21.0 Indigenous Fisheries

21.1 Scope of Assessment

Section 2 of the provincial Environment Impact Statement (EIS) Guidelines identified the requirement for the inclusion and consideration of Indigenous knowledge in the EIS and an assessment of effects on existing and potential commercial, recreational, and Indigenous fisheries and aquaculture operations. Section 4.3.4 of the EIS Guidelines required the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4) to include Indigenous traditional land and resource use (TLRU) as a component for assessment for each of the sites proposed for wind energy generation.

In the context of this assessment, Indigenous fisheries includes a consideration of potential effects on Indigenous commercial and food, social, ceremonial (FSC) fisheries that may occur within freshwater and marine environments within or near the Project Area and Local Assessment Area (LAA).

The Indigenous Fisheries VEC is linked to and informed by the conclusions of the effects assessments for the following VECs:

- Freshwater Fish and Fish Habitat (Chapter 10) – given the link with Indigenous fishing activities.
- Marine Environment and Use (Chapter 11) – given the importance to both marine life and the economic, social, and cultural activities and practices of Indigenous peoples.

21.1.1 Regulatory and Policy Setting

As described in Chapter 1 (Introduction), the Project is subject to the Province of Newfoundland and Labrador's *Environmental Protection Act* (NL EPA) and associated *Environmental Assessment Regulations*. The provincial Minister of NL Department of Environment and Climate Change (NLDECC) required that an EIS be developed in support of the Project; final EIS Guidelines were issued for the Project on December 13, 2022.

The assessment of Indigenous fisheries was completed to meet the requirements outlined in the EIS Guidelines that require inclusion of information related to Indigenous knowledge, Indigenous fisheries, and other TLRU in the Project Area.

As described in Chapter 10 (Freshwater Fish and Fish Habitat) and Chapter 11 (Marine Environment and Use), in addition to the NL EPA, the Project is subject to other federal and provincial legislation, policies and guidance. A description of the primary regulatory requirements and policies that influence the scope of the assessment on freshwater fish and fish habitat is provided in Section 10.1.1 of Chapter 10 (Freshwater Fish and Fish Habitat). A description of the primary regulatory requirements and policies that influence the scope of the assessment on the marine environment is provided in Section 11.1.1 of Chapter 11 (Marine Environment and Use).

Other pertinent guidance that influenced the EIS process with respect to Indigenous engagement and assessment of effects on Indigenous fisheries include the Government of NL's Aboriginal Consultation Policy on Land and Resource Development Decisions (Government of NL 2013) and Government of NL's Guidance for Registration of Onshore Wind Energy Generation and Green Hydrogen Production Projects (Government of NL 2023).

21.1.2 The Influence of Engagement on the Assessment

As part of engagement with Indigenous groups, WEGH2 has documented Indigenous interests, values, current use, and expressions of support and concerns regarding the Project. An overview of WEGH2's Indigenous engagement activities are outlined in Chapter 4 (Consultation and Engagement). WEGH2's engagement with the Indigenous groups began in March 2022. Indigenous knowledge and TLRU information were collected through meetings and information sharing with the Indigenous groups (Section 21.2.1.1). As stated in Chapter 4 (Consultation and Engagement), WEGH2's Indigenous engagement activities have focused on establishing open, meaningful communication, and information exchange through continued dialogue with Indigenous groups, as applicable.

As described in Chapter 4 (Consultation and Engagement), WEGH2 has engaged with Miawpukek First Nation and Qalipu First Nation and associated Indigenous community bands and organizations.

The Project partners have long-standing relationships with Miawpukek First Nation in marine services and fishing. While engagement related specifically to the Project started with Miawpukek First Nation in March of 2022, including a series of meetings between March and May 2022, it was determined by Miawpukek First Nation that they would prefer to be involved in other planned wind to hydrogen projects that had approached the Nation for direct involvement, most of these being closer to Miawpukek First Nation home in Conne River. While this outcome was agreed in 2022, opportunities for Miawpukek First Nation to participate in the project may develop as the industry matures. As an example, initial discussions between the project and Miawpukek Horizon Maritime Services have started regarding short-seas shipping of green ammonia to realize potential logistics and shipping efficiencies, plus accelerating the inclusion of Miawpukek Indigenous seafarers in the industry. The Project partners value their relationship with Miawpukek First Nation and will continue to be open to further discussions as the Project and the industry, evolve.

On October 3, 2023, WEGH2 entered a Memorandum of Understanding (MOU) with Qalipu First Nation that highlights areas of collaboration for the Project, including training and employment opportunities for Qalipu members, environmental protection, economic development, and various business opportunities. The MOU focuses on community benefits, and how the Project will advance the economy and support communities in the region for years to come.

The MOU also supported the collection of Indigenous knowledge applicable to the Project Area, LAA and Regional Assessment Area (RAA). For example, to gain a better understanding of current use within the Project Area, Qalipu First Nation undertook a study entitled, "The Collection of Current Land Use and Aboriginal Traditional Knowledge" (ATK study) in 2023 (QFN 2023). The ATK study was funded through capacity funding provided by WEGH2. The ATK study identified various hunting, trapping, gathering and other cultural activities and sites within the Project Area and LAA, Qalipu First Nation concerns and perceived benefits of the Project, and potential mitigation and/or enhancement measures for WEGH2's consideration in Project planning (QFN 2023). As this VEC is focused on Indigenous fisheries, applicable information collected through the ATK study regarding Qalipu First Nation fisheries has been integrated into the assessment. Potential mitigation measures identified within the ATK study applicable to Indigenous fisheries are described in Section 21.4.

WEGH2 launched a Land and Resource Use (LRU) survey (Stantec 2023) to engage the public (including Indigenous groups) and solicit feedback about land and resource use activities that occur in and near the Project Area, and to identify public perceptions around the potential risks and/or benefits of the Project. The LRU survey was conducted online, and paper copies were also made available to support participation of residents without computer literacy, and/or limited/no access to the internet and/or access to social media websites. The online LRU survey was open to the public from April 3 to 17, 2023, and from May 17 to 31, 2023 (Stantec 2023) this extension was granted in response to community requests . The paper copies of the survey were made available for pick up from May 3, 2023, to May 25, 2023 at the WEGH2 community office in Stephenville, and were also delivered to multiple locations within the Project Area, including Gillis's Store (Codroy), Mountainside General Store (Doyles), Valley Pharmacy (Doyles), Small Town Grocery (Millville), Atlantic Edge Credit Union (Doyles), Port au Port East Gas Bar (Port au Port East), Port au Port West – Aguathuna – Felix Cove Town Office (Port au Port West – Aguathuna – Felix Cove), Benoit First Nation (DeGrau), Cape St. George Town Office (Cape St. George), Mainland Gas Bar (Mainland), Lourdes Town Office (Lourdes), and Parkview Variety Store (Piccadilly). Towns were also encouraged to share information about the survey on their Facebook pages. Participants had the option of dropping off their completed surveys at the community office or mailing them into the office. Surveys were also picked up from the community distribution locations by WEGH2 team members.

21.1.3 Boundaries

21.1.3.1 Spatial Boundaries

The following spatial boundaries were used to assess Project effects, including residual environmental effect on Indigenous fisheries (Figure 21.1 and Figure 21.2):

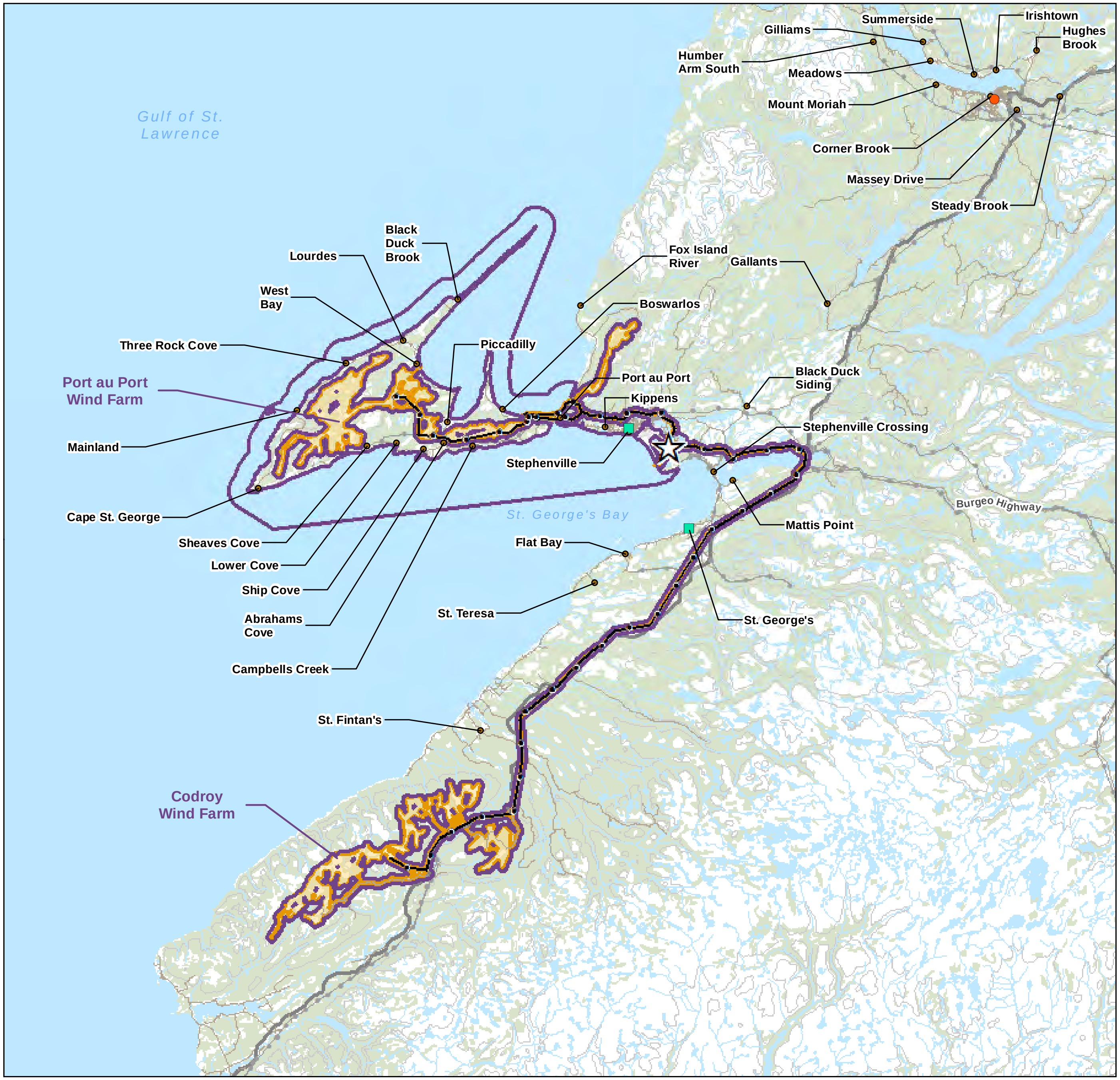
- Project Area: The Project Area encompasses the immediate area in which Project activities and components occur and is comprised of the following distinct Project components: the Port au Port wind farm, the Codroy wind farm, the Hydrogen/Ammonia Production and Storage Facility (hydrogen / ammonia plant), Port Facilities, and the 230 kV transmission lines, as well as associated infrastructure, including roads, substations, industrial water supply and infrastructure. The Project Area is the anticipated area of direct physical disturbance associated with the construction, operation and decommissioning, rehabilitation, and closure of the Project. In addition to encompassing the immediate area in which Project components and activities will occur, the Project Area also includes a buffer of up to 300 m for access roads and turbines and a 350 m corridor to accommodate the 70 to 75 m wide RoW for the transmission line. These buffers allow flexibility for the micro-siting of Project components during detailed design, based on technical considerations as well as the avoidance of environmentally sensitive areas, where practicable

- Local Assessment Area: includes the geographic extent over which direct residual effects on Indigenous fisheries may reasonably be expected to occur. The LAA therefore includes the combined maximum extent of the LAAs established for related VECs assessed in the EIS, (i.e., Chapter 10 Freshwater Fish and Fish Habitat; Chapter 11 Marine Environment and Use) (Figure 21.1).
- Regional Assessment Area: encompasses the maximum extent of the RAAs of the various VECs (as above) to capture relevant potential cumulative effects on Indigenous fisheries (Figure 21.2).

21.1.3.2 Temporal Boundaries

The temporal boundaries for the assessment of potential effects on Indigenous fisheries include:

- Construction: Overall, the construction phase of the Project will be from Q4 2023 through Q2 2027, pending EIS approval and receipt of other required permits and approvals. Early civil works are planned to start Q4 2023 through Q3 2024. Construction of the Port au Port wind farm and associated infrastructure is expected to start in Q3 2024 with completion of the construction in Q1 2026. Construction of the Codroy wind farm and associated infrastructure is expected to start early civil works in Q4 2025 with completion in Q1 2027. The hydrogen and ammonia plant will be constructed in phases from Q2 2024 to Q1 2026. Grid power sources are planned for hydrogen production from 2025 until March 2026, when the electrolyzer is commissioned.
- Operation and maintenance: Wind farm commissioning is anticipated to start Q1 2026 at the Port au Port wind farm and Q2 2027 at the Codroy wind farm. The 600 MW electrolyzer is expected to be commissioned in Q1 2026. The operational life of the Project is 30 years at each site.
- Decommissioning and rehabilitation: After a 30-year operational life, the decommissioning phase is anticipated to occur during 2057 and 2058. Decommissioning is anticipated to begin Q1 2057 at the Port au Port wind farm, with completion in Q3 2058 at the Codroy wind farm.



Stantec

Communities where Qalipu Membership Resides
Qalipu Main Office
Qalipu Administrative Office

Proposed Project Features

Hydrogen / Ammonia Plant Location
Transmission Line 230 kV
Project Area
Local Assessment Area

Other Features

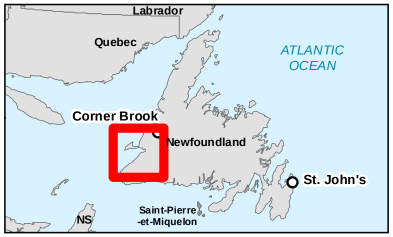
Transmission Line, Existing
Trans-Canada Highway
Road
Contour (100 m)
Watercourse
Waterbody
Forested Area

N

0 10 Kilometres
(At original document size of 8.5x11)
1:800,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: Qalipu First Nation; World Energy GH2, NRCan CanVec, OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

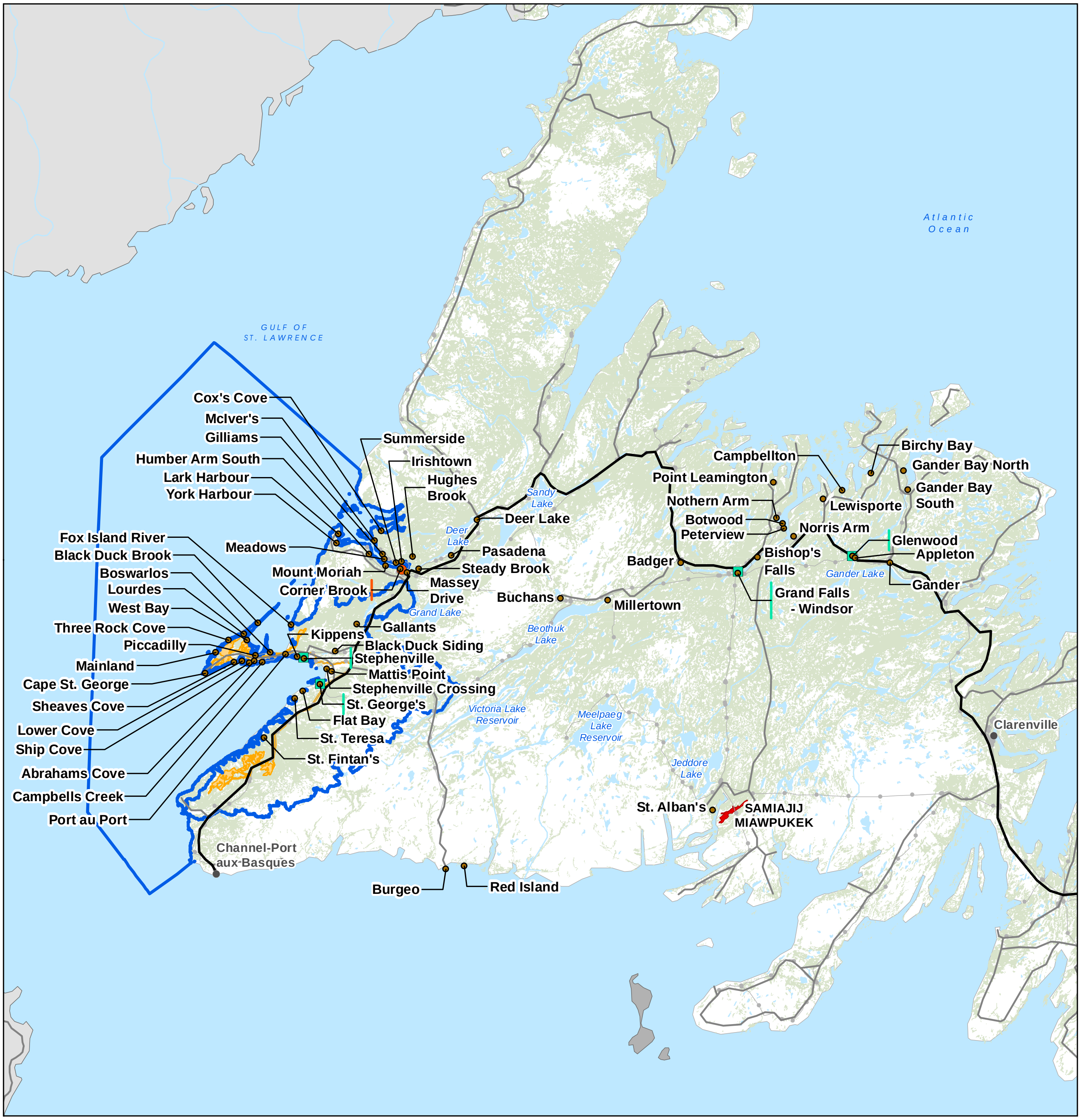
Prepared by NW on 2023-06-29
QR by AW on 2023-06-06

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_027f

Figure No.
21.1

Local Assessment Area



Communities where Qalipu Membership Resides

Qalipu Main Office

Qalipu Administrative Office

Miawpukek Federal Reserve Land

Other Features

Trans-Canada Highway

Secondary Road

Transmission Line

Project

Regional Assessment Area

0 30 60 Kilometres

(At original document size of 8.5x11)
1:3,000,000

N

Stantec

Notes
1. Coordinate System: NAD 1983 UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec

Project Location
Stephenville
NL

Prepared by NW on 2023-06-29
REvised by MB on 2023-07-27
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_27e REVF

Figure No.
21.2

Title
Regional Assessment Area

\\ca0151-PPFSS01\work_group\1214\active\121417233\03_data\gis_cad\gis_data\mapping\mxd\general\Traditional Land and Resource Use\121417233_027e_Fig21.2_TLRU_RAA_Aboriginal_Communities_REVF.mxd Revised: 2023-08-07 By: NiWhite

21.2 Existing Conditions for Indigenous Groups

A characterization of the existing conditions and current use for Indigenous fisheries within the spatial boundaries defined in Section 21.1.3 is provided in the following sections. This includes a discussion of the influences of past and present physical activities on Indigenous fisheries, leading to the present time. An understanding of the existing conditions for Indigenous fisheries within the spatial area being assessed is a key requirement in the prediction of potential Project effects provided in Section 21.5.

21.2.1 Methods

This section describes the use of Indigenous knowledge and information sources, including the LRU survey, the ATK study prepared by Qalipu First Nation, and the broader literature review conducted for the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4).

21.2.1.1 Indigenous Knowledge and Information Sources

Information on existing conditions for the Indigenous groups was obtained through primary and secondary research. As described in Chapter 4 (Consultation and Engagement; Section 4.2.5), primary data was collected through WEGH2's Indigenous engagement activities undertaken for the Project, including open houses, community meetings, the LRU survey (Stantec 2023; described below), and the ATK study (QFN 2023). Secondary research included a desktop (literature) review of publicly available information, such as previous studies, other environmental assessments, and a review of existing Indigenous knowledge sources, where available.

The literature review focused on Indigenous fisheries, as well as information related to the availability of harvested freshwater and marine resources, access to freshwater and marine resources and use areas, and locations of cultural importance that support Indigenous fisheries. Information was drawn from sources relevant to the locations of the Project assessment areas and to the Indigenous groups. The literature review considered information from the following sources:

- Publicly available information collected for studies previously completed by the Indigenous groups for other development projects in the region
- Regulatory filings for proximate projects
- Government reports and databases
- Historical and ethnographic literature
- Peer-reviewed scientific publications
- Relevant internet sources (e.g., Nation web sites)

The literature review and the Nation-specific results of the LRU survey (Stantec 2023) informed the description of the existing conditions for Indigenous groups within the TLRU section of the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4), which included a discussion of Indigenous fisheries. For a more in-depth description of the existing conditions for the Indigenous groups, please refer to the TLRU section of the Socio-economic Environment and Land and

Resource Use Baseline Study (BSA-4). As this VEC is focused on Indigenous fisheries, information collected through the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4) regarding Indigenous fisheries has been integrated into the assessment.

As described in Section 21.1.2, WEGH2 signed an MOU with Qalipu First Nation and coordinated a capacity funding agreement to support the collection of primary data for the Project. Qalipu First Nation prepared a Project-specific ATK study for consideration in the EIS and future Project planning. The ATK study explores the knowledge and understanding of 65 members of the Qalipu First Nation regarding hunting and gathering, as well as culturally significant areas (QFN 2023). The ATK Study Area encompasses the proposed Project Area on the Port au Port Peninsula and the Codroy area (i.e., Anguille Mountains, Codroy Valley, and Bay St. George South regions), which overlaps with the Project Area and LAA for this VEC (QFN 2023).

As described in Section 21.1.2, WEGH2 also launched an LRU survey to engage the Indigenous groups and solicit feedback, identify land and resource use activities that occur in the Project Area, and to identify perceptions around the potential risks and/or benefits of the Project. The LRU survey was completed by 515 participants, including 184 self-identified members of Qalipu First Nation (Stantec 2023).

Data Limitations

Publicly available information regarding Indigenous fisheries within the Project Area, LAA, and RAA is limited.

Sixty-five members of Qalipu First Nation participated in the ATK study, representing approximately 0.2% of the total registered population of Qalipu First Nation members across the country (n=24,979) (CIRNAC 2021; QFN 2023). Members who completed the survey live within the RAA. Qalipu First Nation stated that the data collected through the ATK study "should no way [be considered] a comprehensive representation of how [Qalipu] membership uses the land and the resources it has to offer. Because no digital pins were placed in each area does not imply that the area is not being used as hunting or gathering grounds" (QFN 2023:15).

21.2.2 Qalipu First Nation

Qalipu First Nation was registered as a First Nation and a band as defined in section 2(1) of the *Indian Act* in 2011; it is considered a "landless band" with no designated Indigenous reserve lands under the *Indian Act* (QFN 2016; QFN 2023; Robinson 2014).

Qalipu First Nation is one of the largest Indigenous groups in Canada with a registered population of 24,979 members as of December 2022 (CIRNAC 2021; QFN 2016). Its members are spread across 67 traditional Newfoundland Mi'kmaq communities and nine electoral wards (QFN 2023). Most of the self-identified Qalipu First Nation members who participated in the LRU survey reside within the LAA, including Mainland, Cape St. George, Stephenville (9.8%), Port au Port West – Aguathuna – Felix Cove, Kippens, Lourdes, and Port au Port East (Stantec 2023).

Most of the Qalipu First Nation members who participated in the ATK study reside in Corner Brook / Bay of Islands and Stephenville (QFN 2023). Other Qalipu members who participated in the ATK study reside in Stephenville Crossing, Central Newfoundland, Burgeo, Port au Port, the Northern Peninsula, the Avalon Peninsula, St. George's Bay, Flat Bay, and the Codroy Valley (QFN 2023).

Qalipu First Nation is governed by an elected Chief, two Vice-Chiefs and a Council; each of the nine electoral wards has an elected Ward Councilor (QFN 2016). The elected Chief is the official spokesperson and leader of Qalipu First Nation, and the two Vice-Chiefs represent the western and central Newfoundland communities (QFN 2016). Qalipu First Nation communities are also represented by their central administrative office in Corner Brook, as well as four satellite offices in Glenwood, Grand Falls-Windsor, St. George's, and Stephenville (QFN 2016).

The following section describes Indigenous fisheries known to occur within the Project Area and the LAA. Additional information about Qalipu First Nation is provided in the TLRU section of the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4).

Fishing

Qalipu members harvest freshwater and marine fish as well as other freshwater and marine aquatic species, within the Project Area, LAA, and RAA (FNI 2002; Stantec 2023; QFN 2023; BSA-4). While most activities in the areas relating to marine and freshwater fish and/or aquatic species involve fishing for recreational/food purposes or FSC purposes (Stantec 2023), Indigenous commercial fishing for American eel exists in estuarine and inland waters near the Project (Chapter 10 Freshwater Fish and Fish Habitat). Indigenous commercial smelt fisheries also have the potential to occur although there has been no activity in more than a decade (Chapter 10 Freshwater Fish and Fish Habitat). Qalipu First Nation also has access to salmon for FSC purposes through the recreational fishery (DFO 2020). Fisheries and Oceans Canada (DFO) manage the Atlantic salmon fisheries on the Island of Newfoundland and the management of FSC fisheries is negotiated with Indigenous groups (DFO 2020).

Qalipu members who participated in the ATK study identified three trout harvesting locations and five "unidentified" fish harvesting locations on and around the Port au Port Peninsula. The ATK study participants also identified two eel harvesting sites, one medicinal fish harvesting site, and three trout harvesting sites within Codroy / Bay St. George South (QFN 2023). These sites are located within the LAA and/or within or near the Project Area.

Most of the ATK study participants (n=38) indicated that they never consume trout harvested within the ATK Study Area (Project area/LAA) (QFN 2023). One ATK study participant reported consuming trout a couple times a week, three ATK study participants reported consuming trout about one a month, one ATK study participant reported consuming trout several times a month, and 22 ATK study participants reported occasionally consuming trout (QFN 2023).

Most of the ATK study participants (n=46) indicated that they never consume salmon harvested within the ATK Study Area (Project area/LAA) (QFN 2023). One ATK study participant reported consuming salmon once a week, and 18 ATK study participants reported occasionally consuming salmon harvested in this area (QFN 2023).

Most of the ATK study participants (n=61) indicated that they never consume eel harvested within the ATK Study Area (Project area/LAA) (QFN 2023). One ATK study participant reported consuming eel several times a month, and three ATK study participants reported occasionally consuming eel harvested in this area (QFN 2023).

Most of the self-identified Qalipu members that participated in the LRU survey reported that they, or a member of their family, catch freshwater fish and/or aquatic species in or around Port au Port when the fisheries are open (Stantec 2023). Fewer Qalipu participants reported catching these species within or near Codroy and Stephenville (Stantec 2023). Recreation and/or food was identified by Qalipu participants as the primary purposes for catching freshwater fish and/or aquatic species in the Project Area, and FSC purposes was identified as the second-most common purpose (Stantec 2023). A few Qalipu members reported harvesting these species within or near the Project Area for commercial purposes (Stantec 2023).

Brook trout was the most frequently identified freshwater and/or aquatic species caught in and around the Project Area by the self-identified Qalipu members that participated in the LRU survey (Stantec 2023). In addition to brook trout, Atlantic salmon, rainbow smelt, American eel, and arctic char are caught within or near Port au Port and Codroy areas, and Atlantic salmon and American eel are caught within or near Stephenville (Stantec 2023). Most of the Qalipu participants reported fishing once or twice a week in the Project Area when the fisheries are open, indicating that harvesting freshwater fish and/or aquatic species is an important cultural activity that is frequently undertaken in and around Port au Port, Codroy / Bay St. George South and Stephenville (Stantec 2023). Most of the self-identified Qalipu members that participated in the LRU survey reported consuming freshwater fish and/or aquatic species harvested within the Project Area once or twice a week, indicating that freshwater fish and/or aquatic species are an important dietary staple for some community members (Stantec 2023).

Catching marine fish and/or aquatic species within Port au Port Bay when the fisheries are open was reported by approximately half of the Qalipu participants (Stantec 2023). Fewer Qalipu participants reported catching these species during the open season in Bay St. George and the Port of Stephenville (Stantec 2023). Recreation and/or food was identified by Qalipu participants as the primary purposes for catching freshwater fish and/or aquatic species in the Project Area, and FSC purposes was identified as the second most common purpose (Stantec 2023). Some of the Qalipu participants reported catching marine fish and/or aquatic species in Port au Port Bay for commercial purposes, indicating that these fisheries and this fishing location are an important part of these community members' livelihoods (Stantec 2023). Fewer Qalipu participants reported harvesting these species within or near Bay St. George and the Port of Stephenville for commercial purposes (Stantec 2023).

Atlantic cod, capelin, mackerel, and lobster are the most frequently identified marine fish and/or aquatic species caught in and around the Project Area by Qalipu participants (Stantec 2023). Other marine species caught in and around the Project Area by Qalipu participants include herring, snow crab, scallop, mussels, turbot, flounder, haddock, seal, lumpfish, redfish, pollock, hagfish, hake, and skate (Stantec 2023). Most of the Qalipu participants reported fishing daily in Port au Port Bay and Bay St. George, and once or twice a week in the Port of Stephenville when the fisheries are open, indicating that harvesting marine fish and/or aquatic species is an important cultural activity that is frequently undertaken in and around the Project Area (Stantec 2023). Most of the Qalipu participants reported consuming marine fish and/or aquatic species harvested within the Project Area once or twice a week, indicating that marine fish and/or aquatic species are an important dietary staple for some community members (Stantec 2023).

21.3 Assessment Criteria and Methods

This section describes the criteria and methods used to assess environmental effects on Indigenous fisheries. Residual environmental effects (Section 21.5) are assessed and characterized using criteria defined in Section 21.3.1, including direction, magnitude, geographic extent, timing, duration, frequency, reversibility, and ecological or socio-economic context. The assessment also evaluates the significance of residual effects using threshold criteria or standards beyond which a residual environmental effect is considered significant. The definition of a significant effect on Indigenous fisheries is provided in Section 21.3.2. This is followed by the identification of potential Project interactions with this VEC (Section 21.3.4). Analytical assessment techniques employed for the assessment of potential Project-related environmental effects on Indigenous fisheries are provided in Section 21.3.5. The assumptions that were made to support a conservative approach to the assessment of residual effects on Indigenous fisheries are described in Section 21.3.5.1.

21.3.1 Residual Effects Characterization

Table 21.1 presents definitions for the characterization of residual effects on Indigenous fisheries. The criteria are used to describe the potential residual effects that remain after mitigation measures have been implemented. Quantitative measures have been developed, where possible, to characterize residual effects. Qualitative considerations are used where quantitative measurement is not possible.

Table 21.1 Characterization of Predicted Potential Effects of the Undertaking on Indigenous Fisheries

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Nature	The long-term trend of the residual effect	• **Neutral –** No net change in the measurable parameter(s) to Indigenous fisheries relative to baseline • **Positive –** A residual effect that moves the measurable parameter(s) in a direction beneficial to Indigenous fisheries relative to baseline • **Adverse –** A residual effect that moves the measurable parameter(s) in a direction detrimental to Indigenous fisheries relative to baseline

Table 21.1 Characterization of Predicted Potential Effects of the Undertaking on Indigenous Fisheries

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameter(s) of the VEC relative to existing conditions	• **Negligible** – No measurable change in the effect can be noted • **Low** – A small but measurable change detectable from existing conditions that is within historical norms and/or within the Indigenous fisheries capacity to adapt • **Moderate** – A measurable change from existing conditions that is within historical norms and/or within the Indigenous fisheries capacity to adapt • **High** – A measurable change from existing conditions that is beyond historical norms and/or beyond the Indigenous fisheries capacity to adapt
Geographic Extent	The geographic area in which a residual effect of a defined magnitude occurs	• **Project Area –** Residual effect is restricted to the Project Area • **LAA –** Residual effect extends into the LAA • **RAA –** Residual effect extends into the RAA
Timing	Considers when the residual environmental effect is expected to occur, where applicable or relevant to the VEC.	• **Not Applicable –** Seasonal aspects are unlikely to affect the Indigenous fisheries • **Applicable –** Seasonal aspects may affect the Indigenous fisheries
Duration	The period of time required until the measurable parameter(s) or the VEC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	• **Short-term –** Residual effect is restricted to no more than the duration of the construction phase (4 years) or decommissioning phase (12 months) • **Medium-term –** Residual effect extends through the operation and maintenance phase of the Project (30 years) • **Long-term –** Residual effect extends beyond the life of the Project (greater than 30 years)
Frequency	Identifies how often the residual effect occurs during the Project, during a specific phase of the Project, or during another specified time period	• **Single event -** Effect occurs once • **Multiple irregular event –** Occurs at no set schedule • **Multiple regular event –** Occurs at regular intervals • **Continuous –** Occurs continuously
Reversibility	Describes whether a measurable parameter(s) of the VEC can return to its existing condition after the Project activity ceases, including through active management techniques	• **Reversible** – The residual effect is likely to be reversed after activity completion and reclamation • **Irreversible** – The residual effect is unlikely to be reversed
Ecological / Socio-economic Context	Existing conditions and trends in the area where the residual effect occurs	• **Undisturbed –** Area is relatively undisturbed or not adversely affected by human activity • **Disturbed –** Area has been substantially previously disturbed by human development or human development is still present

21.3.2 Significance Definition

The lack of laws, policies, management plans or standard industry practice regarding thresholds for the assessment of effects on the factors that may affect Indigenous fisheries makes selecting and applying significance thresholds challenging. The subjective nature of describing and understanding the importance of effects on Indigenous fisheries means that selected thresholds might not evenly apply across Indigenous groups and circumstances. Indigenous groups themselves may have differing views on the meaning of significance that reflect oral history traditions and holistic understandings of natural phenomena as it relates to their Indigenous fisheries. In consideration of criteria established for the characterization of residual effects, the following thresholds have been established to define a significant adverse residual environmental effect on Indigenous fisheries.

For the purposes of this effects assessment, a significant adverse residual effect on Indigenous fisheries is defined as a Project-related environmental effect that results in the long-term loss of culturally and/or commercially important freshwater and / or marine fish and aquatic resources, such that Indigenous commercial and / or FSC fisheries are critically reduced or eliminated from the LAA. This could also include substantial disruption to Indigenous fisheries and practices where freshwater and marine fish and aquatic resources, or physical sites, may be significantly affected in the LAA.

21.3.3 Potential Environmental Effects, Project Pathways, and Measurable Parameters

The selection of effects included in the assessment for Indigenous fisheries was established through review of the concerns and issues identified by the Indigenous groups that relate to their commercial and FSC fisheries, potential Project interactions, the results of the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4), the results of the LRU Survey (Stantec 2023), the results of the ATK study (QFN 2023), and in consideration of the provincial EIS Guidelines. The assessment of Project-related effects on Indigenous fisheries therefore focuses on the following potential effect:

- Change in Indigenous Commercial and FSC Fisheries

This potential effect is the primary potential outcome that may result from the possible interaction of Project components and activities with Indigenous fisheries that occur within the Project Area or the LAA. This potential environmental effect and measurable parameters were selected based on review of recent environmental assessments for large development projects on the Island of Newfoundland, comments provided during engagement, and professional judgment.

Effect pathways and measurable parameters used in the assessment of these effects are described in Table 21.2. Measurable parameters are qualitative or quantitative measurements of potential Project effects and provide means to characterize potential effects on Indigenous fisheries. Measurable parameters used in qualitative analyses are defined in the absence of metrics or standards to support quantitative analyses.

Table 21.2 Potential Effects, Effect Pathways, and Measurable Parameters for Indigenous Fisheries

Potential Effect	Effect Pathway(s)	Measurable Parameter(s) and Units of Measurement
Change in Indigenous commercial and FSC fisheries	• Change in freshwater fish habitat (e.g., change in fish passage and/or water flow or water level) • Change in freshwater fish habitat quality (e.g., erosion and sedimentation) • Change in freshwater fish health and survival (e.g., change in fishing pressure and/or water level) • Change in marine habitat quality (e.g., change in noise, change in sedimentation) • Change in marine habitat quantity (e.g., in-water work) • Change in marine species health and survival (e.g., sedimentation; change in noise) • Change in fishing / aquaculture grounds (e.g., displacement from fishing grounds; change in marine habitat quality/quantity) • Change in access (e.g., increased marine vessel traffic)	• Qualitative consideration of change in access to, and / or displacement from, freshwater or marine harvesting areas or navigable waters used for commercial and/or FSC purposes • Qualitative consideration of change in the quantity, quality, or availability of freshwater and marine species harvested for commercial and/or FSC purposes • Qualitative consideration of change in habitat quality and/or quantity for freshwater and marine fish and aquatic species harvested for commercial and/or FSC purposes

21.3.4 Project Interactions with Indigenous Fisheries

Table 21.3 uses checkmarks to indicate the routine Project activities that could interact with Indigenous fisheries and result in the identified environmental effect(s) to be assessed. The interactions identified in Table 21.3 are informed by the interactions identified for Fish and Fish Habitat (Chapter 10; Table 10.4; change in fish habitat quantity and quality and change in fish health and survival) and those identified for the Marine Environment (Chapter 11; Table 11.4; Change in marine habitat quality and quantity, change in marine species health and survival, change in fishing/aquaculture grounds and productivity, and change to other ocean users). Immediately following Table 21.3, environmental effects pathways are briefly described for potential routine Project-related environmental effects and justification is provided in cases where no Project interaction with the VEC (and therefore no potential environmental effect on the VEC) is predicted.

Table 21.3 Project Interactions with Indigenous Fisheries - Environmental Effect and Environmental Effect Pathway

Project Activities	Environmental Effect to be Assessed: Change in Indigenous Commercial and FSC Fisheries
Construction	
Site Preparation and Civil Works (including turbine foundations, road construction, quarries, clearing, grubbing, blasting, cement production, and watercourse crossings)	✓
Transportation of Resources and Equipment (includes trucking, shipping and barging of materials)	✓
Construction / Installation, Presence, Operation, and Maintenance of Temporary Workforce Accommodations and Associated Infrastructure	✓
Installation and Commissioning of Wind Turbines	-
Installation and Commissioning of Collector Systems	✓
Installation and Commissioning of Transmission Lines and Substations (including marine cable crossing)	✓
Installation and Commissioning of Hydrogen / Ammonia Production, and Storage Facilities and Associated Infrastructure (including Industrial water supply infrastructure)	✓
Restoration of Existing Port Facilities (including pile driving and dredging)	✓
Emissions, Discharges, and Wastes[1]	✓
Employment and Expenditures[2]	✓
Operation and Maintenance	
Presence, Operation, and Maintenance of wind farms (including wind turbines, access roads, and collector systems)	✓
Presence, Operation, and Maintenance of Transmission Lines and Substations	✓
Presence, Operation, and Maintenance of Hydrogen / Ammonia Production, and Storage, Facilities and Associated Infrastructure (includes marine discharge from treatment plant)	✓
Presence, Operation, and Maintenance of Port Facilities (includes loading of ammonia and vessel maneuvering within Port)	✓
Emissions, Discharges, and Wastes[1]	✓
Employment and Expenditures[2]	✓

Table 21.3 Project Interactions with Indigenous Fisheries - Environmental Effect and Environmental Effect Pathway

Project Activities	Environmental Effect to be Assessed: Change in Indigenous Commercial and FSC Fisheries
Decommissioning and Rehabilitation	
Presence, Operation, and Maintenance of Temporary Workforce Accommodations and Associated Infrastructure	-
Decommissioning and Rehabilitation of wind farms (including wind turbines, access roads, and collector systems)	✓
Decommissioning and Rehabilitation of Transmission Lines and Substations	✓
Decommissioning and Rehabilitation of Hydrogen / Ammonia Production, and Storage, Facilities and Associated Infrastructure	✓
Decommissioning and Rehabilitation of Port Facilities	✓
Emissions, Discharges, and Wastes[1]	-
Employment and Expenditures[2]	✓

Notes:

✓ = Potential interaction

– = No interaction

[1] Emissions (e.g., light, noise, vibration, air contaminants and GHGs), discharges (e.g., wastewater and other liquid effluents), and hazardous and non-hazardous wastes are generated by many Project activities. Rather than acknowledging this by placing a checkmark against each of these activities, "Emissions, Discharges, and Wastes" is listed as a separate item under each phase of the Project.

[2] Project employment and expenditures are generated by most Project activities and are the main drivers of many potential socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, "Employment and Expenditures" is listed as a separate item under each phase of the Project.

Potential Project interactions with Indigenous fisheries are the same as those identified for Freshwater Fish and Fish Habitat (Chapter 10) and Marine Environment and Use (Chapter 11).

As described in Chapter 10 (Freshwater Fish and Fish Habitat), avoidance measures will reduce potential direct interactions between Project components or activities and freshwater fish and fish habitat by physically relocating these components and activities away from freshwater fish and fish habitat, where practicable. This will reduce potential direct interactions with Indigenous fisheries. In the absence of mitigation, the Project may interact with Indigenous commercial and FSC fisheries in the following ways:

- Site preparation and civil works including clearing vegetation, stripping soils and grading for access road construction may result in run off, which could alter freshwater fish habitat quality and affect freshwater fish health and survival. Freshwater Fish habitat may be lost as a result of construction of watercourse crossings.
- Installation and commissioning of collector systems, transmission lines and substations and presence, operation, and maintenance of transmission lines and substations includes clearing riparian vegetation which may alter freshwater fish habitat quality related to run off or cover, which may in turn affect freshwater fish health and survival.
- As part of the installation and commissioning of hydrogen / ammonia production and storage facilities, freshwater fish habitat may be altered by changes in flow and water levels downstream of the industrial water source. Conversely, freshwater fish habitat may be increased during operation as a result of the raising of water levels in ponds associated with the industrial water supply.
- As part of the presence, operation, and maintenance of hydrogen / ammonia production and storage, facilities water withdrawal activities could cause impingement and thereby affect freshwater fish health and survival.
- The presence, operation, and maintenance of wind farms may alter freshwater fish habitat quality related to run off from access roads, which may in turn affect freshwater fish health and survival.
- Over the life of the Project, employment and expenditure could interact with freshwater fish health and survival if the presence of Project workers or improved access results in increased angling activity in the area.

As described in Chapter 10, the following Project activities are not expected to result in a change in freshwater fish habitat quantity and quality or freshwater fish health and survival:

- Construction / installation, presence, operation, and maintenance of temporary workforce accommodations and associated infrastructure, and presence, operation, and maintenance of temporary workforce accommodations and associated infrastructure will occur on land, away from watercourses and waterbodies and will not interact with freshwater fish and fish habitat.
- Installation and commissioning of wind turbines will occur on land, away from watercourses and waterbodies and will not interact with freshwater fish and fish habitat.

