unlikely to recover to baseline conditions.
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals **R** – Effects occur at regular intervals **C** – effects occur continuously
Reversibility	**R** – wetlands will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to wetlands are permanent and will not recover to baseline conditions

A significant adverse effect to wetlands from the Project is defined as:

– An effect that results in an unmitigated or uncompensated net loss of wetland habitat, including WSS, as defined under the NSECC Wetland Conservation Policy (NSECC, 2019), and its associated no-net loss policy. An adverse effect that does not cause a permanent loss of wetland habitat, in consideration of wetland functions, WSS, and proposed mitigation/compensation, is not considered a significant adverse effect.

5.6.5 Project Interactions and Potential Effects

Project activities and wetland interactions are summarized in Table 5.6-2.

Table 5.6-2 Project Activities and Wetland Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management Transportation
Reclamation	Demolition Earthworks Water management

The Project may impact wetlands through multiple direct and indirect pathways, despite multiple design iterations to reduce impacts to wetlands. The following potential impacts will primarily occur during the construction and operation phases:

– Changes in wetland habitat quality due to clearing of vegetation, introduction of invasive flora species through vehicles and/or people and dust and/or sediment accumulation from construction and operation resulting in indirect impacts to the health and integrity of wetlands.
– Changes to wetland hydrology due to change in catchment area by Project infrastructure and resultant changes in flow and hydrological inputs.

5.6.5.1 Direct Impacts

Direct impacts are the direct loss of wetland habitat due to physical loss resulting from the Project footprint and associated activities. The Project layout and infrastructure has been microsited to avoid direct impacts.

5.6.5.2 Indirect Impacts

Indirect impacts are changes to wetland condition where wetland habitat is not directly lost but may be indirectly altered as the result of Project activities. Project-related indirect impacts to wetlands may occur due to:

– Changes to local hydrology resulting in wetting or drying of wetland habitat, such as inadvertent drainage, groundwater drawdown, or loss of surface water flow within local catchment areas.
– The spread of introduction of invasive species into wetlands through construction equipment, machinery, vehicles, or runoff.
– Potential sedimentation within wetlands as a result of nearby activities (e.g., clearing, grubbing, grading, removal of vegetation, stockpiling of prepared material).
– Dust deposition, which can introduce minerals and nutrients into wetlands and stress wetland vegetation (particularly non-vascular species).

Potential indirect impacts to wetland flora and fauna such as edge effects, dust, and invasive species are discussed in Section 5.8 (Terrestrial Environment). Potential indirect impacts to water quality and quantity are further discussed in Sections 5.4 (Groundwater Resources) and 5.5 (Surface Water Resources). Mitigation measures and monitoring to address potential indirect pathways which may impact wetlands from other VCs, such as dust, sedimentation, invasive species, habitat quality, etc. are presented in the respective VCs mitigation discussions. The potential effect of these pathways on wetlands is anticipated to be mitigated through VC specific measures, however, wetland monitoring will capture impacts from these sources if they occur.

Indirect impacts to wetland function and habitat integrity typically result from changes to wetland hydrology, which occurs through changes in the catchment area, surface water flow reductions, and groundwater drawdown. These potential indirect impacts are assessed through predicted impacts to groundwater and surface water, which is described in Sections 5.4 and 5.5. Indirect impacts to wetlands will be determined during the permitting stage and the monitoring program.

5.6.5.2.1 Indirect Hydrological Impacts

Predicted impacts to groundwater and surface water, as described in their respective VCs, was used to guide wetland effects assessments. To identify potential effects of the Project on local wetland hydrology, the following indirect impact pathways were assessed for each wetland in the PA:

– Predicted flow reductions within each catchment area in which infrastructure is proposed (detailed in Section 5.5); and,
– Changes in headwater contributing area and water management.

Down-gradient, indirect wetland impacts can occur as a result of upgradient hydrological alteration and changes to catchment area size and/or land use. Up-gradient development in catchment areas can impact wetlands by altering natural surface water runoff and groundwater contributions, and thus the amount of water supplied to down-gradient systems. Changes to catchment areas typically result in a reduction of water inputs, however, an increase can also occur if catchments are enlarged or receive managed drainage. Change to catchment surface conditions, such as earth moving, ditching, vegetation clearing, settling ponds, or soil compaction can alter the timing of water inputs by increasing the amplitude and shortening the hydroperiod (e.g., flashier inputs). It is expected that the alteration of hydrological flow paths may result in indirect impacts to wetlands through catchment surface water flow reduction or increase.

The results of the Water Balance Assessment indicate that changes in the catchment areas and streamflow associated with each wetland are <10%. Therefore, indirect impacts are expected to be low magnitude and within natural variation (DFO, 2013). The catchment area that contains WL1 (WC1-DS) is expected to experience a reduction of 0.78% from existing conditions. The contributing drainage area that contains Bald Hill Brook (BHB-SW4) and WL2 is expected to experience an increase in catchment area of 6.83%. Overall, these indirect effects are assessed as not significant because they are not expected to result in a permanent loss of wetland habitat. Additionally, any drying effects that may occur within WL1 are not expected to have a significant negative impact on watercourses further downstream.

All sand extracted from beneath the water table will be removed via dredge. As such, sand extraction is not anticipated to result in groundwater drawdown as the pit area will not be dewatered. Following extraction, any pit areas extracted beneath the water table will either be left as pit lakes, or will be filled with silt and clay, maintaining the adjacent water table elevation.

Freshwater requirements for the wash plant are proposed to be met by withdrawal from an on-site water supply pond. As described in Section 5.4, the process water supply system for the Project will be in essence a closed loop system. Indirect impacts on wetlands from changes in baseflow as result of sand extraction and water withdrawal are expected to be low magnitude and within natural variation (DFO, 2013).

Indirect hydrological effects will continue to be assessed during detailed design and permitting to inform monitoring.

5.6.5.3 Direct and Indirect Impacts Summary

No direct impacts to wetlands will occur due to Project activities. Both wetlands will be avoided. Indirect impacts that may occur include a reduction in the catchment area for WL1 and an increase in the catchment area for WL2, which may impact wetland hydrology. However, the magnitude of the impacts to wetland hydrology are expected to be low and not significant.

Other potential indirect impacts include introduction of invasive species, sedimentation, and dust deposition. Mitigation measures, including an erosion and sedimentation control plan and water management infrastructure, will be developed to reduce the potential indirect impacts.

5.6.6 Mitigation

The following section describes avoidance, mitigation, and monitoring measures that have been taken or are proposed to limit the impacts of Project activities to wetlands.

5.6.6.1 Measures to Avoid

Throughout the iterative process of developing the current Project layout, avoidance of effects to wetlands was attained through several key design considerations.

Initial delineation of wetlands within the PA was completed to help inform an optimized site layout and reduce potential impacts to wetlands. As a result, the Project has been planned to avoid direct impacts to wetlands.

5.6.6.2 Measures to Mitigate

When avoidance measures do not eliminate impacts wetlands, mitigation measures are implemented to reduce impacts. A list of proposed mitigation measures for wetlands is provided in Table 5.6-3.

Table 5.6-3 Wetlands Mitigation Measures

Project Phase	Mitigation Measure
Construction	Ensure all wetlands in the PA are visually delineated with flagging tape prior to construction.
	Complete pre-construction site meetings for all relevant staff/contractors related to working around wetlands and watercourses to minimize unauthorized disturbance.
	Acquire and adhere to wetland alteration permit approvals prior to alteration of any wetland habitat.
Construction and Operation	Implement and adhere to the site-specific ESC Plan
	Follow spill preparedness protocols and ensure fueling areas are a minimum of 30 m from wetlands and watercourses.
	Implement construction methods that reduce the potential to drain or flood surrounding wetlands. For example, no unpermitted pilling of soil/material and no unnecessary ditching/artificial channelization.
	Direct site runoff through natural vegetation, wherever possible.
	Ensure all process water meets water quality standards when it is released into the surrounding environment.

Table 5.6-3 Wetlands Mitigation Measures	
Project Phase	**Mitigation Measure**
	Employ measures to reduce the spread of invasive species (especially by vehicles) into wetlands and retain habitat integrity. This can be accomplished by inspecting vehicles or cleaning them away from wetlands and watercourses.
	Seed disturbed areas once they have reached final grade elevations.
	Construct water management infrastructure including settling ponds, ditches, and silt management areas.
Reclamation	Revegetate areas once the activity is complete.
	Contour and stabilize the pit.

5.6.7 Monitoring and Follow-up

Wetlands are protected under the *Environment Act*, S.N.S. 1994-95, c.1 and Wetland Conservation Policy (NSE, 2019) to mitigate net loss of habitat and function. The wetland alteration permitting process will be completed as required and in consultation with NSECC.

Wetland monitoring will be completed to verify the accuracy of the predicted indirect effects, the effectiveness of the mitigation measures outlined in Section 5.6.6.2, and the potential need for additional mitigation measures. A preliminary monitoring approach is proposed herein. A detailed wetland monitoring plan will be prepared through the wetland permitting process in consultation with NSECC.

Generally, wetland monitoring is developed based on the expected impacts. Typical wetland monitoring methods include hydrological and vegetative approaches to assess potential shifts in wetland characteristics and function over time. Visual observations of wetland conditions are also used to supplement this information. Baseline monitoring (pre-construction) will take place before construction commences to acquire baseline conditions from which to compare post-construction monitoring results. Comparison methods and indicators of change will be detailed in the wetland monitoring plan. If post-construction wetland monitoring indicates a change in the wetlands outside of natural variation, Shaw will consult with NSECC to identify whether corrective actions or compensation will be required. Annual monitoring results, as well as any changes to the program, will be provided to NSECC, as per wetland alteration permit conditions. NSECC will be contacted and consulted in the instance of an unintended direct and/or indirect impact to a wetland.

5.6.8 Residual Effects and Significance Determination

Residual effects and significance determination for predicted residual environmental effects are summarized in Table 5.6-4.

Table 5.6-4 Residual Effects on Wetlands

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – clearing, grubbing, earth moving	Limit impacts through detailed Project design, and onsite wetland training	A	L	PA	A	ST	O	PR Mitigations can not guarantee a return to baseline conditions	Change in catchment area, streamflow, and baseflow	Not significant
Construction and Operation - Indirect impacts to wetlands: hydrological, dust, sediment and erosion, invasive species, accidents/malfunctions)	Sediment and erosion control, maintain hydrological flow paths, wetland health and invasive species monitoring, spill preparedness, water management	A	L	PA	A	LT	R	PR Mitigations can not guarantee a return to baseline conditions	Change in catchment area, streamflow, and baseflow	Not significant
Reclamation	Sediment and erosion control, best practices, spill preparedness.	A	L	PA	A	MT	O	PR Mitigations and reclamation cannot guarantee a return to baseline conditions	Reclamation	Not significant
Legend (refer to Table 5.6-1 for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area		Timing N/A – Not Applicable A – Applicable		Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility R – Reversible IR – Irreversible PR – Partially Reversible		

5.7 Fish and Fish Habitat

5.7.1 Rationale for Valued Component Selection

The Nova Scotia *Environment Act* requires that an approval from NSECC be obtained before any watercourses or water resource can be altered, including changes to the flow of water. Surface water was selected as a VC because watercourses may be directly or indirectly altered, disturbed, or destroyed by the Project.

Fish and fish habitat and aquatic SAR are protected under federal legislation by the *Fisheries Act* and *Species at Risk Act.* Fish and fish habitat were selected as a VC because habitat that supports fish may be directly or indirectly altered, disturbed, or destroyed by the Project.

The *Fisheries Act* prohibits the carrying out of any work, undertaking or activity, other than fishing, that results in the death of fish and/or harmful alteration, disruption, or destruction (HADD) of fish habitat. If a project cannot avoid, or is likely to cause, death of fish and/or HADD of fish habitat, then a *Fisheries Act* Authorization (FAA) is required.

The fish and fish habitat VC is linked to:

– Wetlands (Section 5.6): Wetlands that support fish habitat (as presented in the Biophysical Baseline Report (Appendix F) are further evaluated under effects to fish and fish habitat.
– Groundwater and Surface Water Resources (Sections 5.4 and 5.5): Changes in groundwater and surface water are related directly to fish and fish habitat.
– Socioeconomic Conditions and Mi'kmaq of Nova Scotia (Sections 5.9 and 5.11): Impacts to fish and fish habitat could affect usage of the PA by Mi'kmaq of Nova Scotia and the local community, for both traditional and recreational fishing.

5.7.2 Baseline Program Methodology

Fish and fish habitat surveys were completed to facilitate avoidance of surface water features and fish and fish habitat when possible and to support Fish and fish habitat regulatory applications. Fish and fish habitat were assessed by completing a desktop review and field studies. Field studies were completed within the Aquatic Study Area (ASA), which includes watercourses where there are anticipated effects to Fish and fish habitat.

Field studies completed within the ASA include:

– Wetland and watercourse delineation to identify aquatic habitat within the PA
– In-situ water quality measurements
– Fish collection (i.e. electrofishing and trapping) within selected watercourses and waterbodies
– Detailed fish habitat assessment

5.7.2.1 Wetland and Watercourse Delineation

Wetland and watercourse delineation was completed across the PA and ASA (respectively) in accordance with NS standards for identification of watercourses and wetlands (NSECC, 2015a). A detailed account of wetland and watercourse delineation methods and results is provided in the Baseline Biophysical Report (Appendix F). Each of these aquatic habitat types were evaluated for the presence of fish habitat and potential ability to support fish species during initial assessment and identification.

The following parameters were used to define wetlands:

– Presence of hydrophytic (water loving) vegetation
– Presence of hydrologic conditions that result in periods of flooding, ponding, or saturation during the growing season
– Presence of hydric soils

The following parameters were used to define watercourses:

– Presence of a mineral soil channel
– Presence of sand, gravel and/or cobbles evident in a continuous pattern over a continuous length with little to no vegetation
– Indication that water has flowed in a path or channel for a length of time and rate sufficient to erode channel or pathway
– Presence of pools, riffles or rapids
– Presence of aquatic animals, insects or fish
– Presence of aquatic plants

According to guidance provided by NSECC, any surface feature that meets two of the criteria above meets the definition of a provincially regulated watercourse (NSECC, 2015b).

Fish habitat is described in the context of any aquatic feature which is contiguous with a fish bearing stream, whether it is located within a watercourse, wetland, or waterbody.

Open water features were identified as components of linear watercourses (e.g., ponds) that were more accurately represented graphically by polygon files rather than lines. From a regulatory perspective, open water features are defined as watercourses by the *Environment Act*. Features referred to as open water habitats were typically less than 2 m depth, <8 ha in size, and had less than 50% vegetative cover following guidance from the Army Corps of Engineers wetland delineation manual (Environmental Laboratory, 1987).

The results of baseline wetland and watercourse delineation were used to inform all additional field programs, particularly detailed fish habitat evaluations and fish collection.

5.7.2.2 In-Situ Water Quality Measurements

In-situ water quality measurements were recorded for each watercourse reach delineated through detailed habitat assessments. Water quality measurements were collected using a calibrated Myron Ultrapen DO Pen Probe and Hannah Combo pH/Conductivity/TDS Probe at the time of the sampling event/survey. Detailed results are presented in the Baseline Biophysical Report (Appendix F).

5.7.2.3 Fish Collection

Electrofishing was conducted within three survey locations in the ASA: WC2 (Reach A and B) and WC3. Sampling reaches of approximately 100 m were established. The goal of the electrofishing surveys was to determine fish species presence and to estimate relative abundance within the ASA.

Fish were sampled within open sites (i.e., without the use of barrier nets) using a Halltech Battery Backpack Electrofisher (HT-2000) with unpulsed direct current (DC). A two-pass approach was used, and an open site was employed to ensure the greatest likelihood of capturing any fish present and estimate relative abundance. The operator waded upstream to eliminate the effects of turbidity caused by bottom sediment. A second crew member walked behind the operator to net any stunned fish using a D-frame landing net (1/8" mesh). If fish were captured, they were held in a live well, a 5-gallon plastic bucket that contains ambient stream water. The live well was kept out of the sun and captured fish were checked regularly for signs of stress. In addition, water temperatures were monitored during electrofishing surveys to prevent fishing in water greater than 22°C (per Section 1.5 of the McCallum Environmental Ltd. fish license #341208). At the conclusion of the pass, fish

in the live well were identified to species and measured for length and weight. After recuperating from the electrofishing shock, all fish were released back into the sampled reach. Species abundance estimates were calculated using elcotrofishing Catch Per Unit Effort (CPUE) indices, standardized to 300 seconds of effort.

Trapping was conducted in conjunction with electrofishing surveys to capture and record fish presence within WC2 and Open Water A. Minnow traps and eel pots were used to capture and record fish presence, as water levels at the time of assessment were insufficient to deploy other, larger trap types (e.g. fyke nets). Minnow traps have an effective catch range of body depths approximately 6-50 mm. Eel pots have an effective catch range of body depths approximately 10 – 80 mm. Baited minnow traps and eel pots were set in pools with sufficient water depths to cover the traps, left overnight, and collected the following day.

5.7.2.4 Detailed Fish Habitat Assessment

Detailed fish habitat assessments were completed in three watercourses within the ASA (WC1, WC2, and WC3) and an open water feature (Open Water A). The watercourses were delineated into individual reaches defined by discrete homogeneous units (e.g., riffle, run, pool, flat, etc.) as determined in the field in an upstream to downstream direction. For each reach (i.e., homogenous section of watercourse), a detailed fish habitat survey was completed, which included water quality measurements, designation of substrate and cover types, riparian habitat descriptions, and barrier assessments. Cross-sectional measurements (transects) were established to describe morphological factors (e.g., channel and wetted widths, bank heights) and flow characteristics (e.g., velocities and depths) within the reach. Transect measurements were recorded at every 25 m length of reach. The number of transects and transect locations were selected and modified as needed in the field based on specific habitat features observed, or limitations related to access, wadeability, and safety concerns

Traditional lentic fish habitat characterizations for open water features could not be completed due to wading conditions brought on by deep water and muck substrates. Instead, the general habitat type was described and measurements of depth, substrate, velocity (where possible), vegetative cover and width were recorded and validated with aerial image interpretation.

5.7.3 Baseline Conditions

A summary of baseline conditions is presented in the following sections. Full detail related to baseline conditions is outlined in Appendix F.

5.7.3.1 Watershed

The PA is situated entirely within the Annapolis primary watershed (1DC) and the Annapolis River secondary watershed (1DC-3). The PA is further divided into two tertiary watersheds, 1DC-3-CC (herein referred to as the Nictaux River tertiary watershed) and the 1DC-3-EE (herein referred to as the Annapolis River tertiary watershed). No mapped watercourses or waterbodies were identified within the PA; however, Bald Hill Brook commences approximately 77 m west of the southwestern edge of the PA and flows northwest towards the Nictaux River.

The topographical high within the ASA is situated in the eastern corner. Within the PA, surface water drains from this topographic high in both northerly and westerly directions. Northern flow is directed towards an unnamed tributary to the Annapolis River (herein referred to as WC4) while western flow drains to the Nictaux River. A small amount of surface flow is generated eastward, which similarly is directed toward Bald Hill Brook, which is a tributary to the Annapolis River. These watercourses and the Nictaux River drain into the Annapolis River which is situated approximately 3 km north of the PA. A natural ravine in the south of the PA causes surface water to drain and collect at its base. All surface water originating from the PA is eventually directed north towards the Annapolis River, which flows into the Annapolis Basin and eventually the Bay of Fundy.

Baseline conditions are shown on Figure 5.7-1.

Shaw Middleton Sand Pit Project, Middleton, NS

Fish and Fish Habitat Impacts

WC3
WC1
WC2
WL 1
WL 2
Open water 1

0 200 400 600 800 m

N

Project Area
Project Footprint
Aquatic Study Area
Field Assessed Watercourse
Field Delineated Open Water
Field Delineated Wetlands

Utilities (line)
Existing Transmission Lines

Transportation
Road
Unpaved Road

Water Features
Mapped Stream
Mapped Lakes and Rivers
Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, ISPA Canada, CNVI, HERE, Garmin, USGS

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5.7.3.2 Wetland and Watercourse Delineation

Within the PA, two wetlands were delineated. Within the broader ASA, three watercourses were delineated. One open water feature was identified within the ASA within one of the wetlands. These results are further described in detail in the Baseline Biophysical Report (Appendix F).

5.7.3.3 In-Situ Water Quality Measurements

Recorded summer water temperatures range from 14.6 to 20.6 degrees Celsius and are considered suitable for the local fish community. The pH range for aquatic features sampled within the ASA was between 5.7-7.6, with an average pH of 6.48. All measurements, except for three (6.8 and 6.9 in WC2 and 7.6 in WC3) fall outside of the CCME guidelines (<6.5) but are not considered limiting to the local fish community. Conductivity and TDS are often used as baseline for comparison with background measurements. Major changes in this parameter could indicate that a discharge or some other source of pollution has entered the aquatic resource. Conductivity and TDS levels measured within the PA (100-136 µS/cm and 27-81 mg/L, respectively) are considered acceptable for aquatic life.

5.7.3.4 Fish Collection

Electrofishing surveys resulted in the capture of three species and 14 individual fish within one of the three survey locations, WC2 Reach A. A total of five threespine stickleback (*Gasterosteus aculeatus*), six creek chub (*Semotilus atromaculatus*), and two brook trout (*Salvelinus fontinalis*) were captured. No fish were captured in WC2, Reach B or WC3.

Over the 82.20 hours of trapping within Open Water A (headwaters of WC1), no fish were caught or observed. Over 127.71 hours of trapping within WC2, 101 fish were caught in 3 of the 4 minnow traps. These species included threespine stickleback, with the highest abundance (89 individuals), creek chub (8 individuals) and northern redbelly dace (*Chrosomus eos*) (4 individuals). No fish were captured in eel pots.

During the field program, four species and 115 fish were captured through electrofishing and trapping surveys. All fish species that were collected were captured in WC2. Brook trout are considered the only priority species that was captured in the ASA, composing 2.6% of the total catch. All fish species that were captured are considered coolwater or coldwater species. A summary of fish species captured is presented in Table 5.7-1.

Table 5.7-1 Summary of Fish Species Captured in the ASA

Common Name	Scientific Name	COSEWIC/SARA/ ESA/SRank	Total Catch	
			Total #	% Catch
Northern redbelly dace	*Chrosomus eos*	S5	4	3.4%
Creek chub	*Semotilus atromaculatus*	S5	14	12.1%
Threespine stickleback	*Gasterosteus aculeatus*	S5	94	81.7%
Brook trout	*Salvelinus fontinalis*	S3	3	2.6%
Total Catch			115	

5.7.3.5 Detailed Fish Habitat Assessment

Detailed fish habitat assessments revealed that the watercourses assessed provide suitable habitat for several life stages of the four fish species identified within the ASA. WC1 provides suitable habitat for all life stages of brook trout, creek chub, northern redbelly dace, and threespine stickleback. The upstream reach of WC1 is ephemeral, therefore, during low flow conditions, there is a barrier to fish access to Open Water A. WC2 provides suitable habitat for all life stages of northern redbelly dace and brook trout, spawning habitat for

threespine stickleback, and YOY, juvenile, and adult habitat for creek chub. WC3 provides suitable spawning habitat for northern redbelly dace and threespine stickleback. YOY, juvenile, and adult brook trout habitat is present, as well as suitable juvenile creek chub habitat. The three watercourses are all first order streams with connectivity to downstream fish-bearing watercourses. Detailed results are provided in the Baseline Biophysical Report (Appendix F).

5.7.4 Effects Assessment Methods

5.7.4.1 Boundaries

The boundaries used to define the environmental effects assessment include spatial boundaries, temporal boundaries, technical boundaries, and administrative boundaries. Spatial boundaries were defined based on where the effects of the Project on fish and fish habitat are expected to extend to. Temporal boundaries are based on when Project activities will take place and the duration of those activities. Technical boundaries are the limitations of the effects assessment based on technical aspects (i.e. modelling limitations), and administrative boundaries include the Fisheries Act, Environment Act, SARA, and NSESA.

5.7.4.1.1 Spatial Boundaries

The spatial boundaries used in the effects assessment for fish and fish habitat are defined below and shown on Figure 5.7-2.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The ASA was established to identify watercourses (i.e., fish habitat) that may be directly or indirectly affected by the Project. It incorporates the entirety of WC1 that extends outside of the PA, an unnamed tributary that flows into Nictaux River and that WC1 flows into (WC2), and an unnamed tributary northwest of the PA that flows north, into Nictaux River (WC3).
– The LAA encompasses the Annapolis River tertiary watershed (1DC-3-EE) and the Nictaux River tertiary watershed (1DC-3-CC). These are the two tertiary watersheds that are expected to be impacted.

No RAA has been defined for this VC as the maximum extent of indirect impacts is expected to be within the LAA. The PA lies entirely within the Annapolis River secondary watershed, with potential impacts to two tertiary watersheds. It is expected that impacts to the aquatic environment will be contained within these two tertiary watersheds and shall not extend beyond the ASA. Considering the water management, size and location of the Project and the location of the infrastructure, the activities are not expected to impact downgradient of the ASA (i.e., Nictaux River or the Annapolis River) beyond natural variability. However, as there is potential for impacts beyond the ASA, the LAA is considered the appropriate boundary for the evaluation of this VC.

5.7.4.1.2 Temporal Boundaries

The temporal boundaries for the fish and fish habitat effects assessment are defined by the construction, operation, and reclamation phase of the Project. The assessment of effects to fish and fish habitat is further evaluated based on modelling scenarios.

5.7.4.1.3 Technical Boundaries

Technical boundaries for the assessment of the effects of changes in surface water and groundwater due to Project activities are the limitations of the modelling in the Water Balance Analysis (WBA). For these limitations refer to Appendix E.

Shaw Middleton Sand Pit Project, Middleton, NS

Fish and Fish Habitat Spatial Boundanes

South Farmington

Nictaux

Torbrook Mines

Torbrook

Torbrook West

Nictaux Falls

N

0 0.45 0.9 1.35 1.8 km

- Project Area
- Project Footprint
- Aquatic Study Area
- LAA

Utilities (line)

- Existing Pipeline
- Existing Transmission Lines

Transportation

- Road
- Unpaved Road

Water Features

- Mapped Stream
- Mapped Lakes and Rivers
- Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, ISA Canada, CNWI, HERE, Garmin, USGS

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5.7.4.1.4 Administrative Boundaries

Administrative boundaries are that effects on fish and fish habitat were assessed based on the framework offered by the Fisheries Act and DFOs interpretation of death of fish and HADD of fish habitat. Administrative boundaries also include the SARA, NSESA, and the Environment Act.

5.7.4.2 Thresholds for Determination of Significance

Table 5.7-2 presents the characterization criteria for effects to fish and fish habitat.

Table 5.7-2 Characterization Criteria for Environmental Effects to Fish and fish habitat

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – no measurable change in fish habitat quantity or quality: Less than 1% change in surface flow. No direct loss of fish habitat **L** – a measurable change in fish habitat quantity or quality, but within natural variation with consideration of the following variables: Less than 10% change in surface flow not affecting the ability of fish to use the habitat to carry out one or more life processes. No direct loss of fish habitat **M** – a measurable change in fish habitat quantity or quality which partially limits the ability of fish to use the habitat to carry out one or more life processes (i.e., an effect which occurs only seasonally) with consideration of the following variables: Less than 25% change in surface flow not affecting the ability of fish to use the habitat to carry out one or more life processes. Partial loss of fish habitat quantity **H** – a measurable change in fish habitat quantity or quality to an extent which limits the ability of fish to use the habitat to carry out one or more life processes with consideration of the following variables: More than 25% change in surface flow not affecting the ability of fish to use the habitat to carry out one or more life processes. Complete direct loss of fish habitat
Geographic Extent	**PA** – the residual environmental effect occurs within the PA **ASA** – Occurs beyond the PA and within the ASA **LAA** – Residual effects extend into the LAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months. **MT** – effects can occur beyond 12 months and up to 3 years. **LT** – effects extend beyond 3 years. **P** – valued component unlikely to recover to baseline conditions.
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals **R** – Effects occur at regular intervals **C** – effects occur continuously
Reversibility	**R** – fish and fish habitat will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to fish and fish habitat are permanent and will not recover to baseline conditions

A significant adverse effect to fish and fish habitat from the Project is defined as:

– A Project-related effect that is likely to cause a temporary or permanent change to fish and habitat that impairs the habitat's capacity to support one or more life stages of fish, that cannot be avoided, mitigated, or offset; and/or,

– A Project-related effect that is predicted to cause a measurable change in local fish populations beyond the range of natural variability (through changes in abundance, health, growth, or survival).

5.7.4.3 Water Balance Assessment

A WBA was completed to determine the effects of Project activities on fish and fish habitat by modelling changes in surface water and groundwater. Based on the methods and results discussed in the WBA (Appendix E), the following sections outline and evaluate the predicted change in water quantity within each aquatic feature in the ASA.

