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4.0 Environmental Effects

The purpose of environmental effects assessment is to identify, predict, and reduce or avoid potential negative environmental effects associated with a proposed Project, and predict the significance of residual negative effects.

This evaluation enables a determination to be made as to whether a project is likely to result in significant adverse impacts on the environment. The methods described below are generally compatible with other current environmental assessments and conform to the Province of Newfoundland and Labrador **Environmental Protection Act**, the associated **Environmental Assessment Regulations** as well as the guidelines issued by NLDECC.

Two general types of effects have been considered:

1) Effects of the environment on the Argentia Renewables Project (the Project).
2) Effects of the Project on the environment, including the biophysical and human environments.

Both planned and unplanned (i.e., accidents and malfunctions) aspects of the Project were assessed. The predictions process also accounts for the Project's cumulative effects by considering other ongoing and planned projects. Other "likely" undertakings include only those registered in accordance with the Environmental Assessment Regulations under the **Environmental Protection Act** (https://www.gov.nl.ca/ecc/env-assessment/projects-list/).

A general statement will be presented on the predictions that would apply in the absence of the Project. As with cumulative effects prediction, it is challenging to make firm predictions on future speculation.

Figure 4.0-1 presents the stages involved in conducting this effects assessment. A description of each step is presented below.

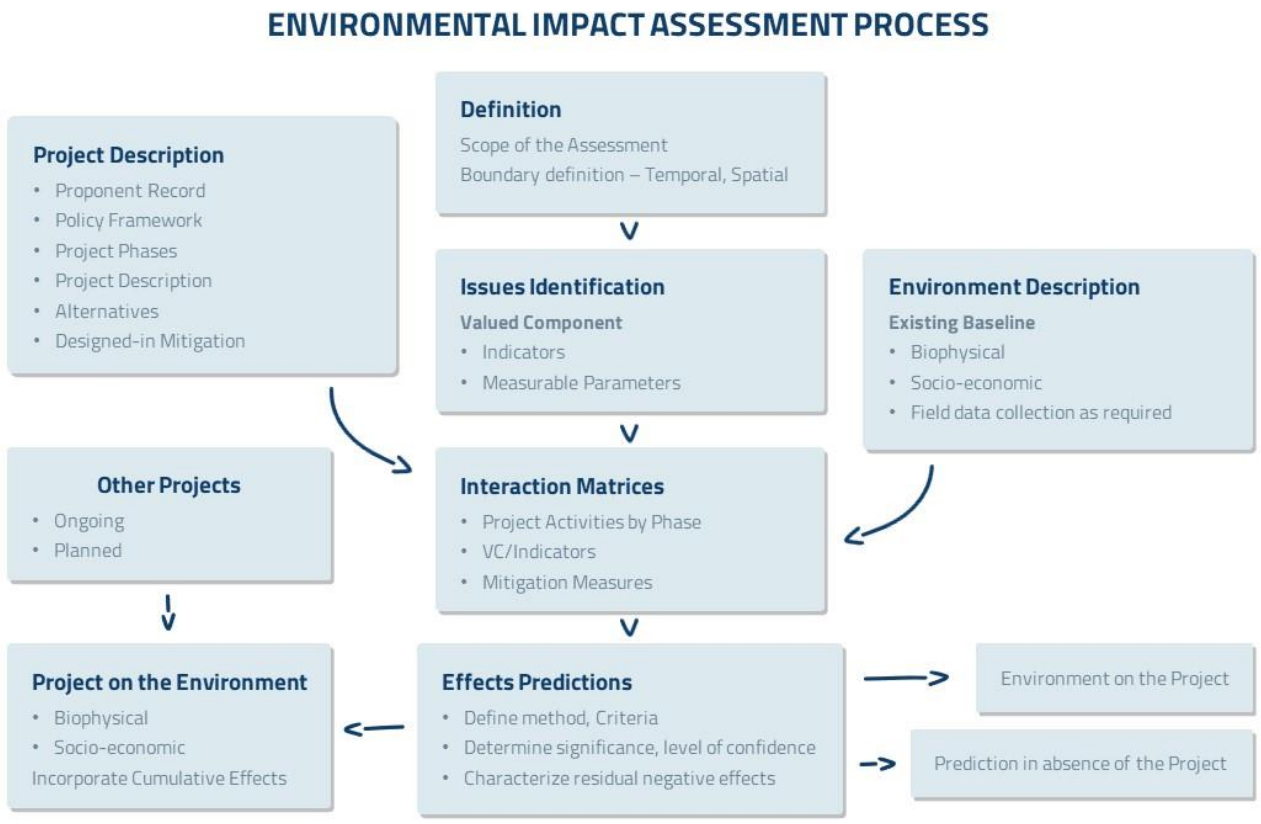

Figure 4.0-1 Staged Approach to Environmental Impact Assessment Process.

4.1 Effects Assessment Methodology

4.1.1 Definition of Scope

As a first step, the scope of the assessment is defined to place boundaries around the exercise and to delineate limitations on the material to be addressed. This exercise also serves to provide evidence of compliance with the requirements of applicable regulations, guidelines, and current practice.

Scoping encompassed the following actions:

- Review of the generic and category-specific guidelines issued by NLDECC for Registration of undertakings.
- Literature review of relevant information on Project elements and environmental effects of similar undertakings.

- Consultations with key interested parties, the public, and Indigenous Peoples to identify issues of concern.
- Consultations with regulatory and resource management agencies.
- Establish the scope of the Undertaking that is to be assessed.

Spatial and temporal boundaries are established to set maximum limits within which the environmental assessment will be conducted. The duration of interaction between the Project (and its associated activities) and potentially affected biophysical and socioeconomic components of the environment constitutes the temporal boundaries. Temporal boundaries have been assigned to Project phases: Construction Phase (29 months), operation phase (nominally 30 years), and decommissioning (one year). Temporal boundaries are therefore from 2025 to 2058.

The starting point for defining the spatial boundaries is the delineation of the Project Area, i.e., physical footprint of the undertaking. These areas conservatively define the Project footprint to account for the possibility of minor changes to the location of Project infrastructure that might occur as the Project moves through detailed engineering and construction. Sections 2.1-2.3 provide greater detail on Project physical and temporal boundaries.

Geographic extent refers to the geographic extent of interaction between the Project and a receptor (species, species group or their habitats). It varies according to the timing and type of Project activity and the sensitivities being assessed. Geographic boundaries are set with the aid of existing literature, modeling exercises, and baseline data collection. Study Areas have been defined to encompass the furthest extent of Project potential influence. Study areas vary by ecosystem, VC, and indicator. Other boundaries to be considered include administrative boundaries such as water supply watersheds, municipal boundaries, statistical areas, and planning zones.

4.1.2 Issues Identification and VC Selection

Key to the conduct of any environmental impact assessment is the thorough identification of issues and concerns related to and flowing from the proposed undertaking. In addition to the guidance provided by NL DECC, an exhaustive program of consultation has been in place by Argentia Renewables over the past two years and has generated interactions with all identified stakeholders, including Indigenous Peoples, community organizations, special interest groups, and regulators. Consultation activities has been designed to facilitate the flow of information out and information in through various mechanisms to provide interested or potentially affected stakeholders with the information required to understand the Project and identify issues or concerned to be addressed during Project planning.

Chapter 8 includes a list of consultation tools and activities as well as a comprehensive list of issues and concerns resulting from these consultations. In conducting the effects assessment, and where possible,

the identified issues have been employed to help define the indicators and measurable parameters that comprise the effects assessment.

In addition to the Argentia Renewables consultation process, both biophysical and socio-economic issues of concern were identified through several other sources, including:

- Media monitoring;
- Interest group interactions;
- Input from subject matter experts;
- Government, regulatory, and resource management agencies; and
- Guidelines issued by the EA Division NL DECC.

The identification of Valued Environmental Components (VECs) and Valued Socio-Economic Components (VSECs) was a concept pioneered by Beanlands and Duinker (1983) to provide focus to an Environmental Impact Assessment. For Onshore Wind Energy Generation and Green Hydrogen Production Projects, a set of Guidelines have been developed (NLDECC 2023) for preparation of a Registration. The Guidelines provide a listing of the following broad categories of Valued Components (VCs), and these have been adopted for this environmental effects assessment:

- Atmospheric Environment;
- Aquatic Environment;
- Terrestrial Environment;
- Land and Resource Use;
- Heritage and Cultural Resources;
- Socio-Economic Environment; and
- Human Health and Quality of Life.

The identified issues and concerns have been categorized in accordance with the broad suite of candidate VCs that require evaluation.

To carry out detailed consideration of potential environmental effects, key indicators are selected for each VC to serve as subjects of close examination. For each key indicator, one or more measurable parameters are then identified to enable measurement/quantification and prediction of changes related to interaction with the Project. Table 4.1.2-1 presents a list of key indicators for each VC utilized in this effects assessment. Further details regarding the selection of each key indicator are provided in Sections 4.2.1-4.2.7.

Table 4.1.2-1 Index of Key Indicators Utilized in Effects Assessment.

Valuable Component	Key Indicator
Atmospheric Environment	Air Quality
	Greenhouse Gas (GHGs) Emissions
	Light
	Sound Quality (Noise)
	Vibration
Aquatic Environment	Surface Water Resources
	Ground Water Resources
	Freshwater Environment (Fish and Fish Habitat)
	Marine Environment (Fish and Fish Habitat)
	Fisheries and Aquaculture
	Species at Risk
	Habitats of Conservation Concern
	Marine Biosecurity
Terrestrial Environment	Flora (Rare Plants and Lichens)
	Wetlands
	Fauna (Mammals)
	Avifauna
	Species at Risk
	Habitats of Conservation Concern[1]
Land and Resource Use	Zoning
	Commercial and Industrial Resource Use
	Recreational and Subsistence Resource Use
	Protected, Special and Sensitive Areas
	Indigenous Land Use
Heritage and Cultural Resources	Historic and Archaeological Resources
	Paleontological Resources
	Architectural Resources
	Burial, Cultural, and Heritage Sites
Socio-Economic Environment	Population Demographics
	Community Health and Wellbeing
	Infrastructure and Services
	Economy
	Employment
	Business
Human Health and Quality of Life	Shadow Flicker
	Ice Throw
	Air Quality[2]
	Light[2]
	Sound Quality (Noise)[2]
	Vibration[2]
	Recreational and Subsistence Resource Use[3]
	Indigenous Land Use[3]

NOTES
[1]Assessed under Land and Resource Use – “Protected, Special and Sensitive Areas”
[2]Assessed under Atmospheric Environment.
[3]Assessed under Land and Resource Use.

4.1.3 Project Description

A full description of the Project has been developed with emphasis on material relevant to the effects prediction process. This includes a description of the Proponent's experience in environmental management, their policy framework applicable to the proposed undertaking, and the network of plans applicable to each Project phase. The level of detail provided has been designed to support the development of interaction matrices as described below in Section 4.1.5.

Information on other projects and undertakings has been developed to support the inclusion of cumulative effects assessment. A challenging aspect of this type of assessment is the inclusion of undertakings that are "likely to proceed". The information provided in Chapter 6 informs the cumulative effects predictions.

Because planning and design is an iterative process, some decisions on Project features remain to be resolved. In such cases, the currently preferred choice will be presented, and possible alternatives (within the undertaking) described in the appropriate section.

4.1.4 Environmental Description

The existing biophysical and socio-economic environment has been described based on available existing information, supplemented by an ongoing field studies program. The relevant information has been presented in Chapter 3, with detailed reports included as appendices. This information and data have been used to support the development of interaction matrices.

4.1.5 Interaction Matrices

To identify the aspects and phases of the Project that could interact with an element of the environment, interaction matrices have been prepared. One axis consists of a listing of project activities by phase including Construction, Operation and Maintenance, Decommissioning, and Unplanned Events. These are summarized below in Table 4.1.5-1. The other axis of the interaction matrices lists environmental elements organized by VC. Timing and location of potential interactions are identified for further consideration.

Identified interactions were then evaluated and grouped into the applicable VC or indicator for more detailed evaluation. This process enables the assessment to focus on key issues and substantive environmental interactions.

For biophysical factors, an interaction was considered to be a potential effect if it could change abundance or distribution of a VC or alter habitat and food chain relationships. The socio-economic VCs were considered for the potential to change socio-economic status of communities or affected populations, as well as the potential to degrade health or quality of life.

Table 4.1.5-1 Summary of Project Components Considered in Effects Assessment.

Phase, Component	Description
Construction	
Site Preparation	Vegetation clearing, grubbing, surface grading and fill placement at: work sites, building and structures sites and laydown areas
Roads	Construction of new access roads, and widen and resurface existing roads, quarrying operations
Staging and Laydown	Installation of temporary facilities including Wind Turbine staging areas, construction compounds, and laydown areas
Material Transport	Road and marine transportation of construction vehicles, equipment, and materials
Wind Turbine Foundations	Installation of Wind Turbine foundations and crane pads (involves necessary blasting, excavation, and construction)
Electrical Infrastructure	Installation of electrical collector lines, substations, and transmission infrastructure
Wind Turbine Installation	Wind Turbine Installation: tower, rotor blades, and nacelle are assembled, and turbines are anchored to the foundations. Met tower installation
Electrolyzer Plant	Install electrolyser plant and associated works to produce hydrogen
Ammonia Plant	Install ASU, ammonia synthesis unit, and compression and refrigeration system to produce ammonia
Ammonia Storage/Transfer	Install ammonia storage tanks and install pipeline to transfer ammonia to shipping vessels
Flares	Install storage and process flare stacks to manage Project emissions
Admin Buildings	Installation of O&M building infrastructure
Operation and Maintenance	
Wind Turbine Operation	Wind turbine operation – noise generation, vibration, flicker, lighting, ice throw,
Wind Turbine Maintenance	Preventative and unplanned maintenance of wind farm components
Electrical Infrastructure	Maintenance of the collector system and transmission lines
Venting and Flaring	Release of product, byproduct either as flares or release to air.
Road Maintenance	Access road, TL road maintenance
Plant Operations	Hydrogen electrolyzer and ammonia plant operations; ammonia storage and transfer to vessels for shipment; Water consumption, discharge; fuel/lubricant storage and transfer;
Ammonia Handling	Ammonia storage, transfer, and product shipment
Decommissioning and Rehabilitation	
Electrical Infrastructure	Disassembly and removal of electrical collector lines and transmission infrastructure
Wind Turbine Removal	Disassembly and removal Wind Turbine infrastructure and met towers
Building Removal	Disassembly and removal of O&M building infrastructure
Plant Removal	Disassembly and removal of hydrogen and ammonia plant facility

Phase, Component	Description
Terrain Reclamation	Reclamation of disturbed areas
Unplanned Events	
Spills and releases	Release of hydrogen, ammonia, chemicals, pesticides or other hazardous substance on land, in air or water
Flaring and venting	Flaring or venting of hydrogen, ammonia, or other gases in the event of a malfunction
Fire or explosion	Any incident involving a fire and/or explosion
Traffic accident	Any Project-related vehicle collision or loss of control that threatens people or property on land or water
Wind Turbine collapse	Any unintended dislodging of a wind tower or turbine blade
Water supply failure	Failure of industrial water supply with subsequent harm (or threat of harm) to equipment, personnel
Wildlife emergency	Any threatened or actual harm to wildlife (birds, mammals, SAR)
Human hazard or injury	Any event which presents a danger or risk in which physical harm or damage may be inflicted upon a person.

4.1.6 Effects Prediction

Given the breadth of this assessment, a variety of methods have been applied to support effects predictions. These include:

- Modelling and statistical analysis;
- Regulatory standards and limits on emissions/discharges;
- Professional judgement and consultation with experts and specialists;
- Examination of baseline information and identified patterns of change;
- Reliance on literature for similar undertakings; and
- Precedents/experience.

The evaluation of each identified interaction concentrated on significant environmental effects by disregarding interactions where the potential was deemed unlikely or incidental. This approach allowed a focused assessment on key issues and substantive environmental effects. An interaction was considered to be a potential effect if it could change the abundance or distribution of VCs directly or indirectly. The potential for an effect was assessed by considering six criteria:

1. The location and duration of the interaction;
2. The existence of any pathways between the project activity and the receiving environment;
3. Modelling exercises;
4. Existing literature on similar interactions and associated effects (including previous environmental assessments);
5. Consultation with experts; and
6. Results of monitoring done in other areas.

In some cases, predictions have been made based on professional judgment. In all prediction statements the associated uncertainty is documented. All effects predictions are premised on the implementation of mitigation measures that have been proven effective and are often mandatory or standard practice.

4.1.7 Evaluation Criteria

Six criteria, as described below in Tables 4.1.7-1 and 4.1.7-2, were used in evaluating the nature and extent of biophysical and socio-economic environmental effects. The definitions and applicability of each of these criteria were customized as necessary for each VC-specific assessment.

Table 4.1.7-1 Biophysical Effects Assessment Evaluation Criteria.

Evaluation Criteria	Rating	Descriptor
Magnitude	1	Negligible – not detectable.
	2	Low – within the range of natural variability and affecting less than 10% of individuals / receptors in an effected area.
	3	Moderate – affects 10 to 25% of individuals / receptors in an affected area.
	4	High – affects between 25 to 50% of individuals / receptors in an affected area.
	5	Very High – affects greater than 50% of individuals / receptors in an affected area.
Frequency	1	Single event – residual effect occurs once.
	2	Infrequent, irregular events- residual effects occur rarely, but more than once.
	3	Multiple irregular events – residual effects occur irregularly but more than once.
	4	Multiple regular events – residual effects occur regularly.
	5	Continuous – residual effects are continuous.
Geographic Extent	1	Spatial extent of an interaction is isolated to brownfield sites inside the Project Area.
	2	Spatial extent of an interaction is limited to the Project Area.
	3	Spatial extent of an interaction is limited to the Local Assessment Area (LAA).
	4	Spatial extent of an interaction is within the Regional Assessment Area (RAA).
	5	Spatial extent of an interaction is beyond the RAA.
Duration	1	Interaction lasts one day or less.
	2	Interaction lasts one to seven days.
	3	Interaction lasts one to four weeks.
	4	Interaction lasts one to twelve months.
	5	Interaction lasts longer than one year.
Reversibility	1	Highly reversible – residual effect is likely to be reversed following end of Project Phase or Project.
	2	N/A
	3	Partially reversible.
	4	N/A
	5	Irreversible – residual effect is likely permanent.
Context	1	Brownfield site.
	2	N/A
	3	Evidence of utilization but with natural features.
	4	N/A
	5	Relatively pristine area.

Table 4.1.7-2 Socio-Economic Effects Assessment Criteria.

Evaluation Criteria	Rating	Descriptor
Magnitude	1	Low – no perceptible impact on the integrity and / or quality of VC or its use by people.
	2	N/A
	3	Moderate – integrity and / or quality of VC or its use by people is affected, but not compromised.
	4	N/A
	5	High – integrity and / or quality of VC or its use by people is compromised.
Frequency	1	Single event – residual effect occurs once.
	2	Infrequent, irregular events- residual effects occur rarely, but more than once.
	3	Multiple irregular events – residual effects occur irregularly but more than once.
	4	Multiple regular events – residual effects occur regularly
	5	Continuous – residual effects are continuous.
Geographic Extent	1	Residual effects limited to Project Area.
		N/A
	3	Residual effects extend to LAA.
	4	N/A
	5	Residual effects extend to RAA.
Duration	1	Short term – residual effects limited to construction.
	2	N/A
	3	Medium term – residual effects extend to operations and maintenance and decommissioning.
	4	N/A
	5	Long term – residual effects extend beyond the life of the Project.
Reversibility	1	Highly reversible – residual effect is likely to be reversed following end of Project Phase or Project.
	2	N/A
	3	Partially reversible.
	4	N/A
	5	Irreversible – residual effect is likely permanent.
Socio-Economic Context	1	Low – not identified by regulators or stakeholders as an issue related to the Project.
	2	N/A
	3	Medium – identified by regulators or stakeholders as an important issue to be addressed / resolved.
	4	N/A
	5	High – Has regulatory protection.

Where a regulatory standard is applicable and compliance can be demonstrated, this will justify an assignment of low or negligible effects magnitude.

4.1.8 Residual Environmental Effects

Once potential environmental effects have been identified and characterized along with the identified mitigation measures, the residual environmental effects are identified and noted for significance with respect to:

- Each Project activity or accident scenario;
- Cumulative effects of Project activities within the Project; and
- Cumulative effects of combined projects within the RAA, with emphasis on the Project Area.

The analysis and prediction of the significance of residual environmental effects encompasses three criteria:

1. Determination of the significance of residual environmental effects;
2. Establishment of the level of confidence in the prediction; and
3. Evaluation of the likelihood of a predicted significant environmental effect occurring and the scientific certainty and probability of occurrence of the residual impact prediction.

Significant environmental effects are those that are of such magnitude, frequency, geographic extent, duration, reversibility, and/or context as to cause a change in a VC that will alter its status or integrity beyond an acceptable level. The establishment of the criteria was based on professional judgment but was transparent and repeatable. Ratings are presented in summary tables of residual environmental effects.

Scientific uncertainty-associated effects predictions may be introduced when considering the accuracy and availability of baseline information, the accuracy of environmental effects predictions, and the expected level of effectiveness of mitigation measures. Confidence level and likelihood have been assessed using qualitative approaches (or quantitative as applicable) and professional judgment. The sources and nature of uncertainty are provided, including how any identified uncertainty may affect conclusions from the effects assessment. The level of confidence and likelihood of each prediction of significance are presented in summary tables using qualitative terms.

4.2 Predicted Environmental Effects of the Undertaking

A comprehensive analysis of the predicted environmental effects of the proposed Project according to each of the VCs is included in the following sections. This information is presented systematically in tabular form for enhanced clarity and accessibility. In addition, a detailed rationale for the presented

information is provided in narrative form to offer comprehensive context and justification. A detailed discussion and evaluation of adverse residual effects is provided, considering the mitigations presented in Section 4.4. A summary of significant residual effects is presented in Chapter 5. This analysis of environmental effects of the undertaking does not include environmental benefits associated with decarbonization as climate change mitigation.

4.2.1 Atmospheric Environment

Atmospheric Environment has been included as a VC because atmospheric conditions may be affected by construction, operation and maintenance, and decommissioning of the Project. There are five aspects through which the Atmospheric Environment VC and the Project interact: air quality, greenhouse gases, light, sound quality (noise), and vibration. While climate change is not considered a key interaction, the greenhouse gas indicator can be used as a proxy to illustrate potential interactions with climate change. Emitted GHGs trap and adsorb heat, thereby resulting in the greenhouse effect, the main driver of climate change.

Generally, Project activities across all phases will generate emissions to the atmospheric environment. Such emissions can have adverse effects on vegetation, wildlife and wildlife habitat, human health and wellbeing, and visual aesthetic of the Project Area. Table 4.2.1-1 lists Key Indicators (KIs) applicable to the Atmospheric Environment VC, as well as geographic scope and applicable measurable parameters for each KI.

Table 4.2.1-1 Scope & Measurable Parameters of Key Indicators: Atmospheric Environment.

Key Indicator	Scope	Measurable Parameters
Air Quality	RAA	Air contaminant concentrations (regulated standards)
Greenhouse Gases	Beyond RAA	GHG emissions in tonnes of CO_2e
Light	LAA	Illuminance
Sound Quality	LAA/RAA	Percent highly annoyed (%HA), indoor nighttime noise (in A-weighted decibels), low frequency noise (LFN)
Vibration	Project Area	Peak particle velocity (PPV)

4.2.1.1 Assessment Criteria

An overview of atmospheric environment effects assessment criteria is presented in Table 4.1.7-1 in Section 4.1.7. Criteria include context, reversibility, frequency, duration, geographic extent, and magnitude.

4.2.1.2 Existing Knowledge

Section 3.1.1 (Atmospheric Environment) summarizes existing knowledge of the Atmospheric Environment, while Appendix A (Atmospheric Environment Baseline) provides a more detailed description of air and sound quality (noise) based on desktop exercise and field studies.

4.2.1.3 Definition of Significance

For the Atmospheric Environment VC, a Significant Effect is defined as:

- Having a high magnitude; or
- A medium magnitude and characterized by either:
    - An extended duration affecting a geographic area that extends beyond the Project Area; or
    - A low level of confidence in the prediction.

Where a significant effect has been predicted, this evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.1.4 Potential Project-Environment Interactions

Potential interactions with identified KIs of the Atmospheric Environment VC are summarized in Table 4.2.1-2.

Table 4.2.1-2 Potential Project Environment Interactions Matrix: Atmospheric Environment.

Project Component and Activity Description	Key Indicators: Atmospheric Environment				
	Air Quality	GHGs	Light	Sound Quality	Vibration
Construction Phase					
Site Preparation	X	X	X	X	X
Roads	X	X	X	X	X
Staging and Laydown	X	X	X	X	X
Material Transport	X	X	X	X	X
Wind Turbine Foundations	X	X	X	X	X
Electrical Infrastructure	X	X	X	X	X
Wind Turbine Installation	X	X	X	X	X
Electrolyser Plant	X	X	X	X	X
Ammonia Plant	X	X	X	X	X
Ammonia Storage/Transfer	X	X	X	X	X
Flares	X	X	X	X	X
Admin Buildings	X	X	X	X	X
Operation and Maintenance Phase					
Wind Turbine Operation			X	X	X
Wind Turbine Maintenance	X	X	X	X	X
Electrical Infrastructure			X	X	
Venting and Flaring	X	X	X	X	
Road Maintenance	X	X	X	X	
Plant Operations	X	X	X	X	
Ammonia Handling	X	X	X	X	
Decommissioning Phase					
Electrical Infrastructure	X	X	X	X	X
Wind Turbine Removal	X	X	X	X	X
Building Removal	X	X	X	X	X
Plant Removal	X	X	X	X	X
Terrain Reclamation	X	X	X	X	X
Unplanned Events					
Spills and releases	X	X			
Flaring and venting	X	X	X	X	X
Fire and explosion	X	X	X	X	X
Traffic accident	X	X	X	X	X
Wind Turbine collapse				X	X
Water supply failure					
Wildlife emergency					
Human hazard or injury					

NOTES
X**:** Potential interactions that might cause an effect.
Blanks indicate that interactions between the Project and the VEC are not expected.

Air Quality

All aspects of the Construction Phase will result in air contaminant releases, namely due to the fact that fossil fuel-fired equipment (mobile and stationary) is required for construction. Additionally, fugitive emissions of air pollutants will be generated as a result of blasting, vehicular traffic on unpaved roads, wind erosion of exposed surfaces (e.g., stockpiles, laydown areas), material handling, and Project component transport. During Project operation and maintenance, air pollutant releases will be reduced significantly, and will arise from mobile equipment, flare pilot operations (continuously lit pilot), and marine transport of ammonia product. Additionally, periodic releases of air contaminants will occur during the operation phase; from use of an emergency generator in the event of a power loss to flaring as required at the plant. An Energy and Emissions Study (Appendix H) was developed to quantify air pollutant releases during construction and operation phases, and to predict ground level concentrations during Project operation. A summary of air pollutant release estimates for Project construction and operation is provided in Table 4.2.1-3.

Emissions in Table 4.2.1-3 do not consider background concentrations and are thus not an accurate depiction of ground level concentrations. Therefore, ground level concentrations were predicted relative to background concentrations using the CALPUFF dispersion modeling system to assess cumulative effects of the Project in consideration of ambient air quality, and thereby other air contaminant sources, in the LAA. Dispersion modeling used background concentrations developed in the Atmospheric Environment Baseline Study (Appendix A), whereby concentrations of air contaminants were processed to statistical metrics required by the CAAQS. Background concentrations were only available for SO_2, NO_2, CO, $PM_{2.5}$ and PM_{10} as they were developed from monitoring data. As such, it was assumed that background concentrations of all other air contaminants of interest were negligible. The air dispersion modeling approach, including inputs such as emission rates, source locations, sensitive receptor locations, and results are detailed in the Energy and Emissions Study (Appendix H). Predicted plus background concentrations were compared to NL AQS and CAAQS. Daily, hourly, and annual atmospheric discharge rates (otherwise known as emission rates) used in the CALPUFF dispersion modeling system are provided in Table 4.2.1-4. Air contaminants for which federal and provincial guidelines do not exist were omitted from Table 4.2.1-4 and provided in Appendix H (Energy and Emissions Study).

Table 4.2.1-3 Annual Air Release Estimate Summary.

Phase	Source	Annual Air Releases (tonnes)								
		CO	SO_2	NOx	VOCs (total)	TSP	PM_{10}	$PM_{2.5}$	Propane	NH_3
Construction	Blasting	4.250	0.125	1.000		0.123	0.064	0.004		
	Stockpile Erosion					1.568	0.784	0.118		
	Aggregate Handling and Transfers					2.494	1.180	0.179		
	Crushing and Screening					2.126	0.794	0.131		
	Laydown Areas					5.754	2.877	0.432		
	Unpaved Roads					2.254	0.645	0.065		
	Mobile Equipment	114.204	39.749	13.842		0.426				
	Stationary Combustion	2.852	0.871	13.238	1.081	0.931	0.931	0.931		
	Total Annual Construction	121.306	40.745	28.080	1.081	15.676	7.275	1.860		
Operation	Emergency Generator	4.287	0.509	16.138	0.413	0.313	0.250	0.242		
	Flare Stacks	0.767		0.283		0.031			1.299	0.667
	Marine Transport	0.248	0.106	2.171			0.040	0.037		
	Mobile Equipment	1.885	0.676	0.218		0.007				
	Total Annual Operation	7.187	1.291	18.810	0.413	0.351	0.290	0.279	1.299	0.667

Table 4.2.1-4 Atmospheric Discharge Rates: Project Operation.

Air Contaminant	Emission Rate (g/s)					
	Hourly		Daily		Annual	
	Flares	Emergency Generator	Flares	Emergency Generator	Flares	Emergency Generator
CO	1.22E-02	12.403	1.22E-02	12.4033129	1.22E-02	1.359E-01
SO_2		1.474		1.47380541		1.615E-02
NOx	1.51E-03 [1] / 26.2 [2]	46.695	1.51E-03 [1] / 1.09 [2]	46.694825	1.51E-03 [1] / 2.99E-03 [2]	5.117E-01
TSP	4.99E-01	9.047E-01	4.99E-01	9.047E-01	4.99E-01	9.915E-03
PM_{10}		7.238E-01		7.238E-01		7.932E-03
$PM_{2.5}$		6.990E-01		6.990E-01		7.660E-03
NH_3	92.6 [2]		3.86 [2]		1.06E-02 [2]	
[1] continuous propane pilots; [2] intermittent release of NH_3						

Based on estimated atmospheric discharge rates in Table 4.2.1-1, maximum ground level concentrations (i.e., background plus predicted) of air contaminants outside of the property boundary of the Argentia Green Fuels Facility are not predicted to exceed applicable guidelines (e.g., NL AQS, CAAQS), where available. Furthermore, guideline exceedances are not anticipated at identified sensitive receptors in the RAA. As detailed in the Energy and Emissions Study (Appendix H), assumptions were made to develop air release estimates that were carried over into air dispersion modeling. As such, atmospheric discharges, and hence maximum predicted ground level concentrations because of operation of the Argentia Green Fuels Facility, are considered conservative.

Air releases were not estimated for Project decommissioning or for Unplanned Events. Project decommissioning activities are anticipated to generate comparable, if not lower, levels of air releases to Project construction. Unplanned Events (e.g., flaring, fire and explosion) may generate air releases, but at levels lower than those generated during other Project phases.

Greenhouse Gas Emissions

Greenhouse gas emissions will arise during Project construction, operation and maintenance, and decommissioning. Due to the nature of Project activities, GHG emissions will be predominantly CO_2 with smaller quantities of CH_4 and N_2O. During construction, Scope 1 (direct) emissions will be generated from blasting and fossil fuel combustion in mobile and stationary equipment. Scope 3 (indirect) emissions will be generated because of marine transport of supplies (e.g., turbine blades, nacelles, tower segments) for Project construction. During operation and maintenance, Scope 1 emissions (direct) will arise from the continuously lit pilots in flare stacks as well as fossil fuel combustion in mobile and stationary combustion. Additionally, indirect emissions will be generated from electricity consumption (Scope 2) and marine transport of product to the global market (Scope 3) during operation and maintenance. GHG emissions for Project construction and operation and maintenance were estimated using preliminary engineering details, publicly available emission factors, and good practice guidelines. Annual Project construction and operation emission estimates are presented in Table 4.2.1-5. Calculation methodologies, inputs and assumptions are detailed in Appendix H (Energy and Emissions Study).

GHG emissions were not estimated for Project decommissioning or for Unplanned Events. Project decommissioning activities are anticipated to generate comparable, if not lower, levels of GHG emissions compared to Project construction. Unplanned Events (e.g., flaring, fire and explosion) may generate GHG emissions, but at levels lower than those generated during other Project phases.

Table 4.2.1-5 Annual GHG Emissions Estimate Summary.

Phase	Source	Annual GHG Emissions (t CO_2e)			
		Scope 1 (Direct)	Scope 2 (Indirect)	Scope 3 (Other Indirect)	Total Scope 1 + Scope 2
Construction	Blasting	24			24
	Stationary Combustion	1,531			1,531
	Mobile Equipment	6,426			6,426
	Marine Transport of Supplies			172,616	0
	Total Annual Construction [1]	7,981	0	172,616	7,981
Operation	Mobile Equipment	48			48
	Flare Stacks	228			101
	Emergency Generator	826			860
	Marine Transport of Product			19,587	0
	Electricity Consumption		1,489		1,489
	Total Annual Operation [2]	1,102	1,489	19,587	2,591

NOTES
[1] Project construction scheduled to occur over a two-year period, marine transport of supplies to occur in a single calendar year.
[2] Operational lifetime of the Project is 30 years.

Overall, Project related GHG emissions are projected to be generated at relatively low quantities, and thus the Project is not anticipated to measurably change atmospheric levels of GHGs. Project GHG emissions are projected to account for less than 1% of provincial GHG emissions when considering 2022 reporting data (Newfoundland and Labrador Department of Environment and Climate Change, n.d.). GHG emissions generated during the operation and maintenance phase will be generated at relatively low quantities and may be reduced with the integration of greener technologies (e.g., electric vehicles) over the lifetime of the Project. This Project, which aims to support the dissolution of fossil fuel reliance by offering a renewable energy source, is being proposed/developed in an opportune time when green technologies are becoming more commonplace and encouraged by regulatory authorities as part of Canada's 2023 Emissions Reduction Plan.