- Restoration of existing port facilities during construction, presence, operation, and maintenance of port facilities, and decommissioning and rehabilitation of port facilities will occur in the marine environment, away from freshwater watercourses and waterbodies and will not interact with freshwater fish and fish habitat.
- Emissions, discharges, and wastes produced through construction, operation, maintenance, decommissioning and rehabilitation activities will occur on land, away from watercourse and waterbodies.

Avoidance and mitigation measures will reduce potential direct interactions with Indigenous fisheries that occur in the marine environment. As described in Chapter 11 (Marine Environment and Use), in the absence of mitigation, the Project may interact with Indigenous commercial and FSC fisheries in the following ways:

- Transportation of resources and equipment in the marine environment increases the risk of vessel collisions with marine animals and ocean users. Vessel movement may affect marine habitat quality and disrupt Indigenous commercial and FSC fishing activities. Marine shellfish aquaculture operations may be affected by the accidental introduction of aquatic invasive species (AIS). Construction of barge landing sites may affect marine habitat quality and quantity, increase risk of mortality to marine species, and disrupt Indigenous fishing activities.
- Installation and commissioning followed by the presence, operation, and maintenance of the marine subsea cable crossing may reduce marine habitat quantity and/or quality, displace Indigenous fishers and other ocean users, and disrupt marine fisheries resources.
- Installation and commissioning of hydrogen / ammonia plant and associated infrastructure will result in the release of treated effluent, which may reduce marine habitat quantity and quality, increase risk of mortality to marine species, displace Indigenous fishers and other ocean users, and disrupt marine fisheries resources.
- Restoration of existing port facilities including upgrades to the dock, pile driving, installation of the jettyless mooring system, and dredging may reduce marine habitat quantity and quality, increase risk of mortality to marine species, displace Indigenous fishers and other ocean users, and disrupt marine fisheries resources.
- Presence, operation, and maintenance of port facilities including vessels maneuvering within the port and maintenance repairs as needed may affect habitat quality, increase risk of mortality to marine species, displace Indigenous fishers and other ocean users, and disrupt marine fisheries resources.
- During construction / installation and operation, and maintenance, emissions, discharges, and other wastes generated from Project activities may affect marine habitat quality and marine species health and survival including EMF emissions from the subsea cable, noise emissions generated from vessels and construction / maintenance equipment, and wastewater discharge from the marine outfall.
- The decommissioning and rehabilitation of port facilities will involve the removal of the jettyless mooring system and potentially the quay and associated mooring infrastructure, which may reduce habitat quality, and displace Indigenous fishers and other ocean users.

The following Project activities are not expected to result in changes to Indigenous commercial and FSC fisheries in the marine environment:

- Site preparation and civil works during construction will occur on land and will not interact with the marine environment.
- Construction / installation, presence, operation, and maintenance of temporary workforce accommodations and associated infrastructure will occur on land and will not interact with the marine environment.
- Installation, commissioning, operation, and decommissioning of wind turbines, collector systems, and transmission lines and substations will occur on land and will not interact with the marine environment (except for the marine submarine cable crossing).
- Installation, commissioning, operation, and decommissioning of hydrogen / ammonia and associated infrastructure will not interact with the marine environment (except marine discharge from marine outfall which is captured under emissions, discharges, and wastes).
- The presence, operation, and maintenance of the marine outfall is not anticipated to affect other ocean users, including Indigenous commercial and FSC fisheries.
- Employment and expenditures will not directly result in changes to the marine environment and Indigenous commercial and FSC fisheries.

21.3.5 Analytical Assessment Techniques and Level of Knowledge

The Indigenous Fisheries VEC assessment considers the conclusions of the assessments of related biophysical VECs, including Chapter 10 (Freshwater Fish and Fish Habitat) and Chapter 11 (Marine Environment and Use).

Potential environmental effects on Indigenous fisheries were determined based on Project engagement activities, the Nation-specific results of the LRU survey (Stantec 2023), the literature review conducted for the Socio-economic Environment and Land and Resource Use Baseline Study (BSA-4), information collected from others VECs, and professional judgement. An ATK study was completed by Qalipu First Nation (QFN 2023) with support from WEGH2 and results specific to Indigenous fisheries were integrated into this assessment. Feedback received after filing will be reviewed in the context of the EIS and integrated into Project planning and regulatory reporting, as applicable.

As described below in Section 21.3.5.1, a conservative approach was used to address uncertainty in the environmental effects assessment, which increases confidence in the final determination of significance by reducing the risk of understating Project effects. The prediction confidence of the assessment for Indigenous fisheries (Section 21.7) incorporates these assumptions and other elements that contribute to the conservative approach.

21.3.5.1 Assumptions and Conservative Approach

In some instances, data limitations necessitated that a conservative approach be taken to accommodate uncertainty for the effects assessment. Conservative assumptions were made with respect to effects on Indigenous fisheries. This assessment assumes that Indigenous fisheries have the potential to occur in accessible marine and freshwater environments within and/or in the vicinity of the Project Area and LAA, and that marine and/or freshwater fish and aquatic species identified as being present near the Project Area could be fished or harvested by Qalipu First Nation, even if Qalipu First Nation did not identify specific fishing sites, areas, or resources in relation to the Project.

21.4 Mitigation Measures and Management Plans

A series of environmental management plans will be developed by WEGH2 to mitigate the effects of Project development on the environment and Indigenous fisheries (Chapter 2.9.2). The ATK study prepared by Qalipu First Nation asked the participants if they had "any suggestions as to how potential [Project] effects could be mitigated?" (QFN 2023:11). Most of the responses provided for this question identified "maintaining contact and collaborating with the locals" (QFN 2023:11).

A full list of mitigation measures to be applied throughout Project construction, operation and maintenance, and decommissioning and rehabilitation is provided in Appendix 26-A. Measures to mitigate the potential effects of the Project on Indigenous fisheries are described in Chapter 10 (Freshwater Fish and Fish Habitat) and Chapter 11 (Marine Environment and Use); key mitigation measures related to Indigenous fisheries are listed in Table 21.4, by category and Project phase.

Table 21.4 Mitigation Measures: Indigenous Fisheries

Control ID #*	Category	Mitigation Measure	Project Phase*		
			C	O	D
1	Mitigation	Existing riparian vegetation will be maintained according to buffer specifications in permits and regulations. Merchantable timber will be salvaged and made available to local communities for fuelwood.	X	-	X
2	Mitigation	Work will be performed so that materials such as sediment, fuel or other hazardous materials do not enter watercourses and waterbodies through implementation of erosion and sediment control measures and hazardous materials management practices.	X	X	X
3	Mitigation	Work operation will be conducted in a manner to protect watercourses and wetlands from siltation and disturbance in accordance with Best Management Practices or as otherwise agreed with the regulator.	X	X	X
4	Mitigation	Sensitive areas (e.g., wetlands, rare plant occurrences, hibernacula, mineral licks, roosts) identified prior to construction will be flagged and appropriate buffers maintained around these areas, where feasible.	X	-	X

Table 21.4 Mitigation Measures: Indigenous Fisheries

Control ID #*	Category	Mitigation Measure	Project Phase*		
			C	O	D
11	Mitigation	Volatile wastes and materials, such as fuel, mineral spirits, oil, or paint thinner will be stored appropriately and will not be permitted to enter into waterways or storm drains. They will be disposed of at an approved site.	X	X	X
12	Mitigation	Where portable toilets are required, waste will be removed from the site by the supplier in a timely manner for appropriate disposal. These toilets will be located more than 30 m from the boundaries of wetlands or watercourses.	X	X	X
17	Mitigation	Fueling and servicing areas will be sited more than 100 m away from watercourses, coastlines, waterbodies, and wetlands.	X	X	X
34	Mitigation	Construction areas will be routinely monitored to identify areas of potential erosion and to apply appropriate mitigation. Best practice erosion and sediment control measures will be implemented, as required.	X	X	X
35	Design	The drainage system for the site will be designed to appropriately manage stormflows considering impacts to on-site downstream watercourses, and coastlines, and infrastructure.	X	X	-
84	Mitigation	In the event of a spill, dry clean up and mopping techniques will be used as appropriate. The area will not be "washed down" as this could cause the spills to spread to the surrounding environment and potentially enter drainage works or environmentally sensitive areas.	X	X	X
86	Design	The potential effects of extreme weather including storms, precipitation, and drought will be considered in Project planning, design, and operation and maintenance strategies, including the selection of materials and equipment, and design of components. These designs will consider projected climate change conditions over the life of the Project.	X	X	X
90	Mitigation	Weather forecasts (including marine forecasts) will be considered when planning construction and operation activities that may be affected by adverse conditions, such as receipt of materials and supplies, and product deliveries, particularly deliveries of products and diesel fuel. Where required, these activities will be scheduled for periods of favorable weather conditions.	X	X	X
93	Mitigation	WEGH2 will maintain up-to-date communication with fishers on Project activities and Project vessel operators, facilitated through a community liaison representative.	X	X	X
94	Mitigation	Navigational Warnings and Notices to Shipping will be issued.	-	X	-
95	Mitigation	Movement of vessels will be subject to the Practices and Procedures for Public Harbours under the *Marine Act.*	X	X	X

Table 21.4 Mitigation Measures: Indigenous Fisheries

Control ID #*	Category	Mitigation Measure	Project Phase*		
			C	O	D
97	Mitigation	All marine-based work undertaken by registered vessels will comply with the requirements of the *Canada Shipping Act*.	X	X	X
98	Mitigation	All marine-based work undertaken by foreign vessels must be undertaken pursuant to a Coasting Trade Permit issued under the *Coasting Trade Act* and will comply with applicable regulations under the International Maritime Organization Conventions including the International Convention for the Prevention of Pollution from Ships (MARPOL).	X	X	X
99	Mitigation	All marine Project activities will be conducted in accordance with the requirements of the Canadian Coast Guard Marine Communication and Traffic Services (CCG-MCTS).	X	X	X
100	Mitigation	Consultation with local fish harvesters and other stakeholders will be undertaken regarding marine-related activities that may interact with fisheries.	X	-	-
120	Mitigation	Project vessels will be equipped with communication mechanisms to communicate with third-party mariners.	X	X	X
121	Mitigation	If construction activities must be scheduled during commercial fishing seasons and be conducted in the fishing grounds, WEGH2 will continue to manage and reduce adverse conflicts with affected fishers.	X	-	-
122	Mitigation	The cable installation contractor will issue regular "Security Messages" stating the vessel is restricted in ability to maneuver, course, speed and intentions. This will also be issued prior to the vessel arriving through the Notice to Mariners.	X	-	-
131	Mitigation	The cable will be de-activated and left in place indefinitely when no longer in use. This end-of-life option will avoid additional seabed disturbance and has, therefore, been selected rather than removal, which would require pulling up the cable along the entire route (including buried and unburied portions), and cause unwarranted disruption to the seabed, sediments, and benthic communities.	-	-	X

Notes:
"Control ID #" denotes the master identification number for mitigation in Chapter 26.2.
"C" denotes the construction phase of the Project.
"O" denotes the operation and maintenance phase of the Project.
"D" denotes the decommissioning and rehabilitation phase of the Project.
"X" denotes the relevant Project phase for the mitigation measure.

21.4.1 Application of the Precautionary Principle to Project Mitigation Measures

As described in Section 21.3.5.1, this assessment assumes that Indigenous fisheries have the potential to occur in accessible marine and freshwater environments within and/or in the vicinity of the Project Area and LAA, and that marine and/or freshwater fish and aquatic species identified as being present near the Project Area could be fished or gathered by Qalipu First Nation, even if Qalipu First Nation did not identify specific fishing sites, areas, or resources in relation to the Project. In the context of this EIS, all aspects of the Project have been examined in a careful and precautionary manner to support the assessment of potential effects on Indigenous fisheries.

The mitigation measures in Table 21.4 were selected based on their effectiveness to mitigate potential changes to Indigenous fisheries, their inclusion as mitigation measures in other energy projects, and professional judgment of the effects assessment team.

21.5 Assessment of Environmental Effects on Indigenous Fisheries

Specific Project activities that may interact with Indigenous commercial and FSC fisheries and result in an environmental effect (i.e., a measurable change that may affect the Indigenous fisheries) are identified and described in Section 21.3.4. The following sections describe the pathways by which a potential Project effect could result from Project activities (i.e., the Project-effect pathway) during each Project phase (i.e., construction, operation and decommissioning). Mitigation and management measures (Section 21.4) are applied to avoid or reduce these potential pathways and resulting environmental effects. Residual effects are those remaining following implementation of mitigation, which are then characterized using the criteria defined in Section 21.3.1. A summary of predicted residual effects is provided in Section 21.5.

The assessment of change in Indigenous commercial and FSC fisheries focuses on the interactions among changes to related biophysical VECs. The interrelationship among various related biophysical VECs plays an important role in how changes to the environment may affect the conditions and material circumstances for Indigenous fisheries. For example, changes in surface water quality may influence fish health, which could in turn affect Indigenous commercial and FSC fisheries. The identification of Project pathways, therefore, relies on the assessments provided for applicable biophysical and socio-economic VECs.

21.5.1 Change in Indigenous Commercial and FSC Fisheries

21.5.1.1 Construction

As described in Section 21.2.2, Indigenous commercial and FSC fishing activities occur within and near the Project Area and LAA (Stantec 2023; QFN 2023). Pathways that affect Indigenous commercial and FSC fisheries are described in Section 21.3.3 (Table 21.2). A change to Indigenous fisheries could occur through a change in access to freshwater or marine harvesting areas or navigable waters used for commercial and/or FSC purposes. A change to Indigenous fisheries could also occur through a related change in the quantity, quality, or availability of freshwater and marine species harvested for commercial and/or FSC purposes, and/or a change in freshwater and marine habitat quantity and/or quality.

As described in Chapter 10 (Freshwater Fish and Fish Habitat), the Project has been designed to avoid loss of fish habitat through careful planning of the placement of infrastructure and shifting locations of activities away from waterbodies/watercourses during the construction phase. Where avoidance is not feasible, the application of best practices in accordance with DFO's "Measures to Protect Fish and Fish Habitat", DFO standards and codes of practices and other standard mitigation measures which are described in Section 21.4 and the Project Environmental Protection Plan (EPP).

As described in Chapter 10 (Freshwater Fish and Fish Habitat), there are no anticipated residual effects on freshwater fish habitat quantity / quality or freshwater fish health and survival due to construction of the temporary workforce accommodations as watercourses/waterbodies will be avoided during Project design. Effects on fish habitat quantity during construction of the Port au Port and Codroy wind farms and associated infrastructure will be limited through Project design and siting of components. A small alteration in fish habitat quantity is anticipated during the installation of stream crossings (culverts) along access roads at the wind farms. Changes in riparian vegetation and cover are anticipated within the proposed rights-of-way (RoW) and there may be small alterations of bed and banks of stream crossings during in-water work associated with the wind farms.

As described in Chapter 10 (Freshwater Fish and Fish Habitat), no residual effects are anticipated on fish habitat quantity due to construction of the transmission lines and substations as the watercourses/waterbodies will be spanned and no in-water work is planned. Changes in riparian vegetation and cover (i.e., fish habitat quality) are however anticipated within the RoW for the transmission line due to clearing activities. It is anticipated there may be an increase in predation of freshwater fish due to loss of riparian vegetation and overhead cover. An increase in fishing pressure is also predicted due to improved road access to interior portions of the Port au Port peninsula and the Anguille Mountains (related to the wind farms) and along the transmission line RoW. As the access roads will be left in-place, the effect of increased availability for fishing will continue post-decommissioning. However, fishing by Project workers will be prohibited on the Project site, and fishing pressure by the public will be regulated through existing fishing regulations for the Island of Newfoundland.

As described in Chapter 10 (Freshwater Fish and Fish Habitat), effects on fish habitat quantity during construction of the hydrogen / ammonia plant will be limited through use of existing industrial water supply infrastructure; there will be some loss of fish habitat because of in-water works associated with the upgraded industrial water supply intake structures. Following mitigation, no residual effects on freshwater fish health and survival or habitat are anticipated due to construction of the hydrogen / ammonia production and storage facilities. There are no interactions anticipated between the port facilities and freshwater fish and fish habitat quantity and quality or freshwater fish health and survival, therefore no residual effects on Indigenous commercial and FSC freshwater fisheries are anticipated through the construction of this Project component.

As described in Chapter 11 (Marine Environment and Use), no residual effects on the marine environment are anticipated due to the construction of the Codroy wind farm and associated infrastructure and the temporary camps. Construction of the barge landing sites at the Port au Port wind farm, the subsea cable installation (Transmission Line), and construction associated with the hydrogen / ammonia plant and the port facilities are however predicted to result in residual effects on the marine environment (e.g., temporary loss of access to fishing grounds and /or displacement; disruptions to fisheries grounds / harvested resources; vessel collisions due to increased vessel activity) during the construction phase. Careful planning will be implemented during construction to avoid these residual effects to the extent practicable through avoiding sensitive / important areas and periods. Where avoidance is not feasible, standard mitigation measures (Chapter 26) will be employed in addition to measures required by applicable federal / provincial regulations. To limit mortality of marine species or interference with seasonal migration patterns, the timing of in-water work will be conducted, where practical, in consideration of sensitive biological periods (e.g., reproductive life stages) for marine species, as determined through discussions with DFO, Indigenous and non-Indigenous fishers, and other regulators.

As described in Table 21.4, WEGH2 will maintain ongoing engagement with affected marine users, including Indigenous commercial and/or FSC fishers. Residual effects on Indigenous commercial and FSC fisheries will be reduced by avoiding active fishing areas. Where avoidance is not feasible, mitigation and consultation with Indigenous fishers and aquaculture operators are anticipated to reduce potential conflicts and/or temporary disruptions in access to resources and/or harvesting areas.

Residual effects predicted for change in access, and for change in freshwater and marine fish and aquatic species and their habitats (Chapter 10 Freshwater Fish and Fish Habitat and Chapter 11 Marine Environment and Use), will result in a residual effect on Indigenous commercial and FSC fisheries.

With the implementation of mitigation measures outlined in Table 21.4 and those identified for related VECs, adverse residual effects on Indigenous commercial and FSC fisheries during the construction phase are anticipated to be low to moderate in magnitude within the LAA and Project Area, inclusive of timing considerations (moderate sensitivity) due to the seasonal movements of migratory fish and aquatic species and seasonal openings for Indigenous commercial and/or FSC fisheries. Overall, Indigenous commercial and FSC fisheries will be able to continue in a manner that is generally consistent with existing conditions within the LAA. Short-term adverse residual effects are expected to be geographically limited to construction areas within the LAA, occur as a single event, and be reversible.

The temporary camp in the Codroy wind farm area, the Port au Port and Codroy wind farms, and the transmission lines and substations in Codroy / Bay St. George South and Port au Port, will occur in relatively undisturbed ecological contexts. The port facilities, the hydrogen / ammonia plant, and the transmission line and substations and temporary work camp in the Port of Stephenville will occur in a relatively disturbed ecological context.

Based on the information above, a summary of residual effects on a change in Indigenous commercial and FSC fisheries during the construction phase is provided in Table 21.5.

Table 21.5 Summary of Effects by Project Component During Construction

Project Site	Summary of Effect during Construction
Temporary Workforce Accommodations	No residual effects are anticipated on Indigenous commercial and FSC fisheries due to construction of the temporary workforce accommodations because: • There are no interactions anticipated with freshwater fish and fish habitat quality or quantity, or fish health and survival as watercourses / waterbodies will be avoided during Project design. • No effects are anticipated on marine habitat quantity and quality, marine species health and survival, or fishing / aquaculture grounds and productivity.
Port au Port and Codroy Wind Farm and Associated Infrastructure	Construction of the Port au Port and Codroy wind farms and associated infrastructure is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • A small alteration in fish habitat quantity is anticipated during the installation of stream crossings (culverts) along access roads. • Changes in riparian vegetation and cover are anticipated within the RoW and there may be small alterations of bed and banks of stream crossings during in-water work. • It is anticipated there may be an increase in predation of freshwater fish due to loss of riparian vegetation and overhead cover and an increase in fishing pressure due to improved road access to interior portions of the Port au Port peninsula and the Anguille Mountains. • Residual effects are anticipated on marine habitat quality and quantity (e.g., alteration of the seabed during construction of the barge landing sites, underwater noise generated from the installation of barge landing sites, potential introduction of AIS through vessel activity) and on marine species health and survival (e.g., benthic disturbance, suspension of sediment, and underwater noise generated through the installation of barge landing sites, potential vessel collisions through vessel activity) associated with the construction of the Port au Port wind farm and associated infrastructure. However, no residual effects are anticipated on marine habitat quality and quantity or marine species health and survival through construction of the Codroy wind farm.
230 kV Transmission Lines and Substations	Construction of the 230 kV transmission lines and substations is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Changes in riparian vegetation and cover are anticipated due to clearing along the RoW. • It is anticipated there may be an increase in predation of freshwater fish due to loss of riparian vegetation and overhead cover and an increase in fishing pressure due to improved road access long the new transmission line RoW. • Residual effects are anticipated on marine habitat quality and quantity (e.g., alteration of the seabed during subsea cable installation, underwater noise generated from subsea cable installation, and potential introduction of AIS through vessel activity) and on marine species health and survival (e.g., benthic disturbance, suspension of sediment, underwater noise generated through subsea cable installation, and potential vessel collisions through vessel activity).

Table 21.5 Summary of Effects by Project Component During Construction

Project Site	Summary of Effect during Construction
Hydrogen / Ammonia Production and Storage Facilities	Construction of the hydrogen / ammonia plant is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • There will be some loss of fish habitat as a result of in-water works associated with the upgraded industrial water supply intake structures. • Residual effects are predicted on marine habitat quantity and quality (e.g., underwater noise generated through marine outfall installation, if required, and potential introduction of AIS through vessel activity) and on marine species health and survival (e.g., benthic disturbance, suspension of sediment, underwater noise generated through marine outfall installation, and potential vessel collisions through vessel activity).
Port Facilities	Construction of the port facilities is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Residual effects are predicted on marine habitat quality and quantity (e.g., alteration of the seabed during dredging and port upgrades, underwater noise generated from port upgrades, and potential introduction of AIS through vessel activity) and on marine species health and survival (e.g., benthic disturbance, suspension of sediment, and underwater noise generated through port upgrades, and potential vessel collisions through vessel activity).

21.5.1.2 Operation and Maintenance

As described in Section 21.2.2, Indigenous commercial and FSC fishing activities occur within and near the Project Area and LAA (Stantec 2023; QFN 2023). Pathways that affect Indigenous commercial and FSC fisheries are described in Section 21.3.3 (Table 21.2). A change to Indigenous fisheries could occur through a change in access to freshwater or marine harvesting areas or navigable waters used for commercial and/or FSC purposes. A change to Indigenous fisheries could also occur through a related change in the quantity, quality, or availability of freshwater and marine species harvested for commercial and/or FSC purposes, and/or a change in freshwater and marine habitat quantity and/or quality.

As described in Chapter 10 (Freshwater Fish and Fish Habitat), the quantity of water being withdrawn for the hydrogen / ammonia plant has the potential to result in indirect loss to fish habitat, however, streams are anticipated to continue to support fisheries . The outflow to Warm Brook will be controlled to maintain ecological flows for fish migration. . No residual effects are anticipated on freshwater fish habitat during the operation and maintenance phase in relation to the other Project components. Operation and maintenance of the Port au Port and Codroy wind farms and transmission line are predicted to result in residual effects on freshwater fish habitat quality (i.e., changes in riparian vegetation and cover within and along the RoWs) and on freshwater fish health and survival (i.e., increase in predation due to loss of riparian vegetation and overhead cover and an increase in fishing pressure due to improved road access). No residual effects are anticipated on freshwater fish habitat quality or freshwater fish health and survival in relation to the other Project components.

As described in Chapter 11 (Marine Environment and Use), residual effects on the marine environment are anticipated in vicinity of the port facilities (e.g., underwater noise), the subsea cable (e.g., disruption to fisheries grounds / resources), and the hydrogen / ammonia plant and the port facilities (e.g., loss of access to fishing grounds and/or displacement) during the operation and maintenance phase. Residual effects on the marine environment are not anticipated in relation to the Port au Port and Codroy wind farms during the operation and maintenance phase.

As described in Table 21.4, WEGH2 will maintain ongoing engagement with affected marine users, including Indigenous commercial and/or FSC fishers. Residual effects to Indigenous commercial and FSC fisheries will be reduced by avoiding active fishing areas. Where avoidance is not feasible, mitigation and consultation with Indigenous fishers and aquaculture operators are anticipated to reduce potential conflicts and/or temporary disruptions in access to resources and/or harvesting areas.

Residual effects predicted for change in access, and for change in freshwater and marine fish and aquatic species and their habitats (Chapter 10 Freshwater Fish and Fish Habitat and Chapter 11 Marine Environment), will result in a residual effect on Indigenous commercial and FSC fisheries.

With the implementation of mitigation measures outlined in Table 21.4 and those identified for related VECs, adverse residual effects on Indigenous commercial and FSC fisheries during the operation and maintenance phase are anticipated to be low to moderate in magnitude within the LAA and Project Area, inclusive of timing considerations (moderate sensitivity). Overall, Indigenous commercial and FSC fisheries will be able to continue in a manner that is generally consistent with existing conditions within the LAA. Medium-term adverse residual effects are expected to be geographically limited to the LAA during the operation and maintenance phase, will occur continuously (i.e., underwater noise) and/or as irregular events (e.g., temporary displacement), and will be reversible.

The transmission lines and substations in Codroy / Bay St. George South and Port au Port, will occur in relatively undisturbed ecological context. The port facilities, the hydrogen / ammonia plant, and the transmission line and substations in the Port of Stephenville will occur in a relatively disturbed ecological context.

Based on the information above, a summary of residual effects on current use during the operation and maintenance phase is provided in Table 21.6.

Table 21.6 Summary of Effects by Project Component During Operation and Maintenance

Project Site	Summary of Effect during Operation and Maintenance
Port au Port and Codroy Wind Farm and Associated Infrastructure	Operation and maintenance of the Port au Port and Codroy wind farms and associated infrastructure is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Changes in riparian vegetation and cover (freshwater fish habitat quality) are anticipated during RoW maintenance. • Change in fish health and survival may occur due to increase in predation of freshwater fish (e.g., through loss of riparian vegetation and overhead cover; increase in fishing pressure due to improved road access to interior portions of the Port au Port peninsula and the Anguille Mountains).

Table 21.6 Summary of Effects by Project Component During Operation and Maintenance

Project Site	Summary of Effect during Operation and Maintenance
230 kV Transmission Lines and Substations	Operation and maintenance of the 230 kV transmission lines and substations is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Changes in riparian vegetation and cover (freshwater fish habitat quality) are anticipated during RoW maintenance. • Change in fish health and survival may occur due to increase in predation of freshwater fish (e.g., through loss of riparian vegetation and overhead cover; increase in fishing pressure due to improved road access) • Residual effects on marine species health and survival are predicted due to EMF emissions from the subsea cable, benthic disturbance, and suspension of sediments through maintenance activities, and potential vessel collisions through vessel activity. • Temporary loss of access to fishing grounds and/or displacement during maintenance activities for the subsea cable and disruption to fisheries grounds / resources during maintenance activities for the subsea cable and EMF emissions.
Hydrogen / Ammonia Production and Storage Facilities	Operation and maintenance of the hydrogen / ammonia plant is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • The quantity of water being withdrawn for the hydrogen / ammonia plant has the potential to result in indirect loss to freshwater fish habitat. Streams are anticipated to continue to support fisheries for the duration of the Project. • Minor changes in freshwater fish habitat quality are anticipated including changes to water velocities and depths in outflowing streams. However, effects of water withdrawals will be managed to maintain ecological flows. • Localized change marine habitat quality (change in temperature and salinity) is predicted to occur within the receiving environment adjacent to the marine outfall. • Marine species health and survival is anticipated to be affected by discharge of wastewater from the marine outfall, benthic disturbance and suspension of sediments through maintenance activities, and potential vessel collisions through vessel activity. • Temporary loss of access to fishing grounds and/or displacement and potential increase in vessel collisions are anticipated during maintenance activities related to the marine outfall. • Temporary disruption to fisheries grounds / resources are anticipated during maintenance activities for the marine outfall and discharge from diffuser.
Port Facilities	Operation and maintenance of the port facilities is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Residual effects are predicted on marine habitat quality and quantity (e.g., potential introduction of AIS through vessel activity; noise generated through the loading of ammonia and vessel maneuvering within port and maintenance activities) and on marine species health and survival (e.g., benthic disturbance and suspension of sediment through maintenance activities, underwater noise generated through the loading of ammonia and vessel maneuvering within port and maintenance activities). • Loss of access and/or displacement of fishing vessels and potential increase risk of vessel collision are predicted during port maintenance activities and shipment of ammonia.

21.5.1.3 Decommissioning and Rehabilitation

As described in Section 21.2.2, Indigenous commercial and FSC fishing activities occur within and near the Project Area and LAA (Stantec 2023; QFN 2023). Pathways that affect Indigenous commercial and FSC fisheries are described in Section 21.3.3 (Table 21.2). A change to Indigenous fisheries could occur through a change in access to freshwater or marine harvesting areas or navigable waters used for commercial and/or FSC purposes. A change to Indigenous fisheries could also occur through a related change in the quantity, quality, or availability of freshwater and marine species harvested for commercial and/or FSC purposes, and/or a change in freshwater and marine habitat quantity and/or quality.

As described in Chapter 10 (Freshwater Fish and Fish Habitat), effects of Project decommissioning and rehabilitation on fish habitat quality are expected to be negligible, as no habitat loss is anticipated. A reduction in fish habitat quality is however predicted to occur in the Project Area during the decommissioning and rehabilitation phase due to small alterations to the bed and banks of stream crossings during fording and changes in riparian vegetation and cover during RoW clearing prior to decommissioning at the wind farms and along the transmission line, and due to minor alterations to the shorelines and pond substrate when removing the water intake structure at the hydrogen / ammonia plant. As riparian vegetation and overhead cover are re-established during the decommissioning and rehabilitation phase, it is predicted that there will be a reduction in predation on freshwater fish species. As the access roads will be left in-place, the effect of increased availability for fishing (i.e., increase in fishing pressure) will continue post-decommissioning.

As described in Chapter 11 (Marine Environment and Use), residual effects are predicted for the port facilities due to the alteration of seabed; underwater noise, risk of vessel collisions, and temporary displacement of marine users (e.g., Indigenous commercial and FSC fishers) during the decommissioning and rehabilitation phase. No effects are anticipated in relation to the other Project components during the decommissioning and rehabilitation phase.

As described in Table 21.4, WEGH2 will maintain ongoing engagement with affected marine users, including Indigenous commercial and/or FSC fishers. Residual effects to Indigenous commercial and FSC fisheries will be reduced by avoiding active fishing areas. Where avoidance is not feasible, mitigation and consultation with Indigenous fishers and aquaculture operators are anticipated to reduce potential conflicts and/or temporary disruptions in access to resources and/or harvesting areas.

During decommissioning, rehabilitation and closure, Project activities will be reduced, and therefore, residual effects are anticipated to be reduced compared to construction activities. Decommissioning, rehabilitation and closure activities will allow for the return of habitat for fish and aquatic species within the Project Area, including areas where Indigenous fisheries occur. A description of the rehabilitation and closure plan is provided in Chapter 2 (Project Description). During rehabilitation activities, hazardous materials will be removed, equipment cleaned and removed, natural drainage patterns will be re-established to the extent practicable, and areas will be covered with overburden materials and revegetated.

Residual effects predicted for change in access and for change in freshwater and marine fish and aquatic species and their habitats (Chapter 10 Freshwater Fish and Fish Habitat and Chapter 11 Marine Environment), will result in a residual effect on Indigenous commercial and FSC fisheries.

With the implementation of mitigation measures outlined in Table 21.4 and those identified for related VECs, adverse residual effects on Indigenous commercial and FSC fisheries during the decommissioning and rehabilitation phase are anticipated to be low in magnitude within the LAA and Project Area, inclusive of timing considerations (moderate sensitivity). Overall, Indigenous commercial and FSC fisheries will be able to continue in a manner that is generally consistent with existing conditions within the LAA. Short-term adverse residual effects are expected to be geographically limited to the Project Area and LAA during the decommissioning and rehabilitation phase and will occur as single events (e.g., temporary displacement). Adverse residual effects associated with the Project components are anticipated to be reversible following Project decommissioning, rehabilitation, and closure.

Based on the information above, a summary of residual effects on current use during the decommissioning and rehabilitation phase is provided in Table 21.7.

Table 21.7 Summary of Effects by Project Component During Decommissioning and Rehabilitation

Project Site	Summary of Effect during Decommissioning and Rehabilitation
Temporary Workforce Accommodations	No interactions are anticipated between the temporary workforce accommodations and freshwater fish and fish habitat and the marine environment during this phase, therefore no residual effects are anticipated on Indigenous commercial and FSC fisheries.
Port au Port and Codroy Wind Farm and Associated Infrastructure	Decommissioning and rehabilitation of the Port au Port and Codroy wind farms and associated infrastructure is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Changes in riparian vegetation and cover (freshwater fish habitat quality) are anticipated during RoW clearing prior to decommissioning and there may be small alterations to the bed and banks of stream crossings during fording. • The access roads will be left in-place and increased (freshwater) fishing pressure will continue post-decommissioning.
230 kV Transmission Lines and Substations	Decommissioning and rehabilitation of the 230 kV transmission lines and substations is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Changes in riparian vegetation and cover (freshwater fish habitat quality) are anticipated during RoW clearing prior to decommissioning and there may be small alterations to the bed and banks of stream crossings during fording. • The access roads will be left in-place and increased (freshwater) fishing pressure will continue post-decommissioning.
Hydrogen / Ammonia Production and Storage Facilities	Decommissioning and rehabilitation of the hydrogen / ammonia plant is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • There may be minor alterations to freshwater fish habitat quantity and quality due to anticipated changes in shorelines and pond substrate when removing the water intake structure.

Project Site	Summary of Effect during Decommissioning and Rehabilitation
Port Facilities	Decommissioning and rehabilitation of the port facilities is predicted to result in residual effects on Indigenous commercial and FSC fisheries because: • Change in marine habitat quantity and quality is predicted due to alteration of the seabed during port decommissioning and underwater noise generated during port decommissioning. • Change in marine species health and survival due to increased underwater noise and risk of vessel collision. • A portion of the marine terminal facilities may be removed (e.g., the jettyless mooring structures, and potentially the quay and associated mooring infrastructure) and the removal of these components could potentially impact fishing and aquaculture activities if marine users are temporarily displaced within the port during decommissioning activities.

21.5.2 Residual Environmental Effects Summary

In general, pathways for effects related to Indigenous fisheries are connected to the pathways identified in Chapter 10 (Freshwater Fish and Fish Habitat) and Chapter 11 (Marine Environment and Use).

A description of the predicted environmental effects on the freshwater environment is provided in Section 10.5.4.2 of Chapter 10 (Freshwater Fish and Fish Habitat). The following summary identifies key predicted environmental effects on freshwater fish and fish habitat that are connected to Indigenous fisheries:

- DFO's "Measures to Protect Fish and Fish Habitat", standard mitigation measures, and best management practices will be followed for work in or near water to mitigate effects to freshwater fish and fish habitat, to the extent practically feasible. WEGH2's goal is to avoid or mitigate loss to fish habitat, to the extent practically feasible. Where avoidance is not feasible, the application of best practices in accordance with DFO's "Measures to Protect Fish and Fish Habitat", DFO standards and codes of practices and other standard mitigation will be employed to reduce the potential for effects. Where residual adverse effects remain, these will be counterbalanced by offsetting through a required authorization pursuant to the Fisheries Act, as required by DFO.
- Localized changes in riparian vegetation and cover, and alterations to the bed and banks are anticipated at watercourse crossings because of RoW clearing and culvert installation. These effects will be mitigated (i.e., banks stabilized, culverts embedded) and residual effects will be localized to the Project Area.
- Improved road access to the Project Area and influx of workers may result in an increase in recreational fishing, placing increased pressures on freshwater fish populations. However, fishing by Project workers will be prohibited on the Project site and fishing pressure by the public will be regulated through existing fishing regulations for the Island of Newfoundland.

A description of the predicted environmental effects on the marine environment is provided in Section 11.5.5.2 of Chapter 11 (Marine Environment and Use). The following summary identifies key predicted environmental effects on the marine environment that are connected to Indigenous fisheries:

- Changes to marine habitat quantity predominantly occurs during the construction phase. Residual effects to marine habitat quantity will be mitigated and be compliant with applicable approvals under the *Water Resources Act* and/or *Fisheries Act*. Changes to marine habitat quality are anticipated to be a result of underwater noise and the introduction of AIS, and discharge from the marine outfall. Mitigation measures will be placed to reduce the effects to marine habitat quality. Compliance monitoring of the marine outfall discharge will occur in accordance with regulatory requirements to maintain water and sediment quality.
- Changes to marine species health and survival are closely associated with habitat quantity and quality and are related to benthic disturbance and suspension of sediment, underwater noise, vessel collisions, EMF emissions, and discharge from the marine outfall. Effects on marine species health and survival can range from auditory masking, behavioural changes, minor injuries, to mortality. Through mitigation, the effects on marine species health and survival will be reduced.
- Changes to fishing grounds and productivity is influenced by marine habitat quantity and quality (and species health and survival). Indigenous commercial fisheries can be adversely affected through a loss of income due to a loss of access to commercial fishing grounds and catch volume, damage to fishing gear, and through disruptions to fisheries resources. Effects to fisheries will be reduced by avoiding active fishing areas. Where avoidance is not feasible, mitigation and consultation with fishers and aquaculture operators will help reduce conflicts and disruptions to resources.
- Indigenous fisheries may be affected through the temporary loss of access to areas within the LAA and an increase in vessel collisions with Project vessels. Activities occurring in the Port of Stephenville (e.g., dredging) are anticipated to affect several users, including shipping and transport vessels, coast guard vessels, and pleasure craft operators. Effects to Indigenous fisheries will be mitigated and Indigenous fishers will be consulted to reduce potential conflicts.

As described in Table 21.4, WEGH2 will maintain ongoing engagement with affected marine users, including Indigenous fishers. Residual effects to Indigenous commercial and FSC fisheries will be reduced by avoiding active fishing areas. Where avoidance is not feasible, mitigation and consultation with Indigenous fishers and aquaculture operators are anticipated to reduce potential conflicts and/or temporary disruptions in access to resources and/or harvesting areas.

21.5.2.1 Residual Environmental Effects Characterization

Table 21.8 summarizes the predicted environmental effects (residual effects) of the Project on Indigenous fisheries.

Table 21.8 Summary of Predicted Environmental Effects of the Undertaking on Indigenous Fisheries

Residual Effect	Residual Effects Characterization							
	Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Construction								
Change in Indigenous Commercial and FSC Fisheries	A	L/M	PA/LAA	MS	ST	S	R	D/U
Operation and Maintenance								
Change in Indigenous Commercial and FSC Fisheries	A	L/M	PA/LAA	MS	MT	IR/C	R	D/U
Decommissioning and Rehabilitation								
Change in Indigenous Commercial and FSC Fisheries	A	L	PA/LAA	MS	ST	S	R	D/U

KEY:

Nature:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term

Timing:
NS: No Sensitivity
MS: Moderate Sensitivity
HS: High Sensitivity

Frequency:
S: Single Event
IR: Irregular Event
R: Regular Event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

21.6 Determination of Significance

A description of the criteria established for the characterization of significant adverse residual effects on the Indigenous fisheries is provided in Section 21.3.2.

As described in Section 21.5.1, residual effects predicted on freshwater fish and fish habitat and the marine species and environment can affect the Indigenous fisheries that are supported by these resources. Freshwater and marine fish and aquatic resources harvested for commercial and/or FSC purposes as well as their habitats, and access to these resources and areas, will be reduced and/ or altered within the Project Area; however, Indigenous fishing activities are predicted to be able to continue in a manner that is generally consistent with existing conditions within the LAA, and long-term loss is not anticipated.

With mitigation and environmental protection measures, including WEGH2's commitment for ongoing engagement with the Indigenous groups, and through the terms of the MOU with Qalipu First Nation, the Project is not predicted to result in a significant residual environmental effect on Indigenous fisheries.

As described in Section 21.3.2, the lack of laws, policies, management plans or standard industry practice regarding thresholds for the assessment of effects on the factors that may affect Indigenous groups makes selecting and applying significance thresholds challenging. The subjective nature of describing and understanding the importance of effects on Indigenous fisheries and related Indigenous interests (e.g., Indigenous health and socio-economic conditions) means that thresholds might not evenly apply across Indigenous groups and circumstances. Indigenous groups themselves may have differing views on the meaning of significance that reflect oral history traditions and holistic understandings of natural phenomena.

Throughout the life of the Project, WEGH2 aims to maintain a positive long-term relationship with Qalipu First Nation. WEGH2 will continue to engage Qalipu First Nation to discuss the Project and its effects, understand concerns that may arise and respond to those concerns. WEGH2 is committed to working with Qalipu First Nation to explore opportunities to further mitigate adverse effects on Indigenous fisheries and enhance Project benefits.

21.7 Prediction Confidence

The level of confidence in the predictions for Project-related residual effects on Indigenous fisheries is moderate. This is based on information collected as part of ongoing engagement activities (Chapter 4 Consultation and Engagement), the ATK study completed by Qalipu First Nation (2023), desktop data compilation and understanding of current existing conditions, GIS data analyses, understanding of Project activities, locations and described interactions, confidence in predictions related to freshwater fish and fish habitat and the marine environment, the predicted effectiveness of mitigation measures, and experience of the assessment team. A moderate level of confidence was given because some of the desktop data were limited in terms of availability (e.g., intensity of Indigenous commercial and/or FSC fisheries), scale (e.g., fishing areas to support harvest evaluation), or degree of specificity (ATK study provided 10 by 10 km polygons denoting harvesting areas and other culturally important sites, so it is not possible to determine their precise location [QFN 2023]). Furthermore, given the qualitative and subjective nature of assessing Indigenous fisheries and related Indigenous interests, the views of Indigenous groups may differ from the findings of this assessment. Many of the mitigation and management measures identified in Section 21.4 are standard practice and have been implemented in previous wind energy projects. WEGH2 will continue to engage with Qalipu First Nation for the identification, review, and analysis of existing and available information on Indigenous fisheries and other Indigenous interests, to consider this throughout Project planning and design.

21.8 Follow-Up and Monitoring

WEGH2's follow-up program includes the following planned engagement activities and commitments:

- Engaging with Qalipu First Nation and Indigenous communities to develop a shared understanding of how the Project may affect their Indigenous fisheries and to discuss the Project and its effects, as well as understand concerns that may arise and respond to those concerns.
- Working directly with Qalipu First Nation to identify opportunities for the Qalipu members to realize potential benefits from the Project that can be used to both offset potential adverse effects and create positive effects for Qalipu First Nation.
- Engaging with Qalipu First Nation and Indigenous communities regarding the development and implementation of Project-specific environmental management and monitoring plans that will contain the mitigation measures described in this assessment.
- WEGH2 will remain available through the EIS review process should Qalipu First Nation and Indigenous communities bring forward additional information related to this assessment or should concerns arise or requests for alternate engagement approaches be requested. Through ongoing engagement (i.e., throughout the life of the Project) the Proponent aims to maintain a positive long-term relationship with Qalipu First Nation and Indigenous communities.