5.7.4.4 Interpretation of Regulatory Guidelines

Effects to fish and fish habitat through flow reductions have been assessed using guidance outlined in the Framework for Assessing the Ecological Flow Requirements to support Fisheries in Canada (DFO, 2013). According to DFO (2013), “The scientific literature supports natural flow regimes as essential to sustaining the health of riverine ecosystems and the fisheries dependant on them. Riverine ecosystems and the fisheries they sustain are placed at increasing risk with increasing alteration of natural flow regimes”.

The probability of these impacts to fish and fish habitat increases with increasing alteration to the natural flow regime. When applicable, changes in surface water runoff have been compared to thresholds outlined in the DFO Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada (DFO, 2013):

– Cumulative flow alterations <10% in amplitude of the actual (instantaneous) flow in the river relative to a “natural flow regime” have a low probability of detectable impacts to ecosystems that support fisheries.
– Cumulative flow alterations that result in instantaneous flows <30% of the mean annual discharge (MAD) have a heightened risk of impacts to fisheries.

As stated in the Framework, “for Canadian rivers and streams, the expert consensus is that cumulative flow alterations of less than +/- 10% of the magnitude of actual (instantaneous) flow in the river relative to a “natural flow regime” have a low probability of detectable negative impacts to ecosystems. In addition, there was consensus amongst workshop participants that cumulative flow alterations that result in instantaneous flows less than 30% of the MAD have a heightened risk of impacts to ecosystems that support fisheries” (DFO, 2013).

As part of the effects assessment, a review of the predicted changes in monthly runoff was completed to determine if the proposed pit expansion would result in an alteration of flow in exceedance of the thresholds outlined by DFO (2013). If monthly flows fall below 30% MAD naturally and is then exacerbated by Project flow reductions, or if the flow is increased or reduced by more than 10% based on Project activities, the resulting alteration can be considered to have a heightened risk of impacts to fisheries and therefore could have a significant negative effect on fish and fish habitat. Alterations that do not exceed these thresholds are considered to have a low probability of detectable impacts to ecosystems that support fisheries.

One key limitation identified by DFO (2013) is that the determinations of effects to fish and fish habitat are not well understood in intermittent, seasonal, or ephemeral watercourses. The in-stream flow needs for watercourses which naturally lack flow at certain times of the year are not well understood, and guidance is lacking to determine effects to fish habitat in these systems. As a result, if these systems are encountered in the effects assessment, a determination will be made based on known physical parameters of the watercourse, known or expected fish usage, and predicted alterations in the natural flow regime. Of the watercourses with expected flow disruption impacts, the majority are second order perennial streams.

5.7.5 Project Interactions and Potential Effects

The works, undertakings, and activities associated with the construction, operation, and reclamation of the Project can impact fish and fish habitat through multiple direct and indirect pathways. The identification of potential Project interactions with fish and fish habitat have been guided by DFO’s Pathways of Effects (2018).

Table 5.7-3 provides a summary of potential effects, effects pathways, and measurable parameters used throughout the effects assessment. Potential impacts to fish and fish habitat are shown on Figure 5.7-1.

Table 5.7-3 Fish and fish habitat effects pathways

Potential Effect	Effect Pathway	Measurable Parameter(s)
Change in fish habitat quantity	Direct removal of fish habitat through excavation, or road crossing	- Area of fish habitat destruction (m^2)
Change in fish habitat quality	Changes in surface flow and temperature through changes to contributing drainage areas resulting in flow increases or reductions in streams within the ASA	- Water level and flow (predicted) - Water quality compared with relevant guidelines and/or requirements for individual species and life stages - Fish habitat suitability
	Changes in water quality through water management practices or release of deleterious substances	
Change in fish health and survival	Use of industrial equipment in or near water	- Abundance - Mortality - Sublethal effects to fish
	Release of deleterious substances	
	Changes in water quality through water management practices	

Project activities and fish and fish habitat interactions are summarized in Table 5.7-4.

Table 5.7-4 Project Activities and Fish and fish habitat Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management
Reclamation	Demolition Earthworks Water management

Table 5.7-5 summarizes the fish and fish habitat that were assessed within the ASA, proposed effects, and the duration of interaction. All of these watercourses and waterbodies were pulled forward through the effects assessment.

Table 5.7-5 Summary of Fish and fish habitat Evaluated

Watercourse/Open Water*	Stream Order	Proposed Effect	Duration of Interaction
WC1	1	Change in streamflow	Irreversible
WC2	1	Change in streamflow	Irreversible
WC3	2	Change in streamflow	Irreversible
WC4	1	Change in streamflow	Irreversible

Table 5.7-5 Summary of Fish and fish habitat Evaluated

Watercourse/Open Water*	Stream Order	Proposed Effect	Duration of Interaction
Bald Hill Brook	1	Change in streamflow	Irreversible
Open Water A	--	Reduction in surface water quantity	Irreversible

*WC4, and Bald Hill Brook did not have field surveys completed. These were evaluated during the WBA only.

5.7.5.1 Change in Surface Water and Fish Habitat Quantity

No surface water features or fisheries resources were identified within the PA, and the closest watercourse, WC1, will be avoided by Project activities. However, as a result of the pit development, watercourses within the ASA will lose contributing draining areas resulting in potential loss of fish habitat.

Seven points of interest (POIs) were identified within the local watersheds surrounding the PA. The local watershed, POIs, area, and associated watercourse are presented in Table 5.7-6 and the WBA (Appendix E).

Table 5.7-6 Summary of the POIs Assessed

Local Watershed/POI	Area (ha)	Watercourse
WC1-SW5	54.19	WC1
WC1-DS	85.73	WC1
WC2	274.42	WC2
WC3	123.57	WC3
WC4	176.28	WC4
BHB-SW4	160.25	Bald Hill Brook
BHB-DS	651.04	Bald Hill Brook

The existing (i.e. baseline) contributing drainage areas, the operating conditions contributing drainage areas, and the percent change for each POI are presented in Table 5.7-7. The contributing drainage areas for each POI under the baseline, operation, and reclamation conditions are presented in the WBA (Appendix E).

Table 5.7-7 Percent changes in contributing drainage area

POI	Existing Area (ha)	Post-development Area (ha)	% Change in Contributing Drainage Area
WC1-SW5	54.19	54.10	-0.17
WC1-DS	85.73	85.06	-0.78
WC2	274.42	273.75	-0.24
WC3	123.57	122.47	-0.89
WC4	176.28	180.61	2.46
BHB-DS	651.04	649.93	-0.17
BHB-SW4	160.25	171.19	6.83

The largest existing contributing drainage area for the POIs assessed belongs to BHB-DS (651.04 ha). The smallest contributing drainage area of the POIs assessed is associated with WC1-DS (85.73 ha).

Despite five of the seven contributing drainage areas experiencing negligible (<1%) changes, further modelling was performed on all of the POIs to more accurately understand potential impacts from the Project. However,

based on the modelled changes in contributing drainage areas, it was determined that no field studies were required on BHB-DS, BHB-SW4, and WC4 as the percent change in the associated contributing drainage area for all POIs is <10%. Therefore, there is a low probability of detectable impacts to ecosystems that support fisheries.

Utilizing the methodology discussed in the WBA (Appendix E), predicted changes to surface water runoff and the resulting impacts to surface water features and fish habitat within or downgradient of the ASA will be discussed. A summary of the predicted annual streamflow volumes, average annual change in streamflow, and maximum average monthly change in runoff at the seven POIs under both existing conditions and proposed conditions is presented in Table 5.7-8 and the WBA (Appendix E). A discussion of the potential effects to fish and fish habitat as a result of changes to stream flow is provided for each POI.

Table 5.7-8 Annual Runoff Volumes for WC1-SW5

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
WC1-SW5				
Baseline	314,326	--	--	--
Operation	316,040	0.55	0.55	January – June and December
Reclamation	314,908	0.19	0.19	January – June and December
WC1-DS				
Baseline	490,463	--	--	--
Operation	486,661	-0.78	-0.78	January – June and December
Reclamation	486,661	-0.78	-0.78	January – June and December

WC1 is a first order stream flows from Open Water A and drains into WC2, which is a tributary to Nictaux River. WC1 is considered a fisheries resource due to connectivity with WC2, which is known to be fish bearing based on trapping and electrofishing results described in the Baseline Biophysical Report (Appendix F).

WC1-SW5 is expected to experience an annual average increase of streamflow of 0.55% during operation and 0.19% during reclamation. The maximum monthly percent change during operation and reclamation are 0.55% and 0.19%, respectively.

WC1-DS is expected to experience an annual average reduction of streamflow of -0.78%, which is also the maximum monthly reduction.

The WBA demonstrates that the change in streamflow never exceeds DFO's Ecological Flow Framework (10% flow disruption increase or decrease) during any month at this POI. Therefore, as per DFO (2013), no detectable changes to flow from existing conditions within this watercourse (WC1) are anticipated and this system is not discussed further in the effects assessment of water quantity or quality on fish and fish habitat.

Table 5.7-9 Annual Runoff Volumes for WC2

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
Baseline	1,586,344	--	--	--
Operation	1,571,213	-0.95	-0.96	January – May and December

Table 5.7-9 Annual Runoff Volumes for WC2

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
Reclamation	1,577,455	-0.56	-0.56	January – July and November - December

WC2 is a predominantly perennial, first order stream that originates southwest of the PA and flows into the Nictaux River. WC2 is considered a fisheries resource. Trapping and electrofishing results revealed the presence of four fish species within the watercourse. Fish collection results are described in the Biophysical Baseline Report (Appendix F).

WC2 is expected to experience an annual average reduction of streamflow of -0.95% during operation and -0.56% during reclamation. The maximum monthly percent change during operation and reclamation are -0.96% and -0.56%, respectively.

The WBA demonstrates that the change in streamflow never exceeds DFO's Ecological Flow Framework (10% flow disruption increase or decrease) during any month at this POI (Appendix E). Therefore, as per DFO (2013), no detectable changes to flow from existing conditions within this watercourse (WC2) are anticipated and this system is not discussed further in the effects assessment of water quantity or quality on fish and fish habitat.

Table 5.7-10 Annual Runoff Volumes for WC3

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
Baseline	750,679	--	--	--
Operation	718,350	-4.31	-4.31	January – June and December
Reclamation	722,427	-3.76	-3.77	January – May and December

WC3 is an intermittent watercourse that originates from a wetland in the northwest portion of the ASA and eventually flows into Nictaux River. WC3 is a fisheries resource due to its connectivity with the Nictaux River and presence of suitable habitat for known species within the ASA.

WC3 is expected to experience an annual average reduction of streamflow of -4.31% during operation and -3.77% during reclamation. The maximum monthly percent change during operation and reclamation are -4.31% and -3.77%, respectively.

The WBA demonstrates that the change in streamflow never exceeds DFO's Ecological Flow Framework (10% flow disruption increase or decrease) during any month at this POI (Appendix E). Therefore, as per DFO (2013), no detectable changes to flow from existing conditions within this watercourse (WC3) are anticipated and this system is not discussed further in the effects assessment of water quantity or quality on fish and fish habitat.

Table 5.7-11 Annual Runoff Volumes for WC4

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
Baseline	1,038,320	--	--	--
Operation	1,035,573	-0.26	0.70	August
Reclamation	1,037,628	-0.07	0.75	August

Flow within the PA is directed northward towards WC4, which eventually flows into the Annapolis River. This watercourse did not have field surveys completed due to the WBA results indicating an expected change in contributing drainage area and streamflow of <10%.

WC4 is expected to experience an annual average reduction of streamflow of -0.26% during operation and -0.07% during reclamation. The maximum monthly percent change during operation and reclamation are 0.70% and 0.75%, respectively.

The WBA demonstrates that the change in streamflow never exceeds DFO's Ecological Flow Framework (10% flow disruption increase or decrease) during any month at this POI (Appendix E). Therefore, as per DFO (2013), no detectable changes to flow from existing conditions within this watercourse (WC4) are anticipated and this system is not discussed further in the effects assessment of water quantity or quality on fish and fish habitat.

Table 5.7-12 Annual Runoff Volumes for BHB-DS

Scenario	Annual Runoff (m^3)	% Change in Streamflow	Max. Monthly % Change	Month of Max. Change
BHB-SW4				
Baseline	913,309	--	--	--
Operation	988,823	8.27	8.30	January – May and December
Reclamation	982,086	7.53	7.56	January – May and December
BHB-DS				
Baseline	3,762,463	--	--	--
Operation	3,842,628	2.13	2.15	January – May and December
Reclamation	3,798,508	0.96	0.97	January – May and December

BHB-DS and BHB-SW4 are located on Bald Hill Brook, which originates approximately 330 m east of the PA. The watercourse flows east into an unnamed tributary to the Annapolis River. Bald Hill Brook is considered a fisheries resource due to its connectivity with the Annapolis River. Based on desktop aerial observations, Bald Hill Brook appears to be approximately 2 – 10 m wide. The substrate likely consists of muck where it flows through the NSECC mapped wetland and coarser material such as boulder, rubble, cobble, and gravel as it flows through the forested areas.

BHB-SW4 is expected to experience an annual average increase of streamflow of 8.27% during operation and 7.53% during reclamation. The maximum monthly percent change during operation and reclamation are 8.30% and 7.56%, respectively.

BHB-DS is expected to experience an annual average increase of streamflow of 2.13% during operation and 0.96% during reclamation. The maximum monthly percent change during operation and reclamation are 2.15% and 0.97%, respectively.

The WBA demonstrates that the change in streamflow never exceeds DFO's Ecological Flow Framework (10% flow disruption increase or decrease) during any month at this POI (Appendix E). Therefore, as per DFO (2013), no detectable changes to flow from existing conditions are anticipated and this system is not discussed further in the effects assessment of water quantity or quality on fish and fish habitat. This watercourse did not have field surveys completed due to the WBA results indicating an expected change in contributing drainage area and streamflow of <10%.

The results of the WBA indicate that the effects on streamflow are negligible (WC1-DS, WC1-SW5, WC2, and WC4) or low (WC3, BHB-DS, and BHB-SW4). Therefore, effects of the Project on surface water quantity are within natural variation and are expected to be not significant.

5.7.5.2 Change in Habitat Quality

Changes in fish habitat quality occurs when the ability of fish habitat to support different life stages changes. Throughout this section, effects to fish and fish habitat will be explored through the following pathways of effects:

– Changes to surface flow (i.e., flow regime) from changes to contributing drainage areas.
– Changes to water temperature from changes to contributing drainage areas.
– Changes in water quality through accidental release of deleterious substances and erosion and sedimentation.

5.7.5.2.1 Flow Regime

Project activities are expected to result in changes to surface flow caused by changes to the contributing drainage areas. Changes in the natural flow regime of riverine ecosystems can be detrimental to fish and fish habitat.

Based on the results of the WBA, changes to contributing drainage areas and streamflow are expected to remain within natural variation (<10%) throughout all phases of the Project for all watercourses and waterbodies. The effects to the flow regime have been assessed as low, and not significant.

WBA results are discussed in Section 5.7.5.1 and the WBA Report (Appendix E).

5.7.5.2.2 Water Quality

Accidental release of deleterious substances is a pathway for effects to fish and fish habitat. All deleterious substances will be stored in appropriate secondary containment. Fuel storage, refuelling, and equipment servicing will not occur within 30 m of a watercourse or waterbody, to prevent accidental release of fuel into surface water. Standard spill prevention and response procedures will be in place and communicated to all relevant personnel.

Erosion and sedimentation may also occur as a result of Project activities such as clearing and grubbing, extraction of material, and stockpiling material can result in sedimentation. Buffers will be maintained on watercourses wherever possible, and removal of vegetation will be minimized. Cleared areas will be regraded and revegetated following the completion of Project activities. Water management infrastructure will include settling ponds, ditches, and silt management areas. The primary goal of water management infrastructure will be to prevent the release of sediment-laden runoff to surrounding watercourses and wetlands.

Another pathway for effects to fish and fish habitat is changes in water temperature. All fish species captured within the ASA were coolwater or coldwater species. Reductions in flow and increases in sedimentation may result in increases in temperature, which could impact the fish species know to inhabit fish habitat within the ASA.

The effects of changes to water temperature due to changes to contributing drainage areas are expected to be low. No changes in contributing drainage areas exceed 10% and are therefore within natural variation.

5.7.6 Mitigation

The following section describes avoidance, mitigation, and monitoring measures that have been taken or are proposed to limit Project effects to fish and fish habitat.

5.7.6.1 Measures to Avoid

Throughout the iterative process of developing the current Project layout, avoidance of effects to fish and fish habitat was attained through key design considerations.

Initial delineation of wetlands and watercourses within the PA was completed to help inform an optimized site layout and reduce potential impacts to fish and fish habitat. As a result, the Project has been planned to avoid direct impacts to fish and fish habitat.

5.7.6.2 Measures to Mitigate

When avoidance measures do not eliminate impacts to fish and fish habitat, mitigation measures are implemented to reduce impacts to fish and fish habitat. Standards and best practices for working in and near water are well understood and will be followed (DFO 2024). A list of proposed mitigation measures is provided in Table 5.7-13.

Table 5.7-13 Fish and fish habitat Mitigation Measures

Project Phase	Mitigation Measure
Construction and Operation	Adhere to all Approval conditions outlined in regulatory approvals, specifically related to timing of works outside of sensitive time windows for fish (June 1- September 30)
	Complete site kick-off meetings with relevant staff/contractors to educate and confirm policies related to working around fish habitats. Ensure fish habitat is adequately signed or flagged in the field, and clearly communicated to staff/contractors
	Limit vegetation clearing, revegetate slopes as soon as possible, and maintain a 30 m buffer on fish habitat wherever practical. Use vegetated buffers to provide shade to onsite ponds wherever practical. Minimize removal of upgradient vegetation and stabilize shorelines disturbed by Project activities
	Ensure machinery on site is clean and maintained and free of fluid leaks
	Implement and adhere to the site-specific erosion and sediment control plan. Use clean, non-ore bearing, non-watercourse derived, non-toxic materials for erosion and control measures. Incorporate drainage structures, where necessary, to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material.
	Follow spill preparedness protocols and ensure fueling areas are a minimum of 30 m from wetlands and watercourses.
	Implement erosion and sediment control structures (e.g., sediment fence, rip rap, check dams etc.) as needed to minimize the potential for sediment release into surface water.
	Stockpiles of material with a potential to cause sedimentation issues will be set back from surface water systems and will be stabilized to reduce the likelihood of erosion and sedimentation.
	Construct water management infrastructure including settling ponds, ditches, and silt management areas.
Reclamation	Reclamation of areas following aggregate removal

5.7.7 Monitoring and Follow-up

Monitoring will be completed over the life of the Project to validate the predicted impacts to surface water quantity and quality and the efficacy of planned mitigation measures. Surface water monitoring locations monitored during baseline conditions are proposed to be monitored during the construction, operation, and reclamation phases. Proposed surface water monitoring locations (SW-1, SW-2, SW-3, SW-4, and SW-5) are shown on Figure 5.5-1.

Surface water quality samples are proposed to be collected on a quarterly basis from the five established stations throughout the construction, operation, and reclamation phases. Water quality samples will be analyzed for general chemistry, total metals, and TSS. Surface water elevations are proposed to be recorded on a quarterly basis at stations SW-4 and SW-5, with continuous water levels recorded via pressure transducer between March and November each year. Pressure transducers are proposed to be removed during the winter months to avoid damage by freezing.

Surface water quality and quantity monitoring will be used to verify the predictions made and ensure potential adverse impacts to fish and fish habitat outside of the predicted effects does not occur.

5.7.8 Residual Effects and Significance Determination

Residual effects and significance determination for predicted residual environmental effects are summarized in Table 5.7-14.

Table 5.7-14 Residual Effects on Fish and fish habitat

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction – clearing, grubbing, grading, road construction, and water management,	Erosion and sediment control Spill preparedness Maintain 30 m buffers Revegetate Watercourse Permitting	A	L	ASA	A	ST	O	PR	None	Not significant
Operation – Processing, overburden management, water management, road maintenance, emissions and waste management, and transportation	Erosion and sediment control Spill preparedness Maintain 30 m buffers Revegetate Water Management	A	L	ASA	A	LT	C	PR	Flow disruption	Not significant
Reclamation – Demolition, earthworks, and water management	Erosion and sediment control Spill preparedness Water quality monitoring	A	L	ASA	A	MT	O	PR	Flow disruption	Not significant
Legend (refer to Table 5.7-2 for definitions)										
Nature of Effect A – Adverse P – Positive	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – PA ASA – Aquatic Study Area LAA – Local Assessment Area	Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility R – Reversible IR – Irreversible PR – Partially Reversible				

5.8 Terrestrial Environment

5.8.1 Rationale for Valued Component Selection

Terrestrial environment encompasses upland and wetland habitats, associated vegetation communities, and wildlife species that depend on these habitats, including terrestrial SAR and SOCI. The terrestrial environment was chosen as a VC because ecosystems, habitat, vegetation communities, and fauna species reliant on these habitats may be altered directly or indirectly by proposed Project activities.

Provincial and federal legislation that protect wildlife and their habitat include the Canada Species at Risk Act, and Migratory Birds Convention Act, along with NS Endangered Species Act, Wildlife Act, and Environment Act. Associated policies include but not limited to, the NS Wetland Conservation Policy (NSECC, 2019). NS species at risk recovery plans and special management practices for SAR were also reviewed. This broad VC includes the following major groups based on taxonomic and ecological similarities:

– Terrestrial habitat and vegetation
– Vascular plants and lichens
– Terrestrial fauna
– Avifauna

5.8.2 Baseline Program Methodologies

The terrestrial environment is a broad VC and includes a diverse group of species, habitat, and taxa. Field methods varied depending on the targeted species, group of species, or habitat being surveyed. For detailed information on the baseline programs, refer to the Biophysical Baseline Report (Appendix F).

5.8.2.1 Priority Species List

A desktop priority species list was created to guide all surveys described in this VC. Species rankings used in the biophysical report and terrestrial effects assessment are based on rankings retrieved from the ACCDC on May 31, 2023. A priority species list functions as an over-arching tool to guide survey design and effort. Priority species include SOCI and SAR. The definition of a priority species and detailed methods in developing this list is described in the Biophysical Baseline Report (Appendix F).

5.8.2.2 Habitat Types and Vegetation Communities

Prior to completing field assessments, several geospatial datasets were reviewed to inform the vegetation community survey. These datasets allowed the surveyor to, at a high-level, identify potential areas of interest, particularly wetland features which often reflect changes in vegetation community structures. Vegetation community surveys took place during wetland and watercourse delineation (June 2023), and in conjunction with breeding bird surveys (July 2023). Avian survey points are laid out strategically to target unique habitat types, therefore vegetation community surveys were completed in conjunction with avian surveys.

5.8.2.3 Vascular Plants and Lichens

The objectives of the vascular plant and lichen baseline surveys were to complete a species inventory, document any rare flora species and to facilitate avoidance where possible, and support understanding of the potential Project interactions with rare species within the PA. Prior to undertaking the vascular plant and lichen field surveys, a detailed desktop review of known vascular plant and lichen observations and potential habitat within the PA was completed. Several databases were reviewed including the ACCDC database, NSNR wetland inventory, results of the vegetation community identification and classification (Appendix F), the priority

species list, the Atlantic Coastal Plain Flora (ACPF) group buffers and the ecological land classifications of Nova Scotia.

Dedicated vascular plant surveys were completed early (June 23, 2023) and late (September 27, 2023) in the growing season (June 1 to September 30) to capture plant species with different flowering periods. Meandering transects were completed on foot, and all major habitat types were assessed, targeting habitats with elevated potential to support priority species. All priority species observed were georeferenced, counted (when possible), photographed, and a description of their habitat was recorded. Additionally, incidental vascular plant observations, particularly priority species, were recorded throughout the suite of other biophysical surveys conducted in 2023.

Lichen surveys were completed throughout the PA in August 2023 and incidentally during other biophysical surveys. Meandering transects were completed on foot and targeted mature trees or other habitats appropriate for hosting priority lichen species. Full methods are presented in the Biophysical Baseline Report (Appendix F).

5.8.2.4 Fauna

Wildlife surveys were completed opportunistically throughout all biophysical surveys in 2023. All observations were identified and recorded by Strum biologists experienced in identification of wildlife tracks, scat and browse, resulting in an overall species list. Where a SAR or SOCI was identified during surveys, additional effort was made in the field to understand the habitat at the sighting location and evaluate whether it was essential to the species' survival or life cycle requirements. Detailed terrestrial fauna methods are described the Biophysical Baseline Report (Appendix F).

Wood turtle (*Glyptemys insculpta*) surveys were not completed on the one identified watercourse within the PA. It was the intention for the surveys to be completed three times, however, the field schedule was interrupted by the forest fires in May and June 2023.

In consultation with Mark McGarrigle, Species at Risk Biologist at Nova Scotia Natural Resources (NSNR), a desktop exercise was used to map potential wood turtle habitat within the PA using detailed stream habitat descriptions collected during fish habitat surveys.

Standalone mainland moose (*Alces alces americana*) surveys were not considered necessary as the PA does not overlap with mainland moose core habitat or concentration areas. The nearest ACCDC record is approximately 14 km away (Appendix F). No evidence of moose was observed during all biophysical surveys.

Standalone bat surveys were not considered to be necessary within the PA, as no abandoned mine openings (AMOs) were located within it. Instead, AMOs on crown land within 5 km of the PA were checked for their conditions. Only AMOs directly accessible from public roads were assessed. During all biophysical surveys, Strum biologists recorded any evidence of caves, open wells, cavities in mature trees, rock outcrops or other potential hibernacula or maternity roosting habitats, or any incidental observations of bats themselves. No evidence of bats or hibernacula was observed during all biophysical surveys.

5.8.2.5 Avifauna

Avian field surveys were initiated in May 2023 and continued through October 2023. The objective of the baseline avifauna field surveys was to identify species and habitat usage with a focus on SAR and SOCI within and surrounding the PA, and also to determine trends in species composition and bird group usage throughout different seasons where possible.

The field studies were completed as follows:

– Spring migration surveys (May 2023)
– Breeding bird surveys (June to July 2023)

– Nightjar surveys (June to July 2023; nightjar focused surveys were conducted due to the likelihood of their presence within and adjacent to the PA based on desktop analyses and, due to their crepuscular nature, nightjars not being reliably detected during the morning migration and breeding surveys)
– Fall migration surveys (August to October 2023)

Incidental avifauna observations were recorded opportunistically throughout the suite of biophysical surveys in 2023. Detailed avifauna methods are described in Appendix F.

5.8.3 Baseline Conditions

The baseline conditions of the terrestrial environment, including terrestrial habitat, plants, lichens, fauna, and avifauna are summarized below. Full descriptions including results from both desktop review and in-field assessments can be found in the Baseline Biophysical Report (Appendix F).

5.8.3.1 Habitat Types and Vegetation Communities.

The PA is comprised of a mosaic of softwood and hardwood dominated stands, and disturbed areas. Disturbed portions of the PA include a road and a large, cleared, forestry operations area. A softwood dominated stand is situated within the center of the PA, remained after harvesting operations. Hardwood forest is present in the southern and northern portions of the PA. Three vegetation community groups were observed within the PA, including upland and wetland vegetation groups (Figure 5.8-1). The observed vegetation communities are typical of this ecoregion. Vegetation community results are provided in the Biophysical Report in Appendix F.

The PA is not located in any protected or conservation areas within federal, provincial, or municipal jurisdiction. No Old Growth Forest polygons were identified through the Old Growth Policy GIS layer (NSNR, 2024) or the Old Growth Forest Policy Dashboard as of July 2024.

5.8.3.2 Vascular Plants and Lichens

A total of 145 vascular plant species were observed within the PA during botany surveys, wetland delineation, and incidentally. None of the vascular plants identified are classified as SAR, however, four are SOCI. The four SOCI vascular plants observed within the PA are: hop sedge (*Carex lupulina),* American beech (*Fagus grandifolia),* white elm (*Ulmus americana),* meadow horsetail (*Equisetum pratense).* Within the PA, 5.5% of the observed vascular plant species comprised of exotics (n=8), 94.5% (n=137) were native.

During field surveys, 26 lichen species and 12 bryophyte species were observed within the PA. No SOCI or SAR lichens or bryophytes were observed.

5.8.3.3 Fauna

Two mammal species were identified within the PA. Fauna observed within the PA include American red squirrel (*Tamiasciurus hudsonicus*) and white-trailed deer (*Odocoileus virginianus*). Mature forested stands do exist within the PA and could provide roosting habitat. However, no bat evidence, maternity roost, or hibernacula were identified within the PA. None of the AMOs checked outside of the PA provided suitable hibernacula as they were all flooded or filled.

No priority herpetofauna species were observed during target surveys or incidentally within the PA. Limited suitable habitat for wood turtles is available within the PA, due to poor aquatic habitat, thermal conditions and nesting sites required for wood turtle’s lifecycle.