Light

Artificial lighting will be required for safe and efficient operation during all Project phases (i.e., construction, operation and maintenance, decommissioning). During construction and decommissioning, Project lighting will be temporary; limited to mobile equipment (e.g., heavy equipment, light duty vehicles, mobile floodlights) and will be removed when activity in a particular location is complete. During operation and maintenance, permanent Project lighting will be installed on buildings, wind turbines, and access roads. Due to the industrial nature of the POA and thus the location of the Argentina Green Fuels Facility, there will be limited potential interactions resulting from ambient light levels. The Argentia Wind Facility, however, is sited in a more natural area, rendering it more susceptible to potential interactions with ambient light levels. Unplanned Events, including flaring, fire / explosion, and traffic accidents, could also diminish ambient light levels temporarily.

Project lighting design has not been finalized; thus, a qualitative impact assessment (Appendix I) was conducted using best judgement of the study team, and in consideration of regulations, codes and guidance set forth by the Institute of Lighting Engineers (ILE) and Transport Canada, as well as provincial regulations, as required (The Institution of Lighting Engineers, 2005; Standard 621 - Obstruction Marking and Lighting - Canadian Aviation Regulations (SOR/96-433), 2021). Final Project lighting design will consider such regulations, codes, and guidance to negate generation of Project-related obtrusive lighting. Following decommissioning, ambient light levels are anticipated to return to pre-Project conditions.

The Light Impact Assessment (Appendix I) evaluated influence of Project lighting on sensitive receptors (i.e., the nearest residential receptors to Project infrastructure). As a conservative measure, it is assumed that 50% of incident light will not reach sensitive receptors due to directionality and line of sight obstructions, namely thick tree cover in the area. Based on surrounding woodland and topographic features, the true quantity of light blocked will be much higher (i.e., greater than 90%), especially when foliage is in full bloom. Total illuminance, the amount of light that covers a surface, for Project operation and maintenance is provided in Table 4.2.1-6. Calculations of total illuminance were performed for a scenario where all equipment is operated at the same time and at the closest sensitive receptor, and for pre- and post-curfew conditions (The Institution of Lighting Engineers, 2005). Methodology used to assess lighting effects on sensitive receptors is further detailed in Appendix I.

Table 4.2.1-6 Illuminance at Receptors: Project Operation & Maintenance.

Period	Illuminance (lux)		ILE Guidance Limit (lux)
	Argentia Green Fuels Facility	Argentia Wind Facility	
Pre-curfew (7:00 – 22:59)	2.42E-02	5.37E-02	5
Post-curfew (23:00 – 06:59)	2.42E-02	5.37E-02	1
ILE = Institution of Lighting Engineers			

Pre- and post-curfew illuminance represent 1.07% and 5.37% of guidance limits, respectively. For context, the post-curfew limit of 1 lux is equivalent to moonlight. Considering this, light effects for the duration of Project operation and maintenance will be two orders of magnitude less than the illuminance of the moon.

Sound Quality

The Project will generate noise emissions during all phases (i.e., construction, operation and maintenance, and decommissioning), thereby resulting in potential diminishment of sound quality. Construction Phase noise, while temporary, will be generated during activities such as earthmoving, pile driving, blasting, electrical infrastructure (e.g., transmission line) installation, and mobile equipment operation. During Project construction, potential interactions that may diminish sound quality will be limited to when noise generating activities occur. The Project will generate considerable noise emissions during the operation and maintenance phase. The Argentia Wind Facility will generate noise as a result

of wind turbine operation; noise emissions from wind turbines generally increase with increasing wind speed. Argentia Green Fuels Facility infrastructure (e.g., compressors, generators, flares) will also generate noise emissions during Project operation. Noise-generating infrastructure is permanent; thus, noise emissions may affect sound quality in the Local Assessment Area (LAA), particularly at locations closest to permanent infrastructure. Noise generated during decommissioning activities is anticipated to be less than construction and Operation and Maintenance Phases. Similar to the Construction Phase, potential interactions that may diminish sound quality will be limited and temporary; ambient sound quality is anticipated to return to pre-Project conditions when Decommissioning is complete. Unplanned Events (e.g., flaring and venting, fire and explosion, traffic accident, wind turbine collapse) will interact with ambient sound quality in a similar matter to the construction and decommissioning phases; noise emissions will be temporary and localized to the location of the unplanned event.

A conservative approach was used to evaluate operation and maintenance phase noise emissions in the Noise and Vibration Study (Appendix J); it was assumed that the largest potential model will operate at the maximum wind speed at the Argentia Wind Facility, while it was assumed that all infrastructure at the Argentia Green Fuels Facility will operate outdoors. The percent highly annoyed (%HA) is a measurable parameter that was assessed in the study, as well as indoor nighttime noise and low frequency noise (LFN). %HA is the percentage of the exposed population that would be annoyed by a particular day-night average sound pressure level l (L_{dn}). LFN is noise with frequency content in the range of 16 to 200 hertz (Hz). %HA was assessed for two Project construction scenarios: (1) wind turbine and Argentia Green Fuels Facility construction; and (2) electrical infrastructure and road construction. Additionally, %HA was assessed for Project operation and maintenance. Indoor nighttime noise and LFN were assessed for Project operation and maintenance only (i.e., construction and decommissioning were not considered). The study considered receptors with the greatest potential exposure to noise sources due to proximity and direct line of sight exposure. Receptor locations were selected in areas where people normally live, work, and take part in recreation; it did not consider workforce of a company. While many more receptor locations exist in the LAA, selected receptor locations are assumed to be representative of Project interactions with sound quality. Results of the %HA assessment in the 'Noise and Vibration Study' are summarized in Table 4.2.1-7.

Table 4.2.1-7 Noise Impact Study Results: %HA Assessment.

Project Component	Baseline		Project Predicted L_{dn} (dBA)	Total (Baseline plus Project)		Δ %HA (Between Total and Baseline)
	L_{dn} (dBA)	%HA		L_{dn} (dBA)	%HA	
Construction Scenario 1 [1]	43 - 61	0.8 - 8.7	21 - 60	43 - 61	0.9 - 8.8	0.0 - 6.0
Construction Scenario 2 [2]			20 - 70	43 - 70	0.8 - 23.2	0.0 - 20.9
Operation and Maintenance			20 - 51	43 - 61	0.9 - 8.8	0.0 - 1.2

NOTES
Δ %HA = change in %HA between total and baseline
[1] Construction of wind turbines and Argentia Green Fuels Facility
[2] Construction of electrical infrastructure and roads

Health Canada recommends that the maximum change in %HA due to Project activities be no more than 6.5% (Health Canada, 2017). Per Table 4.1.2-7, it was predicted that Construction Scenario 2 (construction of electrical infrastructure and roads) will not comply with the 6.5% limit. This instance of non-compliance will occur at a single receptor – %HA at all other receptors were predicted to comply with limits set forth by Health Canada.

In addition to the %HA assessment, an indoor nighttime noise assessment was conducted for Project operation and maintenance. As a conservative measure, 15 dBA was subtracted from outdoor Project noise at the plane of the dwelling window of sensitive receptors to obtain predicted indoor noise levels (Health Canada, 2017). The 15 dBA metric considers an outdoor-to-indoor transmission loss with windows at least partially open. Per Health Canada guidance, outdoor sound level targets for sleep disturbance are 45 and 57 dBA for partially open and fully closed windows, respectively. As a conservative measure, the sleep disturbance target was set to 45 dBA. The predicted indoor nighttime levels during Project operation and maintenance ranged from 0 to 29 dBA and are thus in compliance with the 45 dBA sleep disturbance target.

Additionally, as discussed in Section 2.4.2.1, the Project has taken into consideration a variety of turbine sizes, including a 6.8 MW and 7.2 MW wind turbine. A 6.8 MW wind turbine is the current preferred size; however, noise modelling studies were undertaken prior to this final selection. As such, modelling was completed with 7.2 MW size wind turbine to be conservative. The Argentia Wind Facility with 7.2 MW wind turbines was assessed for the potential to emit high LFN. The difference between A- and C-weighted sound pressure levels were calculated and found to be 12 dB, which is much lower than the 20 dB limit. As such, LFN is not anticipated to be an issue at surrounding receptors during Project operation and maintenance.

Vibration

The Project will generate vibrations during all phases (i.e., construction, operation and maintenance, and decommissioning) of the Project. During Project construction, vibrations will arise from activities such as blasting, earthmoving, pile driving, and vehicular traffic. Vibration emissions during the construction period will frequently occur but will be transient due to the nature of activities and construction schedule. Sources of vibration emissions during Project operation and maintenance will be much less than construction. Since sources of vibration at the Argentia Wind Facility and Argentia Green Fuels Facility will be set back from sensitive areas by 600 m, Project interactions with baseline vibration levels are not anticipated. Similar to the Operation and Maintenance Phase, Project decommissioning and Unplanned Events will also have fewer vibration sources than construction. Due to setbacks and the transient nature of decommissioning activities, interactions with baseline vibration levels are unlikely. Following decommissioning, vibration levels are anticipated to return to pre-Project conditions.

4.2.1.5 Mitigation Measures

Standard mitigation and enhancement measures applicable to the Atmospheric Environment VC are provided by phase in Table 4.2.1-8. Project-specific plans (e.g., the Explosives and Blasting Management Plan) will also include mitigation measures that are applicable to this VC.

Table 4.2.1-8 Mitigation and Enhancement Measures: Atmospheric Environment.

Atmospheric Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
Construction, Decommissioning and Rehabilitation	Air Quality	Project activities may diminish air quality.	• Where feasible, use mobile equipment with Tier 4 engines. • Maintain vehicles and equipment in good working order, ensuring that mufflers are functional. • Implement control measures such as road watering, application of approved chemical suppressants, or physical barriers, where appropriate, to reduce fugitive dust generation on exposed surfaces (e.g., unpaved roads, laydown areas, stockpiles). • The blasting contractor will develop an Explosives and Blasting Management Plan, which will include design measures to reduce dust generation. • Implement and maintain speed limits and, where necessary, speed bumps to limit dust generation. • Vehicles and equipment are to be turned off when left stationary for extended periods. The idling of engines will be avoided whenever possible. • Cover stockpiled material where feasible, to reduce fugitive dust generation.
Operation and Maintenance	Air Quality	Project activities may diminish air quality.	• Where feasible, use mobile equipment with Tier 4 engines. • Maintain vehicles and equipment in good working order, ensuring that mufflers are functional. • Implement control measures such as road watering, application of approved chemical suppressants, or physical barriers, where appropriate, to reduce fugitive dust generation on exposed surfaces (e.g., unpaved roads, laydown areas, stockpiles). • Vehicles and equipment are to be turned off when left stationary for extended periods. The idling of engines will be avoided whenever possible. • Implement control measures such that emissions generated from flare stacks are reduced.
Construction, Operation and Maintenance, Decommissioning and Rehabilitation	GHG Emissions	Project activities may increase atmospheric GHG levels.	• Where feasible, use mobile equipment with Tier 4 engines. • Maintain vehicles and equipment in good working order, ensuring that mufflers are functional. • Vehicles and equipment are to be turned off when left stationary for extended periods. The idling of engines will be avoided whenever possible.
Construction, Decommissioning and Rehabilitation	Light	Project lighting may diminish ambient lighting levels.	• Limit lighting to that which is necessary for safe and efficient Project activity.

Atmospheric Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
			• Where reasonable and feasible, construction should be carried out during standard daytime working hours. • Should nighttime work be required, lighting to be limited to what is necessary for safety and efficiency.
Operation and Maintenance	Light	Project lighting may diminish ambient lighting levels.	• Limit permanent lighting to that which is necessary to enable safe and efficient Project activity. • Install downward-facing lights on buildings, turbine bases and access roads. Where possible and permitted, equip downward-facing lighting with motion and heat sensors. • Set turbine and meteorological tower lighting levels to the minimum allowed by Transport Canada for aeronautical safety. • Use white or red strobe lights with the minimum allowable intensity and flashes per minute as required by Transport Canada.
Construction, Decommissioning and Rehabilitation	Sound Quality	Project activities may diminish sound quality.	• Develop and implement a Construction Noise and Vibration Monitoring Plan. • The blasting contractor will develop an Explosives and Blasting Management Plan, which will include design measures to reduce shock or instantaneous peak noise levels. • Incorporate blast design features (e.g., hole spacing, explosive charge weight, time delay) to meet required noise limits. • Where reasonable and feasible, construction should be carried out during standard daytime working hours. • Schedule high noise activities during normal working hours, and plan to complete such activities by 11:00 pm. • Where feasible, use quieter equipment, using only the necessary sized and powered equipment for Project activities. • Shield sensitive receptors from noisy activities. • Enclose or shield stationary noise sources. • Maintain vehicles and equipment in good working order, ensuring that mufflers are functional.

Atmospheric Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
Operation and Maintenance	Sound Quality	Project activities may diminish sound quality.	• Schedule high noise activities during normal working hours, and plan to complete such activities by 11:00 pm. • Where feasible, use quieter equipment, using only the necessary sized and powered equipment for Project activities. • Enclose or shield stationary noise sources. • Maintain vehicles and equipment in good working order, ensuring that mufflers are functional. • Maximize offset distance between the Argentia Green Fuels Facility and adjacent receptors. • Maintain a minimum setback distance of 600 m between the Argentia Wind Facility and sensitive areas.
Construction	Vibration	Project activities may increase vibration levels.	• Schedule activities during normal working hours, and plan to complete such activities by 11:00 pm. • Where feasible, use quieter equipment, using only the necessary sized and powered equipment for Project activities.
Operation and Maintenance	Vibration	Project activities may increase vibration levels.	• Maximize offset distance between the Argentia Green Fuels Facility and adjacent receptors. • Maintain a minimum setback distance of 600 m between the Argentia Wind Facility wind turbines and sensitive receptors (e.g., occupied residences).

4.2.1.6 Conclusion

Table 4.2.1-9 provides a summary of predicted adverse residual effects on the Atmospheric Environment VC.

Table 4.2.1-9 Potential Environmental Effect of the Undertaking: Atmospheric Environment VC.

Atmospheric Environment							
Project Phase	Key Indicator	Magnitude	Frequency	Extent	Duration	Reversibility	Context*
Construction	Air Quality	3	3	4	5	1	1,3
	GHGs	2	3	5	5	3	1,3
	Light	2	2	3	5	1	1,3
	Sound Quality	2	3	3	5	1	1,3
	Vibration	1	2	3	5	1	1,3
Operation and Maintenance	Air Quality	3	5	4	5	1	1,3
	GHGs	2	5	5	5	3	1,3
	Light	2	4	3	5	1	1,3
	Sound Quality	2	5	3	5	1	1,3
	Vibration	1	5	2	5	1	1,3
	Air Quality	3	3	4	5	1	1,3

Decommissioning	GHGs	2	3	5	5	3	1,3
	Light	2	2	3	5	1	1,3
	Sound Quality	2	3	3	5	1	1,3
	Vibration	1	2	3	5	1	1,3
Unplanned Events	Air Quality	2	1	3	2	1	1,3
	GHGs	2	1	4	2	3	1,3
	Light	1	1	3	1	1	1,3
	Sound Quality	1	1	3	1	1	1,3
	Vibration	1	1	2	1	1	1,3
*Context may be assigned more than one value.							

Table 4.2.1-10 Significance of Potential Residual Environmental Effects of the Project: Atmospheric Environment VC.

Project Phase	**Key Indicator**	**Significance of Predicted Residual Environmental Effects**		**Likelihood***	
		Level of Significance	Level of Confidence	Probability	Scientific Certainty
Construction	Air Quality	NS	3		
	GHGs	NS	3		
	Light	NS	3		
	Sound Quality	NS	3		
	Vibration	NS	3		
Operation and Maintenance	Air Quality	NS	3		
	GHGs	NS	3		
	Light	NS	3		
	Sound Quality	NS	3		
	Vibration	NS	3		
Decommissioning	Air Quality	NS	3		
	GHGs	NS	3		
	Light	NS	3		
	Sound Quality	NS	3		
	Vibration	NS	3		
Unplanned Events	Air Quality	NS	3		
	GHGs	NS	3		
	Light	NS	3		
	Sound Quality	NS	3		
	Vibration	NS	3		

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.2 Aquatic Environment

The Aquatic Environment has been included as a VC because aquatic habitat may be affected by all Project phases as well as Unplanned Events. There are eight aspects through which the Aquatic Environment VC and the Project interact: Surface Water Resources, Ground Water Resources, Freshwater Environment (Fish and Fish Habitat), Marine Environment (Fish and Fish Habitat), Fisheries

and Aquaculture, Species at Risk, Habitats of Conservation Concern, and Marine Biosecurity. Some aspects of the Aquatic Environment, such as surface water, provide a resource that can be utilized by the Project (along with other users). The Aquatic Environment also provides a pathway that links Project activities/elements to other environmental receptors. Aquatic resources such as fish and fish habitat interact with the Project and function as receptors. The Project Area is in Placentia Bay which is utilized by several species at risk and contains many biologically important habitats of conservation interest. Marine shipping associated with the Project may provide interactions with aspects of the marine environment and increase opportunity for introduction of aquatic invasive species (AIS).

The spatial boundaries for the assessment of potential Aquatic Environment effects include the Project Area, LAA and RAA as defined in Section 2.1.

The temporal boundaries for this assessment include three major Project phases: Construction (29 months), Operation (nominally 30 years), and Decommissioning (one year). Temporal boundaries therefore extend from 2025 to 2058.

Table 4.2.2-1 lists the KIs that apply to the Aquatic Environment VC, summarizes the geographic scope for each KI, as well as listing the applicable measurable parameters.

Table 4.2.2-1 Scope & Measurable Parameters of Key Indicators: Aquatic Environment.

Key Indicator	Scope	Measurable Parameters
Surface Water Resources	LAA	Water quantity (i.e., changes in mean annual flow and runoff, Protected Public Water Supply Area (PPWSA) capacity/usage), Water quality (i.e., concentration of chemical parameters compared to applicable guidelines),
Ground Water Resources	Project Area	Water quality (i.e., concentration of chemical parameters compared to applicable guidelines). Water quantity/level of utilization (i.e., reduction in baseflow (%) in surface water, change in well yield (L/min) for existing well users. Movement patterns, recharge zones.
Freshwater Environment (Fish and Fish Habitat)	LAA	Change in habitat quantity (area (m^2 or hectares) of habitat. Change in habitat quality (e.g., altered water quality, Total Suspended Solids (TSS); dissolved oxygen; water temperature; pH; metals; nutrients). Change in fish health and survival (e.g., abundance/biomass, community structure, growth and survival).
Marine Environment (Fish and Fish Habitat)	RAA	Change in habitat quality (i.e., concentration of chemical parameters compared to applicable guidelines at wastewater receiving locations, circulation patterns). Change in habitat quantity (i.e., area m^2 or hectares of habitat). Change in marine species health and survival (e.g., species presence/absence, abundance/biomass, community structure, growth and survival).
Fisheries and Aquaculture	RAA	Duration and extent of displacement of fishers. Change in harvest rates and/or production. Loss of income to fishers. Effects of AIS introductions on aquaculture.
Species at Risk	RAA	Designation under the **Species at Risk Act** (SARA), **Newfoundland and Labrador's Endangered Species Act** (NL ESA), and International Union for Conservation of Nature Red List

Key Indicator	Scope	Measurable Parameters
		of Threatened Species (IUCN Red List). Change in habitat quality, habitat quality and fish health and survival for American eel.
Habitats of Conservation Concern	RAA	Change in habitat area (m^2, hectares) or quality in habitats of conservation concern.
Marine Biosecurity	RAA	Records of new AIS or expansion of range of existing AIS. Effects and impacts of AIS on other marine species and habitats. Impact of AIS on aquaculture operations.

4.2.2.1 Assessment Criteria

An overview of aquatic environment effects assessment criteria is presented in Table 4.1.7-1 in Section 4.1.7. Criteria include magnitude, frequency, geographic extent, duration, reversibility, and context.

Significant negative residual environmental effects are those considered to be of sufficient magnitude, duration, frequency, and geographic extent to cause a change in the Key Indicator that will alter its status or integrity beyond an acceptable level. Establishment of the criteria values is based on professional judgement; however, they are transparent and repeatable. The determination includes allowance for application of the mitigation measures identified (and committed to) in this Registration and their known/proven effectiveness.

4.2.2.2 Existing Knowledge

Section 3.1.2 provides a summary of existing knowledge of the Aquatic Environment, while Appendix B-1 (Aquatic Environment Baseline) provides a more detailed description based on dedicated field surveys. Appendix B-2 (Effluent Dispersion Modelling) provides an assessment of how the Project effluent will interact with the marine environment. Appendix C provides a source water hydrology analysis to evaluate water withdrawal potential to supply the Project. Placentia Bay is a very well studied region of Newfoundland and there is a wealth of information on the aquatic environment to inform the effects assessment of the Marine Environment RAA. In general, there is an adequate knowledge of the key indicators upon which to base effects predictions.

4.2.2.3 Definition of Significance

For the Aquatic Environment VC, a Significant Effect is defined as:

- Having a high magnitude; or
- A medium magnitude and characterized by either:
  - An extended duration affecting a geographic area that extends beyond the Project Area; or
  - A low level of confidence in the prediction.

Where a significant effect has been predicted, this evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.2.4 Potential Project-Environment Interactions

Potential interactions with identified Key Indicators for the Aquatic Environment VC are summarized in Table 4.2.2-2. Certain KIs (e.g., Fisheries and Aquaculture, Habitats of Conservation Concern, Marine Biosecurity) will only have potential interactions in relation to Project related shipping activity in the context of the RAA.

Table 4.2.2-2 Potential Project Environment Interactions Matrix: Aquatic Environment.

Key Indicators: Aquatic Environment								
Project Component and Activity Description	Surface Water Resources	Ground Water Resources	Freshwater Environment	Marine Environment	Fisheries and Aquaculture	Species at Risk	Habitats of Conservation Concern	Marine Biosecurity
Construction Phase								
Site Preparation	X	X	X	X				
Roads	X	X	X			X		
Staging and Laydown	X		X			X		
Material Transport	X			X	X	X	X	X
Wind Turbine Foundations	X	X	X			X		
Electrical Infrastructure	X		X			X		
Wind Turbine Installation	X		X			X		
Electrolyser Plant	X	X		X	X			
Ammonia Plant	X	X	X	X	X			
Ammonia Storage/Transfer	X	X	X	X	X	X	X	
Flares				X				
Admin Buildings	X	X	X					
Operation and Maintenance Phase								
Wind Turbine Operation								
Wind Turbine Maintenance	X		X					
Electrical Infrastructure								
Venting and Flaring				X				
Road Maintenance	X		X					
Plant Operations	X			X				
Ammonia Handling				X	X	X	X	X
Decommissioning Phase								
Electrical Infrastructure	X		X			X		
Wind Turbine Removal	X		X			X		
Building Removal	X			X				
Plant Removal	X			X				

Key Indicators: Aquatic Environment								
Project Component and Activity Description	Surface Water Resources	Ground Water Resources	Freshwater Environment	Marine Environment	Fisheries and Aquaculture	Species at Risk	Habitats of Conservation Concern	Marine Biosecurity
Terrain Reclamation	X		X			X		
Unplanned Events								
Spills and releases	X	X	X	X	X	X	X	
Flaring and venting				X				
Fire, explosion	X	X		X				
Traffic accident	X		X	X				
Wind Turbine collapse	X		X					
Water supply failure	X		X					
Wildlife emergency								
Human hazard or injury								
NOTES X: Potential interactions that might cause an effect. Blanks indicate that interactions between the Project and the VC are not expected.								

Surface Water Resources

Surface water is likely to interact with the Project through several mechanisms, most of which will occur during Construction. The construction of the Project Interconnect and Green Fuels Project Gen-Tie Lines will have a minimal footprint on the aquatic environment due to the elevation of the electric lines. Therefore, the footprint associated with the presence of transmission lines on the aquatic environment will be limited to the grounded base for the support tower. However, there may also be transient effects from fording of streams during construction of transmission lines.

The Project will also require freshwater for operation of the Hydrogen and Ammonia plants, domestic consumption and for fire fighting. An evaluation of the available Protected Public Water Supply has indicated that there is an adequate supply available to meet the needs of the municipality, as well as Port of Argentia and Argentia Renewables. In addition to the planned water extraction during Operations, there is a limited possibility during Construction for other interactions, mainly related to the construction of access roads and turbine generator foundations.

The potential changes in water quality that can result from interactions with the Project are related to work in or near water, clearing and grubbing of vegetation, excavating and grading, construction and installation of stream crossing structures and fording, and introduction of particulate material (silt) from erosion and sedimentation. The operation of Construction equipment, as well as transport vehicles can alter water quality through the introduction of hydrocarbons (fuel, lubricants) solvents and salts. With the

application of proven mitigation measures, the Project may result in minor, temporary reductions in surface water quality that can be expected to occur infrequently during the Construction Phase.

Note, during Operations, there will be limited potential interactions that could alter or diminish freshwater quality. Effluent discharges will be to the marine environment and in compliance with regulatory limits. Operation and maintenance of the wind farms will require use and maintenance of access roads that could result in suspended sediments being carried into adjacent waterbodies.

Decommissioning activities will be similar to Construction, with a similar suite of potential interactions. Transportation along the access road roads during decommissioning, rehabilitation and closure could result in suspended sediments from the roadbed being carried into adjacent waterbodies.

Several scenarios associated with Unplanned Events could introduce contaminants that have the potential to alter water quality, e.g., spills/releases (hydrocarbons), fires/explosions (retardants).

Extensive regulatory guidance and limits have been established for water quality parameters, including for drinking water suitability for consumption, suitability for protection of aquatic life, and acceptability for discharge (water and sewer outfalls). Similarly, measures have been well developed for prevention and mitigation associated with construction activities.

Groundwater Resources

Argentia Renewables does not intend to access or utilize groundwater resources; therefore, interactions will be restricted to a limited number of Project activities, mostly during the Construction Phase. The potential interactions with groundwater could result indirectly from excavations and from alterations to surface water flow patterns and quality. During Construction, the only appreciable material excavations will be for wind turbine foundations, with excavation limited generally to the overburden layer. This could result in temporary lowering of the proximate water table. During Operations, there will be few, if any interactions between the Project and Groundwater. During Decommissioning, assuming the foundations for WTG units will remain in place, there will be few, if any interactions. In the instances of Unplanned Events, it is conceivable that some scenarios (spills/releases, fire/explosions) could affect groundwater quality, but such events would likely be restricted to the Argentia Peninsula. Note as well, groundwater utilization in the region is low and limited to a few private wells, none of which are proximate to the Project Area.

An array of precautionary and mitigation measures has been prescribed to protect surface water quality. These measures will also serve to ensure against potential indirect effects on groundwater.

In all cases, the Frequency of interactions is low. In all phases, the geographic extent is restricted to the LAA. It is conceivable (but highly unlikely) that an unplanned event (major spill or fire/explosion) could

affect a relatively large area; however, given that such events would likely occur at or near the Hydrogen and Ammonia plants located on the Argentia Peninsula brownfield site, and on a level plateau only metres above sea level, as well as Project emergency response planning and protocols, the possibility of any effect on groundwater is considered to be negligible. Given the timeframe for groundwater movement, the duration of any interaction has been rated as long lasting. Reversibility of potential effects is rated to have high potential through all Project phases. Finally, the ecological context of all potential effects on groundwater will be limited to the Project Area, which consists of brownfield and vegetation covered (but highly utilized) Backlands areas. As a result, the Magnitude of environmental effects on groundwater is rated as negligible.

Freshwater Environment (Fish and Fish Habitat)

The freshwater environment, particularly fish and fish habitat, can be affected by alterations to stream flow and habitat features, creation of barriers to fish movement, removal of riparian vegetation (affecting water quality via reduced shade or increased nutrient/energy inputs), introduction of sediments and contaminants, and potentially direct injuries or mortalities from in-water work.

Most of the interactions will occur during Project Construction when activities such as preparation of laydown areas, excavation for foundations, road construction, including water crossings, installation of collector systems, transmission lines and substations, can alter fish habitat quality as a result of run off and changes to water flow patterns, either by creating physical or velocity barriers to fish movement or restrictions to inflows/outflows along water courses, which may in turn affect fish health and survival. Minor quantities of fish habitat may be lost because of construction of the 13 small water crossings (11 streams, 2 waterbodies) associated with the wind farm. These locations also have with the potential to result in an obstruction to fish passage if not properly designed and installed.

During operations and maintenance of wind farms, run off from access roads may affect fish habitat quality, fish production, health, and survival. Since the water supply for operation of the hydrogen/ammonia plant will be from an existing protected public water supply area there will be no new aquatic habitat interactions introduced by the Project.

The effects of decommissioning and rehabilitation activities on fish and fish habitat are anticipated to be similar to Construction; however, it is expected there will be no in-water work associated with this Project phase.

Marine Environment (Fish and Fish Habitat)

Marine fish and fish habitat can be affected by nearshore construction and operations activities. Project site preparation and civil works during construction will occur on land and will not interact directly with the marine environment.

Operation of the hydrogen/ammonia plant and associated infrastructure, and surface runoff from facilities, will result in the release of treated freshwater effluent into the marine environment near the plant site. Wastewater (e.g., stormwater runoff, reject process water, sanitary discharge) will be directed to a sewage treatment system that will operate incompliance with applicable regulatory approvals and discharge criteria.

Note, the POA has plans for dockside expansion of its facilities. This proposed undertaking has been registered with the Impact Assessment Agency of Canada as well as the Government of Newfoundland and Labrador. Both governments have released the project with conditions. See Cumulative Effects for a discussion of the combined effects of the Project and dockside expansion. The existing and planned POA facilities will result in the Project requiring limited, if any additional dock infrastructure.

Section 3.1.2.12, Marine Navigation, addresses historic marine traffic to and from the POA. In summary, a total of 1,736 vessels were recorded by the POA between 2013 and 2022. Figure 4.2.2-1 provides a projection model for marine traffic based on the POA vessel activities from 2013 to 2022. The projection model indicates that by 2050 the yearly vessel traffic will be elevated to approximately 376 vessels, which is double the number of vessels in 2022 (n=189). The model agrees with the performance metric forecast of an estimated 371 vessels per year by the years 2048 to 2052, as provided in The Cooper Cove Marine Terminal Expansion Project Description (Dillon, 2023). However, the marine traffic increases associated with the Argentia Renewables Project may not be linear as more vessels are expected during the Construction Phase as compared to the projection model. The Energy and Emissions Study for the Project (Appendix H) estimated passage of 62 vessels coming to the Port of Argentia during the Construction Phase, while an increase of only 12 vessels yearly is expected during operations.

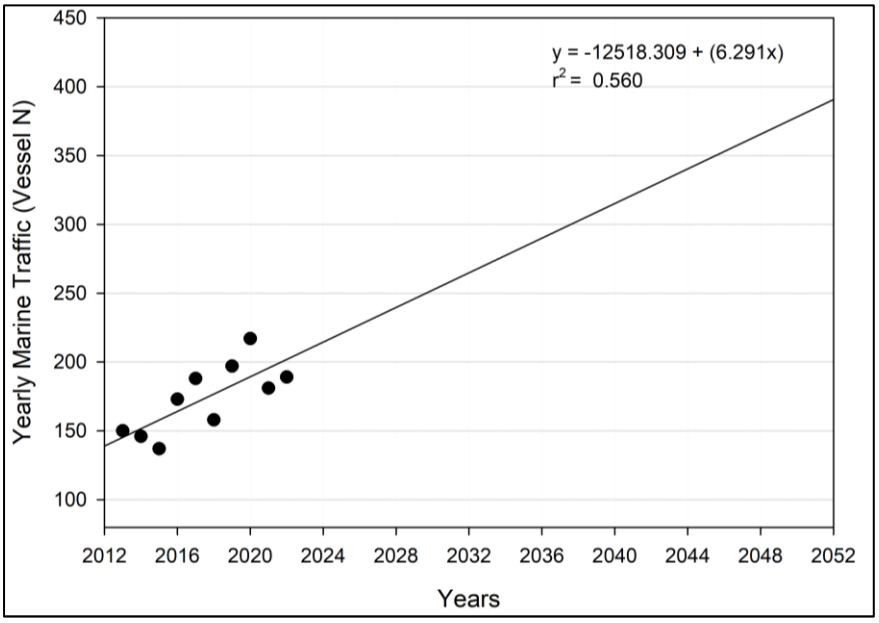

Figure 4.2.2-1 Projection Model for Yearly Marine Vessel Traffic in Argentia Harbour based on the period of 2013-2022.

Transportation of resources and equipment in the marine environment may affect habitat quality and interact with commercial/recreational fishing activities. Marine shellfish aquaculture operations could be affected by any accidental introduction or spread of AIS.

The minimal connection between the Project and the marine environment, combined with adherence to applicable regulatory standards, will result in few potential environmental effects during Construction, Operation and Decommissioning. Unplanned Events could result in deposition into the marine environment resulting in short term effects on fish and fish habitat.

Fisheries and Aquaculture

Potential effects of the Project on fishing/aquaculture grounds during Construction are related to an increase in POA vessel traffic during construction. These activities can limit access to fishing grounds and potentially introduce or spread AIS via transiting vessels. An increase in vessel activity has the potential to increase the risk of collisions or damage to fishing gear. The introduction of AIS through Project vessel activity could also disrupt local aquaculture operations. Several AIS species (e.g., golden star tunicate, oyster thief, vase tunicate, and violet tunicate) are known to cause issues with marine-based shellfish aquaculture operations. There is, however, very limited commercial and recreational fishing occurring near the POA and existing aquaculture operations are well removed from the LAA.

During operations and maintenance, marine infrastructure and vessel activity may result in temporary loss of access to fishing grounds. Changes in water quality during operation can also lead to changes in fishing / aquaculture grounds and productivity. Increases in noise and vibration from increased vessel traffic may cause auditory masking. As above, limited fishing activity occurs near the Port of Argentia; no aquaculture operations in Placentia Bay are close to or planned for the RAA, and the low frequency of vessel traffic (once monthly), will limit interactions and potential effects during Operations.

Potential effects of the Project on fishing/aquaculture grounds during Decommissioning are similar to the Construction Phase and are related to an increase in vessel traffic. It is anticipated that after the life of the Project, the POA marine infrastructure will remain in place for future use.

Species at Risk

Catadromous American eel and anadromous Atlantic salmon (South NL population) have been designated by The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or under SARA and/or NL ESA, and both occur in the RAA. American eel were observed in the Project Area in 2023 in the stream connecting Argentia Pond to Salmon Cove, and the species likely occupies Argentia Pond. There are two pre-existing culverts that cross this stream, one of which may be upgraded for use by the Project to access the Argentia Backlands. The Project activities will not interact with or affect Argentia Pond. Anadromous Atlantic salmon occur in four scheduled salmon rivers in the RAA, but not in the LAA or PA, and therefore will not interact with or be affected by Project activities.