21.9 Capacity of Renewable Resources and Effects on Biological Diversity

As described in the related VEC chapters, the Project is not anticipated to adversely affect renewable resources or biological diversity. Therefore, adverse Project-related effects on the capacity of renewable resources to meet the needs of the present and those of the future, and adverse Project-related effects on biological diversity are not anticipated with respect to Indigenous fisheries.

21.10 Predicted Future Environmental Conditions if the Project Does Not Proceed

If the Project is not allowed to proceed, the existing conditions as described in the baseline section will continue to prevail, including current Indigenous fishery activities and natural conditions. It is possible that future development may occur elsewhere in the region, including wind, but neither the likelihood nor extent of such development can be reasonably predicted at this time based on currently known information.

21.11 References

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22.0 Heritage and Cultural Resources

22.1 Scope of Assessment

Heritage and cultural resources are non-renewable resources consisting of places, buildings, objects, or sediment deposits located above or below the ground and include sites, materials and, in certain instances, landscapes and/or places of historical, archaeological, cultural / spiritual, palaeontological and architectural importance. Such resources can date to the t Pre-contact, Historic or contemporary periods, and are valued for their cultural, spiritual, natural, and scientific importance.

Heritage and cultural resources have been selected as a valued environmental component (VEC) as these resources can comprise the only physical information on Indigenous lifestyles prior to the arrival of Europeans in North America and help to understand the history, land-use, fossil record, and architectural history of a region. Project activities that include surface or sub-surface ground disturbance can interact with heritage and cultural resources, where these resources are present. Undocumented heritage and cultural resources are typically located on or in the soil or rock layers of the earth, and where present, Project interactions would be anticipated only during construction as this is the only phase of the Project where surface or sub-surface ground disturbance is anticipated.

The assessment of heritage and cultural resources is closely linked to and informed by the conclusions of the effect assessments for the following VEC:

- Land and Resource Use (Chapter 20) – given evidence for contemporary land and resource use may serve as proxy indicators of potential for archaeological resources pertaining to the precontact and historic periods
- Indigenous Fisheries (Chapter 21) – given heritage and cultural resources pertaining to Indigenous groups are valued for their historical, educational, and cultural and spiritual importance

The assessment of the potential for heritage and cultural resources to be affected by the Project includes the identification of known sites of historical, archaeological, cultural and spiritual, palaeontological, and architectural importance, along with the identification of locations with potential to contain as yet unrecorded sites. The following subsections (Sections 22.1.1 and 22.1.2) define and describe the scope of the assessment on the VEC.

22.1.1 Regulatory and Policy Setting

In the province of Newfoundland and Labrador (NL), heritage and cultural resources are protected under the provincial *Historic Resources Act* (1985), administered by the Provincial Archaeology Office (PAO) of the Department of Tourism, Culture, Arts and Recreation, and, in the case of architectural resources, by the Heritage Foundation of NL.

Heritage and cultural resources are typically broken down into four broad categories:

- Archaeological sites and materials (e.g., remains of habitation sites and/or stone tools pre-dating 1970)
- Cultural / spiritual sites (e.g., Indigenous and non-Indigenous burial sites and other sacred places)
- Palaeontological sites and materials (fossils)
- Architectural resources (e.g., historical buildings and properties)

Archaeological sites identified during field research in NL are recorded, inventoried, and assigned numbers under the Borden System (the Canadian registry for archaeological resources).

Contemporary cultural and spiritual sites can include, for example, evidence of campsites or tilts, or remains suggestive of hunting, fishing or trapping locations. Though recorded by provincial regulators, contemporary sites are not assigned numbers under the Borden System and they are classified or inventoried as ethnographic sites (i.e., 50 years old or less). Ethnographic sites can be affiliated with Euro-Canadians or Indigenous communities and may be subject to mitigation measures in consultation with the PAO and Indigenous communities, as warranted.

A palaeontological resource means a construct, structure, or work of nature consisting of, or being evidence of, prehistoric multicellular organisms and palaeontological resources that are designated by regulation. These resources are important for their historical, cultural, spiritual, and scientific value. Only sedimentary rocks have the potential to be palaeontological resources (i.e., fossils).

Structures or sites that are of architectural significance are designated Registered Heritage Structures by the Heritage Foundation of NL, established by the provincial government in 1985.

Indigenous groups have also identified cultural, habitation, and spiritual sites within and near the assessment areas (Stantec 2023; QFN 2023). However, information on physical and cultural heritage specific to the Indigenous groups is not publicly available. Specific sites of interest to the Indigenous groups may be recorded as archaeological sites but sites related to fishing, hunting and trapping, harvesting and gathering, water and travel ways, sacred spaces, or other current use features are not typically the types of sites subject to PAO regulation. The Indigenous groups have not identified specific concerns regarding changes to physical and cultural heritage.

22.1.2 Boundaries

22.1.2.1 Spatial Boundaries

The following spatial boundaries were used to assess Project effects, including residual environmental effects, on heritage and cultural resources in areas surrounding the Project components (Figure 22.1):

- Project Area: The Project Area encompasses the immediate area in which Project activities and components occur and is comprised of following distinct areas: the Port au Port Wind Farm, the Codroy Wind Farm, the Hydrogen/Ammonia Production and Storage Facility (hydrogen / ammonia plant), Port Facilities, and the 230 kV Transmission Lines, as well as associated infrastructure including roads, substations, and water supply infrastructure. The Project Area is the anticipated area of direct physical disturbance associated with the construction, operation and decommissioning, rehabilitation and closure of the Project. In addition to encompassing the immediate area in which Project components and activities will occur, the Project Area also includes a buffer of up to 300 m for access roads and turbines and a 350 m-wide corridor to accommodate the 70 to 75 m wide RoW for the transmission line. These buffers allow flexibility for the micro-siting of Project components during detailed design, based on technical considerations as well as the avoidance of environmentally sensitive areas, where practicable.
- Local Assessment Area (LAA): The LAA is based on the area within which direct Project-related ground disturbance has potential to occur within the Project Area. The LAA for heritage and cultural resources is the same as the Project Area as it is only within the Project Area that construction and ground-disturbing activities could interact with heritage and cultural resources. Heritage and cultural resources located outside of the Project Area are discussed in the "existing conditions" section below only to inform this assessment regarding the potential for unknown heritage and cultural resources within the Project Area. However, the resources outside of the Project Area will not be directly affected by the Project and are not considered further in this assessment.
- Regional Assessment Area (RAA): The assessment of heritage and cultural resource potential within the Project Area depends on a larger regional review of southwestern Newfoundland. The RAA for this VEC consists of an area of southwestern Newfoundland bounded to the north by Serpentine River, to the east as far as Island Pond, to the south by the community of Red Rocks, and the west by St. George's Bay and the Gulf of St. Lawrence (Figure 22.1).

Stantec

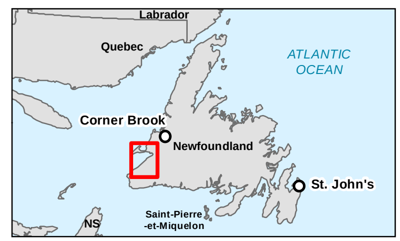
- Project Area / Local Assessment Area
- Regional Assessment Area
- Trans-Canada Highway
- Road
- Transmission Line, Existing
- Ferry Route
- Watercourse
- Waterbody
- Forested Area

N

0 10 20 km
(At original document size of 8.5x11)
1:900,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, and OpenStreetMap.
3. Background: NRCan, CanVec



Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 7/10/2023

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_022a

Figure No.
22.1

Title
Spatial Boundaries for Heritage and Cultural Resources

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22.1.2.2 Temporal Boundaries

The temporal boundaries for the assessment of potential effects on the Heritage and Cultural Resources VEC include:

- Construction Phase – Overall the construction phase of the Project will be from Q4 2023 through Q2 2027, pending EA approval and receipt of other required permits and approvals. Early civil works are planned to start Q4 2023 through Q3 2024. Construction of the Port au Port Wind Farm and associated infrastructure is expected to start in Q3 2024 with completion of the construction in Q4 2026. Construction of the Codroy Wind Farm and associated infrastructure is expected to start Q4 2025 with completion in Q1 2027. The hydrogen / ammonia plant will be constructed in phases from Q2 2024 to Q1 2026. Grid power sources are planned for hydrogen production in 2025 until March 2026, when the electrolyzer is commissioned.
- Operation and Maintenance Phase – Wind farm commissioning is anticipated to start Q1 2026 at the Port au Port wind farm and Q2 2027 at the Codroy wind farm. The 600 MW electrolyzer expected to be commissioned in Q1 2026. The operational life of the Project is 30 years at each site.
- Decommissioning and Rehabilitation Phase – After a 30-year operational life, the decommissioning phase is anticipated to occur during 2057 and 2058. Decommissioning is anticipated to begin Q1 2057 at the Port au Port wind farm, with completion in Q3 2058 at the Codroy wind farm.

Based on the nature of heritage and cultural resources and the location in which they typically found (i.e., in the upper soil and rock layers of the earth) the potential effects on heritage and cultural resources can only occur during ground disturbing Project construction activities. Potential effects on post-construction ground surfaces are not anticipated to interact with heritage and cultural resources as these activities would occur in areas already disturbed by construction. Therefore, the assessment of potential effects to heritage and cultural resources during the operation and maintenance phase and the decommissioning and rehabilitation phase of the Project will not be discussed further in this VEC.

22.2 Existing Environmental Conditions

A characterization of the existing conditions for cultural and heritage use within the spatial boundaries defined in Section 22.1.2 is provided in the following sections. This includes a discussion of the influences of past and present physical activities on cultural and heritage use, leading to the present time. An understanding of the existing conditions within the spatial area being assessed is a key requirement in the prediction of potential Project effects provided in Section 22.5.

22.2.1 Methods

Information on existing conditions (i.e., known information) for heritage and cultural resources was gathered from a desktop level through a combination of documentary research, consultation, and previous archaeological assessments conducted within or near the Project Area. Digital and archival information available from various government and non-government resources was used to gather an understanding of the general and specific history of the Project Area. Resources included:

- General archaeological, historic, and ethnohistoric literature pertaining to the broad culture-historical framework of Pre-Contact and Historic Period settlement in Newfoundland, with particular reference to settlement in the southwest of the province;
- Specific archaeological, historic and ethnohistoric literature bearing on the archaeology of the southwestern Newfoundland;
- Literature and other information on environmental factors pertinent to archaeological potential within the Project Area, such as fauna abundance, coastal, lakeshore, and riverine characteristics, and the effects of previous development;
- Aerial (Google Earth) imagery and topographic maps reviewed for preliminary identification of specific locations of enhanced archaeological potential;
- Topographic hillshade raster datasets generated from Digital Elevation Models (DEM) at 5 m resolution in a Geographic Information System (GIS) to identify potential landforms and topographic features conducive to past human settlement or activity; and
- Relevant information gathered from a traditional land and resource use study conducted for the Project.

For information regarding archaeological resources, the PAO was contacted to request baseline data relating to known heritage and cultural resources as well as reports and literature from previous archaeological work conducted in southwestern Newfoundland. Baseline data provided by PAO included known palaeontological sites. Built heritage (i.e., architectural) resources were identified through a review of the Heritage Foundation of NL's provincial database.

A field assessment for heritage and cultural resources has not yet been undertaken for the Project. A desktop level Historic Resources Overview Assessment (HROA) was completed that outlines baseline conditions and identified areas of enhanced potential for unknown heritage and cultural resources within the Project Area (Stantec 2023). The HROA recommended that if avoidance of known heritage and cultural resource sites and enhanced potential areas for unknown resources by Project-related construction activities was not possible, then a field assessment (i.e., a Historic Resources Impact Assessment (HRIA)) would be required to ground-truth these areas and conduct additional mitigation (i.e., shovel testing or excavation) as warranted.

22.2.2 Existing Conditions

The sections below describe the existing conditions for heritage and cultural resources, including archaeological, built heritage, and paleontological resources.

22.2.2.1 Newfoundland Culture-Historical Overview

Pre-Contact Period

Archaeological investigations in Newfoundland, particularly over the last forty years, have provided a relatively clear understanding of the Island's long-term culture history. The initial human occupation of the Island appears to have occurred late in the Maritime Archaic period, ca. 5,000 - 3,200 years BP (Before Present), although one site in the Deer Lake area may potentially be older (Reader 1999). Nearby southern Labrador shows clear evidence for occupation much earlier in the Maritime Archaic period, by 7,500 - 8,000 BP (McGhee and Tuck 1975, Schwarz 2010), and insular Newfoundland was theoretically habitable by this time as well (Macpherson 1981).

The scarcity of evidence for an early Archaic occupation of the Island, and the apparent delay in the expansion of Archaic hunters from Labrador to Newfoundland, has never been satisfactorily explained. The Maritime Archaic occupation (5,000 BP – 3,200 years BP) is followed, after a hiatus of several centuries, by an Early Pre-Inuit (Groswater) occupation, dating to 2,800 – 2,000 years BP. This in turn is followed by a distinct Late Pre-Inuit (Middle Dorset) occupation beginning ca. 1,900 years BP.

Dorset sites in Newfoundland are both larger and more numerous than those of any other period, and although absolute population estimates are not possible, the Dorset occupation appears to have been the most extensive. Its population levels may be the highest in the Island's pre-contact period. Perhaps because of the large size and number of sites, it has proved possible to recognize regional variation in Newfoundland Dorset artifact styles. It has been suggested that the Dorset population of Newfoundland may be divided into at least three distinct regional groups (Robbins 1985). While it may have seen the most extensive occupation, the Dorset period was also the briefest, apparently ending by ca. 1100 B.P.

The Recent First Nation Period (2,000 years BP to 200 BP) of occupation began with an early “Cow Head Complex” occupation, contemporary with the Dorset, indicating shared occupation of the Island by both Amerindian and Pre-Inuit peoples (Hartery 2007; Holly 2002). It includes subsequent cultural occupations such as the Beaches Complex and the Little Passage Complex before ending with the historically documented extinction of the Beothuk early in the nineteenth century. Beothuk sites of the early contact period (A.D. 1500-1700) have been identified on the Avalon Peninsula, Bonavista Bay, and Notre Dame Bay. Later historic Beothuk sites (A.D. 1700 - 1829) are limited to the Exploits Valley, including Red Indian Lake, among the final refuges of the Beothuk prior to their extinction in 1829 (Devereux 1965, 1970; LeBlanc 1973).

It is important to note that most archaeological work on the Island has been concentrated on the coast (Bell and Renouf 2003). Archaeologists have tended to regard Newfoundland's marine resources as rich and stable, in contrast to an interior resource base, which is limited, impoverished, and prone to periodic fluctuations in abundance (cf. Tuck and Pastore 1985). As a result, archaeologists have tended to concentrate their efforts on investigating coastal sites, assuming that the archaeological potential of the interior is generally low. It has long been recognized that the archaeological potential of one interior region - the Exploits River - has been high, but this has been viewed as unique. The archaeological resources of the Exploits Valley are dominated by the remains of the Beothuk, a people forced into a deep interior caribou hunting adaptation by the spread of European settlement along the coast. Pre-Beothuk remains are relatively scarce along the Exploits. This historic Beothuk interior adaptation ended ultimately in extinction, and the Beothuk have thus been regarded as the exception that proves the rule: successful hunter-gatherer adaptation to the deep interior is impossible over the long term and would not have occurred without competition from expanding European settlement (Robbins 1989).

Archaeological work since the 1980s, however, has somewhat modified this pessimistic view of the Newfoundland interior resource base. Examinations of the interior by a number of archaeologists (for an overview, see Schwarz 1994a) have confirmed the archaeological potential of the Newfoundland interior, for pre-contact sites, particularly on near coastal interior lakes, and along the major SW-NE-oriented river systems (most notably the Exploits River), which offer travel routes into the deep interior and strategic locations from which to intercept migrating caribou. Most of the interior sites identified to date pertain to the Recent First Nation Period, but Maritime Archaic sites have also been identified, and, increasingly, evidence for Early Pre-Inuit occupations has been discovered, even at deep-interior locations, such as Birchy Lake and the Exploits River (Erwin and Holly 2006). Late Pre-Inuit (Dorset) sites in the interior remain relatively rare. In terms of micro-locational attributes, pre-contact interior sites appear to be particularly associated with points of land and constrictions in waterways, as well as with stream mouths and falls or rapids (Schwarz 1992, 1994a).

Historic Period

Newfoundland has a long history of European settlement, and historical archaeology in Newfoundland has tended to focus on the province's unusually early European remains and on the archaeology of the historic Beothuk.

The earliest known historic European site on the Island is the Norse site at L'Anse aux Meadows, dated ca. 1000 BP (Ingstad 1969), a period that archaeologists still generally regard as "pre-contact" in Newfoundland. The intensive European migratory fishery, which developed and expanded through the sixteenth century, is documented by the Basque remains at Red Bay (Tuck and Grenier 1989). The seventeenth century has recently become a focus of investigation; outside of the Avalon, this century is still sparsely documented archaeologically, though there are likely many sites of this period along the coast, pertaining to the English, French, and Basque migratory fisheries. The eighteenth century, a period which saw significant growth in the resident population of Newfoundland, is well represented at archaeological sites across the Island.

Much of the francophone population of Newfoundland's west coast, particularly in and around Stephenville, Bay St. George, and the Codroy Valley, can trace its origins back to Acadian settlers, migrating from Cape Breton Island near the end of the 18th century, who had developed an economy based largely on farming and, to a lesser extent, fishing (Thomas 1983). A second wave of French settlement during the 19th century was the result of French fisherman who deserted their vessels and took up residence on the Port au Port Peninsula (Thomas 1977) at a time when France enjoyed fishing privileges along what is known as the French Treaty Shore (1783 – 1904). The "French Shore" covered all of western Newfoundland from Cape St. John to Cape Ray, and the Port au Port Peninsula was at its centre. Through shared language, regular interaction, and intermarriage, both the Acadians and the French settlers assimilated. Until recently, the isolation and family-based economy of Port au Port allowed for French language and customs to persist.

As with pre-contact archaeology, and for many of the same reasons, research in historic archaeology has been strongly focused on the coast. Historic European activities in the interior such as trapping (Pastore 1987, Schwarz 1995) have not been investigated archaeologically although archaeological research into European near-coastal interior "winterhousing" (Smith 1987) has recently begun (Venovcevs 2016).

For the Beothuk, the only Indigenous group in Canada to become extinct, the centuries from the late 15th century to the death of Shanadathit, the last known Beothuk, in 1829, were years when English, Portuguese, Basque, and French fishermen encroached upon not only the coast and its rich resources, but also upon salmon-fishing rivers (for reviews of this period, see Howley 1915 and Marshall 1996). Mi'kmaq settlement from the mainland also deprived the Beothuk of hunting and fishing locations, although documentary evidence suggests the Beothuk use of the St. George's River estuary near the Project, and even a period of "shared occupation" of inner St. George's Bay between Beothuk and Mi'kmaq in the early 1700s (Marshall 1996: 47-49). The Beothuk rarely traded with Europeans and their need for metal led to raiding of seasonal fishing stations during the winters, followed by retaliation from Europeans. This hostility, coupled with Europeans excluding the Beothuk from the coastline and from favoured salmon fishing spots, contributed to the decline of the Beothuk. By the 19th century the remaining Beothuk were largely confined to the Exploits River and Red Indian Lake, along with the lakes in the interior hinterland of western Notre Dame Bay.

The earliest known historical reference to the Mi'kmaq in Newfoundland is from James Cook who, in 1767, encountered Mi'kmaq families near St. George Harbour in St. George's Bay near the Project (Cook 1767). Through the 18th century, the Mi'kmaq's favoured destinations on the Island included St. George's Bay, Cape Ray, Bay d'Espoir, and Placentia (Speck 1922). Initially, Mi'kmaq in Newfoundland regularly returned to Cape Breton, but by the end of the 18th century or early 19th century, Mi'kmaq families were settling permanently in southern and southwestern Newfoundland, hunting caribou, trapping, and later, serving as guides for European explorers and sportsmen (see Pastore 1978b).

In the 18th and early 19th centuries, there was little territorial overlap between the Mi'kmaq and the Beothuk: Mi'kmaq settlement and harvesting being focused on the southern and southwestern interior from St. George's Bay to Placentia Bay, while the Beothuk ranged to the north, principally along the Exploits and Red Indian Lake (Pastore 1978b). In 1822, William Epps Cormack and his Mi'kmaq guide, Joseph Sylvester, walked across the Newfoundland interior from Trinity Bay to St. George's Bay via Flat Bay Brook near the Project, including the country between Meelpaeg, Granite Lake and George IV Lake (for a complete transcript of Cormack's journal, see Howley 1915). The Mi'kmaq families they encountered along their route informed them that the southern border of Beothuk territory lay 15 to 25 km north of the Mi'kmaq camp on King George IV Lake (Marshall 1996: 156). King George IV Lake marked the approximate eastern limit of Mi'kmaq canoe travel inland from St. George's Bay (Penney 1987).

Through the 19th century, following the demise of the Beothuk, the Mi'kmaq extended their range to encompass most of the central and western Newfoundland interior, as far north as the Bay of Exploits and Gander Bay. Although there was some competition with European trappers in the hinterlands of the northeast coast, through the second half of the 19th century and the beginning of the 20th century, the Mi'kmaq had the interior of the Island largely to themselves (Pastore 1978a: 170). In 1914, the anthropologist Frank Speck mapped the hunting and trapping territories of individual Mi'kmaq families across the Newfoundland interior. For example, the large territory extending from Sandy Lake down through Red Indian Lake, Victoria River and Lake, and Lloyd's River, as far east and Meelpaeg, and as far south as the northern end of King George IV Lake was at that time the territory of Frank Joe, a hunter and trapper of mixed Mi'kmaq and Innu descent (Speck 1922).

Archaeologically, the historic Mi'kmaq occupation of the Newfoundland interior is attested by a number of recorded 20th century "home tilts". Two historic Mi'kmaq sites, both situated on Middle Ridge east of the Bay d'Espoir Highway, have been excavated (Penney and Nicol 1984). Burnt Knaps 1 (DbAv-01) yielded the remains of a rectangular wigwam dating to the first quarter of the 20th century, and Burnt Knaps 2 (DbAv-02), appeared to be slightly older, dating to the last half of the 19th century.

Summary

In summary, previous archaeological work on Newfoundland as a whole indicates approximately 5,000 years of pre-contact Indigenous occupation in four distinct periods: two Pre-Inuit and two of Amerindian affiliation. Indigenous occupation was demonstrably intensive along the coast. Interior occupation, primarily by Amerindian groups, but increasingly including some evidence for Pre-Inuit occupation, appears to have been focused on near-coastal interior lakes, and major NE-SW-oriented lakes and rivers traversing the deep interior. Along these waterways, specific site locations tend to be associated with sandy coves and points of land, prominent constrictions in major waterways, stream confluences and stream mouths, and above or below falls and rapids. Historic European archaeological sites are known primarily from coastal areas until the 20th century, but historic Mi'kmaq and Beothuk sites have been recorded, and may be anticipated, in deep interior settings on the Island.

Ethnohistoric evidence indicates that caribou migrated to the southern barrens semi-annually (Speck 1922) and some herds may have encroached within the Project Area, particularly in the Codroy region, but archaeologically we know that coastal adapted pre-contact peoples relied heavily on the abundant marine fauna, which suggests that archaeological resources may be more conspicuous along coastal areas of the Project or near-coast interior lakes and rivers. In short, within the Project Area there is potential for pre-contact sites of all periods, particularly for sites of Maritime Archaic, Pre-Inuit, and late pre-contact Amerindian peoples. Turning to the potential for Historic Period sites, notwithstanding theoretically high potential for sites relating to European migratory fisheries and settlement, particularly those of Basques, Portuguese, French, or English origin, the Project Area lies within the territory of the Mi'kmaq prior to the second half of the 20th century, so there is potential for historic Mi'kmaq sites and, to a lesser extent, for historic Beothuk sites dating to before the second half of the 18th century, prior to their confinement to interior ranges.

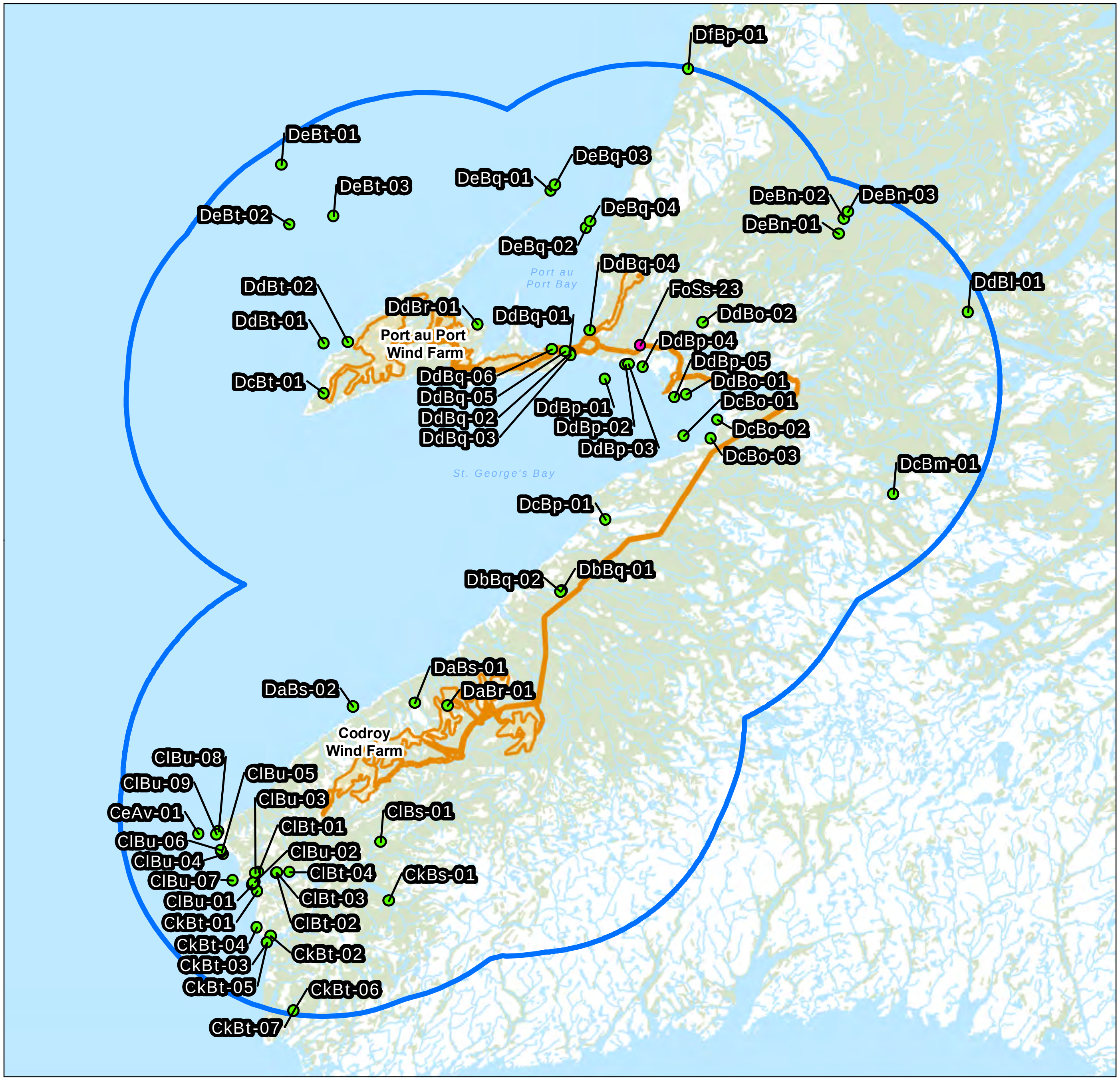
22.2.2.2 Heritage and Cultural Resources of the RAA

As the assessment of heritage and cultural resource potential within the Project Area depends on a larger regional review, this section will focus specifically on the broader RAA of southwestern Newfoundland that is bounded to the north by Serpentine River, to the east as far as Island Pond, to the south by the community of Red Rocks, and to the west by St. George's Bay and the Gulf of St. Lawrence (Figure 22.1). As can be surmised from an RAA of this magnitude, numerous professional archaeological assessments have been undertaken within it including several within the immediate vicinity of the Project Area.

The archaeological history of southwestern Newfoundland extends back to earlier in the 20th century when, in 1929, W.J. Wintemberg of Ottawa's Victoria Museum conducted archaeological surveys of areas that included Flat Bay Brook, Doyles, St. George's District, and the Grand Codroy River (Penney 1994: Appendix A). It was not until 1975, however, when the next intensive archaeological survey of western Newfoundland was conducted by Paul Carignan, Curator of Archaeology for the Newfoundland Museum. His surveys included areas of Port au Port, St George's Bay, and the Codroy Valley among others (Carignan 1975). Following this in 1983, the Port au Port Archaeology Project was initiated by David Simpson of Memorial University on behalf of the Newfoundland Museum. The aim of that project was to construct a culture history for the region and explore subsistence-settlement patterns (Simpson 1983). The next large-scale survey of the region was the Katalisk Archaeological Survey of 1993 led by Gerald Penney. Katalisk is the Mi'kmaq name for the Codroy Valley, and this survey involved a collaborative relationship with the Miawpukek Band Council of Conne River whereby community members participated and learned about archaeological field methods (Penney 1994). The Katalisk Archaeological Survey led to the registration of sixteen archaeological sites, five of which were pre-contact sites.

Development-led archaeological work known as cultural resource management (CRM) emerged over the last three decades with the ratification of the *Historic Resources Act* (1990). Along with several CRM-related archaeological assessments previously conducted within the RAA, several assessments have been conducted by the Provincial Archaeology Office (PAO) as well as by academic researchers (Barnable and Penney 2006; CRM Group 2013; Daly 2015; Daly and Green 2013 and 2014; Deal and Hillier 2007; Edwards and Schofield 2017; Guiry *et al*. 2010; Holly 2002 and 2019; Hull 2001 and 2011; JWEL 1991 and 1992; Keeping 2021; Leonard 2017; MacLean 1991; Mumford and Parcak 2018; Neudorf and Lian 2017; Penney 1980, 1994, 1995, 2001, 2014, and 2015; Penney *et al*. 2017; Rast 2003 and 2010; Reynolds 1997a and 1997b; Robbins 1985 and 1989; Schwarz 1994b; Schwarz *et al*. 2016; Simpson 1983 and 1986; Stantec 2017, 2020, and 2021, and Tuck 1989). Where relevant, information provided by these assessments and studies is presented in the sections below.

As a result of previous archaeological work, assessment of the Project's archaeological potential is therefore initially based on a review of an archaeological site inventory for the RAA provided by the PAO which includes sixty-three (63) archaeological and ethnographic (i.e., 50 years old or less) sites and one palaeontological site (i.e., fossils) for a total of sixty-four provincially registered sites. Of these, thirteen sites are associated with the Pre-contact Period, forty-six are associated with the Historic Period, three include components from both the Pre-contact and Historic Periods, one is undetermined, and one is the fossil site. Figure 22.2 shows the distribution of registered heritage and cultural resource sites within the RAA.



Stantec

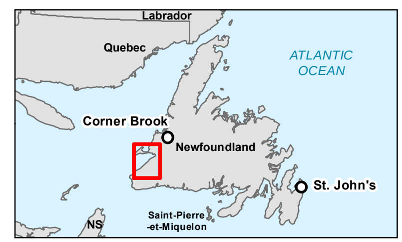
Known Heritage and Cultural Resources

- Archaeological / Ethnographic Site
- Fossil Site
- Project Area / Local Assessment Area
- Regional Assessment Area
- Watercourse
- Waterbody
- Forested Area

N

0 10 20 km
(At original document size of 8.5x11)
1:900,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, and OpenStreetMap.
3. Background: NRCan, CanVec



Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 7/10/2023

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_022b

Figure No.
22.2

Title
Distribution of Known Heritage and Cultural Resource Sites in the Regional Assessment Area

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Included amongst the pre-contact sites within the RAA (including multi-component sites) are nine sites affiliated with Pre-Inuit occupations, six are affiliated with Recent First Nation occupations, one is affiliated with a Maritime Archaic Occupation, one is tentatively affiliated with a Norse occupation, and three are of undetermined cultural affiliation. With one exception (discussed in Section 22.2.2.3), most of the pre-contact sites represent site types that do not reflect habitation per se (due to a lack of dwelling features), but rather undetermined activity areas or find spots. With respect to the RAA's Historic Period sites, thirty-four are considered European, thirteen are considered Euro-American, two are believed to be affiliated with historic Mi'kmaq, and one is of undetermined cultural affiliation. Historic site types include thirteen shipwrecks, twelve habitation sites, five industrial / work sites, five aircraft wrecks, two temporary camp sites, two cemeteries, two log cabin "hotels", a burial site, and five undetermined activity areas.

Although located just outside of the RAA, there is one site complex that is very important to the archaeology of southwest Newfoundland which is the Cape Ray Light site (CjBt-01). It was first excavated in the 1960s and has been re-visited for study by archaeologists on numerous occasions since (Devereux 1966; Fogt 1998; Linnamae 1975). The Cape Ray Light site represents several occupations by Groswater and Dorset Pre-Inuit dating to between 2,400 years BP and 1,300 years BP and includes several dwellings, a midden, hearths, and a possible tent ring. It is interpreted as a seal hunting basecamp and much of the lithic cultural material that was recovered, specifically cherts and soapstone, may have been sourced from outcrops in the Port au Port region (Fogt 1998: 97). As such, traces of Pre-Inuit activity near the Project Area could potentially relate directly to the Cape Ray Light site.

22.2.2.3 Heritage and Cultural Resources of the Project Area

This section will provide more detail on the archaeological sites and signatures of heritage resource potential within or near the Project Area and is organized according to the three main areas of the Project. Preliminarily, it should be noted that out of the sixty-four heritage and cultural resource sites registered by the PAO within the RAA, six interact directly with the Project Area. These are described below (i.e., DdBq-01, DdBq-02, DdBq-05, DdBq-06, FoSs-23, and DaBr-01). Two additional registered sites are within 500 m of the Project Area (i.e., DdBq-03 and DdBq-04) and their relevance for heritage resource potential within the Project Area is discussed. The PAO has confirmed that all sites in proximity to this Project will have a regulatory 50 m "no disturbance" buffer associated with them (email dated June 29, 2023).

At least three previous archaeological assessments were conducted close to the Project Area (i.e., CRM Group 2013; MacLean 1991; and Penney 2014) and a fourth was conducted inside the Project Area (i.e., Penney 2015). The three assessments in close proximity relate to linear corridor projects involving telecommunications and electrical transmission lines that closely parallel much of the proposed 230 kV transmission line component of this Project. One of these assessments (i.e., MacLean 1991) led to the registration of two Historic Period sites while the other two assessments led to negative results. Although they were conducted close to this Project and their findings are taken into account, the areas assessed by those other surveys do not overlap with areas that require assessment in the field for this Project. The fourth previous assessment (i.e., Penney 2015) conducted within the Project Area refers to the Aguathuna Quarry Site, a registered archaeological site discussed in more detail below. One implication of Penney's (2015) assessment of the Aguathuna Quarry Site is that a field-based site reconnaissance of that study's footprint the Project may be unwarranted since it was previously assessed within the last few years.

Port au Port Wind Farm

The proposed Port au Port wind farm comprises the Port au Port West collector system located on the Port au Port Peninsula and the Port au Port East collector system located on the mainland east of the isthmus connecting the two areas. Both areas belong to the Port au Port ecological subregion, which is characterized by exposed limestone barrens, shallow soils with high pH (due to the limestone), and large areas of exposed bedrock. The climate is rather anomalous compared to other nearby subregions in that summers are generally warmer with a longer frost-free period but with cold winters and heavier snowfall (Damman 1983). A key factor in why the Port au Port region would have been attractive to pre-contact peoples, especially for Pre-Inuit groups, is that the peninsula acts as a stopping point for the annual Harp seal migration along the western coast of the Island. Moreover, the rivers in the region are rich in anadromous fish runs and there are outcrops of high-quality chert available. One such outcrop, the East Bay Outcrop, has been registered as an archaeological site (DdBq-04) and is located on the mainland coast of Port au Port Bay at a distance of approximately 400 m from that portion of the Project Area relating to an access road and transmission lines for the Port au Port East collector system. Another outcrop of fine chert has been registered on the peninsula at Piccadilly Head (DdBr-01), 1.5 km from the Project Area.

The Port au Port Site (DdBq-01) interacts directly with the overland 230 kV cable route crossing option at the Port au Port isthmus (one of two cable route options being considered by the proponent, the other being the subsea route across East Bay). The site could be considered the most significant pre-contact site on the peninsula. It was first recorded by Carignan in 1975 and has been re-visited and studied in subsequent years (Carignan 1975; Guiry *et al*. 2010; Robbins 1985; Simpson 1983 and 1986). It is located north of the isthmus overlooking East Bay but stretches for approximately 200 m along an eroding 2 m to 5 m high coastal bank. The site represents a multi-component pre-contact occupation affiliated with Dorset and Recent First Nation groups. The Recent First Nation components yielded lithic cultural material from the Beaches and Little Passage complexes. Carignan (1975) initially attributed some of this material to the Beothuk, but these have since been shown to conform to the Beaches Complex instead (Simpson 1986: 90). Although the site is actively eroding, the Dorset component is well preserved with an assemblage that includes harpoon endblades and endscrapers created from fine cherts, and faunal evidence dominated by seal bones (Simpson 1986). Simpson has suggested the site could represent a summering ground for the seal hunt based on the absence of clearly defined dwelling features. He considered the possibility however that the more substantial (and archaeologically visible) winter dwellings could have been present before potentially being washed away by erosion. Robbins (1989: 145) suggests the Dorset component at the Port au Port Site could reflect a “western expression” of Newfoundland Dorset culture characterized by large permanent or semi-permanent sites based on the availability of migratory and non-migratory seal populations throughout most or all of the year. A small assemblage of Dorset material culture, including soapstone or soapstone-like abraders, was also discovered on the peninsula near the tip of Long Point. The Long Point Site (DeBq-01), identified by Simpson, was probably much more substantial prior to eroding into Port au Port Bay (Simpson 1986:

109). Although well outside the Project Area, the Long Point Site illustrates a Dorset presence on the peninsula in two distinct locales.

Also examined by Carignan (1975) and Simpson (1986) are The Isthmus Site (DdBq-02) and the Gravel Pond Site (DdBq-03). The Isthmus Site interacts directly with the Project Area where the 230 kV transmission line crosses the isthmus at the Gravels and the Gravel Pond Site is within 200 m of this proposed transmission line crossing. Both are affiliated with Late Dorset Pre-Inuit groups and contain possible Recent First Nation components (in the case of DdBq-02) and European components (in the case of DdBq-03).

The Aguathuna Quarry Site (DdBq-06) interacts directly with the Project Area where the 230 kV transmission line, substation, and an associated access road is proposed. Located in the community of Aguathuna on the south shore of East Bay, the Aguathuna Quarry Site is an industrial historic site which supplied limestone for the manufacture of steel from 1912 to 1964. The site represents "a significant early mineral extraction operation and an example of efforts to realize the resource potential of western Newfoundland following the final settlement of the French Shore issue in 1904" (Penney 2015: 76). Moreover, the Aguathuna town site, known as "The Block", is an early example of civic planning in Newfoundland and played an important role in the commercial, cultural, and settlement history of Port au Port. The site was archaeologically assessed in late 2014 by Gerald Penney Associates Ltd. (GPA). GPA identified significant remaining heritage resources at the quarry and town site and noted the considerable geological significance of the site in terms of visible fossil remains in the exposures of stratigraphy in the quarry faces. GPA (Penney 2015: 76) identified four aspects of significant heritage resources: 1) the quarry itself as an early 20th century industrial site; 2) The Block town site; 3) landscape modifications; and 4) Aguathuna as geological attraction. GPA also noted the safety risks associated with access to the quarry including loose material eroding at the 'lips' of the quarry and three conveyor openings (Penney 2015: 77). GPA recommended the openings be capped but it is not known whether this has since occurred.

Another historic period industrial site situated 2 km east of Aguathuna Quarry and which interacts directly with the 230 kV transmission line is the Lead Cove Mine Site (DdBq-05). It is a late 19th century drift mining tunnel at the base of the cliff opening onto the beach. According to Howley ([1873] 2009: 264-265), a mining promoter named Charles Fox Bennett started to mine galena there but as soon as it became promising, a French commander from a nearby fishing station felt the operation would infringe on their fishing rights, forcing the venture to be abandoned.

The Blanche Brook Site (FoSs-23), located on the mainland north of Stephenville but still within the Port au Port ecological subregion, is designated as a significant palaeontological site with protected status due to the prevalence of well-preserved tree and other plant fossils. The site interacts directly with that portion of the Project Area where the 230 kV transmission courses eastward from Port au Port peninsula to the Stephenville hydrogen / ammonia plant. According to site records, fossil occurrences span 3 km up the brook from where it is crossed by Route 460 and there is potential for fossils to be within 50 m on either side of the brook. The PAO also recommends a setback of an additional 20 m from this 50 m zone (email dated June 29, 2023). As such, the potential for fossil resources to be affected by Project-related ground disturbance in this area is considered high. It should also be noted, however, that given the prevalence of limestone bedrock throughout the Port au Port region and the Carboniferous shales of the Codroy Valley, both of which are well known for containing fossil remains, together with the observations of fossils made by GPA at the Aguathuna Quarry (Penney 2015), the potential for fossils to be encountered by Project activities anywhere within the Project Area is enhanced.

With respect to the thirteen registered shipwrecks within the RAA, eight of these are in the Port au Port region and all but three of the thirteen date to the 20th century. The three oldest shipwrecks include two from the late 18th century near Cape Ray and one that is possibly the remains of a Basque vessel at Black Bank near the mouth of St. George's River. None of the known shipwreck's interact with the Project Area but they illustrate the theoretical potential for unknown Historic Period wrecks near the marine-based areas of the Project, particularly near the shorelines around East Bay (Port au Port Bay), Little Port Harmon, and St. George's River. In relation to this, the remains of fishing stations associated with Historic Period migratory fisheries is another site-type that could theoretically be found interacting with the marine-based components of the Project.

For built heritage (i.e., architectural) resources in the Port au Port region, the Heritage Foundation of NL (HFNL 2023) lists two (2) designated heritage places in relative proximity to the Project including:

1. Our Lady of Mercy Roman Catholic Church – located on the isthmus dividing St. George's Bay from Port au Port Bay, the church is an imposing example of Renaissance Revival architecture designed by William F. Butler and built between 1914 – 1925. The building is located approximately 325 m south of the overland route option for the 230 kV transmission line.
2. Lourdes Land Settlement Municipal Heritage Site – an open area near the intersection of Main Street and Clam Bank Cove Road in Lourdes which once had buildings housing participants under the Commission of Government's Land Settlement program in the mid-1930s where the settlement of 27 families occurred. The site is located approximately 2.5 km north of the Project Area.