The results of the desktop habitat exercise demonstrate that there is marginal potential for general and overwintering habitat for priority herpetofauna within the PA (Table 5.8-1). The watercourse may provide marginal general habitat for wood turtles such as foraging or movement, however, overwintering and nesting habitat was not observed due to the prevalence of mucky riparian edges and shallow pools (Appendix F). Suitable overwintering habitat for snapping turtles and eastern painted turtles may be available in the open

water feature of WC1, where there is organic substrate and dense submergent vegetation. The remaining PA is comprised of a mix of softwood dominant forest and disturbed areas, with hardwood forest inclusions along the edges of the PA. Although wood turtles often occupy terrestrial habitats, they require access to water daily for several vital functions such as thermoregulation (ECCC, 2020). The areas identified within the PA may provide foraging and movement opportunities but are considered poor habitat due to the reduced availability of aquatic habitat and thermal conditions.

Table 5.8-1 Summary of Turtle Habitat Suitability Study

Point of Interest	Dominant Substrate	Water Velocity	Riparian and Instream Habitat Descriptions	Suitable Nesting and Overwintering Habitat available
1	Muck	<0.05 m/s	Riparian wetland, shallow flat water. Closed canopy. Vegetated and muck riparian edge.	No suitable overwintering or nesting available habitat. Marginal general habitat.
2	Sand, muck, gravel	<0.05 m/s	Riparian wetland, shallow riffle – run habitat with flat areas and small pools. Closed canopy and no bank or entrenchment.	
3	Gravel	<0.05 m/s	Riparian wetland, shallow flat water. Closed canopy and no bank or entrenchment.	
4	Muck	<0.05 m/s	Riparian wetland, riffle run habitat. Instream vegetation. Closed canopy and no bank or entrenchment.	
5	Muck	<0.05 m/s	Riparian wetland, riffle run habitat. Shallow pooling. Closed canopy and no bank or entrenchment.	
6	Muck	<0.05 m/s	Riparian wetland, riffle run habitat. Shallow pooling. Closed canopy and no bank or entrenchment.	
7	Sand, gravel, cobble	<0.05 m/s	Riparian wetland, riffle-run habitat, instream vegetation. Closed canopy and no bank or entrenchment.	
8	Sand, gravel, cobble	<0.05 m/s	Riparian wetland, shallow pooling. Closed canopy.	
9	Muck	<0.05 m/s	Riparian wetland, low entrenchment of stream banks	
10	Muck	<0.05 m/s	Riparian wetland, coarse woody debris present	
11	Gravel, cobble, rubble	0.05-0.26 m/s	Riparian wetland, channel widens, riffle-run – pool habitats. Closed canopy	Marginal general habitat.
12	Sand, gravel, cobble	0.05-0.26 m/s	Riparian wetland, riffle- run – pool habitats. Channel is moderately entrenchment. Vegetated banks. Closed Canopy.	Marginal general habitat, overwintering habitat available in shallow pool.
13	Sand, gravel	0.05-0.26 m/s	Riparian wetland, channel is moderately entrenched, no suitable turtle banks for nesting or sun exposure.	Marginal general habitat, overwintering habitat available in shallow pool.

5.8.3.4 Avifauna

The PA provides a range of habitats suitable for a variety of bird species with different habitat requirements. There are expansive areas of open habitat that provide foraging and breeding habitat for certain species (e.g., raptors and passerines). Forests and shrub-dominated areas with stand heterogeneity (i.e., stands with different height classes) provide suitable habitat for foraging and breeding for many passerine species. Open habitat transitioning into forested habitat also provides edge habitat that various species use for foraging (e.g., swallows and flycatchers). Overall, survey locations in open areas (e.g., clear-cut area) with forested edges had the highest individual and species counts. The higher number of species and individuals at these locations is likely due to this habitat variability and structure (e.g., vegetation height differences provided by edge habitat). This would attract a variety of species (passerines, woodpeckers, raptors, waterfowl, and shorebirds).

Avian biophysical surveys resulted in the observation of 1,433 individuals, representing 74 bird species.

Passerines were the most abundant bird group and comprised 85.9% of the species observed, followed by waterfowl (6.69%), other landbirds (6.69 %), diurnal raptors (0.49%), nocturnal raptors (0.14%) and other waterbirds (0.07%). These percentages include unknown individuals that were able to be identified to the level of bird group (e.g., passerines) and do not include unknown individuals that could not be identified to the level of bird group. These percentages represent species diversity within the PA. The most observed species was the American robin *(Turdus migratorius)* and Canada goose (*Branta canadensis).*

During nightjars surveys, seven common nighthawks (*Chordeiles minor)* were observed. In total, four avian SAR and four avian SOCI were observed during surveys throughout the dedicated survey period in 2023. The four avian SAR observed were as follows:

– Eastern wood-pewee (*Contopus virens*)
– Olive-sided flycatcher (*Contopus cooperi*)
– Evening grosbeak (*Coccothraustes vespertinus*)
– Common nighthawk

The four avian SOCI species observed were as follows: pine warbler *(Setophaga pinus),* pine siskin *(Spinus pinus),* bay-breasted warbler *(Setophaga castanea)* and red crossbill (*Loxia curvirostra).*

5.8.3.4.1 Species at Risk

Methodology and field results can be referred to in full in the Biophysical Baseline Report (Appendix F), as well as further information regarding desktop review, regulatory context, and more information regarding priority (SAR and SOCI) species.

All the avian SAR observations (eastern wood-pewee, olive-sided flycatcher, evening grosbeak, and common nighthawk) within the PA are associated with edge habitat, open areas, as well as wetlands and watercourses (Figure 5.8-1). The number of SAR (especially eastern wood-pewee and olive-sided flycatcher) can be directly attributed to the presence of edge habitat in and around the PA. Although clear-cut habitat is not suitable breeding/nesting habitat for flycatchers, they commonly will sit on the edges of clear-cuts for foraging. A large clear-cut area with patches of trees throughout sits in the centre of the PA. The forested edge adjacent to cleared area represents edge habitat (a variety in habitat and variation in vegetation structure [e.g., height], which attract a variety of bird species, not just flycatchers).

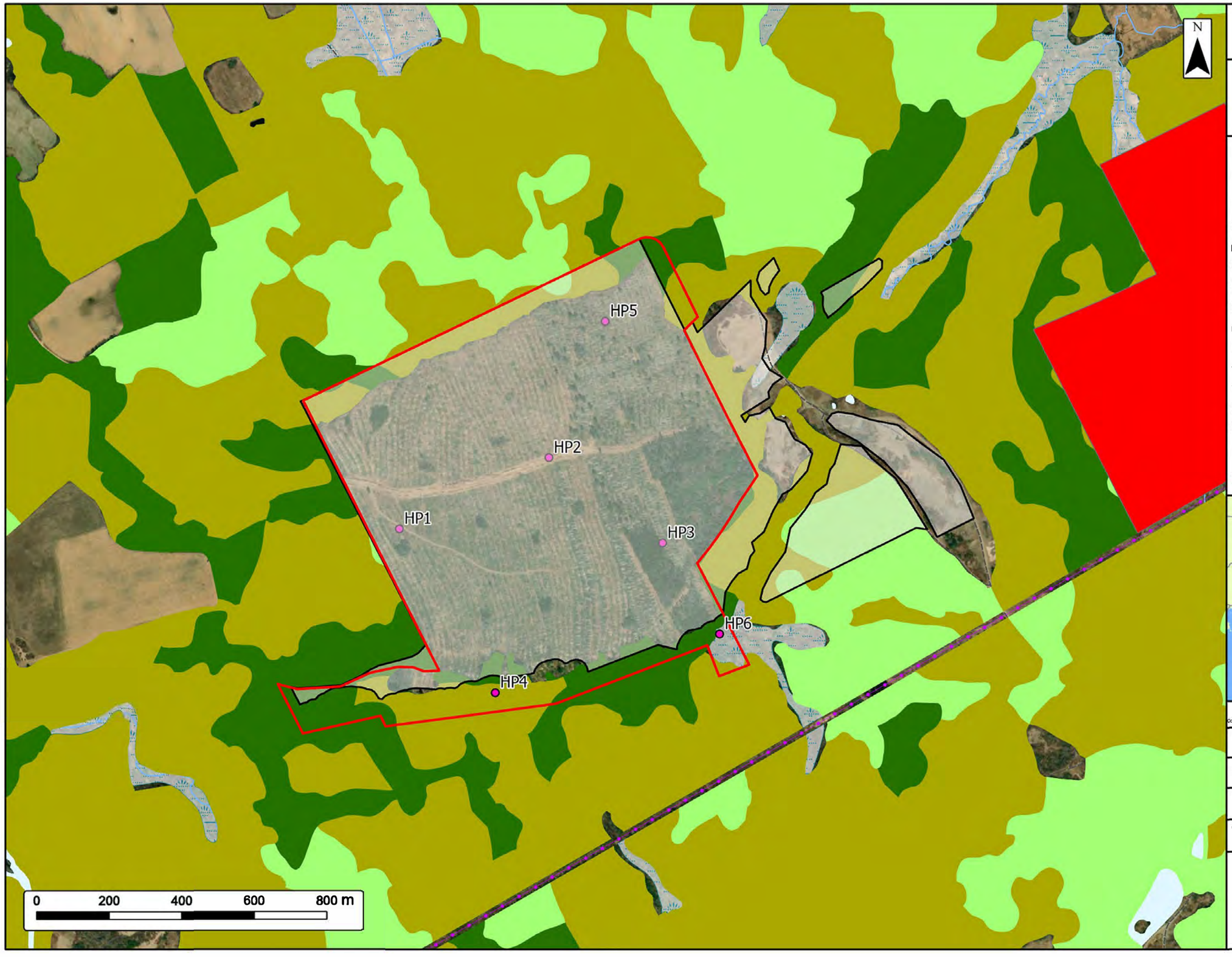
As requested by NSECC in a Project scoping meeting held April 23, 2024, additional surveys were completed to identify potential SAR and SOCI within sand pit areas authorized by the EA approval for the previous Trimper Sand and Gravel Pit Expansion Project, located immediately east of the PA. The desktop analysis of this area highlighted four main sensitive ecological features: presence of bats or bat hibernacula, presence of wood turtles or key habitat to support wood turtles, priority lichen species, and priority vascular plants. Surveys for all four of those sensitive ecological features were conducted on September 20 and 24, 2024. There were

no bats or potential bat maternity roosts identified, no turtles of any species, no suitable wood turtle basic or overwintering habitat, and no priority vascular plant species identified. There was one SOCI lichen species identified within the pit areas, the Atlantic jellyskin lichen. This species has no associated special management practices.

The methodology and results of this additional biophysical survey are provided in Appendix G.

Shaw Middleton Sand Pit Project, Middleton, NS

Terrestrial Habitat



- Project Area
- Project Footprint
- Habitat Points
- Old Growth

Forested Land (Type)

- Softwood
- Mixedwood
- Hardwood

Utilities (line)

- Existing Transmission Lines

Transportation

- Unpaved Road

Water Features

- Mapped Stream
- Mapped Lakes and Rivers
- Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, ISA Canada, CNWI, HERE, Garmin, USGS

Date: 2025-03-11	Project #: 24-10016
Scale: 1:10,000	Drawing #: **5.8-1**
Drawn By: K. Wallace	
Checked By: S. Allain	

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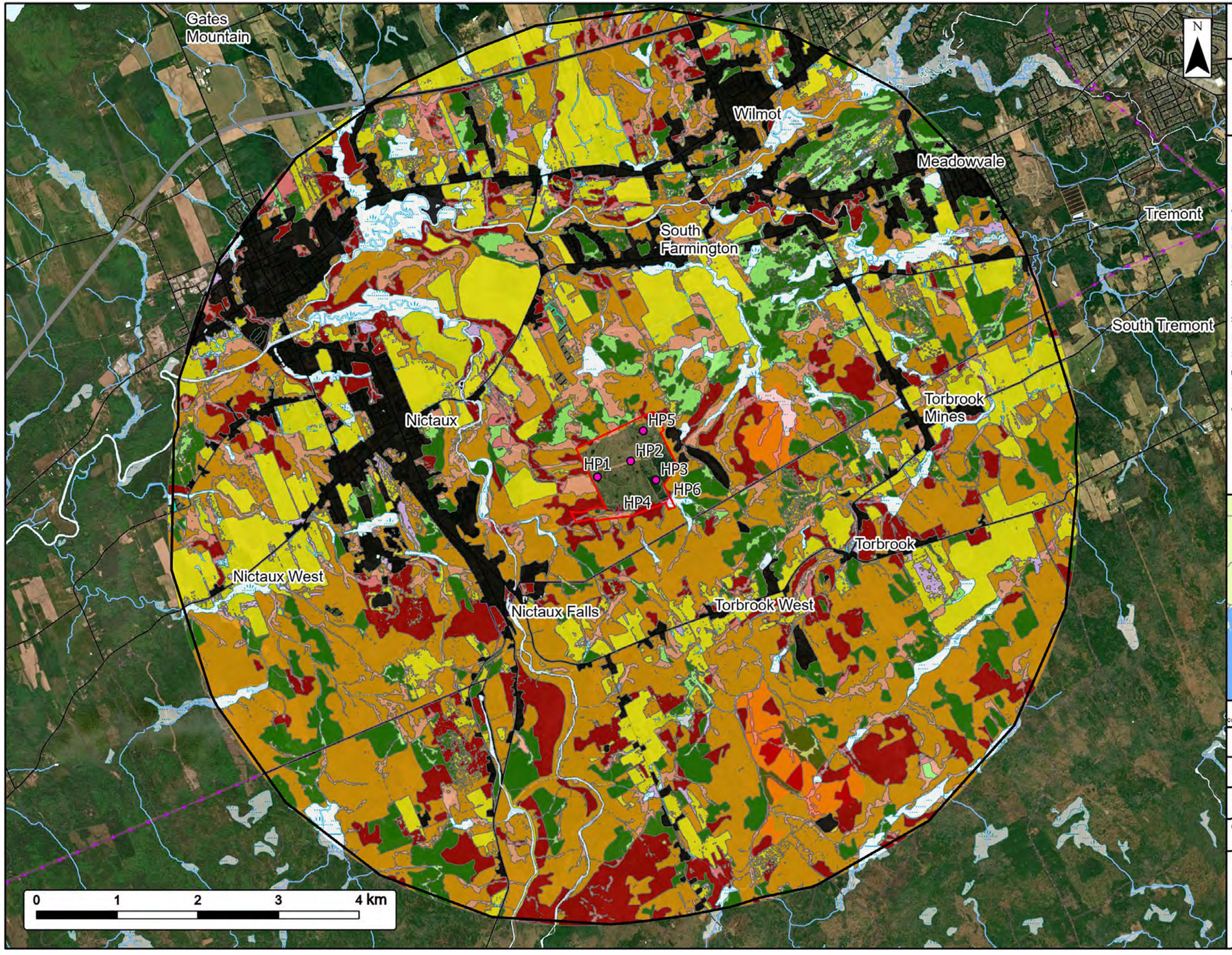
Shaw Middleton Sand Pit Project, Middleton, NS

Terrestrial LAA and Habitat Impacts



Project Area
LAA
Cutover
Cutover Wetland
Mixedwood Forest
Mixedwood Wet Forest
Open Areas
Shrub/ Alders
Softwood Forest
Softwood Wet Forest
Hardwood Forest
Hardwood Wet Forest
Urban/ Developed
Water
Open Wetland

Habitat Points
Old Growth

Utilities (line)
Existing Pipeline
Existing Transmission Lines

Transportation
Highway
Road
Unpaved Road

Water Features
Mapped Stream
Mapped Lakes and Rivers
Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCDC, ISA Canada, CNWI, HERE, Garmin, USGS

Date: 2025-03-10	Project #: 24-10016
Scale: 1:45,000	Drawing #: **5.8-2**
Drawn By: K. Wallace	
Checked By: S. Allain	

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Shaw Middleton Sand Pit Project, Middleton, NS

Terrestrial SAR SOCI Impacts

GHD

N

Red Crossbill
Red Crossbill
Red Crossbill
Pine Siskin
Pine Siskin
Red Crossbill
Red Crossbill
Pine Warbler
White Elm
Pine Siskin
Hop Sedge
Meadow Horsetail
Hop Sedge
White Elm
WC1
Brook Trout
WL 1
WL 2

0 200 400 600 800 m

- Project Area
- Project Footprint
- Freshwater Fish
- Vascular Plant
- Vertebrate
- Field Assessed Watercourse
- Field Deliniated Open Water
- Field Delineated Wetlands

Utilities (line)

- Existing Transmission Lines

Transportation

- Unpaved Road

Water Features

- Mapped Stream
- Mapped Lakes and Rivers
- Mapped Wetlands

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCOC, ISA Canada, CNWI, HERE, Garmin, USGS

Date: 2025-03-11	Project #: 24-10016
Scale: 1:8,500	Drawing #: **5.8-3**
Drawn By: K. Wallace	
Checked By: S. Allain	

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5.8.4 Effects Assessment Methodology

5.8.4.1 Boundaries

The boundaries used to define the environmental effects assessment include spatial boundaries, temporal boundaries, technical boundaries, and administrative boundaries. Spatial boundaries were defined based on the expected maximum extent of direct and indirect impacts to the terrestrial environment. Temporal boundaries are based on the anticipated duration and timing of Project activities. The assessment boundaries are described below.

5.8.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on the terrestrial environment are defined below and are shown on Figure 5.8-4.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. The LAA encompasses 5km buffer surrounding the PA. The LAA boundaries were defined based on the expected maximum extent of direct and indirect to the terrestrial environment. The LAA extends farther than noise levels are expected to travel in order to include the Nictaux River and the associated systems west and north of the PA (i.e., to include provincial core habitat for wood turtles).

A RAA has not been defined for this VC as the maximum extent of indirect impacts is expected to be within the LAA.

5.8.4.1.2 Temporal Boundaries

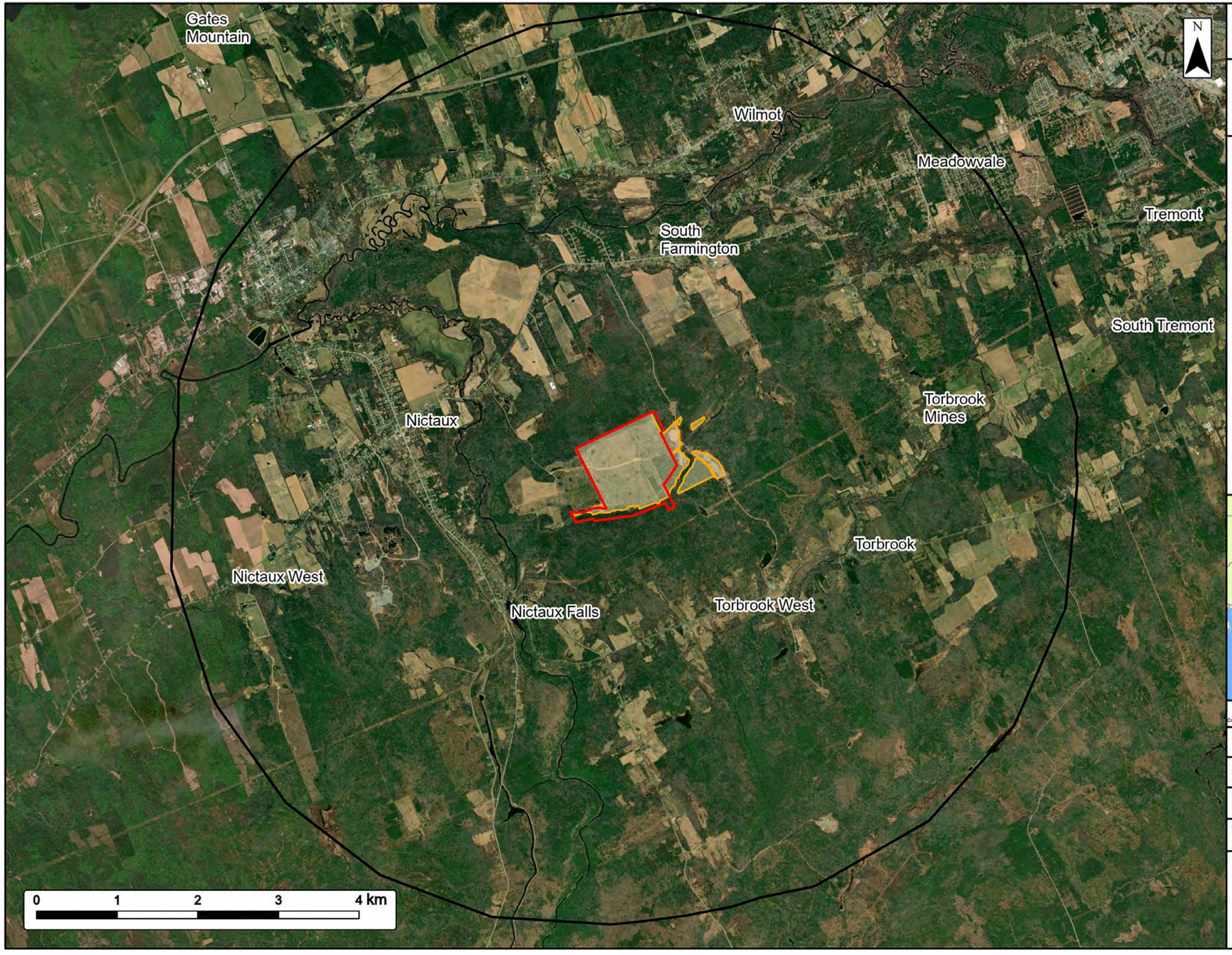
The temporal boundaries for terrestrial environment effects assessment are defined by the construction, operation, and reclamation phase of the Project.

5.8.4.1.3 Technical Boundaries

Prediction of habitat availability and loss within the LAA was limited by the accuracy of the Strum habitat model developed for the effects assessment methodology. Habitats identified in these models were at a coarse scale and did not include other factors that could influence a species inhabiting an area (e.g., habitat adjacent to active quarries, roads, cutovers, or areas subject to sensory disturbance). The model may overpredict or underpredict habitat types within the LAA, notably forest type and forested swamps/wet areas. Other technical boundaries include constraints associated with publicly available provincial government GIS layers that were used in predicting and mapping potential habitat for SAR and the general difficulty in predicting habitat and sampling for SAR.

5.8.4.1.4 Administrative Boundaries

Administrative boundaries for the evaluation management of the terrestrial environment include the Canada Migratory Bird Convention Act [(MBCA) (Canada, 2018)], Migratory Bird Regulations, and Species at Risk Act along with the NS Wildlife Act, Endangered Species Act, Nova Scotia Wetland Conservation Policy (NSECC, 2019), and At-Risk Lichens – Special Management Practices (NSNR, 2018). Nova Scotia species at risk recovery plans and special management practices for SAR were also reviewed.



Shaw Middleton Sand Pit Project, Middleton, NS

Terrestrial Spatial Boundaries

GHD

Project Area

Project Footprint

LAA

Coordinate System: NAD83 UTM Zone 20N

Sources: ESRI Basemaps, GeoNOVA, SNSIS, NSNRR, ACCOC, ISA Canada, CNWI, HERE, Garmin, USGS

Date: 2025-03-11	Project #: 24-10016
Scale: 1:45,000	Drawing #: **5.8-4**
Drawn By: K. Wallace	
Checked By: S. Allain	

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5.8.4.2 Thresholds for Determination of Significance

Significance of Project related impacts to the terrestrial environment were determined as presented in below Table 5.8-2.

Table 5.8-2 Characterization Criteria for Environmental Effects

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – the Project is predicted to result in: – less than 1% direct loss of vegetation and wildlife habitat (inclusive of terrestrial fauna and avifauna) within the LAA – no loss of SAR or SOCI Habitat within the LAA – no direct loss of SAR or SOCI individuals **L** –the Project is predicted to result in: – 1-5% direct loss of vegetation and wildlife habitat (inclusive of terrestrial fauna and avifauna) within the LAA – no loss of SAR or SOCI Habitat within the LAA – no direct loss of SAR or SOCI individuals – loss of habitat is mitigated through reclamation planning and other mitigation measures as determined to be necessary based on flora or wildlife species present. **M** –the Project is predicted to result in: – 5-25% direct loss of vegetation and wildlife habitat (inclusive of terrestrial fauna and avifauna) within the LAA – loss of SAR or SOCI Habitat within the LAA – direct loss of SOCI individuals – loss of habitat is mitigated through reclamation planning and other mitigation measures as determined to be necessary based on flora or wildlife species present. **H** – the Project is predicted to result in: – greater than 25% direct loss of vegetation and wildlife habitat (inclusive of terrestrial fauna and avifauna) within the LAA – loss of SAR or SOCI Habitat within the LAA – direct loss of SAR individual – loss of habitat is not mitigated through reclamation planning and other mitigation measures as determined to be necessary based on flora or wildlife species present.
Geographic Extent	**PA –** direct and indirect effects from Project activities are restricted to the PA. **LAA** – Residual effects extend into the LAA. **RAA** – not defined for this assessment.
Timing	**A**— seasonal aspects may affect VCs
Duration	**ST** – effects are limited to occur from as little as 1 day to 12 months. **MT** – effects can occur beyond 12 months and up to 3 years**.** **LT** – effects extend beyond 3 years. **P** – valued component unlikely to recover to baseline conditions**.**
Frequency	**O** – effects occur once. **S** – effects occur at irregular intervals throughout the Project. **R** – effects occur at regular intervals throughout the Project. **C** – effects occur continuously throughout the Project.

Table 5.8-2 Characterization Criteria for Environmental Effects

Characterization	Quantitative Measure or Definition of Qualitative Categories
Reversibility	**RE** – terrestrial environment will recover to baseline conditions before or after Project activities have been completed. **PR** – mitigation cannot guarantee a return to baseline conditions. **IR** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect on the terrestrial environment from the Project is defined as:

– A Project-related effect that is likely to cause a permanent, unmitigated, alteration to habitat that supports flora and fauna species.

– A Project related direct loss of a SAR individual.

An effect that does not cause a permanent alteration to habitats, species distribution, or permanent loss to habitat is not considered a significant adverse effect. Sessile species such as vascular and non-vascular plants and lichens do not have the ability to avoid direct and indirect impacts from the Project. For these species, the loss of an individual or individuals of a SAR species that is important in the context of the province, or that species' overall abundance or distribution, may be considered significant, if appropriate mitigation measures are not implemented. Mortality of a single SAR could, under some circumstances, be considered a significant effect unless adequately mitigated to preserve the integrity of that individual. The loss of an individual SAR due to an accident or malfunction (i.e., wildlife collision) is not incorporated into the magnitude threshold or overall significance of Project activities.

5.8.4.3 Fauna, Lichens, Flora, and Habitat Effects Methodology

The PA is comprised of a mosaic of softwood and hardwood dominated stands, and disturbed areas.

This diverse assemblage of flora and wildlife represents a variety of habitat requirements across species and groupings. The Project impact within the LAA was analysed to identify loss of habitat since it was not feasible to assess every species identified within the LAA or every species that has potential to be observed within the LAA. Although specific analyses were completed for certain SAR, effects are represented by describing impacts to overall habitat for flora, lichens, fauna within the PA and LAA. The predictive habitat model was extended to the LAA to allow for comparison to be made between the PA and surrounding lands. A layer was made based on the forest inventory GIS database (NSNR, 2021), a Canopy Height Model from GeoNOVAs Elevation Explorer (GeoNOVA, 2024), and the Wet Areas Mapping database (NSNR, 2022). First, three proxy layers were created: the Nova Scotia Forest Inventory layer was re-classified into ten categories based on the "FORNON" attribute, four height classes from the Canopy Height Model were defined as proxies for tree age (0-1 m, 1-6 m, 6-11 m, and >11 m), and the Depth to Water model was used to predict wet areas with 0.5m considered dry. Those three layers were rasterized and combined, then turned into polygons using the "Majority Filter" tool on QGIS. Results were adjusted based on aerial imagery to best reflect. This predictive habitat layer was then used for the following effects assessment on vegetation communities.

5.8.5 Project Interactions and Potential Effects

Table 5.8-3 Project Activities and Terrestrial Environment Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management Transportation
Reclamation	Demolition Earthworks Water management

The Project is expected to interact with the terrestrial environment through several pathways. The potential effects were grouped into two major categories: changes in habitat types and changes in wildlife species usage of the PA. Project related effects can influence the terrestrial environment either directly or indirectly and adversely or positively. A direct effect is defined by interactions that have no intermediates (e.g., mortality by vehicular collision, vegetation community loss) and indirect effects are interactions that have intermediate steps such as edge effects associated with vegetation clearing or changes in predatory-prey dynamics associated with access road/trail development. These interactions have the potential to the terrestrial habitat from baseline conditions as outlined below.

– Changes in vegetation and vegetation communities due to the direct loss of habitat and vegetation, indirect loss of habitat due to edge effects and dust, potential introduction of invasive species due to construction activities and increased traffic, vegetation community shifts due increase light and adjustments in surface water catchments from the Project.
– Changes in wildlife usage including SAR and SOCI due to direct and indirect habitat loss and habitat fragmentation due to the Project Footprint and sensory disturbance, mortality risk due to vehicle collisions or other human-wildlife interactions, rehabilitation and reclamation of habitats during the reclamation phase. The PA is comprised of open (e.g., clear-cut) habitat and a variety of forests (softwood, hardwood, mixed wood and tree swamps).