Most of the potential interactions with American eel will occur during Project Construction owing to activities such as preparation of laydown areas, excavation for foundations, road construction, water crossings, installation of collector systems, transmission lines and substations. These activities can alter American eel habitat quality because of run off and water flow patterns that create physical or velocity barriers to movement. These interactions could in turn affect eel health and survival. Eel habitat could also be lost because of the installation of culverts. During operations and maintenance of wind farms, eel habitat may be affected by run off from access roads, which may in turn affect habitat quality, production, health and survival. Water supply for operation of the hydrogen/ammonia plant will be from public water supply and will not affect eels and eel habitat. The effects of decommissioning and rehabilitation activities on eel habitat are anticipated to be similar to Construction, however, it is expected there will be no in-water work associated with this Project phase. There are 13 water crossings (11 streams, 2 waterbodies) associated with the wind farm. With proper design and adherence to standard construction and maintenance measures, the potential level of interaction with eels and eel habitat is predicted to be minimal.

Atlantic cod (Laurentian North Pop.) and American plaice (NL population) have a high probability of occurrence in the marine areas of the RAA and LAA. Other SARA listed species that have potential to occur in Placentia Bay including white shark, northern wolffish, spotted wolffish, Atlantic wolffish and banded killifish. Leatherback turtles and blue whales, two SARA listed species, are occasionally sighted in Placentia Bay. The potential for any of these species to occur in the RAA or LAA is extremely low. The Project will have limited aspects carried out in the marine environment, over a limited area; therefore, the potential level of interaction with marine species at risk is predicted to be minimal.

Habitats of Conservation Concern

The whole of Placentia Bay is designated as an Ecologically and Biologically Significant Area (EBSA) and this would include the RAA and LAA. Two Significant Benthic Areas (SiBAs) in the south of the bay have been identified, however, these are not close to the RAA. Sensitive areas near the RAA and LAA include capelin spawning beaches, eelgrass beds, salt marshes, wetlands, and scallop beds. There are no Marine Protected Areas (MPAs) or critical habitats, as defined under SARA and the NL ESA, identified near the RAA or LAA. Habitats of conservation concern will not interact with or be affected by the Project.

Marine Biosecurity

Invasive species are a concern, both with respect to new introductions, as well as the possible spread of such species already present within Placentia Bay and other locations in Canada. There are extensive requirements in place in Canada (Fisheries Act - Aquatic Invasive Species Regulations), as well as international protocols, to prevent introductions of invasive species through mechanisms such as ballast water or hull fouling.

To reduce or eliminate the risk of invasive aquatic species and pathogens being introduced into Canadian waters because of shipping, all ships are required to exchange ballast water in accordance with the *Ballast Water Control and Management Regulations* (Transport Canada 2006) and to follow international protocols (International Maritime Organization Code for Approval of Ballast Water Management System). The regulations require that ships transiting to Canadian ports exchange ballast water at sea in deep water away from coastal zones. This measure limits the potential for foreign harmful aquatic organisms or pathogens to be released in Canadian waters where they may colonize. The exchanged ballast water is then to be treated by a Ballast Water Treatment System (BWST) onboard the vessel during the remainder of the voyage. No interaction of ballast waters with the Project area (e.g., introduction of invasive species) is anticipated.

Fouling is the unwanted growth of biological material such as barnacles and algae on the surface of a hull submersed in water. Hull fouling can increase the risk of invasive aquatic species and pathogens being introduced into Canadian waters. Vessels transiting to Argentia from international ports will be required to meet the IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships. This convention requires that vessels possess International Anti-fouling System Certification and that an anti-fouling system be in place on all vessels.

During Construction, the major supply route for equipment will be via marine traffic and originating at ports beyond Newfoundland and Labrador. Laden vessels will have a minimum of ballast water onboard. During Operations, product (ammonia) will be shipped monthly to European ports via charter vessels. When transiting to the POA, it may be assumed that these vessels will carry ballast water and require exchange as per the IMO protocol. During Decommissioning it may be assumed that some equipment and Project structures will be shipped for sale or disposal using chartered vessels. It may be assumed that these vessels will be carrying ballast water during inbound voyages. It is unlikely that an unplanned event would act as a possible mechanism for invasive species introduction. During all shipping activities related to the Project, it is unlikely that vessels will transit to other Placentia Bay or Newfoundland ports.

4.2.2.5 Mitigation Measures

Applicable avoidance and mitigation measures are listed in Table 4.2.2-3. Project-specific plans (e.g., the Environmental Protection Plan) will also include mitigation measures that are applicable to this VC.

Table 4.2.2-3 Mitigation and Enhancement Measures: Aquatic Environment.

Aquatic Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
Construction	Surface Water Resources	• Potential changes in water quality related to work in or near water, clearing/grubbing vegetation, excavating/grading, installation of stream crossing structures, fording, and introduction of silt from erosion and sedimentation. • Potential changes in water quantity due to clearing of areas for turbines. • Introduction of hydrocarbons (fuel, lubricants), solvents, and salts from construction equipment.	• Adhere to Environmental Protection Plan (EPP). • Adhere to Water Management and Monitoring Plan. • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • Monitor water quality via grab samples and real-time monitoring network.
	Ground Water Resources	• Possible temporary lowering of the water table during installation of turbine foundations.	• Adhere to Environmental Protection Plan (EPP).
	Freshwater Environment	• Potential change in fish habitat quantity from stream crossing structures or creation of barriers to migration. • Potential change in fish habitat quality from runoff during road construction, installation of crossing structures, laydown areas, or fording. • Potential change in fish health and survival.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • In-water work will be planned to respect DFO timing windows to protect fish in Newfoundland and Labrador. • If fording is required, follow DFO's temporary ford code of practice. • Ensure proper installation of road crossing structures. • Monitor fish populations for change in community structure, abundance/biomass, and growth.
	Marine Environment	• Temporary impacts to marine habitat during installation of the discharge pipeline. • Transportation of resources and equipment may affect habitat quality.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries.
	Fisheries and Aquaculture	• Increase in transportation of resources and equipment may affect commercial and recreational fisheries.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries.

Aquatic Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
		• Introduction of aquatic invasive species may affect shellfish aquaculture.	• Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
	Species at Risk	• Potential change in American eel habitat quality from runoff during construction of roads. • Potential change in American eel health and survival.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • In-water work will be planned to respect DFO timing windows to protect fish in Newfoundland and Labrador. • If fording is required, follow DFO's temporary ford code of practice. • Ensure proper installation of road crossing structures. • Monitor American eel populations for change in abundance and biomass.
	Habitats of Conservation Concern	• Potential change in Habitats of Conservation Concern during Project Construction • Transportation of materials and equipment may affect habitats of conservation concern.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries.
	Marine Biosecurity	• Introduction of aquatic invasive species from ballast water and hull fouling.	• Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
Operation and Maintenance	Surface Water Resources	• Use of access roads by Project vehicles could result in suspended sediments entering adjacent waterbodies.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • Ensure road, shoulder, and stream crossing structures are well maintained. • Monitor water quality.

Aquatic Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
			• Manage water consumption to ensure such use would not have a material negative impact on municipal water supply.
	Ground Water Resources	• None.	• None.
	Freshwater Environment	• Potential change in fish habitat quality from runoff during use of roads. • Potential change in fish health and survival.	• Site and access roads will be maintained in good condition. • Monitor fish habitat quality. • Monitor fish populations for change in community structure, abundance/biomass, and growth.
	Marine Environment	• Transit of shipping vessels may affect habitat quality and cause auditory masking. • Potential water quality effects from effluent discharge.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries. • Ensure effluent and wastewater comply with applicable regulatory approvals and discharge criteria. • Develop a noise and vibration monitoring plan in consultation with FFA and local environmental non-governmental organizations.
	Fisheries and Aquaculture	• Vessel activity may result in temporary loss of access to fishing grounds. • Introduction of aquatic invasive species may affect shellfish aquaculture.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries. • Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
	Species at Risk	• Potential change in American eel habitat quality from runoff during use of roads. • Potential change in American eel health and survival.	• Site and access roads will be maintained in good condition. • Monitor American eel populations for change in abundance and biomass.
	Habitats of Conservation Concern	• Potential change in Habitats of Conservation Concern during Project Operations • Transportation of materials and equipment may affect habitats of conservation concern.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries.

Aquatic Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
	Marine Biosecurity	• Introduction of aquatic invasive species from ballast water and hull fouling.	• Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
Decommissioning and Rehabilitation	Surface Water Resources	• Transportation along access roads during decommissioning, rehabilitation, and closure could result in suspended sediments entering adjacent waterbodies.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents. • Ensure roads, shoulders, and stream crossing structures are well maintained. • Monitor water quality.
	Ground Water Resources	• None.	• None.
	Freshwater Environment	• Potential change in fish habitat quality from runoff during use of roads. • Potential change in fish health and survival.	• Adhere to Environmental Protection Plan (EPP). • Adhere to DFO guidance documents, standard mitigation measures, and best management practices. • Limit any in-stream work.
	Marine Environment	• Transit of shipping vessels may affect habitat quality.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries.
	Fisheries and Aquaculture	• Transportation of materials and equipment may affect commercial and recreational fisheries. • Introduction of aquatic invasive species may affect shellfish aquaculture.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to safety, environment, and fisheries. • Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
	Species at Risk	• Potential change in American eel habitat quality from runoff during use of roads. • Potential change in American eel health and survival.	• Site and access roads will be maintained in good condition. • Monitor American eel populations for change in abundance and biomass.
	Habitats of Conservation Concern	• Transportation of materials and equipment may affect habitats of conservation concern.	• Ensure vessels comply with Transport Canada's guidelines and regulations related to

Aquatic Environment			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
			safety, environment, and fisheries.
	Marine Biosecurity	• Introduction of aquatic invasive species from ballast water and hull fouling	• Ensure compliance with DFO's Fisheries Act / Aquatic Invasive Species Regulations, Transport Canada's Ballast Water Control and Management Regulations, and IMO International Convention on the Control of Harmful Anti-fouling Systems on Ships.
Unplanned Events	Surface Water Resources	• Spills/releases, fire, and/or explosions could affect surface water quality.	• Ensure containment and rapid cleanup of spills/releases. • Monitor water quality via real-time monitoring network
	Ground Water Resources	• Spills/releases, fire, and/or explosions could affect groundwater quality.	• Ensure containment and rapid cleanup of spills/releases.
	Freshwater Environment	• Spills/releases, fire, and/or explosions could affect fish habitat and fish health and survival.	• Ensure containment and rapid cleanup of spills/releases.
	Marine Environment	• Spills/releases, fire, and/or explosions, and accidents on vessels could result in oil spills and introduction of harmful substances into the marine environment.	• Ensure containment and rapid cleanup of spills/releases. • Maintain inventory of oil spill response equipment.
	Fisheries and Aquaculture	• Spills/releases, fire, and/or explosions, and accidents on vessels could result in oil spills and introduction of harmful substances affecting commercial and recreational fisheries.	• Ensure containment and rapid cleanup of spills/releases. • Maintain inventory of oil spill response equipment. • Consider closure of fisheries if there is potential of contamination.
	Species at Risk	• Spills/releases, fire, and/or explosions could affect American eel habitat and eel health and survival.	• Ensure containment and rapid cleanup of spills/releases.
	Habitats of Conservation Concern	• Spills/releases, fire, and/or explosions, and accidents on vessels could result in oil spills and introduction of harmful substances that could affect habitats of conservation concern.	• Ensure containment and rapid cleanup of spills/releases. • Maintain inventory of oil spill response equipment.
	Marine Biosecurity	• None.	• None.

4.2.2.6 Conclusion

Table 4.2.2-4 below provides a summary of predicted adverse residual effects on the Aquatic Environment VC.

Table 4.2.2-5 presents a summary of the effects prediction of the Project on the Aquatic Environment. These predictions consider the nature and extent of the identified interactions, as well as assuming the implementation of mitigation and monitoring measures as described and committed to in Table 4.2.2-3. There are no predicted negative significant residual environmental effects of the Project (all phases) with respect to the Aquatic Environment.

Table 4.2.2-4 Potential Adverse Residual Environmental Effects of the Project: Aquatic Environment.

Aquatic Environment							
Project Phase	**Key Indicator**	**Magnitude**	**Frequency**	**Extent**	**Duration**	**Reversibility**	**Context***
Construction	Surface Water Resources	2	2	2	3	1	3,5
	Ground Water Resources	1	1	2	3	1	3,5
	Freshwater Environment (Fish and Fish Habitat)	2	2	2	4	3	3,5
	Marine Environment (Fish and Fish Habitat)	1	1	2	2	3	3,5
	Fisheries and Aquaculture	1	1	3	2	1	3,5
	Species at Risk	2	2	2	4	3	3,5
	Habitats of Conservation Concern	1	2	4	3	1	3,5
	Marine Biosecurity	2	1	5	5	3	3
Operation and Maintenance	Surface Water Resources	2	2	2	5	1	3,5
	Ground Water Resources	1	1	2	5	1	3,5
	Freshwater Environment (Fish and Fish Habitat)	2	1	2	2	1	3,5
	Marine Environment (Fish and Fish Habitat)	1	1	2	1	1	3,5
	Fisheries and Aquaculture	1	2	2	1	1	3,5
	Species at Risk	1	1	2	2	1	3,5
	Habitats of Conservation Concern	1	2	4	3	1	3,5
	Marine Biosecurity	2	1	5	5	3	3
Decommissioning	Surface Water Resources	2	2	2	3	1	3,5
	Ground Water Resources	1	1	2	4	1	3,5
	Freshwater Environment (Fish and Fish Habitat)	2	2	2	4	3	3,5
	Marine Environment (Fish and Fish Habitat)	1	1	2	2	3	3,5
	Fisheries and Aquaculture	1	1	3	2	1	3,5
	Species at Risk	2	2	2	4	3	3,5
	Habitats of Conservation Concern	1	2	4	3	1	3,5
	Marine Biosecurity	2	1	5	5	3	3

Aquatic Environment							
Unplanned Events	Surface Water Resources	1	1	2	3	1	3,5
	Ground Water Resources	1	1	2	4	1	3,5
	Freshwater Environment (Fish and Fish Habitat)	2	1	4	1	1	3,5
	Marine Environment (Fish and Fish Habitat)	1	1	3	1	1	3,5
	Fisheries and Aquaculture	1	1	3	1	1	3,5
	Species at Risk	2	2	2	4	3	3,5
	Habitats of Conservation Concern	1	2	4	3	1	3,5
	Marine Biosecurity	2	1	5	3	1	3
*Context may be assigned more than one value.							

Table 4.2.2-5 Significance of Potential Residual Environmental Effects of the Project: Aquatic Environment.

Project Phase	Key Indicator	Significance of Predicted Residual Environmental Effects		Likelihood*	
		Level of Significance	Level of Confidence	Probability	Scientific Certainty
Construction	Surface Water Resources	NS	3		
	Ground Water Resources	NS	3		
	Freshwater Environment	NS	3		
	Marine Environment	NS	3		
	Fisheries and Aquaculture	NS	3		
	Species at Risk	NS	3		
	Habitats of Conservation Concern	NS	3		
	Marine Biosecurity	NS	3		
Operation and Maintenance	Surface Water Resources	NS	3		
	Ground Water Resources	NS	3		
	Freshwater Environment	NS	3		
	Marine Environment	NS	3		
	Fisheries and Aquaculture	NS	3		
	Species at Risk	NS	3		
	Habitats of Conservation Concern	NS	3		
	Marine Biosecurity	NS	3		
Decommissioning	Surface Water Resources	NS	3		
	Ground Water Resources	NS	3		
	Freshwater Environment	NS	3		
	Marine Environment	NS	3		
	Fisheries and Aquaculture	NS	3		
	Species at Risk	NS	3		
	Habitats of Conservation Concern	NS	3		
	Marine Biosecurity	NS	3		
Unplanned Events	Surface Water Resources	NS	3		
	Ground Water Resources	NS	3		
	Freshwater Environment	NS	3		

	Marine Environment	NS	3		
	Fisheries and Aquaculture	NS	3		
	Species at Risk	NS	3		
	Habitats of Conservation Concern	NS	3		
	Marine Biosecurity	NS	3		

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.3 Terrestrial Environment

The Terrestrial Environment was selected as a VC because of the myriad of terrestrial habitats and associated flora and fauna that will interact with Project infrastructure and activities throughout all phases of the Project.

Comprehensive site-specific information was collected through robust field surveys and literature reviews and was utilized to establish a solid foundation for assessing interactions and potential effects. The Ecological Land Classification (ELC) for the Project provided a foundation for field planning, establishing habitat suitability for Key Indicators (KIs), and assessing the potential interactions between the KIs and the Project.

Six Key Indicators were identified for the Terrestrial Environment: Flora (Rare Plants and Lichen), Wetlands, Fauna (Mammals), Avifauna, Species at Risk, and Habitats of Conservation Concern. Each reflects an important feature of the Terrestrial Environment that can be affected by the Project. Terrestrial habitat features (i.e., Flora, Wetlands) can be altered by the Project and in turn affect species utilization.

The spatial boundaries for the assessment of potential Terrestrial Environment effects include the Project Area (PA), LAA, and RAA as defined in Section 2.1. The temporal boundaries for this assessment include three major Project phases: Construction (29 months), Operation (nominally 30 years), and Decommissioning (one year). Temporal boundaries therefore extend from 2025 to 2058.

Table 4.2.3-1 lists the Key Indicators that apply to the Terrestrial Environment VC, summarizes the geographic scope for each KI, and lists the applicable measurable parameters.

A Species at Risk Impacts, Mitigations, and Monitoring Plan (draft) has been submitted as part of this Registration and includes an effects assessment for specific SAR (Appendix R). For this assessment, SAR will be considered as a collective/general KI. Note that Habitats of Conservation Concern have been assessed as part of the Land and Resource Use VC (see Section 4.2.4).

Table 4.2.3-1 Scope & Measurable Parameters of Key Indicators: Terrestrial Environment.

Key Indicator	Scope	Measurable Parameters
Flora (Rare Plants and Lichens)	Project Area	Presence/absence within the PA, locations and number of individuals, amount of suitable habitat in the PA (for lichens), change in habitat quality and/or quantity.
Wetlands	Project Area	Amount of wetland area in the PA, locations of wetlands, delineated boundaries from the ELC.
Fauna (Mammals)	Project Area	Presence/absence of each species from surveys, amount of suitable habitat in the PA.
Avifauna	Project Area, LAA	Relative abundance of each species by season, change to habitat quantity and/or quality. (Note: LAA was also used for marine/coastal birds).
Species at Risk (SAR)	Project Area	Species presence/absence, habitat suitability within the PA, locations of SAR observations.
Habitats of Conservation Concern	LAA	See Land and Resource Use VC (Section 4.2.4).

4.2.3.1 Assessment Criteria

An overview of the Terrestrial Environment effects assessment criteria is presented in Section 4.1.7. Criteria included magnitude, frequency, geographic extent, duration, reversibility, and context.

Significant negative residual environmental effects are those considered to be of sufficient magnitude, duration, frequency, and geographic extent to cause a change in the KI that will alter its status or integrity beyond an acceptable level. These residual effects will potentially exist despite the proposed mitigation measures.

4.2.3.2 Existing Knowledge

Section 3.1.3 provided a summary of existing knowledge of the Terrestrial Environment, while Appendices D1-D7 (Terrestrial Component Studies) provided more detailed descriptions based on dedicated field surveys and literature reviews.

There was sufficient knowledge of the KIs from field and desktop surveys to make confident effects predictions. However, the Project will require a continuation of some field survey programs going forward to improve the understanding of potential interactions and effects, to determine the adequacy of mitigation measures, and to identify opportunities for continuous improvement in environmental stewardship.

4.2.3.3 Definition of Significance

For the Terrestrial Environment VC, a Significant Effect was defined as:

- Having a high magnitude; or
- a moderate magnitude and characterized by either:
    - an extended duration affecting a geographic area that extends beyond the Project Area; or
    - a low level of confidence in the prediction.

For any Species at Risk, a Significant Effect was defined as:

- Having a moderate magnitude; or
- a low magnitude and characterized by either:
    - an extended duration affecting a geographic area that extends beyond the Project Area; or
    - a low level of confidence in the prediction.

Where a significant effect has been predicted, the evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.3.4 Potential Project-Environment Interactions

Potential interactions with identified KIs for the Terrestrial Environment VC are summarized in Table 4.2.3-2. The following discussion considers the nature and extent of potential interactions.

Table 4.2.3-2 Potential Project- Environment Interactions Matrix.

Key Indicators: Terrestrial Environment					
Project Component and Activity Description	Flora	Wetlands	Fauna	Avifauna	Species at Risk
Construction Phase					
Site Preparation	X	X	X	X	X
Roads	X	X	X	X	X
Staging and Laydown	X	X	X	X	X
Material Transport			X		X
Wind Turbine Foundations	X	X	X	X	X
Electrical Infrastructure	X	X	X	X	X
Wind Turbine Installation	X		X	X	X
Electrolyser Plant	X				
Ammonia Plant	X				
Operation and Maintenance Phase					
Wind Turbine Generation	X		X	X	X
Wind Turbine Maintenance			X	X	X
Electrical Infrastructure	X		X	X	X
Venting, flaring				X	X
Road maintenance	X	X	X	X	X
Plant operations					
Ammonia Handling, shipping			X	X	X
Decommissioning and Rehabilitation Phase					
Electrical Infrastructure	X	X	X	X	X
Wind Turbine Removal	X	X	X	X	X
Building Removal	X				X
Plant Removal	X				X
Terrain Reclamation	X	X	X	X	X
Unplanned Events					
Spills, releases*	X	X	X	X	X
Flaring, venting			X	X	X
Fire, explosion	X	X	X	X	X
Traffic accident			X	X	X
Wind Turbine collapse	X	X	X	X	X
Water supply failure					
Wildlife emergency			X	X	X
Human hazard, injury					
NOTES X: Potential interactions that might cause an effect. Blank =Interactions between the Project and the VEC are not expected.					

Flora

This Project will require the alteration and/or fragmentation of the terrestrial landscape, and as such, the frequency of interactions with Flora (Rare Plants and Lichens) is relatively high, especially during the

Construction Phase. During all phases, the geographic extent of interaction is restricted to the Project Area. The total Project Area comprises 5,113 ha, of which the majority (Barrens, Coastline, Mature Coniferous Forest, Meadow, Mixedwood Forest, Regenerating Coniferous Forest, Scrub) comprises productive terrestrial habitat, as summarized in Table 4.2.3-3. Most of the interactions with the Flora KI will be associated with energy generation infrastructure in the Backlands (e.g., new roadwork, other linear features, wind turbine foundations, laydown areas), but there are some rare plants known from the brownfield Argentia Peninsula as well.

Table 4.2.3-3 Ecological Land Classification.

Ecotype	Area (ha)	Percentage of Project Area (%)
Barren	96	1.88
Coastline	75	1.47
Anthropogenic	500	9.78
Mature Coniferous Forest	1,683	32.92
Meadow	255	4.99
Mixedwood Forest	35	0.68
Regenerating Coniferous Forest	1,031	20.16
Scrub	804	15.72
Open Water	266	5.20
Wetland	368	7.20
Total	**5,113 ha**	100%

Blue Felt Lichen in Newfoundland grow predominately on native yellow birch in coastal areas but occasionally on white spruce where spillover effects allow (COSEWIC, 2010). An estimated 30% of the known thalli exist on non-native red maple (COSEWIC, 2010). In the Project Area, the lichen was found to be present in yellow birch mixedwood forests in the Northeast portion of the Argentia Backlands surrounding Big Shalloway Pond. Small mixedwood forests in the Project Area were observed to include white birch, yellow birch, and balsam fir. Sampling of this forest type has resulted in the observation of numerous thalli of blue felt lichen. The yellow birch forests present in the Big Shalloway Pond area occupy the same areas of sloped terrain where humid air travels from the ocean through the valley. It is highly probable, based on observations to date, that all the yellow birch (“mixedwood forests”), as shown on the rare lichen habitat suitability maps, contain blue felt lichen thalli. Observations of blue felt lichen were obtained in closed coniferous dominated mixedwoods but were most abundantly present in large, open yellow birch and white spruce canopy dominated areas where low-growing regenerating balsam fir is present in the shrub layer. These areas have been highly grazed by moose. Alterations to surrounding forested areas during construction may produce changes in atmospheric conditions surrounding these thalli and cause desiccation and mortalities. Consequently, protective measures should apply not only to trees associated with thallus growth but include provision for buffers around the habitat type possessing the thalli as a means for the mixedwood patches to persist.

Boreal Felt Lichen grows in coniferous stands dominated by Balsam Fir adjacent to wetlands. Habitat suitability studies indicate a high likelihood of the species presence. Small areas of habitat may be lost through the removal of mature balsam fir forest stands during Project construction.

Rare lichens such as boreal and blue felt lichen require humid conditions with low air pollution. Epiphytic lichens, including all those found in the Project Area, demonstrate a high sensitivity and intolerance to air pollutants, such that they are widely used as an indicator species for air pollution (Pescott *et al*., 2015; Nimis *et al*., 2002). They are especially sensitive to nitrogen oxides and sulfur dioxide (Elsinger *et al*., 2007; ECCC, 2022). Further, once impacted by air pollution, lichens demonstrate a weak capacity for population restoration (Weldon & Grandin, 2021).

In a mature forest habitat, large balsam fir or yellow birch (i.e., dominant phorophytes for both species) are naturally spaced apart. Development of roads or other infrastructure located close to such mature trees can alter the habitat quality of the rare lichens they host. Exposure to the elements by tree cutting and the development of roads or other infrastructure will alter the atmospheric conditions within rare lichen habitat, and desiccation or mortality of rare lichens may occur (Cameron *et al*., 2013).

This effect could be amplified during operation phase by the microclimate effects of air movement from wind turbine operation. Vertical mixing, turbulence, and wakes created by wind turbine blades can result in changes to local temperature, moisture, and CO_2 levels (Kaffine, D.T., 2019). Research has shown a reduced biodiversity of plant species close to wind farms and the displacement of rare plants by invasive species (Urziceanu *et al*., 2021; Urziceanu, 2024).

Due to the nature of interactions between the Project and Flora (e.g., through the clearing of vegetation, removal of soil/overburden, alteration of microclimates or moisture regime, etc.), the duration of environmental effects during the Construction, Operations and Decommissioning phases will be long-term. Reversibility is generally ranked as partial since, during Decommissioning, some areas will likely be subject to rehabilitation/revegetation efforts, but some of the necessary conditions for the rare lichens (and possibly plants) will be altered for many decades.

It is conceivable (but highly unlikely) that an Unplanned Event (major spill or fire/explosion) could affect a relatively large area of the Argentia Peninsula (the most serious of such events are associated with the hydrogen and ammonia plants). Such events could have interactions with the known rare plants from this brownfield site. However, given the likelihood, the risk to Flora from Unplanned Events is low to negligible.

Mitigation measures can reduce the level of interactions as well as the potential environmental effects on Flora. Project design will include reference to the ELC mapping to locate and avoid sensitive areas, including challenging terrain and productive habitats (especially for SAR). The Construction EPP will

include measures to limit the extent of vegetation clearing and reduce the likelihood of Unplanned Events. Overall, the magnitude of the effects of the Project on Flora is predicted to be Low to Moderate.

Wetlands

Wetlands exist throughout the Argentia Backlands, primarily in the form of bogs and fens, and on the Argentia Peninsula in the form of anthropogenically-formed marshes in drainage areas. Collectively, Wetlands comprise 368 ha in the Project Area.

During Construction, route planning will attempt to avoid Wetlands and limit interaction. However, some activities and structures will be required near Wetlands. When construction within the 15 m legislated buffer can not be avoided, the Project will not proceed without required permits. The Water Resources Management Division of the Department of Environment and Climate Change maintains a **Policy for Development in Wetlands** that establishes criteria for issuing a permit for development activities in and affecting wetlands in accordance with Section 48 of the **Water Resources Act** (Water Resources Act, 2002). The stated objective of this Policy is to limit developments in wetlands to those which do not adversely affect water quantity, water quality, hydrological characteristics, functions, or habitats. Outlined within the Policy are the types of developments having indirect or direct effects to wetlands that are not permitted, and development activities that may be approved only with written permission by the Minister of Environment and Climate Change. When developments affecting wetland are permitted under the Act, any required mitigative or restoration measures are specified in the terms and conditions of the environmental approval.

The frequency of interactions was rated as level 2 (infrequent) for all Project phases. Similarly, during all phases, the geographic extent is restricted to the Argentia Backlands portion of the Project Area (i.e., the natural wetlands). The anticipated interactions between the Project and Wetlands during all Project phases will be relatively limited in duration.

Given the nature of potential interactions with Wetlands throughout all phases of the Project, many restoration efforts can be implemented during Decommissioning phase. However, the lasting effects of disturbance will be long-term, as wetland function can take decades to re-develop after disturbance (Trombulak and Frissell, 2000). There is the potential for hydrological function to be restored after the access road and turbine pads are decommissioned and surface and groundwater flow are re-established. While these changes will occur relatively rapidly, restoration of biochemical function, habitat functions, and functional diversity to pre-effect conditions could take several decades or longer (Trombulak and Frissell, 2000). Consequently, reversibility is generally ranked as partial. The context of all these interactions will fall within the Argentia Backlands portion of the Project Area, which is characterized as a utilized area that retains natural features. The implementation of standard mitigation measures throughout all Project phases will reduce both the likelihood and potential consequences of any potential negative environmental effect on Wetlands.

It is conceivable (but highly unlikely) that an Unplanned Event (major spill or fire/explosion) could affect some areas of natural Wetland; however, given that the most serious of such events are associated with the hydrogen and ammonia plants located on the Argentia Peninsula brownfield site, the magnitude of any effect on natural Wetlands from Unplanned Events is considered to be low to negligible. Overall, and through all Project phases, the magnitude of potential negative environmental effects on Wetlands is rated as Low.

Fauna (Mammals)

This KI excludes avifauna as well as SAR, it comprises mammals only. The brownfield nature of the Argentia Peninsula reduces (but does not eliminate) the potential for Project–Fauna interactions. The Argentia Backlands contain a high proportion of habitat suitable for mammal fauna typical of the region (e.g., moose, red squirrel, mink, snowshoe hare, meadow vole). The construction and maintenance of roads and turbine pads throughout the Backlands will create disturbance and habitat fragmentation (Helldin et al., 2012; Scholl & Nopp-Mayr, 2021; Colman et al., 2013).

During all Project phases, there will be some interactions with mammals that, at a minimum will elicit avoidance behaviours for many species. The long-term effects of wind turbine developments on mammal species are not well-studied (Helldin et al., 2012; Scholl & Nopp-Mayr, 2021), but there is sparse literature available. A recent study on the impacts of wind turbines on moose has concluded that wind turbines do not have a significant impact on their activity and habitat use (Berndt et al., 2021). Another study on the impacts of wind turbines on semi-domesticated reindeer found that there was no conclusive effect on their behaviour; some moved away from the turbine, whereas others moved closer (Flydal et al., 2004). Colman et al. corroborate this research, as they theorize that vegetation preferences are more important for semi-domesticated reindeer than the presence of wind turbines, and that access roads are the main cause of avoidance behaviours rather than wind turbines themselves (2013). While impacts on large mammals may be negligible, smaller mammals may be disturbed. The noise and vibration from wind turbine operations have been found to affect the anti-predator behaviour of the European ground squirrel (Rabin et al., 2006). Conversely, it was found that wind turbines do not affect the movements of the European hamster, although behavioural effects remain unknown (Lopucki & Perzanowski, 2018). While responses to wind turbines will differ between species, one study indicates that there may be a correlation between herbivorous mammals and wind turbine avoidance (Lopucki et al., 2017). This study found that where hare and deer avoided wind turbines, foxes behaved neutrally (Lopucki et al., 2017). Aside from the habitat fragmentation and avoidance behaviour associated with the Construction Phase, wind turbine interactions with mammals may be relatively minimal. While it is difficult to extrapolate across species (and geographic regions), these studies above provide some indications that there will likely be some avoidance effects.

Frequency of interaction is likely to be correlated with the level of activity throughout the Project Area and will be more likely during Construction and Decommissioning and reduced during Operation and

Maintenance or as a consequence of Unplanned Events. It is conceivable that an Unplanned Event (major spill or fire/explosion) could affect Fauna in a meaningful way; but, given that such events are associated with the hydrogen and ammonia plants located on the Argentia Peninsula brownfield site, the magnitude of any effect on Fauna from Unplanned Events is considered to be low to negligible. Overall, and through all Project phases, the magnitude of potential negative environmental effects on Fauna is rated as Low.

During all Project phases, the geographic extent of interactions will be restricted to the Project Area, with a greater proportion of interactions likely to occur in the Argentia Backlands. The anticipated interactions between the Project and Fauna during all Project phases will be limited in duration.

The context of all these interactions will fall within the Project Area, including both the Argentia Peninsula brownfield and the Argentia Backlands. The implementation of standard mitigation measures throughout all Project phases will reduce both the likelihood and potential consequences of any potential negative environmental effect on Fauna. Overall, and through all Project phases, the magnitude of potential negative environmental effects on Fauna is rated as Low.

Avifauna

Designated avian Species at Risk are excluded from this section and addressed under the SAR KI. An assortment of both resident and migratory species has been confirmed as present in the Project Area. Suitable foraging and nesting habitat have been identified throughout the Argentia Backlands. As well, to a lesser extent on the Argentia Peninsula, the Meadow habitat provides some limited passerine habitat, and the Coastal habitat is occupied by a variety of seabirds. The interactions between these myriads of bird species, occupying all ecological niches, and the Project are likely at all phases, and throughout the Project Area.

Avifauna habitat will be directly lost during construction through vegetation being cleared at each of the turbine pads, for access roads, and other associated infrastructure. The clearing and infilling will be wide enough to allow the transport of large equipment during construction. While the turbine pads and roads will remain clear throughout the lifespan of the Project and will be constructed with gravel/crushed stone fill, they will be reduced in size and the surrounding land recovered during the Operation and Maintenance Phase. Based on preliminary design, the quantity of habitat that will be altered for turbine pad/laydown area and road construction is outlined in Table 4.2.3-4. This calculation excluded collector lines, the Project Gen-Tie, and the Interconnect Line, as such the ELC habitat data excluded the Project Interconnect Line right-of-way.