Neither of these heritage places are anticipated to be affected by the Project. Furthermore, a search of the Heritage Foundation of NL's database has found that all other designated heritage places in the vicinity of the Project, including the Stephenville area, the Codroy Valley, and all areas of the Project in between, are at least 5 km or more away in distance from the Project Area. As a result, interactions between Project activities and built heritage resources are not anticipated.

Codroy Wind Farm

The proposed Codroy wind farm is located in the Codroy ecological subregion in the Anguille Mountains of the Codroy Valley (Figure 1.1). The Anguille Mountains are part of the Long Range Mountains from Cape Anguille along St. Georges Bay. The U-shaped Codroy Valley is evidence of a rich glacial history that formed a rugged and mountainous region characterized by steep slopes and deep protected valleys that are climatically the warmest on the Island (PAANL 2008). The subregion is heavily forested, primarily with balsam fir, and is covered with lush, fern-dominated vegetation due to the rich soils formed from glacial deposits and runoff. The region's wildlife is among the most diverse on the Island, particularly for migratory birds (PAANL 2008). The valley is drained by the Grand and Little Codroy rivers and is underlain by Carboniferous shales. The Grand Codroy River system provides a thoroughfare for travel between the south coast and St. Georges Bay.

Known archaeological sites in this area are primarily concentrated in the south along the coast and near the mouth of the Grand Codroy River. Many of these sites were identified during the Katalisk Archaeological Survey and include a mix of historic European and pre-contact sites attributed to Dorset Pre-Inuit and Recent First Nation occupations (Penney 1994). Closer to the proposed Codroy wind farm, only one registered archaeological site interacts directly with the Project Area with the next nearest site being more than 3 km away. The paucity of known sites in proximity to this part of the Project Area could be attributed to a combination of biases in archaeological research, which disproportionally favours the coast, and the rugged topography of the region, which might have impeded field surveys. It is also understood that historic period European groups comprised of French, Irish, English, and predominantly Scotch settlers, who arrived in the mid-19th century, tended to avoid these more elevated and rugged areas of the region. As agrarian communities, they favoured the protected valley floors with rich soils near major waterways such as the Grand Codroy River and laid the foundations for the established communities that dot the valley today (Ommer 1973). Pre-contact and Historic Period Indigenous groups are also not likely to have strayed too far from the abundant resources of the valleys, but temporary encampments from logistical forays (Binford 1982) could still potentially be encountered in the mountainous areas pertaining to caribou hunting, trapping, tool-stone acquisition, and the harvesting of edible plants and balsam fir for fuel and construction.

The Codroy Pond C-54 Site (DaBr-01) is the only site that interacts directly with the Project Area associated with the Codroy wind farm. It comprises a Douglas C-54A Skymaster aircraft wreck that crashed in the mountains as it made its way to deliver cargo and supplies to Harmon Air Force Base in 1944 (Deal and Hillier 2007). As of 2006, many pieces of the wreck still remained at the site, but it may have been subjected to looting. The location of the crash site is at a distance of approximately 200 m from the location of a proposed wind turbine and has a 50 m regulatory no disturbance buffer.

Port of Stephenville Hydrogen / Ammonia Plant and Port Facilities

The Port of Stephenville hydrogen / ammonia plant and port facilities will be located on privately-owned land at the Port of Stephenville on a property already designated for industrial use. Based on a review of aerial imagery including historic air photos from Natural Resources Canada (NRC 1949), the landscape around the site has undergone extensive previous development, modification, and disturbance since it was constructed by the US Corps of Engineers in the early 1950s after which it served as a base for naval, commercial, and government marine operations for national and international users (Port of Stephenville 2023). The overall property is known locally as the Abitibi Mill site. From 1970 to 1973, the Linerboard Mill was located there before it closed in 1977 and was subsequently acquired by Abitibi-Price in 1979. They eventually became the Abitibi-Consolidated Company of Canada and converted the facility to a newsprint operation up until 2005. Demolition and limited site rehabilitation was conducted during 2007 and 2008. This industrial area is considered a brownfield and still contains several large above ground bulk fuel and liquids storage tanks and piles of demolition debris with the most visible components being piles of broken concrete with rebar scattered over the old plant site.

Although the area in and around the barriered lagoon could have been attractive for Pre-contact and Historic Period use, the areas specifically where the plant and port facilities are proposed appear to have been stripped away of original soils that might have contained heritage resources, particularly for the plant site property and the southeastern shoreline of the lagoon where extensive modifications to the land have occurred. The nearest registered sites to this part of the Project include the Seal Cove Site (DdBo-01), a Recent First Nation occupation, and the Rosalie Mage Site (DdBp-05), a 1942 freighter shipwreck. Both of these sites are 2 - 3 km away from the Project Area along the Indian Head coastline.

22.2.2.4 Heritage and Cultural Resources from Traditional Land and Resource Use Study

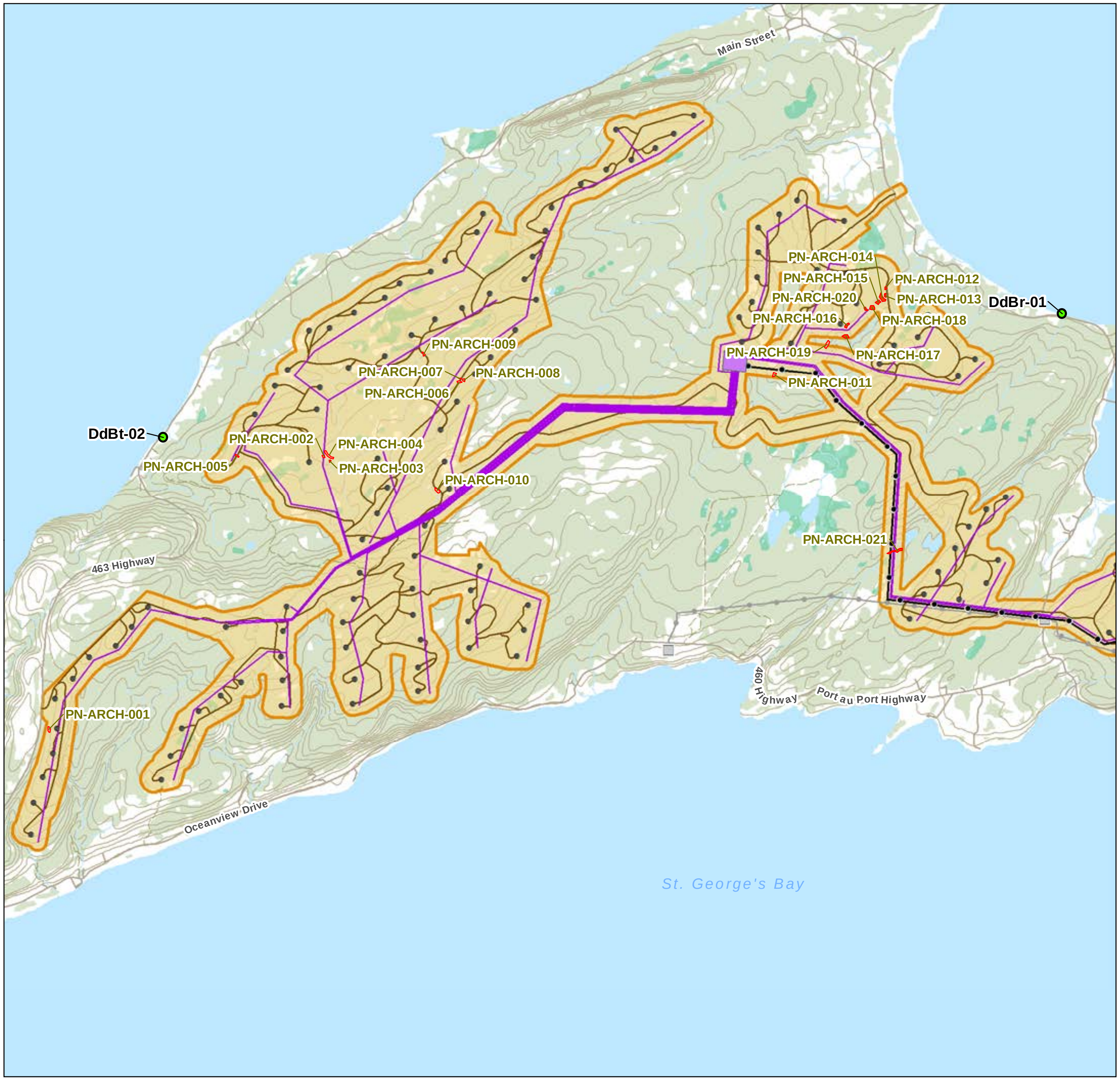
As part of the Project's environmental baseline studies, a study on the traditional land and resource use (TLRU) by Indigenous groups was conducted (see Chapter 21). Qalipu First Nation undertook a study entitled, "The Collection of Current Land Use and Aboriginal Traditional Knowledge" (ATK study) in 2023 (QFN 2023). Qalipu First Nation have identified several current use sites (e.g., Mi'kmaq village sites, harvesting sites, cultural and spiritual sites / features, etc.) within or near the Project Area. These sites were all represented as 10 km² polygons in consideration of data sensitivity and user anonymity (QFN 2023: 5). Due to the generalized nature of the spatial data reported in the ATK study, it is not possible to discern the precise location of each of the current use sites or determine if any of these sites are already known and/or registered with the PAO and described above, nor is it possible to calculate the exact distance between these current use sites and Project components. As a result, it is unclear if one or more of these current use sites would be directly affected by Project-related ground disturbance and / or land clearing activities during the construction phase. WEGH2 will continue to engage with the Indigenous communities regarding the Project design and that once additional details on the specific proposed locations of Project features are identified, this information will be shared with the Indigenous community to determine if there may be potential interactions with the current use sites. Where interactions are confirmed, mitigation will be implemented, in consultation with the PAO and Indigenous community, up to and including changes to the design of the Project to avoid these sites as practicable.

22.2.2.5 Heritage and Cultural Resource Potential within the Project Area

Five registered archaeological sites and one registered palaeontological site have been inventoried for a total of six known heritage and cultural resource sites within the Project Area. These known sites support theoretical potential for unknown heritage and cultural resources elsewhere within the Project Area, including the potential for resources relating to fossils, or to human activity from any period and culture within the last 5,000 years of human occupancy on the Island of Newfoundland. Some potential may have been reduced by the effects of previous development; including industrial development or the flooding of rivers and lakes for hydroelectric projects. Potential may be particularly high, however, on dry, level, habitable terrain, particularly near coves or points of land and constrictions in waterways, stream mouths and confluences, falls, and rapids.

As detailed in the Aquatic Environment Baseline Study (BSA-2), the Project will require approximately 600 watercourse / waterbody crossings. With a Project Area of this magnitude, an effort was made to refine the scope of the assessment of archaeological potential by excluding proximity to specific watercourse / waterbody types that are not necessarily conducive to past human activity. These include watercourses defined as overland drainages (e.g., slopewash) and those documented with no visible channels. For waterbodies, bog holes were excluded from consideration as data-driven archaeological modeling suggests that known sites do not appear to be affiliated with water features exhibiting these characteristics. Specific attention was given to areas within 50 m of all major watercourses and coastal areas within the Project Area as well as fish-bearing streams and lakes which are known to have been favoured by Pre-contact and Historic Period peoples.

Review of mapping overlays that combined aerial imagery, topographic hillshades generated from 5 m DEMs, refined surface water data, and known heritage and cultural resource baseline data led to the identification of 77 locations within the Project Area with enhanced potential to yield heritage resources. Other topographic characteristics such as steep slopes, aspect, and elevation were also considered during the assessment. Areas of enhanced potential that have been identified are subdivided into three main categories: 'Medium', 'High', and 'Known' Areas of heritage and cultural resource potential. Collectively, these areas are referred to as 'enhanced' archaeological potential areas. For this assessment specifically, the 'Medium" potential category refers to areas within the elevated, mountainous portions of the Project such as found at the Port au Port West and East collector systems and the Codroy wind farm (Anguille Mountains) where evidence for transitory activity areas or temporary encampments from logistical forays by past peoples might be found. Of the 77 enhanced archaeological potential areas, 21 are associated with the 'Medium' potential category. The 'High' potential category refers to those areas more conventionally understood to be favoured by past groups characterized by proximity to various amenities. Fifty-one areas out of the 77 are associated with the 'High' potential category. The latter 'Known' potential category refers to areas where the Project interacts with known sites. Five areas out of the 77 are associated with 'Known' archaeological potential. It should be noted that although these areas all lie within the Project Area, several of these locations may not interact directly with Project components that require ground disturbing activities, for example, the transmission line will only have groundbreaking at the structure locations (although there will be vegetation removal between the structures). Figure 22.3 shows the areas of enhanced archaeological resource potential within the Project Area.



Stantec

Archaeological Potential Area
- Medium Potential
- High Potential

Known Heritage and Cultural Resources
- Archaeological / Ethnographic Site

Proposed Project Features
- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Substation
- Project Area

Other Features
- Substation, Existing
- Transmission Line, Existing
- Road
- Resource Road / Trail
- Contour (20 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

0 1.5 3 km
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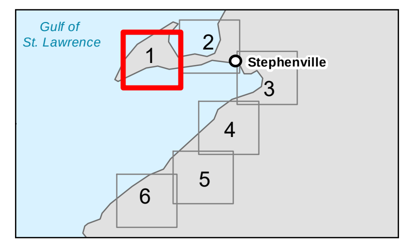
Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MR on 7/7/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
22.3

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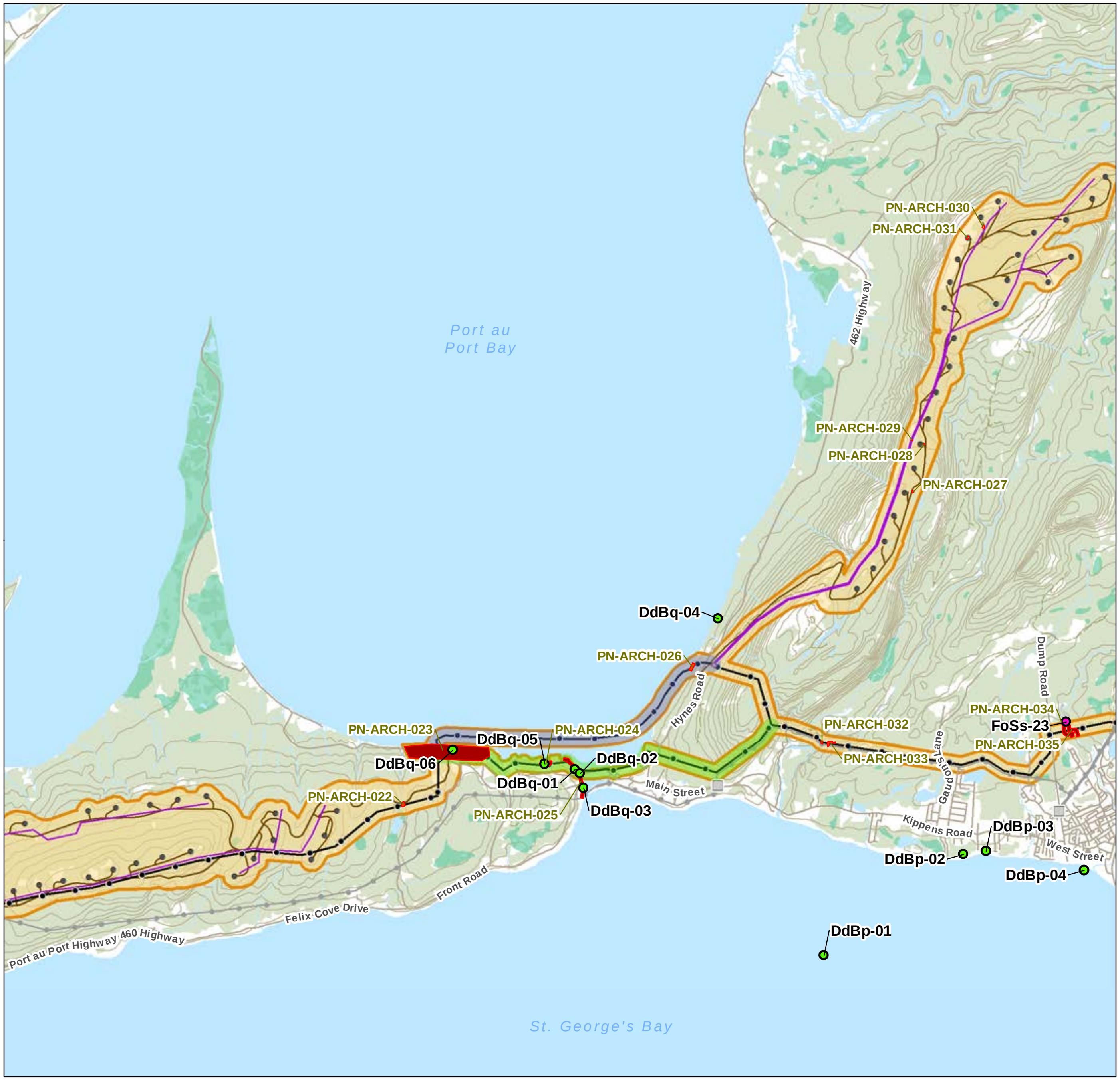
Archaeological Potential Areas - Port au Port West



Stantec

Archaeological Potential Area

- Medium Potential
- High Potential
- Known Potential

Known Heritage and Cultural Resources

- Archaeological / Ethnographic Site
- Fossil Site

Proposed Project Features

- Turbine Location
- Transmission Line 230 kV

Port au Port Interconnection

- Proposed Route
- Alternate Route

- Collector Line
- Access Road
- Substation
- Project Area

Other Features

- Substation, Existing
- Transmission Line, Existing
- Road
- Resource Road / Trail
- Contour (20 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

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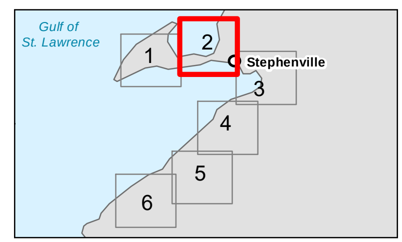
Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MR on 7/11/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
22.3

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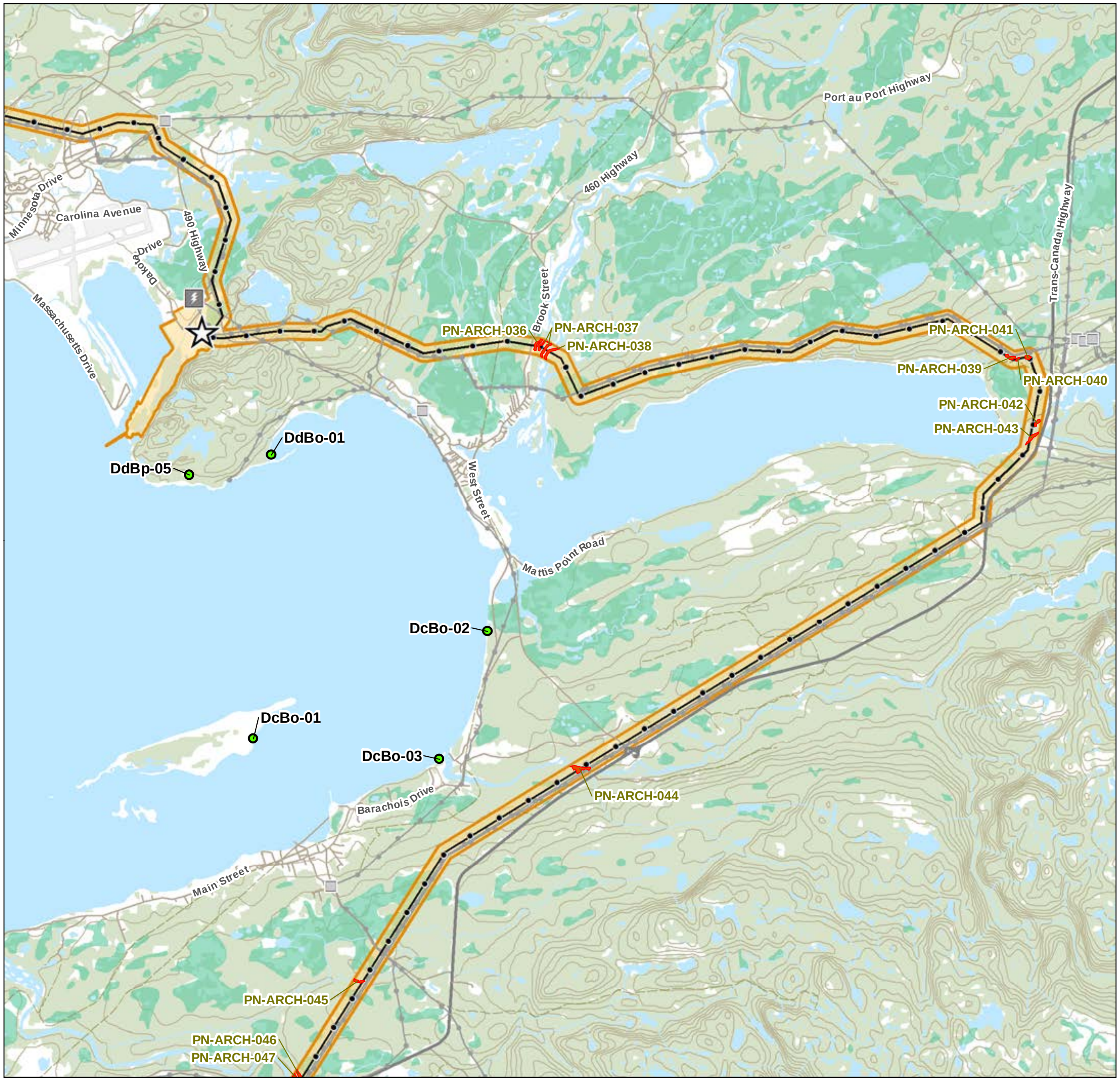
Archaeological Potential Areas - Port au Port East



Stantec

Archaeological Potential Area

High Potential

Known Heritage and Cultural Resources

Archaeological / Ethnographic Site

Proposed Project Features

Hydrogen / Ammonia Plant Location

Transmission Line 230 kV

Project Area

Other Features

Substation, Existing

Electrical Generation, Existing

Transmission Line, Existing

Trans-Canada Highway

Road

Resource Road / Trail

Contour (20 m)

Watercourse

Waterbody

Wetland

Forested Area

N

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Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
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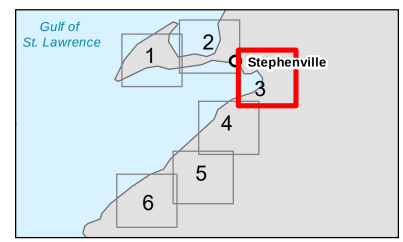

Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
22.3

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Archaeological Potential Areas - Port of Stephenville

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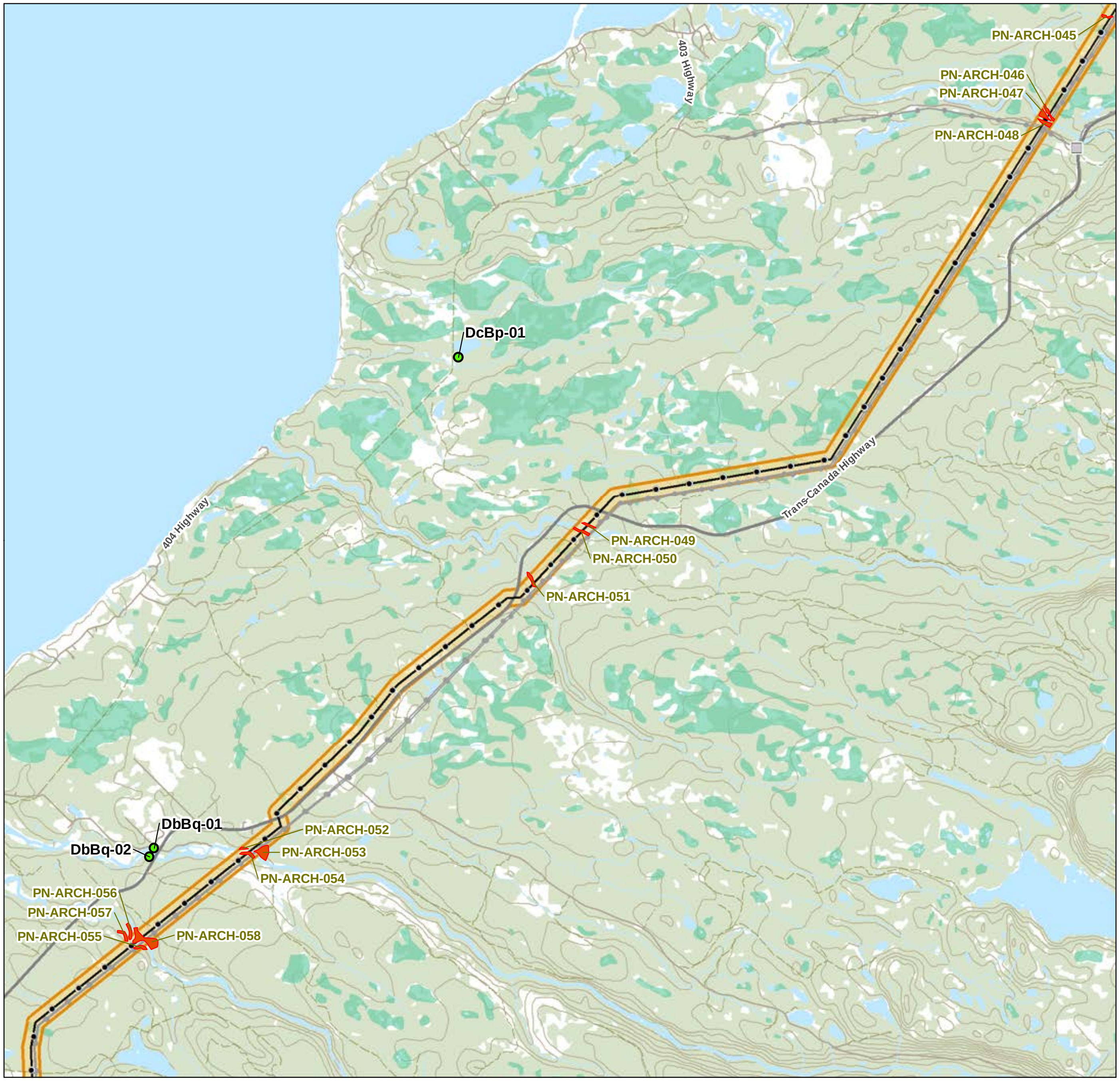

Stantec

Archaeological Potential Area

High Potential

Known Heritage and Cultural Resources

Archaeological / Ethnographic Site

Proposed Project Features

Transmission Line 230 kV

Project Area

Other Features

Substation, Existing

Transmission Line, Existing

Trans-Canada Highway

Road

Resource Road / Trail

Contour (20 m)

Watercourse

Waterbody

Wetland

Forested Area

N

0 1.5 3 km

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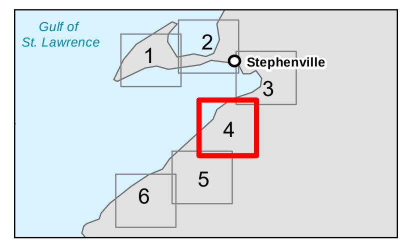
Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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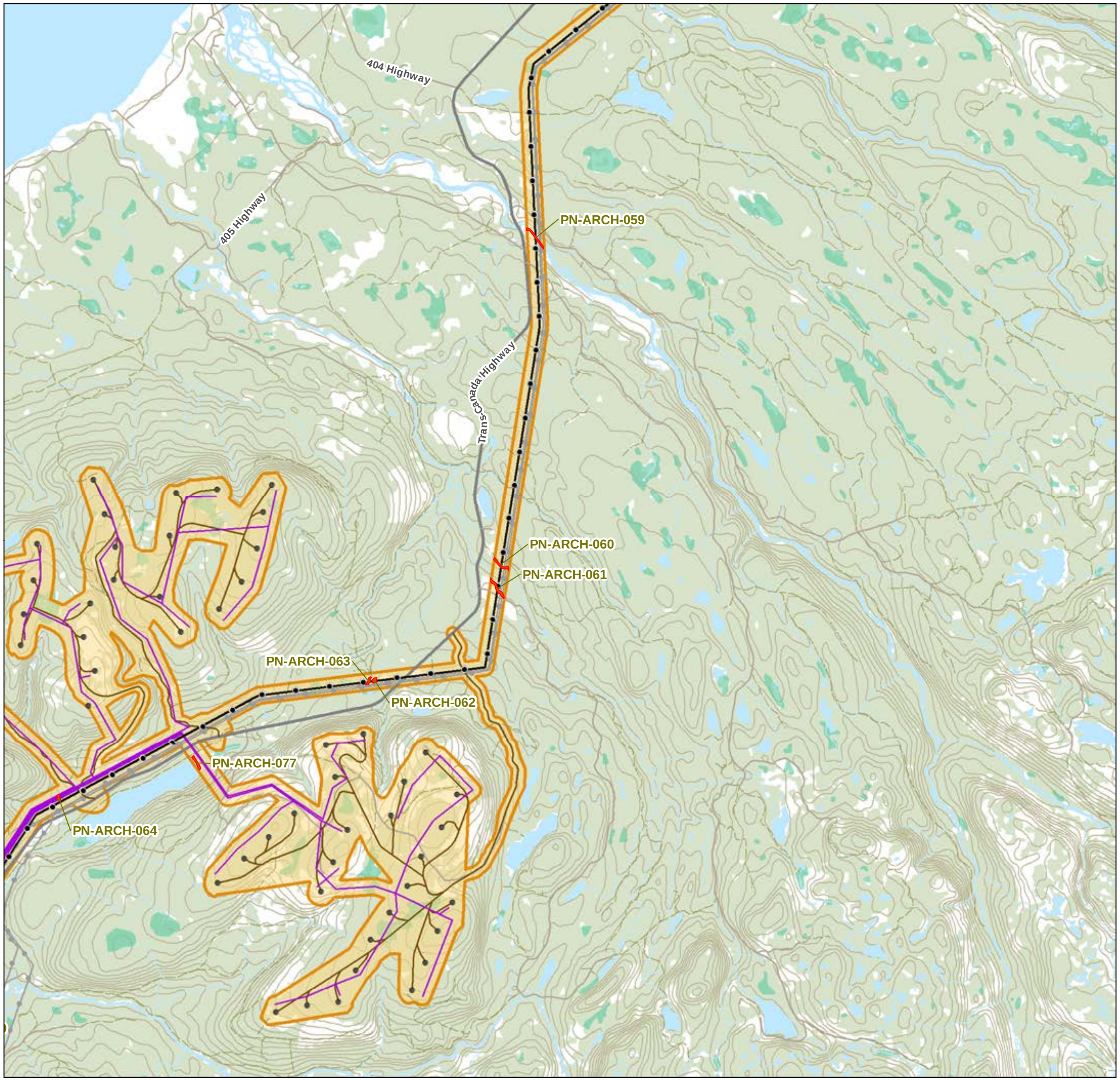
Figure No.
22.3

Archaeological Potential Areas - Fischells



Stantec

Archaeological Potential Area
- High Potential

Proposed Project Features
- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Project Area

Other Features
- Transmission Line, Existing
- Trans-Canada Highway
- Road
- Resource Road / Trail
- Contour (20 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
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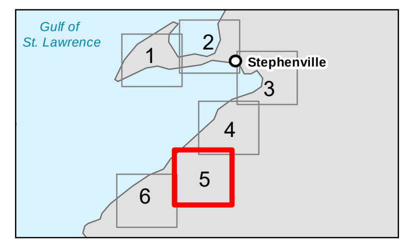

Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
22.3

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Archaeological Potential Areas - Highlands

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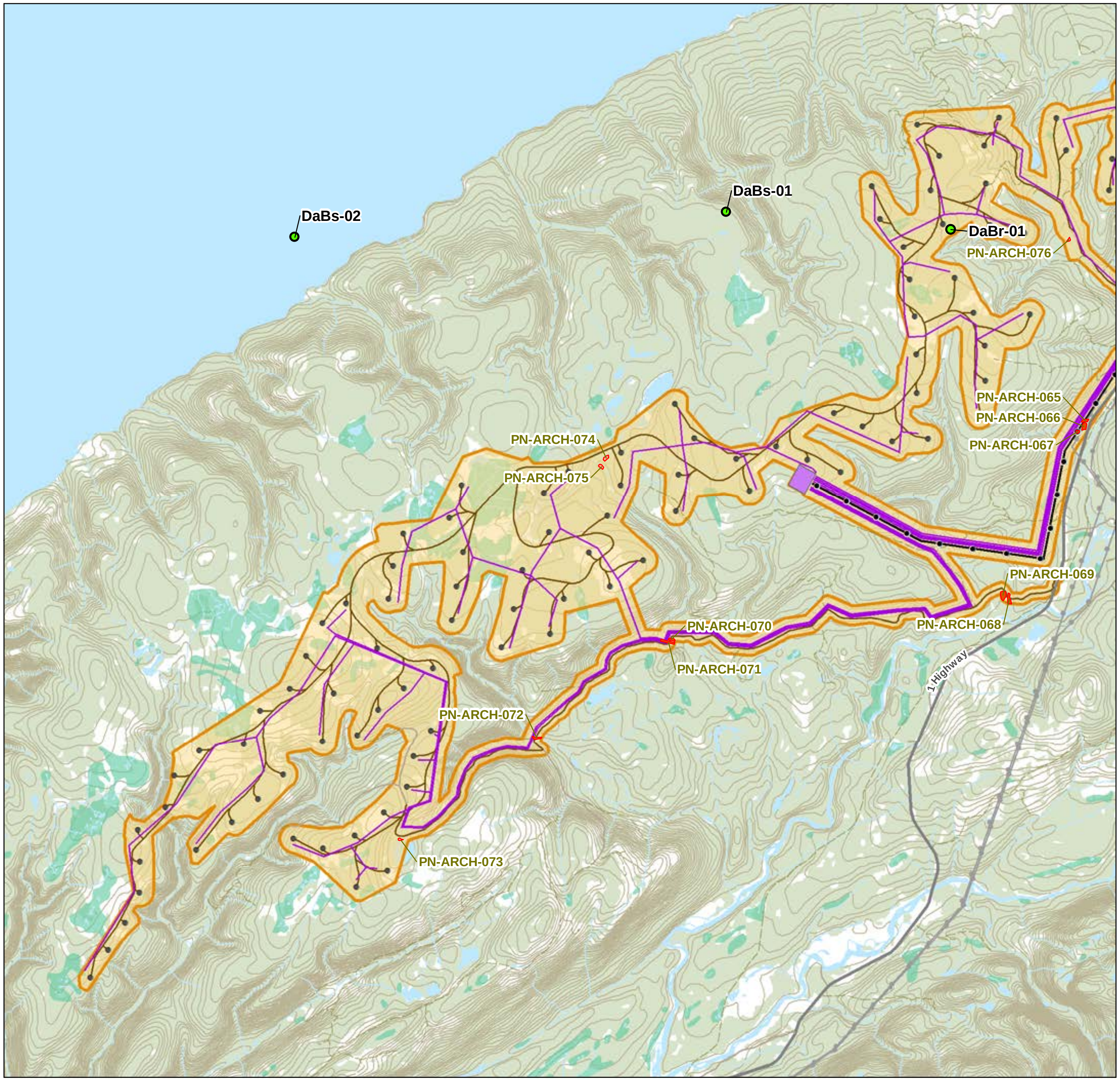

Stantec

Archaeological Potential Area
- Medium Potential
- High Potential

Known Heritage and Cultural Resources
- Archaeological / Ethnographic Site

Proposed Project Features
- Turbine Location
- Transmission Line 230 kV
- Collector Line
- Access Road
- Substation
- Project Area

Other Features
- Transmission Line, Existing
- Trans-Canada Highway
- Road
- Resource Road / Trail
- Contour (20 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, PAO, NRCan CanVec, OpenStreetMap
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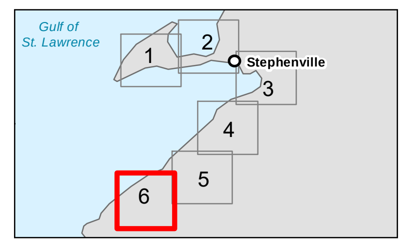

Project Location
Stephenville
NL

Prepared by MR on 7/10/2023
QR by AW on 2023-07-07

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
22.3

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Archaeological Potential Areas - Codroy

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22.3 Assessment Criteria and Methods

This section describes the criteria and methods used to assess environmental effects on heritage and cultural resources. Residual environmental effects (Section 22.5) are assessed and characterized using criteria defined in Section 22.3.1, including direction, magnitude, geographic extent, timing, duration, frequency, reversibility, and ecological or socio-economic context. The assessment also evaluates the significance of residual effects using threshold criteria or standards beyond which a residual environmental effect is considered significant. The definition of a significant effect for heritage and cultural resources is provided in Section 22.3.2. Section 22.3.3 identifies the environmental effects to be assessed for heritage and cultural resources, including effect pathways and measurable parameters. This is followed by the identification of potential Project interactions with this VEC (Section 22.3.4). Analytical assessment techniques employed for the assessment of potential Project-related environmental effects on heritage and cultural resources are provided in Section 22.3.5. The assumptions that were made to support a conservative approach to the assessment of residual effects on heritage and cultural resources are described in Section 22.3.5.1.

22.3.1 Residual Effects Characterization

Table 22.1 presents definitions for the predicted environmental effects characterization of the undertaking on heritage and cultural resources. The criteria are used to describe the potential residual effects that remain after mitigation measures have been implemented. Quantitative measures have been developed, where possible, to characterize residual effects. Qualitative considerations are used where quantitative measurement is not possible.

Table 22.1 Characterization of Predicted Environmental Effects of the Undertaking on Heritage and Cultural Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Nature	The long-term trend of the residual effect	• **Neutral –** No net change in the measurable parameter(s) for heritage and cultural resources relative to baseline • **Positive –** A residual effect that moves the measurable parameter(s) in a direction beneficial to heritage and cultural resources relative to baseline • **Adverse –** A residual effect that moves the measurable parameter(s) in a direction detrimental to heritage and cultural resources relative to baseline

Table 22.1 Characterization of Predicted Environmental Effects of the Undertaking on Heritage and Cultural Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	The amount of change in measurable parameter(s) of the VEC relative to existing conditions	• **Negligible** – No likely loss or disturbance of significant (as determined by the PAO) heritage resources • **Low** – Disturbance of heritage resources determined to be significant by the PAO, although with implementation of prior mitigation for effective recovery of the resource and associated information, and with all necessary regulatory approvals • **Moderate** – Moderate disturbance or loss of all or a portion of a heritage resource determined to be significant by the PAO, and its associated information, or a direct effect on a known heritage resource, which is of interest and concern to the associated community that does not reduce the overall integrity and cultural value of the site • **High** – Disturbance or loss of a heritage resource determined to be significant by the PAO, with no retrieval of the resource and its associated information, or a direct effect on a heritage resource, which reduces the overall integrity and cultural value of the site
Geographic Extent	The geographic area in which a residual effect of a defined magnitude occurs	• **Project Area –** Residual effect is restricted to the Project Area
Timing	Considers when the residual environmental effect is expected to occur, where applicable or relevant to the VEC	• **No Sensitivity –** Timing does not affect heritage and cultural resources
Duration	The period of time required until the measurable parameter(s) or the VEC returns to its existing (baseline) condition, or the residual effect can no longer be measured or otherwise perceived	• **Permanent –** Heritage and cultural resources are static and finite; therefore, residual effects are always permanent, with no return to pre-existing conditions
Frequency	Identifies how often the residual effect occurs during the Project, during a specific phase of the Project, or during another specified time period	• **Single event –** An effect on heritage and cultural resources occurs only once (i.e., disturbance results in the loss of context)
Reversibility	Describes whether a measurable parameter(s) or the VEC can return to its existing condition after the Project activity ceases, including through active management techniques	• **Irreversible –** Residual effect is unlikely to be reversed

Table 22.1 Characterization of Predicted Environmental Effects of the Undertaking on Heritage and Cultural Resources

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Ecological / Socio-economic Context	Existing conditions and trends in the area where the residual effect occurs	• **Undisturbed –** Area is relatively undisturbed or not adversely affected by human activity • **Disturbed –** Area has been substantially previously disturbed by human development or human development is still present

22.3.2 Significance Definition

A significant residual adverse effect on heritage and cultural resources, in accordance with the *Historic Resources Act*, is defined as a residual Project-related change to the environment that results in the following:

- The unauthorized disturbance or destruction of a heritage resource that is determined by the provincial regulator (PAO) to be an archaeologically significant heritage resource and that cannot be mitigated

22.3.3 Potential Environmental Effects, Project Pathways, and Measurable Parameters

Table 22.2 lists the potential Project effects on heritage and cultural resources and provides a summary of the Project effect pathways and measurable parameters and units of measurement to assess potential effects. Potential environmental effects and measurable parameters were selected based on review of recent environmental assessments for large development projects in NL, renewable energy projects in other parts of Canada, comments provided during engagement, and professional judgment.

Table 22.2 Environmental Effects, Effect Pathways, and Measurable Parameters for Heritage and Cultural Resources

Environmental Effect(s)	Effect Pathway(s)	Measurable Parameter(s) and Units of Measurement
Loss of information about or alteration to heritage and cultural resources and their context	• Project interactions whereby physical works result in the disturbance or destruction of whole or part of a heritage and cultural resource during Project-related ground disturbance during construction.	• Significance (i.e., Negligible, Low, Moderate, or High as determined by the PAO) of the heritage and cultural resource affected in the Project Area • Integrity (i.e., undisturbed, partially disturbed, or disturbed) of a heritage and cultural resource site in Project Area

Undocumented heritage and cultural resources, where present, are typically located in the upper soil or rock layers of the earth and, therefore, potential interactions between these resources (particularly archaeological resources and palaeontological resources, if they are present) and the Project would take place during the construction phase. Construction activities that could result in a potential interaction with heritage resources include site preparation (*e.g.*, clearing, grubbing, detouring and ditching, excavation and blasting, if required), temporary facilities, and the construction of Project components. Groundbreaking, earth moving, and in-filling activities will be limited to areas of the Project where major construction components and activities are anticipated. These activities will largely be carried out by mechanical means and can interact with heritage resources as these activities may result in some ground disturbance. Specifically, ground disturbance could interact with registered archaeological / palaeontological sites within the Project Area or unknown sub-surface archaeological and palaeontological resources, if present, within the Project Area. With no built heritage resources identified inside the Project Area, interactions between Project construction activities and built heritage resources are not anticipated. Therefore, built heritage resources will not be assessed further in this VEC. Any equipment that may need to be installed will take place after foundations and other surface and subsurface infrastructure are installed and will not interact with heritage resources.