5.8.5.1 Impacts to Vegetation Communities, Flora, and Lichens

The proposed Project will result in both indirect and direct impacts to both vascular and nonvascular plants, lichens, and vegetative community types associated with wetland and upland habitat. These impacts are described in the following subsections.

5.8.5.1.1 Direct Impacts

The direct loss of habitat, vegetative communities, vascular and nonvascular plants, and lichens will be primarily occurring during the construction phase and will be restricted to the PA. Clearing and grubbing account for the most notable impact.

There will be no direct impacts to SOCI flora or lichens within the PA. All observations of SOCI flora fall outside the proposed Project footprint and or have been avoided by the Project. No SAR or SOCI lichens were observed during the biophysical surveys.

A total of 90% (99 ha) of the PA will be impacted as a result of the Project footprint. Of this, 9% is intact habitat, consisting of hardwood or mixed wood forests. The remaining impact area is either roads or recently cleared area from forestry activity. Within the LAA, hardwood and mixed wood forests account for 43% of the land cover (4347.2 ha in the LAA). Considering the abundance hardwood and mixed wood forests within the LAA, the overall magnitude of impacts to vegetation communities is considered negligible (<1% loss). Habitat types identified in the LAA and expected direct impacts of the Project are presented below (Table 5.8-4).

Table 5.8-4 Predicted Habitat Types and Impacts within the Project Area

Habitat Type	Total Area of Habitat Type within PA (ha)	Approximate Percentage of PA (%)	Total Area of Habitat Impacted within the Project Area	Approximate Percentage of Habitat Impacted within the Project Area(%)	Total Area of Habitat Type within LAA (ha)*	Percentage Impact of total Habitat type available in LAA
Hardwood Wet Forest	1.20	<1%	<1%	0%	170.4	0
Hardwood Forest	7.81	7%	3.5	3%	1068.2	<1%
Softwood Wet Forest	0.21	<1%	0.21	<1%	289.2	0%
Softwood Forest	0.17	<1%	0.17	<1%	1033.9	0%
Mixedwood Wet Forest	3.89	4%	<1%	0%	707.7	0%
Mixedwood Forests	6.13	6%	6.13	6%	3279.0	<1%
Open Wetland	0.74	<1%	0	0%	410.3	0%
Cutover Wetland	0	0	0	0%	3.5	0%
Open Area	0.04	<1%	<1%	0%	1796.3	0%
Disturbed (Cutover)	89.29	82%	89	-	10.40	-
Total	**110**	**100%**	**99**	**9%**	**10118.8**	**<1%**

*These habitat types and area calculations are from the publicly available databases and have not been updated to match current land conditions if they have changed since the layer was released (i.e. - does not account for recent forestry)

5.8.5.1.2 Indirect Impacts

Removal of vegetation and habitat loss during the construction and operation of the Project can result in indirect effects through edge effects. The effects include changes in microclimate, increased light availability and changes in vegetation communities. Clearing of habitats could also result in the potential of invasive plant species to establish an area.

Lichens and nonvascular plants are notably sensitive to edge effects and air quality due to being poikilohydric organisms with an inability to regulate and maintain their water content (Nash, 2008). Forested communities adjacent to clearings often have a microclimate which varies from interior forests, which is a result of increased solar radiation, high wind velocity and lower humidity (Rheult et al., 2002). Edge effects can result in the desiccation and death of lichen species and is one of the biggest threats to SAR and SOCI lichens. The extent in which lichens and plants are impacted by edge effects (referred as depth of influence) have been well documented, however, the depth of influence is context-dependent (e.g., dependent on size of the clearings,

substrate, type of climate etc.). For simplicity, and consideration that not all lichens, vascular and nonvascular plants respond the same to edge effects, a depth of influence of 100 m was selected. Observed priority lichen and plant species within the depth of influence by edge effects, has potential for adverse effects from the Project. All four SOCI vascular plants, hop sedge, American beech, white elm and meadow horsetail are located within the 100m depth of influence.

Construction and operation activities such as clearing, sand excavation and hauling sand may result in deposition of dust on vegetation (including lichens) within the PA and LAA, especially when conditions are dry. Dust deposition onto vegetation can cover the leaves, block stomata and cellular respiration and reduce the overall efficiency of photosynthesis (Farmer, 1993). Dust can be absorbed through the soil resulting in overall decline in plant health and even lead to necrosis (Hosker & Lindberg, 1967). Dust deposition would largely be associated with activities during the operation phases of the Project.

Additional indirect impacts to native plant communities include the potential for introduction of invasive species to the PA. Seeds and roots of invasive species can be transferred from construction equipment, transportation vehicles, or workers (footwear and clothing) into adjacent habitats during construction and operational activities. Introduction of invasive species can occur when equipment or people enter vascular plant communities, or indirectly via runoff or dust from the roads. Invasive species, inclusive but not limited to purple loosestrife (*Lythrum salicaria*), Japanese knotweed (*Fallopia japonica*), common reed (*Phragmites australis*) and glossy buckthorn (Frangula alnus) can severely degrade habitat quality and outcompete many native species, particularly along roadsides. Impacts to the PA and surrounding area by the possible introduction of invasive species during construction and operation is planned to be reduced by implementing mitigation measures that will be included in the Wildlife Management Plan, which will be developed for the Project at the permitting stage.

Contamination of vegetation and habitat can occur during all Project phases by accidental spills involving the deposition of deleterious substances, including fuel, lubricants, and engine oils. This could result in altering vegetation communities and death of certain plant species.

5.8.5.2 Impacts to Wildlife

The Project is expected to result in changes in wildlife and priority species usage within the PA and LAA via direct and indirect Project related impacts. Wildlife and priority species could experience direct and indirect impacts through mortality, habitat alteration, and sensory disturbance.

5.8.5.2.1 Direct Impacts

Direct mortality of wildlife species could result from Project activities, particularly due to the increase in traffic during construction and operation of the Project. Increased traffic within the PA could potentially increase the risk of wildlife and vehicle collisions.

The Project phase with the highest levels of truck traffic, and therefore the highest risk of wildlife vehicle collisions, is the operation phase of the Project. During construction and reclamation, trucks and other equipment will be accessing and working at the site but at a much lower frequency, lessening the potential interaction with wildlife.

Road infrastructure and traffic have a negative impact on those species that are attracted to roads but lack the speed or reaction time to avoid traffic [e.g., turtles attracted to gravel roadsides for nesting (Fahrig & Rytwinski, 2009)]. Ruts, caused by equipment and vehicles, may fill with water in the spring and attract breeding amphibians. Since these ruts would likely dry up in the summer, this presents a potential risk to species that hatch.

Small mammals are generally able to avoid collisions with vehicles. Amphibians benefit from culvert installation where wetlands and watercourses intersect roads, as an alternative to crossing the roads - resulting in lessened mortality (Bouchard et al., 2009). The risk of collisions with wildlife will vary depending on the season

and the species. For instance, during winters with deep snow conditions, white-tailed deer (*Odocoileus virginianus*) are more likely to use roads and trails, putting them at an elevated risk of collisions.

Turtles are drawn to roadsides, sand and gravel pits to nest in bare ground in sandy or gravelly soils in May and June. Sand pits pose as ecological traps for turtles, and may result in direct mortality due to vehicle collisions or burial (ECCC, 2020). During spring and summer, porcupine (*Erethizon dorsatum*) and skunk (*Mephitis mephitis*) may forage on roadside vegetation at dawn and dusk, increasing the risk of collisions with those species. As such, the risk of wildlife collisions is present at any time of year.

Additionally, accidents such as fuel spills have the potential to cause indirect mortality to fauna due to exposure of contaminants. Direct mortality to fauna from Project activities is possible but unlikely to occur and only infrequently if at all.

There is potential that Project infrastructure may attract certain species for nesting. Barn swallows (*Hirundo rustica*) often construct nests in anthropogenic structures such as buildings and under bridges, and bank swallows (*Riparia riparia*) may nest along soil stockpiles with steep slopes. Generalist bird species such as crows (*Corvus brachyrhynchos*) and ravens (*Corvus corax*) may nest on structures and equipment not being used. The changes in the overall landscape and habitat can result in changes in wildlife patterns and increased risk in mortality.

For some species (e.g., porcupine), the construction can be beneficial by providing new foraging opportunities, while species that rely on interior forest conditions (e.g., fisher (*Pekania pennanti*)) are likely to avoid areas with new construction in favour of more undisturbed habitats. Local level changes in abundance and distribution of species may occur as the result of Project activities.

5.8.5.2.2 Indirect Impacts

Habitat Alteration

The Project will result in direct and indirect impacts to habitat used by terrestrial fauna within the PA. Most effects to wildlife are expected to occur gradually as the Project progresses. The Project development will result in increased habitat fragmentation, which restricts animal movements and connectivity to additional habitats, and a decrease in habitat quality for fauna.

Habitat alteration will impact different species in different ways. Some species will find new opportunities in fragmented habitats (i.e. foraging), while others are likely to avoid areas with new construction in favour of undisturbed habitats.

Additional edge habitat will be created as a result of Project activities, which is favourable to some species. Stockpiling of aggregate and overburden may attract ground nesting birds, that may often remain in the area until chicks are fledged, once a nest is established. The management of surface water may also create new habitats for waterfowl and ducks; the newly created settling ponds will, however, be relatively small and may be reclaimed upon the decommissioning of the Project. Reclamation and re-vegetation will also help birds move back into the area. Lastly, incidents and accidents also have the potential to alter habitats used by birds.

Linear features such as roads, trails and transmission corridors have the potential to influence wildlife movement patterns. They create a barrier to movement for certain species, may act as a conduit to movement for other species and the types of human activity can influence wildlife movement. Bears are tolerant of some human activity but will avoid features when human frequency is high (Jalkotzy et al., 1997). Studies completed by Buckmaster et al. (Buckmaster et al., 1999) indicate that wildlife populations may be expected to disperse from the area during periods of construction. Based upon the vegetation characteristics in adjacent areas, and the conclusions of Buckmaster et al. (1999), it is expected that displacement of wildlife will be temporary.

Wildlife species that currently use the habitat within the PA will be displaced during the initial stages of the Project from changes in habitat availability and associated sensory disturbances. This could potentially cause direct mortality of species if individuals are unable to relocate to alternate suitable habitat. However, there are

areas of suitable nesting habitat in adjacent lands and the regional area in general. The proposed Project is located in a rural, relatively untouched setting, surrounded by forested landscape that may provide alternative suitable habitat.

The Project is likely to result in an increase in habitat fragmentation and an increased amount of forest edges. Habitat fragmentation and increased edge areas may lead to increased predation. A study by Manolis, Andersen, and Cuthbert (2002) found that distance to nearest clear-cut was the best predictor of nest predation in multiple ground laying birds. The Project will alter habitat within the PA; alterations will have both negative and positive effects depending on the species. However, some bird species benefit from forest edge habitat and have shown to return in subsequent years after an area is cleared due to the availability of foraging opportunities and other niche habitats. A study in Alberta showed that the abundance of alder flycatchers increased in a previously cut area (Tittler et al., 2001). Not all alteration will be permanent, a relatively small area is being lost and furthermore, alterations will not have a significantly negative impact on local habitat as similar habitat for fauna is present in the surrounding landscape.

Overall, effects to wildlife habitat as a result of the Project are limited due to the relatively small geographic extent of alteration (99 ha) when compared to the level of available habitat in the vicinity. Majority of the Project's footprint disturbance will occur within an area with historical forestry activity. Shaw has committed to limited impacts to wetlands and its associated habitat within the PA. The habitat present in the Project footprint is common to the regional area and alternate habitat for wildlife exists on adjacent undeveloped lands, therefore, changes in abundance and distribution could be expected, but overall fauna population changes are not expected as a result of the Project. The reclamation of the sand pit will result in a positive effect on the Project, involving the reclamation of land and re-establishment of vegetation across disturbed portions of the PA. Reclamation will return the PA to a condition that is consistent with the natural surroundings and community use.

Sensory disturbance

Sensory disturbance to fauna is expected to occur throughout all Project phases and would result from activities such as sand excavation, processing and transportation. This will likely result in the localized wildlife avoidance of the Project. Some species may tend to avoid the area, while others may be attracted to the increased activity, including opportunistic species such as eastern coyote (*Canis latrans*), northern racoon (*Procyon lotor*), striped skunk, or American black bear (*Ursus americanus*).

Noise is the type of sensory disturbance that is most likely to affect fauna within the PA. Although the auditory capabilities of fauna species vary (Shannon et al., 2016) and fauna behaviour in response to noise is largely related to perceived threats, not noise intensity (Bowles, 1995), changes to ambient noise levels have the potential to adversely affect fauna. Many species have sensitive windows for breeding and birthing, and any small disruption to these activities may reduce reproductive success in the population. Sensory disruptions may result from sound/vibration or excess light. The iterative Project design process has prioritized avoidance and minimization of interactions with important wildlife habitat such as wetlands and intact forest, which will minimize sensory disturbances in these areas. Shaw will ensure that noise levels are kept within required limits as established in the NS Pit and Quarry Guidelines (1999).

Light is another source of sensory disturbance that can impact fauna by potentially causing disorientation, or attraction and avoidance behaviour (Longcore & Rich, 2004). In turn, these behavioural changes can affect the success of foraging, reproduction, and communication of wildlife (Longcore and Rich, 2004) in addition to disrupting habitat connectivity (Bliss-Ketchum et al., 2016). All sensory disturbances are expected to be temporary and will not persist beyond project completion. While the Project is active, the disturbance will primarily be observed during sand excavation, processing and hauling of aggregate.

In summary, sensory disturbance (noise and light) to wildlife is expected to occur by the Project, however, how a species may respond to this disturbance is often species or species group specific. An overall negative effect to wildlife by the Project is expected to occur as species approach the PA. This sensory disturbance could result in behavioural changes and changes in wildlife movement. Due to the proportion of the habitats

proposed to be impacted by the Project and habitat availability in the LAA, available suitable habitat for many species is present. Although movement of species may change, habitats required for their survival are present within the LAA. The overall magnitude of impact to wildlife from sensory disturbances is predicted to be low and are temporary in nature.

5.8.5.2.3 Impacts to Wildlife Species at Risk

Herpetofauna Species at Risk

Although no priority herpetofauna species were observed within the Project Area, potential suitable habitat was observed for wood, eastern painted and snapping turtle species along WC1. Marginal general habitat were observed for wood turtles. Suitable overwintering and general habitat for eastern painted and snapping turtles was observed in the open water section of WC1 (Appendix F). No other suitable habitat was observed within the PA.

Given that turtles can travel long distances in pursuit of nesting, overwintering, new streams and foraging areas and the proximity to the special management practice zone (SMP) for wood turtles outside the PA, there is a possibility that turtles will be encountered within the PA. The Project will create nesting habitat for turtles through increased availability of bare ground during the construction and operation stages of the Project. This is recognized as an ecological trap and poses as threat to turtles (ECCC, 2020). The Project may result in direct and indirect impact to turtles such as direct mortality due to collisions or burial and changes in habitat due to changes in surface water flow through water management. Mitigation measures will be employed to minimize risk to priority herpetofauna during sensitive windows (see Section 5.8.6).

Sensitive windows for herpetofauna may relate to overwintering or nesting periods, and interference with these animals' activities during these windows may disrupt their natural life history. Interference may be both temporal and spatial. Project related activities occurring during sensitive windows may impact migratory or breeding behaviours, and habitat removal or fragmentation may create a physical barrier to herpetofauna species from reaching important habitat. Limited impacts to fragmentation and life history are expected due to the small Project footprint and minimized interactions with important habitat features such as wetlands and watercourses.

Wood turtle and snapping turtle habitat is described in the Biophysical Baseline Report (Appendix F).

Avifauna Species at Risk

Four SAR avifauna species were observed within the biophysical surveys for the Project. All avian SAR within the PA are associated with edge habitat, open areas, as well as wetlands and watercourses. The number of SAR (especially eastern wood-pewee and olive-sided flycatcher) can be directly attributed to the presence of edge habitat in and around the PA. All phases of the project will result in the removal of habitat but also in the creation of edge habitat, which is favourable for some bird species. Edge habitat provides a variation in vegetation structure [e.g., height], which attract a variety of bird species, not just eastern wood-pewee and olive-sided flycatchers. The Project has prioritized the use of existing roads and previously disturbed areas in developing the PA, which minimizes impacts to preferred habitats for both breeding and foraging, including wetlands. Further information on species at risk observed within the PA is in the Biophysical Baseline Report (Appendix F). A more in-depth discussion of avian SAR observations where breeding habitat was also determined to be present follows below.

Seven eastern-wood pewee observations occurred within the PA. These observations are all associated with either edge or wetland habitat. The PA contains suitable foraging and breeding habitat for this species in the form of forest clearings and edges of wetlands and deciduous and mixed forests (COSEWIC, 2012). Two observations of eastern-wood pewee occurred within wetland habitat that would provide suitable breeding habitat and will not be directly impacted by the Project. All other eastern wood-pewee observations occurred in upland or edge habitat. The Project will not result in the loss of breeding habitat this species, overall impact to this species is low.

One olive olive-sided flycatcher was observed within the PA. The observation occurred in upland habitat and this bird was not observed to be associated with a wetland that would provide suitable breeding habitat. The Project will not result in the loss of breeding habitat this species, overall impact to this species is low.

A total of four evening grosbeaks were observed during biophysical surveys, two of which were within the PA.

Evening Grosbeak utilize softwood or softwood-dominant mixed wood forests, ranging from second-growth to mature (ECCC, 2022). Suitable breeding habitat for this species was not observed within the PA.

Common Nighthawks were observed during nocturnal and breeding bird field surveys. All observations occurred outside the PA within adjacent roadside and clearings. No confirmed breeding evidence was observed. Common nighthawk prefer to nest in gravelly substrates and are best detected while foraging for insects shortly after sunset (Bird Studies Canada, 2024). The Project's activities are anticipated to generate suitable breeding habitat for Common nighthawks.

5.8.5.3 Direct and Indirect Impact Summary

Direct

There will be no direct impact to any SOCI flora or lichens within the PA. It is expected that a total loss of 99 ha (90% of the PA, <1% of LAA) of habitat will be directly impacted by the Project footprint. Majority of the Project's impact will be to previously disturbed areas (89 ha) with the remaining impact (9.63 ha) to intact habitat, consisting of hardwood or mixed wood forests. Within the LAA, hardwood and mixed wood forests account for 43% of the land cover (4347.2 ha in the LAA). Considering the abundance hardwood and mixed wood forests within the LAA, the overall magnitude of impacts to vegetation communities is considered negligible (<1% loss). Project activities during construction and operation could pose a mortality risk to wildlife primarily through land clearing, sand extraction and increased traffic or attracting nesting of wildlife to inappropriate areas.

Indirect

The Project can result in edge effects for vegetation communities and the introduction of invasive species. Wildlife will be affected by increased habitat fragmentation and sensory disturbance. The overall magnitude of impact to wildlife from habitat fragmentation and sensory disturbances is predicted to be low and are temporary in nature.

5.8.6 Mitigation

Several management plans addressing standard mitigation measures and common practices as it relates to the terrestrial environment will be provided prior to commencement of the Project. Table 5.8-5 lists the proposed specific terrestrial environment mitigation measures to reduce overall direct and indirect impacts from the Project.

Table 5.8-5 Mitigation Measures of the Terrestrial Environment

Project Phase	Mitigation Measure
Construction, Operation	Provide wildlife awareness training to site personnel to reduce interactions between site personnel and wildlife.
	Clearing of vegetation will occur outside the breeding bird window (April 15th – August 31st) where possible. If this is not possible, then nest sweeps will be completed by a qualified biologist prior to clearing. Shaw will work with NSNRR and NSECC to develop nest sweep protocols
Operation	NSECC Pit and Quarry Guidelines (1999) will be followed to reduce the impact of noise and vibration on wildlife.
	Employ measures to reduce the spread of invasive species (particularly by vehicles) into wetlands and retain habitat integrity. Inspect vehicles regularly, particularly vehicles

Table 5.8-5 Mitigation Measures of the Terrestrial Environment

Project Phase	Mitigation Measure
	arriving from outside the PA. If necessary, cleaning will be undertaken at a designated cleaning station, away from wetlands and watercourses.
	During dry periods, water and/or dust suppressants will be applied to the access road and haul roads as needed to mitigate dust emissions.
	A site-specific erosion and sediment control plan will be developed to outline control measures to be implemented around all disturbed areas.
	Inspection and repair of erosion and sediment control devices will be regularly conducted.
	Install signage where specific wildlife concerns have been identified.
	Project vehicles will be required to comply with established speed limits to limit fugitive dust generation from vehicle travel on unpaved roads.
	Equipment, vehicles and haul trucks will be maintained in good working order and equipped with appropriate mufflers to reduce noise.
	A Wildlife Management Plan will be developed as part of the IA amendment application (post EA approval).
	A Project Contingency Plan will be developed and will include site specific best management practices and mitigation methods associated with vegetation removal, dust suppression, progressive reclamation and re-vegetation of the pit
	The Project Contingency Plan will include methods by which the Project can take place while minimizing interactions with wildlife. This plan will be provided to NSECC as part of the IA amendment application (post EA approval).
Reclamation	Reclamation activities will use native species.
	Topsoil and organic soil material removed during construction will be saved and used during reclamation in order to use the local seed bank.

Herpetofauna

Appropriate measures must be taken to exclude herpetofauna SAR from interacting with Project infrastructure and activities. Turtles may be attracted to exposed gravel areas for nesting during clearing, grubbing, road building and other Project activities. The following mitigation measures will be included in the design of the Project to minimize effects:

– Wildlife awareness training will be provided to Project personnel.
– Vehicle speed limits established on Project roads and signage posted in areas of potential turtle crossing. Turtle exclusion fencing should be erected where identified potential turtle areas and based on site observations of turtles. and kept in effective working condition. During the nesting season Project personnel will conduct a visual inspection of stockpiles before handling to ensure no nests are present.
– Follow NS Pit and Quarry Guidelines (1999) to reduce impact of noise and vibration on wildlife.

5.8.7 Monitoring and Follow-up

Monitoring and management Plans will be developed to assess the accuracy of the predicted environmental effects and effectiveness of the mitigation measures. The management and monitoring Plans are subject to modifications after consultation with NSNR and NSECC. The following Plans will be developed as part of the Project's commitment to monitoring and mitigation of adverse effects to the Terrestrial Environment:

– Wildlife Management Plan – The primary goal of this Plan is to provide strategies in reducing human-wildlife interactions, promote safety of both wildlife and site personnel and best management practices for

vegetation management including invasive species management. This Plan will occur during the duration of the construction, operation and reclamation phase of the Project.

5.8.8 Residual Effects and Significance Determination

The predicted residual environmental effects of the Project on the Terrestrial Environment are assessed to be low.

Vegetation clearing and grubbing during the construction phase will result in the direct loss of habitat. The magnitude of habitat loss varies by species and their habitat requirements. However, the overall magnitude for direct loss of habitat and habitat for species is estimated to negligible (<1% direct loss). There will be no direct loss to SOCI flora or lichen species, resulting in an overall negligible magnitude. It is expected that a total loss of 99 ha (90% of the PA, <1% of LAA) of habitat will be directly impacted by the Project footprint. The Project will only impact 9.63 ha of intact hardwood or mixedwood forests within the PA (<1% direct loss of the LAA), resulting in an overall negligible magnitude.

Table 5.8-6 Residual Effects on Terrestrial Environment

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction Habitat loss from clearing and grubbing	Limit habitat disturbance and minimize Project footprint during detailed design Re-establish habitat and associated vegetation communities during reclamation	A	N <1% direct loss of habitat types observed in the LAA	LAA Potential adverse effects to vegetation and vegetation communities outside the PA	A Although clearing and grubbing will occur outside the sensitive species timing window for wildlife, other activities will not	LT Effects occur beyond 3 years	O Effects occur once during the construction phase	PR Mitigation cannot guarantee a return to baseline conditions	Disturbance, habitat loss	Not Significant
Construction Sensory disturbance [noise, light, dust deposition] and wildlife vehicle collisions from construction activities)	Limit habitat disturbance and minimize Project footprint during detailed design. Implement speed limits and minimize lighting, best management practices and spill preparedness	A	L	LAA Potential adverse effects to wildlife outside the PA	A Although clearing and grubbing will occur outside the sensitive species timing window for wildlife, other activities will not	LT Effects may extend beyond 3 years	R Effects occur at regular intervals during the construction phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Operation Sensory disturbance (noise, light, dust deposition) and wildlife vehicle collisions from Project activities	Reduce speed limit and implement dust control measures Minimize lighting Implement WMP and associated monitoring Plans	A	L	LAA Potential adverse effects to wildlife outside the PA	A Although clearing and grubbing will occur outside the sensitive species timing window for wildlife, other activities will not	LT Effects may extend beyond 3 years	R Effects occur at regular intervals during the operational phase	R VC will recover to baseline conditions	Disturbance	Not Significant
Reclamation Demolition, earthworks	N/A	P	L Minor change from baseline conditions	LAA Potential adverse effects to wildlife outside the PA	N/A VC is not expected to be affected by timing.	LT Effects extend beyond active reclamation phase	O Effects occur once during the reclamation phase.	PR Mitigation cannot guarantee a return to baseline conditions	Habitat Reclamation	Not Significant

Legend (refer to Table 5.8-2 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	R – Reversible IR – Irreversible PR – Partially Reversible

5.9 Socioeconomic Conditions

5.9.1 Rationale for Valued Component Selection

The rationale for inclusion of the socioeconomic conditions as a VC follow:

- **Economy and Employment**: The Project may contribute to the local and provincial economies through employment and business activity throughout all phases.
- **Land and Resource Use**: Lands within and near the Project may be zoned for purposes other than extraction of sand or gravel. The Project may conflict with land and resource use activities by other groups.
- **Traffic**: Development activities may result in changes (e.g., increased traffic or changes to traffic patterns) that may result in concerns about public safety and disruptions to travel and/or access.

Various aspects of the Project that may also affect human communities (e.g., dust, noise, water resources), are discussed in other sections of this report (Sections 5.1, 5.2, and 5.5) that address related topics such as changes to air, light, noise, groundwater and surface water. In addition, human activities may be affected directly or indirectly by the effects of development on fish, animals, birds or plants and the habitats that support these species (Section 5.8). Potential Project-related effects on cultural and heritage resources and the Mi'kmaq of Nova Scotia are discussed in Sections 5.10 and 5.11. These related effects are not repeated in this VC section.

5.9.2 Baseline Program Methods

The Socioeconomic Conditions VC includes information mainly obtained through desktop research and analysis. Data related to population, employment, income and health were mainly obtained from Statistics Canada. Information on the regional economy and land use zoning was obtained from the Municipality of the County of Annapolis website. Federal and provincial government agencies publish information on important industries, which was helpful for describing aspects such as and current economic activity, health status and tourism and recreation.

Relevant information is not readily available for small rural communities such as those near the Project. Statistical data for the Municipality of the County of Annapolis was selected to represent Annapolis County because it encompasses all nearby communities including Middleton (selecting the census subdivision would have excluded Middleton).

GHD prepared a traffic impact study for the Project (Appendix H). This work included recording baseline traffic volume and speed data from November 19 to 22, 2024 using an automatic traffic recording (ATR) unit at key intersections. The study was also important for forecasting changes to traffic, planning vehicular access for the Project and selecting a preferred trucking route.

5.9.3 Baseline Conditions

The Project is in the Municipality of the County of Annapolis. The nearest communities are South Farmington, Meadowvale, Torbrook Mines, Torbrook, Torbrook West, Nictaux Falls, Nictaux and Middleton. As limited data are available for the small communities, regional information is used to describe socioeconomic conditions.

5.9.3.1 Economy

The Annapolis County Economic Region includes Annapolis, Hants and Kings Counties (County of Annapolis, 2024). The regional economy is supported by key drivers and large employers such as Canadian Forces Base (CFB) Greenwood, Acadia University, Michelin Tire Waterville Plant, ANDRITZ Fabrics and Rolls and Crown

Fibre Tube Inc. (County of Annapolis, 2024). Other important employers include Mountains and Meadows Care Group, MacLeod Cares Annapolis Royal Nursing Home, Den Hann Greenhouses, Acadian Seaplants, Foamworx Canada and NS Community College's Centre of Geographic Sciences.

Agriculture, including the largest fruit-producing region in Eastern Canada, and forestry are also important sectors in Annapolis County (Valley Regional Enterprise Network, 2024). The Valley Regional Entrepreneurial Acceleration Program (REAP) is establishing an Agricultural Technology (Ag-Tech) Accelerator. Agri-Food Canada's Kentville Research and Development Centre is in Kentville (Agri-Food Canada, 2024).

5.9.3.1.1 Employment

This section describes employment and income characteristics for Annapolis County and NS. Detailed data are not available for the small communities surrounding the Project due to population size.

5.9.3.1.2 Working Age Population

The 2021 population of Annapolis County (21,252) and NS (969,383) both increased following the previous census with a larger gain in NS: 5% compared to 3.2% for Annapolis County (Statistics Canada, 2023b). The working age cohort (i.e., ages 15-64) made up a smaller percentage of the 2021 population in Annapolis County compared to NS (Table 5.9-1). Both trends align with an older and ageing population typical of rural Canada.