Table 4.2.3-4 Habitat Altered in Argentia Backlands and Argentia Peninsula by Preliminary Project Layout (roads and turbine pads)

ELC Ecotype	Habitat Area in Argentia Backlands and Argentia Peninsula (ha)	Habitat Altered by Preliminary Project Layout (ha)	Percent Altered per Ecotype (%)
Coastline	14.34	0.2	1.39
Rocky Barren	40.03	2.42	6.05
Wetland	244.64	4.32	1.77
Meadow	173.76	7.6	4.37
Regenerating Coniferous Forest	425.27	7.92	1.86
Coniferous Scrub	415.48	16.37	3.94
Mature coniferous	1332.36	39.89	2.99
Mixedwood Forest	368.5	6.66	1.81
Open Water	245.76	0	0.00
Anthropogenic	276.91	14.34	5.18

This amounts to an estimated 99.72 ha altered ecotype or less than 3% in the Project Area (preliminary roads and turbine alterations only). At the time of this calculation, Project infrastructure is estimated to alter 4.32 ha of wetland, however, the Project maintains the goal of not effecting any wetlands. This is justified currently by the use of a preliminary Project layout and ELC mapping (Appendix D3) for this modelling. The Project layout will still undergo micro-siting adjustments prior to construction to avoid and minimize effects on wetlands in the Project Area.

The construction of wind turbines also leads to indirect habitat loss through habitat fragmentation and sensory disturbance, which negatively impacts avian species (Brawn *et al*., 2001; Fonturbel *et al*., 2021). In areas where vegetation is cleared for Project infrastructure, habitat fragmentation and new transitional areas will be created, leading to a type of habitat alteration described as edge effects. These changes may include changes in species composition, increases in predation, changes in vegetation structure, and microclimates. Species that rely on intact, contiguous tracts of forest may be more affected than the generalist species that often benefit from edges. Even resident forest-dwelling birds that may not necessarily fly high enough to be struck by turbine blades may be impacted by the effects of habitat disturbance (Fonturbel *et al*., 2021). For example, habitat fragmentation and deforestation are known to be the primary threat to the Red Crossbill percna subspecies, an endangered subspecies found in the Project Area (COSEWIC, 2016).

Excessive additive light in SAR habitat can alter the daily activity schedule of individuals. Singing (for birds), foraging, breeding, and migration may all be temporally or spatially modified by the presence of light; singing may start earlier in the morning, foraging for insects may continue later into the evening, and migration routes may be altered to favour areas of enhanced lighting, which also often coincides with heightened risk (of collisions with light sources). Given the Project Area landscape context (i.e.,

brownfield adjacent to an industrial port) it is anticipated that the site preparation and construction activities will result in minimal additive sensory disturbance for these SAR.

The effects on habitat quality from sensory disturbance will continue throughout the Operation and Maintenance Phase of the Project; noise will remain amplified over baseline conditions because of the rotating turbines, road traffic for maintenance and regular operation activities (and the associated noise of those activities). Lighting will be present in the Project Area to meet Transport Canada lighting requirements, for the safety of site personnel, for the maintenance of the facilities and equipment, and travel along the access roads. The effects on birds from lighting associated with wind projects are poorly understood (Marques *et al*. 2014). Turbines with lights can attract birds, increasing the risk of collision, especially in conditions of poor visibility where visual cues are lacking, and birds depend on magnetic compass navigation (Poot *et al*. 2008). This possibility also applies to the flaring stack at the production and storage facility. Bird collisions with lit structures are likely to be more pronounced at sea than on land, and particularly during nighttime storms and associated with heavy migration traffic (Hüppop *et al*., 2006). While the Project is on land, its adjacency to the coast may result in interaction with avifauna.

During the Operation and Maintenance Phase, collisions often occur when birds are preoccupied with hunting, landing, or fighting (Willard, 1978). Turbine strikes are a threat to both migratory and resident bird species; however, collision risk seems to be species-specific, even among birds of the same groupings (Krijgsveld *et al*., 2009; Dohm *et al*., 2019). Research has shown that wind turbines kill less birds than other anthropogenic structures, perhaps due to the avoidance behaviour of some avian species (Zimmerling *et al*., 2013; Santos *et al*., 2022; Campedelli *et al*., 2013; Marques *et al*., 2019). While these behaviours lead to reduced mortality rates, they also present a risk of habitat displacement. For example, studies have shown that wind turbines displace resident raptors from their usual habitat (Campedelli *et al*., 2013; Dohm *et al*., 2019).

Raptors are considered the most highly affected avian group through interactions with wind turbines. The site choice for turbines favours locations with elevated and sustained winds. These same locations may often be used by raptors seeking updrafts to soar along corridors and conserve energy. The typical landscapes for wind turbine farms also can serve as hunting, foraging, and in some cases nesting sites for birds of prey. The hunting habits of many of these raptors involve scanning the landscape for prey items at a height that is beyond the view of prey species, but close enough to the ground to site prey. This preferred elevation is often at the height of the wind turbine rotors (May *et al*., 2020). There is evidence that certain raptors return to wind farm sites in the years succeeding project development; however, this is a species-specific reaction (Dohm *et al*., 2019). In Dohm et al.'s study, the Northern Harrier (which is found in the Project Area), did not return to their habitat (2019).

Nocturnal neotropical and temperate migrant birds (e.g., Passerines) can, under some conditions interact with wind projects. In most cases these birds fly at altitudes well above turbines; however, during severe

weather events, birds can occupy relatively lower altitudes. Under such conditions, there is a potential for collisions with turbines.

Birds generally can also be affected by passive collisions with transmission lines (Bevanger, 1994) and associated towers. The majority of Project electricity distribution lines will be overhead and the Project Interconnect Line running from the Project to interconnect with the NLH grid will generally run parallel to existing linear facilities. As a result, the potential for collisions by avifauna is low.

Several Decommissioning and Rehabilitation Phase activities have the potential to interact with avifauna including removal of salvageable equipment and materials, demolition and removal of buildings and foundations, and earthworks including re-contouring, and overburden and topsoil replacement. During this phase, interactions will be similar, but somewhat less intensive as the Site Preparation and Construction Phase. Noise and lights will potentially interact with local avifauna, and fatalities could occur through collisions with light vehicles or machinery. While the removal of equipment will occur relatively quickly, revegetating the Project Area with healthy, sustainable vegetation that supports existing, native ecosystems will take longer.

The frequency of interaction is likely to be irregular and correlate with the level of avifauna activity throughout the Project Area, and therefore will be more likely affected initially during habitat alteration and sensory disturbance during the Construction Phase and seasonally during Operation and Maintenance or because of Unplanned Events. During all Project phases, the geographic extent of interactions will generally be restricted to the Project Area, with a greater proportion of interactions likely to occur in the Argentia Backlands given the much greater habitat suitability for a much larger biodiversity of bird species. In addition, the Project Area, given the amount of field surveys conducted year-round, does not appear to be an important migration route or staging area for migratory birds. The anticipated interactions between the Project and Avifauna during all Project phases will be limited in duration.

Given the nature of potential interactions with Avifauna throughout all phases of the Project, many of the interactions, will be reversible. Habitat changes resulting from Project construction and operations are anticipated to be long term, but reversible. An Unplanned Event can include vehicle collisions with associated mortalities; hence reversibility is ranked as unlikely for this Project phase.

The context of all these interactions will fall within the Project Area, including both the Argentia Peninsula brownfield as well as the Argentia Backlands. The implementation of standard mitigation measures throughout all Project phases will reduce both the likelihood and potential consequences of any potential negative environmental effect on Avifauna. Overall, and through all Project phases, the magnitude of potential negative environmental effects on Avifauna is rated as Low.

Species at Risk

The scope of this Key Indicator encompasses Species at Risk (SAR) as well as Species of Conservation Concern as designated by Provincial and Federal legislation. The identified SAR present in the Project Area and considered in this section include a total of 11 species: two bat species, four bird species, two plant species, two lichens, and one insect species. A draft Species at Risk Impacts, Mitigations, and Monitoring Plan (draft) has been submitted as part of this registration and includes an effects assessment for specific SAR (Appendix R). For this assessment, SAR will be considered as a collective/general KI.

While most of the suitable habitat for SAR is found in the Backlands, the Argentia Peninsula has known occurrences of plant SAR as well as some bird species. Special effort has been dedicated to the identification of SAR presence and suitable habitat throughout the Project Area so that potential interactions can be avoided; however, given the behaviours and distributions of the various SAR species, multiple irregular interactions are likely. Interactions will be possible during Construction and Decommissioning through the fragmentation or loss of habitat, noise disturbance and the presence of humans and heavy machinery. The phase of greatest risk for interaction is Operations and Maintenance, in particular for the bat SAR and some of the avian SAR. During all Project phases, the geographic extent of interactions will generally be restricted to the Project Area, with a greater proportion of interactions likely to occur in the Argentia Backlands. The anticipated interactions between the Project and SAR during all Project phases will be limited in duration.

SHORT-EARED OWL

Short-eared Owl prefers open grassland habitats for hunting, and they construct their nests in shallow scrapes on the ground. They fly relatively close to the ground and are most active during dawn, dusk and at night. Low shrub and barren habitats may be used by Short-eared Owl within the Project area during the nesting season. Minimal habitat loss will occur due to site preparation; however, the effects will be small as there is limited grasslands habitat in the LAA and RAA and those that do exist are contained within wetlands, a habitat that will see minimal disturbance. Short-eared Owl likely has an elevated potential for collisions with vehicles due to their tendency to fly low when hunting in open areas (including clearings and along roadsides). In addition, as a ground-nester, there is potential for the destruction of Short-eared Owl nests should site clearing be conducted during the breeding season.

As discussed in the avifauna KI, collisions often occur when birds are preoccupied with hunting, landing, or fighting (Willard 1978). However, a range of biological and external factors will affect the potential risks to a specific SAR. Among the most important considerations are a species' vision and its flying abilities. This can help explain why some birds of prey with highly binocular vision (eyes in front of the head) often are susceptible to collisions (Bevanger 1994, Tucker 2001). While their straight-ahead view is excellent, large blind zones to the sides increase vulnerability (Tucker 2001). This characteristic also applies to the Short-eared Owl. The crepuscular nature of the Short-eared Owl may also increase susceptibility due to the poor light associated with dawn and dusk (Bevanger 1994).

PASSERINE

The effects of the Project on passerine SAR overlap directly with those discussed in the avifauna KI. Below is an expanded discussion on the species-specific habitat usage and how they may be affected by the Project. Effects discussed earlier are more general, especially during the Operation and Maintenance Phase; however, they are to be considered to all apply to the following species when completing this assessment.

Red Crossbill prefers to forage on the seeds of conifer forests (pine trees and black spruce) and are reliant on these habitats for roosting and nesting. They are most active during the day, exhibiting irruptive behaviour in search of abundant food resources. Habitat loss and habitat fragmentation from tree clearing may occur for Red Crossbill due to site preparation and construction in the Argentia Backlands; however the effect will be reduced due to the nomadic lifestyle of the Red Crossbill and their ability to adapt. Since the species nests throughout the year, nest monitoring and avoidance will be required during vegetation clearing in the Project Area (see section 4.2). Red Crossbill has a high likelihood of interacting with the Project during site preparation and construction because they nest throughout the year in habitat types that will be disturbed during site clearing. They are the most SAR to be affected by habitat fragmentation; however, given the continuous forests outside of the Project Area and their nomadic lifestyle, the project impacts are assessed to be low. This SAR is unlikely to interact with vehicles outside of their migration periods in the spring and fall, preferring localized foraging near their nest and rearing habitat in clearings adjacent to mature forests.

Gray-cheeked Thrush prefers to ground forage and nest in dense low thickets characteristic of Newfoundland coastal habitat that occurs throughout the LAA and RAA. Clearing along pre-existing forest edges and coastal habitat will affect their nesting and foraging during site preparation, however, there is abundant alternate habitat available within the LAA and RAA. Gray-cheeked Thrush may interact with the Project Construction Phase during corridor widening and site clearing. Nesting and foraging for this species occur in dense thickets typical of the habitat type present in the Project Area. Site clearing during the nesting season presents the risk of destruction of nests/eggs/nestlings. However, the dense composition of trees and thickets created by edge effects may increase the habitat availability for this species. This SAR is unlikely to interact with vehicles outside of their migration periods in the spring and fall, preferring localized foraging near their nest and rearing habitat in clearings adjacent to mature forests.

Rusty Blackbird prefers to forage in shallow waters of wetlands surrounded by coniferous-dominant forests, and their nests are usually established in shrubs or small trees near/over water. A small amount of habitat loss may occur for Rusty Blackbird due to site preparation and construction (possibly due to habitat alteration by disturbance), but the potential effect will be reduced due to the quantity of suitable available habitat that exists in the LAA and RAA. Rusty Blackbird is likely to interact with the Project during site preparation and construction since it is known from field surveys to be present in the area.

Any site clearing in or near wetland habitat during nesting season has the potential to destroy nests/eggs/nestlings. However, minimal to negligible habitat alteration is to occur in wetlands. Rusty Blackbird seldom leaves the wetland habitats in which it breeds, so interaction with vehicles is unlikely

Olive-sided Flycatcher prefer to forage in open areas including mature forests near wet areas, including rivers and bogs, semi-open mature forests, barrens, and clearcuts. A small quantity of habitat loss may occur in the removal of mature forest stands, however the open habitat created might be beneficial to this species. Olive-sided Flycatcher is likely to interact with the Project given their habitat preference for edge habitat such as existing and new clearings. Their territory range during nesting is 10-20 ha in predominantly coniferous trees. Therefore, site clearing activities during nesting periods may result in interactions. This SAR is unlikely to interact with vehicles outside of their migration periods in the spring and fall, preferring localized foraging near their nest and rearing habitat in clearings adjacent to mature forests.

Evening Grosbeak prefers to forage on invertebrates in the summer months and fruit and conifer seeds in the winter. Their preferred habitat for mating and foraging is in mature mixedwood forests that are predominantly coniferous. A small quantity of habitat loss may occur for Rusty Blackbird due to site preparation and construction (possibly due to habitat alteration by disturbance), but the potential effect will be minimal due to the amount of available habitat that exists in the LAA and RAA and their nomadic lifestyle. Evening Grosbeak were not identified as present in the conducted surveys. However, their nomadic lifestyle allows for the possibility of occasional occurrences, including nesting. In such cases site clearing activities may affect such individuals. This SAR is unlikely to interact with vehicles outside of their migration periods in the spring and fall, preferring localized foraging near their nest and rearing habitat in clearings adjacent to mature forests.

BATS

Northern myotis and little brown myotis prefer forested areas or open water for foraging, and establish maternity roosts occur in trees, snags, or human structures. The preliminary Project infrastructure layout will affect marginal habitat for Little Brown Myotis, hence the effect of loss of habitat for this SAR from site preparation and clearing will be minimal.

The range of the migratory silver-haired bat likely does not extend to the Project area (aside from the rare outlier vagrant individual). The species occupies a similar niche to the Little Brown Myotis, foraging over waterbodies and roosting in forested habitat. The potential for the Project Area, LAA, or RAA to contain habitat for this species is minimal.

Hoary Bat has a higher wing loading and aspect ratio than the other three bat species, restricting it to less cluttered areas for foraging. Little is known about this species' foraging behaviour and diet in eastern Canada, but other studies have shown that their migratory diet resembles that while on summer grounds

(Reimer *et. al*. 2010). Some evidence suggests that this species may seek out larger waterbodies (Reimer *et al*. 2010) and it seems unlikely that the Project Area (or the LAA or RAA) would provide quality foraging habitat. More local information would be beneficial for this species, and the Post-Construction Monitoring Plan (PCMP) may contribute to this gap. Bat incidental mortality is unlikely to occur during the site preparation and Construction Phase. There are no known hibernacula in the RAA. There is, however, the potential for natural maternity roost habitats in snags, large roost trees, and/or cliff sides within the Project area. Further monitoring surveys for presence of natural maternity roosts (in addition to outbuildings and abandoned bunkers) will be completed prior to site clearing and/or blasting.

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Lights and flaring stacks can alter habitat, often by attracting insects which may be foraged by insectivorous bats. If densities of insects increase in the LAA due to additional lighting, they could act as a sink for bats. Wind turbine operations may result in sensory disturbance for bats beyond the footprint of the turbines (the Project Area) and result in changes to localized bat behaviour (e.g., within the LAA). Research has shown that anthropogenic noise affects bat foraging effort and success; bats have been found to spend less time foraging in noisy areas (Luo *et al*. 2015, Siemers and Schaub 2011, Schaub *et al*. 2008). Another study (Barré *et al*. 2018) indicated that, in addition to a decrease in activity for several bat species near turbines, sensory disturbance for bats can also extend as far as 1 km from wind turbines.

The effects of wind energy projects can vary substantially across the ranges of bat species (Environment and Climate Change Canada 2018). Bat mortalities are most commonly caused by collisions with rotors. Bats account for the majority of vertebrate fatalities at wind turbines, making wind energy production the leading cause of multiple mortality events in bats (Voigt *et. al*. 2024). However, it is also acknowledged that regions characterized by high wind speeds, like Newfoundland and the Argentia area, exhibit a reduced potential for turbine collisions due to relative lower habitat use by bats.

Aside from impact fatalities, Myotis bats also demonstrate avoidance behaviours near wind turbines, which in turn leads to habitat loss (Gaultier *et al*. 2023). Given the steep declines of bat populations in eastern Canada due to White-Nose Syndrome (WNS), any effects on individual bats of the SARA-listed species have the potential to be significant. Mortality of any remaining individuals, particularly breeding adults, can negatively affect the survival of local populations, slow the rate of recovery, and possibly delay the development of resistance to the fungus that causes WNS (Environment and Climate Change Canada, 2018).

Bats can be vulnerable to vehicle collisions (Fensome and Mathews 2016). Low-flying species are more prone to collisions than high-flying species, and juveniles are more vulnerable than adults (Fensome and Mathews 2016). Given that most light vehicle traffic associated with routine inspections and maintenance of the Project infrastructure will be during the day, and traffic volumes will be low (single vehicles), the potential for bat SAR interactions with light vehicles is low.

INSECTS

Yellow-banded bumblebee is generalist and can be observed in many different natural habitats and anthropogenic areas (COSEWIC, 2015). This bee can be observed in any area with abundant flowering plants. As such, existing transmission line right-of-way, open meadows, and unoccupied land on the Argentia Peninsula have the potential to support this species. Therefore, site preparation of turbine sites, transmission lines, and plant facilities all interact with potential suitable habitat. Yellow-banded Bumblebee mortalities are possible when clearing of land occurs during the colony's active season (May – August). During the fall and winter months, site preparation activities pose the risk of disturbing overwintering queens in shallow loose soil burrows or rotting logs.

While wind turbine operation does cause insect mortality, there is limited knowledge on this topic (Voigt, 2021). One recent study indicated that wind turbines do not appear to affect honeybee colonies (Fourrier *et al*., 2023). However, where the insect SAR identified in the Project Area is a bumble bee rather than a honeybee, extrapolating these conclusions provides limited inference to this species.

The relationship between bat fatalities and insect foraging has led to literature which may be used to support the evidence of insect interactions with wind turbines. There is a positive correlation between bat mortalities at wind turbines and the migration windows of high-flying migratory insects (Rydell *et al*., 2010). This may indicate that high-flying migratory insect species are susceptible to turbine strikes (Rydell *et al*., 2010). Another study found that insects of the order Lepidoptera (e.g., moths, butterflies) were dominant in the stomachs of bats killed by turbines, indicating that these insects may interact with turbine blades themselves (Foo *et al*., 2017).

While the potential is there for collision with turbine blades, the COSEWIC Assessment and Status Report on the yellow-banded bumble bee, assessed the threat of renewable energy as negligible. While they also state that the development may also result in a beneficial increase in flowers (COSEWIC, 2015).

PLANTS AND LICHENS

Lichen SAR including blue felt lichen, boreal felt lichen, and graceful felt lichen were considered and addressed in the Flora KI. In summary, lichen mortality is possible, either directly because of site clearing in yellow birch and balsam fir stands of high suitability or indirectly when nearby forest stands are eliminated causing alteration in local atmospheric conditions.

Water pygmyweed is located on the Argentia Peninsula along its northwestern coast. Should this area be used during the Construction Phase as a laydown area for Project components, there could be interactions with water pygmyweed. Mitigations will be sought through consultation with NL WD.

SUMMARY

The Local Assessment Area contains sufficient habitat to support any of the identified SAR, hence decommissioning and rehabilitation can be expected to result in negligible negative effects and, for many aspects of the work, will benefit the SAR using the area. Given the nature of potential interactions with SAR throughout all phases of the Project, many, but probably not all, will be reversible to some extent. An Unplanned Event can include vehicle collisions with associated mortalities; hence reversibility is ranked as unlikely for this Project phase.

The context of all these interactions will fall within the Project Area, including both the Argentia Peninsula brownfield as well as the Argentia Backlands. The implementation of standard and custom-designed mitigation measures throughout all Project phases will reduce both the likelihood and consequences of any potential negative environmental effect on SAR. Overall, and through all Project phases, the magnitude of potential negative environmental effects on SAR, while rated as Low, will nonetheless rely on the successful implementation of mitigation measures and the associated monitoring for feedback on environmental effects as well as the use of adaptive environmental management throughout all phases of the Project. A draft Species at Risk Impacts Mitigation and Monitoring Plan has been included with this Registration document (Appendix R) which outlines all the proposed mitigations for SAR.

4.2.3.5 Mitigation Measures

Applicable avoidance and mitigation measures are listed in Table 4.2.3-5. Project-specific plans (e.g., SAR IMMP, PCMP) will also include mitigation measures that are applicable to this VC.

Table 4.2.3-5 Mitigation and Enhancement Measures: Terrestrial Environment.

Terrestrial Environment			
Project Phase	**KI**	**Interaction**	**Mitigation/Enhancement**
Construction	Fauna Avifauna Flora SAR	• Loss and fragmentation of wildlife habitat due to vegetation clearing. • Change in ecological community diversity as a result of loss of forest.	• Remove as little vegetation as possible. • Clearing, grubbing, and topsoil overburden removal will be clearly identified in the field using flagging and survey stakes. • Vegetation removal will be limited to within the construction footprint area.
Construction Decommissioning and Rehabilitation	Fauna Avifauna Flora SAR	• Loss and fragmentation of wildlife habitat due to vegetation clearing.	• Rehabilitation will be initiated within all temporary construction and decommissioning areas as appropriate to

			the type of habitat that was removed, i.e., replant forested areas using native stock.
Construction	Fauna Avifauna SAR	• Possible mortality of nesting birds. • Loss and/or degradation of nesting habitat. • Disturbance and/or displacement of nesting birds.	• Site clearing and grubbing will be avoided during breeding bird season. • If vegetation must be removed during the bird nesting season of April 1 to August 31, mitigations will be applied in accordance with the **Migratory Birds Convention Act**. • Pre-clearing surveys for active migratory bird nests will be carried out for work done during the breeding season, and buffer / set-back distances from active nests will be established.
Construction	Fauna Avifauna SAR	• Possible mortality of nesting birds. • Loss and/or degradation of nesting habitat. • Disturbance and/or displacement of nesting birds.	• A qualified Avian Biologist will be present during clearing activities to supervise vegetation removal and carry out nest surveys.
Construction	Fauna Avifauna SAR	• Possible mortality of nesting birds. • Loss and/or degradation of nesting habitat. • Disturbance and/or displacement of nesting birds.	• A buffer zone shall be established around the active bird nest or confirmed bird nesting activity if one is discovered. The radius of the buffer will vary depending on the species, level of disturbance, and landscape context. The buffer will be developed in consultation with Wildlife Division. The nest is expected to be protected by the minimum buffer area of 10 m surrounding the nest from minor work such as vegetation clearing, building access roads, general heavy machinery use, and vehicle operation.
Construction	Fauna Avifauna SAR Flora	• Loss and fragmentation of wildlife habitat due to sub-surface excavation activities. • Possible mortality and/or harm to terrestrial wildlife. • Disturbance to wildlife due to construction noise and vibration.	• Limit the affected area of blasting to minimize disturbance to wildlife while carrying out blasting operations in accordance with relevant Federal and Provincial guidelines and standards.
Construction	Fauna Avifauna SAR	• Loss and fragmentation of wildlife habitat due to sub-surface excavation activities.	• Prior to blasting, a qualified Biologist is to undertake an area search of the intended blasting area to determine whether wildlife is present on the day of blasting. If wildlife is encountered in the blasting zone, deterrence measures are to be employed, up to implementation of a delay in blasting until the wildlife has vacated the area.

		• Possible mortality and/or harm to terrestrial wildlife. • Disturbance to wildlife due to construction noise and vibration.	
Construction	Fauna Avifauna SAR	• Loss and fragmentation of wildlife habitat due to sub-surface excavation activities. • Possible mortality and/or harm to terrestrial wildlife. • Disturbance to wildlife due to construction noise and vibration.	• Time delay blasting cycles or blast mats will be used to control debris generated from blasting. • Blasting will only occur in areas that have been cleared of vegetation.
Construction	Fauna Avifauna SAR	• Loss and fragmentation of wildlife habitat due to sub-surface excavation activities. • Possible mortality and/or harm to terrestrial wildlife. • Disturbance to wildlife due to construction noise and vibration.	• All blasting activities will be overseen by an Environmental Monitor as per the Construction EPP. The designated monitor will check the site prior to and during blasting activities to ensure compliance with the Blasting Plan.
Operations	Fauna Avifauna	• Possible bat and bird mortality as a result of collision with wind turbines. • Disturbance to wildlife caused by noise and light from Project infrastructure, and possible avoidance of the area.	• Wind turbine and meteorological tower lighting levels will be at the minimum allowed by Transport Canada for aeronautical safety, and white or red strobe lights may be used with the minimum intensity and flashes per minute allowable.
Operations	Fauna Avifauna SAR	• Disturbance to wildlife caused by noise and light from Project infrastructure, and possible avoidance of the area.	• Ground-level external lights on buildings and wind turbine bases will be pointed downward and shall use motion or heat sensors when possible and permitted by relevant codes and the authority with jurisdiction.
Construction, Operations and Maintenance, and Decommissioning and Rehabilitation	Fauna Avifauna SAR	• Disturbance to wildlife caused by noise and light from Project infrastructure, and	• Project lighting will be limited to that which is necessary for safe and efficient Project activity.

		possible avoidance of the area.	
Operations	Avifauna SAR	• Possible bat and bird mortality as a result of collision with wind turbines.	• Curtail turbines during Year One at wind speeds below 6 m/s, from dusk to dawn, when ambient air temperatures are above 6 degrees Celsius, between July 1 and September 30.
Operations	Avifauna SAR	• Possible bat and bird mortality as a result of collision with wind turbines.	• A post-construction mortality monitoring program (PCMP) will be established, and carcass searches will be conducted at all turbines between April and October for at least the first year, with thermal camera and/or acoustic monitoring occurring at least in the first, second, fifth, and seventh years of operations. Surveys will be designed to account for searcher efficiency and scavenger rates. The mortality monitoring program will be developed in consultation with the NL WD. • An adaptive management framework will be used to introduce new mitigation measures if high fatality rates are observed as per the Operations EPP.
Construction, Operations and Maintenance, and Decommissioning and Rehabilitation	Fauna Avifauna SAR	• Possible wildlife interactions with personnel, equipment, and vehicles	• A Wildlife Response Protocol will be developed and implemented. • Project personnel must record and report all wildlife sightings and human-wildlife interactions and conflicts to the Environmental Coordinator. • SAR sightings and human-wildlife interactions will be reported to FFA
Construction, Operations and Maintenance, and Decommissioning and Rehabilitation	SAR	• Possible destruction and/or fragmentation of avian SAR habitat. • Change in mortality risk – harm, harassment, and/or killing of SAR.	• Staff will receive formal training on how to recognize SAR that may be present in the Project Area and the proper procedure to follow if SAR are encountered as per the EPP.
Construction	SAR	• Possible destruction and/or fragmentation of avian SAR habitat. • Change in mortality risk – harm, harassment, and/or killing of SAR.	• Construction work must stop immediately within 10 m of a SAR observation until a qualified biologist can confirm the species has vacated the construction disturbance footprint. If the species is not present within the vicinity of the previous observation after a 24-hour period, work can resume.
Construction, Operations and Maintenance, and Decommissioning and Rehabilitation	Fauna Avifauna SAR	• Mortality to wildlife as a result of vehicles using access roads.	• Establish Project speed limits that are protective of wildlife. • Post signage and monitor for adherence to the limits set. • Inform staff to be vigilant for wildlife while driving on site.
Construction	Fauna Avifauna SAR	• Possible mortality, harm, and/or harassment to wildlife due to	• As per the Construction EPP, Environmental Monitors will be present during construction activities such as clearing vegetation, dewatering, and

		construction activities. • Disturbance to wildlife.	blasting to ensure adherence to environmental regulations.

4.2.3.6 Conclusion

Table 4.2.3-6 provides a summary of predicted adverse residual effects on the Terrestrial Environment VC.

Table 4.2.3-6 Potential Adverse Residual Environmental Effects of the Project: Terrestrial Environment.

Terrestrial Environment							
Project Phase	Key Indicator	Magnitude	Frequency	Extent	Duration	Reversibility	Context*
Construction	Flora	3	4	1	5	3	1,3
	Wetlands	2	2	2	3	3	3
	Fauna	2	3	3	1	1	1,3
	Avifauna	2	3	3	4	3	1,3
	Species at Risk	2	3	2	3	3	1,3
Operation and Maintenance	Flora	2	3	1	5	3	1,3
	Wetlands	2	2	2	3	3	3
	Fauna	2	2	3	1	1	1,3
	Avifauna	2	2	2	2	3	1,3
	Species at Risk	2	2	2	1	3	1,3
Decommissioning	Flora	3	4	1	5	3	1,3
	Wetlands	2	2	2	3	3	3
	Fauna	2	3	3	1	1	1,3
	Avifauna	2	3	3	4	3	1,3
	Species at Risk	2	3	2	3	3	1,3
Unplanned Events	Flora	2	2	1	4	3	1,3
	Wetlands	2	2	2	3	3	3
	Fauna	2	2	3	1	5	1,3
	Avifauna	2	2	2	1	5	1,3
	Species at Risk	2	1	2	1	3	1,3
NOTES *Context may be assigned more than one value.							

Table 4.2.3-7 presents a summary of the effects prediction of the Project on the Terrestrial Environment. These predictions consider the nature and extent of the identified interactions, as well as assuming the implementation of mitigation and monitoring measures as described and committed to (see Table 4.2.3-5). Special attention will focus on the contents of Appendix R (Species at Risk Impacts Monitoring and Mitigation Plan) and the Post-Construction Monitoring Plan (Appendix S). There are no predicted

negative significant residual environmental effects of the Project (all phases) with respect to the Terrestrial Environment.

Table 4.2.3-7 Significance of Potential Residual Environmental Effects of the Project: Terrestrial Environment

Project Phase	Key Indicator	Significance of Predicted Residual Environmental Effects		Likelihood*	
		Level of Significance	Level of Confidence	Probability	Scientific Certainty
Construction	Flora	NS	3		
	Wetlands	NS	3		
	Fauna	NS	3		
	Avifauna	NS	3		
	Species at Risk	NS	3		
Operation and Maintenance	Flora	NS	3		
	Wetlands	NS	3		
	Fauna	NS	3		
	Avifauna	NS	3		
	Species at Risk	NS	3		
Decommissioning	Flora	NS	3		
	Wetlands	NS	3		
	Fauna	NS	3		
	Avifauna	NS	3		
	Species at Risk	NS	3		
Unplanned Events	Flora	NS	3		
	Wetlands	NS	3		
	Fauna	NS	3		
	Avifauna	NS	3		
	Species at Risk	NS	3		

NOTES
*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.4 Land and Resource Use

Land and Resource Use is selected as a VC because of the potential interactions between the Project and the use of lands and resources in and nearby the Project Area, and their socio-economic value to the region. There are five KIs through which the Land and Resource Use VC and the Project interact: private and municipal designated land use, commercial and industrial resource use, recreational and subsistence land and resource use, protected sensitive areas (Habitats of Conservation Concern), and Indigenous land use.

The spatial boundaries for the assessment of potential Land and Resource Use effects include the Project Area, LAA and RAA as defined in Section 2.1. Table 4.2.4-1 lists KIs applicable to the Land and Resource Use VC, as well as geographic scope and applicable measurable parameters for each KI.

Table 4.2.4-1 Scope & Measurable Parameters of Key Indicators: Land and Resource Use.

Key Indicator	Scope	Measurable Parameters
Zoning	Project Area	• Qualitative description of property development plans and zoning requirements • Qualitative description of activities affecting PPWSA • Extent of current land use sites (including tenured lands) overlapped by the Project • Change / restriction or disruption of land use (ha) • Proximity to land use sites (km)
Commercial and Industrial Resource Use	Project Area, LAA and RAA	• Extent of current resource use sites including tenured land (i.e., POA, mining/quarrying, agriculture, radar towers) • Change or disruption affecting resource use (ha) • Proximity to resource use sites (km)
Recreational and Subsistence Resource Use	Project Area and LAA	• Qualitative use of area (e.g., hunting/trapping/ angling, domestic wood harvesting, berry picking, swimming) • Change / restriction or disruption of land use (ha) • Proximity to recreation use sites (km)
Protected, Special and Sensitive Areas	Project Area, LAA and RAA	• Qualitative use of area (e.g., Parks and reserves, proposed protected areas, sensitive wildlife areas) • Proximity to Protected, Special and Sensitive Areas (km)
Indigenous Land Use	Project Area, LAA and RAA	• Proximity to contemporary indigenous land use areas (km)

4.2.4.1 Assessment Criteria

Assessment criteria presented in Table 4.1.7-2 were used to evaluate the effects of the Project on the Land and Resource Use VC.

4.2.4.2 Existing Knowledge

The existing knowledge of the five key indicators of Land and Resource Use are described in Section3.1.4.

4.2.4.3 Definition of Significance

For the Land and Resource Use VC, a significant adverse residual effect is defined as:

- Having a high magnitude; or
- A medium magnitude and characterized by either:
    - An extended duration affecting a geographic area that extends beyond the Project Area; or
    - A low level of confidence in the prediction.

Where a significant effect has been predicted, this evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.4.4 Potential Project-Environment Interactions

Potential interactions with identified KIs of the Land and Resource Use VC are summarized below in Table 4.2.4-2.

Given the absence of contemporary Indigenous land use within the RAA, there are no potential interactions anticipated with respect to the proposed Project during any phase. Indigenous land use is therefore not discussed further in this chapter.

Table 4.2.4-2 Potential Project Environment Interactions Matrix: Land and Resource Use.