22.3.4 Project Interactions with Heritage and Cultural Resources

Table 22.3 uses checkmarks to indicate the routine Project activities that could interact with heritage and cultural resources and result in the identified environmental effect(s) to be assessed. Immediately following Table 22.3, environmental effects pathways are briefly described for potential routine Project-related environmental effects and justification is provided in cases where no Project interaction with the VEC (and therefore no potential environmental effect on the VEC) is predicted.

Table 22.3 Project Interactions with Heritage and Cultural Resources, Environmental Effects, and Environmental Effect Pathways

Project Activities	Environmental Effect(s) to be Assessed
	Loss or Disturbance of Heritage and Cultural Resources
Construction	
Site Preparation and Civil Works (including turbine foundations, road construction, quarries, clearing, grubbing, blasting, cement production, and watercourse crossings)	✓
Transportation of Resources and Equipment (includes trucking, shipping and barging of materials)	-
Construction / Installation, Presence, Operation, and Maintenance of Temporary Workforce Accommodations and Associated Infrastructure	✓
Installation and Commissioning of Wind Turbines	✓
Installation and Commissioning of Collector Systems	✓
Installation and Commissioning of Transmission Lines and Substations (including marine cable crossing)	✓

Table 22.3 Project Interactions with Heritage and Cultural Resources, Environmental Effects, and Environmental Effect Pathways

Project Activities	Environmental Effect(s) to be Assessed: Loss or Disturbance of Heritage and Cultural Resources
Installation and Commissioning of Hydrogen / Ammonia Production, and Storage Facilities and Associated Infrastructure (including Industrial water supply infrastructure)	✓
Restoration of Existing Port Facilities (including pile driving and dredging)	✓
Emissions, Discharges, and Wastes[1]	-
Employment and Expenditures[2]	-
Operation and Maintenance	
Presence, Operation, and Maintenance of Wind Farms (including wind turbines, access roads, and collector systems)	-
Presence, Operation, and Maintenance of Transmission Lines and Substations	-
Presence, Operation, and Maintenance of Hydrogen / Ammonia Production, and Storage, Facilities and Associated Infrastructure (includes marine discharge from treatment plant)	-
Presence, Operation, and Maintenance of Port Facilities (includes loading of ammonia and vessel maneuvering within Port)	-
Emissions, Discharges, and Wastes[1]	-
Employment and Expenditures[2]	-
Decommissioning and Rehabilitation	
Presence, Operation, and Maintenance of Temporary Workforce Accommodations and Associated Infrastructure	-
Decommissioning and Rehabilitation of Wind Farms (including wind turbines, access roads, and collector systems)	-
Decommissioning and Rehabilitation of Transmission Lines and Substations	-
Decommissioning and Rehabilitation of Hydrogen / Ammonia Production, and Storage, Facilities and Associated Infrastructure	-
Decommissioning and Rehabilitation of Port Facilities	-
Emissions, Discharges, and Wastes[1]	-
Employment and Expenditures[2]	-

Notes:
✓ = Potential interaction
– = No interaction
1 Emissions (e.g., light, noise, vibration, air contaminants and GHGs), discharges (e.g., wastewater and other liquid effluents), and hazardous and non-hazardous wastes are generated by many Project activities. Rather than acknowledging this by placing a checkmark against each of these activities, "Emissions, Discharges, and Wastes" is listed as a separate item under each phase of the Project.
2 Project employment and expenditures are generated by most Project activities and are the main drivers of many potential socio-economic effects. Rather than acknowledging this by placing a checkmark against each of these activities, "Employment and Expenditures" is listed as a separate item under each phase of the Project.

In the absence of mitigation, the Project may interact with heritage and cultural resources in the following ways:

- Site preparation and civil works as well as the installation of site infrastructure require some level of ground disturbance and could therefore disturb or destroy archaeological sites and objects and, equally importantly, may disturb or destroy the context that provides information on their order of deposition in the ground as well as what natural processes have taken place in the ground since their deposition.

The following Project activities are not expected to result in a loss or disturbance of heritage and cultural resources:

- Given that heritage and cultural resources are located on or immediately beneath the surface and are static and finite, Project interactions are restricted to physical works that are associated with ground disturbance and are primarily associated with construction activities. Therefore, Project activities on post-construction ground surfaces are not anticipated to interact with heritage and cultural resources as these activities would occur in areas already disturbed by construction.

22.3.5 Analytical Assessment Techniques and Level of Knowledge

The assessment of residual environmental effects on heritage and cultural resources is based on their definition as static and situated upon or beneath the ground surface. It is assumed that ground disturbance, particularly extensive ground disturbance, has the potential to adversely affect known heritage and cultural resources in the Project Area and any unknown heritage and cultural resources, if present, in the Project Area.

Six known heritage and cultural resource sites (i.e., five archaeological sites and one palaeontological site) are present within the Project Area and the potential exists for the presence of unknown heritage resources. In the case of archaeological resources, archaeological potential is highest on dry, level terrain adjacent to streams and waterbodies, particularly at constrictions, confluences, and rapids. Seventy-seven archaeological potential areas have been identified within the Project Area. Based on the geology of the Project Area, which is underlain by sedimentary rock, the potential for unknown palaeontological resources is also enhanced.

22.3.5.1 Assumptions and Conservative Approach

Archaeological field assessment of enhanced potential locations prior to ground disturbance can verify the potential of these locations and enable the implementation of further mitigation measures. However, field assessment cannot be certain that all heritage and cultural resources which may be present have been identified, and it is feasible for heritage and/or cultural resources to be present in areas other than the high-potential locations as determined by the HROA conducted for this Project. Consequently, mitigation must also include development and implementation of measures to enable identification and mitigation of unanticipated discoveries.

22.4 Mitigation Measures

A series of environmental management plans will be developed by WEGH2 to mitigate the effects of Project development on the environment. A full list of mitigation measures to be applied throughout Project construction, is provided in Section 26.2. Measures to mitigate potential adverse effects on heritage and cultural resources include measures to be undertaken with approval and appropriate permits issued by the PAO. In addition, the Environmental Protection Plan will include a Heritage and Cultural Resources Protection Plan that will outline mitigation for potential adverse effects on heritage resources resulting from unplanned discovery. Key measures to mitigate the potential effects of the Project on heritage and cultural resources are listed in Table 22.4, by category and Project phase.

Table 22.4 Mitigation Measures: Heritage and Cultural Resources

ID #*	Mitigation Type	Mitigation Measure	Project Phase*		
			C	O	D
300	Mitigation	Planned avoidance of known heritage and cultural resource sites (and their 50 m setbacks) by Project-related ground disturbance and land-clearing construction activities will be undertaken.	X	-	-
301	Mitigation	Measures to be undertaken with approval and appropriate permits issued by the PAO: If avoidance of areas of 'Medium' or 'High' archaeological potential is not possible, then a field assessment will be undertaken to re-evaluate these areas for heritage and cultural resource potential.	X	-	-
302	Mitigation	Measures to be undertaken with approval and appropriate permits issued by the PAO: Should the field assessment determine that the heritage and cultural resource potential of any of the identified areas remains enhanced, then additional mitigation (i.e., judgmental shovel testing) will be conducted	X	-	-
303	Mitigation	Measures to be undertaken with approval and appropriate permits issued by the PAO: If avoidance is not possible, specifically for areas of 'Known' heritage and cultural resource potential (i.e., registered historic resource sites), then additional mitigation, in consultation with the PAO, will be conducted which could include aerial excavation and documentation of the known resources.	X	-	-
304	Mitigation	Measures to be undertaken with approval and appropriate permits issued by the PAO: With regard to the two options being considered for the 230 kV cable route crossing at the Port au Port isthmus, should the proponent decide on the subsea cable route across East Bay (Port au Port Bay), a marine-based field assessment will be undertaken.	X	-	-

Table 22.4 Mitigation Measures: Heritage and Cultural Resources

ID #*	Mitigation Type	Mitigation Measure	Project Phase*		
			C	**O**	**D**
305	Mitigation	Measures to be included in the Environmental Protection Plan's Heritage and Cultural Resources Protection Plan: Prior to construction, personnel will be made aware of potential heritage and cultural resources in the area, and understand their responsibility should they identify potential heritage resources.	X	-	-
306	Mitigation	Measures to be included in the Environmental Protection Plan's Heritage and Cultural Resources Protection Plan: Personnel will be advised to report findings potentially related to heritage resources to the Site Supervisor and avoid touching or moving such findings.	X	-	-
307	Mitigation	Measures to be included in the Environmental Protection Plan's Heritage and Cultural Resources Protection Plan: Should a potential heritage and cultural resource be identified during construction, work will be suspended in the immediate area.	X	-	-
308	Mitigation	Measures to be included in the Environmental Protection Plan's Heritage and Cultural Resources Protection Plan: The area of findings will be flagged to protect it from further disturbance or looting .	X	-	-
309	Mitigation	Measures to be included in the Environmental Protection Plan's Heritage and Cultural Resources Protection Plan: A qualified archaeologist or historic resources professional will be contacted by the Site Supervisor to conduct an assessment of the site, determine if the findings are heritage resources, and make recommendations for the mitigation measures in consultation with the PAO and WEGH2, and Indigenous communities, as applicable.	X	-	-

* Note:
"ID #" denotes the master identification number for mitigation in Appendix 26-A
"C" denotes the construction phase of the Project.
"O" denotes the operation and maintenance phase of the Project.
"D" denotes the decommissioning and rehabilitation phase of the Project.
"X" denotes the relevant Project phase for the mitigation measure.

22.4.1 Application of the Precautionary Principle to Project Mitigation Measures

The mitigation measures in Section 22.4 have been selected in consideration of the environmental effects pathways and include standard proven mitigation measures for heritage and cultural resources. This assessment is based on the professional judgment of qualified archaeologists in consideration of standard codes and practices and industry standards for effective heritage management. Regulations, industry standards, and best practices have been cited where applicable.

Detailed design of the Project and mitigation strategies is currently ongoing. Mitigation measures will be refined in consideration of environmental assessment approval conditions and permit stipulations that will be incorporated into final environmental management planning. The effectiveness of these mitigation measures will be confirmed by qualified professional archaeologists and historic resource specialists as part of the development of detailed mitigation and heritage management planning in consultation with regulatory agencies (i.e., the PAO), as warranted.

The precautionary principle was used in determining mitigation measures for the Project. For example, based on our understanding of the anticipated locations for heritage resources in the region, it is not anticipated that heritage and cultural resources are present in all portions of the Project Area. However, mitigation measures are developed based on the assumption that heritage and cultural resources could be present at any location across the landscape and that there is at least some potential, however small, that a heritage or cultural resource could be found anywhere within the Project Area. Therefore, it is prudent to mitigate this possibility through the development of a Heritage and Cultural Resource Protection Plan in case of unplanned discovery.

The primary mitigation measure for heritage and cultural resources is planned avoidance of known heritage and cultural resource sites. If avoidance of areas of 'Medium' or 'High' archaeological potential is not possible, then a field assessment will be undertaken to re-evaluate these areas for heritage and cultural resource potential and additional mitigation (i.e., shovel testing) may be required. Using this conservative approach will reduce adverse Project-related effects to heritage and cultural resources.

As a result of using the precautionary principle, it is expected that the mitigation measures presented are appropriate for reducing potential adverse effects.

22.5 Residual Environmental Effects

22.5.1 Loss or Disturbance of Heritage and Cultural Resources

22.5.1.1 Construction

Potential pathways that affect heritage and cultural resources are related to direct ground disturbance resulting from site preparation and construction activities planned within the Project Area. A field-based HRIA will be conducted for the Project to evaluate archaeological potential areas identified during the desktop HROA that cannot be avoided by the construction of Project components that require ground disturbance. The HRIA will determine whether additional mitigation (i.e., judgmental shovel testing) will be required at these locations, if avoidance is not possible. The interaction with heritage and cultural resources during construction would be adverse in direction and low to high in magnitude (as determined by the PAO) as the disturbance of a heritage resource may result in the loss of information and the ability to implement mitigation following the identification of a heritage resource. The geographic extent is limited to the Project Area, the area of physical disturbance during this phase of the Project where heritage resources are located and thus the implementation of mitigation is achievable. Timing of the effect is not applicable since heritage resources are relatively permanent features of the environment, and frequency of the effect would be a single event as the disturbance of a heritage resource can only be adversely affected once. Duration of the effect is permanent, and the effect would be irreversible as the disturbance of heritage resources may result in the permanent loss of some information and context relating to the heritage resource. The implementation of a Heritage and Cultural Resource Protection Plan, however, would likely result in the recovery of most information and contribute to the understanding of the area's history. The ecological / socioeconomic context of the Project Area is disturbed / undisturbed for construction activities, since portions of the area have been subject to agricultural and previous development activities in the relatively recent past, but many areas remain where pre-Project disturbance is minimal.

In the unlikely event that a heritage resource (i.e., archaeological or palaeontological) is encountered, if it is damaged and determined by the PAO to be important, then the effect would be adverse. However, with the implementation of the mitigation described above, this effect is unlikely and, if it were to occur, would be further mitigated by the implementation of the Heritage and Cultural Resource Protection Plan that will be included in the Environmental Protection Plan to be developed for the Project.

Based on the information above, a summary of residual effects on loss or disturbance of heritage and cultural resources during the construction phase is provided in Table 22.5.

Table 22.5 Summary of Effects by Project Component During Construction

Project Site	Summary of Effect during Construction
Temporary Workforce Accommodations	Effects to heritage and cultural resources will be negligible if the siting of components for temporary workforce accommodations avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.
Port au Port Wind Farm and Associated Infrastructure	Effects to heritage and cultural resources will be negligible if the siting of components for the Port au Port wind farm and associated infrastructure avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.
Codroy Wind Farm and Associated Infrastructure	Effects to heritage and cultural resources will be negligible if the siting of components for the Codroy wind farm and associated infrastructure avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.
230 kV Transmission Lines and Substations	Effects to heritage and cultural resources will be negligible if the siting of components for the 230 kV transmission lines and substations avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.
Hydrogen / Ammonia Production and Storage Facilities	Effects to heritage and cultural resources will be negligible if the siting of components for the hydrogen / ammonia production and storage facilities avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.
Port Facilities	Effects to heritage and cultural resources will be negligible if the siting of components for port facilities and substations avoid known heritage resource sites or identified archaeological potential areas. If avoidance is not possible, effects to heritage resources are unlikely if mitigation measures outlined in Table 22.4 are applied prior to construction activities.

22.5.2 Residual Environmental Effects Summary

22.5.2.1 Residual Environmental Effects Characterization

Overall, residual effects of the Project on heritage and cultural resources are predicted to be adverse in nature and be low to moderate in magnitude, as determined by the PAO, since the disturbance of a heritage resource may result in the loss of information and the ability to implement mitigation following the identification of a heritage resource. Residual effects are anticipated to be limited to the Project Area and be permanent. Residual effects will generally occur as a single event, be irreversible, and occur in areas that range from primarily undisturbed (i.e., at the wind farm sites) to previously disturbed (i.e., at the sites of the hydrogen / ammonia production plant and port facilities). However, within the Project Area the residual effects would be limited to those areas where pre-construction mitigation was not implemented. Table 22.11 summarizes the predicted environmental effects (residual effects) of the undertaking on heritage and cultural resources.

Table 22.6 Summary of Predicted Environmental Effects of the Undertaking on Heritage and Cultural Resources

Residual Effect	Residual Effects Characterization							
	Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Construction								
Loss of Disturbance of Heritage and Cultural Resources	A	L/M	PA	NS	P	S	I	U/D
Operation and Maintenance								
Loss of Disturbance of Heritage and Cultural Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Decommissioning and Rehabilitation								
Loss of Disturbance of Heritage and Cultural Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

KEY:

Nature:
P: Positive
A: Adverse
N: Neutral

Magnitude:
N: Negligible
L: Low
M: Moderate
H: High

Geographic Extent:
PA: Project Area
LAA: Local Assessment Area
RAA: Regional Assessment Area

Duration:
ST: Short-term
MT: Medium-term
LT: Long-term
P: Permanent

Timing:
NS: No Sensitivity
MS: Moderate Sensitivity
HS: High Sensitivity

Frequency:
S: Single Event
IR: Irregular Event
R: Regular Event
C: Continuous

Reversibility:
R: Reversible
I: Irreversible

Ecological / Socio-Economic Context:
D: Disturbed
U: Undisturbed

22.5.2.2 Summary of Predicted Environmental Effects

As summarized in Table 22.11, the predicted environmental effects (i.e., the loss or disturbance of heritage and cultural resources) would be limited spatially and temporally but would be adverse and irreversible.

22.6 Determination of Significance

In consideration of the VEC-specific significance criteria defined above, the residual effect(s) of routine Project activities on heritage and cultural resources (i.e., loss or disturbance to heritage and/or cultural resources) are predicted to be not significant. With the implementation of mitigation and environmental protection measures as described above including planned avoidance of known sites, field assessment of 'Medium' and 'High' potential sites where avoidance is not possible, and consultation with the PAO and the Indigenous community, as appropriate, it is anticipated that the residual adverse environmental effects of the Project on heritage and cultural resources will be not significant. The proponent will follow the Heritage and Cultural Resources Protection Plan protocols in the Environmental Protection Plan to mitigate unexpected discoveries. If heritage resources are discovered during construction activities, a mitigation plan will be developed in consultation with the proponent, the PAO, and Indigenous communities, as appropriate. The level of confidence in this prediction is discussed in Section 22.7.

22.7 Prediction Confidence

There is a high degree of confidence in the effects prediction. If heritage and cultural resources are discovered during archeological field assessment of this, or future, projects, they will be handled appropriately and removed in keeping with government protocols and archaeological methods. Once archaeological field assessment has been completed, where required (Table 22.4), there will be low potential for interaction with unidentified sites. The planned effects management and mitigation measures are anticipated to be effective.

22.8 Follow-Up and Monitoring

As outlined in Table 22.4, the EPP will include a Heritage and Cultural Resources Protection Plan to mitigate the potential for adverse effects on heritage resources resulting from unplanned discovery. No follow-up or post construction monitoring is recommended for the Project as interactions with heritage and cultural resources are not anticipated after the construction phase since any post-construction Project activities involving ground disturbance will occur in areas already disturbed by construction.

22.9 Capacity of Renewable Resources and Effects on Biological Diversity

Potential interactions between the Project and heritage and cultural resources are not anticipated to adversely affect renewable resources or biological diversity. Therefore, adverse Project-related effects on the capacity of renewable resources to meet the needs of the present and those of the future, and adverse Project-related effects on biological diversity, are not anticipated with respect to heritage and cultural resources.

22.10 Predicted Future Environmental Conditions if the Project Does Not Proceed

Given heritage and cultural resources are static and finite, the distribution of heritage and/or cultural resources will not be altered, nor will their abundance increase if the Project does not proceed. If the Project does not proceed, there is a decreased likelihood that heritage and cultural resources, which may be present in the Project Area, will be identified, located and brought under provincial management, regulation, and protection.

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23.0 Cumulative Environmental Effects

23.1 Approach

Definitions of key terms and description of the general methodological approach used for the assessment of potential cumulative environmental effects is provided in EIS Section 5.4.1 Cumulative Environmental Effects. The following provides further details.

Given the unique aspects of assessing cumulative effects, as identified below, the approach here follows a two-step process: 1): screening; and, 2) detailed assessment. Potential effects are first screened to identify any potential cumulative effects of a substantive nature and for which adequate information is known to conduct further assessment. In Section 23.4, where screening is done, a "Project Contribution to Cumulative Effects" and/or a "Potential Degree of Overall Cumulative Interaction" ranked as Low indicates a cumulative effect that is relatively minor and adequately managed by conventional Project and other existing measures. A ranking of Moderate or High triggers advancement to detailed assessment.

The basis of this approach, in general, is to focus on key effects pathways in reflection of Project description, environmental setting, Project effects management measures, available information descriptive of other physical activities and availability of applicable effects thresholds. In specific, this approach reflects the following fundamental assumptions for this cumulative effects assessment:

- past and existing physical activities are reflected in baseline conditions
- effects of the Project are generally spatially limited; Project-specific effects assessed within the Valued Environmental Component (VEC) Local Assessment Areas (LAAs) represent the dominant spatial and temporal extent of Project and cumulative effects
- assessment of potential Project effects in the prior VEC Sections (EIS Sections 6 to 22) already represents an assessment of cumulative effects in that study area regarding cumulative interactions with other past and present physical activities
- assessment of effects on some VECs, due to the regional nature of their analysis and spatial extent of baseline, are inherently cumulative; i.e., atmospheric, acoustic and associated with socio-economics (Employment, Economy and Business; Community; Human Health; Land and Resource Use; Indigenous Fisheries)
- fullness of assessing cumulative effects is often limited by lack of details available for reasonably foreseeable physical activities at regional spatial scales
- potential cumulative effects requires identification of at least one clear cause-effect pathway that propagates Project effects beyond the LAA into the RAA; examples include:
  - multiple users of the same resource (e.g., potable water)
  - long distant transport of physical effects (e.g., air contaminants)
  - local effect on a mobile ecological receptor that transits through, away or towards the Project (e.g., avian species)

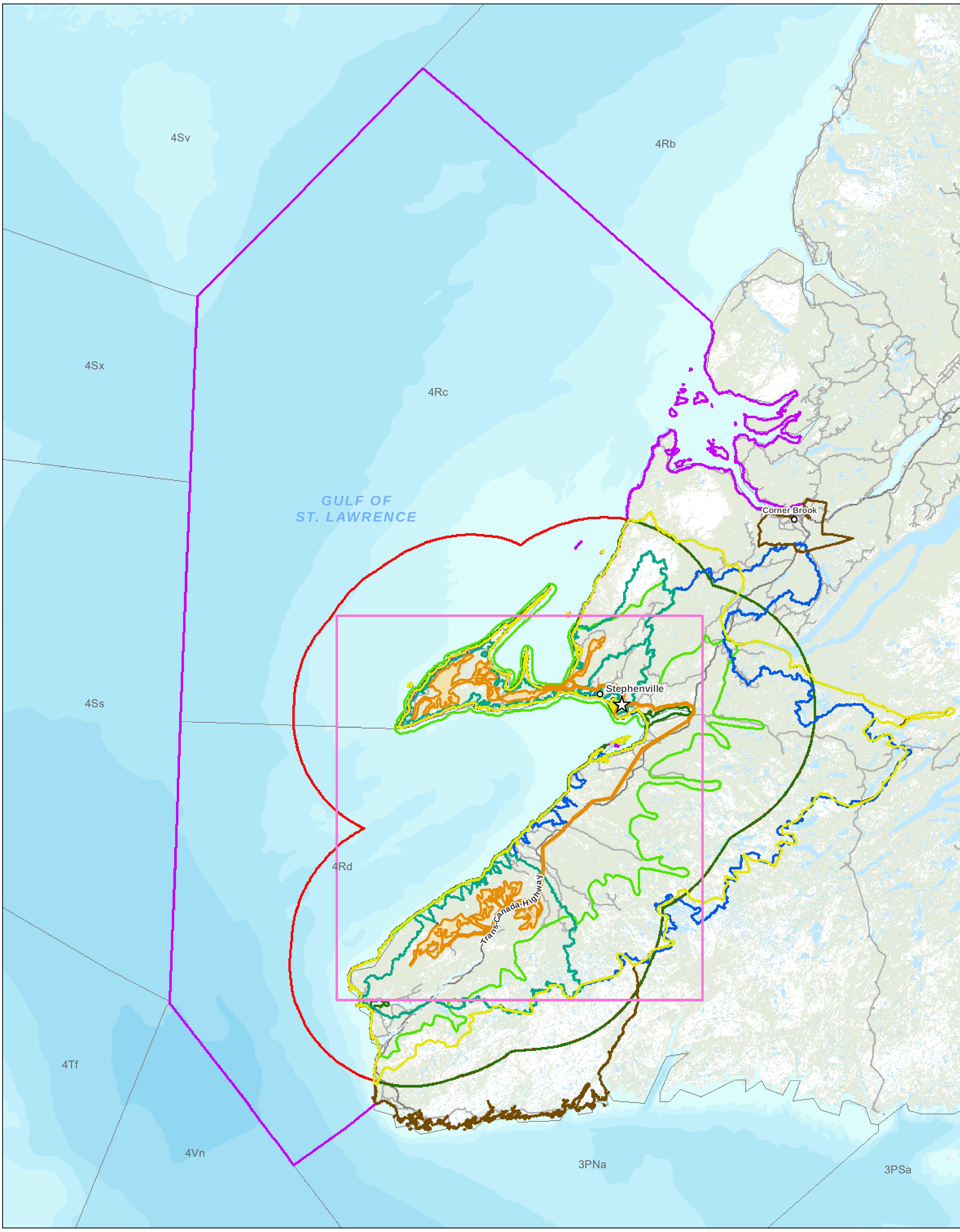
- new or improved road access
- footprint overlap of VECs broadly distributed regionally (e.g., merchantable timber)
- economic and/or social network and/or public infrastructure that expands due to human business and social interactions (e.g., competition for human resources)

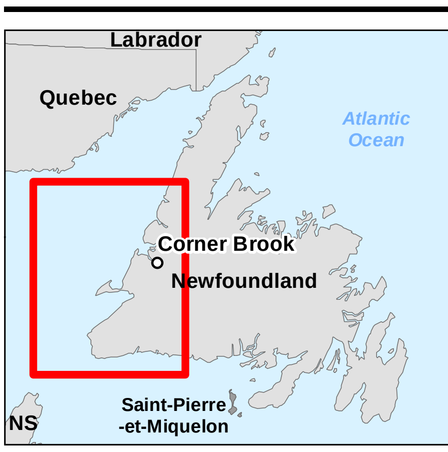
- given the above, a focus of assessment of potential cumulative effects focuses on reasonably foreseeable (future) projects that may occur in the RAAs
- there are some relatively minor but few major reasonably foreseeable physical activities, the latter more typical in contributing to important cumulative effects
- thresholds relevant to acceptable limits of change, with the exception of some air and water constituent based regulatory standards, are not available

The assessment does not assess hypothetical (conceptual) physical activities and their inclusion is not required. Such physical activities are highly uncertain regarding progression into tangible projects. Hypothetical physical activities also typically lack adequate description to be able to conduct a comprehensive cumulative effects assessment. Two types of such hypothetical physical activities are resource exploration and areas of resource potential, the latter is further discussed in the context of this assessment in Section 23.3.1, regarding other potential wind farms.

23.1.1 Study Areas

The applicable study areas for this assessment are the RAAs as identified for the assessed 17 VECs as provided in EIS Sections 6 to 22. A generic rationalization of the basis for the assessment area basis is provided in EIS Section 5.3.13 Boundaries, with additional rationalization specific to each VEC in each VEC's Boundaries sub-section. Figure 23.1 provides a compilation of RAAs except for the Employment, Economy and Business VEC for which the RAA is the island portion of the province of Newfoundland and Labrador.





Notes
1. Economy and Employment RAA encompasses the Province Newfoundland and Labrador
2. Human Health RAA is variable depending on the specific effect and effect pathway being evaluated
3. Coordinate System: NAD 1983 CSRS UTM Zone 21N
4. Data Sources: Client, Province of Newfoundland and Labrador, ACCDC, Stantec
5. Background: Natural Resources Canada CanVec

Regional Assessment Areas

- Atmospheric / Acoustic Environment
- Areas of Conservation Concern
- Communities
- Groundwater
- Heritage and Cultural Resources
- Land and Resource Use
- Marine Environment
- Surface Water / Fish and Fish Habitat
- Terrestrial Environment

Other Features

- Hydrogen / Ammonia Plant Location
- Project Area
- NAFO Unit

0 20 40 Kilometres

(At original document size of 11x17)
1:1,000,000

N

Stantec

Project Location
Stephenville
NL

Prepared by IP on 2023/07/24
Revised by NW on 2023/07/25
QR by AW on 2023/07/26

Client/Project
121417233_202

World Energy GH2
Project Nujio'qonik

Figure No.
23.1

Title
Regional Assessment Areas

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23.2 Regional Overview

Detailed descriptions of environmental (including human) setting are broadly provided throughout the EIS in the form of baseline information for each VEC, notably so in the context of regional setting in EIS Section 20 Land and Resource Use.

Generally, the applicable region (as shown in Figure 23.1), at the western extremity of the Island of Newfoundland, contains relatively isolated communities and commercial and industrial scale operations. Few other physical activities due to their nature and distance from the Project present likely cumulative effects pathways.

23.3 Other Physical Activities

Other physical activities with the potential to cumulatively interact with the Project were identified and compiled in a Project Inclusion list (PIL) (Appendix 23-A). The PIL is organized into two main parts: Past and Existing, and, Reasonably Foreseeable. Each of these is then further organized by the following, reflecting types of physical activities described in Section 20 Land and Resource Use:

- Electrical Infrastructure
- Mining, Quarrying, Mineral and Petroleum Exploration
- Fishing and Aquaculture
- Forestry and Agriculture
- Tourism / Culture / Recreation
- Protected Areas / Parks / Recreational Areas
- Other

For each unique physical activity (each row in the table in Appendix 23-A), a brief description is provided, accompanied by a distance to the nearest Project component (sometimes approximate) and operational state. Some physical activities are for a site-specific project for which the project and proponent's name are provided, while some physical activities represent generalized descriptions of broad and/or multiple occurrences of a type of land and resource use.

Figure 23.2 shows reasonably foreseeable physical activities within the region encapsulated by the VEC RAAs except for the VEC of Employment, Economy and Business. While some baseline conditions (e.g., communities) are shown, further details on such conditions can be found in the baseline sections for each VEC, and especially so from Chapter 20 Land and Resource Use.

23.3.1 Potential for Other Wind Farms

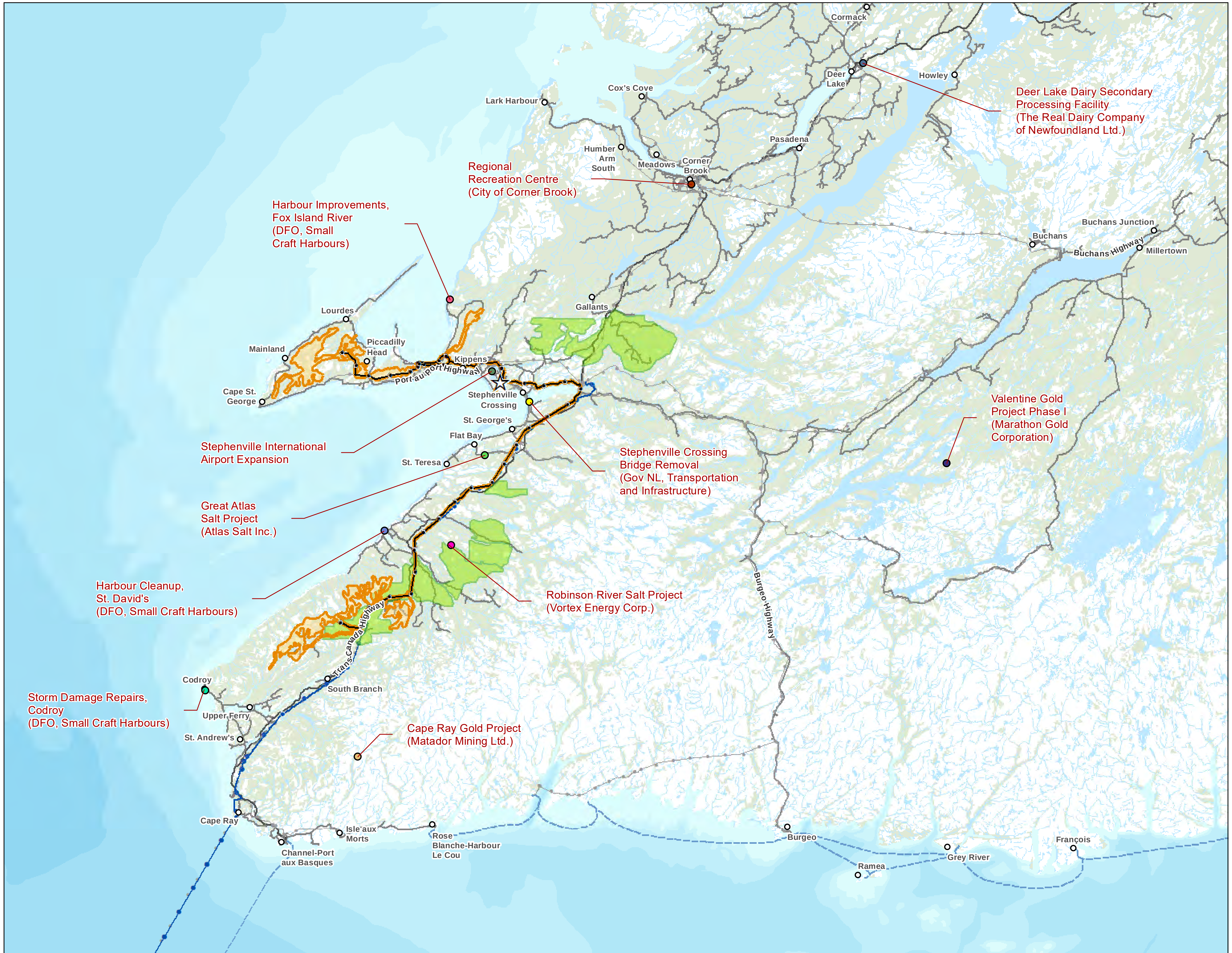
As explained in Section 23.1, potential cumulative effects with hypothetical physical activities are generally not assessed. However, the nature of the Project and associated provincial actions represents a unique situation that merits acknowledgement; namely, the possibility of other future similar projects to WEGH2 arising from the Newfoundland and Labrador government's Crown Land Call for Bids for Wind-Hydrogen Development (NLDIET 2023a). If other similar projects are constructed and operated in spatial proximity to WEGH2's Project (i.e., within the RAAs shown in Figure 23.1) this would create an important potential for cumulative effects, notably based on some ecological and economic cumulative effects drivers.

In 2006, the Newfoundland and Labrador government restricted commercial wind energy development in the province. However, in April 2022, the Order was lifted, allowing proponents to proceed with resource development projects. The NL Department of Industry, Energy, and Technology announced a Crown Lands Nomination and Bid Process for Wind Energy Projects. The department received 24 bids from 19 companies, which underwent a stage one review. Nine bids from nine companies have been approved to proceed to stage two, including WEGH2. Stage two is expected to be completed sometime in 2023 (NLDIET 2023b).

Stage one and two reviews are part of the evaluation process for submissions. The first stage review evaluates whether submissions meet the minimum criteria expected for a bidder to plan, construct, and operate a wind energy project. The stage two review includes a deeper examination of the application such as the bidders' experience, project financing, community engagement, benefits, and electricity grid connection requirements.

Details on where companies have applied to develop wind farms is currently not publicly available. However, various proponents have publicly expressed interest at the recent 2023 Energy NL conference in St. John's in advancing green hydrogen and wind developments. Recent examples include Pattern Energy (Argentia area), North Atlantic (Come By Chance area), Brookfield Renewable Partners (Placentia Bay area), Red Earth Energy (Trinity Bay area), Everwind Fuels (Burin Peninsula area), and The Exploits Valley Renewable Energy Corporation (Exploits Valley area) (CBC 2023a).

Figure 23.3 shows Crown lands available for bids for wind energy projects, revealing areas to the south and east of the WEGH2 Project and within some of the VEC RAAs for the Project, and beyond in the province, thus at least overlapping WEGH2 Project's Employment, Economy and Business VEC and possibly other VECs. Should such projects be developed in bid areas in proximity to the WEGH2 Project, there is at least the potential for cumulative effects with WEGH2 for some VECs due to potential interactions over such spatial scales and temporally overlapping for avian species and bats during operations. However, assessment of such effects, not currently possible, would be investigated by proponents of any other such projects as part of their later regulatory application requirements.



Stantec

- Cape Ray Gold Project
- Deer Lake Dairy Secondary Processing Facility
- Great Atlas Salt Project
- Harbour Cleanup, St. David's (Crabbe River)
- Harbour Improvements, Fox Island River
- Regional Recreation Centre
- Robinson River Salt Project
- Stephenville Crossing Bridge Removal
- Stephenville International Airport Expansion
- Storm Damage Repairs to Small Craft Harbour, Codroy
- Valentine Gold Project Phase I
- Maritime Link
- Zone 6 Five-Year Forestry Operating Plan (2024-2028)

Proposed Project Features

- Hydrogen / Ammonia Plant Facility
- Transmission Line 230 kV
- Project Area

Other Features

- Transmission Line, Existing
- Trans-Canada Highway
- Road / Highway
- Ferry Route

N

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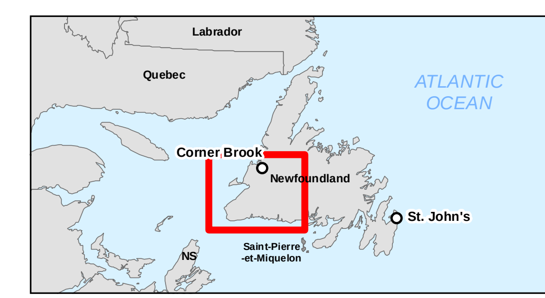
Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Forestry Five-Year Plan digitized at 1:500 k scale
3. Data Sources: World Energy GH2; NL ECC Water Resources Management Division; NL Fisheries, Forestry and Agriculture; Environment and Climate Change Canada; NRCan CanVec; OpenStreetMap
4. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by NW on 2023-07-31
QR by AW on 2023-08-07

Client/Project
121417233_203b REVE

World Energy GH2
Project Nujio'qonik

Figure No.
23.2

Title
Reasonably Foreseeable Physical Activities in the Project Region

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Source: From NLDIET 2023b

Figure 23.3 Crown Lands Available for Bids for Wind Energy Projects

23.3.2 Information Sources

The following sources of information, representing various web and map-based sources beyond those already used for preparation of the VEC baselines, were researched to identify reasonably foreseeable physical activities:

- Canadian Impact Assessment Registry (IAAC 2022a, 2022b, 2023a, 2023b)
- NL Department of Environment and Climate Change (NLDECC 2023a, 2023b, 2023c)
- Inventory of Major Capital Projects 2023 (Gov of NL 2023)
- News Articles (CBC 2023b, 2023c; VOCM 2022)
- Company Websites (Atlas Salt 2023; Vortex Energy 2023)

23.4 Assessment of Potential Cumulative Effects

23.4.1 Screening

Table 23.1 provides the results of the screening level assessment of potential cumulative effects. The following is stated for each VEC:

- *Dominant Cumulative Effects Drivers*: at least one key driver (as discussed in Section 23.1)
  - economic/social network
  - economic/social/public infrastructure network
  - long distant transport
  - mobile ecological receptor
  - multiple users
  - overlap and regionally distributed
  - road access, economic/social network
- *Dominant Spatial and Temporal Nature*: brief description of spatial and temporal characteristics specific to the VEC
- *Potential Cumulative Effects*: brief description of potential effects specific to the VEC
- *Potential Interaction with Reasonably Foreseeable Physical Activities*: brief description of any specific reasonably foreseeable physical activities that may interact cumulatively with the WEGH2 Project
- *Project Contribution to Cumulative Effects*: ranking of potential contribution by the WEGH2 Project to overall (regional) cumulative effects on a three-point scale based on implications to long term VEC condition and implementation of escalating management measures:
  - Low: Possible trends in the VEC under known levels of development may result in a decline in the VEC in the RAA during the life of the project, but VEC levels should recover to baseline during operations or after Project closure. No immediate management initiatives, other than requirements for conventional practices are required. Includes any negative change in VEC value of less than 1% from benchmark (if available) regardless of VEC trend at the time of the assessment.
  - Moderate: Possible trends in the VEC under known levels of development will likely result in a decline in the VEC to lower-than baseline but stable levels in the RAA during operations or after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required if additional land use activities are proposed for the RAA before project closure. Includes any negative change in VEC value of greater than 1% and less than 25% from benchmark (if available) regardless of VEC trend at the time of the assessment.

  - High: Possible trends in the VEC under known levels of development could threaten the sustainability of the VEC in the RAA and should be considered of management concern. Research, monitoring and/or recovery initiatives should be considered under an integrated resource management framework. Includes any negative change in VEC value of greater than 25% from benchmark (if available) regardless of VEC trend at the time of the assessment.
- *Potential Degree of Overall Cumulative Interaction*: same ranking as above for Project Contribution to Cumulative Effects
- *Mitigation*: identification of one of two applicable levels of environmental management measures
  - Conventional project-specific: implementation of effects management measures as described in the VEC assessment of project-specific effects likely adequate to address cumulative effects
  - Regional collaborative: additional (to conventional) implementation of management measures required to address substantial/unique cumulative effects that can best or only be addressed through the collective response of the applicable multiple regional land and resource users and administering governments

23.4.2 Detailed Assessment

All "Project Contribution to Cumulative Effects" and "Potential Degree of Overall Cumulative Interaction" are ranked as Low. Therefore, as explained in Section 23.1, advancement to detailed assessment is not required.