Table 5.9-1 Working Age Population Cohorts (2021)

Cohort (years)	Annapolis County (%)	NS (%)
15 to 64	58.2	63.7
20 to 34	12.5	18.3
35 to 49	15.4	17.9
50 to 64	26.1	22.5

Source: Statistics Canada (2023b)

5.9.3.1.3 Labour Force

Labour force statistics describe the population employed or looking for work. In 2021, Annapolis County had lower labour force participation and employment compared to the provincial rates (Statistics Canada, 2023b). In both jurisdictions, women+ had lower participation and employment rates than men+ (Table 5.9-2). The difference in participation rates was similar between men+ and women+ in Annapolis County and NS. In NS generally, women+ had higher unemployment, but this was not the case in Annapolis County.

Table 5.9-2 Labour Force Characteristics (2021)

Indicator (population 15 year and older)	Annapolis County		NS	
	Men+	Women+	Men+	Women+
Participation rate (%)	54.8	47.9	63.1	56.1
Employment rate (%)	48	42.1	55.3	48.7
Unemployment rate (%)	12.4	11.9	12.3	13.1

Source: Statistics Canada (2023b)

5.9.3.1.4 Employment by Economic Sector

Table 5.9-3 shows labour force organized by the North American Industry Classification System (NAICS) 2017 including disaggregated data by gender. In 2021, Annapolis County's largest economic sectors in terms of employment were "Transportation and Warehousing", "Retail Trade", "Public Administration", "Manufacturing",

“Construction” and “Agriculture, Forestry, Fishing and Hunting”, which together account for nearly 62% of employment (Statistics Canada, 2023b). NS shares these sectors as the most important employers with two exceptions. “Agriculture, Forestry, Fishing and Hunting” does not employ as large a portion of the provincial labour force, which reflects the importance of agriculture in Annapolis County and “Professional, scientific and technical services” employs a greater portion of the labour force provincially than in Annapolis County. For both jurisdictions, women+ showed strongest employment in “Health Care and Social Assistance”, “Educational Services”, while men+ were more likely to be employed in “Construction”.

Table 5.9-3 Labour Force by Industry (2021)

North American Industry Classification System (NAICS) 2017	Annapolis County		NS	
	Men+	Women+	Men+	Women+
Agriculture, forestry, fishing and hunting (%)	11	4.8	5.6	1.7
Mining, quarrying, and oil and gas extraction (%)	0.7	0	1.1	0.1
Utilities (%)	0.6	0.3	1.1	0.4
Construction (%)	14.5	1.6	12.7	1.7
Manufacturing (%)	11.6	5.1	9.1	3.5
Wholesale trade (%)	2.3	0.9	3.3	1.4
Retail trade (%)	11.9	16.4	10.8	13.5
Transportation and warehousing (%)	6.4	2.7	6.2	1.9
Information and cultural industries (%)	1	0.8	1.9	1.5
Finance and insurance (%)	0.6	2.1	2.6	4.2
Real estate and rental and leasing (%)	0.8	1.1	1.4	1.3
Professional, scientific and technical services (%)	3.7	4.2	7	5.9
Management of companies and enterprises (%)	0	0	0.1	0.2
Administrative and support, waste management and remediation services (%)	3.9	2.8	5.2	3.6
Educational services (%)	3.2	10.2	4.7	11.3
Health care and social assistance (%)	4.1	24.9	5.1	24.4
Arts, entertainment and recreation (%)	2.6	2	1.8	1.9
Accommodation and food services (%)	2.6	6.2	5.1	7.3
Other services (except public administration) (%)	4.2	5.2	3.7	4.2
Public administration (%)	11.8	5.7	9.4	7.8

Source: Statistics Canada (2023b)

5.9.3.1.5 Income

Provincially, average employment income is higher than in Annapolis County (Table 5.9-4). In both jurisdictions, men+ earn higher employment income than women+ though the difference is larger provincially.

Table 5.9-4 Average Employment Income (2020)

Indicator	Annapolis County		NS	
	Men+	Women+	Men+	Women+
Average employment income ($)	38,440	27,960	50,080	36,320

Source: Statistics Canada (2023b)

5.9.3.2 Land Use

The following sections describe land and resource use including land use planning and property ownership. The surrounding communities are within the jurisdiction of the Municipality of the County of Annapolis for land use planning. Shaw currently owns all parcels of Project lands.

5.9.3.2.1 Existing Land Use

The Project is in a rural area mainly on agricultural lands. Though it is not the largest sector by employment, Annapolis County specializes in agricultural development (County of Annapolis, 2024a; County of Annapolis, 2024b). Agriculture is characteristic of rural areas of Annapolis County with approximately 3.8% of land within the municipal planning area (MPA) of the Municipality of the County of Annapolis used for agriculture or identified as having agricultural potential. Forestry accounts for 88.5% of land in the County and nearly all land in the South Mountain area.

5.9.3.2.2 Land Use Planning

In April 2024, the Municipality of the County of Annapolis adopted a revised County-Wide Municipal Planning Strategy (MPS) and Land Use By-laws (LUBs), which provide a general framework for future development and Provincial Interests (County of Annapolis, 2024b). The Project is within the Annapolis County East End Planning Area, which has a Secondary Planning Strategy (SPS). The Municipality of the County of Annapolis is currently reviewing the East End Planning Area SPS and LUBs to align with the county-wide MPS. Areas of special interest in the East End Planning Area SPS review include:

– Current and future residential land (including cottages)
– Identification and protection of forestry and agricultural land (Provincial Interest)
– Commercial and institutional areas
– Concentrating development in areas with existing municipal services
– Commercial development at highway interchanges
– Opportunities along existing underdeveloped collector roads (e.g., Trunks 1, 201 and 10)
– Appropriate development or restrictions around lakes, rivers, brooks, wetlands and flood prone areas
– Water supply protection (Provincial Interest)
– Transportation on arterial roads (Highway 101), collector roads (Trunks 1, 201 and 10), local roads, municipal roads and other roads

The existing SPS adopted for the East End Planning Area in 2012 indicates Project lands are mainly zoned as Agricultural (AG) with a small amount of land zoned as Rural (R-5) (County of Annapolis, 2012a). In the East End SPS, “Extractive Related Facilities means the use of buildings and structures related to, associated with and/or fundamental to the operation of an extractive surface, subsurface or underground mine, pit, quarry or drill site, including those lands, buildings and structures related to, associated with and/or fundamental to the storage, washing, crushing, sifting, reducing, leaching, weighing, processing, distribution and/or sale of such extracted materials, including but not limited to, sand, gravel, oil and natural gas, minerals, stone, rock or clay”. Extractive Related Facilities are a permitted use in R-5 but not in the AG zone.

Development of the Project may require rezoning of lands currently zoned as AG in the Project to R-5 or Light Industrial (IND2) where extractive related facilities are also a permitted use. Shaw has engaged with representatives of the Municipality of the County of Annapolis on several occasions regarding the Project, including the development officer and CAO. Engagement will continue in 2025 to clarify the direction of the East End SPS review relative to alignment with the Municipality of the Annapolis County MPS and a provincial goal of protecting agricultural land.

5.9.3.2.3 Conservation of Agricultural Land

Nova Scotia's statements of Provincial Interest (SPI) identify a goal of protecting agricultural land from being lost to non-agricultural development (Government of Nova Scotia, 1998). The SPI directs municipalities to identify agricultural lands and address protection when amending planning documents. Municipalities are directed to balance non-agricultural uses with conservation of agricultural land, establish separation distances between agricultural and new non-agricultural development to reduce land-use conflicts and to establish measures to reduce topsoil removal on lands of highest agricultural value.

The Annapolis County MPS (Policy 4.4.8 Rezoning Agricultural Zones to Other Uses) indicates Council will "consider rezoning property in an Agricultural (AG) Zone to another use based on consideration of an Agricultural Impact Assessment Report prepared and signed by a qualified professional at the expense of the property owner that shall document the Canada Land Inventory (CLI) soil classification applicable to the land; the implications of discontinuing or fragmenting its agricultural use; the availability of services, particularly water and wastewater networks; and the compatibility of potential alternative land uses with adjacent agricultural and rural lands, particularly potential residential uses that may conflict with established agricultural operations." (Annapolis County, 2024a).

5.9.3.3 Transportation

Various roads and highways in Annapolis County are near the Project (Figure 5.9-1). These are also described and in the Traffic Impact Assessment (Appendix H) and identified below.

– Freeman Street, which accesses the Project, is a north-south local road with one lane in each direction and an assumed unposted speed limit of 50 km/h.
– Route 201 is an east-west provincial arterial highway with one lane in each direction. Two posted speed limits were identified near the Project – 70 km/h near Trunk 10, and 80 km/h near Freeman Street.
– Trunk 10 is a north-south provincial arterial highway with one lane in each direction. Near Middleton, the posted speed limit is 50 km/h. Further along this road near Route 201, the posted speed limit is 70 km/h.
– Trunk 1 is an east-west provincial arterial highway with one lane in each direction. The posted speed limit ranges between 50 km/h in Middleton and 80 km/h near Bayard Road.
– Victoria Road is a north-south local road with one lane in each direction and with a posted speed limit of 60 km/h. This roadway provides the link between Project and the transportation network via Highway 101.

Table 5.9-5 provides a summary of existing traffic conditions for identified intersections during weekday AM and PM peak hours. The NS Department of Public Works (NSDPW) Traffic Impact Analysis guidelines indicate critical operations are present when the volume to capacity ratio (v/c) exceeds 0.90 for any given movement, or when the system operates at a "E" or 'F' level of service (LOS). Thus, the 2024 existing conditions analysis indicates no critical operations are currently experienced at the intersections for AM or PM peak conditions. Delays experienced were between two and 17 seconds(s).

Table 5.9-5 2024 Existing Traffic Operations

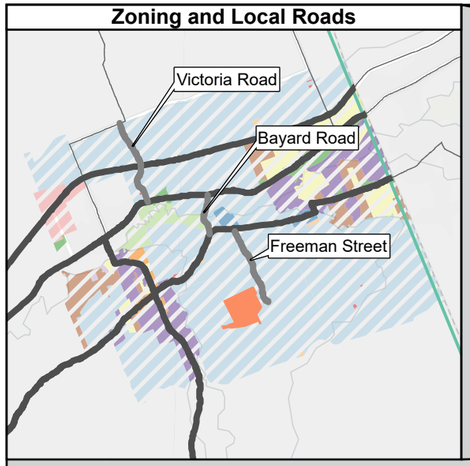
Intersection	Overall Intersection		Movements with Highest V/C Ratio / Critical Movements			
	LOS	Delay (s)	Movement	LOS	Delay (s)	V/C
AM Peak Hour						
Trunk 1 and Victoria Road	A	3	SBLR	B	11	0.15
Trunk 1 and Trunk 10	A	4	NBLR	C	17	0.22
Trunk 10 and Route 201	A	5	EBTLR	B	11	0.10

Table 5.9-5 2024 Existing Traffic Operations

Intersection	Overall Intersection		Movements with Highest V/C Ratio / Critical Movements			
	LOS	Delay (s)	Movement	LOS	Delay (s)	V/C
Route 201 and Bayard Road	A	2	SBLR	A	9	0.02
PM Peak Hour						
Trunk 1 and Victoria Road	A	2	SBLR	B	12	0.18
Trunk 1 and Trunk 10	A	3	NBLR	B	13	0.10
Trunk 10 and Route 201	A	6	WBTLR	B	12	0.19
Route 201 and Bayard Road	A	2	SBLR	A	9	0.06

Notes:
s: seconds
SBLR: Southbound left/right
NBLR: Northbound left/right
EBTLR: Eastbound through/left/ right
WBTLR: Westbound through/left/right

Zoning and Local Roads



Highway 101
Trunk 1
Route 201
Trunk 10

Legend

- Study Area Arterial Roads
- Study Area Local Roads
- Other Roads
- Regional Assessment Area
- Local Assessment Area
- Project Area

Zoning Designation (January, 2022)

- AGRICULTURAL
- COUNTRY RESIDENTIAL
- ENVIRO OPEN SPACE
- HIGHWAY COMM
- INDUSTRIAL
- INSTITUTIONAL
- LIGHT INDUSTRIAL
- NICTAUX COMM
- RES GROUP DWG
- RES HIGH DENSITY
- RES LOW DENSITY
- RES MED DENSITY
- RURAL
- RURAL RESIDENTIAL

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

LAND USE PLANNING AND TRANSPORTATION

Project No. **12584960**
Revision No. **-**
Date **Mar 11, 2025**

FIGURE 5.9-1

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_013_LandUsePlanning_Transportation
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5.9.3.4 Recreation and Tourism

Tourism plays a key role in the regional economy of Annapolis Valley (VREN, 2024). In 2018, room nights sold in the region totalled 360,000 and were only exceeded by Halifax Metro and Cape Breton regions. Key tourism draws in Annapolis County include Port-Royal National Historic Site and Fort Anne National Historic Site (Figure 5.9-2). Both Port-Royal and Fort Anne, along with other historic sites, are in the Annapolis Royal area.

Kejimkujik National Park and National Historic Site are in Southwest NS. A portion of the National Park overlaps with the southwest area of Annapolis County (Figure 5.9-2). Permitted activities at Kejimkujik including camping, hiking, bicycling, paddling and camping (Parks Canada 2025). The Park offers opportunities to learn about the natural environment and Mi'kmaw culture (e.g., Mi'kmaw petroglyphs, traditional encampment areas and canoe routes). Kejimkujik includes NS's only Dark-Sky Preserve. The Southwest Nova Biosphere Region, instituted in 2001, is one of 19 ecosystems in Canada to receive this designation from the United Nations Educational, Scientific and Cultural Organization (Southwest Nova Biosphere Region 2025). Kejimkujik National Park is one of two protected areas in the Biosphere Region.

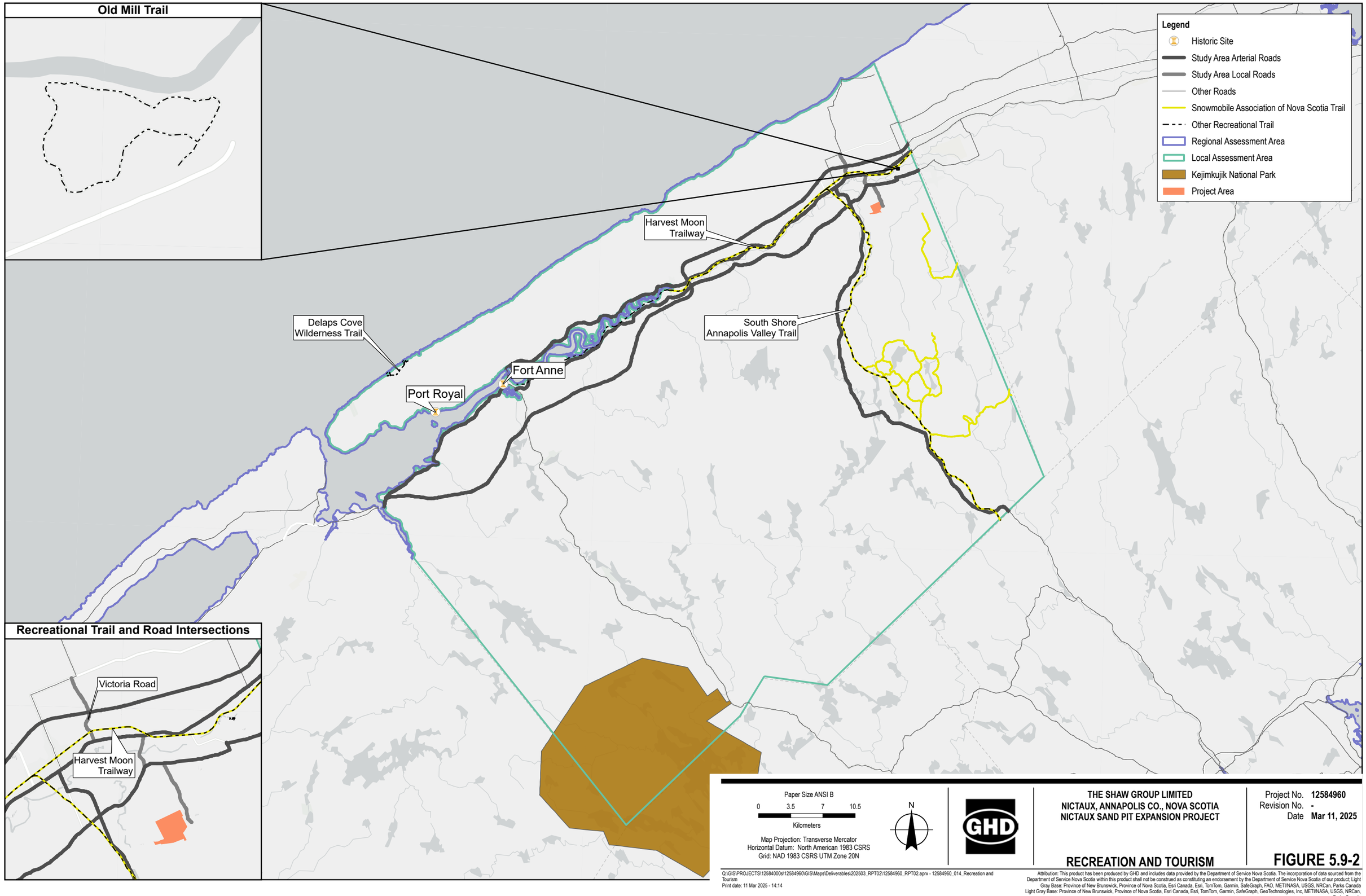
Figure 5.9-2 shows trails near the Project. The Harvest Moon Trailway runs from Grand Pré at its north end to Annapolis Royal in the south mainly along Trunk 1 and through Annapolis County and Middleton (Destination Trails Nova Scotia, 2024). The South Shore Annapolis Valley Recreational Trail runs between Middleton and New Germany in Lunenburg County with access from most communities on Highway 10 (County of Annapolis, 2024a). Trail users my include hikers/walkers, bicyclists, horseback riders, ATV riders and off-road motorcyclists with cross-country skiers and snowshoers when winter conditions are favourable. Other trails in Annapolis County include the Old Mill Trail in South Farmington, which includes an 800 m trail within a 2.2-acre accessible nature park and Delaps Cove Wilderness Trail, which includes two trails on the shore of the Bay of Fundy (Tourism Nova Scotia, 2024). Snowmobilers Association of NS maintains a groomed trail system throughout NS including those in Annapolis County (Snowmobilers Association of NS, 2025).

5.9.3.5 Human Health

Detailed data on health status of the population of Annapolis County or NS Health Western Zone (i.e., Annapolis Valley, South Shore and South West) were not available and limited current information were available for NS. A NS Health Profile (2015) indicated that leading causes of death in the province were cancer (malignant neoplasms), major cardiovascular diseases, accidents (unintentional injuries), chronic lower respiratory diseases and diabetes mellitus (Government of Nova Scotia, 2015). The following data describes 2021 health status for Canada and NS, where available.

In 2021, nearly half of Canadians lived with at least one major chronic disease but the prevalence and number of chronic conditions increased with age and were higher for females than males in all age groups (Statistics Canada, 2023c). Canadians with lower household incomes experienced higher prevalence of chronic diseases compared with those with higher incomes. For most chronic diseases, except asthma, prevalence was highest among people aged 65 and older. In the case of chronic obstructive pulmonary disease (COPD), 80% to 90% of cases were mainly attributed to cigarette smoking though other risk factors include exposure to second-hand smoke, occupational exposure to dusts and fumes, outdoor air pollution and repeated childhood respiratory tract infections.

The most common chronic conditions in Canada in 2021 were being overweight, obesity, arthritis and high blood pressure (Table 5.9-6). The same was true for NS though rates of obesity, arthritis and high blood pressure were higher provincially. This was at least in part age-related as a greater proportion of people 65 and older reported having the most common chronic conditions (other than obesity and asthma) compared with other age groups (Statistics Canada, 2023b; Statistics Canada, 2023c). The NS population is older than that of Canada as the proportion of the NS population over 65 was 22% compared to 19% for Canada (Statistics Canada, 2023b; Statistics Canada, 2023c).



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

Project No. 12584960
Revision No. -
Date Mar 11, 2025

RECREATION AND TOURISM

FIGURE 5.9-2

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Table 5.9-6 Prevalence of Common Chronic Conditions (2021)

Conditions	Canada	NS
Overweight (adults) (%)	35.5	34.4
Obesity (adults) (%)	29.2	37.0
Overweight or obesity (youth) (%)	27.2	27.6*
Arthritis (%)	19.5	26.7
High blood pressure (%)	17.7	22.4
Asthma (%)	8.7	12.1
Cancer (%)	7.6	8.9
Diabetes (%)	7.3	8.7
Heart disease (%)	6.5	8.1
Chronic Obstructive Pulmonary Disease (COPD) (%)	3.9	7.6
Stroke (%)	1.1*	1.4*

Note: * use with caution
Sources: Statistics Canada (2023b); Statistics Canada (2023c)

While no data were available for NS, in 2021, more than 3.3 million Canadians aged 12 and older (10.4%) reported having been diagnosed with an anxiety disorder (Statistics Canada, 2023c). Over 9.6% reported having a mood disorder. The incidence of anxiety and mood disorders increased from 2015 to 2021 and was higher among females than males, First Nations people living off reserve and Métis compared to non-Indigenous people and higher for those in the lowest income quintile than the highest income quintile. From 2015 to 2021, comparative declines in self-reported mental health were reported for all age groups but most prominent in young adults aged 18 to 34 years old. In 2021, 63.0% of males reported very good or excellent mental health compared to females at 55.1%. Reported differences by sex were largest for 12- to 17-year-olds.

It is important to note the effects of the COVID-19 pandemic on mental health would have affected data collected in the 2021 census. During the pandemic, social isolation due to distancing policies and other health protection measures led to increases in conditions such as anxiety, depression and post-traumatic stress disorder, and resulted in higher outpatient and emergency department mental health-related visits for Canadian youths under 18 years old (Statistics Canada, 2024b). Further from April 1, 2018 to March 5, 2022, rates of youth hospitalizations for mental health and addictions were higher for females compared to males in all provinces and territories.

5.9.4 Effects Assessment Methods

5.9.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

5.9.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on socioeconomic conditions are defined below and are shown on Figure 5.9-3.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or

portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.

– The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. For the purposes of determining effects on Socioeconomic Conditions, the LAA is the Municipality of the County of Annapolis.
– The RAA encompasses all Project and VC interactions including diffuse or longer-range effects such as those from Project activities on the socioeconomic environment. The RAA for this VC is NS as economic effects and employment will be experienced more broadly than Annapolis County.

5.9.4.1.2 Temporal Boundaries

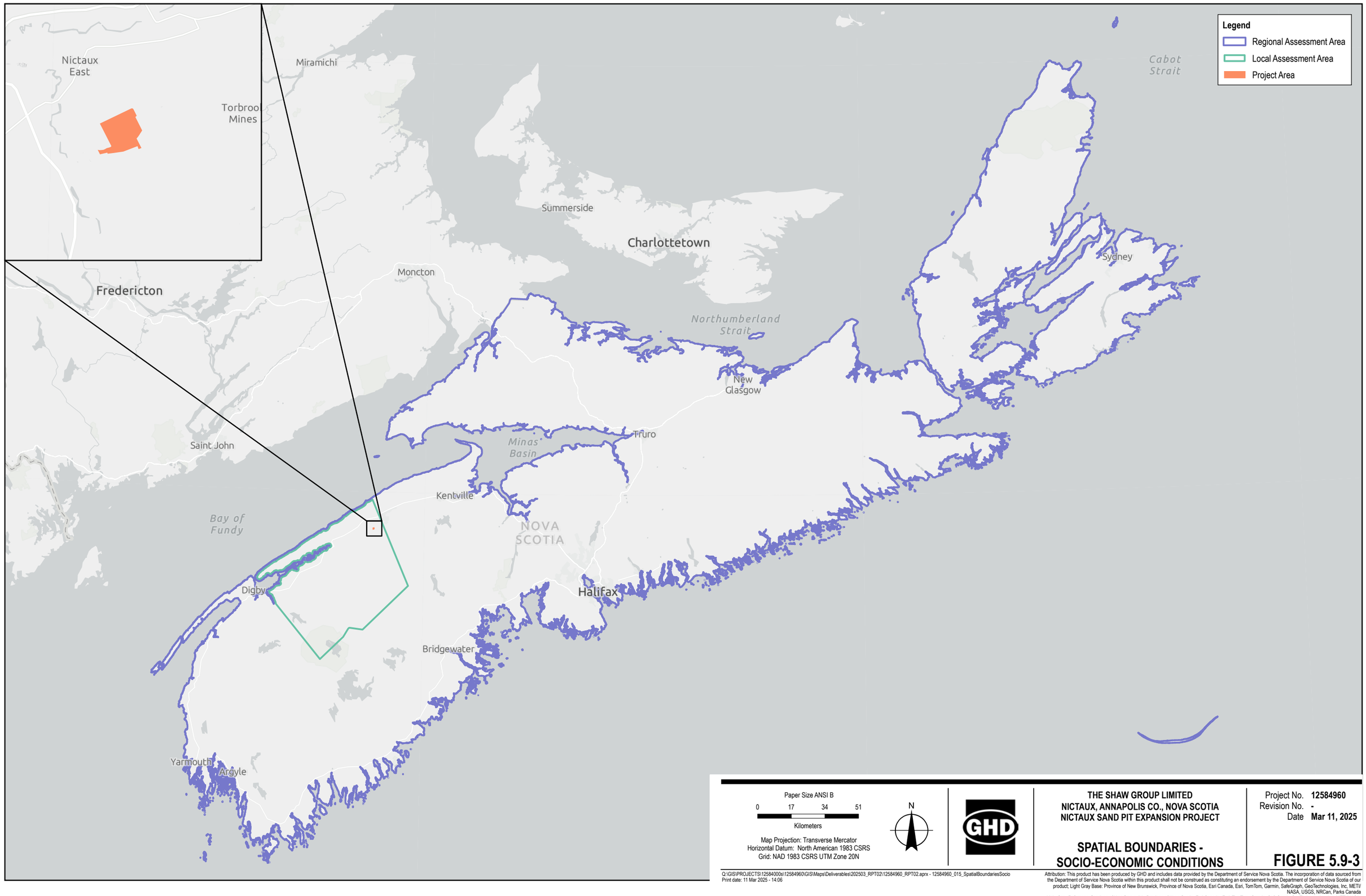
The temporal boundaries used for the assessment of effects on the socioeconomic components of the Project includes the construction, operation and reclamation phases.

5.9.4.1.3 Technical Boundaries

Municipality of the County of Annapolis information is used to present the demographic profile due to lack of available information for the small communities.

5.9.4.1.4 Administrative Boundaries

Administrative boundaries represent the regulatory, public policy and/or economic limitations placed on the execution of the Project and in this case are regional and provincial.



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

SPATIAL BOUNDARIES - SOCIO-ECONOMIC CONDITIONS

Project No. 12584960
Revision No. -
Date Mar 11, 2025

FIGURE 5.9-3

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5.9.4.2 Thresholds for Determination of Significance

Table 5.9-7 provides quantitative measures or definition of qualitative categories for assessment of residual effects on Socioeconomic Conditions.

Table 5.9-7 Characterization Criteria for Environmental Effects Socioeconomic Conditions

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – no detectable direct or indirect adverse effects. **L** – short or medium-term effects within the context of mitigations and consultation with appropriate regulators, communities, and user groups. **M** – long-term effects within the context of mitigations and consultation with appropriate regulators, communities, and user groups. **H** – permanent effects within the context of mitigations and consultation with appropriate regulators, communities, and user groups.
Geographic Extent	**PA** – the residual environmental effect occurs within the PA **LAA** – Occurs beyond the PA and within the LAA **RAA** – Occurs beyond the PA and LAA and within the RAA
Timing	**Not Applicable (N/A)** – seasonal aspects are unlikely to affect VCs **Applicable** – seasonal aspects may affect VCs
Duration	**Short-Term** – effects are limited to occur from as little as 1 day to 12 months **Medium-Term** – effects can occur beyond 12 months and up to 3 years **Long-Term** – effects extend beyond 3 years **Permanent** – valued component unlikely to recover to baseline conditions
Frequency	**Once** – effects occur once **Sporadic** – effects occur at irregular intervals throughout the Project **Regular** – effects occur at regular intervals throughout the Project **Continuous** – effects occur continuously throughout the Project
Reversibility	**Reversible** – VCs will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible -** mitigation cannot guarantee a return to baseline conditions **Irreversible** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect to Socioeconomic Conditions from the Project is defined as:

– A Project related effect that results in permanent uncompensated loss of lands and resources used by other industry sectors or by residential or commercial users.

– A Project related effect that results in permanent adverse health or safety conditions for relevant communities.

5.9.5 Project Interactions and Potential Effects

Socioeconomic Conditions have the potential to be adversely affected by sand extraction and related activities. This includes those Project activities listed in Table 5.9-8.