Key Indicators: Land and Resource Use					
Project Component and Activity Description	**Zoning**	**Commercial and Industrial Resource Use**	**Recreational and Subsistence Resource Use**	**Protected, Special, and Sensitive Areas**	**Indigenous Land Use**
Construction Phase					
Site Preparation		X	X		
Roads	X	X			
Staging and Laydown	X	X		X	
Material Transport		X			
Wind Turbine Foundations	X	X			
Electrical Infrastructure	X	X	X	X	
Wind Turbine Installation		X		X	
Electrolyser Plant	X	X			
Ammonia Plant	X	X			
Ammonia Storage/Transfer		X			
Flares		X			
Admin Buildings	X	X			
Operation and Maintenance Phase					
Wind Turbine Operation				X	
Wind Turbine Maintenance					
Electrical Infrastructure			X		
Venting and Flaring					
Road Maintenance		X			
Plant Operations		X			
Ammonia Handling		X			
Decommissioning Phase					
Electrical Infrastructure		X	X		
Wind Turbine Removal		X		X	
Building Removal		X			
Plant Removal		X			

Key Indicators: Land and Resource Use					
Project Component and Activity Description	**Zoning**	**Commercial and Industrial Resource Use**	**Recreational and Subsistence Resource Use**	**Protected, Special, and Sensitive Areas**	**Indigenous Land Use**
Terrain Reclamation		X	X		
Unplanned Events					
Spills and releases		X			
Flaring and venting					
Fire, explosion		X			
Traffic accident		X			
Wind Turbine collapse		X		X	
Water supply failure		X			
Wildlife emergency					
Human hazard or injury					
NOTES X: Potential interactions that might cause an effect. Blanks indicate that interactions between the Project and the VC are not expected.					

Zoning

Potential issues and concerns that may arise with zoning because of Project activities would result from the proposed footprint of the Argentia Green Fuels Facility, the Argentia Wind Facility and associated linear infrastructure on the Argentia Backlands. Should Project features and activities be incompatible with designated land uses, and/or impede or restrict future land development, then such an interaction could result in potential zoning changes or potential negative effects.

In general, the Project will be able to comply with all existing zoning requirements and restrictions during all Project phases. The facilities on the Argentia Peninsula are to be sited within an existing industrially zoned area. The Argentia Backlands required for the construction of the wind turbines and electrical

infrastructure will need to be zoned and appropriately permitted within the Municipal Planning Area of Placentia. In discussion with the Town of Placentia, the following modifications are to be considered:

- Substation location must be classified as industrial, or rules for rural zoning must be amended to allow substations.
- Wind turbine locations must be classified as industrial, or rules for rural zoning must be amended.
- Discussion regarding whether the Argentia Green Fuels Facility is considered compatible with a regular industrial zone or a hazardous industrial zone.

In addition, the Project Interconnect Line will be substantially located on Crown Lands until joining the Long Harbour Terminal Station. The Long Harbour substation is zoned as special industrial. Permission will be required for construction of the Project Interconnect Line on Crown Land along the proposed routing. To the extent practical, the route will parallel existing rights-of-way.

Two Protected Public Water Supply Areas (PPWSAs) are located within the Project Area and include Clarkes Pond/Larkins Pond and Wyses Pond/Curve Pond. Construction adjacent to a PPWSA will comply with the Town of Placentia Municipal Plan, whereby no major development is permitted in these watersheds. The construction of roads as well as Collector Lines, the Project Gen-Tie, and the Project Interconnect Line within the PPWSA will require the approval of the NL DECC.

There are two segments of Protected Road zoning that run parallel with the proposed Project Interconnect Line. The first zone begins at the Southeast Placentia Road and extends east along Route 100 approximately 4.2 km and buffers 100 m on either side of the highway. The second section abuts the first continuing east along NL-100 extending to the Trans Canada Highway (TCH) and buffers 100 m on either side of the highway. The Project Interconnect Line is proposed to pass through these buffered areas and will require approval under Section 61 of the **Urban and Rural Planning Act** (2000).

Zoning adjustments will be solidified to proceed with construction permitting. Therefore, the Project will not interact with zoning concerns in the Operation and Maintenance, Decommissioning and Rehabilitation phases of the Project, nor during Unplanned Events.

Commercial and Industrial Resource Use

Potential concerns could arise with Commercial and Industrial Resource Use and Project features because of interactions with mineral land tenure accessibility, disturbance of adjacent properties and users, as well as commercial and industrial activities within the POA Property (e.g., quarrying). As discussed in Section 3.1.4.2, other activities including forestry, agriculture, aquaculture, and petroleum exploration will not interact with the Project.

Access to mineral land tenures located in the Argentia Backlands may be restricted throughout all Project phases. As of April 26, 2024, there are 8 subsurface licences which overlap with the Preliminary Layout of the Argentia Wind Facility, with a total of approximately 775 ha. Further, there are two quarries currently located on the POA Property. One is permitted to Tier 1 Capital Corporation Edward Collins Contracting Limited located on Broad Cove Head, Argentia, and encompasses 3.17 ha. The second is permitted to Pennecon Heavy Civil Ltd. located on Silver Mine Rd, Argentia, and encompasses 3.87 ha. Access will continue to be available to operational quarries and project infrastructure will not overlap with their permitted land areas, however, limited restrictions could apply to access routing.

The operation by Canadian Coast Guard (CCG) of the Vessel Traffic Centre includes use of a radar system, the effectiveness of which could be affected by the presence of physical structures within its viewing arc. Argentia Renewables is currently working with CCG to find a mutually beneficial solution to mitigate false returns due to wind turbine clutter and any loss of detection downrange due to shadowing. In order to reduce potential effects on radar activities in the general area of Placentia and the POA, the Project will continue to work with the CCG to minimize potential effects from wind turbines on radar activities. This will include the micro-siting of wind turbines (e.g., selecting a turbine location behind a coast guard radar rather than in front of it, modifying final wind turbine layout to further reduce effects) and may also include other measures such as funding software upgrades to utilize existing radar capabilities, based on direct consultation with the CCG.

The operations of the POA will not be reduced or restricted during any Project phases; rather, shipping during all phases will marginally increase marine traffic and port activity. Road transport of turbine components from the POA to the Argentia Backlands has the potential to produce temporary traffic delays. A Traffic Management Plan has been developed to address means to reduce interactions and ensure the smooth flow of road traffic (Appendix E). Potential for negative effects for the POA resource use would be the direct and indirect interactions caused by an Unplanned Event, as discussed in Section 4.3. Such Unplanned Events are addressed in detail in the Emergency Response Plan (Appendix M), and the Risk Assessment Workshop Report (Appendix V).

Any temporary disturbance to nearby properties will be limited to the Construction, and Decommissioning and Rehabilitation phases because of increased activity. During the Operation and Maintenance phase, levels of disturbance will be minimal. Given the industrial zoning of the POA, and the nature of ongoing (and anticipated) POA activities, there is minimal potential for Project activities to disrupt other commercial and industrial resource use.

Recreational and Subsistence Resource Use

Given the existing status of the POA Property as private lands, minimal Project interactions are expected with Recreational and Subsistence Resource Use. Anticipated interactions associated with the Construction phase will include temporary reduced access to hunting, fishing, swimming, and berry picking areas within the Argentia Backlands.

Some interactions could, however, result from the Construction, Operation and Maintenance of the Project Interconnect Line where the corridor crosses Crown Lands. This may affect recreational uses and domestic wood harvesting along the route as trees will be cleared and maintained throughout the life of the Project. The domestic wood harvesting zones D01-H-5D and D01-H-7D run along Route NL-101 and Route NL-100 respectively, and both are within the vicinity of the proposed Project Interconnect Line for the Project.

There may be restrictions within the Argentia Backlands for selected recreational activities during all Project phases, however other activities such as hiking will be facilitated. The Project will alter the visual landscape of the Argentia Backlands following the erection of the wind turbines, and this could alter the pattern of local tourism resource use.

Tourism facilities adjacent to the POA have the potential to be affected by the Project, especially during the Construction, and Decommissioning and Rehabilitation phases. Tourism facilities that overlap with the Project Area are outlined in Section 3.1.4.3 and include the Argentia Provincial Visitor Centre and the Sunset RV Park. These facilities will see increased activities during their operating seasons. While all phases of the Project will alter the viewscapes of the area, it is anticipated to generate interest in the region. Additional tourism facilities and related economic interactions with the Project are addressed by the Socio-economic VC (Sections 3.1.5 and 4.2.6) and in the Socio-economic Baseline Study (Appendix G).

Protected, Special and Sensitive Areas

There are few locations of Protected, Special, and Sensitive Areas either within or adjacent to the Project Area. One exception pertains to the provincially designated sensitive wildlife area associated with the recent observations of a provincially protected rare plant species (water pygmyweed) at two sites on the Argentia Peninsula (see Appendix D6). The potential for interaction is at its highest during the Construction, and Decommissioning and Rehabilitation phases due to increased activity on the turbine laydown area (the former runway) thus increasing the possibility of species disturbance. Operation and Maintenance interactions include air temperature/wind differences created by wind turbine operation that could alter the microclimate adjacent to the rare plant. In addition, located 25 kilometres from the Argentia Ferry, Fitzgerald’s Pond Provincial Park within the RAA protects a population of rare boreal felt lichen, however, overlap with the proposed park expansion is limited to potential for interaction with the Project Interconnect Line.

The Project will interact with the landscape when viewed from the historic site in the RAA, Castle Hill., however, this interaction will not compromise the integrity of the site itself. In reference to the Historic Resources Overview Assessment (Appendix F), there are minimal interactions with any other heritage sites by the Project. Otherwise, there are no designated or proposed protected areas that will interact with the Project.

4.2.4.5 Mitigation Measures

Standard mitigation and enhancement measures applicable to the Land and Resource Use VC are provided by Project phase in Table 4.2.4-3. Project-specific plans (e.g., the Waste Management Plan) will also include mitigation measures that are applicable to this VC.

Table 4.2.4-3 Mitigation and Enhancement Measures: Land and Resource Use.

Land and Resource Use			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
Construction	Zoning	• Project activities may be incompatible with designated land uses. • Project activities may impede or restrict future land development.	• The Project will apply for the appropriate rezoning under the Municipal Plan. • The Project will apply for the appropriate permits within the Municipal Planning Area of Placentia. • The Project is to occur on privately owned lands with the Project Interconnect Line to follow existing linear corridors for minimal restriction to future land development.
	Commercial and Industrial Resource Use	• Land tenure and quarry accessibility. • Temporary disturbance to nearby properties (e.g., noise, dust). • Periodic increased traffic delays at the port.	• Vehicles and equipment are to be maintained in good working order. • Dust suppression will be used. • Schedule transport of oversize loads outside of peak traffic hours. • The Project will consult and work with the Mineral Lands division of the Newfoundland and Labrador Department of Industry, Energy and Technology (NLDIET) to ensure that project site safety is maintained while mitigating any issues from the mineral licences and their holders. • In order to reduce potential impacts to Canadian Coast Guard radar activities in the general area of Placentia and the Port of Argentia, the Project will continue to work with the Canadian Coast Guard to minimize potential impacts that wind turbines may pose to radar activities.
	Recreational and Subsistence Resource Use	• Project clearing may result in the alteration of recreational and/or subsistence land use along Project Interconnect Line due to changes in resource accessibility and availability. • Activities may reduce access to or quality of recreational land use.	• Plan to route electrical infrastructure and access roads along existing rights-of-way wherever possible to reduce infrastructure footprint. • Vehicles and equipment are to be maintained in good working order. • Dust suppression will be used. • Facilitate hiking trail development in the Argentia Backlands through identification of viewing areas and coordination of trail route selection.

Land and Resource Use			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
		• The project will visually interact with local tourism.	
	Protected, Special and Sensitive Areas	• Project activities adjacent to sensitive wildlife areas at turbine laydown areas.	• Appropriate buffers will be set according to species-specific management plans and implemented to prevent disturbance to the sensitive wildlife area.
Operation and Maintenance	Commercial and Industrial Resource Use	• Land tenure and quarry accessibility.	• Agreements will be made with existing quarries.
	Recreational and Subsistence Resource Use	• Project infrastructure may result in the alteration of recreational and/or subsistence land use along Project Interconnect Line due to changes in resource accessibility and availability. • The project will visually interact with local tourism.	• Plan to route electrical infrastructure and access roads along existing rights-of-way wherever possible to reduce infrastructure footprint. • The project will collaborate with local tourism stakeholders.
	Protected, Special and Sensitive Areas	• Wind turbine operation adjacent to sensitive wildlife areas may negatively affect endangered plants.	• Appropriate buffers will be maintained in accordance with species-specific management plans to prevent disturbance to the sensitive wildlife area.
Decommissioning	Commercial and Industrial Resource Use	• Temporary disturbance to nearby properties (e.g., noise, dust). • Periodic increased traffic delays at the port.	• Vehicles and equipment are to be maintained in good working order. • Dust suppression will be used. • Timing of transport of materials will occur outside of peak traffic hours.
	Recreational and Subsistence Resource Use	• Project clearing for infrastructure removal may result in the alteration of recreational and/or subsistence land use along Project Interconnect Line due to changes in resource accessibility and availability.	• Plan to route electrical infrastructure and access roads along existing rights-of-way wherever possible to reduce infrastructure footprint. • Vehicles and equipment are to be maintained in good working order. • Dust suppression will be used.

Land and Resource Use			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
		• Activities may reduce access to or quality of recreational land use. • The project will visually interact with local tourism.	
	Protected, Special and Sensitive Areas	• Wind turbine operation adjacent to sensitive wildlife areas may negatively affect endangered plants.	• Appropriate buffers will be maintained in accordance with species-specific management plans to prevent disturbance to the sensitive wildlife area.
Unplanned Events	Commercial and Industrial Resource Use	• Unplanned Events may interact with the operations of properties on the Argentia Peninsula.	• A sensor will be installed on the connection point of the ammonia transfer and pipeline feed to detect pressure losses and ammonia leaks. Instrumentation will be equipped with automated shut-off value closure to initiate emergency stops. • Atmospheric tanks double walled with no bund will be used for ammonia storage. Tanks will be designed as complete containment systems that can hold liquids and vapours. • Hydrogen storage and pipelines will be located away from sources of heat and ignition. • Ensure vehicles, heavy equipment, and machinery are inspected and free of fluid leaks. • Site maintenance, vehicle maintenance, and fuelling will be done in specified areas more than 30 m away from wetlands and waterbodies. • Use secondary containment to store any potential contaminants (e.g., oil, fuels, and chemicals) in designated areas. • All spills are to be reported and cleaned up as soon as possible, with contaminated soils removed from site for disposal at an approved/licensed location. • Personnel on-site will be trained to use firefighting equipment. • Fire detection and protection systems will be installed in high-risk areas such as fuel and hazardous material storage.
	Recreational and Subsistence Resource Use	• Unplanned Events (fire or spills) along the Project Interconnect Line may alter recreational and/or subsistence land use along Project Interconnect Line due to changes in resource accessibility and availability. • Unplanned Events may reduce access to or quality of recreational land use. • Unplanned Events may interact with local tourism by restricting access to areas including the Marine Atlantic Terminal and the Argentia Sunset RV Park.	
	Protected, Special and Sensitive Areas	• Unplanned Events located near sensitive wildlife areas may disrupt or destroy sensitive habitat critical to the species.	

Land and Resource Use			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
		• Unplanned Events may result in altered landscape for which the nearest historic site overlooks.	• Turbines and hydrogen ammonia facility will be routinely inspected, and regular maintenance will take place to ensure proper operation.

4.2.4.6 Conclusion

Table 4.2.4-4 provides a summary of predicted adverse residual effects on the Land and Resource Use VC. The magnitude of effects is ranked as either negligible (1), low (2), or moderate (3).

Given the significance criteria defined above in Section 4.2.4.3, no Project phase was determined to result in significant residual effects to any KI of the Land and Resource Use VC, as summarized in Table 4.2.4-5. While two negative residual effects with KI's in the Construction Phase were determined to be moderate, neither were determined significant because of the high level of confidence in the outcomes of the desktop review.

Table 4.2.4-4 Potential Adverse Residual Environmental Effects of the Project: Land and Resource Use.

Land and Resource Use							
Project Phase	**Key Indicator**	**Magnitude**	**Frequency**	**Extent**	**Duration**	**Reversibility**	**Context***
Construction	Zoning	1	1	1	5	3	1,3
	Commercial and Industrial Resource Use	1	5	3	3	3	1,3
	Recreational and Subsistence Resource Use	3	3	3	3	3	1,3
	Protected, Special and Sensitive Areas	3	4	1	1	1	5
Operation and Maintenance	Zoning	N/A	N/A	N/A	N/A	N/A	N/A
	Commercial and Industrial Resource Use	1	5	1	3	3	1,3
	Recreational and Subsistence Resource Use	1	5	1	3	3	3
	Protected, Special and Sensitive Areas	1	4	1	1	1	5
Decommissioning	Zoning	N/A	N/A	N/A	N/A	N/A	N/A
	Commercial and Industrial Resource Use	1	5	1	3	3	1
	Recreational and Subsistence Resource Use	1	3	1	3	3	3
	Protected, Special and Sensitive Areas	1	4	1	1	1	5
Unplanned Events	Zoning	N/A	N/A	N/A	N/A	N/A	N/A
	Commercial and Industrial Resource Use	2	1	2	2	3	1,3

Land and Resource Use							
Project Phase	**Key Indicator**	**Magnitude**	**Frequency**	**Extent**	**Duration**	**Reversibility**	**Context***
	Recreational and Subsistence Resource Use	2	1	2	2	3	1,3
	Protected, Special and Sensitive Areas	1	1	2	2	3	1,3
*Context may be assigned more than one value.							

Table 4.2.4-5 Significance of Potential Residual Environmental Effects of the Project: Land and Resource Use.

Project Phase	**Key Indicator**	**Significance of Predicted Residual Environmental Effects**		**Likelihood***	
		Level of Significance	**Level of Confidence**	**Probability**	**Scientific Certainty**
Construction	Zoning	NS	3		
	Commercial and Industrial Resource Use	NS	3		
	Recreational and Subsistence Resource Use	NS	3		
	Protected, Special and Sensitive Areas	NS	3		
Operation and Maintenance	Zoning	N/A	N/A		
	Commercial and Industrial Resource Use	NS	3		
	Recreational and Subsistence Resource Use	NS	3		
	Protected, Special and Sensitive Areas	NS	3		
Decommissioning	Zoning	N/A	N/A		
	Commercial and Industrial Resource Use	NS	3		
	Recreational and Subsistence Resource Use	NS	3		
	Protected, Special and Sensitive Areas	NS	3		
Unplanned Events	Zoning	N/A	N/A		
	Commercial and Industrial Resource Use	NS	3		
	Recreational and Subsistence Resource Use	NS	3		
	Protected, Special and Sensitive Areas	NS	3		

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.5 Heritage and Cultural Resources

Heritage and Cultural Resources are included as a VC because they are valued by Indigenous Peoples and the public at large for the general and scientific information they can provide about past peoples, their societies, cultures and lifeways, and the connections and interactions they may have had with other groups. The study area utilized for this assessment is presented in Section 3.2 (Baseline Studies).

KIs presented in Table 4.2.5-1 for this VC include Historic and Archaeological Resources, which typically comprise materials such as stone tools, ceramics, glass, and metal objects, as well as structural remains (e.g., wooden or stone) that are 50 years old or older and show evidence of manufacture, alteration or use by humans. Also included can be burial, cultural, spiritual, and other types of heritage sites or artifacts that date to the Precontact and Historic Periods.

Another potential KI for this VC is architectural resources, which typically include buildings or structures of significance that have been recorded and registered with the Heritage NL (Newfoundland and Labrador Department of Tourism, Culture and Recreation,1990) or the Town of Placentia as a Municipal Heritage Site.

Heritage and Cultural Resources also include fossils (i.e., Palaeontological Resources), which in the Province of NL are protected under the **Historic Resources Act** (1985) and are registered and inventoried by the Provincial Archaeology Office (PAO) of the Department of Tourism, Culture, Arts and Recreation. There are no known or registered fossils in the Project Area (and the potential for them to be present is low due to the geological composition of the region), therefore Palaeontological Resources are not assessed further in this chapter.

This effects assessment is limited to the one registered archaeological site and one registered architectural resource situated within the Project Area, but also includes any heritage structures or features meeting the necessary criteria for registration with the PAO, Heritage NL, or the Town of Placentia as a Municipal Heritage Site, as well as any high potential locations worthy of field investigation during any required Historic Resources Impact Assessment. Potential for residual effect is restricted to the Project Area.

Table 4.2.5-1 Scope and Measurable Parameters of Key Indicators: Heritage and Cultural Resources.

Key Indicator	Scope	Measurable Parameters
Historic and Archaeological Resources	Project Area	The number of sites identified. The number/quantity of materials associated with a site.
Architectural Resources	Project Area	The number of sites identified. The number/quantity of materials associated with a site.

4.2.5.1 Assessment Criteria

A custom list of criteria will be used to evaluate the effects of the Project on the Heritage and Cultural Resources VC. Some of the generic criteria have been modified for applicability to this VC. Other criteria are not applicable to the Heritage and Cultural Resources effects assessment, as noted in Table 4.2.5-2 below.

Table 4.2.5-2 Assessment Criteria: Heritage and Cultural Resources.

Evaluation Criteria	Rating	Descriptor
Magnitude	1	Negligible – no perceptible effect on the integrity and/or quality of a Heritage and Cultural Resource
	2	Low - disturbance of a Cultural and Heritage Resource is predicted; however, the integrity and/or quality of the resource can be fully preserved.
	3	Medium – some disturbance or loss occurs to a portion of a Cultural and Heritage Resource and its associated information that is of interest and concern to the associated community.
	4	NA
	5	High – Complete disturbance or loss of a Cultural and Heritage Resource, with no retrieval of the resource and its associated information.
Frequency	Not applicable. An effect on Heritage and Cultural Resources occurs only once (i.e., disturbance results in the loss of context).	
Geographic Extent	Not applicable. Any extent is limited to specific Heritage and Cultural Resource site.	
Duration	Not applicable. Heritage and Cultural Resources are static and finite; therefore, residual effects are always permanent, with no return to pre-existing conditions.	
Reversibility	Not applicable. Any residual effect is not reversible.	
Historic or Cultural Context	1	Undisturbed - Area is relatively undisturbed or not adversely affected by human activity.
	2	NA
	3	NA
	4	NA
	5	Disturbed – Area has been substantially previously disturbed by human development or human development is still present.

4.2.5.2 Existing Knowledge

A Historic Resources Overview Assessment (HROA) prepared for the purposes of this effects assessment, and in accordance with PAO (PAO requirements, is summarized in Section 3.5). The full study, complete with maps of the Project Area that show the location of the one registered archaeological site and the one registered architectural resource, along with other potential sites and features, and several areas with historic and archaeological resources potential, appears in Appendix F.

4.2.5.3 Definition of Significance

A significant residual adverse effect on Heritage and Cultural Resources, in accordance with the **Historic Resources Act** (1985), is defined as a residual Project-related change to the environment that results in the unauthorized disturbance or destruction of a Heritage and Cultural Resource that is determined by

the provincial regulator (PAO) to be historically, archaeologically, or culturally significant and that cannot be mitigated.

4.2.5.4 Potential Project-Environment Interactions

Historic, Archaeological, or Architectural sites or materials could be lost or disturbed by the Project. The Project phase of most concern is Construction when the greatest extent of physical disturbance to the landscape will occur. Activities such as site preparation, construction of roads, and establishment of wind turbine foundations all involve potentially disruptive aspects. During the Operation and Maintenance Phase, there will be few potential interactions due to the nature of Project activities. Decommissioning and Rehabilitation will mirror Construction regarding physical disturbance, albeit with far less potential for site disturbance. Similarly, only some of the Unplanned Events are candidates for interaction with Heritage and Cultural Resources. Potential interactions with identified KIs of the VC are summarized in Table 4.2.5-3.

According to information provided by the PAO, there is only one registered archaeological site situated within the Argentia Backlands sector of the Project Area, and it is comprised of 13 separate, concrete structures, associated with the US Military defenses constructed in the area during WWII. Potential interactions with this site could occur from access road construction and/or upgrading, but more directly from installation and operation of a wind turbine based on preliminary wind turbine layout, if it is positioned too close to a site component (see Figure 3.1.5-2). All other potential WWII military facilities, the site of the former Silver Cliff Mine, and the locations near waterbodies that were rated as having high and/or medium historic / archaeological potential appear sufficiently distant from Project works, thus no interactions are anticipated. Regarding the one registered architectural resource situated within the Argentia Backlands, while the proposed Project Interconnection Line does extend close to the southern boundary of this High potential area, it too appears to be oriented is such a way that no direct interactions with this resource are expected (Figure 3.1.5-2).

One area identified in the HROA as having high potential for as-of-yet undiscovered historic and archaeological resources (PA-18) is very close to the Project Interconnect Line (Figure 3.1.5-2), however, in this area the Line is expected to be constructed within an existing right-of-way so potential for disturbance of PA-18 is low.

Table 4.2.5-3 Potential Project Environment Interactions Matrix: Heritage and Cultural Resources.

Key Indicators: Heritage and Cultural Resources		
Project Component and Activity Description	Historic and Archaeological Resources	Architectural Resources
Construction Phase		
Site Preparation	X	X
Roads	X	X
Staging and Laydown	X	X
Material Transport	X	X
Wind Turbine Foundations	X	X
Electrical Infrastructure	X	X
Wind Turbine Installation	X	X
Electrolyser Plant		
Ammonia Plant		
Ammonia Storage/Transfer		
Flares		
Admin Buildings		
Operation and Maintenance Phase		
Wind Turbine Operation	X	X
Wind Turbine Maintenance		
Electrical Infrastructure		
Venting and Flaring		
Road Maintenance	X	X
Plant Operations		
Ammonia Handling		
Decommissioning Phase		
Electrical Infrastructure	X	X
Wind Turbine Removal	X	X
Building Removal	X	X
Plant Removal		
Terrain Reclamation	X	X
Unplanned Events		
Spills and releases		
Flaring and venting		
Fire, explosion	X	X
Traffic accident	X	X
Wind Turbine collapse	X	X
Water supply failure		
Wildlife emergency		
Human hazard or injury		
NOTES X: Potential interactions that might cause an effect. Blanks indicate that interactions between the Project and the VC are not expected.		

4.2.5.5 Mitigation Measures

The applicable avoidance and mitigation measures are listed in Table 4.2.5-4 and discussed in detail in Appendix F. Based on the HROA, the best approach is to avoid disturbance to documented site. For potential sites of heritage and cultural importance, having a Contingency Plan in place for the discovery of a candidate site will mitigate disturbance.

Table 4.2.5-4 Mitigation and Enhancement Measures: Heritage and Cultural Resources.

Heritage and Cultural Resources			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation / Enhancement**
All	Historic and Archaeological Resources	Physical disturbance of the material or site causing a loss of integrity and/or quality.	• Avoidance of the one registered archaeological site situated within the Project Area. • Avoidance of any other structures or features eligible for registration with the PAO. • Completion of an Historic Resources Impact Assessment (HRIA) prior to conducting any Project activities that may alter or disturb any existing structural remains or terrain identified in the HROA as having High potential for existing and/or as-of-yet undiscovered historic and archaeological resources.
	Architectural Resources		• Avoidance of the one registered architectural resource situated within the Project Area. • Avoidance of any other structures or features eligible for registration with Heritage NL or the Town of Placentia as a Municipal Heritage Site.

As recommended in the HROA, a detailed Contingency Plan would describe the measures and procedures to follow and the personnel to be contacted at the PAO if any suspected Historic and Archaeological Resources are encountered on the surface or are unearthed during any phase of the Project. The Contingency Plan would be provided to and discussed with all personnel working on the Project, particularly those involved in ground disturbing activities.

4.2.5.6 Conclusion

Table 4.2.5-5 identifies and characterizes the potential residual adverse effects. As noted, most of the criteria are not applicable. The magnitude of effects is ranked as either negligible (1) or low (2).

Table 4.2.5-5 Potential Adverse Residual Environmental Effects of the Project: Heritage and Cultural Resources.

Heritage and Cultural Resources							
Project Phase	Key Indicator	**Magnitude**	Frequency	Extent	Duration	Reversibility	Context
Construction	Historic and Archaeological Resources	2	N/A	N/A	N/A	N/A	1,5
	Architectural Resources	2	N/A	N/A	N/A	N/A	1,5
Operation and Maintenance	Historic and Archaeological Resources	1	N/A	N/A	N/A	N/A	5
	Architectural Resources	1	N/A	N/A	N/A	N/A	5
Decommissioning	Historic and Archaeological Resources	1	N/A	N/A	N/A	N/A	5
	Architectural Resources	1	N/A	N/A	N/A	N/A	5
Unplanned Events	Historic and Archaeological Resources	2	N/A	N/A	N/A	N/A	1,5
	Architectural Resources	2	N/A	N/A	N/A	N/A	1,5
*Context may be assigned more than one value.							

Given the significance criteria defined above in Section 4.2.5.3, no Project phase was determined to result in significant negative residual effects to any KI of the Heritage and Cultural Resources VC, as summarized in Table 4.2.5-6. This prediction is based on the implementation of the measures identified in the HROA and summarized as:

- Avoidance of the one registered archaeological site and the one registered architectural resource situated within the Project Area and any other structures or features potentially worthy of registration with the PAO, Heritage NL, or the Town of Placentia as a Municipal Heritage Site.
- Completion of an Historic Resources Impact Assessment (HRIA) prior to conducting any Project activities that may alter or disturb any existing structural remains or terrain identified in the HROA as having High potential for existing and/or as-of-yet undiscovered historic and archaeological resources.
- The development of a detailed Contingency Plan that outlines the measures and procedures to follow and the personnel to be contacted at the PAO if any suspected Historic and Archaeological Resources are encountered on the surface or are unearthed during any phase of the Project.

Table 4.2.5-6 Significance of Potential Residual Environmental Effects of the Project: Land and Resource Use.

Project Phase	**Key Indicator**	**Significance of Predicted Residual Environmental Effects**		**Likelihood***	
		Level of Significance	**Level of Confidence**	**Probability**	**Scientific Certainty**
Construction	Historic and Archaeological Resources	NS	3		
	Architectural Resources	NS	3		
Operation and Maintenance	Historic and Archaeological Resources	NS	3		
	Architectural Resources	NS	3		

Project Phase	Key Indicator	Significance of Predicted Residual Environmental Effects		Likelihood*	
		Level of Significance	Level of Confidence	Probability	Scientific Certainty
Decommissioning	Historic and Archaeological Resources	NS	3		
	Architectural Resources	NS	3		
Unplanned Events	Historic and Archaeological Resources	NS	3		
	Architectural Resources	NS	3		

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.6 Socio-Economic Environment

The NL DECC *Environmental Assessment Guidance for Registration of Onshore Wind Energy Generation and Green Hydrogen Production Projects* identifies the need for proponents to provide information on various topics including communities, population demographic data, health services and social programs, family life, recreation and culture, education and training, fire and emergency services and housing and property values. For this Registration, these are captured in the Communities VC. Information on economy, employment and business capacity relative to procurement of goods and services is captured in the Economy, Employment and Business VC. Short-term tourist accommodations are also included in this VC. Study areas regarded for this assessment are presented in Section 3.2.

Communities are included as a VC because municipalities, local service districts, unincorporated communities, and rural residents may be affected by construction, operation / maintenance, and decommissioning of the Project as discussed in Section 4.2.6.4. KIs and Measurable Parameters of the Communities VC are identified in Table 4.2.6-1.

Various aspects of the Project that may affect human communities are discussed in other VC sections that address related topics such as air, light, noise, shadow flicker, ice-throw, viewscapes, groundwater and surface water. In addition, human activities may be affected indirectly by effects on fish, animals, birds, or plants and the habitats that support them. For brevity of the Registration, these related effects are not repeated here.

Economy, Employment and Business has been included as a VC because economic conditions may be affected by construction, operation / maintenance, and decommissioning of the Project. Economic activity, employment and business growth are the foundations of the livelihoods of residents and associated benefits arising from earned income. In addition, employer-sponsored benefits may provide security and enhance quality of life. Economic effects (e.g., labour, labour income and contributions to

GDP and government revenues) are of interest to the public, stakeholders, Indigenous Peoples, regulators and governments. KIs and Measurable Parameters of the Economy, Employment and Business VC are identified in Table 4.2.6-1.

The assessment of effects on the Economy, Employment and Business VC is linked to the assessment of the Communities VC due to potential changes in community wellbeing resulting from enhanced employment opportunities and income. Argentia Renewables is expected to make a strong contribution to the local, regional, and provincial economies resulting from taxation and royalties as well as employment and business activity throughout all Project phases. This assessment does not account for economic benefits resulting from the Project relating to either a) direct community benefits (e.g., environmental stewardship funding of the Cape St. Mary's Ecological Preserve for research, maintenance, and employment) or b) significant economic benefits that the municipality of Placentia will receive from the revenue that POA will receive as the landowner in the Project.

Table 4.2.6-1 Scope & Measurable Parameters of Key Indicators: Socio-Economic Environment

Valuable Component	Key Indicator	Scope	Measurable Parameters
Communities	Population Demographics	Socio-Economic RAA	• Population growth / trends • Age • Diversity
	Community Health and Wellbeing	Socio-Economic RAA	• Education • Income • Housing • Food security • Health and social services • Diversity, equity and inclusion
	Infrastructure and Services	Socio-Economic RAA	• Water and sewer • Waste management • Transportation • Utilities and communications • Prevention and emergency services • Recreation
Economy, Employment, and Business	Economy	Socio-Economic RAA	• GDP • Tax revenue
	Employment	Socio-Economic RAA	• Labour supply • Employment equity and diversity
	Business	Socio-Economic RAA	• Other economic sectors • Capacity and growth

4.2.6.1 Assessment Criteria

Assessment criteria presented in Table 4.1.7-2 were used to evaluate the effects of the Project on the socio-economic environment. The assessment evaluates the significance of potential effects using threshold criteria beyond which adverse residual effects are considered for significance, as described in Section 4.2.6.5.

4.2.6.2 Existing Knowledge

Section 3.1.6 (Socio-Economic Environment) summarizes existing knowledge while Appendix G (Socio-Economic Baseline) provides a more detailed description based on desktop research. Table 4.2.6-2 identifies KIs and summarizes issues and concerns, which will be discussed in following sections.

Economic activity and associated benefits arising from earned income and employer-sponsored programs may provide security and enhance quality of life, which may help to stabilize the population. These benefits may also result in improvements to the health and wellbeing of subsets of the population such as women and other groups that show historical economic disadvantages, especially in heavy industry. Short- and long-term changes to population may result in challenges for some types of infrastructure and services that are sensitive to population size.

Generally, Project activities result in economic stimuli that provide revenue or income to governments, businesses, and individuals. Major capital projects also result in spending that generates direct, indirect and induced economic activity, such as is currently experienced in Placentia due to the Cenovus construction project. Potential adverse effects of the Project, identified in Table 4.2.6-2, include an ageing labour force that may result in increased labour competition. Green hydrogen is a new sector for which some trades are not yet available. Some population segments may require support to ensure their successful participation in the Project. Increased year-round business in the service sector (e.g., accommodations, restaurants, convenience stores, supermarkets, service stations) is beneficial and the Project may result in increased demand for businesses (e.g., accommodations) that are used seasonally by tourists. Additionally, while Placentia and regional businesses are experienced with heavy industry, green hydrogen is a new sector representing both an opportunity and a challenge.