Table 23.1 Screening of Potential Cumulative Environmental Effects

VEC	Dominant Cumulative Effects Drivers	Dominant Spatial and Temporal Nature	Potential Cumulative Effects	Potential Interaction with Reasonably Foreseeable Physical Activities	Project Contribution to Cumulative Effects	Potential Degree of Overall Cumulative Interaction	Mitigation
Atmospheric Environment	long distant transport	regional airshed, construction and operations	Project emissions (construction and hydrogen / ammonia plant) and vibration and viewshed changes interacting with other emissions in airshed, mechanical activities and viewsheds	Atlantic Salt, Stephenville Airport	Low	Low, no threshold exceedances	Conventional project-specific
Acoustic Environment	long distant transport	localized to Project Area, construction and operations	Project noise (construction and hydrogen / ammonia plant), mostly temporary during construction, interacting with other local noise sources	Stephenville Airport	Low	Low, no threshold exceedances	Conventional project-specific
Groundwater Resources	multiple users	localized to Project Area construction and operations	Project local effects due to construction drawdown and potential water use interacting with other groundwater users	None	Low	Low	Conventional project-specific
Surface Water Resources	multiple users	localized to Project Area, operations	Project potable (hydrogen / ammonia plant and camps) and process water use (hydrogen / ammonia plant) interacting with use by others from same water source	None	Low	Low, WEGH2 continues to adaptively design its water needs to not interfere with other water users	Conventional project-specific and continuous refinement of engineering design
Freshwater Fish and Fish Habitat	mobile ecological receptor	regional watershed, operations	Project habitat and water quality changes (construction and operations) interacting with other similar changes	Small Craft Harbours	Low	Low	Conventional project-specific

Table 23.1 Screening of Potential Cumulative Environmental Effects

VEC	Dominant Cumulative Effects Drivers	Dominant Spatial and Temporal Nature	Potential Cumulative Effects	Potential Interaction with Reasonably Foreseeable Physical Activities	Project Contribution to Cumulative Effects	Potential Degree of Overall Cumulative Interaction	Mitigation
Marine Environment and Use	mobile ecological receptor	marine waters, operations	Project vessel operation, for temporary construction and infrequent operations traffic, interacting with other vessels, some along established shipping routes for regular transits and some for randomly dispersed traffic	Small Craft Harbours	Low	Low	Conventional project-specific
Wetlands and Vegetation, including Rare Plants	overlap and regionally distributed	regional lands construction and operations	Project changes to habitat interacting with other similar changes	Corner Brook Pulp and Paper Zone 6 Forest Operating Plan	Low	Low	Conventional project-specific
Avifauna	mobile ecological receptor	regional airspace and habitat, construction and operations	Project changes to habitat and wind turbine direct mortality combining with other similar changes	Corner Brook Pulp and Paper Zone 6 Forest Operating Plan	Low	None for direct mortality, low for habitat change	Conventional project-specific
Bats	mobile ecological receptor	regional airspace and habitat, construction and operations	Project changes to habitat and wind turbine direct mortality combining with other similar changes	Corner Brook Pulp and Paper Zone 6 Forest Operating Plan	Low	None for direct mortality, low for habitat change	Conventional project-specific
Other Wildlife	mobile ecological receptor	regional, operations	Project changes to habitat interacting with other similar changes	Corner Brook Pulp and Paper Zone 6 Forest Operating Plan	Low	Low	Conventional project-specific

Table 23.1 Screening of Potential Cumulative Environmental Effects

VEC	Dominant Cumulative Effects Drivers	Dominant Spatial and Temporal Nature	Potential Cumulative Effects	Potential Interaction with Reasonably Foreseeable Physical Activities	Project Contribution to Cumulative Effects	Potential Degree of Overall Cumulative Interaction	Mitigation
Areas of Conservation Concern	overlap and regionally distributed	regional, construction and operations	Project changes to air, water and habitat interacting with other similar changes	Corner Brook Pulp and Paper Zone 6 Forest Operating Plan	Low	Low	Conventional project-specific
Economy, Employment and Business	economic/ social network	provincial, construction and operations	Positive (beneficial) changes with some competition for similar person and materials resources	All	Low	Low	Conventional project-specific
Communities	economic/ social/public infrastructure network	provincial, construction and operations	Positive (beneficial) changes with some competition for similar person and materials resources and changes to social/cultural interactions	All	Low	Low	Conventional project-specific
Human Health and Quality of Life	long distant transport; economic/ social/public infrastructure network	provincial, construction and operations	Project changes in human health and safety environment interacting with other similar changes	All	Low	Low	Conventional project-specific
Land and Resource Use	road access, economic/social network	regional, construction and operations	Project changes to access and availability to other resource users	All	Low	Low	Conventional project-specific
Indigenous Fisheries	economic/ social network	marine waters, operations	Project changes to access and availability of fish and traditional fisheries interacting with other users during temporary construction and infrequent operations traffic	Small Craft Harbours	Low	Low	Conventional project-specific

Table 23.1 Screening of Potential Cumulative Environmental Effects

VEC	Dominant Cumulative Effects Drivers	Dominant Spatial and Temporal Nature	Potential Cumulative Effects	Potential Interaction with Reasonably Foreseeable Physical Activities	Project Contribution to Cumulative Effects	Potential Degree of Overall Cumulative Interaction	Mitigation
Heritage and Cultural Resources	overlap and regionally distributed	localized to Project Area, construction	Project loss or disturbance of sites and other similar changes by other users	All	Low	Low	Conventional project-specific

23.5 Summary of Cumulative Environmental Effects

A screening level assessment of potential cumulative effects was conducted for the 17 VECs with potential cumulative effects drivers identified for each. Project contribution to cumulative effects and overall regional cumulative effects were concluded to be low. Low means that the long-term sustainability of the VEC is not anticipated to be compromised and that conventional project-specific mitigation remains adequate. Therefore, further detailed assessment was not required. Such results are not unexpected given the relatively minor nature of Project effects and isolated location of the Project relative to other physical activities with which WEGH2 Project effects may interact.

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24.0 Accidents and Malfunctions

24.1 Approach

In accordance with section 6.3 of the Environmental Impact Statement (EIS) Guidelines, this chapter assesses environmental effects of accidents or malfunctions that may occur as a result of the Project. Accidents or malfunctions are rare, unplanned events or conditions that occur outside of routine functions or activities of the Project. The risk of accidents or malfunctions can be reduced or controlled through Project design and planning. A Project Emergency Response/Contingency Plan (ERCP; Appendix 2-F) provides details to mitigate adverse environmental effects should an accident or malfunction occur.

World Energy GH2 (WEGH2) is developing specific, detailed environmental management plans for the construction, operation and maintenance, and decommissioning and rehabilitation phases of the Project. In addition to an Environmental Protection Plan (EPP; Appendix 2-E), and follow-up and monitoring plans, phase-specific environmental management plans will include an ERCP to manage, mitigate, and remediate adverse environmental effects resulting from accidents or malfunctions. These plans are typically aligned under an overarching Environmental Management System (EMS), which is the point of reference when discussing mitigation for this chapter.

Accidents and malfunctions were assessed using the following approach:

- Selection of accidents and malfunctions, referred to as scenarios, that could occur during construction, operation and maintenance, and decommissioning and rehabilitation of the Project (Section 24.3), and result in potential environmental effects that require assessment
- Description of these scenarios and identification of Project design and safety measures that will be implemented to reduce or control potential effects of each scenario (Section 24.4)
- Assessment of the potential residual adverse effects on Valued Environmental Components (VECs) that may result from each scenario, once design and safety measures and emergency response measures have been applied (Section 24.4)

24.2 Proponent's Approach to Accident Prevention and Emergency Response Planning

WEGH2 is committed to providing a safe and healthy work facility for its employees, the surrounding community, and the environment. Although green ammonia is an emerging industry, the large-scale production of both hydrogen and ammonia are well established, and safety standards have been developed to support the design and operations of the facilities. The facility will be designed to safely produce and store hydrogen and ammonia using applicable Canadian codes as well as applicable 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, which covers both hydrogen and ammonia.

The facility will be designed to flare both hydrogen and ammonia only in the event of an emergency. Emergency response procedures will be established to respond to gaseous releases of hydrogen or ammonia as well as liquid releases of ammonia. Emergency response procedures will be developed to mitigate the risk to surrounding communities, wildlife, and the environment. As design progresses, and specific equipment selection is finalized, a hazard identification study will be conducted to determine high-level risks and suitable mitigation measures. In later phases of Project design, a structured hazard and operability study will be conducted to further identify and evaluate risks and potential hazards in the system.

As hydrogen is flammable and ammonia is toxic, specific precautions will be taken for the safety of personnel at site. These precautions will include training of personnel, development of plant-specific safety guidelines, emergency procedures and drills, installation of sensors and alarms in enclosed spaces, and design of facilities to appropriate standards, among others.

The facility will be designed such that there will be no ammonia vapour releases during normal operation. In unusual conditions where safety requires the rapid depressurization of the facility, ammonia and hydrogen will be safely combusted in the flaring system. The flares will be specifically designed to reduce un-combusted ammonia. In the event of a vapour release, a water spray, mist, or fog will be employed to knock down the ammonia and prevent it from escaping a controlled area.

The facility will have a fully dedicated Emergency Response Team (ERT) on premises 24 hours a day. This team will be provided with the necessary Personnel Protective Equipment (PPE) and response equipment within the facility. In addition, response procedures will be coordinated with Stephenville's and other local community ERTs. These teams will be provided with appropriate equipment and training for participating in an emergency response.

The facility's ERT will be trained to respond in an appropriate and efficient manner to protect employees and the community, as well as the facilities and property. This training will be developed as an integral component of the Project's ERCP. Included in the ERCP, at a high level, are evacuation procedures, designation of exit routes, location identification of staging areas, and alarm systems (both audible and visible). The ERCP also contains procedures to be followed in the event of an incident. This includes actions to be taken by plant and community responders in response to potential product leaks, spills, fires, and transportation emergencies.

Anticipated emergency response equipment will include:

- Firefighting brigade and operators trained in fighting fires that may include hydrogen and ammonia
- Emergency medical responders trained in treatment of fire and chemical exposure cases
- Water spray and fogging equipment for suppression of ammonia fires and vapour releases
- Chemical firefighting / foam cannons for use on hydrogen and ancillary fires
- Hydrogen and ammonia detection sensors
- Firefighting and medical responder PPE (full bunker gear including Canadian Standards Association approved positive-pressure self-contained breathing apparatus) to protect against potential hazardous combustion and decomposition products

Facility personnel who are expected to take protective action in the event of a hydrogen release will be trained to respond appropriately to protect people and property. Training will be based on the specific system in place and will be coordinated with any facility-wide Emergency Response Plan(s). Training will be provided to municipal and other area emergency response teams to develop a fully capable and coordinated response if needed.

24.3 Selection of Scenarios

Scenarios were identified based on professional judgment and experience with similar projects. This assessment considers the following scenarios that have the potential to occur during the construction, operation and maintenance or decommissioning and rehabilitation phases of the Project. The assessments presented in this chapter focus on worst-case outcomes. Table 24.1 outlines the scenario concordance with the guidelines.

Table 24.1 Scenario Concordance with Guidelines

EIS Guideline Requirement	Considerations	EIS Section Reference of Response
Accidental Spills and/or Releases of Hydrogen, Ammonia, Chemicals, Pesticides or Potentially Hazardous Substances on Land or in Air or Water	• This includes the assessment of potential effects resulting from the unplanned release of hydrogen and/or ammonia, including fire, explosion and vapour cloud. • This includes the assessment of potential effects from a fuel and hazardous material spill as a result of equipment leakage / failure, storage tank leak or rupture, spill from vehicles on-site, and/or spill from vehicles off-site (i.e., along the access road).	Section 24.4.1 – Unplanned Hydrogen and/or Ammonia Release Section 24.4.2 – Fuel and Hazardous Materials Spill
Fire and Explosions	• Potential effects from fire and/or explosion as a result of activity at the hydrogen / ammonia facility. • Potential effects associated with wildfires is assessed in Effects of the Environment on the Project.	Section 24.4.1 – Unplanned Hydrogen and/or Ammonia Release Section 25.2.4 – Forest Fires
Vehicle Accidents	• This includes the assessment of potential effects associated with vehicle accidents, including accidental collisions from Project vehicles and/or heavy equipment resulting in human mortality or injury. • Potential effects from vehicle collisions with wildlife. • Potential effects from accidents resulting in the release of fuel to the environment (both land and water).	Section 24.4.2 – Fuel and Hazardous Materials Spill Section 24.4.3 – Vehicle Accident Section 13 – Avifauna Section 14 – Bats Section 15 – Other Wildlife
Collapse of a Wind Tower or Dislodging of a Turbine Blade	• This includes the assessment of potential effects as a result of the collapse of a wind tower or dislodging of a turbine blade resulting in impacts to the environment.	Section 24.4.4 – Collapse of a Wind Tower or Dislodging of a Turbine Blade

Table 24.1 Scenario Concordance with Guidelines

EIS Guideline Requirement	Considerations	EIS Section Reference of Response
Failure of Industrial Water Supply	• In the event of a failure of industrial water supply, the hydrogen / ammonia plant will require a temporary shut-down. Based on the Project design measures to shut down the plant in the event of a failure of industrial water supply, unplanned releases of a process-based constituent (i.e., hydrogen or ammonia) to the atmosphere are not anticipated. As such, as no accident or malfunction is anticipated, this scenario is not assessed further.	N/A
Energy Generation / Transmission Failure	• Power will be provided for the Project in a three-tiered approach: – The Stephenville Terminal Station will be connected to the Newfoundland and Labrador (NL) Hydro facilities for the import of power from the grid – Power will also be supplied by the Port au Port and the Codroy Wind Farms – The plant will also be equipped with a battery energy storage system • In the event of an energy generation / transmission failure, the Project will use power from the grid or the battery energy storage system. If there is a failure with the three different power sources and there is a total loss of power, emergency bio-diesel generators will be used to provide temporary power to accomplish such tasks as flushing and draining the unit as part of emergency shutdown procedures. • Based on the Project design measures to shut down the plant in the event of an energy generation / transmission failure, to safely secure the unit operation and protect personnel, unplanned releases of a process-based constituent (i.e., hydrogen or ammonia) to the atmosphere are not anticipated. As such, as no accident or malfunction is anticipated, this scenario is not assessed further.	N/A
Wildlife Emergencies / Incidents (e.g., bird mortality events of 10 or more birds in a single event, or an individual species at risk during a single event due to collisions with wind energy infrastructure)	• Potential effects from collisions resulting in wildlife emergencies.	Section 13 – Avifauna Section 14 – Bats Section 15 – Other Wildlife

In the event of a major accident or malfunction that results in the Project having an extended shutdown, there is potential for a low magnitude adverse effect to local and regional economies by effects to wages, government revenues and, depending on the length of the shutdown, provincial gross domestic product. There may also be increased localized spending with short-term benefit to nearby communities for businesses supplying goods and services in support of the emergency responses. Effects to the economic environment would be short term in duration and likely reversible once operations have resumed; therefore, residual effects to employment and economy from an accident or malfunction are not discussed further.

The facility will have emergency response equipment on-site; however, a major accident or malfunction has the potential to require additional support from surrounding communities, such as fire departments and hospitals. Support from community infrastructure and services would be infrequent if they occur and potential effects would be short term in duration; residual effects to community infrastructure and services from an accident or malfunction are not discussed further.

See Table 24.2 for a summary of scenarios requiring further assessment.

Table 24.2 Summary of Scenarios Requiring Further Assessment

Accident / Malfunction	Description of Scenario	Description of Potential Adverse Effects	Potentially Affected	Key Mitigation / Project Design
Unplanned Hydrogen / Ammonia Release	Hydrogen could be released into the atmosphere as a result of equipment, piping and storage ruptures or leaks. Similarly, ammonia could be released on land or into the atmosphere as a result of equipment, piping, and storage ruptures or leaks. In many cases, an ammonia leak could be a liquid that evaporates into the atmosphere. These scenarios would typically occur during operation. Ammonia could also be released into the marine environment as a result of an accident during the process of loading ammonia into the ships.	A release of hydrogen or ammonia could lead to flammable hazards. Additionally, a release of ammonia could lead to toxicity hazards. Therefore, off-site members of the public could be at risk of harm. A release of ammonia into the marine water would lead to toxicity hazards and could be harmful to aquatic life depending on the concentration of ammonia in water.	• Public • Fish and Fish Habitat • Marine Environment	Ammonia storage tanks will be designed as full containment systems that provide two shells independently able to contain the liquid and vapors. Additionally, there will be a berm around the storage tanks. Robust instrumented systems designed to detect the release of ammonia or hydrogen and to initiate shutdown procedures. Water curtains to contain the spread of ammonia vapours in the event of a release.

Table 24.2 Summary of Scenarios Requiring Further Assessment

Accident / Malfunction	Description of Scenario	Description of Potential Adverse Effects	Potentially Affected	Key Mitigation / Project Design
Fuel and Hazardous Materials Spill	A fuel and hazardous material spill could occur as a result of equipment leakage / failure, storage tank leak or rupture, spill from vehicles on-site, and/or spill from vehicles off-site (i.e., along the access road). A fuel and hazardous material spill could occur during construction, operation and maintenance or decommissioning and rehabilitation.	A large spill may contaminate soil, groundwater and surface water resources, thereby potentially adversely affecting the quality of fish and fish habitat, and vegetated habitat, and resulting in the ingestion / uptake of contaminants by wildlife.	• Public • Groundwater Resources • Surface Water Resources • Freshwater Fish and Fish Habitat • Wetlands and Vegetation, including Rare Plants • Avifauna • Bats • Other Wildlife • Communities • Land and Resource Use • Traditional Land and Resource Use • Historic and Cultural Resources	Meet or exceed federal and provincial regulations including federal *Sulphur in Diesel Fuel Regulations*, and provincial *Storage and Handling of Gasoline and Associated Products Regulations.* Transportation of hazardous materials will be conducted in compliance with the federal *Transportation of Dangerous Goods Act* and the provincial *Dangerous Goods Transportation Act.* WEGH2 will regularly inspect and monitor Project infrastructure and equipment and take required action to maintain, repair and upgrade infrastructure / equipment as needed.

Table 24.2 Summary of Scenarios Requiring Further Assessment

Accident / Malfunction	Description of Scenario	Description of Potential Adverse Effects	Potentially Affected	Key Mitigation / Project Design
Fire and Explosions	Accidental events associated with Project activities, such as equipment malfunction (including wind turbines), or uncontrolled explosions, could result in a fire directly related to Project infrastructure and facilities, or within the Project Area as a forest fire.	A fire could result in release of emissions to the atmosphere, affect surface water quality and fish habitat, affect forests and wildlife habitat adjacent to the Project Area. A fire could also result in an explosion. Fires arising from other causes and potentially affecting the Project are assessed as an Effect of the Environment on the Project (Chapter 25).	• Public • Atmospheric Environment • Surface Water Resources • Freshwater Fish and Fish Habitat • Wetlands and Vegetation, including Rare Plants • Avifauna • Bats • Other Wildlife • Communities • Land and Resource Use • Traditional Land and Resource Use	Fire and explosion prevention measures and management, including on-site equipment and trained personnel, as described in the ERCP.
Vehicle Accident	Vehicle accidents, including single vehicle accidents, could result in the release of fuel or hazardous material to the environment, and accidental collisions from the operation of Project vehicles or heavy equipment could also result in human mortality or injury.	A vehicle collision could adversely affect wildlife and/or members of the public using the access road. Potential effects resulting from a spill from a vehicle accident are discussed in the assessment of a fuel or hazardous material spill (Section 24.4.2). Potential adverse effects caused by vehicle collisions with wildlife are assessed in Avifauna, Bats, and Other Wildlife Chapters (Chapters 13, 14, and 15, respectively).	• Public • Avifauna • Bats • Other Wildlife • Communities	WEGH2 will develop and implement a Traffic Management Plan (Appendix 2-C) to manage transportation of workers and materials to site, product leaving site, and the number of vehicles accessing the site. Several traffic safety measures will be implemented to reduce the potential for vehicle malfunctions or accidents.

Table 24.2 Summary of Scenarios Requiring Further Assessment

Accident / Malfunction	Description of Scenario	Description of Potential Adverse Effects	Potentially Affected	Key Mitigation / Project Design
Collapse of a Wind Tower or Dislodging of a Turbine Blade	Accidental events associated with the collapse of a wind tower or the dislodging of a turbine blade could cause damage to property and affect public safety.	The collapse of a wind tower or the dislodging of a turbine blade could adversely affect the public during the operations and maintenance phase of the Project.	• Public	Geotechnical surveys will be conducted to help determine the optimal foundation style (i.e., gravity foundations or rock anchor foundations) for the wind turbines. During the operation and maintenance phase, weather forecasts will be regularly monitored and, prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Project. WEGH2 will establish sufficient setback of wind turbines to mitigate risks to surrounding residences.

24.4 Effects Assessment for Selected Scenarios

24.4.1 Unplanned Hydrogen / Ammonia Release

24.4.1.1 Unplanned Hydrogen / Ammonia Release in the Marine Environment

The anhydrous ammonia will be transported to market by ships designed and certified for carriage of its product. Ships will use the marine terminal in the Port of Stephenville to load anhydrous ammonia from the facility via a 24" diameter pipe. The offloading system design remains under consideration. While options are being considered, the probable methodologies will be standard quayside loading arms or a jettyless floating offloading system. With hoses connected, jettyless systems are floated to a vessel's side by tugs and secured to a vessel's hull with a specialized mooring system. Accidental release may occur during loading of the ships and, as a result, ammonia could enter into the marine environment and mix with the water.

The primary hazard associated with an accidental release of ammonia into the marine environment is due to acute and chronic elevated concentrations of un-ionized ammonia in water that is toxic to aquatic life. This can cause adverse effects on fish and other marine organisms, leading to impaired growth, reproduction, and even mortality.

The Project Nujio'qonik, Fate and Transport of Ammonia in Marine Water Report (Appendix 24-A) assesses this scenario in detail for possible acute and chronic concentrations of un-ionized ammonia and maximum extent of the ammonia plume in the marine water as a result of an accidental release. Ammonia transportation rate is approximately 1,400 m^3/hr in a 24" pipe. The Emergency Shutdown System will be designed as per the requirements of Title 33 of the United States (US) Code of Federal Regulations (https://www.ecfr.gov/current/title-33/chapter-I/subchapter-O/part-154/subpart-C/section-154.550) and other applicable international and Canadian codes and standards. This code also applies to some Canadian ships, and states that there must be a means to stop the flow within 30 seconds in the event of an accidental spill. It has been assumed that a total release time of 2 minutes is a conservative assumption for this scenario to account for detection and activation of the emergency shutdown system and valve closure.

The Project will be designed and operated such that if a release of this magnitude occurred, multiple alarms would be activated, and at least one operator would monitor the transfer and would observe the release as it happened. Additionally, there would be a strong smell of ammonia, which would indicate to anyone in the area that a large spill had occurred. The means to stop the flow would occur almost immediately, thus using a 2-minute release time is a conservative estimate since it allows for 90 seconds to initiate the means to stop the flow. In addition, as a conservative assumption from the marine water impact assessment, it was assumed that the spill occurred under the water and 100% of the anhydrous ammonia mixes and dissolves in the water. Therefore, a total spill rate of 46.7 m^3 (i.e., 31.87 t) over a period of 2 minutes near the marine terminal berth was modelled for this scenario.

24.4.1.2 Unplanned Hydrogen / Ammonia Release in the Atmospheric Environment

Hydrogen gas is produced and stored on-site. Additionally, ammonia gas is produced, and is condensed and stored as a liquid. Should there be a loss of containment, hydrogen and ammonia gas could be released as a result.

The primary hazard associated with an accidental release of hydrogen gas is due to its flammability and reactivity. The released gas could immediately ignite, forming a jet fire. Alternatively, the ignition could be delayed, leading to a potential flash fire, or delayed jet fire. Should the dispersing gas enter a congested area before ignition, a vapour cloud explosion or process / storage vessel explosion could occur.

The primary hazard associated with an accidental release of ammonia is toxicity through inhalation. Should ammonia be released as a gas, a toxic cloud may form. If ammonia is released as a liquid, a pool will form that releases toxic vapours into a cloud. Ammonia is also flammable and so presents an additional flammability hazard.

The Quantitative Risk Assessment – Nujio'qonik Ammonia Production Facility Supporting Study (Appendix 24-B) assesses this scenario in detail for possible toxic hazard extents. Loss of containment was considered from processes at the hydrogen / ammonia product plant. Process equipment release scenarios were grouped into the following categories:

- Pinhole leaks, which normally represent the smallest leaks that might occur in the system. Pinhole leaks may be difficult to identify by visual inspection and may also be difficult to detect through deviations in process flow rates, pressures, or temperatures.
- Ruptures, which can range in size depending on the process of asset. For piping, it is common to estimate rupture sizes based on some fraction of the cross-sectional area of the pipe. For storage vessels, rupture sizes are often related to the size of pipe connections servicing the vessel but also can scale with the storage volume.
- Guillotine ruptures, which are specific to piping, refer to scenarios where a pipe is severed, leaving both ends of the pipe open to the atmosphere.
- Catastrophic failures, often specific to storage vessels, where the contents of the storage vessel are released in a short timeframe.

24.4.1.3 Project Design and Safety Measures to Reduce Environmental Effects

As indicated in Appendix 24-B, releases of liquid ammonia from the storage vessels were found to be a large contributor to the individual risk. Passive mitigation measures that were considered in the risk modelling include:

- The storage tanks were considered "full containment" systems. This consists of a double-wall tank where both the outer and inner tanks are designed to be fully capable of holding the ammonia without compromising structural integrity or release of vapour. A loss of contents would only occur in the highly unlikely event that both the outer and inner tank were breached simultaneously.
- Tertiary containment in the form of a berm around the tanks, to prevent a liquid spill of ammonia from spreading.

The Facility will have the following additional mitigation measures, which will likely reduce the risk:

- Physical and electronic security systems will be implemented to protect all plant components from hazards that would result in damage to the facility and to minimize the potential for accidental release.
- The inclusion of robust instrumented systems designed to detect any releases of ammonia or hydrogen, and to initiate shutdown procedures to isolate and minimize the discharge while also providing indications to personnel of potential danger and prompting egress from the affected area. The intent is to detect and react to any release before it has the potential to adversely affect people or the environment.
- Methodologies to address and react to any events that may occur. Most notably, reactions that would contain a release of ammonia and minimize the spread of vapors into the environment and surrounding communities. Ammonia vapors can be effectively contained by using water curtains produced by water monitors, sprinklers, foggers, or a combination of these. The ammonia vapors readily dissolve in the water and fall to earth where the water can be collected and treated. Additionally, liquid ammonia spills may be physically covered with tarps or other physical barriers to contain vapors while the liquid is collected for treatment.
- Community response procedures will be put in place to inform the local community of any situations arising from the plant. These measures will be developed in conjunction with local emergency management organizations and could include shelter in place orders and evacuation procedures for responding to extreme situations.

It is the intent of the Nujio'qonik project to design, build, and operate a safe facility; detailed studies of potential mishaps and accidents will be studied. Further refinement of response and mitigation plans will be developed and coordinated with the local communities. Inclusion of these additional mitigation methods would likely reduce the risk associated with operation of the Facility.

24.4.1.4 Emergency Response Measures

The ERCP indicates that in the event of a loss of containment, the first priority is to prevent product flow (providing it is safe to do so). The second priority is to eliminate sources of ignition, such as by shutting off electrical power. The shift supervisor is to be made aware of the situation, and ERTs are to be contacted if the spill is uncontrollable. From there, emergency services (e.g., fire department) can be contacted in order to assist.

24.4.1.5 Environmental Effects Assessment

Marine Environment

The Fate and Transport of Ammonia in Marine Water Report (Appendix 24-A) provides an overview of methods used to evaluate the effects of ammonia spill into the marine environment. The maximum extent of un-ionized ammonia was simulated for a period of one month under typical summer and winter conditions. For this scenario, the maximum extent of the un-ionized ammonia plume is limited to the areas inside and near the entrance of Port Harmon. Therefore, the effects of the accidental spill on the marine environment are limited to areas inside the port. In addition, the Fate and Transport of Ammonia in Marine Water Report indicates that tidal flushing reduces concentrations of un-ionized ammonia inside the port over time.

A review of the fate and transport modelling results under typical winter conditions indicates a high short-term un-ionized ammonia concentration of 760.3 mg/L at the spill location immediately after the spill and 4.3 mg/L at the port entrance 29 hours after the spill; however, the concentrations quickly reduce as a result of mixing with marine waters and tidal activity and reduces to 0.4 mg/L and 0 mg/L at the spill location and port entrance, respectively, after one month of simulation in winter. A review of the fate and transport modelling results under typical summer conditions indicates a high short-term un-ionized ammonia concentration of 1,091.5 mg/L at the spill location immediately after the spill, and 2.3 mg/L at the port entrance 25 hours after the spill; however, the concentrations rapidly reduce as a result of mixing with the marine water and tidal activity and reduce to 0.42 mg/L and 0 mg/L at the spill location and port entrance, respectively, after one month of simulation in summer.

Atmospheric Environment

The Quantitative Risk Assessment (QRA; see Appendix 24-B) provides an overview of the procedures and methods used. The objective of the QRA was to estimate off-site risks associated with accidental releases. The risk is based on the likelihood and severity of the release scenarios, and can be compared against land-use planning guidelines to determine if facility operations would impose restrictions on current land-use surrounding the Facility.

A potential loss of containment of ammonia or hydrogen could lead to a hazardous event, as described above. These events, however rare, may result in harm of the individuals in surrounding communities. The Canadian Society for Chemical Engineering (CSChE) has developed risk exposure guidelines for land use planning purposes (see Section 5.1 of Appendix 24-B). Based on comparison against the

CSChE land-use-planning guidelines, it is predicted that sole consideration of the proposed Facility is not predicted to result in unacceptable land use in the lands adjacent to it.

Additional mitigative measures, such as those described above, will provide an extra barrier to reduce the consequences of a potential release.

24.4.2 Fuel and Hazardous Materials Spill

24.4.2.1 Description of Scenario

Gasoline, diesel fuel, lubricants, and other hazardous materials such as chemicals, cleaning agents and pesticides will be stored and used on-site during all phases of the Project (i.e., construction, operation and maintenance, and decommissioning and rehabilitation). Improper handling, use or storage of these materials could result in a release or discharge of these materials into the environment. Most accidental releases of small-scale (e.g., several litres) are highly localized and can be readily cleaned up by on-site crews using standard equipment. In the event of a substantial release during all phases of the Project, contamination could affect groundwater resources, surface water resources, fish and fish habitat, wetlands and vegetation, including rare plants, avifauna, bats, other wildlife, communities, land and resource use, traditional land and resource use, and historic and cultural resources (see Table 24.2). Spills or releases involving hydrogen and ammonia are discussed in Section 24.4.1.

24.4.2.2 Project Design and Safety Measures to Reduce Environmental Effects

Several traffic safety measures will be implemented to reduce the potential for fuel and hazardous material spills as a result of the Project. These include, although are not limited to, the following:

- Hazardous products will be stored according to industrial requirements and standards, and safely secured so that access is limited to authorized personnel.
- Fuelling and servicing will be conducted at designated sites furnished with spill containment equipment.
- Fuelling and servicing areas will be sited away from watercourses and coastlines.
- The potential for spills will be reduced through the use of standard good practices, such as the use of appropriate containers, and avoiding overfilling.
- Vehicles, heavy equipment, and machinery will be properly maintained to reduce the risk of leakage. Routine preventative maintenance and inspection of hydraulic equipment and machinery will be undertaken to avoid a hazardous material release.
- Best practices for the proper handling, storage, and disposal of spilled hazardous chemicals and fuels will be included in the EPP and implemented by the Project personnel and contractors.
- WEGH2 will liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources, including training and equipment required to respond to accidents and emergencies, are in place.
- Mandatory safety orientations will be provided for employees.

- The ERCP includes spill prevention and response, emergency response measures, training, responsibilities, clean-up equipment and materials, and contact and reporting procedures.
- Appropriate Project personnel will be trained in fuel handling, equipment maintenance, and fire prevention and response measures (Appendix 2-H).
- Spill response kits will be available on-site. Project vehicles will be equipped with appropriately sized spill kits containing the necessary supplies to handle the quantity and type(s) of hazardous materials that are on-site.
- In the event of a chemical spill, dry clean up and mopping techniques will be used as appropriate. The area will not be "washed down" as this could cause the spills to spread to the surrounding environment and potentially enter drainage works or environmentally sensitive areas.
- Soil that may have become contaminated during the course of construction will be remediated. This may be done on-site or removed from site for disposal at an approved location.

24.4.2.3 Emergency Response Measures

The ERCP indicates that in the event of a loss of containment, the first priority is to prevent product flow (providing it is safe to do so). The second priority is to eliminate sources of ignition, such as by shutting off electrical power. The shift supervisor will be notified of the situation, and ERTs will be contacted if the spill is uncontrollable, and emergency services (i.e., fire department) will be engaged as required.

24.4.2.4 Environmental Effects Assessment

Fuel and hazardous material releases, if they occur, are expected to be limited in volume and area, and will be cleaned up by on-site crews using standard equipment. Site assessment and remediation may be required if a release results in the contamination of soil, vegetation, surface water or groundwater.

24.4.3 Vehicle Accident

A vehicle accident could cause damage to property and could result in injury to the individuals involved. A number of public roads will be used to access the Project, in addition to access roads that will be constructed within both the Port au Port and Codroy Wind Farms to connect the turbine locations.

The Port au Port Wind Farm (comprised of portions of the Port au Port Peninsula extending eastward to Port au Port East) is located west and north of Stephenville. A narrow isthmus connects the Port au Port Peninsula to the island of Newfoundland. The peninsula is accessible via Newfoundland and Labrador (NL) Routes 460 and 463, both of which are paved two-lane highways. Using Routes 460 and 463, there is an 80 km loop around the perimeter of the roughly triangular peninsula. The Codroy wind farm is 75 km south of Stephenville via NL Route 490 and Route 1 – Trans-Canada Highway (TCH). The hydrogen / ammonia plant will be located on privately owned land at the Port of Stephenville (in the Town of Stephenville) and is accessible via NL Route 490. All highways are maintained year-round by the NL Department of Transportation and Infrastructure.

24.4.3.1 Description of Scenario

Vehicle accidents, including single vehicle accidents, could potentially occur during all phases of the Project, resulting in the release of fuel or hazardous material to the environment (Section 24.4.2). During construction, higher levels of worker and vehicle traffic to and from the site, and the operation of heavy equipment on-site, increases the potential for vehicle accidents. Site traffic and equipment activity in the Project Area during decommissioning and rehabilitation are expected to be similar to, or less than, activity levels during construction. Accidental collisions from the operation of Project vehicles or heavy equipment could also result in human mortality or injury and the need for support from local emergency services. Increased vehicle use during construction, and decommissioning and rehabilitation, may also increase collision-related mortality risk to wildlife and is assessed in Avifauna, Bats, and Other Wildlife Chapters (Chapters 13, 14 and 15, respectively).

24.4.3.2 Project Design and Safety Measures to Reduce Environmental Effects

Traffic will increase during construction, and decommissioning and rehabilitation. Vehicle accidents may occur on highways that are more heavily used for the Project, which includes Routes 460, 463, 490, and the TCH. WEGH2 has also prepared a Traffic Management Plan (Appendix 2-C) for Project-related vehicular traffic during transportation of oversized and overweight loads through municipal roadways.

Several traffic safety measures will be implemented to reduce the potential for vehicle accidents or malfunctions as a result of the Project. These include, although are not limited to, the following:

- Project drivers will be cautioned to obey the speed limit and other traffic laws.
- Traffic management measures will be put in place and consistently implemented to control on-site traffic, as well as the practices of drivers to and from construction sites. Emergency vehicle access will be maintained.

24.4.3.3 Emergency Response Measures

WEGH2 has prepared an ERCP (Appendix 2-F) for the Project, which outlines response procedures for potential accidents, malfunctions and emergency scenarios, including vehicle accidents. The ERCP includes an emergency communication strategy with those potentially affected, and also describes the capacity of WEGH2 / nearby communities to respond to each type of vehicle accident. WEGH2 will liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond to accidents and emergencies are in place, such as if a vehicle accident occurs on-site, and emergency services (911) need to be engaged.

24.4.3.4 Environmental Effects Assessment

Access to the Project is primarily via highways, in addition to the access roads that will be constructed to connect the turbine locations. The presence of Project-related vehicles on public highways and site access roads, has the potential to increase the number of vehicle accidents on public roads, resulting in temporary delays to road traffic, damage to vehicles, or harm to individuals involved, including potential injury or mortality to wildlife, as well as interactions with communities.

Avifauna, Bats and Other Wildlife

Vehicle-related wildlife mortality has the potential to affect a wider range of species, including passerines (perching birds), bats and species that can be difficult for drivers to see, such as nocturnal marten and yellow-banded bumble bee. The number of vehicles and equipment will increase in the local assessment area (LAA), particularly during construction, and collisions involving vehicles and equipment could result in increased wildlife mortality. Safe driving practices, including speed limits, will be implemented to avoid collisions with species at risk and other wildlife. Residual effects from a vehicle accident on wildlife are further described in Chapters 13, 14 and 15.

Communities

A vehicle accident has the potential to result in injury or loss of life and requires support from local emergency and health care services. Vehicle accidents, if they occur, are expected to be infrequent, and are more likely during construction, and decommissioning and rehabilitation, due to increased vehicle traffic and personnel movement, as well as transportation of oversized and overweight Project materials and equipment. Project operation and maintenance is expected to have a negligible effect on accident rates in the LAA and regional assessment area (RAA) for communities. The Project will comply with applicable traffic rules and regulations, and with WEGH2's policies and procedures for traffic management, and an ERCP will be developed to reduce the potential for Project-related accidents and the demands on infrastructure and services.

24.4.4 Collapse of a Wind Tower or Dislodging of a Turbine Blade

The Port au Port Wind Farm and the Codroy Wind Farm will include up to 328 turbines and collectively produce approximately 2 gigawatts (GW) of renewable electricity required for hydrogen production. The current base case assumption for the Project is to use the Siemens Gamesa SG 6.6-155 wind turbine type. Both the Port au Port and Codroy Wind Farms will each contain up to 164 wind turbines, and each individual wind turbine will occupy approximately 1.25 ha. These wind turbines will consist of three-blade rotors, and tubular towers. Each of the turbines will stand at an approximate height of 120 m from its base to hub (pending final design configuration) and use 76-m blades, allowing the 155-m rotor diameter to provide an installed capacity of 6.6 MW. See section 2.3.2 for further details on the wind turbines.

24.4.4.1 Description of Scenario

The collapse of a wind tower or the dislodging of a turbine blade could cause damage to property and affect public safety. This could potentially occur during the operation and maintenance phase once the turbines have been erected. The collapse of a wind tower may occur due to structural issues such as cracks or corrosion, which could potentially happen over time as the turbines are exposed to the elements. Issues with the foundation and anchoring system may also lead to wind tower collapse.

Although rare, one of the most common external wind turbine failures is due to blade failure. As the wind turbines age, surface damage such as cracks and corrosion could result in structural damage to the blades. Turbine blades may also become dislodged due to damage caused by bird strikes, or extreme weather events such as lightning strikes, rainfall, high winds, and hail. These events could result in either whole blades or pieces of blades being thrown from the turbines.

24.4.4.2 Project Design and Safety Measures to Reduce Environmental Effects

The potential effects of extreme weather, including storms, precipitation, and drought, will be considered in Project planning, design, and operation and maintenance strategies, including the selection of materials and equipment, and design of components. These designs will consider projected climate change conditions over the life of the Project.

Geotechnical surveys will be conducted to help determine the optimal foundation style (i.e., gravity foundations or rock anchor foundations) for the wind turbines. The foundations will include an envelope of engineered gravel to provide positive drainage away from the foundation, and surface grading will provide positive runoff and avoid ponding of rainfall to help maintain the integrity of the foundations.

During the operations and maintenance phase, weather forecasts will be regularly monitored and, prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the turbines and establish sufficient setback to mitigate risks to surrounding residences.

24.4.4.3 Emergency Response Measures

As per the ERCP (Appendix 2-F) for the Project, if an accidental event associated with the collapse of a wind tower or the dislodging of a turbine blade occurs, work will be stopped, and the situation assessed. The Shift Supervisor will be contacted using the emergency channel and an Incident Commander will secure the scene.

24.4.4.4 Environmental Effects Assessment

For the Port au Port Wind Farm, there are two turbine locations (turbine 6 near Route 463 and turbine 18 near Cape St. George Community pasture) in the vicinity of areas used by the public. For the Codroy Wind Farm, the TCH passes in close proximity to two turbines (turbines 11 and 12), and potential receptors (buildings visible on imagery that may be residences or seasonal dwellings) were also identified within 1.5 km of several wind turbines. The Port au Port and Codroy Wind Farms have generally been sited to avoid proximity to residences. This assessment evaluated the current turbine layout and initial identified receptor locations; however, WEGH2 is committed to establishing sufficient setback to mitigate risks to surrounding residences.

Damage to public property and public safety due to the collapse of a wind tower or the dislodging of a turbine blade is unlikely for the Port au Port and Codroy Wind Farms. Although rare, wind turbine accidents are still recorded each year and the rate of occurrence internationally over the last 20 years has increased, with blade failures accounting for the majority of wind farm-related incidents (Ma et al. 2018).

24.5 Summary

WEGH2 is committed to providing a safe and healthy work facility for its employees, the surrounding community, and the environment. The Project will be planned, designed, constructed and operated in a manner to avoid accidents or malfunctions through adherence to applicable regulations, guidelines and best practices.

24.6 References

Ma, Y, P. Martinez-Vazquez and C.C. Baniotopoulos. 2018. Wind Turbine Tower Collapse Cases: A Historical Overview. Institution of Civil Engineers Proceedings Structures and Buildings, 172(8): 18 pp. https://doi.org/10.1680/jstbu.17.00167.

25.0 Effects of the Environment on the Project

25.1 Scope of Assessment

As required by the Provincial Environmental Impact Statement (EIS) Guidelines, this chapter provides a discussion of the potential effects of environmental changes and hazards on the Project and provides details of planning, design, construction and operation strategies that aim to reduce the potential for adverse environmental effects of the environment on the Project. A key concern is that severe weather events or natural hazards could affect or damage Project infrastructure, resulting in failures, malfunctions or accidental events, which in turn could result in adverse effects to the environment.

Effects of the environment on the Project to be considered in this assessment are those resulting in:

- A substantial change of the Project schedule (e.g., extended delays in construction) or long-term interruption in Project operations
- Damage to Project infrastructure or equipment that results in a release of hazardous materials into the environment and / or substantial increase in risks to the health and/or safety of Project personnel and/or the public
- Damage to Project infrastructure resulting in repairs that could not be technically or economically implemented and / or resulting in substantial risks of a business interruption

The environment has the ability to affect the construction, operation and maintenance, and decommissioning of the Project through:

- Weather, climate and metocean conditions (e.g., winds, storms, waves, ice)
- Climate change
- Geological hazards (e.g., terrain stability, seismic activity)
- Forest fires

The EIS Guidelines require consideration of algal blooms as an additional effect of the environment on the Project. Algal blooms in the freshwater environment could potentially affect the quality of source water and require an alteration in the water treatment process. Source water quality will be monitored regularly prior to and throughout operations to inform water treatment processes. Changes in source water quality would be detected early and managed accordingly such that it would not be predicted to result in a substantial change in the Project schedule or operations, a substantial increase in risks to the health and/or safety of Project personnel and/or the public; or damage to project infrastructure that could not be technically or economically implemented and / or result in substantial risks of a business interruption. Algal blooms are therefore not considered further as an environmental factor in this chapter.

Adverse environmental effects of the environment on the Project are those that would have the potential to directly affect schedules, infrastructure, and operations, which are contained within the Project Area. Effects on the Project from the environment can also adversely contribute to and/or complicate malfunctions and accidental events. Project malfunctions and accidental events, with relevant spatial boundaries, are addressed in Chapter 24. The temporal boundaries for the assessment of effects of the environment on the Project include the construction, operation and maintenance, and decommissioning and rehabilitation phases of the Project. After a 30-year operational life, the decommissioning phase is anticipated to occur during 2057 and 2058. Refer to Section 5.3.1.3 for definitions of the spatial boundaries (Project Area) and temporal boundaries for assessment.

For each category of environmental effect, existing conditions are described, and where applicable, climate change projections are included. Potential effects on the Project are identified, applicable mitigation (including but not limited to planning and engineering design) is outlined, and residual effects are evaluated.

25.2 Assessment of Effects of the Environment on the Project

25.2.1 Weather, Climate, and Metocean Conditions

The existing conditions, potential effects, mitigation and residual effects for weather, climate and metocean conditions are described below. An Atmospheric Environment Baseline Study has also been developed. The baseline study focuses on air quality, climate and greenhouse gases (GHGs), noise, vibration and light (Stantec 2023).