Table 5.9-8 Project Activities and Socioeconomic Conditions Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing and grading Road construction Water management
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management
Reclamation	Demolition Earthworks Water management

5.9.5.1 Economy

All phases of the Project will provide employment and procurement opportunities, as well as make positive contributions to gross domestic product (GDP), royalties and taxes for municipal, provincial and/or federal governments. The Project will provide direct and indirect employment for its workers and suppliers, as well as for the transportation and construction industries. The Keddy facility has made a significant contribution to the local economy with employment of approximately 15 people (full time and seasonal) on an annual basis and has paid approximately $3 million in wages, royalties, fees and taxes over the last 5 years, and more previously. The Project is expected to have a similar economic impact.

The Project is expected to also create indirect economic value via contractor, service, consulting procurement and employment opportunities during pre-engineering, construction and operation. As an example, in 2021, the NS mining industry employed 2,187 individuals directly and 841 indirectly meaning for every three jobs in the mining industry, another position was created indirectly in the supply sector (MANS, 2024).

The Project will have a positive impact in this rural area due to business and employment opportunities (direct, indirect and induced). Shaw will be using operational staff from another pit site that will be closed thus providing continuous employment for existing staff. Due to potential labour shortages, the construction phase may face challenges with labour procurement. In this environment, the Project may present an opportunity to employ those normally underrepresented (e.g., women, people of colour, Indigenous people and immigrants) for Project construction. No adverse effects are anticipated for the economy.

5.9.5.2 Land Use

The overview in Section 5.9.3.2 indicates the Project may be, at least in part, compatible with current land use zoning, but this should be reviewed with planning staff at Municipality of the County of Annapolis. Development of the Project may require rezoning of lands currently zoned as AG in the PA to R-5 or Light Industrial (IND2) where extractive related facilities are also a permitted use. However, a discussion with Municipal staff will help clarify the direction of the East End SPS review relative to alignment with the 2024 Annapolis County MPS and a provincial goal of protecting agricultural land.

5.9.5.3 Transportation

Construction will require mobilization of heavy equipment for earthworks and site preparation, as well as mobilization of infrastructure. During operation, additional traffic (i.e., large trucks, employee vehicles and service vehicles) will be experienced along the haul route. During reclamation, the infrastructure will be removed resulting in a second period of increased activity. All phases will include use of large trucks and passenger vehicles.

As this proposed sand pit is intended to replace Shaw's Keddy facility located at 1516 S Bishop Road in the community of Coldbrook, the Keddy facility was used as a proxy to estimate the number of trips that would be generated by the new sand pit in South Farmington. The data received from Shaw for Keddy provided the average amount of loads per day for each month of the year based on 2023 year-round counts. It was found that in 2023, the highest average of daily loads occurred in May, with an average of 57 loads per day. To be conservative, this highest volume of the year of daily truck loads was used for the future conditions traffic analysis. To determine the number of trips that would be generated during the AM and PM peak hours being specifically considered, it was conservatively assumed that all of the 57 loads for the day would be transported in only 4 hours of the day and that during the AM and PM peak hours alone, a quarter of this daily load (approximately 15 vehicles) would be transported for each these peak hours. Accounting for the possibility of empty trucks reaching the sand pit to be filled at the start of the peak hour, and then being filled and redirected to the network within the same peak hour, it was assumed for the purpose of analysis that 15 trips in both directions, entering and exiting the site, were going to be generated by the new proposed sand pit for each of the two peak hours.

A summary of associated future traffic operations for the proposed haul route is presented in Table 5.9-9. As shown, the 2031 future total conditions capacity analysis for the proposed haul route indicates that no critical operations are expected at the identified intersections for either peak AM or PM hour conditions.

Table 5.9-9 2031 Future Total Traffic Operations – Proposed Haul Route

Intersection	Overall Intersection		Movements with Highest V/C Ratio / Critical Movements			
	LOS	Delay (s)	Movement	LOS	Delay (s)	V/C
AM Peak Hour						
Trunk 1 and Victoria Road	A	3	SBLR	B	13	0.27
Trunk 1 and Trunk 10	A	6	NBLR	D	35	0.51
Trunk 10 and Route 201	A	6	WBTLR	B	13	0.17
Route 201 and Bayard Road	A	2	SBLR	A	9	0.02
PM Peak Hour						
Trunk 1 and Victoria Road	A	3	SBLR	C	16	0.35
Trunk 1 and Trunk 10	A	4	NBLR	C	20	0.22
Trunk 10 and Route 201	A	8	WBTLR	B	15	0.34
Route 201 and Bayard Road	A	2	SBLR	A	10	0.09

The assessed haul route is as follows: trucks looking to access Highway 101 from the PA would turn left from Freeman Street into Route 201 bypassing the Bayard Road intersection, make a westbound right-turn movement into Trunk 10, turn right into Trunk 1, make an eastbound left-turn movement into Victoria Road and a northbound right-turn movement to access Highway 101 via exit 18A. An alternative route involves turning west from Trunk 10 onto Trunk 1 and then north onto Brooklyn Road to access Highway 101 via Exit 18. Baseline and projected traffic conditions for both haul routes are anticipated to be similar.

The projected future total traffic conditions for the proposed haul route up until 2031 were found to be acceptable as no critical operations expected at any of the identified intersections for either daily period of peak traffic conditions. The modelling showed generally good traffic operations can be expected at the intersections of Trunk 1 and Victoria Road and Route 201 and Bayard Road. The Trunk 1/Trunk 10 intersection has an anticipated delay of 35 seconds in the AM peak for the 2031 future total conditions, which is at the threshold of the critical LOS “E”).

Along both haul routes considered, minor traffic hazards include overhead height clearance concerns, small turning radii and partially obstructed signage and driveways. Bridge crossings along the proposed haul route do not have any weight or height restrictions.

5.9.5.4 Recreation and Tourism

The PA does not intersect recreational trails (e.g., hiking, bicycling and snowmobiling). The proposed haul route is described in Section 5.9.3.3. Recreational users of the Harvest Moon Trailway may encounter Project haul truck traffic at the crossing of Victoria Road.

5.9.5.5 Human Health

The Project may result in changes to air quality and noise. Sections 5.1 and 5.2 identify sensitive receptors (e.g., nearest homes, cottages, communities) for air quality and noise and forecast changes with mitigation measures as appropriate.

5.9.6 Mitigation

Shaw has considered the beneficial and adverse effects of the Project on Socioeconomic Conditions and designed the Project to avoid adverse effects wherever possible. Shaw has also developed mitigations to minimize any adverse effects. The following sections outline mitigations to reduce potential adverse effects from the Project and measures to enhance Project benefits.

Mitigation measures relevant to socioeconomic conditions are presented in Table 5.9-10

Table 5.9-10 Socioeconomic Conditions Mitigation Measures

Socioeconomic Conditions	Mitigation Measure
Economy	Shaw is committed to maximizing local recruitment and employment, local labour market training, procurement and service opportunities throughout all Project phases. As a responsible employer, Shaw provides a safe and healthy workplace where employees are treated fairly and given opportunities to improve their skills.
Land Use	Shaw will comply with all regulations and permitting requirements for the Project in all phases as identified by the Municipality of the County of Annapolis and Government of NS. Private land parcels have already been purchased for the Project. No crown lands or land purchases are required.
Transportation	Shaw acknowledges that an increase in traffic above current conditions is inevitable due to the Project. All haul truck drivers will adhere to speed limits and other road laws and will adjust to changing road conditions. Prior to operating equipment or vehicles for construction of the Project, Shaw is committed to meeting NSDPW requirements and employing traffic management standards (e.g., signage) to identify any risks and appropriate policies and programs to ensure public and worker safety.
Recreation and Tourism	Shaw is committed to public safety including compliance with regulations such as speed limits and meeting NSDPW requirements and best practices. The Project CLC will help Shaw to communicate with stakeholders and learn of concerns so any issues can be addressed as soon as possible.
Human Health	Mitigation measures for Project-related air quality and noise issues are presented Sections 5.1 and 5.2.

5.9.7 Monitoring and Follow-up

It is not anticipated that ongoing monitoring will be required for Socioeconomic Conditions such as economy, land use, recreation and tourism. Shaw's safety policies and programs will help manage onsite traffic. Offsite traffic management is regulated and monitored by provincial and/or regional authorities. Shaw will maintain open lines of communication with the Municipality of Annapolis County, Town of Middleton and the broader community to learn of concerns and address any issues. Proposed monitoring for air quality and noise associated with human health is described in Sections 5.1 and 5.2.

5.9.8 Residual Effects and Significance Determination

The predicted residual effects (following mitigation) of the Project on Socioeconomic Conditions are assessed to be both positive and adverse, but not significant. The overall residual effect of the Project on Socioeconomic Conditions is assessed as not likely to have significant adverse effects after appropriate mitigation measures have been implemented as summarized in Section 5.9.6.

A significant adverse effect on the Socioeconomic Conditions VC was defined in Section 5.9.4.2 as:

– A Project related effect that results in permanent uncompensated loss of lands and resources used by other industry sectors or residential or commercial users.
– A Project related effect that results in permanent adverse health or safety conditions for relevant communities through increased traffic.

This Project will make an economic contribution in the Municipality of the County of Annapolis and NS. It will generate employment in all Project phases (and related income and taxation benefits). Contracting and sub-contracting for required goods and services (i.e., equipment and supplies) and associated expenditures will provide business opportunities for qualified firms. Creation of employment will benefit businesses through employee spending. Project benefits are not considered in evaluation of adverse residual effects.

Shaw will comply with all regulations and permitting requirements for land use planning with the Municipality of the County of Annapolis. Traffic management measures will reduce the effects of increased traffic due to the Project. Residual effects of the Project on traffic after mitigation are likely to be moderate, long term, within the LAA (as traffic extends beyond the PA) and continuous throughout all Project phases. Traffic management will also serve to protect the safety of recreational users. Traffic is anticipated to return to baseline conditions after completion of the Project.

Table 5.9-11 Residual Effects on Socioeconomic Conditions

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, operation and reclamation - economy	Shaw is committed to maximizing local recruitment and employment, local labour market training, procurement and service opportunities.	P Beneficial effects are anticipated from direct and indirect employment. Other positive benefits for local, regional and provincial economies are derived from procurement, taxes, and royalties.	M	RAA	N/A	LT Occurs for all phases of the Project.	C	R	Direct and indirect employment opportunities and other positive benefits for the local, regional and provincial economies. No adverse residual effects	Primarily positive and beneficial to the economy
Construction, operation and reclamation - land use	Shaw will comply with all regulations and permitting requirements for land use planning with the Municipality of the County of Annapolis.	N	N	PA	N/A	ST Occurs pre-development	O	R	No adverse residual effects	N/A
Construction, operation and reclamation - transportation	All haul truck drivers will adhere to speed limits and other road laws and will adjust to changing road conditions as appropriate.	A Increased traffic associated with haul trucking.	M	LAA	A	LT Haul truck traffic will mainly be present during the operation phase.	R	R	Increased truck traffic volumes on public roads.	Not significant
Construction, operation and reclamation - tourism and recreation	All haul truck drivers will adhere to speed limits and other road laws and will adjust to changing road conditions as appropriate.	A Increased traffic associated with haul trucking.	M	LAA	A	LT Haul truck traffic will mainly be present during the operation phase.	R	R	Increased truck traffic volumes on public roads.	Not significant

Legend (refer to Table 5.9-11 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse	N – Negligible	PA – Project Area	N/A – Not Applicable	ST – Short-Term	O – Once	R – Reversible
P – Positive	L – Low	LAA – Local Assessment Area	A – Applicable	MT – Medium-Term	S – Sporadic	IR – Irreversible
N – Neutral	M – Moderate	RAA – Regional Assessment Area		LT – Long-Term	R – Regular	PR – Partially Reversible
	H – High			P – Permanent	C – Continuous	

5.10 Mi’kmaq of Nova Scotia

5.10.1 Rationale for Valued Component Selection

Assessment of the potential of the Project to affect the Mi’kmaq of Nova Scotia is included as a VC due to the following:

– The historic presence of the Mi’kmaq throughout NS.
– Recognition of established Aboriginal and Treaty Rights.
– Canada’s Duty to Consult with Indigenous Peoples.
– Reconciliation with Indigenous Peoples.
– The potential for the Project to affect the Mi’kmaq’s ability to access some lands and/or to alter the presence or availability of animals or plants the Mi’kmaq rely upon for traditional or cultural purposes.

Various aspects of this EA that may affect the Mi’kmaq of Nova Scotia are discussed in other VC chapters that address related topics such as air quality (Section 5.1), noise (Section 5.2), groundwater (Section 5.4), surface water (Section 5.5), socioeconomic conditions (Section 5.9) and cultural and heritage resources (Section 5.11). In addition, Indigenous activities may be affected directly or indirectly by the effects of a project on species of fish, animals, birds, or plants (Section 5.8) on which they rely for food or cultural significance and the habitats that support relevant species. These related effects are not repeated in this VC.

5.10.2 Baseline Program Methods

The following description of baseline conditions is derived from publicly available sources. Shaw’s engagement activities with the Mi’kmaq of Nova Scotia are described in Section 3. Any information received about Project lands or concerns regarding the Project have been incorporated into the effects assessment.

5.10.3 Baseline Conditions

The present-day provinces of NS, New Brunswick (NB) and Prince Edward Island (PEI), as well as the Gaspé Peninsula, are founded on land historically occupied by the Mi’kmaq. Following contact with colonial interests, between 1726 and 1779 the British government formed Peace and Friendship Treaties with Mi’kmaq, Maliseet and Passamaquoddy Indigenous groups to facilitate trade of goods and solidify strategic alliances (CIRNAC 2013). Generally, the Mi’kmaq agreed to accept established colonial settlements, and the British agreed to ongoing Indigenous use of traditional fishing, hunting and planting grounds. As settlement increased and competition for resources grew, Indigenous groups began to petition government to uphold the Treaties especially around harvesting.

Beginning in the 19th century, reserves were established throughout Atlantic Canada mainly on lands that were frequented by Indigenous groups (CIRNAC 2013). NS has 13 Mi’kmaq First Nation communities occupying one or more parcels of reserve lands (CIRNAC 2024). The locations of Mi’kmaq communities and reserve lands are shown in Figure 5.10-1 in relation to historic Mi’kmaq political districts. The Project location is within the historic political district of Kespukwitk (Parks Canada 2025).

Since 1973, Canada has signed 26 modern land claims and four self-government agreements with Indigenous groups (CIRNAC 2021). No comprehensive land claims have been established in NS. In 1976, the Mi’kmaq Grand Council and the Union of Nova Scotia Indians (representing 10 Mi'kmaw First Nations: Acadia, Annapolis Valley, Bear River, Eskasoni, Glooscap, Paq'tnkek, Pictou Landing, Potlotek, Wagmatcook and We'koqma'q) submitted a comprehensive land claim (covering the whole of NS) to the Governments of Canada and NS (Government of Canada 2023; KMKNO 2024). This claim was not accepted for negotiation by the Crown. KMKNO indicates the claim was rejected on the basis that it was “superseded by law” (KMKNO 2024).

The Government of Canada has committed to settling specific claims, which relate to administration of land and other First Nation assets as well as fulfilment of historic treaties and other agreements. No specific claims are within the historic political district of Kespukwitk (Government of Canada 2023).

5.10.3.1 Aboriginal Rights and Treaty Rights

Indigenous Rights include Aboriginal Rights to hunt, fish and gather for food, social and ceremonial (FSC) or traditional purposes as protected by Section 35 of the *Constitution Act, 1982*. Treaty Rights have been confirmed and upheld in various decisions of the Supreme Court of Canada (SCC). For instance, in September 1999, the SCC issued an historic decision based on the Treaties of 1760-1761 (UNSM 2021). In R. v. Marshall, the SCC affirmed the Treaty Right of Mi'kmaq people in NS, NB and parts of Québec, to fish commercially and attain a "moderate livelihood".

5.10.3.2 Consultation with Indigenous Peoples

In 2004 and 2005, the SCC passed three landmark decisions, which established the Crown's (i.e., Canada and provincial / territorial governments and agencies) Duty to Consult with Indigenous Peoples regarding decisions, or taking actions, that might adversely affect their established or potential Aboriginal Rights or Treaty rights as outlined in the *Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* (Government of Canada, 2011).

In 2007, the Governments of NS, Canada and the Mi'kmaq of Nova Scotia established the *Mi'kmaq Canada Nova Scotia Consultation Terms of Reference*, which establishes the process to resolve issues related to Aboriginal Rights and Treaty Rights (UNSM 2021). Discussions among the parties have resulted in agreements such as the Mi'kmaq Education Agreement in 1997 and the Terms of Reference for a Mi'kmaq – Nova Scotia – Canada Consultation Process in 2010 (CIRNAC 2016).

While First Nations may represent themselves in any or matters that affects them, various organizations support Mi'kmaq individuals and First Nations in NS. The Kwilmu'kw Maw-klusuaqn (KMKNO) reports to the Association of Nova Scotia Mi'kmaq Chiefs (ANSMC), which provides governance for the Mi'kmaq of Nova Scotia, oversight for decision making on common issues, and direction to KMKNO on the Made in Nova Scotia process concerning implementation of Mi'kmaq Aboriginal and Treaty Rights (KMKNO 2024). The KMKNO represents 10 NS Bands in consultation matters with the exceptions of Sipekne'katik First Nation, Millbrook First Nation and Membertou First Nation. The Union of Nova Scotia Mi'kmaq (UNSM) provides governance capacity services to member groups to improve economic and social conditions of the Mi'kmaq of Nova Scotia (UNSM 2021). Mi'kmaw Kina'matnewey (MK) delivers education to Mi'kmaq communities (MK 2024). The CMM, which is the Tribal Council, has a mission "to proactively promote and assist Mi'kmaw communities' initiatives toward self- determination and enhancement of community" (CMM 2024).

5.10.3.3 Annapolis Valley First Nation

Annapolis Valley First Nation[1], which is highlighted as its reserve lands are closest to the Project, includes two (2) reserves (Table 5.10-1) in Cambridge NS, in the Municipality of the County of Kings. The St. Croix Reserve is uninhabited and includes old growth Acadian forest (Annapolis Valley First Nation 2022).

Table 5.10-1 Annapolis Valley First Nation Reserves

Reserve	Location / Area	Area (hectares)
Annapolis Valley First Nation	88 km NW of Halifax	59
St. Croix 34	46.4 NW of Halifax	126.2

Source: CIRNAC 2024

[1] Though referred to as Wasoqopa'q First Nation in some documents, Acadia First Nation is used on the Nation's official website.

5.10.3.3.1 Governance

Annapolis Valley First Nation, which is affiliated with the CMM Tribal Council, is governed by a chief and two councillors. The Council was elected in 2023 for a two-year term ending on December 20, 2025 (CIRNAC 2024).

5.10.3.3.1.1 Demographic Profile

As of February 2025, the total registered membership of Annapolis Valley First Nation was 327 (CIRNAC 2025). Approximately 37% of members were living on Reserve lands and 63% lived elsewhere (Table 5.10-2)

Table 5.10-2 Registered Population of Annapolis Valley First Nation (February 2025)

Registered Population	Male	Female	Total	%
Registered Population on Own Reserve	65	55	120	37%
Registered Population Off Reserve	87	120	207	63%
Total Registered Population	152	175	327	100%

Source: CIRNAC 2025

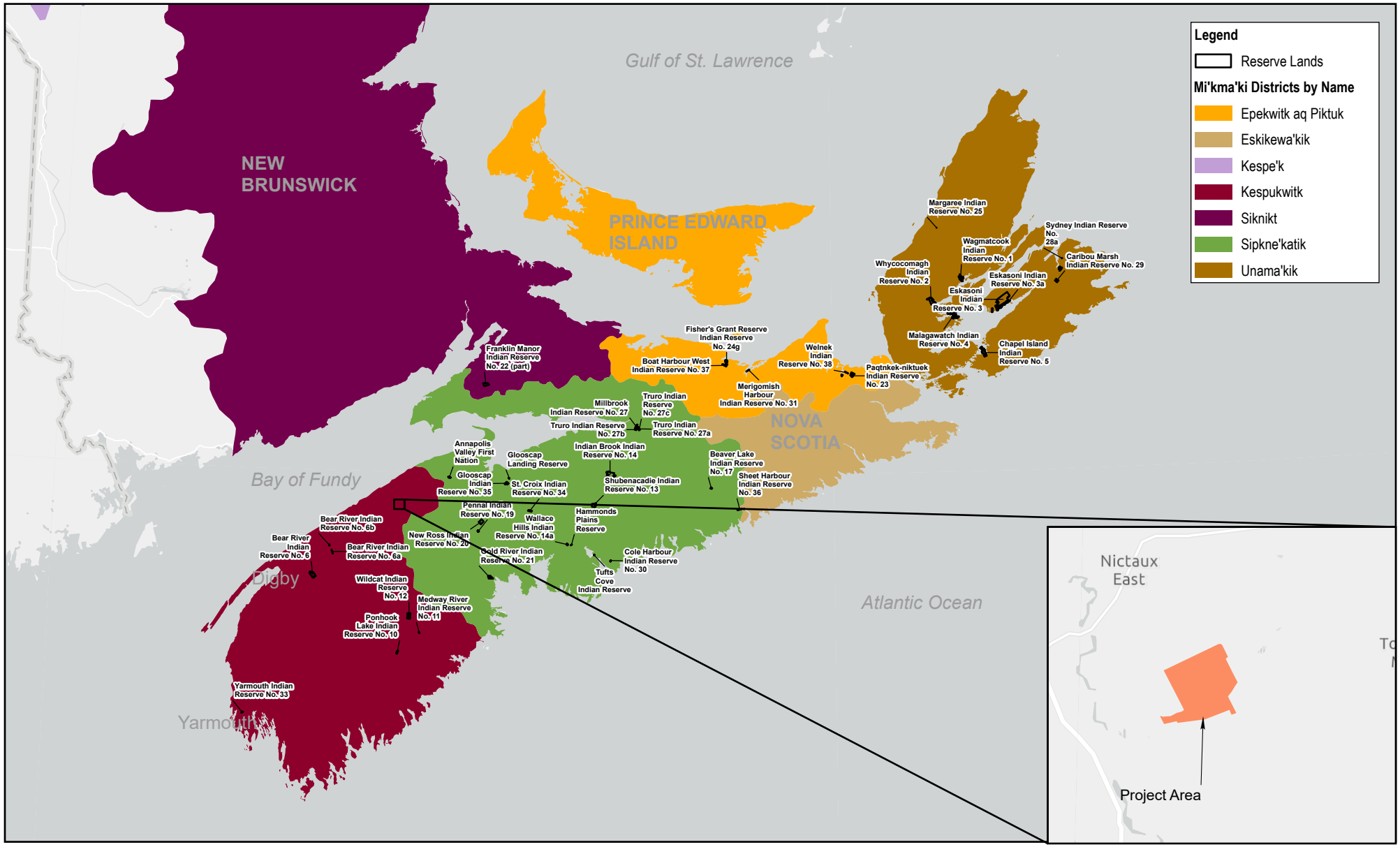
In 2021, Annapolis Valley First Nation had a total population of 743[2] living on the Reserve (Table 5.10-3) The Reserve population had a median age about two years younger than NS, which was 45.6 years (Statistics Canada 2023).

Table 5.10-3 Population of Annapolis Valley First Nation Reserve (2021)

Reserve	Population	Median Age	Indigenous Identity	Registered Status
Annapolis Valley First Nation	743	43.6	185	135

Source: Statistics Canada 2023

[2] Use with caution. Statistics Canada 2023.



Paper Size ANSI A

0 25 50 75

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

MI'KMAQ POLITICAL DISTRICTS AND FIRST NATIONS RESERVE LANDS IN NOVA SCOTIA

Project No. **12584960**
Revision No. **-**
Date **Mar 11, 2025**

FIGURE 5.10-1

Q:\GIS\PROJECTS\12584000s\12584960\GIS\Maps\Deliverables\202503_RPT02\12584960_RPT02.aprx - 12584960_016_Mi'kmaq Political Districts and First Nations Reserve Lands in Nova Scotia
Print date: 11 Mar 2025 - 14:12

5.10.3.3.2 Social and Economic Development

Annapolis Valley First Nation has undertaken various endeavours for economic development and delivery of services and infrastructure to its members (Annapolis Valley First Nation 2022). Priority initiatives are shown in Table 5.10-4.

Table 5.10-4 Annapolis Valley First Nation Priorities

Departments	Priorities
Enterprises	– Annapolis Valley First Nation Gaming – Annapolis Valley First Nation Smoke Shop – Annapolis Valley First Nations Gas Bar
Webster Farms	Specializes in strawberry, raspberry, dry bean, rhubarb and winter rye production. Also operates a seasonal mill for manufacturing of traditional wooden berry boxes.
Three Wishes Learning Centre	Provides daycare program, Kindergarten program, After School program, Aboriginal Head Start on-reserve program, and various Cultural Programs for the children.
Learning Centre	Offers Primary to Grade 12 Education Adult Education focussed on culturally appropriate education.
Health Centre	Operates a community health centre

Source: Annapolis Valley First Nation 2022

At least 15 Council members and staff are engaged in band management, finance, economic development, employment, education, social development, housing, advocacy, fisheries, emergency management and health care (Annapolis Valley First Nation 2022). The Annapolis Valley First Nation health care centre offers programs to promote health and wellness and address health conditions and issues (Annapolis Valley 2024). Programs and services address interests such as weight control, diabetes-prevention, foot-care, dental care, oral health, prenatal care, babies, parenting, seasonal influenza, massage therapy, physical activity, drug and alcohol abuse prevention, suicide prevention and injury/illness prevention.

5.10.3.4 Land and Resource Use

Prior to contact with Europeans, the Mi'kmaq of NS lived in semi-nomadic bands of a few patrilineal related families and subsisted on fishing and hunting in a seasonal cycle of movement from dispersed interior winter camps to larger coastal communities in summer (First Nations Info, 2024). The Mi'kmaq hunted, fished and gathered natural resources to meet their needs. Important fish and shellfish included salmon, eels and sturgeon along with freshwater species (e.g., smelt) and marine species such as herring, cod, lobster and squid. Geese and seabirds were harvested for food and eggs. Marine mammals such as porpoises, whales, walrus and seals provided meat. Moose was an important species as it was used for food and materials to make clothing, cordage, tools and crafts. Deer, caribou, bear, rabbit, beaver, porcupine and small animals were harvested for food, clothing and other materials including for adornment of costumes and clothing. Maple trees were used to make bows and arrows for hunting. Saplings, mainly spruce, formed the structure of wigwams that would be covered in birch bark. Some regional variation in species available likely affected harvesting such as more blueberries and caribou near Acadia First Nation than in other areas of NS.

5.10.4 Effects Assessment Methods

5.10.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

5.10.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on the Mi'kmaq of Nova Scotia are defined below and are shown on Figure 5.10-2.

– The PA encompasses the immediate area where Project activities occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– The LAA encompasses adjacent areas outside of the PA where Project related effects to VCs are reasonably expected to occur. For the purposes of determining effects on the Mi'kmaq of Nova Scotia, the LAA is the Mi'kmaq political district of Kespukwitk.
– The RAA is defined as the province of NS as Mi'kmaq confirmed and asserted Rights encompass the whole province.