Table 4.2.6-2 Summary of Issues, Concerns, Opportunities: Socio-Economic Environment.

Key Indicators	Issues, Concerns and Opportunities
Population Demographics	Major projects may result in short- and long-term population change.
Community Health and Wellbeing	Major projects' effects on community health and wellbeing may be both beneficial (e.g., increased income) and adverse (e.g., increased cost of living).
	Short- and long-term population changes resulting from major projects may affect availability and affordability of housing.
	Short- and long-term population changes resulting from major projects may affect availability and capacity of health and social infrastructure and services.
Infrastructure and Services	Major projects that use water resources or result in short- or long-term population changes may affect local water and sewer infrastructure and services.
	Major projects that generate solid or hazardous waste or result in population changes may affect local water and sewer infrastructure and services.
	Construction workforces for major projects may result in increased vehicular activity. Movement of large project infrastructure components may affect local traffic.

Key Indicators	Issues, Concerns and Opportunities
	Major projects that increase demand on energy or communications, or result in short- or long-term population changes, may affect local utilities and communications infrastructure and services.
	Major projects may require support from emergency response services.
	Major projects may overlap with recreation facilities or activity areas.
Economy	Major projects contribute to GDP and tax revenue.
Employment	Major projects result in short- and long-term employment (direct, indirect, induced). The NL labour force is ageing with frequent competition for labour with required skill sets. The green hydrogen sector is new with limited local training and experience.
Employment	Certain population segments may be underrepresented in employment and business opportunities particularly in industrial sectors.
	The green hydrogen energy sector is new with limited training opportunities available.
Business	Procurement for major projects stimulates business activity (direct, indirect, induced) locally, regionally and provincially. The culture and tourism sector may experience beneficial and adverse effects depending on the component (e.g., marine ferry, recreation facilities and activity areas, short-term accommodations) and Project phase.
	Local, regional, and provincial businesses have experience with major projects. Local businesses also have experience and capacity in industrial development and in supporting products and services. However, the green hydrogen sector is new with limited local business experience.

4.2.6.3 Definition of Significance

A significant effect on the Communities VC is defined as an adverse residual Project-related effect to the socio-economic environment that results in either, or both, of the following:

- Long term deterioration of community health and well-being, which cannot be managed through planned Project mitigation measures, or public policies, plans and programs (current or adjusted); or
- Long term exceedance of available capacity, or a substantial decrease in quality of infrastructure or services, which cannot be managed through planned Project mitigation measures, or current or adjusted public policies, plans and programs.

A significant effect on the Economy, Employment and Business VC is defined as an adverse residual Project-related effect to the socio-economic environment that results in:

- A measurable change distinguishable from current conditions and trends, lasting beyond the life of the Project, and cannot be managed through planned Project mitigation measures or by application of current or adjusted public policies, plans or programs.

Where a significant effect has been predicted, this evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.6.4 Potential Project-Environment Interactions

Table 4.2.6-3 outlines potential interactions between the Project and KIs for the socio-economic environment VCs. Generally, all Project phases (construction, operations / maintenance, and decommissioning) are likely to interact with population demographics, community health and wellbeing, and infrastructure and services. Potential effects of these interactions are discussed below. From the perspective of the Communities VC, Project effects would be similar regardless of the components being constructed, operated or decommissioned, as these are caused by Project employment, spending, and the presence of a non-resident workforce or changes in permanent population. Similarly, industrial development is expected to affect nearby communities through all Project phases. Therefore, Project components have been removed from Table 4.2.6-3. Unplanned Events are unlikely to result in changes to Communities or to Economy, Employment and Business and are not discussed further in the socio-economic effects assessment. Argentia Renewables has developed a Project Emergency Response Plan (Appendix M) that addresses potential effects and appropriate response measures.

Table 4.2.6-3 Potential Project Environment Interactions Matrix: Socio-Economic Environment

Key Indicators: Socio-Economic Environment						
Project Activity	**Population Demographics**	**Community Health and Wellbeing**	**Infrastructure and Services**	**Economy**	**Employment**	**Business**
Construction Phase	X	X	X	X	X	X
Operation and Maintenance Phase	X	X	X	X	X	X
Decommissioning Phase	X	X	X	X	X	X
Unplanned Events						
NOTES X: Potential interactions that might cause an effect. Blanks indicate that interactions between the Project and the VC are not expected.						

Population Demographics

The Project may result in temporary or permanent increases in population, which vary by Project phase. Population increases are generally considered positive in communities such as Placentia that are experiencing population decline. The Project will have a positive effect in Placentia due to employment

opportunities and the possibility of retaining and / or gaining new permanent residents. This may result in a younger and more diverse population.

As the existing permanent population may not be able to supply sufficient labour and support for businesses during a construction project of this scale, non-resident workers may reside short term in the community to help satisfy the demand for workers (peak 660 positions) during the Construction Phase. Non-resident workers are not expected to relocate permanently to the community while working on a construction project. The Project may present an opportunity to employ population subsets normally underrepresented in heavy industry in NL.

Existing population may be retained during the Operations and Maintenance Phase, or new residents may be attracted to permanent employment (anticipated to be about 65 positions) with the Project or in supporting businesses during the 30-year operational period. Through consultation and engagement activities, Argentia Renewables has met with residents enquiring about employment opportunities. Non-residents may consider relocating for these opportunities.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses. Project Decommissioning and Rehabilitation may require the support of a non-resident labour force as with construction. Following Decommissioning and Rehabilitation activities, permanent population may decline due to fewer permanent employment and business opportunities.

Community Health and Wellbeing

Community health and wellbeing has been evaluated in terms of social determinants of health parameters, which may be enhanced by employment opportunities. Conversely, the Project may result in adverse effects on some segments of the population due to the tendency of industrial economic development to create or aggravate economic disparity and social disadvantages.

The Project will result in opportunities for employment that may require formal education and / or on-the-job training. These opportunities will enhance the ability of participants to engage in employment that provides higher income and better conditions for individuals and families. With a focus on gender equity, diversity and inclusion, Argentia Renewables can have a positive effect on women and others often overlooked in traditionally male-dominated industries and professions found in construction projects and natural resource developments.

For Project construction, it is anticipated that at least some construction workers will come from the Avalon and may live too far away for daily commuting. As Argentia Renewables is not planning to provide temporary accommodations for construction workers, it is likely dwellings will be rented by non-resident workers who have longer commute distances, which may result in constrained availability and increased costs of rental housing normally used by residents, particularly when rental prices and other costs are

already elevated due to inflation. Conversely, a reduction in vacancy rates will benefit owners of such properties through higher demand and increased rental rates.

While data were not available for Placentia, St. John's rental prices are increasing and the vacancy rate decreasing. In October 2023, median rental prices in St. John's showed a year-over-year increase of 7% while the vacancy rate declined from 2.9% to 1.5% (CMHC 2024). Rental affordability and availability are less likely to be problematic in rural areas of the province due to declining population. However, individuals and families with low or fixed incomes using market rental housing are most likely to be at risk of dwelling shortages or rent increases, which may contribute to other issues such as food insecurity. Individuals and families living in publicly subsidized housing, which is rent controlled and restricted to those meeting specific criteria, are less likely to be affected by rental shortages.

Workers in the construction industry may be subject to pressures related to the nature of working long shifts and extended rotations. Increased disposable income may also lead to unhealthy behaviour and unsafe working conditions related to increased use of alcohol / Cannabis and other substances (e.g., illicit drugs) arising from mental and physical strain of working long shifts and (for some) factors such as peer pressure or being away from home for long periods of time (ConstructConnect 2021, ConstructConnect 2023, Drug and Alcohol Testing Association of Canada 2021, New York University 2019, Public Health Ontario 2022).

The presence of a non-resident construction workforce could possibly contribute to shortages of health services. Limited urgent care services are available in Placentia with additional support available in Carbonear and St. John's. A declining population may have resulted in excess capacity in some health and social services, but the health care system in NL is experiencing a high number of job vacancies. In March 2023, NL Health Services listed 13 vacancies at Placentia including nine registered nurses, two licensed practical nurses and two personal care attendants (NL Health Services 2024). Argentia Renewables and its contractors will provide health and safety programs for workers to help ensure their safety and wellbeing, and to limit demand on local facilities.

The 30-year Operations and Maintenance phase will result in an estimated 51 full-time positions for the Argentia Green Fuels Facility and an estimated 14 full-time positions for the Argentia Wind Facility. Individuals accessing favourable long-term employment and income may benefit from improved social and health outcomes through better housing, higher education, more nutritious foods, and additional recreational activities.

Any shortages or price increases in rental housing should stabilize during Operations and Maintenance as the non-resident construction workforce will no longer be present in the community. It is anticipated that, due to the smaller number of employees, any non-resident or visiting workers would not adversely affect rental housing. With a declining population, Placentia may have excess housing available for rent

or purchase during Operations and Maintenance. Following construction, demand for health and social services is likely to stabilize.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses. Following this phase, the community is likely to return to pre-Project conditions with challenges due to loss of employment and income.

Infrastructure and Services

Temporary and permanent changes to population may affect the usage and capacity of infrastructure and services. The type and degree of changes depend on the number of individuals, Project phase and type of infrastructure or service.

The Project will require a temporary workforce anticipated to be drawn from the labour force of Placentia, Avalon, and potentially other areas of NL. Specialized technical workers may be recruited from other areas of Canada or internationally since Green Hydrogen is a new industry to the province.

During construction, the non-resident population may increase demands for water and sewer infrastructure owned and operated by the Town of Placentia. The POA site has existing water and sewer services that will be used for the Project. Where workers use temporary accommodation in other parts of Placentia, increased demand may occur but as the population has been declining, capacity may be available. Nonetheless, Placentia's infrastructure is ageing and requires a robust maintenance and replacement program. Argentia Renewables is working with the Town of Placentia and the POA regarding access to and use of existing infrastructure.

Large scale projects can generate a high volume of waste especially during construction and decommissioning. From a financial perspective, as well as for environmental reasons, it will be beneficial to sort waste appropriately prior to transport to Robin Hood Bay. This is addressed in detail in the Project Waste Management Plan (Appendix N).

The Project will require electricity and communications services. Electricity in the RAA is provided by NLH and Newfoundland Power. Argentia Renewables will develop a new transmission line to Long Harbour to access additional electricity from NLH only when needed. Therefore, the Project will not compromise Placentia's power supply. Argentia Renewables will also work with communications service providers and the POA to ensure adequate communications services are available at the site.

Project construction may affect traffic at the POA and in Placentia generally. During construction, traffic may increase because of the number of workers commuting to the Project site from and through Placentia. Currently, peak traffic periods would likely include the beginning and end of work shifts for the existing construction project. A Project Traffic Management Plan has been developed for the Project

(Appendix E). The Plan examines mitigation measures that apply to oversize/overweight traffic as well as other Project related traffic during all phases.

The ferry has a capacity of 1100 passengers and 470 cars or 120 lorries/trailers/trucks (CruiseMapper, 2024). Vehicle capacity depends on the type of vehicle transported, as large vehicles (e.g., transport trucks and recreational vehicles) use more space. Argentia Renewables will work with the POA and Marine Atlantic to plan Project activities to avoid effects on ferry-related road traffic during construction.

While most recreation amenities are outside the POA site, the Argentia Backlands Trails (and proposed trails) and Argentia Sunset RV Park are within the industrial park boundaries. Argentia Renewables is working with the POA to avoid potential conflicts with recreation infrastructure and usage, especially for trails and the RV park.

Increased demands for water, sewer, and waste management are anticipated to be relieved during operations and maintenance due to completion of construction activities and a smaller workforce. The need for additional capacity in utilities and communications will have been satisfied during construction through installation of new services as required for the Project. Effects on recreation infrastructure at the POA will be mitigated during Project design by changing the location of Project infrastructure (e.g., wind turbines).

During Operations and Maintenance, the Project will require a clean water supply. In cooperation with the Town of Placentia, Argentia Renewables is studying the existing water supplies to identify the best solution for the Project and the community.

Any construction-related traffic concerns will be relieved during Operations and Maintenance. With 65 permanent employees, the Project is not expected to generate enough change in population to result in a perceptible change in traffic patterns.

Placentia’s volunteer fire department has satisfactory ratings for residential fire suppression but may not have the capacity, skills or equipment necessary to respond to a potential Project-related incident. Argentia Renewables is working with the Town of Placentia to increase capacity to deal with potential emergencies and to enhance the area’s emergency response capability.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses and potential issues such as waste management will be incorporated into an approved Plan for this phase of the Project. Following Decommissioning and Rehabilitation, infrastructure utilization and associated services are likely to return to pre-Project levels.

Economy

All phases of the Project will provide revenue due to fees, taxation and royalties. The Government of NL has created a land title and economic development regime for the wind-hydrogen industry (Government of NL 2023).

Crown Land Fees will apply only to a portion of the Project Interconnect Line, as most of the Project is limited to privately held lands owned by the POA and within the Town of Placentia. The Project will access water from the PPWSA managed by the Town. The Project will also make a positive contribution to GDP.

The Construction Phase will include most of the spending for procurement in construction contracts and materials / components. The Project is expected to require a substantial capital investment of more than $1 billion CAD.

During Operations and Maintenance, the Project will result in spending to procure goods and services and to engage staff. These will all result in economic benefits locally, regionally, and provincially through direct, indirect, and induced economic activity and contribution to GDP and taxation revenues of governments.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses. The value of decommissioning and rehabilitation will depend on costing and other requirements at that time. Detailed data are not available but decommissioning of the Exxon Mobil Goldboro liquefied natural gas plant in Nova Scotia was estimated at $42 million in 2010 dollars (CBC 2016). Based on this information, decommissioning and rehabilitation of the Argentia Renewables Project is likely to be much smaller than construction. Following decommissioning and rehabilitation activities, the local economy may retract due to fewer employment and business opportunities.

Employment

Section 3.1.6 presents an overview of anticipated employment numbers and occupation categories. Project planning and studies are ongoing and more detailed information will be provided when available. As an equal opportunity employer, Argentia Renewables will focus on diversity, equity and inclusion in all phases of the Project. For more information on Argentia Renewables policies, see Appendix Q (Workforce and Employment Plan).

Placentia residents are skilled in industrial settings due to the presence of a large industrial park and a current major construction project. However, residents experience higher unemployment than Avalon or NL generally, meaning that individuals will likely be seeking work. Specialized training will be required for some technical aspects of the Project.

The Project is expected to create 660 construction jobs during peak construction. Construction trade jobs include heavy equipment operators, carpenters, masons, painters, boilermakers, electricians, millwrights, pipefitters, ironworkers, sheet metal workers, crane operators, drillers and blasters, industrial truck drivers, machinery operators, trades helpers and labourers, electrical trades and collector line and telecommunications workers, and contractors and supervisors. Placentia residents are skilled in industrial settings due to the presence of a large industrial park. Also, the current major construction project accesses tradespeople from within the community and beyond.

Permanent jobs associated with Operations and Maintenance include approximately 52 positions in plant operation and maintenance and approximately 13 positions in wind Operation and Maintenance. As Placentia has higher unemployment than Avalon or NL, residents will likely be seeking work with the Project.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses. Project decommissioning may require the support of a resident and non-resident labour force but smaller than labour requirements for construction.

Business

The POA Industrial Park provides opportunities for local and regional businesses and has a spin-off effect on the economy supporting other sectors. The POA is currently hosting a major capital project and local and regional companies have experience in supporting large scale construction projects and heavy industrial activities.

Many of the businesses at the POA, especially those involved in the Cenovus construction project, are compatible with the Argentia Renewables Project. However, the POA is the location of the Marine Atlantic Ferry Terminal, the RV Park and hiking trails (existing and proposed). In addition, the Town of Placentia and other sites in the region are cultural tourist destinations. Thus, the tourism sector is potentially sensitive to changes brought on by the Project.

Placentia has limited tourist accommodations. As discussed in Section 2.3.5.1, non-resident workers are expected to rent temporary accommodation in Placentia or nearby communities While this is good for businesses, it likely limits the availability of accommodations for tourists such as those entering or exiting eastern Newfoundland via the Marine Atlantic Ferry. As tourists may have difficulty finding accommodations, this may result in lower participation, attendance, and revenue for cultural and recreation-based tourism service providers. Additionally, given high competition for labour in NL, Project contractors (including local businesses) may be challenged to attract and retain workers in other sectors during construction.

Demand for accommodations is likely to decrease during operations and maintenance though the presence of the Project will result in ongoing need, presenting a business opportunity. Though fewer than in the Construction Phase, Project-related non-resident workers will also require other services (e.g., accommodations, food) that support local businesses outside the summer tourist season. In addition, population stabilization and sustained employment, because of the Project's operation phase, is likely to result in steady demand and / or opportunities for local business operations.

More information on the Decommissioning and Rehabilitation phase will be available as Project planning progresses. Project Decommissioning and Rehabilitation will include engagement of contractors to conduct various activities including dismantling and removal of waste materials for reuse or disposal. Completion of these activities will result in reduced business opportunities although businesses may have developed new capacity and opportunities due to the presence of the Project and spin-off opportunities.

4.2.6.5 Mitigation Measures

Argentia Renewables has considered the beneficial and adverse effects of the Project on Communities, Economy, Employment and Business and designed measures that will serve to avoid or reduce adverse effects and enhance beneficial ones. Key measures to mitigate and / or enhance potential Project effects on the Communities VC and the Economy, Employment and Business VC are listed in Table 4.2.6-4, by category and Project phase. Some mitigations identified for Community Health and Wellbeing (e.g., hiring locally as much as possible) and Services and Infrastructure (e.g., working closely with Marine Atlantic) will address issues and / or enhance conditions for Economy, Employment and Business, and are not repeated. Project-specific plans (e.g., the Workforce and Employment Plan) will also include mitigation measures that are applicable to this VC.

Management of Project effects include compliance with all Project EA conditions and municipal, provincial, and federal regulatory requirements and policies that address concerns and manage issues. These include NL statutes such as **Buildings Accessibility Act, Water Resources Act, Environmental Protection Act, Occupational Health and Safety Act, Highway Traffic Act** and **Transportation of Dangerous Goods Act**. Other policies and guidance (e.g., NL Traffic Control Manual) will also apply to the Project.

The ongoing program of consultation and communications with stakeholders, including the POA, the Town of Placentia, and the business community, will serve to monitor effectiveness, address issues, and identify opportunities to enhance benefits. The Project will work with POA, the Town of Placentia, and community stakeholders to develop a community benefit program that will reflect concerns and priorities of the local community.

Table 4.2.6-4 Mitigation and Enhancement Measures: Socio-Economic Environment.

Socio-Economic Environment			
Project Phase	**Key Indicator**	**Measurable Parameter**	**Mitigation / Enhancement**
All	Communities	Population Demographics	Hire locally / regionally as much as possible to the extent that labour force with appropriate training and skills is available.
All		Community Health and Wellbeing	Institute policies and programs to facilitate inclusion and success of women and other groups typically underrepresented in heavy industry.
All			Prepare a gender equity and diversity plan for the Project.
All			Ensure contractor compliance with workers health and safety regulations.
All			Institute worker health and safety programs to promote the health, safety and wellbeing of workers.
All			Cooperate with education institutions (e.g., College of the North Atlantic) on local training opportunities for the new industry sector.
Construction			Hire locally / regionally as much as possible to the extent that labour force with appropriate training and skills is available to reduce effects of rental housing that may become occupied by companies or individuals associated with the Project.
Construction			Institute worker health and safety programs to avoid or reduce use of local health and social services.
All			Enter into a Regional Community Benefits Program to ensure benefits to municipalities and Local Service Districts in the region have a lasting effect.
All		Infrastructure and Services	Enter into a shared services agreement with the Town of Placentia.
All			Work with the Town of Placentia to ensure equitable allocation of community water supplies that can satisfy local needs.
All			Implement a waste management and waste reduction plan for the Project with special emphasis on construction and decommissioning and rehabilitation.
Construction			Develop incentives to encourage worker carpooling and / or bussing options.
Construction			Work with Marine Atlantic to avoid traffic congestion during arrival and departure of the marine ferry.
All			Work with the Town of Placentia to increase training and capacity in emergency response infrastructure and services.
Construction			Design and install Project infrastructure to ensure safe distances are maintained between Project structures and the RV Park along with existing and proposed hiking trails.
All	Economy	GDP, tax revenue	Procure goods and services provincially as much as possible to the extent that they are available.
All	Employment	Labour Force	Hire locally / regionally as much as possible to the extent that labour force with appropriate training and skills is available.
All	Business	Capacity and Growth	Enter into a Regional Community Benefits Program to support the local economy and sectors that may be disadvantaged.
All			Procure goods and services locally / regionally as much as possible to the extent that they are available.
All			Prepare a gender equity and diversity plan to outline procurement policies.
Construction	Business	Other Sectors (i.e., Tourism)	Design and install Project infrastructure to avoid, or maximize safe distances to, the RV Park and existing / proposed hiking trails.

Socio-Economic Environment			
Project Phase	**Key Indicator**	**Measurable Parameter**	**Mitigation / Enhancement**
Construction			Include local cultural venues and events in sponsorship programs to help alleviate any effects due to lack of availability of tourist accommodations.

4.2.6.6 Conclusion

Table 4.2.6-5 provides a summary of predicted adverse residual effects on the Socio-Economic Environment VCs.

Table 4.2.6-5 Potential Adverse Residual Environmental Effects of the Project: Socio-Economic Environment.

Socio-Economic Environment								
Project Phase	**Valuable Component**	**Key Indicator**	**Magnitude**	**Frequency**	**Extent**	**Duration**	**Reversibility**	**Socio-Economic Context**
Construction	Communities	Population Demographics	N/A	N/A	N/A	N/A	N/A	N/A
		Community Health and Wellbeing	1	5	3	1	1	3
		Infrastructure and Services	3	5	3	1	1	5
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A	N/A	N/A
		Business	3	5	3	1	1	3
Operation and Maintenance	Communities	Population Demographics	N/A	N/A	N/A	N/A	N/A	N/A
		Community Health and Wellbeing	N/A	N/A	N/A	N/A	N/A	N/A
		Infrastructure and Services	N/A	N/A	N/A	N/A	N/A	N/A
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A	N/A	N/A
		Business	N/A	N/A	N/A	N/A	N/A	N/A
Decommissioning	Communities	Population Demographics	N/A	N/A	N/A	N/A	N/A	N/A
		Community Health and Wellbeing	1	5	3	1	1	3
		Infrastructure and Services	1	5	3	1	1	5
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A	N/A	N/A
		Business	1	5	3	1	1	3
*Context may be assigned more than one value.								

Communities

Project construction and decommissioning and rehabilitation could potentially result in adverse residual effects on the Communities VC. Non-resident workers are likely to be present in the community during these phases. Where these workers rent housing, it could result in availability and affordability issues for a small portion of the permanent population. These effects are conservatively determined to be medium

in magnitude and continuous during these Project phases. The conclusion is based on uncertainty with respect to the number of locally hired workers compared to those from the RAA and other areas and the number of low-income people in market housing. Nonetheless, adverse residual effects on community health and wellbeing are expected to be short term, limited to the LAA and reversible. Effects on community health and wellbeing (particularly market rental housing) are characterized as medium value to the community as they have been identified as important by stakeholders.

Non-resident workers could also affect usage of services and infrastructure during Construction and Decommissioning and Rehabilitation. In consideration of planned mitigation and enhancement measures, these effects are predicted to be low in magnitude. It is anticipated that usage of water and sewer infrastructure, waste management services and roads will increase and be continuous during construction and decommissioning but not to the extent that it will compromise usage by residents. These residual effects will be short term, limited to the LAA and reversible following Construction and Decommissioning and Rehabilitation phases. Within the socio-economic context, they are characterized as low value given that Argentia Renewables is working with the Town of Placentia to address water supply needs and will comply with all relevant legislation related to water supplies, effluent discharge, solid waste and traffic.

Economy, Employment, and Business

Following implementation of mitigation and enhancement measures, Project residual effects on the Economy, Employment and Business VC are predicted to be generally positive. The only potentially adverse effects are with respect to business in the tourism sector.

While businesses offering services such as short-term accommodations or food to the tourism sector will experience increased usage and revenue during construction, other portions of the tourism sector (e.g., cultural venues and events) may experience fewer visitors and lower revenue due to limitations on availability of short-term accommodations. In addition, businesses in the service sector may be challenged to attract and retain workers when competing with an industrial project that can offer higher wages and year-round employment. The effects on the tourism sector of local business are conservatively considered to be of low to medium magnitude and within the LAA. Effects are expected to be continuous and short-term in duration (construction and decommissioning and rehabilitation) and reversible following completion of construction and / or decommissioning and rehabilitation. Within the socio-economic context, these effects are considered to be of medium value to the community as potential effects on tourism businesses have been identified by regulators as an issue to be considered for this Project.

Determination of Significance

Given the significance criteria defined above in Section 4.2.6.5, the residual effects of routine Project activities on the Communities VC are predicted to be “not significant”. Adverse residual effects on rental

housing and health and wellbeing are anticipated to be limited to construction and can be largely mitigated in decommissioning and rehabilitation through actions of the Proponent and through legislation and public programs to address relevant issues. Anticipated increased demand on services and infrastructure is likely to be within capacity due to population decline or will be managed through proven mitigations and / or application of government regulations, policies and programs designed to address these issues.

Similarly, the residual effects of routine Project activities on the Economy, Employment and Business VC are predicted to be “not significant”. Adverse residual effects are anticipated to be limited to some types of businesses / organizations in the tourism sector during construction and to a lesser extent in decommissioning and rehabilitation and can be mitigated through actions of Argentia Renewables (e.g., sponsorship initiatives) and government programs. Anticipated competition for higher wages in industry compared to the service sector is balanced as it is a combination of both positive and adverse effects throughout all phases of the Project.

Table 4.2.6-6 provides an overview of the significance of residual effects. Note that these assessments did not consider positive effects in the discussion of residual effects. The level of confidence for the Communities VC is medium due to lack of data regarding the number of workers that may access health care services or rent housing during construction and decommissioning and rehabilitation though these effects are generally understood based on similar projects. The level of confidence for the Economy, Employment, and Business VC is medium due to lack of specific data on businesses, their operation and workforce. Similar effects have been observed in other parts of the province during boom-and-bust economic cycles.

Table 4.2.6-6 Significance of Potential Residual Environmental Effects of the Project: Socio-Economic Environment.

Project Phase	**Valuable Component**	**Key Indicator**	**Significance of Predicted Residual Environmental Effects**		**Likelihood***	
			Level of Significance	Level of Confidence	Probability	Scientific Certainty
Construction	Communities	Population Demographics	N/A	N/A	N/A	N/A
		Community Health and Wellbeing	NS	2	N/A	N/A
		Infrastructure and Services	NS	2	N/A	N/A
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A
		Business	NS	M	N/A	N/A
Operation and Maintenance	Communities	Population Demographics	N/A	N/A	N/A	N/A

Project Phase	Valuable Component	Key Indicator	Significance of Predicted Residual Environmental Effects		Likelihood*	
			Level of Significance	Level of Confidence	Probability	Scientific Certainty
		Community Health and Wellbeing	N/A	N/A	N/A	N/A
		Infrastructure and Services	N/A	N/A	N/A	N/A
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A
		Business	N/A	N/A	N/A	N/A
Decommissioning	Communities	Population Demographics	N/A	N/A	N/A	N/A
		Community Health and Wellbeing	NS	2	N/A	N/A
		Infrastructure and Services	NS	2	N/A	N/A
	Economy, Employment, and Business	Economy	N/A	N/A	N/A	N/A
		Employment	N/A	N/A	N/A	N/A
		Business	NS	M	N/A	N/A

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.2.7 Human Health and Quality of Life

Human Health and Quality of Life has been included as a VC because health and quality of life of local residents and visitors may be affected by Construction, Operation and Maintenance, and Decommissioning and Rehabilitation of the Project. There are five aspects through which the Human Health and Quality of Life VC and the Project interact: air quality, light, sound quality (noise), vibration, shadow flicker, and ice throw.

Various aspects of the Project that may affect the Human Health and Quality of Life VC are discussed in the Atmospheric Environment VC section (Section 4.2.1) that address air, light, sound quality (noise) and vibration. Additionally, the Human Health and Quality of Life VC may be affected by Project interactions with weather radar, domestic wood harvesting, viewscapes, and traditional, cultural, recreational, and Indigenous activities. Weather radar was considered in Project planning and siting, while others are discussed in the Land and Resource Use VC section (Section 4.2.4). Effects on groundwater and surface water, as well as fish, animals, birds or plants and the habitats that support them (Section 4.2.2 and 4.2.3) may also affect Human Health and Quality of Life VC. For brevity of the Registration, these related effects are not repeated here.

Table 4.2.7-1 lists all the relevant KIs, showing where each is addressed in other sections of the Registration, but applicable to the Human Health and Quality of Life VC. Geographic scope for the assessment is consistent with study areas presented in Section 2.1. Applicable Measurable Parameters for each KI are also included. As is noted, this section will address Shadow Flicker and Ice Throw.

Table 4.2.7-1 Scope & Measurable Parameters of Key Indicators: Human Health and Quality of Life.

Key Indicator	Scope	Measurable Parameters
Air Quality	See above Section 4.2.1	
Greenhouse Gases		
Light		
Sound Quality		
Vibration		
Shadow Flicker	LAA/RAA	Shadow hours
Ice Throw	LAA	Ice throw distance
Recreational and Subsistence Resource Use	Including domestic wood harvesting, viewscapes, traditional, cultural, and recreational land use, see above Section 4.2.4	
Indigenous Land Use	See above Section 4.2.4	

4.2.7.1 Assessment Criteria

An overview of the assessment criteria utilized to characterize potential effects to human health and quality of life are in-line with the socio-economic effects assessment criteria presented in Table 4.1.7-2 in Section 4.1.7. Criteria include socio-economic context, reversibility, frequency, duration, geographic extent, and magnitude.

4.2.7.2 Existing Knowledge

Section 3.1.1 (Atmospheric Environment) summarizes existing knowledge of the ambient light conditions in the RAA while Section 2.3.4.1 and Appendix K (Shadow Flicker Analysis) details the concept of shadow flicker from wind turbines. Ice throw is contextualized in Appendix L (Ice Throw Analysis).

4.2.7.3 Definition of Significance

For the Human Health and Quality of Life VC, a Significant Effect is defined as:

- Having a high magnitude; or
- A medium magnitude and characterized by either:
    - An extended duration affecting a geographic area that extends beyond the Project Area; or
    - A low level of confidence in the prediction.

Where a significant effect has been predicted, this evaluation then includes a determination of the likelihood associated with the predicted effect. “Likelihood” includes both the probability of occurrence as well as the scientific certainty of the predicted effect.

4.2.7.4 Potential Project-Environment Interactions

Potential interactions with identified KIs of the Human Health and Quality of Life VC are summarized in Table 4.2.7-2.

Table 4.2.7-2 Potential Project Environment Interactions Matrix: Human Health and Quality of Life.

Human Health and Quality of Life		
Project Component and Activity Description	**Shadow Flicker**	**Ice Throw**
Construction Phase		
Site Preparation		
Roads		
Staging and Laydown		
Material Transport		
Wind Turbine Foundations		
Electrical Infrastructure		
Wind Turbine Installation		
Electrolyser Plant		
Ammonia Plant		
Ammonia Storage/Transfer		
Flares		
Admin Buildings		
Operation and Maintenance Phase		
Wind Turbine Operation	X	X
Wind Turbine Maintenance		
Electrical Infrastructure		
Venting and Flaring		
Road Maintenance		
Plant Operations		
Ammonia Handling		
Decommissioning and Rehabilitation Phase		
Electrical Infrastructure		
Wind Turbine Removal		
Building Removal		
Plant Removal		
Terrain Reclamation		
Unplanned Events		
Spills and releases		
Flaring and venting		

Human Health and Quality of Life		
Project Component and Activity Description	**Shadow Flicker**	**Ice Throw**
Fire and explosion		
Traffic accident		
Wind Turbine collapse		
Water supply failure		
Wildlife emergency		
Human hazard or injury		
NOTES X: Potential interactions that might cause an effect. Blanks indicate that interactions between the Project and the VEC are not expected.		

Shadow Flicker

Shadow flicker (SF) happens when the sun shines through the rotating blades of a wind turbine, casting a moving shadow. The “flicker” caused by the rotating blades can be perceived as a nuisance to onlookers, nearby homeowners, or businesses. Project construction, decommissioning and rehabilitation, and Unplanned Events will not generate Shadow Flicker and are not discussed further in this assessment; only wind turbine operation will cause the effect.

Shadow Flicker Analysis (Appendix K) was conducted to assess interactions and potential effects on receptors in the area of influence of the Argentia Wind Facility. The largest potential wind turbine model that is being considered for the Project (i.e., 7.2 MW turbine) was used in the modeling exercise as it corresponds to an anticipated greatest potential level of SF interaction with receptors. SF effects were modeled assuming worst case and real case. The worst-case analysis was based on the astronomic model, assuming that the sun shines every day (i.e., no clouds), turbines operate continuously at 90 degrees (°) towards the sun throughout the day, and SF occurs when the sun is more than 3° above the horizon. Existing forest obstacles were also excluded from the worst-case model. The real case analysis was calculated using forest obstacles, sunshine probabilities, and long-term directional wind frequencies collected in the Project Area.

Due to limitations (i.e., considerable data gaps) of the meteorological station in Argentia, sunshine probabilities from St. John’s were used in the real case model. Since the Project Area experiences considerably less sunlight than St. John’s, the real case model provides a conservative estimate of SF effects.

In the absence of federal and provincial regulations that specify criteria or limits of SF from wind turbines, a generally accepted guideline which originates from Europe was used (Staatliches Umweltamt Schleswig, 1999) (Länderausschuss für Immissionsschutz, 2020). The guideline stipulates that SF exposure should not exceed 30 hours per year and 30 minutes per day at a receptor using obstacle data such as forest stand heights. Of the 2,492 receptors modeled in the real case scenario, the 30-hour

threshold was exceeded at a single receptor during Project operation. Individual receptor results for the worst case and real case models are provided in Appendix K.

Based on results of the preliminary modeling exercise, SF modeling was re-initiated using the 6.8 MW turbine. When the 6.8 MW turbine is used in the real case model, the number of shadow hours is below the 30-hour threshold (i.e., 23:08 shadow hours per year) at the receptor where an exceedance was detected with the 7.2 MW turbine. Further mitigation is expected to reduce shadow flicker by reducing the tower height of a 6.8 MW turbine to 99 m. Following decommissioning and rehabilitation, shadow flicker will not occur, and conditions are anticipated to return to pre-Project conditions.