25.2.1.1 Existing Conditions

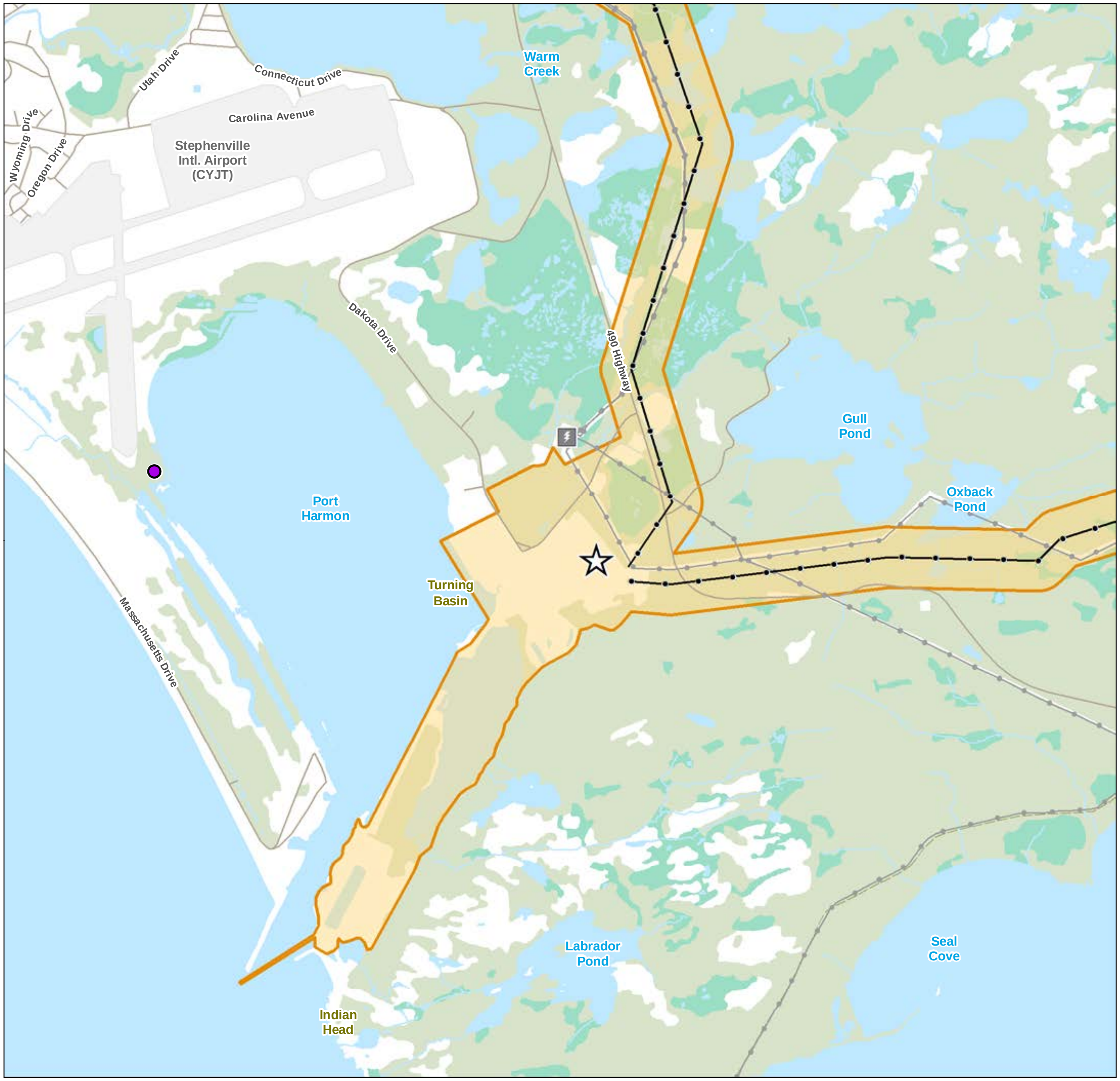
The following sections describe the existing conditions for weather, climate, and metocean conditions. These include atmospheric, temperature, precipitation, and wind conditions, storms, sea water level, offshore waves, ocean-water temperatures, and sea ice conditions.

Atmospheric

The existing atmospheric conditions in the Project Area are characterized using Environment and Climate Change Canada (ECCC) data from the Stephenville airport meteorological station (Stephenville meteorological station) (Figure 25.1), since it is located nearest to the Project and has sufficient available data. Climate normals data for the 30-year period from 1981 to 2010 are presented below, including temperature and precipitation data. Climate normals data refer to arithmetic calculations based on observed climate values for a given location over a specified period of time (ECCC 2020). Wind data collected at the Stephenville station from 2018 to 2022 are presented below. Information about historical storm events in Newfoundland and Labrador (NL), from literature and published data, are also summarized below. For more detail, see the Atmospheric Environment Baseline Study (Stantec 2023).

Temperature

The daily average temperatures at the Stephenville meteorological station range between -6.7 degrees Celsius (°C) to 16.7°C, with the lowest average temperatures occurring in February and the highest occurring in August. Extreme daily minimum and maximum temperatures range between -29.5°C (February) to 30.6°C (July) (ECCC 2023). The 1981 to 2010 temperature climate normals for the Stephenville meteorological station are presented in Table 25.1. These include daily average, daily maximum, daily minimum, extreme daily maximum and extreme daily minimum temperature data.



Stantec

ECCC Weather Station

Proposed Project Features

Hydrogen / Ammonia Plant Location

Transmission Line 230 kV

Project Area

Other Features

Electrical Generation, Existing

Transmission Line, Existing

Road

Resource Road / Trail

Watercourse

Waterbody

Wetland

Forested Area

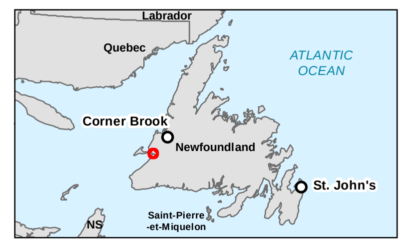
N

0 0.8 Kilometres

(At original document size of 8.5x11) 1:35,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MB on 2023-07-26
QR by AW on 2023-07-25

Client/Project
World Energy GH2
Project Nujio'qonik

121417575_001

Figure No.
25.1

Location of Meteorological Station

V:\1214\active\121417233\03_data\gis_cad\gis_data\mapping\mxd\general\Effects_of_Envrionment\121417575_001_ECCC_Station_REVA.mxd Revised: 2023-07-26 By: mblackwood

Table 25.1 Climate Normals, Stephenville, NL (1981 to 2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Average (°C)		-6.7	-3.5	2.6	7.6	12.1	16.4	16.7	12.8	7.4	2.7	-2.4	5
Daily Maximum (°C)	-2.4	-2.6	0.6	6.4	11.9	16.4	20.2	20.6	16.7	10.8	5.6	0.7	8.7
Daily Minimum (°C)	-9.4	-10.7	-7.6	-1.3	3.2	7.8	12.6	12.8	8.9	4	-0.2	-5.3	1.2
Extreme Daily Maximum (°C)	14.6	12.7	19.7	23.8	27.2	30	30.6	29.9	29.1	22.4	20.6	16.1	-
Date (yyyy/dd)	2006/15	1996/17	1999/29	1986/26	1950/26	1954/27	1949/31	2001/01	1989/10	2010/01	1967/05	1966/01	-
Extreme Daily Minimum (°C)	-26.1	-29.5	-29.2	-15.6	-7.1	-1.1	3.5	2.2	-0.7	-5.6	-14.9	-20.2	-
Date (yyyy/dd)	1957/29	1990/05	1990/08	1994/02	1993/11	1943/01	2009/08	1975/25	1986/21	1969/31	1992/24	1984/26	-
Precipitation													
Rainfall (mm)	28.9	27.2	36.9	61.5	94	104.1	118.4	130.4	127.5	124	93.8	48.6	995.3
Snowfall (cm)	113.3	90.1	54.4	17	3.3	0	0	0	0.1	2.9	26.2	86	393.2
Precipitation (mm)	124.6	105.3	86.2	77.7	97.4	104.1	118.4	130.4	127.6	126.9	118.4	123.4	1340.4
Extreme Daily Rainfall (mm)	52.8	83.8	50.8	68.8	53.6	130.7	84.1	96	76.4	50.2	63	48.2	-
Date (yyyy/dd)	1979/08	1946/22	1968/20	1994/07	1993/14	1995/08	1979/17	1989/05	2005/27	2000/10	1951/08	1990/08	-
Extreme Daily Snowfall (cm)	56.1	41.7	34	21.1	14	2.5	0	0	2.4	12.7	20.8	35.3	-
Date (yyyy/dd)	1973/31	1964/17	1993/14	1964/02	1963/10	1946/01	1942/01	1942/01	1989/27	1969/23	1997/29	1952/31	-
Extreme Daily Precipitation (mm)	58.8	94	50.8	68.8	58.9	130.7	84.1	96	81	50.2	70.1	48.2	-
Date (yyyy/dd)	1979/08	1946/22	1968/20	1994/07	1954/22	1995/08	1979/17	1989/05	1955/21	2000/10	1958/07	1990/08	-

Table 25.1 Climate Normals, Stephenville, NL (1981 to 2010)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Visibility (Fog) (hours with)													
< 1 km	29.5	18.5	11.4	8	6.4	12.5	13.2	4	2.7	3	4.7	15.9	129.8
1 to 9 km	207.4	155.5	98.8	61.6	52.2	65.4	82.5	56.6	44.1	37.2	70.8	154	1085.9
> 9 km	507.1	504	633.9	650.4	685.4	642.1	648.3	683.4	673.2	703.8	644.5	574.1	7550.3
Source: ECCC 2023													

Precipitation

Total annual average precipitation (snow and rain) at Stephenville meteorological station is 1,340.4 millimetres (mm), with 393 centimetres (cm) of snow and 995 mm of rain. Monthly average precipitation ranges between 78 to 130 mm, with the least occurring in April and the most occurring in August. There is a measured increase in the hours of reduced visibility / fog (less than 1 kilometre [km]) in winter relative to the other months. The Stephenville meteorological station has experienced, on average, 129.8 hours (5.4 days) per year when visibility is less than 1 km (ECCC 2023). The 1981 to 2010 precipitation and visibility (fog) climate normals for the Stephenville meteorological station are presented in Table 25.1. These include rainfall, snowfall, precipitation, extreme daily rainfall, extreme daily snowfall, extreme daily precipitation, and visibility data.

Droughts are usually characterized in terms of severity, duration and intensity. As explained by FracFlow (2023), defining what is considered to be a drought determines the duration of drought conditions. For example, using the mean value for the precipitation as the truncation level produces long periods of drought. For this analysis, the precipitation data from the Stephenville meteorological station between 1942 and 2022 were used with the truncation level (drought condition) being defined as the mean precipitation value minus one standard deviation.

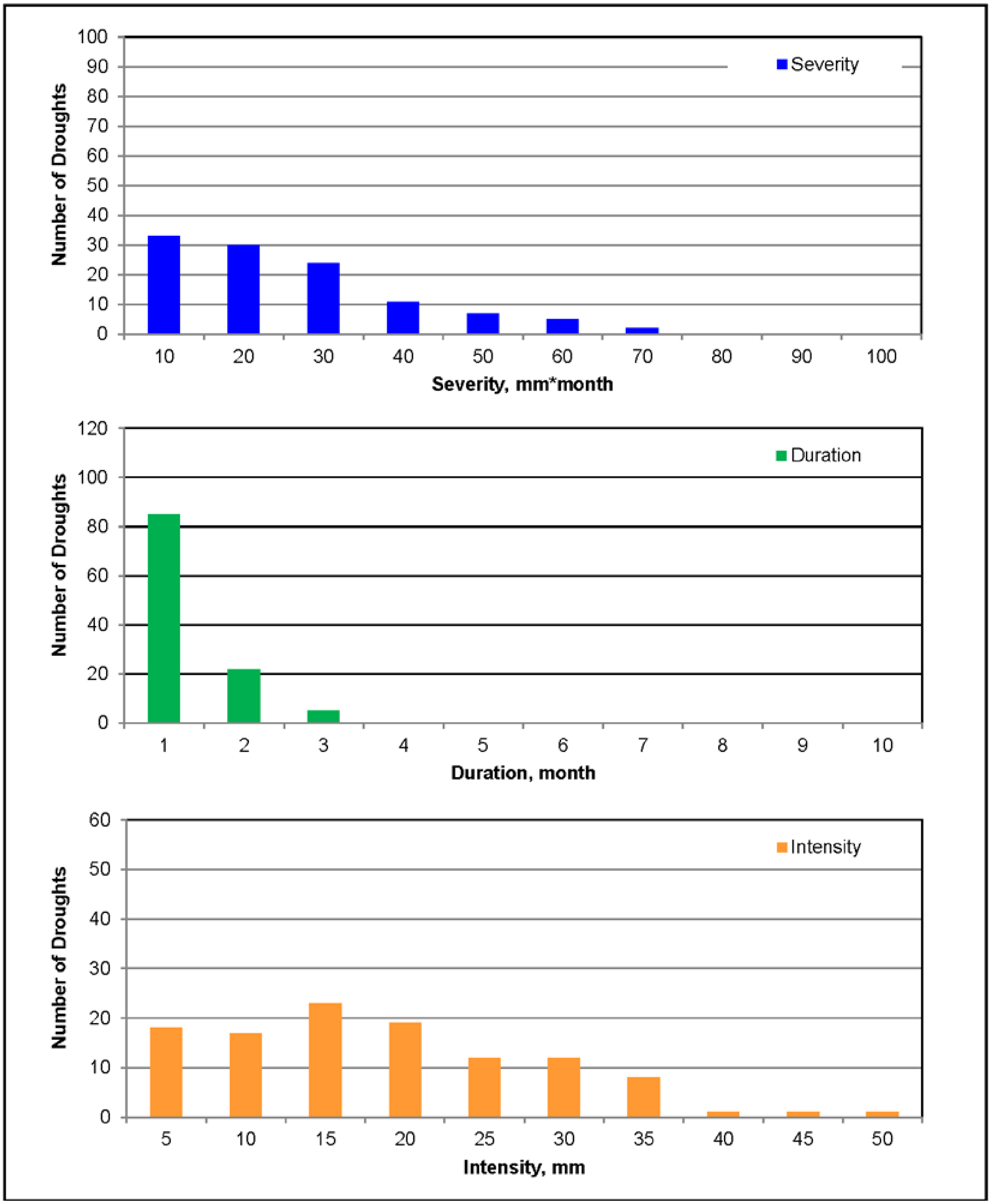
The historical pattern of 30-day drought severity, duration and intensity is shown on Figure 25.2. The monthly data for part of the precipitation record (2005 to 2010) is shown on Figure 25.3, which illustrates extended droughts have a duration of approximately one month, with lesser drought conditions for adjacent monthly periods.

Wind

Winds at the Stephenville meteorological station prevail from the west, northwest, and east directions. The highest wind speeds occur most frequently from the northwest direction and the lowest wind speeds occur most frequently from the northeast direction. Generally, the seasonal winds are consistent, with winds prevailing predominantly from the west and east. The wind speed is generally lower in the summer months (June, July and August) (ECCC 2023). Wind rose plots of the annual and seasonal winds at Stephenville meteorological station are shown in Figures 25.4 and 25.5.

Storms

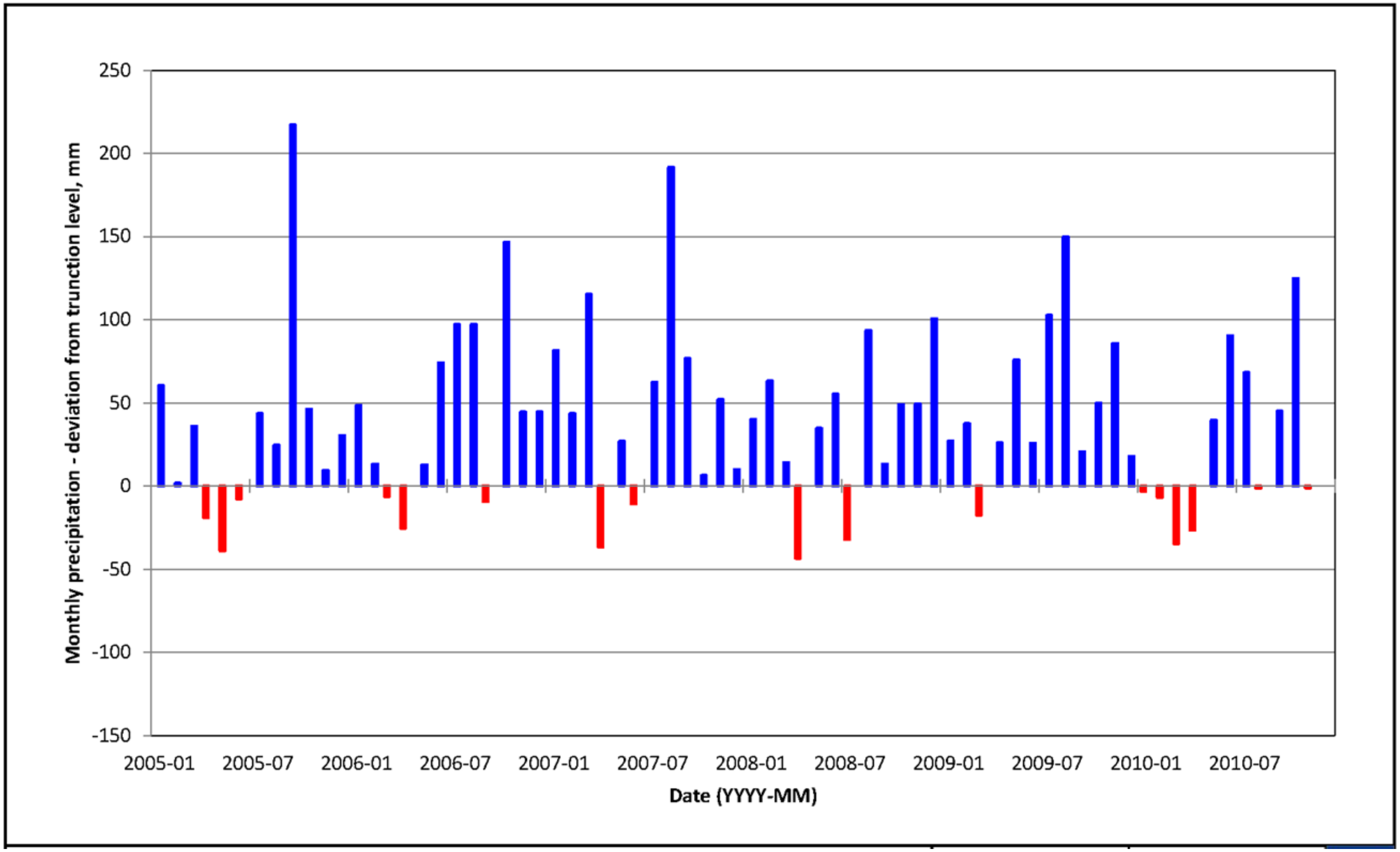
Storm events in NL tend to be more common in the winter (Government of NL 2023), and consist of high winds, snow, rain and ice. A study commissioned by the Government of NL reviewed documented storm events that occurred from 1950 to 2014. Over this period, a total of 296 storm events occurred (an average of five storm events per year); the west coast region of NL experienced 105 storm events during this time (Government of NL 2023). According to climate normals data collected at the Stephenville meteorological station, the largest average snowfall amounts occur in the months of January (113.3 cm) and February (90.1 cm) (Table 25.1)



Source: FracFlow 2023

Note: Uses precipitation data from the Stephenville A Station (1942 to 2022), with the mean minus one standard deviation as the truncation level.

Figure 25.2 Distribution of 30-day / Monthly Drought Characteristics



Source: FracFlow 2023

Note: The truncation level is mean minus one standard deviation using precipitation data from Stephenville A Station between 1997 and 2022.

Figure 25.3 Deviation of Precipitation from the Truncation Level, 2005 to 2010

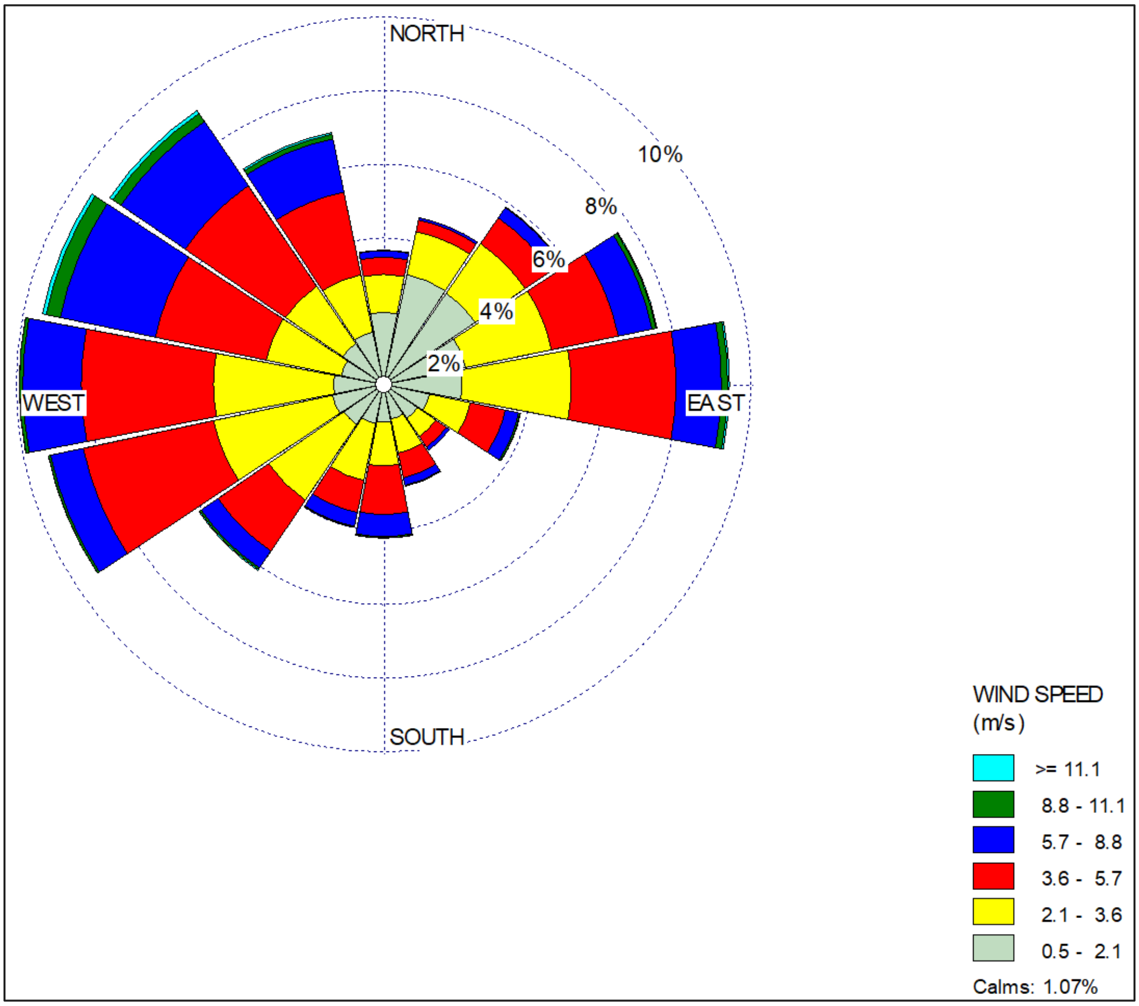


Figure 25.4 Winds at Stephenville, NL (2018 to 2022)

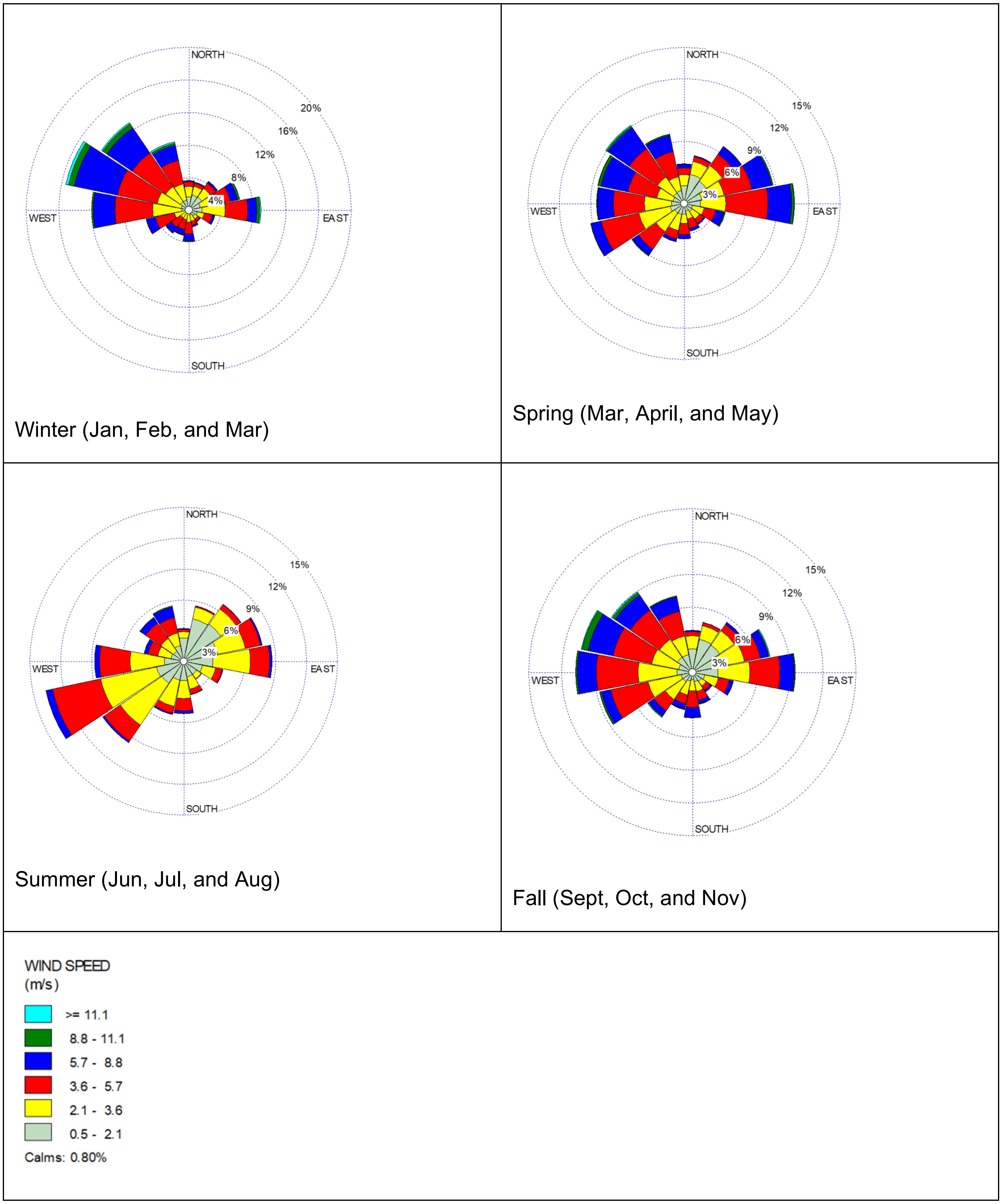


Figure 25.5 Seasonal Winds at Stephenville, NL (2018 to 2022)

Hurricane season occurs between June and November. The aforementioned study found that storm events in September have caused the greatest flooding impacts across NL (Government of NL 2023). For more information on recent hurricanes in NL, see Section 3.3.1 in the Atmospheric Environment Baseline Study (Stantec 2023).

Sea Water Level

The tides along the southern coast of St. George's Bay are classified as mixed, mainly semi-diurnal with successive highs and lows of unequal heights. The tides in the area also have a spring-neap cycle where tidal ranges that occur during the spring tides are approximately double those that occur during the neap tides. Canadian Hydrographic Service tide tables provide tide levels due to astronomical tides. Table 25.2 summarizes tidal levels at Fisheries and Oceans Canada (DFO) stations #2710 and #2720 in Port Harmon and St. George's Bay, respectively referenced to the chart datum (CD).

Table 25.2 DFO Tide Levels in St. George's Bay

Tides	DFO station #2710 Elevation (m, CD)	DFO station #2720 Elevation (m, CD)
Highest Astronomical Tide	1.58	1.60
Higher High Water Large Tide	1.57	1.58
Higher High Water Mean Tide	1.36	1.32
Mean Water Level	0.84	0.82
Lower Low Water mean Tide	0.32	0.34
Lower Low Water Large Tide	0.02	0.03
Lowest Astronomical Tide	-0.01	0.00
Source: 2023 DFO Tide Station #2710: Port Harmon and #2720: St. Georges		

Offshore Waves

Hourly estimated offshore wave data including significant wave height, peak wave period, and mean wave direction was obtained from Meteorological Service of Canada (MSC) 50 North Atlantic Wave Hindcast grid points M6013677 and M6014156 which are located in St. Georges Bay approximately 65 and 5 km southwest of Stephenville's shoreline, respectively. Table 25.3 summarizes available records of wave data at these two grid point locations.

Table 25.3 Offshore MSC50 Wave Records in Proximity to the Project Area

MSC50 Grid Point	Coordinates		Available Data Records
	Easting (m)	Northing (m)	
M6013677	329099.6	5341087.6	Hourly significant wave height, peak wave period, and wave direction from 1/1954 to 12/2018
M6014156	381806.9	5373111.7	Hourly significant wave height, peak wave period, and wave direction from 1/1954 to 12/2018

A wave rose of hourly significant wave height and wave direction at MSC50 grid M6013677 for the period 1954 to 2018 is presented in Figure 25.6. Significant wave height for this period ranged from 0.10 to 9.63 m, with an average significant wave height of 1.42 m. A review of the rose plot indicates that the dominant wave direction is from the west and southwest.

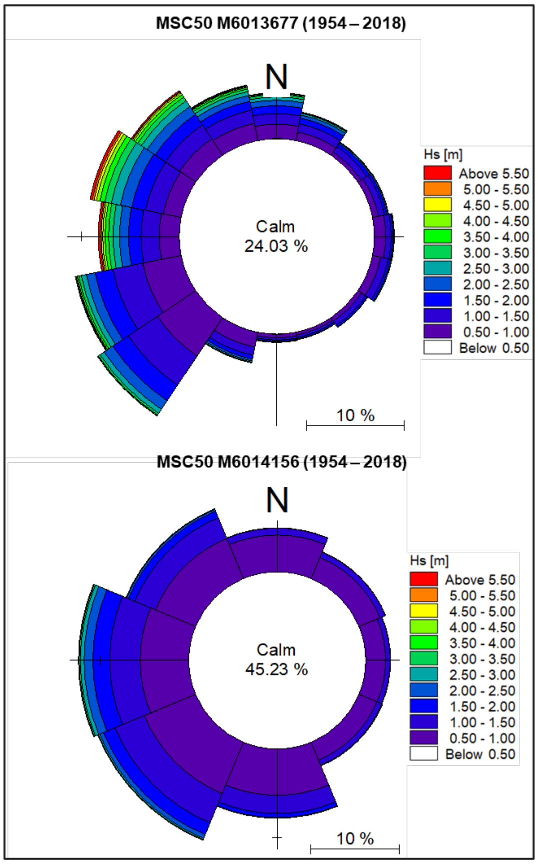
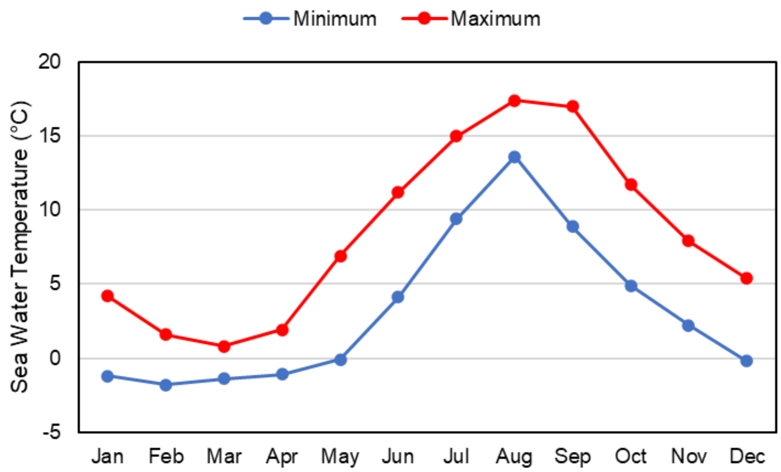


Figure 25.6 Rose Plot of Hourly Significant Wave Height and Wave Direction (from) at MSC50 M6013677 and M6014156 for the Period 1954 – 2018

A wave rose of hourly significant wave height and wave direction at MSC50 grid M6014156 for the period 1954 to 2018 is also presented in Figure 25.6. Significant wave height for this period ranged from 0.10 to 4.8 m, with an average significant wave height of 0.74 m. A review of the rose plot indicates that the dominant wave direction is from the west and southwest.

Ocean-Water Temperatures

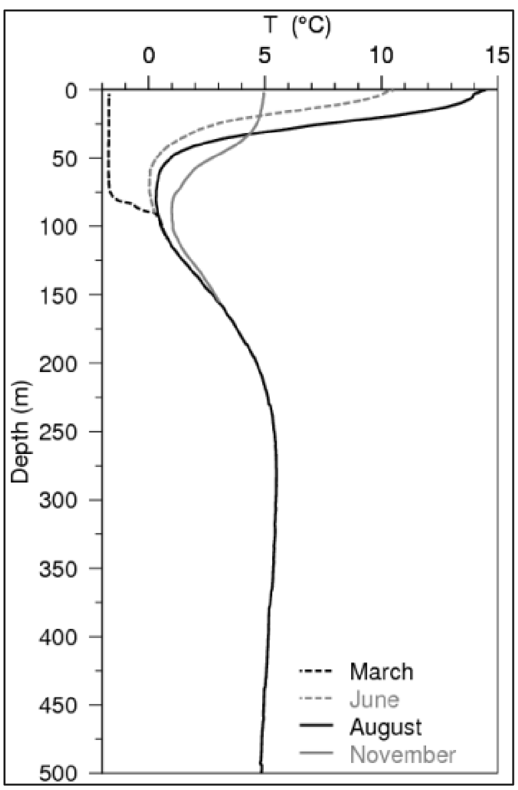
Recorded sea surface water temperature data at Stephenville Crossing by the National Oceanic and Atmospheric Administration (NOAA) are summarized in Figure 25.7, which indicates a range from -1.8ºC to 17.4ºC for near surface temperature.



Source: seatemperature.org

Figure 25.7 Seawater Surface Temperature at Stephenville Crossing

Figure 25.8 presents typical seasonal variation of ocean water temperature in the Gulf of St. Lawrence with a bottom temperature close to 5ºC.



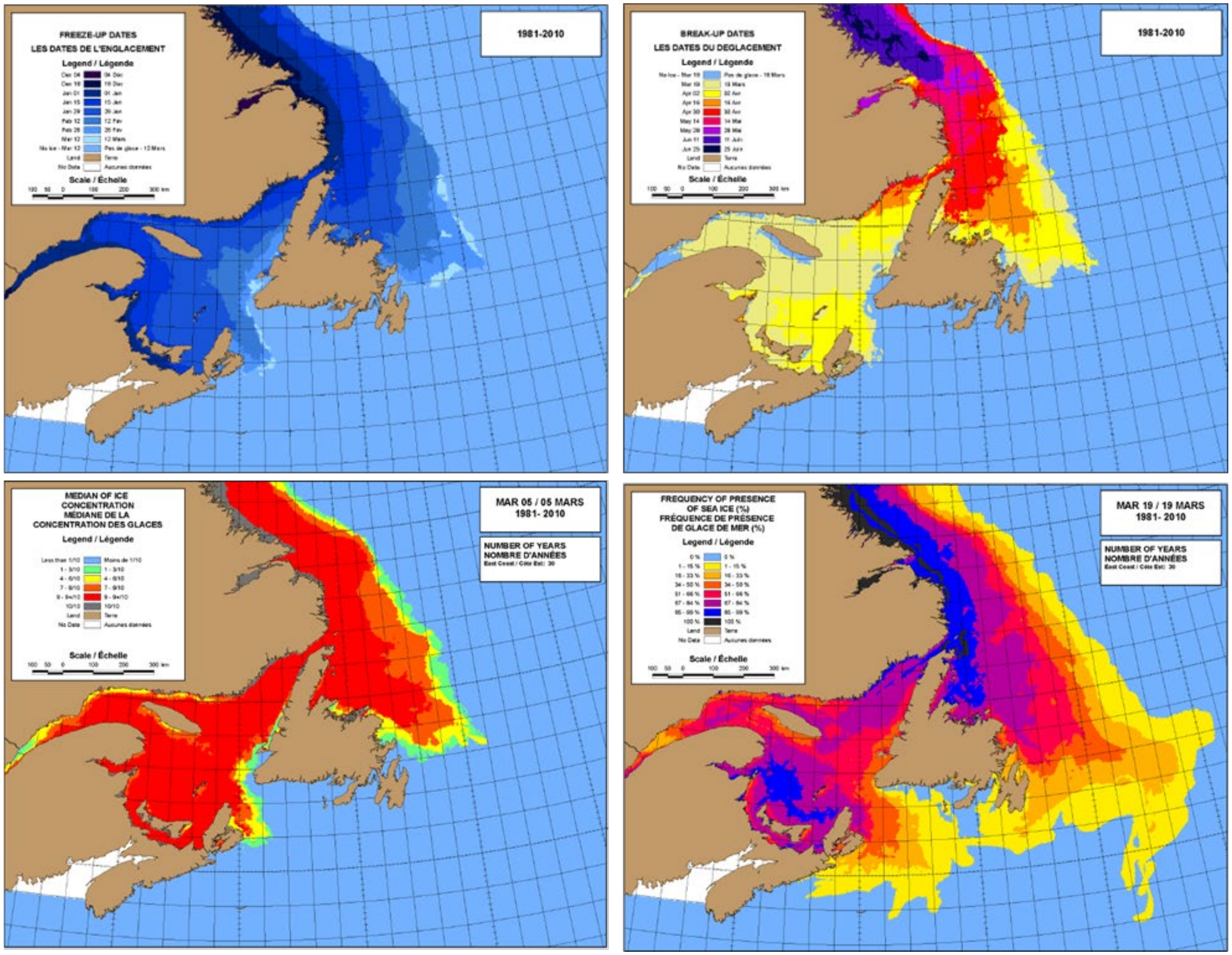
Source: Figure from Galbraith et al. 2012

Figure 25.8 Typical Seasonal Variation of Temperature Over Depth Observed in the Gulf of St. Lawrence

Sea Ice Conditions

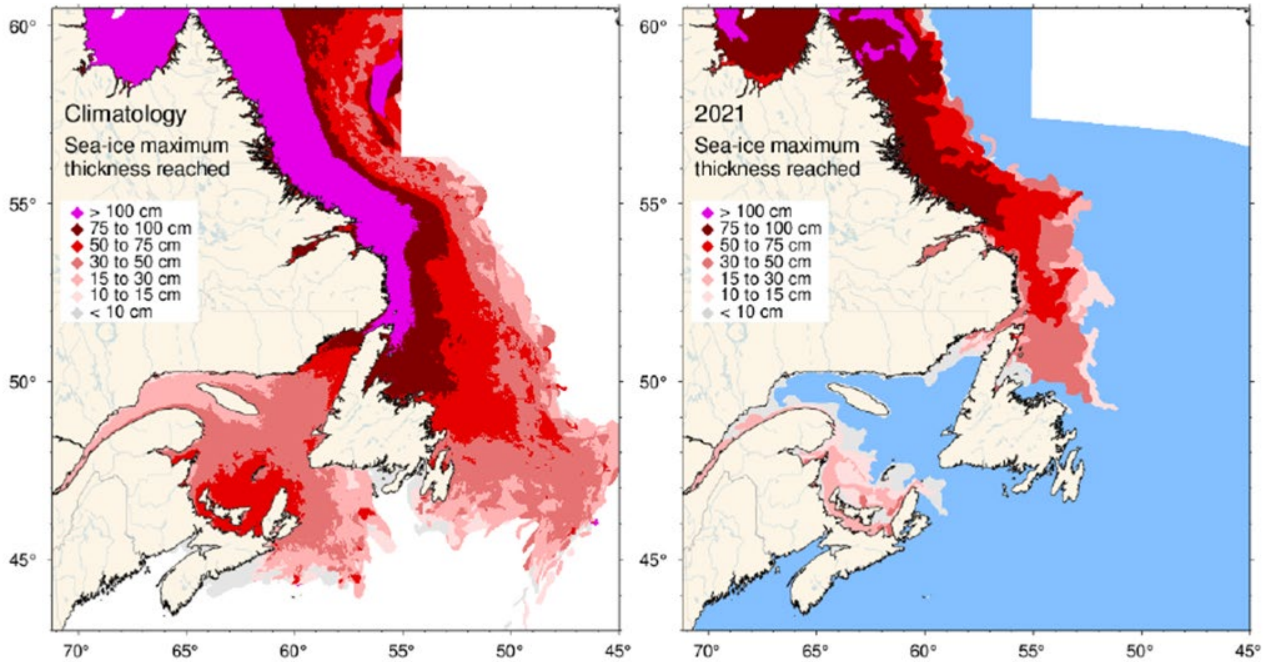
ECCC's *Sea Ice Climate Atlas for the East Coast* (ECCC 2011) provides sea ice conditions for the period from 1980 to 2010. The ice charts contained within this atlas are derived climatological products representing a 30-year "normal" of various ice parameters. Figure 25.9 presents a summary of ice information obtained from the Atlas. A review of available information in the Atlas near the Project Area indicates that ice freeze-up can occur in January in St. George's Bay and Port au Port Bay with a freeze up in April. As shown in Figure 25.9, frequency of presence of sea ice is higher in March, with a maximum frequency of (34% to 50%) and (51% to 66%) in St. George's Bay near Stephenville and Port au Port Bay, receptively. The maximum ice concentration[1] in the St. George's Bay is less than 1/10 and 9-9+/10 in Port au Port Bay. Therefore, the probability of sea ice formation in Port au Port Bay is much higher compared to St. George's Bay. Figure 25.10 presents maximum ice thickness for 2021 and 1991-2020 for the week with the maximum annual volume on the Newfoundland and Labrador Shelf, which indicates that the maximum ice thickness at these locations during this period reached from 30 to 50 cm.

[1] Ice concentration on ice charts indicates the ice coverage of an area and expressed in tenths.



Source: ECCC 2011

Figure 25.9 Sea Ice Atlas Charts Presenting Freeze-up and Break-up Dates, Ice Concentrations, and Frequency of Presence of Sea Ice



Source: DFO 2022

Figure 25.10 Spatial Variation of Ice Thickness for 2021 for the Week with the Maximum Annual Volume on the Newfoundland and Labrador Shelf and for the 1991-2020 Climatology of the Weekly Maximum

25.2.1.2 Potential Effects

Weather, climate, and metocean conditions could have the following potential effects on the Project:

- Damage to infrastructure and equipment
- Water shortage due to extended drought conditions
- Delays in receipt of materials and supplies and delays in delivering products to market
- Delays or interruption to construction activities or Project operations
- Reduced visibility and inability to maneuver equipment
- Changes in the ability of workers to access the site (e.g., if a road were to wash out, or poor driving conditions)
- Loss of electrical power resulting in potential loss of production
- Public safety risks associated with ice build-up on infrastructure (e.g., ice throw from turbine blades)

Extreme precipitation and associated surface water runoff from snowmelt, rainfall and freezing rain events have the potential to cause flooding, erosion, and wash out roads. These events could cause erosion of topsoil, degradation of water quality and the structure and stability of soil, changes to slope stability, and the failure of erosion or sedimentation control structures. If a road is washed out, access to the site could be restricted, delaying the transportation of materials, supplies, products, and workers to and from site.