5.10.4.1.2 Temporal Boundaries

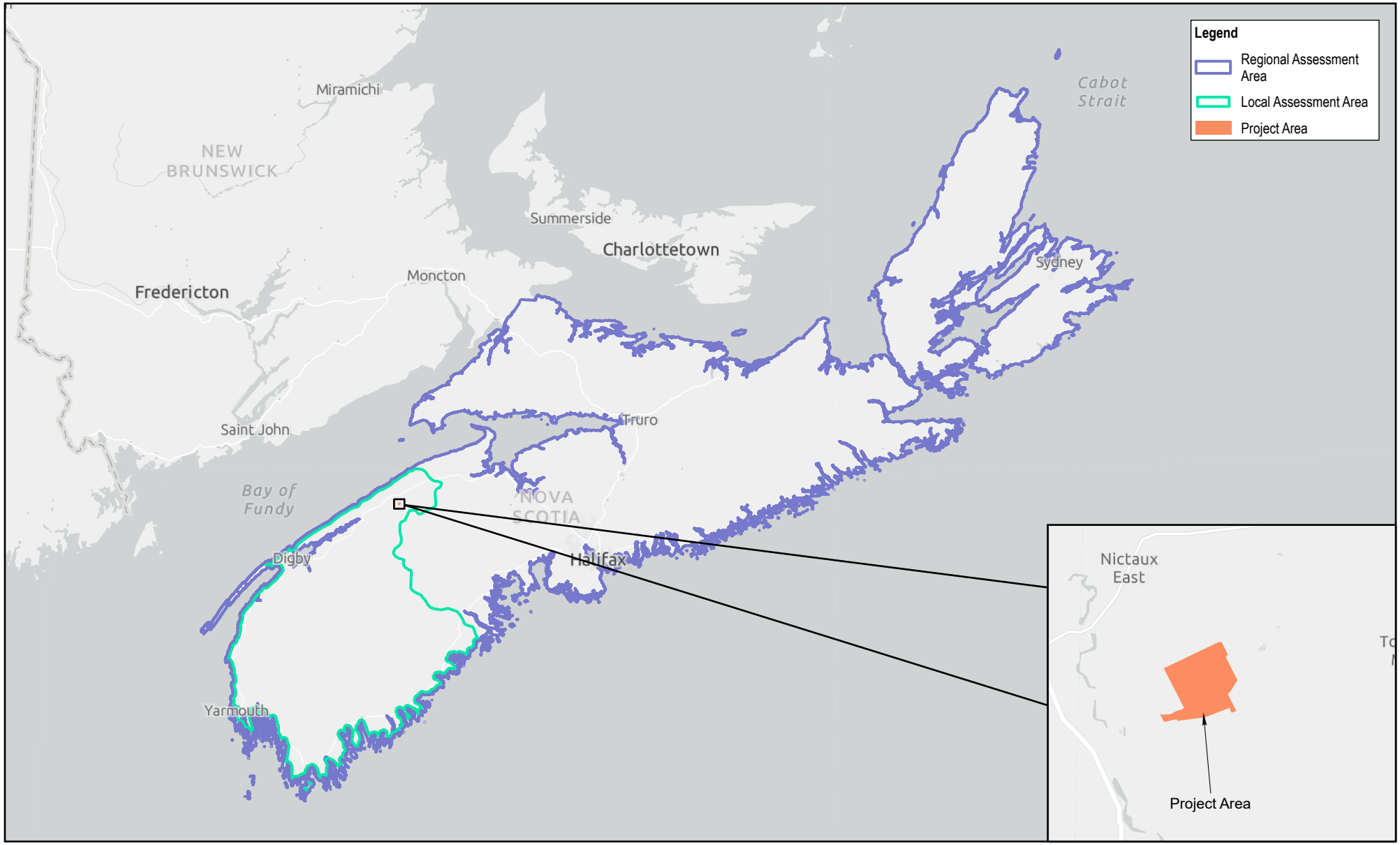
The temporal boundaries used for the assessment of effects of the Project includes the construction, operation and reclamation phases.

5.10.4.1.3 Technical Boundaries

The limited evidence to establish historic occupation of the PA by the Mi'kmaq of Nova Scotia may be the result of lack of historical documentation though no archaeological evidence was identified in the PA through investigations conducted for the Project (Section 5.11).

5.10.4.1.4 Administrative Boundaries

As outlined in the *Proponents' Guide: Engagement with the Mi'kmaq of Nova Scotia*, the NS Environmental Assessment Regulations require proponents to identify the concerns of the Mi'kmaq of Nova Scotia regarding potential project effects and to describe steps taken or proposed to address issues. While the Crown may delegate aspects of consultation to project proponents, it maintains the duty to consult and decision-making authority.



Paper Size ANSI A

0 30 60 90

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983 CSRS
Grid: NAD 1983 CSRS UTM Zone 20N

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THE SHAW GROUP LIMITED
NICTAUX, ANNAPOLIS CO., NOVA SCOTIA
NICTAUX SAND PIT EXPANSION PROJECT

SPATIAL BOUNDARIES - MI'KMAQ OF NOVA SCOTIA

Project No. **12584960**
Revision No. **-**
Date **Mar 11, 2025**

FIGURE 5.10-2

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5.10.4.2 Thresholds for Determination of Significance

Table 5.10-5 provides quantitative measures or definition of qualitative categories for assessment of residual effects on the Mi'kmaq of Nova Scotia

Table 5.10-5 Characterization Criteria for Environmental Effects Mi'kmaq of Nova Scotia

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – no detectable direct or indirect effects on the Mi'kmaq of Nova Scotia. **L** – short or medium-term effects on traditional land use areas within the context of mitigations and consultation with appropriate regulators and Indigenous groups. **M** – long-term effects on traditional land and resource use within the context of mitigations and consultation with appropriate regulators and Indigenous groups. **H** – permanent effects on traditional land and resource use or adverse effects on Indigenous communities without mitigations and consultation with appropriate regulators and Indigenous groups.
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – direct and indirect effects from Project activities are restricted to the LAA **RAA** – direct and indirect effects from Project activities are restricted to the RAA
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**Short-Term** – effects are limited to occur from as little as 1 day to 12 months **Medium-Term** – effects can occur beyond 12 months and up to 3 years **Long-Term** – effects extend beyond 3 years **Permanent** – valued component unlikely to recover to baseline conditions
Frequency	**Once** – effects occur once **Sporadic** – effects occur at irregular intervals throughout the Project **Regular** – effects occur at regular intervals throughout the Project **Continuous** – effects occur continuously throughout the Project
Reversibility	**Reversible** – VCs will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible -** mitigation cannot guarantee a return to baseline conditions **Irreversible** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect on the Mi'kmaq of Nova Scotia is defined as:

– A Project related effect that results in permanent loss of lands and resources relied upon for traditional use.

5.10.5 Project Interactions and Potential Effects

The various activities listed in Table 5.10-6 as physical works for construction, operation, and reclamation may affect Indigenous Rights such as access to lands, traditional harvesting and other cultural activities.

Table 5.10-6 Project Activities and Mi'kmaq of Nova Scotia Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction Water management

Table 5.10-6 Project Activities and Mi'kmaq of Nova Scotia Interactions

Project Phase	Relevant Project Activity
Operation	Processing Overburden management Water management Road maintenance Emissions and waste management
Reclamation	Demolition Earthworks Water management

All phases of the Project will provide direct and indirect employment and procurement opportunities for NS residents including the Mi'kmaq of Nova Scotia. Benefits arising from construction and operational spending that accrue to the Mi'kmaq of Nova Scotia will depend on factors including any agreements between the Mi'kmaq of Nova Scotia and Shaw, Project-related opportunities for Mi'kmaq-owned businesses, the capacity of Mi'kmaq owned enterprises to provide services needed and the availability of the Mi'kmaq labour force.

Based on the information presented, effects on land and resource use are anticipated to be limited as no traditional land use has been identified in the PA to date. Continued engagement and discussions with the Mi'kmaq of Nova Scotia and consideration of Indigenous Rights in decision-making regarding the Project will aid in minimizing any effects on traditional land and resource use.

5.10.6 Mitigation

Shaw is attempting to engage with Mi'kmaq organizations to discuss potential Aboriginal Rights regarding traditional land use and employment/training and procurement opportunities.

Table 5.10-7 Mi'kmaq of Nova Scotia Mitigation Measures

Project Phase	Mitigation Measure
Construction, Operation and Reclamation	Ongoing engagement with Mi'kmaq First Nations and/or representative organizations.

5.10.7 Monitoring and Follow-up

Engagement with relevant Mi'kmaq First Nations and organizations will continue through the life of the Project. Shaw acknowledges the importance and value of effective engagement with the Mi'kmaq of Nova Scotia.

5.10.8 Residual Effects and Significance Determination

The predicted residual effects of the Project on the Mi'kmaq of Nova Scotia are assessed to be both positive and adverse, but not significant. The Project is not likely to result in significant adverse residual effects on the Mi'kmaq of Nova Scotia following implementation of mitigation and enhancement measures (Table 5.10-8) Shaw is also committed to engagement with the Mi'kmaq of Nova Scotia to discuss any arising issues of the Project on Indigenous Rights.

A significant adverse effect on the Mi'kmaq of Nova Scotia was defined in Section 5.10.4.2 as:

– A Project-related effect that results in permanent loss of lands and resources relied upon for traditional use.

As no traditional land and resource use has been identified in the PA, effects are conservatively predicted to be of low magnitude, long term and continuous within the PA as access to the site will be controlled throughout the life of the Project. These effects are likely to be reversible with the restoration of lands and future access to the PA. Section 5.8 discusses the effects on other plant and animal life in the PA.

The Project will generate new opportunities for employment, training, contracting and sub-contracting for the Mi'kmaq of Nova Scotia. Increased employment and business revenue will benefit community conditions generally through indirect and/or induced effects. Project benefits are not considered in evaluation of adverse residual effects.

Residual effects to Mi'kmaq of Nova Scotia are summarized in Table 5.10-8.

Table 5.10-8 Residual Effects on Mi'kmaq of Nova Scotia

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction, Operation, Reclamation	Shaw is committed to ongoing engagement with Mi'kmaq organizations and First Nations.	P/A Both positive and adverse effects are anticipated associated with the Project. Land access will be restricted in and around Project infrastructure. The Project will result in employment and economic benefits for the Mi'kmaq of Nova Scotia.	L	PA	N/A	LT	C	R	No traditional land use has been identified but land access will be restricted in and around Project infrastructure.	N/A
Legend (refer to Table 5.10-8 for definitions)										
Nature of Effect A – Adverse P – Positive N – Neutral	Magnitude N – Negligible L – Low M – Moderate H – High	Geographic Extent PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area		Timing N/A – Not Applicable A – Applicable	Duration ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	Frequency O – Once S – Sporadic R – Regular C – Continuous	Reversibility R – Reversible IR – Irreversible PR – Partially Reversible			

5.11 Cultural and Heritage Resources

5.11.1 Rationale for Valued Component Selection

A substantial portion of our understanding of the past is derived from historical records and written documentation. However, to fully appreciate the complexity and richness of human history and culture, it is essential to analyse materials and artifacts that offer insights into the lives, practices and worldviews of ancient civilizations (Doroszenko, 2009). Physical remnants provide a means to reconstruct and conceptualize societal structures, technologies and interactions of the past in the absence of written records.

In the Canadian context, cultural and heritage resources serve as invaluable repositories of knowledge, particularly regarding Indigenous peoples and their deep connection to the land and natural environment prior to European colonization (referred to as the precontact period). These resources reveal the nature of the relationships of Indigenous peoples, such as the Mi'kmaq, with their surroundings through both spiritual and practical dimensions. Additionally, historic artefacts of non-Indigenous populations following European contact provides information on the environmental and cultural transformations that unfolded in the post-Contact period, alongside Mi'kmaq heritage and perspectives.

Cultural and heritage resources is identified as a VC due to its societal value and for regulatory reasons. Site preparation and construction activities for the proposed Project have the potential to affect cultural and heritage resources through damage or removal. Physical and cultural heritage are protected through the NS *Special Places Protection Act*, which supports the preservation, regulation and study of archaeological, historical and paleontological sites and artifacts deemed to be important to the natural or cultural heritage of NS.

5.11.2 Baseline Program Methods

The following archaeological study was conducted by Cultural Resource Management Group Limited (CRM Group) for the Project to identify any known cultural and heritage resources and areas of resource potential:

– "Middleton Sand Pit – Archaeological Resource Impact Assessment (ARIA) Screening and Reconnaissance 2023 Final Report, Heritage Research Permit #A2023NS234"

The work included engagement with the Mi'kmaq of Nova Scotia, a background study and archaeological reconnaissance fieldwork in the PA (within PIDs 05058268, 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853, 05313861). This study also used predictive analysis to identify known patterns of land use to indicate potential locations of past human activities. The report offers recommendations for protection of any cultural and heritage resources and areas of archaeological resource potential in the PA.

For the ARIA, areas with archaeological resource potential were identified through use of various geospatial tools and techniques. These included analysis of topographic maps, aerial imagery and advanced satellite data, complemented by LiDAR-derived DEM and review of relevant historic documentation incorporating land grant records, legal surveys and historic maps and local and regional histories, as well as previous archaeological reports. This approach facilitates identification of environmental and topographic features, as well as remnants of historical resources or areas (e.g., navigable waterways) that may have played a significant role in shaping past human settlement patterns and resource use.

Field investigations, conducted on November 24, 2023, involved systematic visual inspections of the ground surface and vegetation cover along carefully spaced walking transects to ensure thorough examination. These surveys aimed to delineate areas of low, moderate and high archaeological potential based on direct field observations, building upon insights gained through engagement with the Mi'kmaq of NS, background research and an analysis of landscape characteristics. Following these assessments, three specific areas were selected for targeted shovel testing to further evaluate surficial geology and the potential for archaeological resources.

However, no artifacts or cultural materials, whether modern, historic or precontact, were discovered during fieldwork. Consequently, no additional analysis or investigative measures were deemed necessary.

5.11.3 Baseline Conditions

The lands of NS have been home to the Mi'kmaq and their ancestors for at least 13,000 to 9,000 years before present (BP). Prior to European contact and colonialization, the Mi'kmaq used the land widely and site-specific land use may be difficult to ascertain. Historic European documentation and known cultural and heritage resources are used to supplement oral history to better understand the Mi'kmaq's use of lands and resources.

5.11.3.1.1 Heritage Resources

Based on information presented in the ARIA, no reported cultural and heritage resources (e.g., archaeological sites, cemeteries or other features) have been identified in the PA. Despite abundant evidence of precontact Mi'kmaq habitation outside the PA along the Annapolis River and Nictaux River, and other historic activity along early roads and railways and at mines, the results of research, engagement with the Mi'kmaq of Nova Scotia, archaeological reconnaissance and strategic shovel testing in the PA yielded no evidence of cultural and heritage resources.

5.11.3.1.2 Elevated Archaeological Potential

Based on the results of the ARIA, most of the PA is ascribed low archaeological resource potential as it is distant from navigable waterways, early roads, historic railways and areas of settlement and industrial development. One area of moderate elevated potential for Mi'kmaq archaeological resources was identified within the PA. This landscape feature is an esker located in the southern half of the PA, which is ascribed moderate archaeological resource potential as it is a naturally elevated dry linear corridor that could have been used as an east/west travel-way (eastward from the Nictaux River floodplain toward the Black River Valley) throughout the precontact, contact and historic periods.

5.11.4 Effects Assessment Methods

5.11.4.1 Boundaries

The assessment of Project effects requires consideration of various boundaries: spatial, temporal, administrative and technical. The spatial boundaries for assessment of potential effects of the Project includes the PA, LAA and RAA.

5.11.4.1.1 Spatial Boundaries

The spatial boundaries used for the assessment of effects on cultural and heritage resources are defined below:

– The PA encompasses the immediate area in which Project activities may occur and are likely to cause direct and indirect effects to VCs. The PA includes the sand pit and all associated infrastructure encompassing all, or portions of, 11 parcels with the following PIDs: 05058334, 05059688, 05194030, 05286968, 05286976, 05286984, 05291448, 05291455, 05310834, 05313853 and 05313861.
– An LAA or RAA have not been identified for the Cultural and Heritage Resources VC, as damage or removal of cultural or heritage resources related to this Project could only occur within the PA.

5.11.4.1.2 Temporal Boundaries

The temporal boundaries used for the assessment of effects to cultural and heritage resources are limited to the construction phase of the Project.

5.11.4.1.3 Technical Boundaries

The limited known archaeological evidence to indicate the presence of early peoples in the PA may be the result of lack of investigation and/or few accidental archaeological finds, rather than lack of use or occupation. As a precaution, the methodology assumes the area may have been used for centuries.

5.11.4.1.4 Administrative Boundaries

Protection of cultural and heritage resources is provincially regulated through the *Special Places Protection Act*. This legislation provides protection of both known and unknown cultural and heritage resources. Unknown resources are identified through potential mapping and assessment on a project-by-project basis.

5.11.4.2 Thresholds for Determination of Significance

Table 5.11-1 provides quantitative measures or definition of qualitative categories for assessment of residual effects on cultural and heritage resources.

Table 5.11-1 Characterization Criteria for Effects on Cultural and Heritage Resources

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – no direct or indirect effects on cultural and heritage resources. **L** – effects on historic features within the context of mitigations and consultation with regulators and no effects on Indigenous cultural or heritage resources. **M** – direct effects on cultural and/or heritage resources in the context of mitigations and consultation with appropriate regulators and Indigenous groups. **H** – direct effects on cultural and/or heritage resources without mitigations and consultation with appropriate regulators and Indigenous groups.
Geographic Extent	**PA** – direct and indirect effects restricted to the PA.
Timing	**N/A** – seasonal aspects are unlikely to affect VCs **A** – seasonal aspects may affect VCs
Duration	**ST** – Effects are limited to occur from as little as 1 day to 12 months **MT** – Effects can occur beyond 12 months and up to seven (7) years **LT** – Effects extend beyond 7 years **P** – Effects to noise are unlikely to recover to baseline conditions
Frequency	**O** – Effects occur once **S** – Effects occur at irregular intervals throughout the Project **R** – Effects occur at regular intervals throughout the Project **C** – Effects occur continuously through the Project
Reversibility	**Reversible** – Cultural and Heritage Resources will recover to baseline conditions before or after Project activities have been completed. **Partially Reversible -** mitigation cannot guarantee a return to baseline conditions **Irreversible** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect on cultural and heritage resources is defined as:

– A Project-related effect that results in unauthorized disturbance or destruction of an archaeologically, culturally, or historically important resource, within the context of the *Special Places Protection Act*, that cannot be mitigated.

5.11.5 Project Interactions and Potential Effects

Site preparation, excavation, construction and related works have the potential to result in damage to an area identified as having moderate elevated potential for archaeological resources. These activities could also

potentially result in disturbance or removal of unidentified heritage resources in the PA (Table 5.11-2). All archaeological sites (including known and unknown sites) are protected from disturbance through the NS *Special Places Protection Act* unless the investigation is conducted under the supervision of a qualified archaeologist with a Heritage Research Permit issued by the Department of Communities, Culture, Tourism and Heritage.

No effects on cultural and heritage resources are anticipated from operation or reclamation as ground disturbance will have already occurred during site preparation, construction and excavation. No indirect effects on cultural and heritage resources are anticipated as disturbance will already have occurred.

Table 5.11-2 Project Activities and Cultural and Heritage Resources Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Road construction
Operation	No interaction anticipated
Reclamation	No interaction anticipated

5.11.6 Mitigation

As discussed, no known cultural and heritage resources are known within the PA. Table 5.11-3 provides proposed mitigations for protection of unknown potential cultural and heritage resources in the PA.

Table 5.11-3 Cultural and Heritage Resources Mitigation Measures

Project Phase	Mitigations
Construction	Prior to beginning of any Project-related groundwork in the area of moderate potential for archaeological resources, a shovel testing program will be undertaken to search for cultural and heritage resources and to assess requirements for further archaeological testing or mitigation. Where any expansion is proposed in the PA, an ARIA including archaeological reconnaissance will be conducted. If archaeological deposits or human remains are encountered during any activity within the PA, all work in the associated area(s) will be halted in compliance with the NS *Special Places Protection Act* and immediate contact made with the Special Places Program
Operation and Reclamation	No mitigation measures are planned as no effect is expected to occur during the reclamation phase

5.11.7 Monitoring and Follow-up

A monitoring program is generally not implemented for cultural and heritage resources. However, in the unlikely event that an archaeological resource is encountered during Project activities, monitoring by a registered archaeologist may be required in line with provincial regulations.

5.11.8 Residual Effects and Significance Determination

The predicted residual effects of the Project on cultural and heritage resources are assessed as adverse but not significant. With the implementation of appropriate mitigation measures, the Project is unlikely to result in any significant adverse residual impacts on cultural and heritage resources (Table 1.4).

A significant adverse effect on the Cultural and Heritage Resources VC was defined in Section 5.11.4.2 as:

– A Project-related effect that results in unauthorized disturbance or destruction of an archaeologically, culturally, or historically important resource, within the context of the *Special Places Protection Act*, that cannot be mitigated.

The ARIA identified one area of moderate elevated potential for archaeological resources within the PA. By complying with regulations and implementing mitigation measures such as conducting additional archaeological testing if required, residual effects of the Project on cultural and heritage resources including areas of moderate elevated potential are predicted to be not significant. This is based on known information about cultural and heritage resources in the PA and configuration of the Project.

Table 5.11-4 Residual Effects on Cultural and Heritage Resources

Project Phase	Mitigation and Compensation Measures	Nature of Effect	Residual Effects Characteristics						Residual Effect	Significance
			Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility		
Construction	Avoidance of areas of elevated potential for cultural and heritage resources Conducting additional shovel testing if required	A The Project has the potential to disturb an area of moderate elevated potential for cultural and heritage resources	L	PA	N/A	P If a resource is destroyed due to the Project	O	IR	No known cultural and heritage resources were identified in the PA. Compliance with regulations and conducting additional archaeological testing if required, reduces the potential for residual effects on any known but potential cultural and heritage resources.	Not significant

Legend (refer to table 1.1 for definitions)

Nature of Effect	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility
A – Adverse P – Positive	N – Negligible L – Low M – Moderate H – High	PA – Project Area LAA – Local Assessment Area RAA – Regional Assessment Area	N/A – Not Applicable A – Applicable	ST – Short-Term MT – Medium-Term LT – Long-Term P – Permanent	O – Once S – Sporadic R – Regular C – Continuous	R – Reversible IR – Irreversible PR – Partially Reversible

6. Other Undertakings in the Area

Existing projects with current IAs in Annapolis County are shown in Table 6.1-1 These sites include four pits, six quarries, an asphalt plant and a concrete plant along with a used oil collection facility and a bulk petroleum storage site. None of the identified undertakings overlap with the PA though two are within 5 km of it and four others are within 15 km. No active mines or those in care and maintenance were identified in Annapolis County in 2022 though mineral exploration was active in 2023 including in the Nictaux area (NSDNR Geoscience and Mines Branch, 2024).

Table 6.1-1 Industrial Approvals in Annapolis County (Government of Nova Scotia, 2024)

Approval Holder	Type of Operation	Distance to PA (km)	Size (ha)	Community	PID
Municipal Enterprises Limited	Pit	1.36	1.79	South Farmington	05007901
Christopher M Hankinson	Quarry	2.39	55.07	Nictaux	05085279
Loomer's Pumping Service Limited	Used Oil Collection Facility	5.28	2.58	Wilmot	05035811
Chapman Bros. Construction Ltd.	Quarry	5.56	13.14	South Williamston	05116348
West Nova Fuels Limited	Bulk Petroleum Storage	5.62	0.86	Wilmot	05035704
Rick Aldred	Pit	10.24	30.60	Prince Albert	05021563
Prospect Industrial Equipment Sales and Rentals Limited	Pit	11.50	32.77	Margaretsville	05021266
Acadian Seaplants Limited	Land Application of Non-livestock Generated Waste Facility	14.73	109.86	Paradise	05118708
Municipal Enterprises Limited	Pit, Quarry and Asphalt Plant (3 permits on one site)	14.96	138.04	Paradise	05118682
Mark Gallant	Pet Cremation	21.00	7.22	West Paradise	05219118
Rice's Contracting Company Limited	Quarry	24.32	19.25	Hampton	05169297
V.J. Rice Concrete Limited	Ready Mix Concrete Plant	24.75	20.20	Carleton Corner	05141254
Daniel L Bruce	Land Application of Non-livestock Generated Waste Facility	27.61	6.25	Centrelea	05167242
L. J. Beck Excavating Limited	Quarry	28.94	3.80	Falkland Ridge	05155668
Brown Bros. Excavating Limited	Quarry	41.76	38.40	Granville Ferry	05130802
Acadian Seaplants Limited	Biotechnology Products Manufacturing Plant	55.82	5.26	Cornwallis Park	05210687
Bear River Vineyards Ltd.	Beer or Wine Processing Plant	61.29	2.07	Bear River	05045851

A review of the NSECC Environmental Assessment Project Registry in September 2024 revealed no provincial projects (that require environmental assessment) in progress at or near the PA. A review of approved projects since 2014 indicates a project approved in 2020 is within 30 km of the PA and one approved in 2017 is within 20 km, as shown in Table 6-2.

Table 6.1-2 Environmental Assessment Approvals (NSECC, 2024)

Approval Holder	Site	Distance to PA (km)	Size (ha)	Community	PID
B. Spicer Construction (approved with conditions 2020)	Spicer North Mountain Quarry Expansion Project	29.96	151.23	Upper Granville	05166004 05166012 05166020 05166095
Arlington Heights C&D Limited (approved with conditions 2017)	Asbestos Waste Disposal Facility Project	19.70	58.61	Hampton	05127873 05127881 05127899 05127269 05127907 05128160

A review of the Canadian Impact Assessment Registry in September 2024 showed no current federal projects (requiring assessment) in Annapolis County. The nearest projects (active with the Impact Assessment Agency) are in Kings County approximately 7 km from the PA (IAAC 2024). Seven initiatives (non-designated projects) on Federal Lands at Canadian Forces Base 14 Wing, Greenwood include construction, replacement, recapitalization, removal and/or demolition of infrastructure and ancillary facilities at the Base.

In summary, no other undertakings intersect the PA, however nine other industrial projects are within 15 km of the PA. Adverse Project-related effects in conjunction with other undertakings are not likely to occur, given the status of proposed initiatives and the anticipated effectiveness of mitigative measures identified for the Project.

7. Accidents and Malfunctions

Accidents and malfunctions are events that occur outside of planned Project activities and operation. Despite efforts to prevent such events by implementing best management practices and preventative measures, they have the potential to adversely impact the environment and/or employee or public safety. Accidents and malfunctions can be avoided, or their impact reduced through careful planning, through the creation of a Contingency Plan and implementation of mitigation measures into standard operating procedures. By identifying potential worst-case scenarios and their effects, Shaw can develop strategies to prevent, minimize or manage the consequences of accidents and malfunctions.

7.1 Structural Failures

All phases of the Project have the potential for structural failures. Possible structural failures include:

– Failure of overburden slopes caused by erosion from vegetation stripping and surface water runoff.
– Failure of overburden stockpile slopes due to improperly designed lifts and erosion from surface water runoff.
– Failure of settling ponds, either via berm overflow or berm structure failure.

The worst-case scenario for slope failures, including those of stockpiles and pit walls, would be collapse of areas and ground surface slump affecting Project infrastructure. Erosion via vegetation stripping and surface water runoff, in

addition to material removal, are the most likely conductors of slope failure. Slope failures can be reduced by implementing a phased approach to pit development through the operation phase, reducing the amount of disturbed land and stockpiled material.

The worst-case scenario for the failure of the settling ponds, either due to pond overflow or berm structure failure, would be an uncontrolled release of sediment laden water to the environment. The capacity demand of the ponds will be designed to accommodate operational activities and weather events, including additional capacity to account for the effects of climate change. Settling pond management and monitoring procedures will be detailed in the IA amendment application following EA release.

All banks, berms, slopes and faces will be regularly monitored for indicators of potential failure. Indicators of failure may include cracking, slumping, unanticipated groundwater discharge, seeping and erosion.

7.2 Accidents

All phases of the Project have the potential for accidents. The accidents listed below have the highest risk of occurring:

– Fuel and chemical spills
– Mobile equipment accident

The risk of fuel spills is highest during vehicle refueling, filling of on-site fuel storage tanks, maintaining mobile equipment, and operation of vehicles and heavy equipment. A worst-case scenario would be a transportation collision resulting in the entire amount of material being transported to be spilled into a water body. The impact of such a spill would vary depending on the type of material. For instance, diesel fuel and gasoline are toxic to aquatic life and could cause environmental damage. The risk of fuel spills will be mitigated by ensuring fuel dispensing and storage systems are installed and maintained according to manufacturer specifications and regulatory requirements. Spill kits will be available at all storage and fueling stations, in addition to being placed throughout the PA for easy access regardless of incident location.

Chemical spills can occur due to storage tank or tote failures, improper transfer procedures, or vehicle accidents. Any hazardous materials and dangerous goods associated with the Project will be carefully managed in accordance with *Nova Scotia Dangerous Goods Management Regulations*. Individuals handling or using these materials will undergo comprehensive training. Safety data sheets will be available, and all hazardous materials will be clearly identified within the Contingency Plan. Regular inspections of hazardous materials and dangerous goods storage will be conducted by qualified personnel to ensure compliance and safety. Fuel storage tanks exceeding 4000 L will undergo permitting and be managed under the *Nova Scotia Petroleum Management Regulations*.

All phases of the Project will have potential for vehicular accidents. In a worst-case scenario, a severe accident could cause serious injuries or death. To mitigate these risks, guided traffic patterns, speed limits, right-of-way signage and thorough training will be implemented. Structural roadway designs will enhance mitigation measures, with roads designed to accommodate multiple vehicle types depending on planned usage, safety berms constructed where there is increased risk of vehicles leaving a roadway and reduced road grades where possible.

7.3 Malfunctions

Throughout every stage of the Project, there is a risk of failure of erosion and sediment control structures (e.g., silt fencing, check dams, ditches). In a worst-case scenario, such failures could lead to uncontrolled discharge of sediment-laden water into adjacent watercourses and wetlands. Routine monitoring and maintenance will be conducted in areas with exposed soils, erosion and sediment control structures, as well as near the receiving wetlands and watercourses to ensure sediment releases are prevented. Monitoring will occur before and after significant rain events, and during periods of high spring melt. An Erosion and Sediment Control Plan will be prepared for the Project and submitted for NSECC review as part of the IA amendment application.

8. Effects of the Environment on the Undertaking

The Project has the potential to be impacted by conditions and factors in the local environment. Climate change, extreme weather, slope stability and earthquakes have the potential to impact the Project through all phases and activities, from construction to reclamation. Substantial potential adverse effects have been reduced thorough Project design. Where climate change and extreme weather impacts may be amplified by human activity, mitigation measures to reduce amplification of impacts are presented in Section 5.