Ice Throw

At a wind power facility, ice can form on buildings, power lines, roads, walkways, stairs, towers, nacelles, hubs, blades, weather masts, and any other structure (Canadian Renewable Energy Association, 2020). Ice throw occurs when ice fragments detach from rotating wind turbine blades during operation, while ice fall occurs when ice fragments detach from the turbine when the blades are paused or idle. Both phenomena occur when temperatures rise rapidly from below freezing, or are rapidly changing near 0°C. The phenomenon may also occur when the wind turbine resumes operation following a pause during an icing event.

Project construction, decommissioning and rehabilitation, and Unplanned Events will not generate Ice Throw and are not discussed further in this assessment; only wind turbine operation will cause the effect. Ice Throw Analysis (Appendix L) was conducted to assess ice throw and ice fall hazard to people, animals, and property that lie within the maximum ice throw or ice fall zone.

Icing refers to any type of accumulation of ice or snow on a structure and occurs when water present in the air freezes after it encounters a surface. Icing events are either meteorological or instrumental. Meteorological icing happens due to suitable weather conditions. Instrumental icing is the period during which ice is present and visible on the instrument, and thus the ice can melt, sublimate, and shed (i.e., be thrown by a rotating blade). Instrumental ice can still be present on the site for days after meteorological icing. The Ice Throw Analysis indicated that meteorological icing is anticipated to occur 0.5-3% of the year (average of 1.8 to 11.0 days per year), while instrumental icing is anticipated to occur 1-9% of the year (average of 3.7 to 32.9 days per year).

The largest potential wind turbine model that is being considered for the Project (i.e., 7.2 MW turbine) was used to model ice throw zone and ice fall distance as it corresponds to the greatest potential level of hazard to receptors. A conservative estimate of the ice fall zone was developed using maximum daily wind gust speeds from the Project Area. It was determined that the maximum ice throw distance for the 7.2 MW turbine is 507 m. Should the 6.8 MW turbine be utilized, the maximum ice throw distance will be

reduced to approximately 422 m. Maximum ice fall distance by wind speed is outlined in Table 4.2.7-3. Ice fall distance was computed for the 7.2 MW turbine.

Table 4.2.7-3 Maximum Ice Fall Distance by Wind Speed: Argentia Wind Facility 7.2 MW Turbine.

Wind Speed (m/s)	Wind Speed (km/hr)	Maximum Ice Fall Distance (m)
0	0	0
5	18	84
10	36	168
15	54	252
20	72	336
25	90	420
30	108	504

Potential Project ice throw and ice fall interactions may arise at locations throughout the Project Area. A comprehensive list of receptors is provided in Appendix L. Following decommissioning, ice throw and ice fall will not occur, and conditions are anticipated to return to pre-Project conditions. This analysis does not account for ice throw mitigation that will be in place.

4.2.7.5 Mitigation Measures

Standard mitigation and enhancement measures applicable to the Human Health and Quality of Life VC are provided by phase in Table 4.2.7-4. Project-specific plans (e.g., the Traffic Management Plan) will also include mitigation measures that are applicable to this VC.

The installed wind energy capacity in cold climates currently makes up 22% of the global capacity (Roberge et.al., 2023). To meet challenges such as ice accretion on the rotor blades, multiple wind turbine suppliers and retrofitters have made various technologies for anti-icing and de-icing available since the 1990s. Active de-icing technologies such as electro-thermal heating and air-circulated heating are commonly implemented and can drastically improve the performance of wind turbines under icing conditions (Roberge et.al., 2023; Wind Energy IQ, n.d.). Passive anti-icing paints and coatings that prevent the formation of ice are newer and therefore less prevalent. More conventionally, ice throw protection devices such as grating, or roofs built above worker access pathways or ground-level infrastructure such as transformers are regarded as a best practice for hazard mitigation (Canadian Renewable Energy Association, 2020).

Based on modeling included in this registration, there is a potential for ice throw from wind turbine blades. While conservative ice throw calculations identify a maximum ice throw distance well below the Project minimum wind turbine setbacks from sensitive registers (e.g., occupied residences), all Project wind turbines are planned to be outfitted with winter weatherization operational package as well as de-icing or anti-icing technology.

The selection of an effective system will include consideration of:

a) a de-icing system (i.e., hot air heating of blades with heater and fan mounted in root of blades to prevent ice buildup), or

b) an anti-icing system (i.e., heating elements embedded in the blades to prevent ice buildup); and

c) an ice detection system, which has the ability to stop the turbine when ice build-up reaches a critical point.

Table 4.2.7-4 Mitigation and Enhancement Measures: Human Health and Quality of Life.

Human Health and Quality of Life			
Project Phase	**Key Indicator**	**Interaction**	**Mitigation**
Operation and Maintenance	Shadow Flicker	• Project activities may generate shadow flicker during the daytime, causing visual nuisance.	• Implement a curtailment schedule to minimize duration of shadow flicker effects. • Where feasible, install screening (e.g., trees, fences) to reduce shadow flicker effects. • All Project wind turbines will be set back at least the greater of 600 m or 3.0 times the blade tip height of the wind turbines.
Operation and Maintenance	Ice Throw	• Project activities may result in ice throw and ice fall hazard, posing a risk of injury to people and animals or property damage.	• Equip turbines with ice throw mitigation technology - heated blades, low friction coatings. • Equip turbines with ice protection devices to provide safe worker access. • Add public education and warning signage that explain hazards to prevent members of the public from entering maximum ice throw areas during periods of rotor icing. • Educate and train employees in potential risks in accordance with best practices and guidelines. • All Project wind turbines will be set back at least the greater of 600 m or 3.0 times the blade tip height of the wind turbines.

Incidence of shadow flicker is commonly mitigated by installing screening that acts to block the receptor line of sight. Aesthetically pleasing, and effective, options in rural areas include transplanting trees and installation of fencing.

To accommodate the concerns of nearby landowners, wind projects are commonly developed with minimum setbacks from sensitive receptors (e.g., occupied residences). These setbacks are either defined in terms of an absolute distance (e.g., 500m) or relative distance in terms of wind turbine maximum blade tip height (e.g., 1.1 times turbine height). In Ontario, the minimum setback from non-participating residences required by the Provincial government is 550 m. In other jurisdictions, turbines may be required to be 1.5 or 2.0 times the blade tip height. Overly small setbacks amplify the concerns of local landowners while overly large setbacks can, whether by deliberate design or simple

consequence, preclude wind development altogether (especially on private land with other environmental and constructability siting constraints). To address landowner concerns, all Project wind turbines will be set back at least the greater of 600m or 3.0 times the blade tip height of the wind turbines. Furthermore, the Project will microsite wind turbines to further minimize visibility to nearby landowners to the extent practicable and will consider reduced turbine height (e.g., from 119m to 99m) where other approaches are not feasible.

4.2.7.6 Conclusion

Table 4.2.7-5 provides a summary of predicted adverse residual effects on the Human Health and Quality of Life VC.

Table 4.2.7-5 Potential Adverse Residual Environmental Effects of the Project: Human Health and Quality of Life.

Human Health and Quality of Life							
Project Phase	**Key Indicator**	**Magnitude**	**Frequency**	**Extent**	**Duration**	**Reversibility**	**Context***
Operation and Maintenance	Shadow Flicker	1	2	3	1	1	1, 3
	Ice Throw	2	2	3	1	1	1,3
*Context may be assigned more than one value.							

Project operations could result in adverse effects to quality of life due to shadow flicker, however, of the potential 2,492 receptors modeled, the recommended 30-shadow hours per year threshold was exceeded at just a single receptor using the largest (7.2 MW) wind turbine model for Project operation. Additional height reductions would further reduce potential shadow flicker. The effect is highly reversible, of short duration (i.e., restricted to daylight hours), restricted to the LAA, and infrequent (less than 30 hours per year). Shadow flicker exposure is not regulated in NL and has not been identified as an issue related to the Project by stakeholders.

Project operations could result in adverse effects to human health and quality of life due to ice throw, however, this risk is mainly restricted to workers accessing the wind turbines for maintenance / operations purposes during periods of rotor icing who may be struck by a falling or thrown ice fragment. The mitigation measures available to reduce the probability of occurrence of ice throw and hence the potential for injury are adequate to reduce the consequences associated with the risk of ice throw.

Property damage is mostly limited to the wind turbine structure itself or associated aboveground electrical or other infrastructure, however, can be mitigated with protective caging or housing and is highly reversible (i.e., damage can be repaired). The frequency of icing conditions was predicted at a maximum

of 42.9 days per year (i.e., 11% annually), therefore ice throw events are expected to be infrequent over the Operations and Maintenance phase. An ice throw event has a very short duration. The modelled ice throw zones for each turbine are limited to the Project Area or the LAA, and given that the model of wind turbine under consideration will cut out at wind speeds greater than 25 m/s, the maximum distance indicated in the model that ice can fall is unlikely to occur. The effectiveness of ice protection systems integrated in the turbine design such as heated blades and low friction coverings, is known to be high (Roberge et.al., 2023) and therefore the magnitude of effect is greatly reduced.

Given the significance criteria defined above in Section 4.2.7.3, neither shadow flicker nor ice throw were determined to result in significant residual effects to human health and quality of life. Level of confidence in the outcomes of both modelling exercises are high. These conclusions are summarized below in Table 4.2.7-6.

Table 4.2.7-6 Significance of Potential Residual Environmental Effects of the Project: Human Health and Quality of Life.

Project Phase	Key Indicator	Significance of Predicted Residual Environmental Effects		Likelihood*	
		Level of Significance	Level of Confidence	Probability	Scientific Certainty
Operation and Maintenance	Shadow Flicker	NS	3		
	Ice Throw	NS	3		

*Only applicable to significant effects.
Significance
Level of Significance: S = significant; NS =not significant; P= positive
Level of Confidence: 1= low; 2= medium; 3= high
Likelihood (Only applicable for significant effect (rated as S)
Probability of Occurrence; 1= low; 2= medium; 3=high
Scientific Certainty: 1=low; 2=medium; 3=high.

4.3 Accidents and Malfunctions

The NL DECC *Environmental Assessment Guidance for Registration of Onshore Wind Energy Generation and Green Hydrogen Production Projects* requires that potential accidents and malfunction be considered in the Registration of the Project. By definition, an accident is an unforeseen or unplanned event or circumstance, and a malfunction is a failure to operate or function in the correct manner. In this chapter, accidents and malfunctions are jointly referred to as incidents. Incidents have the potential to occur during all Project phases, and potentially have significant adverse effects.

Argentia Renewables is committed to protecting the safety of its personnel, contractors, the public, and the environment. Upholding this commitment requires extensive planning and preparation. The Project will follow established good engineering practices throughout its development, with a focus on proactively identifying and addressing risks and hazards at each stage of design, construction, and operation. An Emergency Response Plan (ERP) has been prepared to detail the prevention, preparedness and response procedures to be taken in avoiding or responding to an incident (Appendix M). Environmental

management measures and mitigation measures will be described in the Environmental Protection Plan, to be developed prior to project Construction Phase (An annotated table of contents for the EPP is presented in Section 9). These plans will be used to drive prevention measures, standards, and protocols that the Design, Operations and HSE teams will put in place before the Project Operations and Maintenance phase commences. All staff and personnel working on the Project will be trained and aware of the full suite of Project Environmental, and Occupational Health and Safety plans.

Through the development of the ERP and the completion of an Environmental Effects Assessment and Risk Assessment Workshop (trajectorE, 2024), Argentia Renewables has identified and evaluated incidents that could potentially affect the Project. The risk of an incident is assessed by identifying its likelihood of occurrence combined with the severity of potentially adverse consequences. A diverse group of subject matter experts with experience from similar projects and facility operations, identified such potential incidents – including both natural occurrences as well as events arising from the operation of a complex energy and chemical-generating facility.

The potential scenarios identified during the assessment are listed in Table 4.3.2-1. The likelihood of a major incident occurring that is associated with the Project is considered low; however, it is possible that additional scenarios other than those presented in the table could occur. Since risk management is an active process that requires regular evaluation, Argentia Renewables will regularly review and refine its approach to preventative and response protocols.

4.3.1 Emergency Preparedness

The Project will have a dedicated and trained Emergency Response Team (ERT). The Project ERP details the organizational structure, responsibilities, training, and specific procedures and actions to be taken in the event of an incident. The primary goals of the plan are to protect lives, reduce injuries, prevent property damage, and ensure the continuity of essential functions during and after an emergency. The ERP offers guidelines for a well-coordinated emergency management system for the production facility and the wind energy generating facility operations, ensuring effective responses to such situations. In instances requiring it, the system will harness the collective efforts of all departments, mutual aid groups, and municipal agencies to address emergency incidents safely, efficiently, and promptly. To this end, Mutual Aid Agreements will be established with local and provincial response organizations as the Project planning advances.

The Argentia Renewables facility will be designed to safely produce and store hydrogen and ammonia using applicable Canadian codes, as well as relevant international codes, such as: ASME B31.3 Process Piping; ASME B31.12 Hydrogen Piping and Pipelines; ASME STPPT- 006 Design Guidelines for Hydrogen Piping and Pipelines; and National Fire Protection Association (NFPA) 2 Hydrogen Technologies Code and NFPA 55 Compressed Gases and Cryogenic Fluids Code (covers both hydrogen and ammonia).

The design process will incorporate an array of “designed-in” mitigation measures that will serve to eliminate or reduce potential hazards. Features such as inclusion of a flaring facility and keeping hydrogen storage to a minimum exemplify this approach.

As an industrial site, the Project is vulnerable to accidents such as chemical spills, fires, or equipment malfunctions. In addition to a program of active planning to prevent incidents, a high level of emergency preparedness will be maintained throughout all Project phases. On-site emergency equipment, such as firefighting, confined space rescue, high angle rescue, medical aid kits, and spill response materials will enable a rapid and effective response that can contain and mitigate the severity of such incidents. The availability of this equipment is essential for safeguarding lives, protecting the environment, complying with regulations, and maintaining operational continuity.

The ERP has been developed based on early-stage engineering and as such many of the necessary design details are yet to be completed. In turn, further design work will enable improvements and refinements to emergency response procedures. As changes are identified, the plan will be updated and provided to all interested parties.

4.3.2 Incident Scenarios

The scenarios assessed are in accordance with the Project Registration guidance (NL DECC, 2023). Each scenario has been assessed based on a reasonable “worst-case scenario” during any phase of the Project. A summary of the assessment is outline in Table 4.3.2 -1, and further described in Section 4.2.

Table 4.3.2-1 Summary of Identified Incident Scenarios.

Incident Category	Description	Environmental Interactions
a. Accidental spills and/or releases of hydrogen, ammonia, chemicals, pesticides or any potentially hazardous substance on land or in air or water	The release of ammonia or hydrogen during Project Operations and Maintenance phase. Hydrogen and ammonia release scenarios may arise from catastrophic failure of the mixing drum, electrolyzer containment, storage tank containment, and reactor. Pipe ruptures of the mixing drum, ammonia transfer line, ammonia ship loading arm, recirculation line, reactor inlet pipe, and reactor discharge piping are also potential sources of hydrogen release. Hazardous spills can arise during all Project phases from the use of	An ammonia release to the atmosphere could lead to toxicity concerns for receptors, especially humans. An ammonia release would generate a vapour cloud that, prior to dispersing would compromise air quality over a portion of the Project area depending on the quantity released. Ammonia release into the marine environment could introduce a hazardous substance to aquatic receptors depending on the concentration of ammonia. Hydrogen release could result in flash fires, jet fires, fireballs, vapour

Incident Category	Description	Environmental Interactions
	fuel (storage, refuelling, operation of heavy machinery, and vehicle traffic) and handling/storage of assorted chemicals.	cloud explosions, and pressure vessel explosions. Although hydrogen fires do not produce smoke themselves, burning of nearby combustible materials can result in smoke. Hazardous spills could contaminate air, soil, and water. Inhalation, ingestion, and contact with contaminated air, water, and soil can impair the health and safety of receptors, including humans.
b. Traffic accident	Traffic accidents during all Project phases involving vehicles and heavy equipment, affecting humans and wildlife.	A traffic accident could result in injury or fatalities to people and wildlife, as well as property damage.
c. Fire and explosions (other than from Hydrogen)	Fires and explosions could occur during all Project phases as a result of equipment malfunction, mishandling of flammable materials/substances, or flaring/venting of gases.	Fires and explosions arising from ignition of combustible materials will threaten human safety (injury/fatality) as well as Project infrastructure and facilities. Animal injuries and fatalities could occur, along with damage to riparian and terrestrial habitat. A fire or explosion could result in an increase of greenhouse gas emissions, negatively affecting the atmospheric environment in the Project area and neighbouring communities.
d. Dislodging of wind tower or turbine blade	The collapse of a wind tower or dislodging of a turbine blade could occur during any phase of the Project. The likelihood of this happening during the Operation and Maintenance phase is lower than would be the case during the Construction Phase and Decommissioning and Rehabilitation phase due to the use of tower cranes, and heavy lifting equipment.	Incidents involving the dislodging of a turbine blade, or the collapse of a wind tower have the potential to compromise public safety, and cause damage to infrastructure and property.

Incident Category	Description	Environmental Interactions
e. Occupational hazards and human injuries	As with most industrial sites, a variety of tasks and activities expose workers to an array of hazards during all Project phases. A key issue will result from the produced chemical – ammonia.	Inhalation or direct contact can result in health effects ranging in severity from irritation to fatalities. The greater the concentration of ammonia, the more severe the symptoms. A liquid phase exposure on skin can cause both thermal and chemical burns. Other workplace hazards include a variety of Construction phase and Operations and Maintenance phase activities.
f. Failure of water supply	In the event of a loss of water availability for processes and operations, the Argentia Green Fuels Facility may be required to shut down. Unplanned releases of hazardous products (hydrogen or ammonia) are possible due to equipment failure/leakage or infrastructure damage.	Given the provision for emergency fire water supply, interactions would likely be indirect, likely resulting from response actions to the water loss event. Direct interactions with the biophysical environment are unlikely.
g. Flaring/venting of hydrogen, ammonia, other gases in the event of malfunction	During Project Operations and Maintenance phase, Flare units provide for safe release of flammable gases, e.g., off-gases from electrolysis, ammonia loop, refrigeration, and ammonia storage. The flare units will be designed to operate during power outages and boil-off system failures.	Gaseous ammonia may be released to the atmosphere in the event of malfunction of the Process Flare and the Tank Flare. Ammonia released into the atmosphere may interact with nearby receptors, including humans, posing a health risk.
h. Wildlife emergencies/incidents	During all Project phases, interactions between various forms of wildlife and workers or Project infrastructure can occur. During the Project Operations and Maintenance phase, moving or stationary wind turbine blades can interact with avian species. Human presence in the Project Area could increase human-wildlife interactions as some wildlife species become acclimated to their presence.	Collisions with wind turbines and other Project infrastructure (meteorological towers, overhead collector lines, transmission system) can result in injury and mortalities for birds and bats, including species at risk. The association of humans and food can lead to human-wildlife conflict. Wildlife attacks may result in injury or fatality of Project personnel.

4.3.3 Risk and Risk Management

For each category of incidents, an evaluation has been carried out to assess the likelihood of occurrence and consequence severity of each. A formal risk assessment has been conducted for the scenarios involving a release of hydrogen and ammonia, the planned output of the Project. The results of these considerations are presented below, along with a summary of mitigation measures that will be applied for the purposes of reducing the likelihood or severity of consequences from each category of incidents.

4.3.3.1 Accidental Spill or Release of Hydrogen, Ammonia or Hazardous Materials

Hydrogen and Ammonia

A specialist design firm - trajectorE was engaged by Argentia Renewables as part of the Project to conduct a series of Structured What-If Analysis (SWIFT) workshops. These sessions focused on Hydrogen and Ammonia Production, Ammonia Storage, Ammonia Ship Loading, and Hydrogen Storage at site. The assessment considered the Argentia Green Fuels Facility and Loading Facility. The SWIFT is a type of high-level Process Hazard Analysis (PHA) that uses a structured brainstorming technique to identify major potential hazards and then applies a risk matrix to characterize the likelihood and consequences of said hazards. The results are used to identify candidate mitigation measures for application for each hazard as an integral component of planning and design.

A total of 72 “What-If” scenarios were identified during the workshops. The list was then screened for relevance and the remaining scenarios entered into a worksheet and each assigned a consequence (impact) and likelihood rating, which generated risk ranking. Results of the report are presented in the trajectorE Risk Assessment Workshop Report (trajectorE, 2024) presented in Appendix V.

HYDROGEN - RISK

Hazardous substance releases could occur due to hydrogen storage tank leakage or ruptures, pipeline transfer leakage, and connection leakage at the electrolyzer.

Since hydrogen has a very wide flammability range and low ignition energy, it should be assumed that any hydrogen release is likely to result in hydrogen fire. Hydrogen fires can damage or ignite objects in the vicinity through heat transmitted by radiation and convection.

HYDROGEN - RISK REDUCTION

Emergency shut-down procedures for a hydrogen gas fire in the Argentia Green Fuels Facility will be established to ensure the safety of personnel, equipment, and the surrounding environment. Refer to the ERP.

Hydrogen storage and pipelines will be located away from sources of heat and ignition. Thermal imaging cameras and flame detectors will be used to verify that a hydrogen flame is present. Argentia Green Fuels Facility operation is designed to minimize the quantity of hydrogen in storage by synchronizing hydrogen production with ammonia conversion.

Argentia Renewables plans to install auto-isolating valves on both hydrogen tanks. These will substantially reduce the probability and consequence of a hydrogen spill or leakage event.

AMMONIA - RISK

Ammonia releases could occur due to storage tank leakage or ruptures, ammonia handling equipment, pipeline transfer leakage, pumps, and the ammonia loading arms.

The most common ammonia release occurs as a result of liquid that evaporates into the atmosphere. Although hazardous substance releases can occur during all phases of the Project, usually these situations arise during the Project Operations and Maintenance phase.

AMMONIA - RISK REDUCTION

A sensor will be installed on the connection point of the ammonia transfer and pipeline feed to detect pressure losses and ammonia leaks. Instrumentation will be equipped with automated shut-off valve closure to initiate emergency stops.

Ammonia storage will employ double walled tanks with no bund. Tanks will be designed as complete containment systems that can hold liquids and vapours. These design features will substantially reduce the probability and consequences of an ammonia spill or leakage event.

In the event of a release, all surrounding neighbours are to be notified in a timely fashion and advised of the extents of the hazard zone.

Emergency response procedures in the event of an unplanned hydrogen or ammonia leak are described in the ERP in Sections 9.2.6 and 9.2.7.

It is expected that through prudent and responsible engineering design development many of the risks identified will be mitigated during upcoming design phases of the Project. To ensure that all recommendations shown in the SWIFT Worksheet (Appendix V) are actioned and fully managed it is recommended that this list of risks be transferred to the overall project risk register and tracked and managed accordingly (trajectorE, 2024).

Hazardous Material

RISK

The facility is expected to contain various hazardous chemicals and reagents such as fuels, oils, and cleaners; however, given the access to various nearby suppliers, none of these are currently contemplated to be stored in substantial quantities and all will be managed according to applicable regulatory requirements and safety standards. The Project includes several features that will reduce the likelihood of occurrence or consequence severity of various types of spills.

Since the Project is to be constructed and operated within an industrial site (POA), the Project from inception will have infrastructure available, including a road network and electricity supply. The availability of these will reduce the extent of construction required to bring the facility into the Project Operations and Maintenance phase. It will also result in minimal requirements, for on site fuel and hazardous material storage. In the event of an incident, the ability to respond is enhanced through the ready accessibility of outside resources. Further, the nature of the terrain comprising the Project Area will reduce the potential consequences of unplanned releases. The Argentia Peninsula is a brownfield site, so that travel distances from a spill source to sensitive receptors (e.g., marine environment) for any form of spill will likely be enough to enable deployment of containment and recovery measures. The Argentia Backlands is an area of high topographic relief, characterized by small watershed areas. As a result, these natural features will serve to contain a spill and enable response actions to be geographically focused.

Both the likelihood of occurrence, as well as the consequence severity of a hazardous substance spill is judged to be low for this Project. Additionally, as described below, a well-developed ERP will be maintained by Argentia Renewables at all Project phases.

RISK REDUCTION

A series of preventative and mitigation measures will be in place to further reduce the potential for, and consequences of, a hazardous material spill.

Measures on-site to prevent a spill or release of chemicals include, but not limited to:

- Mandatory Health, Safety and Environment (HSE) orientation.
- Training in proper handling and best practices, and incident response.
- Ensure proper equipment and material are available on-site to respond to an incident.
- Ensure vehicles, heavy equipment, and machinery are inspected and free of fluid leaks.
- Site maintenance, vehicle maintenance, and fuelling will be done in specified areas more than 30 m away from wetlands and waterbodies.

- Use secondary containment to store any potential contaminants (i.e., oil, fuels, and chemicals) in designated areas.
- All spills are to be reported and cleaned up as soon as possible, with contaminated soils removed from site for disposal at an approved/licensed location.

The ERP details the procedure to manage a spill, this includes: assessing the situation, alerting others, isolating the area, ensuring use of proper Personal Protective Equipment (PPE), containment, if possible, using appropriate materials (e.g., absorbent pads, booms), evacuate (if necessary), activate Spill Response Team, spill cleanup, properly disposal of contaminated materials according to local, provincial, and federal regulations, report the spill to the relevant authorities, and decontaminate affected personnel, surfaces and equipment, as necessary.

4.3.3.2 Traffic Accident

Public roads, private Port of Argentia roads, and Project constructed access roads will be utilized during all phases of the Project; however, heavier traffic is anticipated during Construction and Decommissioning and Rehabilitation phases.

Risk

While the compact nature of the Project Area will serve to reduce vehicular travel during all Project phases, the likelihood of occurrence of a traffic accident is directly tied to the volume of traffic associated with the Project. A major factor affecting consequence severity is traffic speed. For roads within control of Argentia Renewables, a strictly enforced maximum speed will be posted and enforced. Overall, both the likelihood of occurrence, as well as the consequence severity of a traffic accident is judged to be low for this Project. As described below, a well-developed program of awareness and enforcement capability will be maintained by Argentia Renewables during all Project phases. Potential for vehicle incidents exist with activities such as:

- Passenger vehicle movement carrying people and freight throughout the Project site.
- Travel from Project site areas to the POA.
- Heavy equipment movement and transport on access roads throughout the Project site.
- Passenger vehicle movement and heavy equipment usage along the transmission line access.

The likelihood of a vehicle incident varies according to changing conditions. These conditions may include:

- Road conditions (including dust, loose roadbed or unstable road shoulders, ice/snow cover);
- Mechanical failure in vehicle systems; and/or
- Operator error in judgment.

Risk Reduction

Traffic related mitigation measures will ensure that Project activities take place with minimal disruption to the public, local businesses, and the environment. A Traffic Management Plan has been developed for the Project, see Appendix E.

Several traffic safety measures will be implemented to reduce vehicle related incidents:

- The Traffic Management Plan, driver education, and driver safety will be covered during site orientation to ensure all Project personnel are informed of their legal responsibilities and are focused on the safety of the public and the environmental.
- Regularly held toolbox meetings and informative safety briefing will be held to ensure drivers are equipped with the necessary knowledge and skills to navigate roadways safely.
- All Project personnel will be required to obey all posted speed limits and traffic rules.
- All vehicles are to be maintained in good working order.
- Traffic control signage and other measures will be used for the safe flow of traffic.
- Movement of oversized or overweight loads will be scheduled to avoid peak traffic periods.

Responding to a vehicle accident on a worksite requires a well-defined and organized procedure to ensure the safety of individuals, the environment, and property. The ERP details the roles and responsibilities of on-site emergency response crews, as well as coordination with relevant authorities and local emergency services.

4.3.3.3 Fire and Explosions

The main threat to the Project from fires and explosions would result from hydrogen or ammonia releases (see Section 4.3.3.1). Other fire/explosion risks are associated with several Project activities at all phases. There is also the potential for fires to originate from other sources within and adjacent to the Project Area that could spread to the Project Area and threaten site features.

Risk

The likelihood of a fire and/or explosion must be regarded as moderate, given the nature of activities associated with the Project Construction and Operations and Maintenance phases. With allowance for a high level of emergency preparedness, and the proximate availability of support resources, the consequences severity has been rated as low.

Risk Reduction

Project buildings and facilities will be designed and constructed in compliance will all National and provincial fire code requirements. Fire prevention and response mitigation measures include, but are not limited to:

- Training and orientation for Project personnel regarding fire hazards, prevention, and roles and responsibilities in the event of a fire.
- Installation of fire detection and protection systems in high-risk areas such as fuel and hazardous material storage.
- Proper disposal of flammable materials.
- Necessary fire response equipment on-site, such as fire extinguishers and personal protective equipment (PPE). A complete list of the fire response equipment is included in the ERP.
- Clearly identified “no smoking” areas.

The ERP details the process for maintaining a high level of preparedness to prevent and, as necessary, respond to a fire or explosion.

4.3.3.4 Dislodge of Wind Tower or Turbine Blade

The Project includes an array of wind turbines on Port of Argentia lands. The dislodgement of a wind turbine tower or blade could occur during any Project phase. This could happen because of a failure during the erection or disassembly of structures, as a consequence of structural failures such as cracks and corrosion, or from failure of foundations and anchors.

The likelihood of the collapse of a wind tower or dislodging of a turbine blade during the Project Operations and Maintenance Phase is low due to preventative measures considered in the design phase. The chance of wind turbine part dislodgement increases during the Construction and Decommissioning and Rehabilitation phases due to issues related to the use of tower cranes, and heavy lifting equipment.

The likelihood of occurrence for a failure scenario is considered low in light of both industry and proponent experience. The consequence severity of such an event (other than financial considerations) would be limited to the immediate proximity of the structure, and hence is judged as low.

Risk Reduction

Site-appropriate design and effective Quality Management (including diligent monitoring and early detection) are the best means to prevent catastrophic failures. Prior to actual Construction Phase, detailed planning and design activities are conducted, including the collection of required site-specific information. These surveys characterize a variety of site conditions. Major studies include geotechnical

surveys (detailed further below), installation and operation of meteorological towers to gather critical weather data and environmental surveys to establish baseline conditions. Wind turbine site selection, infrastructure routing, and wind turbine foundation design are dependant on the results of these surveys.

Geotechnical field assessments during the planning phase will identify unstable conditions such as high erosion potential, slope instability, and rock fall hazards. The best foundation design for wind turbines (gravity foundation or rock-anchored foundation) will also be determined from site characterization assessments.

Setback distances for wind turbines will also be established during the planning phase to reduce hazards associated with collapse or dislodgment of a wind turbine component. Wind turbines will be sited a safe distance away from nearby residences to ensure public safety.

Facility maintenance activities include regular scheduled monitoring of performance leading to updates to equipment and preventative maintenance and repairs. A maintenance schedule will be developed and followed, and data analyzed to find trends and improve performance. This includes monitoring energy output, availability, and reliability of the wind turbines. Continuous monitoring of wind speed and direction, air temperature, atmospheric pressure, electricity generation, and turbine performance will ensure optimal performance of the Argentia Wind Facility.

If a turbine or turbine blade suffers a catastrophic failure, it will be isolated and de-energized. The area will be cordoned off to prevent entry by untrained personnel, and all stakeholders and local authorities notified. Due to the size and weight of turbines and turbine blades, mobile cranes will be required to either repair or remove the damaged equipment.

4.3.3.5 Occupational Hazards and Human Injuries

Argentia Renewables will follow the Occupation Health and Safety Act to ensure a safe and healthy workplace. The ERP outlines procedures for hazard recognition and assessment. Hazards associated with chemicals such as ammonia or hydrogen material exposure are described in the ERP. As noted above, workers could be exposed to an array of hazards during all Project phases.

Risk

Argentia Renewables is dedicated to a Safety Culture that effectively reduces worker injuries to below industry averages. Newfoundland and Labrador overall has one of the lowest lost-time injury rates in Canada, and the trend is towards a continuing decline (WorkplaceNL, 2017), especially for the Construction and Manufacturing sectors. Nevertheless, both wind energy and hydrogen/ammonia production represent a new emerging industry for the province.

Argentia Renewables is committed to achieving both a low level of occurrence and consequence severity with respect to worker and workplace safety.

Risk Reduction

All Project personnel and visitors will be required to complete a health and safety orientation to access the site. This will mitigate risks related to occupational hazards and human injuries. Near misses will be tracked to ensure any occupational hazards that may arise are rectified. This will mitigate risks related to reoccurring occupational hazards and human injuries. Other mitigations include, but are not limited to:

- Site health and safety orientation for all Project personal and visitors.
- Training for safe work procedures.
- Requirement for proper PPE to be always worn.
- Ensuring regular maintenance of equipment and facilities.
- Posting of safety and hazard signage is appropriate locations.
- Use of toolbox talks to reinforce safety messages and review of safe work practices and hazards associated with work tasks.
- Use of educational material and signage at worksites as daily reminders for safe work practices. Focus on common workplace injuries such as slips, trips, and falls.

The ERP details the on-site procedure to administer first aid, as well as local emergency responders and medical clinics in the event the incident is serious and requires medical attention.

4.3.3.6 Failure of Industrial Water Supply

If there is a loss of water supply, the Argentia Green Fuels Facility will have to be shut down, isolated, and purged. The cause of the loss of water will have to be identified and the Argentia Green Fuels Facility will remain shut-down until the cause of the failure is identified and corrected. Fire water will still be available during this investigation. Emergency shut-down procedures in an ammonia processing plant are critical to ensuring the safety of personnel, protecting the environment, and preventing equipment damage. The loss of water in an ammonia plant can lead to potentially dangerous situations, including the formation of anhydrous ammonia, which is highly reactive and poses serious risks.

The Argentia Green Fuels Facility will require a temporary shut down should the industrial water supply fail. While unplanned releases of hazardous products (hydrogen and ammonia) into the environment are not anticipated during a shut-down, there is a possibility of equipment failure/leakage or infrastructure damage that could result in a release.

Risk

The Project is heavily reliant on a secure suitable water supply. Based on consultations and detailed resource assessments, the Protected Public Water Supply administered by the Town of Placentia meets and exceeds these requirements. Given the availability of a reserve water supply designed into the system, the likelihood of a total failure of the water supply is regarded as low. As noted, the consequences severity of such an event, while major for the Project, are less so for the surrounding biophysical environment.

Risk Reduction

Mitigations associated with a failure of industrial water supply and subsequent Argentia Green Fuels Facility shut-down include, but are not limited to:

- Design of the Argentia Green Fuels Facility shut-down mechanisms.
- Operator training of the Argentia Green Fuels Facility shut-down procedures.
- Routine maintenance of Argentia Green Fuels Facility infrastructure and equipment.
- Regular review of supply system capability and water resource availability.