8.1 Climate Change

In NS, climate change is anticipated to include warmer temperatures, a reduction of total snowfall with higher volumes of rain, increased frequency and intensity of storms, rising ocean levels and changing ocean oxygen and acidity levels (NSECC, 2022). By 2030, the highest climate concern in NS will be flooding risk, shifting to wildfires as the highest concern by 2050, and extreme temperatures with potential to adversely affect food production, infrastructure, human health and natural ecosystems by 2080.

NSECC has prepared climate change projections for Nova Scotia's 18 provincial census divisions (historical counties, county municipalities and regional municipalities) in 30-year intervals (NSECC, 2022). The Project is in the Municipality of the County of Annapolis, which is one of the seven census divisions anticipated to have the highest need to adapt to climate change. Table 8.1-1 presents NSECC projected average annual daily mean temperatures, total annual precipitation and total annual days with rain for the Municipality of the County of Annapolis.

Table 8.1-1 Historic and Projected Climate Data, Municipality of the County of Annapolis (NSECC, 2023)

Metric	Historical (1981-2010)	Projected (2015-2045)	Projected (2035-2065)	Projected (2065-2095)
Average Daily Mean Temperature (°C)	6.9	8.3	9.6	11.5
Annual Precipitation (mm)	1,292.9	1,344.0	1,376.9	1,437.6
Annual Days with Rain	108.4	115.1	120.6	127.8

Intense storms which deposit high volumes of precipitation pose a risk to the Project in the form of flooding. Additionally, high velocity water runoff events could escalate the risk of sediment and soil erosion. Taking these risks into account, the water management infrastructure proposed Project will be designed to withstand increased intensity storm systems and their effects.

While climate change is anticipated to have significant impacts, the Project will be designed to withstand projected effects. An understanding of future climate risks offers the ability to adjust infrastructure designs and create contingency plans. Responses to isolated events such as storms may include temporary operational closures and delayed activities to protect employees and infrastructure.

8.2 Extreme Weather

Extreme weather events may result in either drought conditions or surpluses of water. The effects of a drought on the Project may include increased dust causing reduced visibility and decreased availability of water for Project activities. Potential effects of extreme precipitation include damage to Project infrastructure and production delays in the event the pit becomes flooded. Haul roads may become flooded or eroded, and transportation of materials, suspended temporarily. The Project is up-gradient of the nearby Nictaux River and is unlikely to be affected by seasonal flooding events. While flooding events are not anticipated to have effects within the PA, the trucking haul route travels through

a number of low elevation areas which have higher potential to be impacted by flooding. In the event the trucking haul route is affected by road flooding, hauling will be paused until the route is deemed safe and passable again.

8.3 Slope Stability

Slope instability can result in mass wasting movements such as landslides, rockfalls, subsidence and slope creep. Areas with potential for slope failure within the PA include the pit itself and stockpiles of overburden material. Where erosion of slopes is a possibility during storm and flooding events, climate change-based forecasting will be taken into consideration when finalizing slope grade designs. Additionally, a staged pit expansion will reduce the potential for both pit wall and overburden/topsoil stockpile failure, as the total surface area of slopes present at the Project are minimized.

8.4 Wildfires

Drought conditions may result in an increased risk of wildfire, as vegetation dries out and flammability increases. Wildfires have become increasingly commonplace across Canada and NS as climate change progresses, burning large swaths of land and consuming habitats and community assets including residences. In 2023, NS experienced its largest wildfire to date - the Barrington wildfire consumed 23,525 ha within a month (NSDNRR, 2023). If a fire were to occur on-site, impacts could include risk to human and animal health and safety, loss of vegetation and habitat and/or loss of infrastructure.

Wildfires have two main causes: lightning and human activity. While lightning induced forest fires and human activities occurring outside of the PA cannot be mitigated by the Proponent, human activities within the PA can be controlled to minimize risk of fires. The Project's Contingency Plan, which will be prepared prior to commencement of construction, will include fire prevention measures (e.g., guidance related to smoking, restricted activities during high fire index periods) and firefighting planning and procedures.

8.5 Earthquakes

Earthquakes are largely caused by movement at tectonic plate boundaries, resulting in seismic waves travelling across the earth's crust and occasionally creating shaking movement at the surface. The intensity of an earthquake is dictated primarily by the degree of tectonic shift that has occurred and is measured from 1 to 10 on the Richter scale. Generally, earthquakes that measure a magnitude 3 or above can be felt in the area local to the earthquake epicentre, and a magnitude of 5 is the threshold for related damage. NS is located within the inner continental region of the North American tectonic plate where the rate of earthquake frequency is low, and events are of low intensity when they do occur. On average, 450 earthquakes occur annually in Eastern Canada (i.e., Ontario, Quebec and the Atlantic Provinces). Of these, an estimated 30 earthquakes register as exceeding a magnitude of 3 (NRCAN, 2021), and most earthquakes are located outside the Northern Appalachians Seismic Zone where the Project is located. No significant earthquakes (>/= magnitude of 5) were recorded in NS between 1600 and 2006 (Lamontagne et all., 2008). Given no earthquakes of significant magnitude were recorded in NS in the last 425 years, it is anticipated that the Project is not at risk of adverse effects from earthquakes.

9. Environmental Assessment Summary and Conclusions

4389818 Nova Scotia Limited proposes to develop the Nictaux Sand Pit Expansion Project, an expansion of the existing Trimper Sand and Gravel Pit located near Nictaux, Annapolis County, Nova Scotia. The Minister of Environment and Climate Change has granted consent to transfer the existing EA approval dated April 20, 2012 for the Trimper Sand and Gravel Pit Expansion Project originally issued to Ivan H. Trimper Construction Ltd. to 4389818

Nova Scotia Limited. 4389818 Nova Scotia Limited is a numbered company wholly owned by the Shaw. Shaw intends to expand the PA authorized by this EA approval to include extraction of a sand resource located on parcels with the following premises identification numbers (PIDs): 05291448, 05291455, 05286976, 05286984, 05310834, 05286968, 05194030, 05313853, 05059688, and 05058334.

Shaw proposes to operate the Project for the purpose of extracting commercial sand at a rate of approximately 590,000 tonnes per year. The existing sand pit will be expanded from the approved 26 ha to approximately 125 ha in size so that Shaw may continue to extract and supply aggregate to meet local and regional demand. The Project schedule will be contingent on issuance of EA and IA approvals. Construction activities are anticipated to commence in 2026. The three phases planned for the Project and their estimated durations are as follows:

– Construction – approximately six months
– Operation – 30+ years depending on market demand
– Reclamation – one to three years, dependent on the monitoring duration and the success of reclamation activities

Shaw has collected baseline environmental data in support of this EARD since 2023, include baseline monitoring of groundwater, surface water, wetlands, terrestrial environment, and fish and fish habitat. Several technical studies have been conducted to evaluate the potential impacts of Project development, including a hydrogeological investigation, water balance analysis, and traffic impact study. The predicted residual effects of the Project on all VCs selected were assessed to be not significant following the implementation of mitigation measures outlined throughout the EARD. Monitoring and follow-up programs will be implemented to confirm the predicted effects and determine if the proposed mitigation measures are effective at reducing or eliminating those effects. The Project will result in economic benefits, including continued employment and an economic source of quality aggregates to local demand markets.

10. References

Agri-Food Canada. 2024. Kentville Research and Development Centre. Retrieved from: https://profils-profiles.science.gc.ca/en/research-centre/kentville-research-and-development-centre.

Annapolis Valley. 2024a. Annapolis Valley First Nation. Retrieved from: https://haveitallav.ca/en/move-and-settle/annapolis-valley-first-nation.aspx

Annapolis Valley First Nation. 2024. Our Community. Retrieved from: https://www.avfn.ca/community-information

Bird Studies Canada. 2024. Maritimes Breeding Bird Atlas—Atlas des oiseaux nicheurs des Maritimes. Retrieved from: https://www.mba-aom.ca/

Bliss-Ketchum, L. L., de Rivera, C. E., Turner, B. C., & Weisbaum, D. M. 2016. The effect of artificial light on wildlife use of a passage structure. Biological Conservation, 199, 25–28. Retrieved from: https://doi.org/10.1016/j.biocon.2016.04.025

Bouchard, J., Ford, A., Eigenbrod, F. E., & Fahrig, L. 2009. Behavioral responses of northern leopard frogs (Rana pipiens) to roads and traffic: Implications for population persistence. Ecology and Society, 14(23). Retrieved from: https://doi.org/10.5751/ES-03022-140223

Bowles, A. E. 1995. Responses of wildlife to noise. In wildlife and recreationists: Coexistence through management and research. Island Press, 109–156.

Buckmaster, G., Smith, k, Bonar, R., Beck, B., Beck, J., & Quinlan, R. 1999. Elk Winter Foraging Habitat Suitability Index Model,. Retrieved from: http://www.fmf.ab.ca/pdf/h_elk.pdf

Canada. 2018. Migratory Birds Convention Act (MBCA) and Regulations. Environment and Climate Change Canada. https://www.canada.ca/en/environment-climate-change/services/migratory-birds-legal-protection/convention-act-regulations.html

CIRNAC. 2016. General Briefing Note on Canada's Self-government and Comprehensive Land Claims Policies and the Status of Negotiations. Retrieved from: https://www.rcaanc-cirnac.gc.ca/eng/1373385502190/1542727338550

CIRNAC. 2021. Indigenous People and Lands. Retrieved: Retrieved from: https://www.rcaanc cirnac.gc.ca/eng/1605796533652/1605796625692#sec3.

CIRNAC. 2024. First Nation Profiles. Retrieved from: https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Index.aspx?lang=eng

CIRNAC. 2025. First Nations: Registered Population. Retrieved from: https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Search/FNRegPopulation.aspx?BAND_NUMBER=20&lang=eng

Confederacy of Mainland Mi'kmaq (CMM). 2024. Mission statement. Retrieved from: https://cmmns.com

County of Annapolis. No Date. South Shore Annapolis Valley Trail. Retrieved from: https://annapoliscounty.ca/community-development/parks-trails/1015-south-shore-annapolis-valley-trail

County of Annapolis. 2012a. Annapolis County East End Area Land Use By-Law. Effective Date: August 16, 2012. Retrieved from: https://annapoliscounty.ca/images/2025/Planning/East_End_Planning_Area/2012_East_End_Area_Land_Use_Bylaw.pdf

County of Annapolis. 2012b. Annapolis County East End Area Municipal Planning Strategy. Effective Date: August 16, 2012. Retrieved from: https://annapoliscounty.ca/component/easyfolderlistingpro/?view=download&format=raw&data=eNpNkEFPxCAQhf8K4W7aRrMqPalbT2tiYjxvxjJlSShtYLq71fjfHdpFPTE8eLzvAaqq1FdUGyW7wWkMso7q7lbJ7dBOPXqKRdV8Pi9HOxupeBr6fvKW5i0eixeeWjuCe3XgvfXmjQIQmnkHXr9HfJyvHJyKBlwiNV4_BIT0PFwnyiliWAPjXCIpWeYjM2GkPxhm2e8XbUFbrR56TNtSybRsVtVqWVtVrqaAbgQ6_LvF3s46zN6bayUrkdgEw4lEXCd-C4ncSORKycIOPNNlGnV34cPzaAPGHF5xHhBBe0gfKOuPRb1nR8CjxdPai5nNMBjHLN8_CY2AZw

County of Annapolis. 2024a. County of Annapolis Municipal Planning Strategy. Amended date: October 25, 2024. Retrieved from: https://www.annapoliscounty.ca/images/2023/Planning-Development/Annapolis_County_MPS_Amended_October_25_2024.pdf

County of Annapolis. 2024b. Annapolis County Municipal Planning Strategy. Effective Date: April 23, 2024. Retrieved from: https://annapoliscounty.ca/images/2023/Planning-Development/Annapolis_County_MPS_April_2024.pdf

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern Wood-pewee Contopus virens in Canada (p. 30). Committee on the Status of Endangered Wildlife in Canada.

Crown Indigenous Relations and Northern Affairs Canada (CIRNAC). 2013. Peace and Friendship Treaties (1725-1779). Retrieved from: https://www.rcaanc-cirnac.gc.ca/eng/1360937048903/1544619681681

Destination Trails Nova Scotia. 2024. Harvest Moon Trailway. Retrieved from: https://destinationtrailsnovascotia.com/trails/harvest-moon-trailway/

DFO. (2013). Framework for assessing the ecological flow requirements to support fisheries in Canada. Government of Canada. Retrieved from: https://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2013/2013_017-eng.html

DFO. (2024, October 4). Pathways of effects [Guide]. Fisheries and Oceans Canada, Public Affairs, Digital and Creative Services. Retrieved from: https://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html

Doroszenko, D. 2009. Exploration, Exploitation, Expansion, and Settlement: Historical Archaeology in Canada. In International Handbook of Historical Archaeology (pp. 507-524). New York, NY: Springer New York.

ECCC. 2020. Recovery strategy for the wood turtle (Glyptemys insculpta) in Canada (Species at Risk Act Recovery Strategy Series). Environment and Climate Change Canada. Retrieved from: https://publications.gc.ca/collections/collection_2020/eccc/En3-4-333-2020-eng.pdf

ECCC. 2022. Evening grosbeak (Coccothraustes vespertinus): Management plan proposed 2022 (Species at Risk Act Management Plan Series). Environment and Climate Change Canada. Retrieved from: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/management-plans/evening-grosbeak-proposed-2022.html

Environment and Climate Change Canada (ECCC). 2024. Government of Canada. Canadian Climate Normals 1981-2010 Station Data from Greenwood A, Nova Scotia. Retrieved on March 12, 2025 from: https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=6354&autofwd=1

Environmental Laboratory. (1987). Corps of Engineers wetlands delineation manual (No. Y-87-1 (online edition); Wetlands Research Program Technical Report, p. 143). US Army Corps of Engineers. Retrieved from: https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/4532/

Fahrig, L., & Rytwinski, T. (2009). Effects of roads on animal abundance: An empirical review and synthesis. Ecology and Society, 14(1).

Farmer, A. M. 1993. The effects of dust on vegetation—A review. Environmental Pollution, 79(1), 63–75. today. Retrieved from: https://doi.org/10.1016/0269-7491(93)90179-R

First Nations Info. 2024. Acadia First Nation. Retrieved from: https://www.first-nations.info/acadia-first-nation.html

Fowell, S.J., and Traverse, A. (1995). Palynology and age of the upper Blomidon Formation, Fundy basin, Nova Scotia. Review of Palaeobotany and Palynology, 86(3) 211-233. Retrieved from: https://www.sciencedirect.com/science/article/pii/003466679400147C

GeoNOVA. 2024. Nova Scotia digital elevation map [Dataset]. Retrieved from: https://nsgi.novascotia.ca/datalocator/elevation/

Government of Canada, 2011. Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult March 2011. Retrieved from: https://rcaanc cirnac.gc.ca/eng/1100100014664/1609421824729.

Government of Canada. 2023. Aboriginal and Treaty Rights Information System. Retrieved from: https://sidait-atris.rcaanc-cirnac.gc.ca/SIDAIT-GEO-ATRIS/index-eng.html

Government of Nova Scotia. 1998. Statements of Provincial Interest under Section 193 and subsections 194(2) and (5) of the Municipal Government Act, S.N.S. 1998, c. 18, N.S. Reg. 101/2001 (April 1, 1999), N.S. Reg. 272/2013 (August 6, 2013). Retrieved from: https://novascotia.ca/just/regulations/regs/mgstmt.htm#TOC2_5

Government of Nova Scotia. 2015. Nova Scotia Health Profile. Retrieved from: https://novascotia.ca/dhw/publichealth/documents/population-health-profile-nova-scotia.pdf

Government of Nova Scotia. 2024. Industrial Approvals Online Search. Retrieved from: https://novascotia.ca/nse/ia#jumpToResults

Health Canada. 2023. Guidance for Evaluating Human Health Effects in Impact Assessment: Noise. Department of Health. (Accessed on February 18, 2025), Retrieved from: https://publications.gc.ca/collections/collection_2024/sc-hc/H129-54-3-2023-eng.pdf

Hosker, R. P., & Lindberg, S. E. 1967. Atmospheric deposition and plant assimilation of gases and particles. Atmospheric Environment, 16(5), 889–910.

Impact Assessment Agency of Canada. 2024. Canadian Impact Assessment Registry. Retrieved from: https://iaac-aeic.gc.ca/050/evaluations

Jalkotzy, M. G., Ross, P. I., & Nasserden, M. D. 1997. The effects of linear developments on wildlife: A review of selected scientific literature. Arc Wildlife Services Ltd,.

Kespukwitk Conservation Collaborative. 2025. About Us. Retrieved from: https://kswnsconservation.ca/about-us/#place

Kwilmu'kw Maw-klusuaqn Negotiating Office (KMKNO). 2024. We Are Seeking Consensus. Retrieved from: https://mikmaqrights.com/

Lamontagne, M., Halchuk, S., Cassidy, J.F., and Rogers, G.C. 2008. Significant Canadian Earthquakes of the Period 1600-2006. Seismological Research Letters. Volume 79, Number 2.

Longcore, T., & Rich, C. 2004. Ecological light pollution. Frontiers in Ecology and the Environment, 2(4), 191–198. Retrieved from: https://doi.org/10.1890/1540-9295(2004)002[0191:ELP]2.0.CO;2

MacDougall, J. I. and Nowland, J. L. (compilers) 1972. Soils of Nova Scotia. Soil Research Institute, Canada Department of Agriculture, Scale 1:450 000.

Mehrotra, A., Shukla, S. P., Shukla, A. K., Manar, M. K., Singh, S. K., & Mehrotra, M. 2024. A Comprehensive Review of Auditory and Non-Auditory Effects of Noise on Human Health. Noise and Health, 26(121), 59-69.

Michaud, D. S., Marro, L., Denning, A., Shackleton, S., Toutant, N., & McNamee, J. P. 2022. A comparison of self-reported health status and perceptual responses toward environmental noise in rural, suburban, and urban regions in Canada. The Journal of the Acoustical Society of America, 151(3), 1532-1544.

Mi'kmaw Kina'matnewey (MK). 2024. Serving Communities & Empowering Mi'kmaq Learning. Retrieved from: https://www.kinu.ca/

Mining Association of Nova Scotia (MANS). 2024. About. Retrieved from: https://tmans.ca/about

Municipality of the County of Annapolis. 2024. Development of Secondary Planning Strategies and Land Use Bylaws for Bridgetown and East End Planning Areas. Retrieved from: https://annapoliscounty.ca/images/2024/Tenders/RFP_2024_Bridgetown_East_End_SPS_Review_.pdf

Nash, T. I. 2008. Lichen biology. Cambridge University Press, 41(6). Retrieved from: https://doi.org/10.1017/CBO9780511790478

Nova Scotia. (1995). Environment Act, S.N.S. 1994-95, c. 1. Retrieved from: https://www.canlii.org/en/ns/laws/stat/sns-1994-95-c-1/latest/sns-1994-95-c-1.pdf

Nova Scotia Department of Public Works. 2024. 511 Nova Scotia. Retrieved from: https://511.novascotia.ca/about/about

Nova Scotia Environment and Climate Change (NSECC). 2015a. Guide to altering watercourses (p. 62) [Guide]. Nova Scotia Environment and Climate Change. Retrieved from: https://novascotia.ca/nse/watercourse-alteration/docs/NSE-Watercourse-Alteration-Program-May29.pdf

Nova Scotia Environment and Climate Change (NSECC). 2015b. Nova Scotia Watercourse Alterations Standard. Nova Scotia Environment and Climate Change. Retrieved from: https://www.novascotia.ca/nse/watercourse-alteration/docs/Watercourse-Alterations-Standard.pdf

Nova Scotia Environment and Climate Change (NSECC). 2019. Nova Scotia Wetlands Conservation Policy. Nova Scotia Environment and Climate Change. Retrieved from: https://novascotia.ca/nse/wetland/docs/nova.scotia.wetland.cons

Nova Scotia Environment and Climate Change (NSECC). 2020. Air Quality Regulations made under Section 25 and 112 of the Environment Act. N.S. Reg. 8/2020.

Nova Scotia Environment and Climate Change (NSECC). 2022a. Weathering What's Ahead: Climate Change Risk and Nova Scotia's Well-Being. Retrieved from: https://climatechange.novascotia.ca/sites/default/files/uploads/climate-change-risk-report.pdf

Nova Scotia Environment and Climate Change (NSECC). 2022b. Activities Designation Regulations made under Section 66 of the Environment Act. Department of Environment and Climate Change (N.S. Reg. 329/2022). Government of Nova Scotia.

Nova Scotia Environment and Climate Change (NSECC). 2023a. NS Climate Change Projections (CMIP5). Retrieved from: https://data.novascotia.ca/Nature-and-Environment/NS-Climate-Change-Projections-CMIP5-/r7d9-j7wx/about_data

Nova Scotia Environment and Climate Change (NSECC). 2023b. Guidelines for Environmental Noise Measurement and Assessment. Department of Environment and Climate Change. Government of Nova Scotia. (Accessed on February 12, 2025), Retrieved from: https://novascotia.ca/nse/air/docs/guidelines-environmental-noise-measurement-and-assessment.pdf

Nova Scotia Environment and Climate Change (NSECC). 2024a. Nova Scotia Provincial Ambient Fine Particulate Matter (PM2.5) Hourly Data Kentville BAM/T640. Retrieved on Dec 20 from: https://data.novascotia.ca/Environment-and-Energy/Nova-Scotia-Provincial-Ambient-Fine-Particulate-Ma/5hnc-kmpv/about_data

Nova Scotia Environment and Climate Change (NSECC). 2024b. Nova Scotia Provincial Ambient Ground-level Ozone (O3) Hourly Data Kentville. Retrieved on Dec 20 from: https://data.novascotia.ca/Environment-and-Energy/Nova-Scotia-Provincial-Ambient-Ground-level-Ozone-/ccem-uxu9/about_data

Nova Scotia Environment and Climate Change (NSECC). 2024c. Nova Scotia Provincial Ambient Nitrogen Oxides (NOx, NO2, NO) Hourly Data Kentville. Retrieved on Dec 20 from: https://data.novascotia.ca/Environment-and-Energy/Nova-Scotia-Provincial-Ambient-Nitrogen-Oxides-NOx/wqvb-pd78/about_data

Nova Scotia Environment and Climate Change (NSECC). 2024d. Environment and Climate Change, Projects. Retrieved from: https://novascotia.ca/nse/ea/projects.asp

Nova Scotia Environment and Climate Change (NSECC), 2025. Guide to Developing Erosion and Sediment Control Plans. Retrieved from: https://www.novascotia.ca/nse/surface.water/docs/guide-developing-erosion-sediment-control-plans-en.pdf

Nova Scotia Natural Resources and Renewables, Geoscience and Mines Branch. 2024. Mineral Management Division Information Circular ME 78: Mineral Production in 2022 and Exploration in 2023. Retrieved from: https://novascotia.ca/natr/meb/data/pubs/ic/ic_me_078.pdf

NRCAN. 2021. Earthquake zones in Eastern Canada. Retrieved from: https://www.earthquakescanada.nrcan.gc.ca/zones/eastcan-en.php#NASZ

NSDNRR. 2006. Till Geochemistry Survey over Mainland Nova Scotia. Retrieved from: https://novascotia.ca/NATR/meb/download/dp138.asp#location

NSDNRR. 2023. Barrington Lake Wildfire Under Control. Retrieved from: https://news.novascotia.ca/en/2023/06/13/barrington-lake-wildfire-under-control

NSNR. 2018. At-Risk Lichens–Special Management Practices. Nova Scotia Natural Resources. Retrieved from: https://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_BFL_At-Risk-Lichens.pdf

NSNR. 2021a. Wetlands inventory [Dataset]. Nova Scotia Natural Resources.

NSNR. 2021b. Nova Scotia interpreted forest inventory [Dataset]. Nova Scotia Natural Resources. Retrieved from: https://nsgi.novascotia.ca/gdd/

NSNR. 2022. Wet areas mapping (WAM) [Dataset]. Nova Scotia Natural Resources.

NSNR. 2024. Old Growth Forest Policy Map [Dataset]. Nova Scotia Natural Resources. Retrieved from: https://data.novascotia.ca/Lands-Forests-and-Wildlife/Old-Growth-Forest-Policy-Map/fdyh-ypsm

Parks Canada. 2025. Map of the Districts of Mi'kma'ki (Kjipuktuk aq Mi'kma'ki). Retrieved from: https://parks.canada.ca/lhn-nhs/ns/fortanne/culture/autochtone-indigenous/carte-mikmaki-map

Parks Canada. 2025. Kejimkujik National Park and National Historic Site. Retrieved from: https://parks.canada.ca/pn-np/ns/kejimkujik

Plaza, F., Wen, Y., Liang, X. 2018. Acid rock drainage passive remediation using alkaline clay: Hydro-geochemical study and impacts of vegetation and sand on remediation. Retrieved from: https://www.sciencedirect.com/science/article/abs/pii/S0048969718316462

Rheult, H., Drapeau, P., Bergeron, Y., & Esseen, P. A. 2002. Edge effects on epiphytic lichen in managed black spruce forest of eastern north america. Canadian Journal of Forest Research., 33, 23–32. Retrieved from: https://DOI:10.1139/x02-152

Shannon, G., Crooks, K. R., Wittemyer, G., Fristrup, K. M., & Angeloni, L. M. 2016. Road noise causes earlier predator detection and flight response in a free-ranging mammal. Behavioral Ecology, 27(5), 1370–1375. Retrieved from: https://doi.org/10.1093/beheco/arw058

Shannon, G., McKenna, M. F., Angeloni, L. M., Crooks, K. R., Fristrup, K. M., Brown, E., ... & Wittemyer, G. 2016. A synthesis of two decades of research documenting the effects of noise on wildlife. Biological Reviews, 91(4), 982-1005.

Snowmobilers Association of NS. 2025. Trail Map 2024-2025 Season. Retrieved from: https://sans.evtrails.com/#

Southwest Nova Biosphere Region. 2025. Welcome to the Southwest Nova Biosphere Region! Retrieved from: https://swnovabiosphere.ca/

Statistics Canada. 2023a. Canada is the first country to provide census data on transgender and non-binary people. Retrieved from: https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427b-eng.htm

Statistics Canada. 2023b. Census Profile, 2021 Census of Population – Newfoundland and Labrador. Retrieved from: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/search-recherche/lst/results-resultats.cfm?Lang=E&GEOCODE=10

Statistics Canada. 2023c. Health outcomes. Retrieved from: https://www150.statcan.gc.ca/n1/pub/82-570-x/2023001/section1-eng.htm

Statistics Canada. 2024d. Value per acre of farm land and buildings at July 1. Retrieved from: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3210004701

Statistics Canada. 2024e. Original quantitative research – Assessing the impact of the COVID-19 pandemic on the mental health–related hospitalization rate of youth in Canada: an interrupted time series analysis. Retrieved from: https://www.canada.ca/en/public-health/services/reports-publications/health-promotion-chronic-disease-prevention-canada-research-policy-practice/vol-44-no-10-2024/assessing-impact-covid-19-pandemic-mental-health-related-hospitalization-youth-canada-interrupted-time-series-analysis.html

Stea, R. R., Conley, H., and Brown, Y. (compilers) 1992. Surficial Geology of the Province of Nova Scotia; Nova Scotia Department of Natural Resources, Map 92-3, Scale 1:500 000.

Tourism Nova Scotia. 2024. Old Mill Trail. Retrieved from: https://www.novascotia.com/see-do/trails/old-mill-trail/6102

Union of Nova Scotia Mi'kmaq (UNSM). 2021. Union of Nova Scotia Mi'kmaq. Retrieved from: https://www.unsm.org/.

United States Department of Transportation (DOT). 2006. FHWA Construction Noise Handbook, 9.0 Construction Equipment Noise Levels and Ranges. (Accessed on February 18, 2025), Retrieved from: https://rosap.ntl.bts.gov/view/dot/8837#:~:text=The%20Handbook%20provides%20guidance%20to%20U.S.%20state%20transportation,mitigating%20highway%20construction%20noise%20and%20developing%20noise%20criteria.

United States Environmental Protection Agency (USEPA). 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin on safety. Office of Noise Control. 242 pp. (Accessed on February 18, 2025), Retrieved from: https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF

United States Nuclear Regulatory Commission (NRC). 2012. Biological assessment preparation advanced training manual, 7.0 construction noise impact assessment. (Accessed on February 18, 2025), Retrieved from: https://www.nrc.gov/docs/ML1225/ML12250A723.pdf

Valley Regional Enterprise Network (VREN). 2024. Business Sectors. Retrieved from: https://haveitallav.ca/en/work-and-learn/business-sectors.aspx

Webster Farms. 2025. Who are we? Retrieved from: https://www.websterfarms.ca/index.html

White, C.E. 2009. Pre-Carboniferous Bedrock Geology of the Annapolis Valley Area (NTS 21A/14, 15 and 16; 21H/01 and 02), Southern Nova Scotia. Retrieved from: https://novascotia.ca/natr/meb/data/pubs/10re01/10re01_18White.pdf