Emergency response procedures in the event of an unplanned hydrogen or ammonia leak is the same a noted in Section 4.3.3.1.

4.3.3.7 Flaring/Venting of Hydrogen, Ammonia, other Gases

Flaring is the controlled burning of fuel or waste gas that takes place during production and processing. Fuel or waste gas is ignited at the top of a flare stack, causing the characteristic flame associated with flaring. Some odours may be associated with flaring. Venting is a controlled release of unburned gases into the atmosphere, such as natural gas or other hydrocarbon vapours, water vapour, oxygen, or other gases. Venting may occur during operational processes and during maintenance activities. Odours may be associated with venting.

Risk

Venting and flaring act as means to address other Unplanned Events and thereby avoid more severe consequences. The likelihood of an individual occurrence is therefore directly tied to the likelihood of a causative event. To be conservative, it is suggested that a moderate probability has been assigned to such an event. Conversely, the consequence severity is generally low.

Risk Reduction

The Project design includes flare units for the burn-off of flammable gas to prevent the release of hazardous off-gases from the electrolyzer process and ammonia synthesis production and storage. The

flare units will be designed to manage Unplanned Events such as power outages and boil-off system failures.

Mitigation measures associated with the flaring or venting of hydrogen, ammonia, or other gases include, but are not limited to:

- Flare units will be equipped with continuous emissions measurement devices.
- Flare units will be designed to handle large ammonia volumes from Unplanned Events.
- an ambient Air Quality Monitoring Station will be installed to evaluate and monitor air quality in Argentia.

The ERP details the procedure to respond to an uncontrolled event of flaring and/or venting. The Emergency Response Team will be immediately notified and activated to assess the situation and manage the response.

4.3.3.8 Wildlife Emergencies/Incidents

Since the Project Area includes sections of wildlife habitat, it is possible that different types of animals may be encountered during normal working activities. Interaction with animals such as caribou, moose, and black bears has the potential to harm people, property, and the subject animals. Human presence in the Project Area will increase human-wildlife interactions as wildlife become tolerant of disturbance.

Note, the issue of chronic interactions between wind turbine blades and avian species (including Species at Risk) is addressed separately and in detail for each of the identified Key Indicators of the Terrestrial Environment VC (see Section 4.2.3).

Risk

The likelihood of interactions between Project personnel and wildlife is relatively high, given the proximity of the Project Area to natural landscapes. Subject to implementation of preventative and cautionary measures, the consequence severity is considered to be low.

Risk Reduction

The primary mitigation associated with wildlife incidents is to ensure that Project personnel who have the potential to encounter wildlife are aware of the applicable policies and ways to prevent and respond.

Applicable measures include, but are not limited to:

- Providing a means for employees to request deterrents (such as bear spray or air horn) and address the hazards associated with the use of such deterrents.

- Feeding of wildlife will be prohibited on Argentia Renewables properties.
- The development of a Species at Risk Impacts Mitigation and Monitoring Plan (Appendix R) and ensuring personnel are familiar with and adhere to the plan. The plan describes mitigation and monitoring measures to be implemented to assess effects and minimize impacts.

When animals, such as black bear, moose, caribou, or fox, pose a threat or a problem in the Project area, the priority will be personnel safety. After measures have been taken to minimize risk of injury to people, consideration will be given to avoid or reduce effects on the animals. Live animal traps cannot be set within the Argentia Renewables area unless a permit is granted by the Department of Fisheries, Forestry and Agriculture (NL FFA). Responsive actions for the situation will be determined by the Environmental Coordinator through consultation with the Facility Manager or designate, and the NL FFA Wildlife Division. Project personnel must record and report all wildlife sightings and human-wildlife interactions and conflicts.

4.4 Effects of the Environment on the Project

This section describes the effects of the environment on the Project over the expected lifespan of the Project. This analysis aids in distinguishing the effects of environmental changes on the Project and those arising from natural processes. The following discussion considers the continued effects of ongoing interactions along with natural environmental processes. The potential effects of the environment on the project include the following:

- Weather and Climate Change
- Algal Bloom
- Geological Hazards
- Forest Fires

4.4.1 Weather and Climate Change

Harsh weather conditions, including extreme snowfall, freezing rain, storms, and hurricanes, present a risk of causing damage to Project infrastructure and equipment. A detailed baseline study on the existing atmospheric environment in addition to climate projections is discussed in Section 3.1.1. The effects of weather and climate change will be considered for all phases and for the lifetime of the Project.

4.4.1.1 Temperature

Daily average temperatures in the Project Area, as outlined in Section 3.1.1, ranges from -4.0 to 15.9 degrees Celsius (°C), with the lowest average temperatures occurring in February and the highest in August (Government of Canada, 2023). The wind turbine being considered for the Project has an operating temperature range between -20°C and +45°C (with provision for a -30°C minimum operating

temperature based on inclusion of a cold weather operating package). It is expected with climate change that temperature increases (4.4°C to 5.3°C) will occur in Argentia over the next century. Rising temperature trends indicate less precipitation in the form of snow and more in the form of rain. There will be fewer days with temperatures below freezing, particularly in the fall and spring.

Temperature alone is anticipated to have minimal effect on the Project Area; however, temperature could contribute to increased severity of storms, significant weather events, and seasonal fluctuations (e.g., rapid freeze and thaw conditions in winter). Hotter and drier conditions increase the risk of droughts and wildfires. Winter temperature fluctuations and increased winter rain could result in road washouts temporarily limiting access to areas of the Project. Globally as the atmospheric and subsequently ocean temperatures rise, increased storm events such as hurricanes may become more frequent and with sustained strength upon landfall. Storms are further discussed below in Section 4.4.1.3.

4.4.1.2 Precipitation

The Project Area is characterized by a humid coastal climate, however, with climate change, there are projected increases in precipitation event intensity along the south coast; Argentia may see substantial changes in precipitation intensity in the winter, spring, and fall. Projected changes in maximum 3-day, 5-day, and 10-day precipitation as well as the 90th percentile of precipitation events follow regional patterns similar to those described for mean precipitation intensity. Hazardous events typically occur over several days, during which time reservoirs, soil moisture capacity, and waterbodies reach capacity, eventually resulting in overflow and potential flooding. The greatest changes for consecutive precipitation days for the Avalon Peninsula occur in the winter and are concentrated along the south coast. Given the nature of the topography in the Argentia Backlands and the local siting of Wind Facility infrastructure, any potential overflow from local ponds will have minimal effect on the Project.

Extreme precipitation events, coupled with consequential surface water runoff, could lead to flooding, erosion, and road washouts. Should a road become impassable due to washouts or poor driving conditions, access to the Project site may be limited. This restriction could give rise to delays in the transportation of crucial Project components – receipt of materials and supplies, delivery of products to market, and the workforce to and from the site.

The low flow period within the Project Area generally occurs in August, as outlined in Section 3.1.2, while ponds re-charge from September to April. The Source Water Hydrology Analysis and the Placentia Regional Water Supply Study (Appendix C1) confirmed sufficient baseline water availability for the Project with considerations for seasonal variability and potential effects from public water withdrawal. The proposed Project water withdrawal is estimated to range from 11.5% to 12.4% of the available water, based on historical data and climate change projections.

While the area is not prone historically to drought-like conditions, the increase in extreme weather from climate change could cause drier than normal conditions. During these times, it is possible that water usage restrictions would apply to the Argentia Green Fuels Facility, and thus limit or temporarily cease operations until conditions improve. It is also possible that the period of drought would increase in length over time as well, as outlined in Section 3.1.1, from 2.9 days (existing) to 3.4 days (2041 to 2070 projections).

4.4.1.3 Snowfall, Freezing Rain, and Storms

As with precipitation, the Project Area commonly experiences winter weather including snowfall, freezing rain, and storms, all of which have been considered in the Project's design. However, climate change precipitation analyses predict that there will be fewer but heavier snowstorms and more frequent and heavier occurrences of rain throughout the cold season.

The accumulation of heavy snowfall can strain structures (Argentia Green Fuels Facility and Argentia Wind Facility components) and utility systems (collector and transmission system, electricity grid connection), potentially leading to structural issues or failures. In addition, loss of electrical power could compromise production. Snow accumulation may also decrease visibility and impair road conditions, preventing workers from accessing the site, thus delaying Project activities during all Project phases.

Freezing rain poses the threat of ice accretion on surfaces, increasing the risk of damage to exposed equipment and infrastructure. Adverse cold weather conditions, such as heavy snowfall, freezing rain, and ice pellets, constitutes the risk of ice accumulation on critical infrastructure, which becomes particularly precarious in the context of wind turbines. Inactive periods of wind turbines may lead to the buildup of ice on the turbine blades. Subsequently, during operation, the potential for ice throw emerges, where chunks of accumulated ice may be thrown from the rotating blades. Freezing rain may also impair road conditions, preventing workers from accessing the site, thus delaying Project activities during all Project phases.

Storms, characterized by strong winds and intense precipitation, can cause flooding, harm to structures, and compromise the integrity of equipment. The primary flood risk lies with the Argentia Green Fuels Facility. The facility faces exposure to coastal flooding and waves caused by storm surges, especially considering potential increasing intensity of storms. Coastal areas on the Island of Newfoundland, previously unaffected by storm surges, are now becoming vulnerable due to the increasing severity of storm conditions. This is further amplified by sea level rise as discussed below.

Storms may also delay the receipt of materials for Construction (i.e., turbine components, plant components), because of shipping delays. The presence of extreme winds necessitates a safeguard mechanism for wind turbines. Specifically, when the 10-minute average wind speeds surpass 25 m/s, a protective protocol engages the rotor to stop moving. The design of the wind turbine foundations (gravity

and rock-anchored) will take into the consideration of high winds. Storms may also decrease visibility and impair road conditions, preventing workers from accessing the site, thus delaying Project work during all phases. As mitigation for ice accumulation on wind turbine blades, all Project wind turbines will be outfitted with de-icing technology and icing protocols will be implemented throughout operations of the Project.

4.4.1.4 Sea Level and Ice

The rise in sea level, attributed to the melting of ice, carries the potential for adverse effects. Coastal sea level in Argentia is projected to rise, as outlined in Section 3.1.2, by 40 cm by 2049 and more than 100 cm by 2099 (Batterson & Liverman, 2010). Local effects of crustal rebound (i.e., rising of land mass as ice sheets melt) in Argentia are projected to be +2 mm annually, thereby offsetting to a very minor extent, the effect of rising sea level. Infrastructure faces increased vulnerability as rising sea levels encroach upon coastal areas. Shipping routes, vital for transportation, may be disrupted or altered due to changes in water depth and navigation challenges. Adjacent terrestrial land areas are susceptible to coastal erosion and submersion of low-lying areas. With less sea ice cover acting as a protective buffer, Project areas situated along shorelines become more exposed to the forces of waves and storm surges. Consequently, the heightened exposure increases the likelihood of erosion and flooding, bringing additional challenges to project stability. Waves and coastal flooding from storm surge pose a risk to the Argentia Green Fuels Facility; this is further amplified by sea level rise.

Reduced sea ice increases opportunities for shipping, tourism, resource exploration, and industrial activities, which may benefit the Project. Further, as the sea level conditions change and considering the Project will be located on the privately owned Port of Argentia, the Port is likely to conduct upgrades to mitigate the effects of climate change.

4.4.1.5 Wind

Maximum hourly wind speeds at the Long Harbour Climate Monitoring Station were recorded at 53 to 79 kilometres per hour (km/hr); highest wind speeds were historically detected between October and March. The prevailing wind direction is westerly in the fall and winter months and southwesterly in the spring and summer months.

The wind turbine being considered for this Project has a cut-in speed of 3 m/s (10.8 km/hr) and a cut-off speed of 25 m/s (90 km/hr). While these specifications are within the typical seasonal average for the region, prolonged operation in extreme winds might cause structural damage to the blades, turbine, and even the support structure. Prolonged periods of winds may also damage Project electrical infrastructure.

Wind conditions along the coast of Argentia will vary seasonally and during major weather events. High winds in excess of 90 km/hr are most likely to occur from September to May and could be a potential

cause of damage to infrastructure (i.e., buildings, fences). Wind thresholds are established to protect the turbine blades from and the turbines themselves. Therefore, increased sustained winds above 90 km/hr will lead to the increased occurrence of precautionary temporary shut down of turbines. As climate changes and storms increase in frequency and intensity, spanning a couple days or more, this may lead to reduced energy production and supply to the Argentia Green Fuels Facility.

4.4.2 Algal Bloom

The Project proposes to withdraw water from local ponds, as outlined in Section 3.1.2, which are within a designated PPWSA. It is recognized that these ponds may be susceptible to algal blooms, potentially affecting water quality. Algal blooms may degrade water quality which could necessitate the implementation of additional water treatment processes for operation of the Argentia Green Fuels Facility. Moreover, algal blooms could potentially clog intake systems or filtration equipment, potentially leading to operational interruptions.

Water quality at the ponds is currently regularly monitored by the Town of Placentia, given their designation as PPWSA. Consequently, deviations in water quality or the occurrence of algal blooms would be detected ahead of time and managed accordingly. Therefore, it is anticipated that algal blooms are not expected to have an environmental effect on the Project.

4.4.3 Geological Hazards

Geological desktop analysis and interpretation has been conducted on the Project Area. The purpose of the study was to review, interpret, and predict possible geological hazards and suggest reasonable mitigation measures to reduce the effects of any unpredicted hazardous events. Review of topographic, surficial and bedrock mapping, and publicly available geological research was used to complete this assessment. Further information regarding the surficial and bedrock geology of the Project Area is provided in Section 3.1.3.

4.4.3.1 Terrain Stability

No indication of any type of large-scale landslides, rockfalls or slope instability was observed on satellite imagery or reported in the available literature. While the town of Placentia experiences frequent energetic erosional events from storm surges, these conditions have little to no effects on the Project Area.

It is expected that some coastal rockfalls are possible from the freeze-thaw cycles of the area, however, as Placentia Sound is well protected from currents and wave action from Placentia Bay, high-energy storm-surge erosion in this coastal area is unlikely. The Project Area is mainly covered by vegetation and wetlands, which also assists in adding to the stability of the coastal edges and interior areas. Erosion along the banks of the Port is mostly managed and mitigated by the Argentia Port Authority.

4.4.3.2 Seismic Activity

Seismic hazard is quantified by determining the probability of experiencing damaging ground motions caused by earthquakes. The Geological Survey of Canada prepares seismic hazard maps and assesses regional seismic hazards based on statistical analysis of previous earthquakes and information about Canada's tectonic and geological structure. There was a total of 31 earthquakes documented within a 250 km radius of the Argentia Peninsula from 1985 to 2023: 22 earthquakes of magnitude 2.0 or greater, eight earthquakes of magnitude 3.0 or higher, and one earthquake of magnitude 4.2. There have been no reported seismic occurrences in the Project Area (NRCan, 2021), hence the seismic hazard probability for the area is regarded as very low.

The causes of earthquakes in Newfoundland and eastern Canada are not well understood. Unlike tectonic plate boundary regions where the rate and size of seismic activity is directly correlated with plate interaction, eastern Canada is part of the stable interior of the North American Plate. Seismic activity in areas like these seems to be related to the regional stress fields, with the earthquakes concentrated in regions of crustal weakness (Natural Resources Canada, 2021).

The Island of Newfoundland is in a stable continental region within the North American Plate, so the seismic hazard risk is low according to 2015 and 2020 seismic hazard maps of Canada, implying that the probability of significant damage to buildings, which occur with seismic magnitudes greater then 3, within the region is less than 1% in 50 years (Natural Resources Canada, 2021). The probability of a seismic event occurring in the Project Area that could result in Project damage or interruption is low given the minimal seismic activity risk and the implementation of the nationally recognized design standards. Project infrastructure will be designed and constructed to accommodate potential seismic events and as recommended by the National Building Code of Canada (National Research Council of Canada, 2015).

4.4.4 Forest Fires

The Project Area is within the Avalon Peninsula of Newfoundland, where the largest fire was the Spread Eagle Fire in 1999 (Department of Fisheries, Forestry & Agriculture, 2016). Other large-scale forest fires on the Avalon peninsula occurred near Bay de Verde and along the Southern Shore in the 1960's (Department of Fisheries, Forestry & Agriculture, 2016).

Forest fires have the potential to cause delays in schedule, loss of production, and damage to Project infrastructure. Electrical infrastructure such as substations, transmission lines, and collector lines are also vulnerable to damage, potentially resulting in electricity loss. Forest fires may also obstruct access roads and damage water crossings. Other potential negative effects of forest fires on the Project include reduced visibility due to smoke and health and safety concerns for personnel.

Climate change might exacerbate the risk of forest fires in the Project Area because of an increase in daily maximum temperatures across all seasons, as outlined in Section 3.1.1, and a 17% increase in mean dry spell length between 20th century climate conditions (2.9 days) and climate change projections in 2041 to 2070 (3.4 days). However, in this same timeframe the maximum number of consecutive dry days is expected to decrease by 27% from 14.4 days to 10.5 days. Overall, it is expected that Climate Change will have minimal effect on the probability of forest fires in or close to the Project Area.

Project infrastructure will be designed and operated to reduce risk of damage from wildfire (e.g., transmission rights-of-way will be maintained to ensure vegetation is maintained to decrease fuel load and maintain reliability, turbine pads will be maintained to avoid the accumulation of vegetation that represents fuel load in the event of wildfire).

4.5 Mitigations

Robust mitigations are essential to ensure that Argentia Renewables has adequately addressed the myriad social, technical, and environmental issues that may accompany the Project.

Argentia Renewables has adopted a “mitigation-in-design” approach to the Planning and Design phase, which considered environmental constraints for MET tower siting and installation, transmission corridor and access road routing, siting of the Argentia Green Fuels Facility, and placement of wind turbine infrastructure. In addition, Argentia Renewables has incorporated mitigations resulting from extensive and regular consultation with the provincial government, and other stakeholders such as residents of the Placentia area. By integrating these mitigations into all phases of the Project (i.e., Planning and Design, Construction, Operations and Maintenance, and Decommissioning and Rehabilitation) Argentia Renewables will minimize the environmental footprint of the Project, proactively address community members’ concerns, and create a sustainable and beneficial project for the region and the province.

The numerous mitigations varied in nature across the VCs, but broadly included mitigations to address:

- Environmental constraints like sensitive habitats (e.g., SAR, wetlands, migratory routes);
- Human health considerations like noise, ice throw, visual impact, emissions, and shadow flicker;
- Stakeholder concerns (e.g., local residents, regulatory agencies, Indigenous Peoples, and environmental groups);
- Wildlife collisions with Project infrastructure or activities (e.g., turbines, vehicle collisions, transmission lines);
- Conservation of natural vegetation communities to minimize habitat fragmentation and edge effects (e.g., reclamation of temporary impacts to natural habitats);
- Reduction of noise and/or vibration by utilizing the newest technology in turbine design and operational controls to minimize disturbance;
- Minimizing the effects of blasting on the natural environment;

- Housing issues in the Placentia area to ensure that the Project does not exacerbate the local shortages in affordable housing;
- Ensuring local hiring and training to maximize opportunities for residents; and
- Implementing safety and regulatory compliance procedures to avoid accidents during all phases of the Project.

Argentia Renewables is committed to an iterative process of avoidance and minimization of impacts to sensitive resources (i.e., VCs). Where there is uncertainty around the efficacy of a mitigation measure to ensure there is no material impact to a VC, this may include adaptive management throughout the life of the applicable Project phase, such as additional monitoring of appropriate KIs and the success of mitigations. In this way, Argentia Renewables can assess the ongoing effects of the Project on the sensitive resources in the environment and with respect to residents of the area. Additional mitigations will be developed over the course of Project development, construction, and operations based on further stakeholder input and as additional Project design specifications are advanced.

Appendix W provides a comprehensive summary listing of mitigation measures proposed throughout the life of the Project. The listing includes references to the successful application of mitigations in other jurisdictions and/or projects. Additionally, to characterize the level of effectiveness associated with each mitigation measure, ranking has been employed as:

1. Regulatory requirement/standard condition; proven effectiveness.
2. Industry standard practice; generally effective.
3. Innovative, customized to Project; effectiveness not proven.

For all rank three mitigation measures, an associated monitoring program will be initiated to provide feedback and, as appropriate, allow for adaptive management. Identification of roles and responsibilities for implementing specific mitigations will be included in each of the management plans developed for the Project, found in Appendices E, and M to T.

4.6 Plans and Environmental Management

Environmental management is necessary to reduce or avoid negative environmental effects, track environmental performance, and advance long-term environmental sustainability. Effective environmental management requires a shared commitment to the principles of sustainable development, pollution prevention, environmental protection and enhancement, and due diligence. Argentia Renewables is accountable for sound environmental stewardship through continuous measurement that demonstrates performance improvement.

The Argentia Renewables operational policies and procedures, including those related to the environment, seek to avoid or reduce negative environmental effects, track environmental performance, demonstrate compliance with applicable environmental laws and regulations, document Project adherence to environmental commitments, promote sustainable practices, and set out requirements for environmental incident reporting for employees. Argentia Renewables provides Project employees with education and training on environmental policies, procedures, and practices to enable them to work with respect for the environment and their community.

In addition to compliance with applicable environmental legislation, regulations and policies, Argentia Renewables applies industry best practices for sound environmental stewardship at individual and corporate levels.

Environmental performance is measured by comparing environmental management achievements against environmental policy and, more specifically, the associated environmental management objectives and targets.

4.6.1 Environmental Policy

Argentia Renewables is committed to reducing its negative effect on the environment, and to incorporating sustainability into its core business operations. This is achieved by employing commercially reasonable measures throughout its operations. It is the policy of Argentia Renewables to conduct its operations in a manner that is environmentally responsible and befitting of a good corporate neighbor and citizen.

To further this policy, Argentia Renewables will:

- Operate its facilities in compliance with all applicable environmental laws and regulations, in a way that is protective of the health and safety of its employees and the surrounding communities and environment.
- Strive to improve environmental quality, by minimizing waste and emissions, reducing, reusing and recycling, purchasing environmentally preferable products, reducing the use of natural resources and promoting pollution prevention efforts throughout the company.
- Review its facilities and programs on a regular basis and establish goals for continuous improvement in the environmental arena.
- Encourage the integration of environmental considerations into business planning and decisions, including design, procurement, production and facilities management.

- Promote a workplace in which all employees are properly trained to comply with applicable environmental laws, regulations, and procedures, to meet environmental program goals and to take personal responsibility for protecting the environment.

4.6.2 Environmental Management Framework

Argentia Renewables has established an Environmental Management Framework (EMF) to guide the implementation of its Environmental Management Policy. Argentia Renewables has relied on the internationally recognized standard ISO 14001 in developing its EMF. This EMF is intended to achieve the following benefits through its implementation:

- Avoided or reduced negative environmental effects;
- Pro-active rather than re-active environmental and community management planning and control;
- Facilitation of continuous improvement;
- Improved operational structure and efficiency with regard to environment management;
- Foster good relations with the community and stakeholders;
- Achieve a level of environmental performance that goes beyond compliance with applicable laws;
- Affective management of environmental risks; and
- Efficient use of resources.

The EMF and associated management plans are Life of Project endeavours. They apply from the onset of the Construction Phase, throughout the Operations and Maintenance phase, and eventually during the Decommissioning and Rehabilitation phase of the Project. The key elements of the framework are illustrated in Figure 4.6.2-1.

Figure 4.6.2-1 Continuous Improvement Process of the Environmental Management Framework.

The Argentia Renewables approach follows the sequence of “Policy – Planning – Implementation and Operation – Checking and Corrective Actions – Management Review Process” that must be in place to ensure that the Project is executed in an environmentally and socially acceptable manner, consistent with a continuous improvement cycle and employing adaptive management principles. This approach follows the Plan-Do-Check-Act (PDCA) model, which is an iterative, four-stage approach for achieving continual improvement. It involves identifying objectives and targets, systematically testing possible solutions, assessing the results, and implementing the ones that are shown to work.

4.6.2.1 Roles and Responsibilities

The Chief Executive Officer of Argentia Renewables is responsible for obtaining an annual written statement of assurance regarding the degree of implementation and effectiveness of the Health, Safety, and Environment (HSE) Management System.

The Operations Manager is responsible for the HSE performance, the implementation of the HSE Management System, the maintenance of the HSE Management System, and for providing an annual statement of assurance to the Chief Executive Officer.

The HSE Officer will have prime responsibility for health, safety, and environmental duties including: provision of advice to management in meeting their HSE Management System responsibilities; development and implementation of a program for awareness; training and competency validation for staff; and Plan maintenance and performance documentation.

Employees will comply with all HSE rules and regulations, and promptly report any Health, Safety, and Environmental incidents. Employees will follow all Operational Controls. Argentia Renewables will implement and maintain the HSE Management System by providing the necessary human, material, and financial resources.

4.6.2.2 Planning

Planning encompasses a series of actions leading to development of management plans for selected environmental aspects. As part of the preparatory work associated with the Project, Argentia Renewables will conduct a Hazard Identification exercise for its planned operational activities. As reflected in the Project Registration, the company has identified the suite of legal and other regulatory requirements associated with the proposed undertaking. For each environmental aspect, manageable objectives and targets are being developed to measure progress and success in implementation of specific management plans.

By initiating HSE practices early in the Project life cycle, Argentia Renewables has been able to avoid many potentially adverse effects through the “designed-in mitigation” approach. Measures identified through this approach include:

- Appropriate water quality standards and treatment methods;
- Allowance for climate changes such as marine water levels in aspects of siting the Green Fuels Facility;
- Using state-of-the-art equipment with well maintained exhaust emission controls to reduce GHG emissions during the relatively brief Construction Phase period;
- Development and application of a Diversity Plan for personnel hiring, training, and promotion; and
- Implementing energy efficiency measures into building construction.

4.6.2.3 Management Plans

Argentia Renewables is continuing to develop and refine a suite of Management Plans to address identified environmental issues and concerns. Each plan follows a similar format to ensure completeness and consistency. Table 4.6.2-1 provides a listing of Argentia Renewables’ standard components with a description of the required contents for each section. Individual plans may vary depending on the selected topic, but also to address external requirements (e.g., regulatory permit conditions, industry standards).

Table 4.6.2-1 Argentia Renewables Management Plan Format.

#	Title	Description
1	Cover Page - Document Identification	a. Document title b. Corporate identification (owner of the document) c. Project phase, activity d. Affected facility/location e. Effective date
2	Document Control	a. Approval page- name, title signature of persons responsible for I. Document development II. Document approval III. Document implementation b. Documentation record of updates and amendments c. Document Distribution list
3	Table of Contents	Provide listing of sections of the plan. Paginate by section (1-1, 2-1 etc.) to facilitate updates.
4	Introduction	a. Describe the rationale for generating the document. b. Identify relevant environmental aspects and anticipated interactions. c. Identify how the document is to be communicated to users, and results reported to relevant stakeholders.
5	Legal	a. Identification of applicable legislation and regulations, as well as permits and approvals. b. Identify reporting and compliance conditions associated with permits and approvals.
6	Scope	Describe the scope for the plan, including: a. The subject matter addressed by the document. b. Relationship to other plans. c. Potential overlap/redundancy and how this is addressed/resolved. d. The relationship of the plan to employees, contractors, and other entities.
7	Objectives	a. Describe the planned outcome of the plan, including long term Goals, as well as interim Objectives and achievable Targets. b. Performance targets will comply (and where possible exceed) regulatory limits.
8	Roles and Responsibilities	Identify personnel responsibilities and reporting relationships for: a. Monitoring; b. Measuring; c. Observing; d. Acting (incident response); e. Reporting; f. Evaluating; and g. Approval.
9	Monitoring and Reporting	Identify: a. The parameters to be measured; b. The methods and procedures to employ; c. The means of documentation; d. The frequency of measurement; e. The contents of reports; f. Regulatory requirements for measurement and reporting; and g. Plan review procedures and participation.

#	Title	Description
10	Training	a. Identify required training by task and role. b. Identify orientation requirements for Project employees, site visitors, material, and service contractors. c. Describe method for records maintenance of training and qualification (append relevant records).
11	Emergency Contacts and Procedures	a. Provide contact information for internal (Argentia Renewables) reporting, as well as incident reporting (e.g., HSE emergencies). b. Include reporting forms to utilize in addressing emergencies.
12	Auditing	Identify audit procedures and provisions to facilitate task completion by internal audit team.
13	Plan Review and Updating	Describe procedures for participating in plan review, and for submitting suggestions for changes, improvements, and updating.
14	Appendices	As required to supplement plan documentation. All appendices need to be referenced in the main document.

Table 4.6.2-2 provides a summary of the required plans as laid out in the Environmental Assessment Guidance for Registration of Onshore Wind Energy Generation and Green Hydrogen Production Projects (EAR-GWH), and as required by various government agencies. The plans that will be required to be developed by Argentia Renewables are shown as **bold** in Column two. Each of the **bolded** documents has been prepared to at least a full draft stage, subject to internal and/or external/regulatory review. These plans, and others to be developed, as and when a need is identified, will be implemented in all Project phases including Construction, Operation and Maintenance, Decommissioning and Rehabilitation, and ultimate closure.

Table 4.6.2-2 Summary of Plans Required for Argentia Renewables Project.

#	Plan Title	Components	Notes
1	Business Plan / Development Plan	a. Market analysis b. Products c. Marketing and sales strategy d. Management and Organization e. Financial Projections	Provides a detailed description of target market, competition, financial projections, and the strategies that will be used to achieve success. Long-term strategic goals and objectives for the Project will be set.
2	Project Execution Plan	a. Project Overview b. Scope and Objectives c. Project Organization d. Schedule e. Budget and Cost Control f. Quality Management g. Risk Management h. Health, Safety, and Environment (HSE) i. Procurement and Contracts j. Stakeholder Management k. Change Control l. Resource Control m. Closeout and Handover	Outlines the specific strategies, activities, and procedures to be followed during the execution phase of the Project. Essential for ensuring the Project is completed on time, within budget, and to the specified quality standards. Can be issued separately for each phase of the Project.

#	Plan Title	Components	Notes
3	Environmental Protection Plan	a. Document Control b. Purpose c. Corporate Environmental Policy d. Regulatory Requirements e. Scope and Objectives f. Project Overview g. Roles and Responsibilities h. General Environmental Protection Procedures i. Resource Specific Protection Procedures j. Area Specific Protection Procedures k. Mitigation Measures l. Monitoring and Reporting m. Contingency Planning n. Training	Can be issued separately for each phase of the Project. Drafted annotated table of contents appears in Project Registration Section 9.
4	Emergency Response/Contingency Plan	a. Inspections b. Preparedness c. Facilities, supplies, and equipment d. Fire/explosion e. Spills f. Medical emergencies g. Recovery h. Site clean-up and restoration operations i. Post Emergency Reporting	Developed to provide an organizational and procedural framework for the management of emergency incidents that personnel may encounter in the daily activities associated with the Project worksite. Provides further protection of personnel and property, as well as that of the surrounding environment.
5	Waste Management Plan	a. Organics b. Bulk material c. Hazardous materials	Describes all liquid and solid waste expected to be generated during Project activities for all components of the Project. Provides methods to reduce, reuse, recycle, recover, and/or manage residual waste through disposal. Can be issued separately for each phase of the Project.
6	Hazardous Materials Response and Training Plan	a. Objective b. Overview c. Responsibilities d. Training Requirements e. Emergency Response Equipment and Vehicles f. Review and Auditing Procedures	Outlines the requirements for hazardous material training and performance within the Argentia Renewables Site. Prescribes mandatory practices that assure adequate training and qualification of personnel whose job duties impact and influence hazardous material response. The program includes initial, and refresher training and qualification.
7	Transportation Impact Study and Traffic Management Plan	a. Scope and Objectives b. Roles and Responsibilities c. Road Infrastructure d. Traffic Analysis e. Transport Methods	This plan focuses on the road networks for the Project, comprising the wind turbine access roads and traffic movement through Argentia and the Port of Argentia.

#	Plan Title	Components	Notes
		f. Traffic Management Plan g. Monitoring and Reporting h. Training i. Emergency Contacts and Reporting j. Review and Auditing Procedures	Describes the utilization of existing infrastructure for transporting oversized Project materials and equipment during the Argentia Wind Facility construction, and the analysis of traffic volume along preliminary transportation routes. Delineates control measures for Project-related traffic and provides a description of transporter vehicles for oversized and overweight Project components.
8	Public Participation Plan	a. Engagement Strategies b. Engagement and Communications Tools c. Community and Stakeholder Feedback / Response Protocol d. Indigenous Engagement	Describes how the public would meaningfully participate in the planning of all phases of the Project and how they would continue to be consulted throughout the life of the Project, including in the monitoring of environmental effects.
9	Workforce and Employment Plan	a. Workforce Forecast b. Recruitment Strategy c. Employment Equity d. Benefits Agreement e. Tracking and Reporting	Outlines the positions required, timelines for employment, and a reporting schedule of the workforce and employment statistics throughout all phases of the Project.
10	Environmental effects follow up and monitoring programs (EEMPs)	a. Species at Risk Impact Monitoring and Mitigation Plan b. Post Construction Monitoring Plan	Mitigation, monitoring, and adaptive management frameworks for the SAR and species of concern, as it relates to the Project. Aims to meet the requirements for the issuance of a Section 19 permit under the NL ESA.

4.6.2.4 Plan Implementation

Implementation of each plan will include training and orientation for assigned tasks and responsibilities. Briefings will be arranged to familiarize all staff with the Argentia Renewables HSE Management System, and workshops used to familiarize staff with monitoring and documentation requirements.

Continuous Improvement follows the Plan-Do-Check-Act (PDCA) model, which is an iterative, four-stage approach for achieving continual improvement. The Check phase involves an evaluation of performance to confirm the effectiveness of management plans. This is achieved through a process of measuring performance against the environmental objectives and targets set within each plan. In all cases performance targets are made with awareness of regulated standards. Where possible, internal performance standards are set well within regulatory requirements. In that manner, corrective action can be taken in advance of any compliance failure.

Where there is an incident or performance failure (e.g., material spill), a review will be conducted to identify lessons learned and opportunities for improvement. This review will form the basis of implementing corrective action to reduce the likelihood of future system failures.

4.6.2.5 Management Reviews and Assurance

It is important that senior management regularly review the HSE Management System as well as individual plans to determine their continued suitability, adequacy, and effectiveness. Argentia Renewables will conduct internal audits to determine the degree of success in implementation of its HSE Management System, and to verify the level of performance within individual management plans. At least once a year, Argentia Renewables will conduct a formal review to assess corporate environmental, health and safety performance and to reconfirm their commitment to the Sustainable Development Policy.