Low flow and drought conditions were factored into the assessment of a reliable water source for the Project. The stream from Gull (Mine) Pond tends to have minimum low flows or dry up during low flow or drought events (after it leaves the flow control barrier). Drought conditions can and do occur from the Gull (Mine) Pond supply. However, additional confirmation of the industrial water that was available from the Warm Creek discharge into Noels Pond is provided by the data in The Water Resources Atlas of Newfoundland, which notes that Abitibi mill site operators used an average of more than 15.9 m^3/min of industrial water that was drawn from the Muddy Pond and Noels Pond system through the large diameter pipeline between Muddy Pond and Gull (Mine) Pond. Noels Pond was also part of the original source of the potable water for the Town of Stephenville, but was decommissioned in the early 2000s in favor of a groundwater source in the Blanche Brook drainage basin. It is estimated that more than 37.9 m^3/min of water were being withdrawn from Noels Pond when both the Town of Stephenville and the industrial users were withdrawing water from Noels Pond. The Project is projected to draw less than 65% of that amount on the average, at maximum demand.

Extreme snowfall, freezing rain, storms and hurricanes could damage infrastructure and equipment, cause delays in the receipt of construction materials, result in additional effort for snow clearing and removal, prevent or delay workers from accessing the site, or could cause an interruption to Project construction, operation, or maintenance. Extreme snow and ice could increase load on buildings and other Project infrastructure and could result in damage if the accumulated loading exceeds design loads. These conditions can also cause electricity outages, resulting in potential loss of production.

High winds, especially those greater than 90 km/hr, have the potential to damage buildings, fences, and other outdoor structures.

Reduced visibility can be caused by fog, heavy precipitation and strong winds. Reduced visibility could make it difficult to maneuver equipment, and could cause delays to construction activities, moving materials, and the receipt of equipment and supplies.

Cold weather, heavy snow, freezing rain, and ice pellets can result in ice build-up on infrastructure. Accumulated ice may fall from the wind turbine when it is not in operation (referred to as ice fall), and ice throw (i.e., ice detaches from the rotating blades) can occur when a wind turbine is in operation. Ice shedding is a term that refers to both ice fall and ice throw (CanREA 2020).Ice throw distance and strike location depends on multiple factors such as wind direction and wind speed, but also the blade rotational speed, location on blade where the ice detaches, the shape/ice type of the ice fragments, and others. Based on modelling conducted for the Project, turbine blade icing is expected to occur approximately 11 days per year in total, typically between October and May. Blade icing events typically last one to two days before the ice naturally thaws. This can equate to approximately 2,300 ice fragments thrown per year, if a wind turbine is operating (i.e., spinning at intended rpm) continuously during ice events, and the expected median fragment size in the range of 0.5 kg to 1.0 kg. Model simulations showed that in the event of ice throw by turbine blades, throw distances would be typically less than 170 m from the wind turbine bases, and the maximum throw distance would be up to 290 m. However, it is improbable that this maximum distance would be reached during the Project life as the predicted rate for ice throw at this maximum distance is once every 1,000,000 years per m^2 (DNV Canada Ltd. 2023).

Extreme storms and hurricanes result in generating large waves in the ocean and potentially limit vessel operation and reduce maneuverability of the vessels in the ocean. As a result, delays may occur in receipt of materials and supplies and delays in delivering ammonia to market. A combination of high water level, future sea level rise, and storms can result in coastal flooding and potential damage to the shoreline.

In addition, the presence of sea ice can limit the operation of the vessels depending on the concentration and thickness of sea ice. A review of the Sea Ice Atlas indicates that freeze-up and ice break-up near the Project Area occur late January and mid-March, respectively and therefore, it is expected that depending on concentration and thickness of ice, vessel operation and maneuvering will be limited during this period. When sea ice is present, ice concentration can reach to 9-9+/10 in the Gulf of St. Lawrence with a maximum ice thickness from 30 to 50 cm.

25.2.1.3 Mitigation

Mitigation measures presented in Table 25.4 will help manage the interactions between weather, climate, and metocean conditions and the Project.

Table 25.4 Summary of Mitigation: Weather, Climate, and Metocean Conditions

Mitigation	C	O	D
The Project will be designed and constructed to meet applicable engineering codes, standards and best management practices (e.g., National Building Code of Canada, Canadian Standards Association Guide to Canadian Wind Turbine Codes and Standards, National Fire Code of Canada). The codes and standards account for safety features that address hazards from power outages, sudden system upset/disruption, weather variables, including extreme conditions, that could affect the structural integrity of buildings and infrastructure. Designs will also consider projected climate change over the life of the Project. For example, the National Building Code of Canada contains design requirements to account for extreme weather on infrastructure such as: • Critical structures and steel selection to prevent brittle fracture at low ambient temperatures • Electrical grounding structures for lightning protection • Maximum motor ambient temperature • Ice and freeze protection	✓	✓	✓
To mitigate ice shedding: • WEGH2 will install warning signs to indicate the potential risk of ice shedding around the wind turbines • WEGH2 will implement winter operating protocols and controls to reduce unwanted loads from iced blades, as well as reduce the risk of ice fragments striking a person or other structure. This includes, for example, shutting down wind turbines when higher icing risk conditions exist. • WEGH2 will implement a minimum 412.5 m safety setback within which no person will be allowed to enter during icing conditions, even when the turbine is idle. • Staff will require personal protection equipment to be worn at all times near the wind turbines		✓	

Table 25.4 Summary of Mitigation: Weather, Climate, and Metocean Conditions

Mitigation	C	O	D
The potential effects of extreme weather including storms, precipitation, flooding / ice jams, and drought will be considered in Project planning, design and operation and maintenance strategies, including the selection of materials and equipment, and design of components. These designs will consider projected climate change conditions over the life of the Project.	✓	✓	✓
WEGH2 will regularly inspect and monitor Project infrastructure and equipment that may be impacted by the environment (in addition to its normal function) and take required action to maintain, repair and upgrade infrastructure / equipment as needed.	✓	✓	✓
Work activities will include allowance / procedures for delays due to poor weather.	✓	✓	✓
Contingency plans, including emergency back-up power for necessary operations, will be in place to manage delays, such as temporary power outages.	✓	✓	✓
Weather forecasts (including marine forecasts) will be considered when planning construction and operation activities that may be affected by adverse conditions, such as receipt of materials and supplies, product deliveries, particularly deliveries of chemicals and reagents, movement of turbine components during construction, and shipment of ammonia. Where required, these activities will be scheduled for periods of favourable weather conditions.	✓	✓	✓
Weather forecasts (including marine forecasts) will be regularly monitored and prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Project. This will include site inspection by staff to secure loose items and identify other risks (for wind events), and inspection / maintenance of sediment and erosion control measures prior to and following precipitation events.	✓	✓	✓
Notes: C – Construction Activities; O – Operation Activities; D – Decommissioning, Rehabilitation and Closure Activities			

25.2.1.4 Residual Effects

Effects of the environment, including weather, climate, and metocean conditions, will be considered and incorporated into the planning, design, construction and operation of the Project. With the implementation of the mitigation measures and use of the design standards and guidelines described above, weather, climate and metocean conditions are not anticipated to have substantial adverse residual effects on the Project.

25.2.2 Climate Change

Mathematical and statistical models are used to predict climate change and these predictions are then considered in the context of the Project timeframe. Model results can be used to guide Project planning, design, and adaption, . The nominal Project design life is estimated to be 30 years, with the decommissioning anticipated for 2057. Over the next 50 years, Atlantic Canada is predicted to experience warmer temperatures, increased precipitation, more frequent and intense storm events, sea level rise, and increased flooding (Poitras et al. 2022; Dietz and Arnold 2021; Comeau and Nunes 2019).

25.2.2.1 Existing Conditions

The following sections describe the predicted climate changes for atmospheric and oceanographic conditions.

Atmospheric Climate Changes

Temperature

In 2018, the Government of NL commissioned a Climate Projections Study that identifies how the province's climate, including temperature and precipitation, is projected to change by the year 2100 (Memorial University of Newfoundland [MUN] 2018).

Daily mean, minimum and maximum temperatures are projected to increase throughout NL, with the largest changes in the winter, at high latitudes, and away from coastlines (MUN 2018). The average daily mean temperature in Stephenville is expected to rise from 5.1°C in the 20th century to 8.4°C by 2070 and 10.4°C by 2100 (MUN 2018). This correlates with data published by Climate Data, a collaboration between ECCC, the Computer Research Institute of Montréal, Ouranos, the Pacific Climate Impacts Consortium, the Prairie Climate Centre, and HabitatSeven. According to Climate Data projections, the mean annual temperature in Stephenville is expected to rise to 8.5°C between 2041 and 2070, and to 10.7°C between 2070 and 2100 (Climate Data 2023c).

For additional detail, including a presentation of the projected daily mean temperature at Stephenville from the Climate Projections Study, refer to Section 3.3.2 in the Atmospheric Environment Baseline Study (Stantec 2023).

Precipitation and Storms

According to the Climate Projections Study commissioned by the Government of NL, daily mean precipitation is expected to increase throughout the province of NL by mid-century, and larger changes are expected by the end of the century (MUN 2018). At Stephenville, daily mean precipitation by 2100 is expected to be slightly lower in the winter (0.1 mm less) compared to 20th century climate. Daily mean precipitation in the spring, summer, and fall is expected to increase slightly by an average of 0.6 mm per day (MUN 2018). Additionally, the typical precipitation event is expected to become more intense over time (MUN 2018). At Stephenville, the mean intensity of precipitation events in 2100 is expected to increase by as much as 16% (from 8.5 mm to 10.0 mm) (MUN 2018). Climate Data estimates the total annual precipitation at Stephenville to increase from 1,214 mm (1991 to 2020) to 1,409 mm (2070 to 2100), which is an increase of approximately 14% (Climate Data 2023c).

The Climate Projections Study includes expected changes to intensity-duration-frequency precipitation (IDF) analyses. IDF curves are graphical tools that describe the likelihood of a range of extreme rainfall events, typically ranging from 5 minutes to 24 hours (Climate Data 2023a). The median projected IDF response indicates considerable increases in extreme precipitation can be expected in NL in the future (MUN 2018). For example, on a 24-hour basis, a 1-in-100 years storm is expected to result in 147.7 mm of precipitation by 2070 and 183.7 mm by 2100; this represents an increase from 133.0 mm expected in the current climate.

For additional detail, including a presentation of the projected daily (24-hour) mean precipitation, mean intensity of precipitation events, and median of IDF precipitation projections at Stephenville, refer to Section 3.3.2 in the Atmospheric Environment Baseline Study (Stantec 2023).

Changes in Oceanographic Conditions

Ocean-Water Temperatures

According to Chapter 7 of *Canada's Changing Climate Report: Changes in Oceans Surrounding Canada* (Greenan et al. 2018), in the northern Atlantic Ocean off the Atlantic provinces, a long-term warming trend was observed based on available data in the Gulf of St. Lawrence, Scotian Shelf, and Gulf of Maine (Galbraith et al., 2017; Hebert et al., 2016). There has been a high correlation between mean water surface temperature and regional air temperature in the Gulf of St. Lawrence since 1985. Therefore, it is expected that the near surface temperature increases by the projected long-term increase in air temperature. Near the bottom a warming rate of 0.23°C per decade is projected which is related to an increasing influence of subtropical waters from the Gulf stream transported at depth into the Laurentian Channel (Gilbert et al. 2005).

Waves

According to Chapter 7 of *Canada's Changing Climate Report: Changes in Oceans Surrounding Canada* (Greenan et al. 2018), small increases in summer wave heights (approximately 2 cm per decade) and decreases in winter were observed for the period of 1948-2008 (Bromirski and Cayan 2015). However, results of observation from voluntary observing ships (VOS) indicated an increase around 0.10 m per decade for the period of 1958-2002 (Gulev and Griforieva 2006). Projections in the Gulf of St. Lawrence suggest decreased mean wave heights in summer and increased wave heights in winter. Reduced sea ice is an important factor, allowing an increase in wave heights in winter (Long et al. 2015; Perrie et al. 2015; Wang et al. 2018).

Sea Level

Sea level rise can result in increased height of water levels, waves, and tides. The implication for coastal change in NL includes an increase in the extent and frequency of coastal flooding, increased erosion of the cliff base, and landward migration of beaches and dunes (Batterson 2020). In 2020, the government of NL funded the development of a data portal for information on the implications of sea level rise. The portal includes case studies about coastal changes across the province and a user guide on how to use the data (Government of NL n.d.). According to the study, a relative sea level rise[2] of over 110 cm is expected for eastern parts of NL by the year 2100, with somewhat lesser rise predicted on the west coast of the Island of Newfoundland (Batterson 2020). Climate Data predicts that sea level rise on the west

[2] Relative sea level rise refers to how the height of the ocean rises and falls relative to the land at a specific location. In contrast, absolute sea level change refers to the height of the ocean surface above the centre of the earth (US EPA 2022).

coast, near Stephenville, will increase by 38 to 111 cm by 2100 (assuming a Representative Concentration Pathway [RCP] of 8.5[3]) (Climate Data 2023c).

Changes in Sea Ice Conditions

Due to an increasing trend of ocean surface temperature discussed in Greenan et al. (2018), a declining trend in sea ice is projected which impacts the ocean wave conditions in winter and increases in winter wave heights are projected (Long et al. 2015; Perrie et al. 2015; Wang et al. 2018).

25.2.2.2 Potential Effects

In addition to the effects listed in Section 25.2.1.2, it is expected that climate change could result in increased ambient temperatures, increased frequency and intensity of precipitation and storm events, and increased incidence of flooding and erosion. These changes could result in an increased severity or likelihood of potential effects described in Section 25.2.1.2.

25.2.2.3 Mitigation

Climate change will be considered during the planning and design of the Project, and climate change projections will be incorporated into the design criteria. The mitigation measures listed in Table 25.1 for weather, climate and metocean conditions also apply to climate change.

25.2.2.4 Residual Effects

The effects of climate change will be considered and incorporated into the planning, design, construction and operation of the Project. With the implementation of the mitigation measures and use of the design standards and guidelines described above, climate change is not anticipated to have substantial adverse residual effects on the Project.

25.2.3 Geological Hazards

Terrain mapping has been completed for the Port-au-Port Peninsula and a 500 m wide swath centered along the proposed transmission line between the peninsula and the port facility located in Stephenville (Stantec 2023). The purpose of this mapping was to review the surficial and bedrock geology, as well as complete an assessment of constraints or hazards that may be present within the proposed Project Area. Terrain mapping was not completed for the Codroy Wind Farm; however, commentary is based on publicly available information.

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[3] RCPs represent climate projection results from different combinations of assumptions about population growth, economic activity, energy intensity, socio-economic development, land use change, and climate policies; different combinations of assumptions lead to different amounts of GHG emissions in the future. RCP 8.5 is the high emissions scenario, where GHG emissions continue to increase through the century, stabilizing by the year 2250 (Climate Data 2023b).

25.2.3.1 Existing Conditions

The following sections describe the existing conditions for surficial geology, bedrock geology, terrain stability, and seismic activity.

Surficial Geology

The landscape of the Project Area is influenced by the most recent glaciation as well as by post-glacial erosion and deposition processes. Around Stephenville and Port au Port, according to the detailed surficial geology map of Newfoundland and Labrador, the dominant surficial geology at the proposed sites for the infrastructure appear to consist of rock concealed by vegetation and till on the Port au Port peninsula and glaciofluvial sediments around the Stephenville area (Geology Survey of Canada 1973; Grant 1991; Batterson 2001). Colluvial deposits may be locally important along hill slopes, ridges, and on coastal cliffs. Peat bogs and fens have accumulated over the poorly drained glacial deposits.

Similar conditions are depicted at the Codroy Wind Farm (Liverman and Taylor 1990), where there is exposed and concealed bedrock indicated to be present, as well as till veneers. Glacioflucial gravel and sand deposits are to be anticipated along former drainage channels that are shown to travel towards the Bay of St-Lawrence at several locations along the proposed transmission alignment to the Stephenville port.

The sea level was estimated to have risen by 44 m above present sea level after the retreat of Late Wisconsinan glacial ice in the area (Brookes et al. 1985). This suggests that soils at elevations lower than 44 m could contain fine-grained marine deposits.

Bedrock Geology

Baseline information on bedrock geology of the Project Area is publicly available in the Geoscience Atlas of Newfoundland and Labrador developed by the Geological Survey Division of the Mining and Mineral Department of the Government of Newfoundland and Labrador (Tamarack Geographic Technologies Ltd. 2013). Based on the *Newfoundland Detailed Bedrock Geology* map (Colman-Sadd et al. 2000), most of the Project Area on the Port-au-Port peninsula consists of carbonates and carbonate limestones belonging to the Port-au-Port group from the middle Cambrian to early Ordovician (between 487 and 505 million years ago). On the North and North-West of the peninsula, the bedrock consists of siliciclastic marine rocks that belong to the Goose Tickle Group from the middle to late Ordovician (between 454 and 465 million years ago), and sedimentary rocks which belongs to the Humber Arm Allochthon from the middle Ordovician (between 458 and 612 million years ago).

The Stephenville area comprises many different groups such as the Port au Port group, the Labrador group, the Humber Arm Allochthon, and the Table Head group with bedrocks formed by carbonate, siliciclastic, sedimentary, and carbonate limestone rocks, respectively.

The Codroy area, and transmission route towards Stephenville, is comprised of two primary groups, the Anguille and Codroy Groups, that are formed of siliciclastic and sedimentary rock (Knight 1983).

Terrain Stability (Landslides, Rockfalls, Erosion, Subsidence, and Avalanches)

The topography of the Stephenville area is mainly planar with some undulating areas, while the Port-au-Port peninsula consists mostly of bedrock-controlled hummocky to undulating topography. Ridged structures are visible wherever bedrock is exposed or at shallow depths.

Shoreline erosion and landslide activity were identified along the escarpment marking the shoreline of Saint George's Bay just south of Main Street (area west of Stephenville) which is primarily comprised of sandy to gravely glaciofluvial deposits.

Based on observations made as part of the field reconnaissance visit during the terrain mapping (Stantec 2023), the erosion appears to be related to both rainfall/surface runoff and wave action along the base of the escarpment. The current rate of erosion along the section of shoreline located alongside the proposed 230 kV transmission line route is currently unknown. The observed landslides were in the same section of shoreline subject to erosion (Figure 25.11).

Source: Stantec 2023

Figure 25.11 Shoreline Erosion and Landslide Activity (in white outline) Seismic Activity

Indications of large-scale landslides, rockfalls, and slope instability were not observed using publicly available satellite imagery within the Project Area at Codroy Wind Farm.

The Project Area is categorized as having a low seismic hazard by the Geological Survey of Canada, as illustrated in the seismic hazard maps produced by the Geological Survey of Canada (2015).

The Natural Resources Canada database identified earthquakes that have occurred between January 1, 1980, to February 21, 2023, within a 250 km radius centred on Port au Port Peninsula (Figure 25.12). Figure 25.13 illustrates that only two earthquakes have been recorded in proximity to the Project Area.

25.2.3.2 Potential Effects

Terrain Stability (Landslides, Rockfalls, Erosion, Subsidence, and Avalanches)

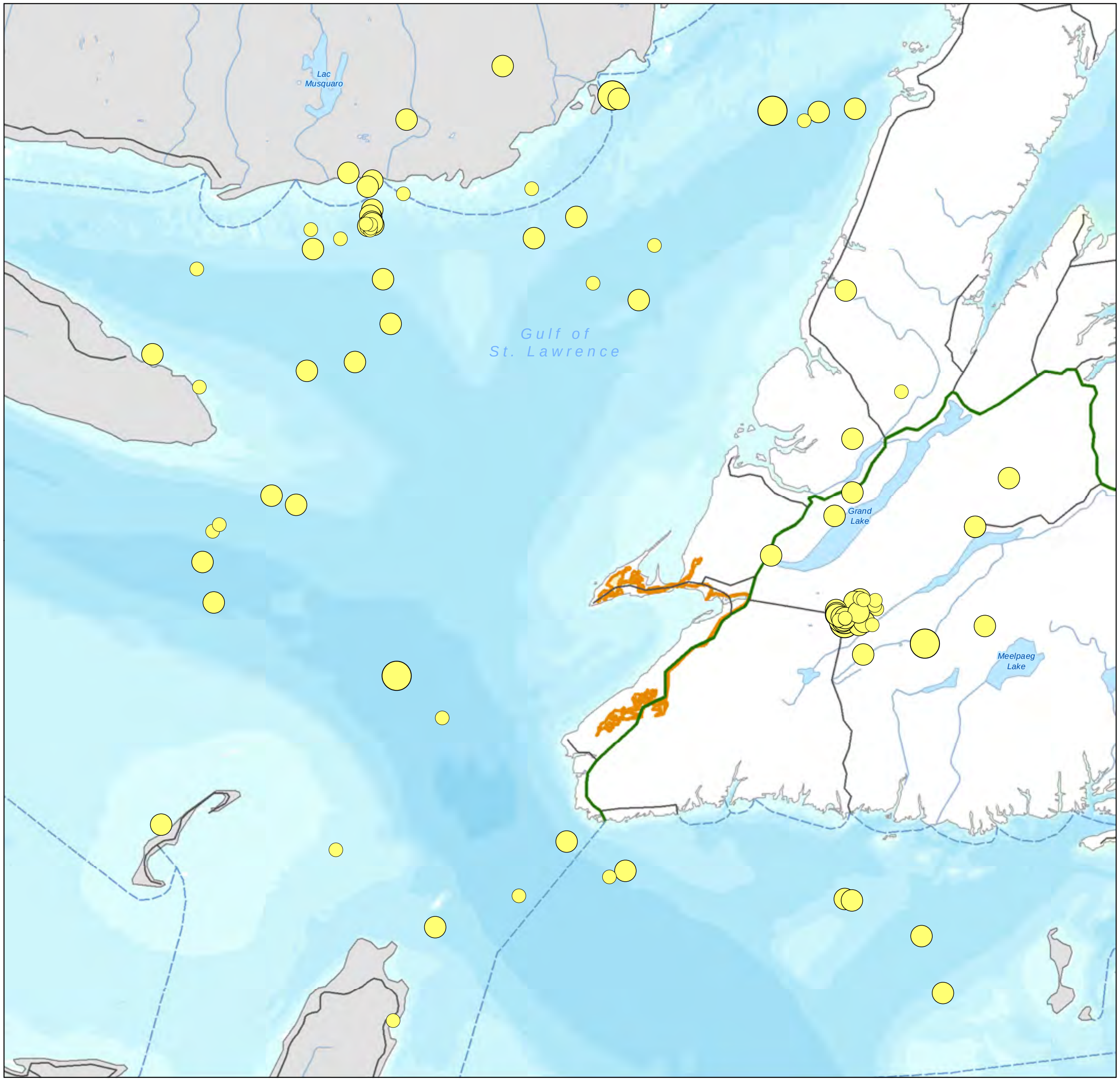
Based on the recent observations of slope instability and coastal erosion it is anticipated that these effects will continue to occur and evolve in the Stephenville area. Project infrastructure will be designed and constructed with this knowledge as the basis of design. The Project Area at Codroy Wind Farm is located inland and therefore is not vulnerable to coastal erosion, however based on the surficial geological mapping (Liverman and Taylor 1990) it is anticipated that erosional features would be most likely be encountered along the rivers and streams where more readily erodible sands and gravels are expected to be present.

In the absence of indications of naturally occurring rockslides and landslides in the Project Area, the potential for landslides and rockfills will be primarily influenced by the development of the overall site. At locations where there are rock cuts required for the construction of new roads, or benching of slopes or general re-grading, there is the potential for rockfalls to occur.

Carbonate bedrock, such as the gypsum and limestone formations found within the Project Area do have the inherent risk of developing karst topography as a result of subsidence. Based on the terrain mapping completed for Stephenville evidence of past karst topography was not observed within the local carbonate deposits.

Seismic Activity

The risk of adverse seismic activity in NL is low and there is only two past seismic events recorded in the vicinity of the Project Area (and none in the immediate Project Area). Nonetheless, Project infrastructure (e.g., turbines, buildings, electrolyzers, transmission lines) will be designed to account for potential seismic events in accordance with the recommendations provided by the National Building Code of Canada (National Research Council of Canada 2015). The probability of a seismic event occurring in the Project Area that would have the potential to result in Project damage or interruption is low due to the combination of low seismic hazard risk with the adoption of the nationally accepted design standards.



Seismic Activity (1985-2023)

Magnitude (MN)

- 1.1 (lowest) - 2
- 2.01 - 3
- 3.01 - 3.5 (highest)

Proposed Project Features

- Project Area

Other Features

- Trans-Canada Highway
- Secondary Highway

Source: Natural Resources Canada 2023. Available at: https://earthquakescanada.nrcan.gc.ca/stndon/NEDB-BNDS/bulletin-en.php

Note: Earthquakes recorded between January 1, 1980, to February 21, 2023, within a 250 km radius centred on Port au Port Peninsula

See Figure 25.13 for earthquakes recorded in vicinity of the Project Areas.

N

0 30 60 Kilometres
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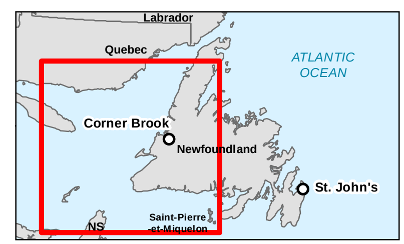
1:2,800,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, Natural Resources Canada 2023 Earthquake Database
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MB on 2023-07-27
QR by AW on 2023-07-25

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_055a

Figure No.
25.12

Earthquakes Recorded within a 250 km Radius Centred on Port au Port Peninsula

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Stantec

Seismic Activity (1985-2023)

Magnitude (MN)

- 1.1 (lowest) - 2
- 2.01 - 3
- 3.01 - 3.5 (highest)

Proposed Project Features

- Hydrogen / Ammonia Plant Location
- Transmission Line 230 kV
- Project Area

Other Features

- Transmission Line, Existing
- Trans-Canada Highway
- Road
- Resource Road / Trail
- Contour (100 m)
- Watercourse
- Waterbody
- Forested Area

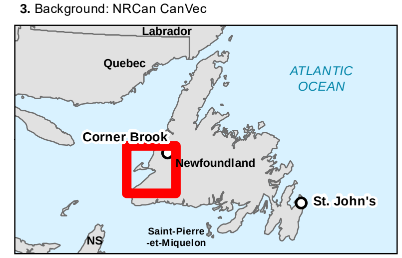
Source: Natural Resources Canada 2023 Available at: https://earthquakescanada.nrcan.gc.ca/stndon/NEDB-BNDS/bulletin-en.php

Note: Earthquakes recorded between January 1, 1980, to February 21, 2023, within a 250 km radius centred on Port au Port Peninsula

N

0 10 Kilometres
(At original document size of 8.5x11)
1:775,000

Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: World Energy GH2, NRCan CanVec, OpenStreetMap, Natural Resources Canada 2023 Earthquake Database
3. Background: NRCan CanVec



Project Location
Stephenville
NL

Prepared by MB on 2023-07-27
QR by AW on 2023-07-25

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_055

Figure No.
25.13

Earthquakes Recorded in Vicinity of the Project Area

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25.2.3.3 Mitigation

Mitigation measures presented in Table 25.5 will help manage the interactions between geological hazards and the Project.

Table 25.5 Summary of Mitigation Measures: Geological Hazards

Mitigation	C	O	D
The Project will be designed and constructed to meet applicable engineering codes, standards, and best management practices, including the National Building Code of Canada, which provide standards of safety to account for geological hazards, including seismic activity.	✓	✓	✓
Site-specific erosion and sedimentation control plans will be developed during detailed design phase of the Project and implemented.	✓	✓	✓
The following mitigation will be implemented to address risk of slope instability: • A detailed terrain mapping assessment, including ground-truthing, for the final Project Area will be completed to identify both construction constraints as well as geohazards that may impact the Project. • Slope stability assessments will be completed as part of the design, particularly at locations where this is re-grading proposed as well as glacio-fluvial deposits that are susceptible to erosion and undermining as seen at Stephenville.	✓		
The following mitigation will be implemented to address risk of subsidence: • WEGH2 will complete a detailed terrain mapping assessment using LiDAR from the Project Area to assess for karst formation that may be present.	✓		
The following mitigation will be implemented to address risk of landslide/rock fall: • A detailed terrain mapping assessment will be used to identify historical landslides and rock fall activity within the Project Area. Identification of naturally occurring past events may necessitate further investigation or avoidance. • For human-made rock cuts, or largescale re-grading of rock slopes, geotechnical investigation and design will be conducted so that the final cuts / grading are stable and will not cause potential instability during construction or long term.	✓		
Notes: C – Construction Activities; O – Operation Activities; D – Decommissioning, Rehabilitation and Closure Activities			

25.2.3.4 Residual Effects

Mitigation of geological hazards is incorporated into the design of the Project, reducing the potential for damage to infrastructure and equipment, and for unplanned changes to construction or operation schedules of the Project. With the mitigation measures and use of the design standards and guidelines listed in the sections above, geological hazards are not anticipated to have substantial adverse residual effects on the Project.

25.2.4 Forest Fires

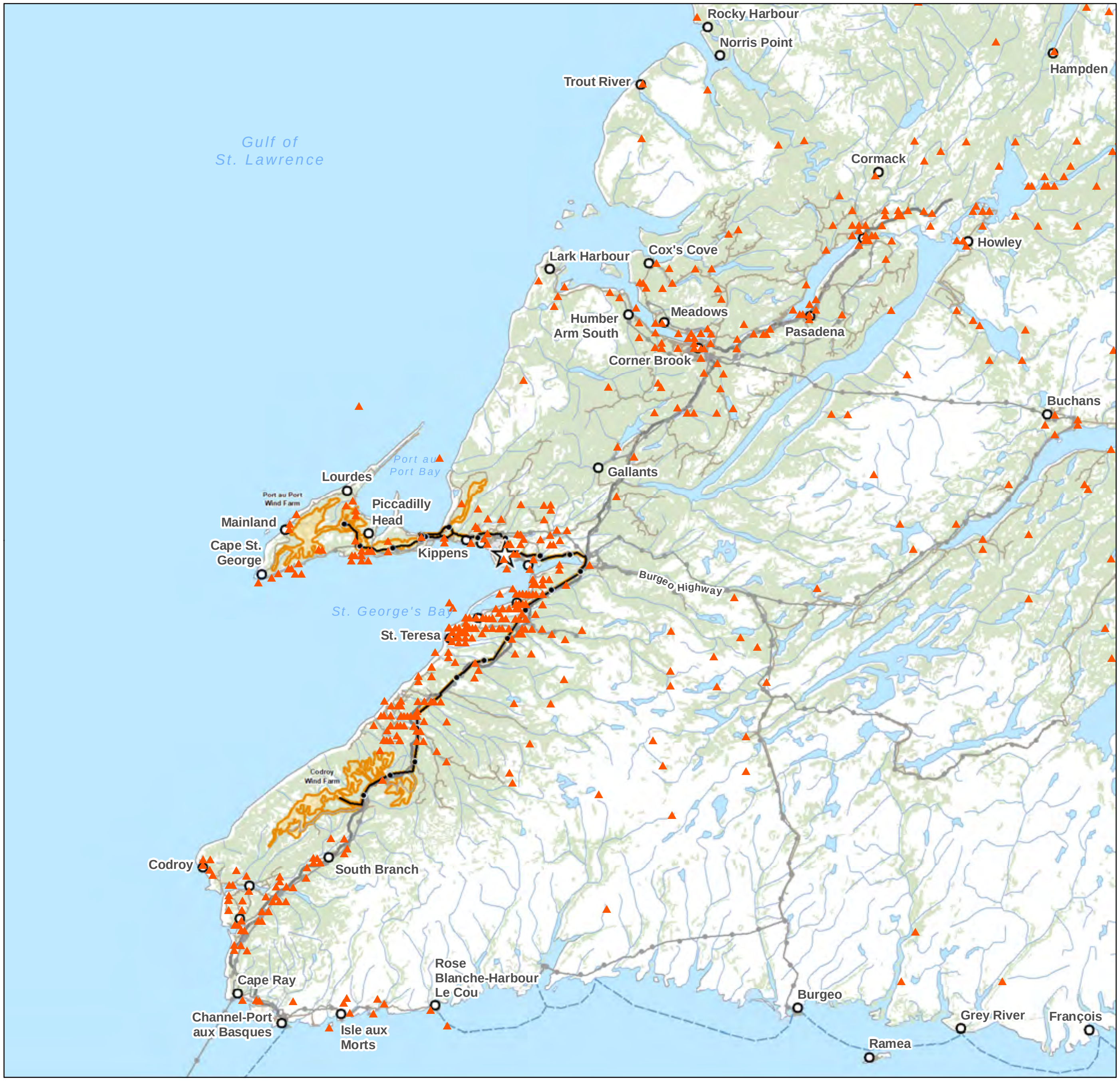
The existing conditions, potential effects, mitigation and residual effects for forest fires are described below.

25.2.4.1 Existing Conditions

Forest fires have occurred in and around the Project Area, mainly due to relatively long winters and abundant precipitation in the region (Section 25.2.1). The Canadian National Fire Database is a collection of forest fire data from various sources and indicates the perimeters of past forest fire locations. In total, there have been 503 forest fires within 100 km of the Project Area from 1946 to 2021 (Figure 25.14). Sixteen fires have occurred within the Project Area over this period, including transmission line portions (none have occurred within the Codroy Wind Farm portion of the Project Area) (Table 25.6). The most recent forest fire in the Project Area occurred in August 2021, and the most recent fire within 100 km of the Project Area, also occurred in August 2021, near Big Bonne Bay Pond (approximately 99 km northeast from the nearest Project Area boundary). Forest fires caused by lightning are infrequent in NL as the occurrence of lightning is low; most forest fires in the area are caused by people.

Table 25.6 Forest Fires within the Project Area (1986 to 2021)

Year	Month	Day	Relative Location within the Project Area
1986	May	14	Port au Port Peninsula
1986	May	15	Port au Port Peninsula
1987	July	20	Stephenville Area
1992	July	6	Stephenville Area
1995	May	14	Stephenville Area
2000	June	20	Transmission Line from Stephenville to Codroy Wind Farm
2001	May	24	Port au Port Peninsula
2003	May	19	Port au Port Peninsula
2005	June	5	Transmission Line from Stephenville to Codroy Wind Farm
2006	May	1	Port au Port Peninsula
2009	May	4	Port au Port Peninsula
2012	June	4	Transmission Line from Stephenville to Codroy Wind Farm
2018	September	1	Transmission Line from Stephenville to Codroy Wind Farm
2018	September	5	Stephenville Area
2019	July	30	Transmission Line from Stephenville to Codroy Wind Farm
2021	August	18	Transmission Line from Stephenville to Codroy Wind Farm



Stantec

Forest Fire Occurrences (1946-2021)

Proposed Project Features

- Hydrogen / Ammonia Plant Location
- Transmission Line 230 kV
- Project Area

Other Features

- Transmission Line, Existing
- Trans-Canada Highway
- Road
- Ferry Route
- Watercourse
- Waterbody
- Forested Area

Source: Canadian National Fire Database 2023. Available at: https://cwfis.cfs.nrcan.gc.ca/ha/nfdb

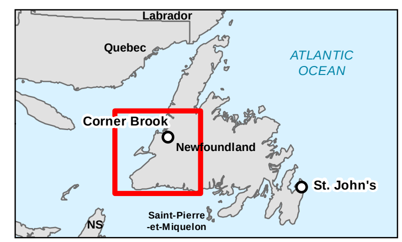
N

0 10 20 km

(At original document size of 8.5x11) 1:1,350,000

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 21N
2. Data Sources: Client, Statistics Canada, GovNL, Canadian National Fire Database 2023
3. Background: NRCan, CanVec



Project Location
Stephenville
NL

Prepared by MB on 2023-07-27
QR by AW on 2023-07-25

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_056

Figure No.
25.14

Title
Forest Fires that have Occurred in Proximity to the Project Area

25.2.4.2 Potential Effects

Forest fires are distinct from fires that result from Project activities that spread to surrounding areas. The potential effects of Project-related fire and explosion scenarios are addressed in Chapter 24, as are the adverse environmental effects from the malfunction of Project infrastructure.

Forest fires could adversely affect the Project by:

- Necessitating evacuation of Project facilities, including accommodations camps
- Damaging infrastructure (accommodations camps, turbines, maintenance facilities)
- Damaging electrical infrastructure (substations, transmission lines) and resulting loss of electrical power
- Obstructing access roads and damaging water crossings
- Reducing visibility due to smoke
- Creating health and safety concerns for personnel who inhale smoke
- Creating delays in schedule
- Causing an explosion due to contact with fuel storage tanks or explosives storage facility
- Causing an explosion due to contact with hydrogen and ammonia storage tanks or related facilities

Forest fires have the potential to damage Project infrastructure and equipment, which could in turn result in effects to the environment (e.g., socio-economic effects related to construction shutdown, loss of power to residents and businesses).

25.2.4.3 Mitigation

The management, monitoring and control of forest fires in NL is the responsibility of the NL Department of Fisheries, Forestry and Agriculture (NLDFFA) under the *Forestry Act*, including through the Forest Fire Regulations, Forest Fire Offence and Penalty Regulations, Forest Fires Liability and Compensation Regulations and annual Forest Fire Season Order. Forest fires are reported to the Provincial Forest Fire Communications Centre (or respective regional centres).

Project-specific mitigation measures presented in Table 25.7 will help manage the interactions between forest fires and the Project.

Table 25.7 Summary of Mitigation Measures: Forest Fires

Mitigation	C	O	D
WEGH2's Emergency Response Plan will describe emergency response measures, training requirements, roles and responsibilities, and contact and reporting procedures in the event of a fire at or near the Project Area.	✓	✓	✓
The hydrogen / ammonia plant will be designed with sufficient buffer area provided and preventative measures will be established during the design phase to mitigate the risk associated with a potential forest fire affecting the plant and associated infrastructure.			
WEGH2 will actively monitor wildfires that could affect the wind turbines, substations, supporting transmission infrastructure, and/or access road and coordinate with provincial authorities with respect to response, including the need for potential shutdown and evacuation of employees.	✓	✓	✓
On-site fire prevention and response equipment will be provided and maintained, and WEGH2 will have employees / teams that will be trained in safe fire response. While the purpose of this response training and equipment is to respond to Project-related fire scenarios, NLDFFA would be responsible for response to a forest fire in the area not related to the Project.	✓	✓	✓
Proper fire breaks will be considered and cleared where warranted during clearing and site layout.	✓		
Project-related activities will be adjusted in case of a severe fire and as needed to protect the health and safety of employees.	✓	✓	✓
Notes: C – Construction Activities; O – Operation Activities; D – Decommissioning, Rehabilitation and Closure Activities			

25.2.4.4 Residual Effects

WEGH2's Emergency Response Plan includes responding to forest fires and identifies the personnel and equipment necessary to quickly mobilize, coordinate with provincial responders, and implement appropriate response measures, reducing the risk to the health and safety of Project personnel and infrastructure.

The NLDFFA is responsible for responding to a large forest fire, which, if not brought under control and was to spread to Project infrastructure, could cause substantial damage to buildings, equipment and other infrastructure. Reagents, hydrogen and ammonia storage tanks, diesel fuel storage tanks and blasting material contained within the Project Area would also create the risk of explosion. Damage resulting from a forest fire could therefore result in a substantial delay in Project construction or operations. An explosion, where large quantities of pressurized flammable substances (e.g., hydrogen, ammonia or diesel tanks) could accelerate forest fire intensity and spread, thus requiring more resources for NLDFFA fire response. Additionally, explosions have the potential to produce changes to air quality, noise, human health, fish and wildlife receptors due to effects from combustion (particulates and chemical compounds), pressure changes and vibration. While there is a history of forest fire in the region, the risk of a large, uncontrolled forest fire affecting the Project is considered low, especially at the plant site within the Port of Stephenville. The potential for forest fire interaction with hydrogen, ammonia or diesel storage tanks leading to explosion is also low and is likely to be controlled through mitigation measures. The environmental effects of Project-related fire / explosion are assessed in Chapter 24.

25.3 Summary

The environment has the ability to affect the construction, operation and maintenance, and decommissioning of the Project through:

- Weather, climate and metocean conditions (e.g., winds, storms, waves, ice)
- Climate change
- Geological hazards (e.g., terrain stability, seismic activity)
- Forest Fires

Effects of the environment on the Project are largely addressed through sound Project planning and design. Engineering design will adhere to applicable provincial, national, and international codes and standards. These codes and standards document the proper engineering design for site-specific normal and extreme physical environmental conditions and provide design criteria that regulatory agencies consider satisfactory for withstanding the potential physical environmental conditions. These codes consider physical environmental criteria such as temperature, wind, snow and ice loading, drainage, and climate change. The design life of the Project will be taken into consideration so that materials are chosen with sufficient durability and corrosion resistance.

In consideration of existing and predicted environmental conditions and Project design and mitigation measures, the risk of a substantial interaction between environmental hazards and the Project is low.

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26.0 Summary and Conclusions

World Energy GH2 (WEGH2) is proposing Project Nujio'qonik (the Project). The Project involves the development, construction, operation and maintenance, and eventual decommissioning and rehabilitation of one of the first Canadian commercial-scale, "green hydrogen" and ammonia production plants powered by renewable wind energy. Green hydrogen (in the form of green ammonia) produced from electrolysis using renewable energy is widely recognized as having the potential to play a pivotal role in meeting international energy and climate goals. Renewable hydrogen / ammonia can also help support energy security and self-sufficiency for importing countries by decreasing their dependency on imported fossil fuels. Renewable hydrogen / ammonia provides a solution for decarbonizing sectors where direct electrification is not feasible and/or there is no low-carbon alternative.

The Project's need and purpose is to produce cost-effective green electrolytic hydrogen and ammonia for export to meet growing market demand, supporting the reduction in greenhouse gases emissions and the global energy transition, while generating long-term benefits for the province of Newfoundland and Labrador (NL). Delivering on that purpose gives rise to the potential to become Canada's first commercial green hydrogen and ammonia production facility powered by wind energy. The Project will help the region and Canada achieve the Government of Canada's goals outlined in the Hydrogen Strategy for Canada (NRCan 2020) and other policy documents, which seeks to develop the hydrogen market, diversify the economy, and position Canada as word-leading exporter of clean hydrogen.

Located on the southwest coast of the Island of Newfoundland, the Project will have a maximum production of up to approximately 206,000 tonnes of green hydrogen (equivalent to approximately 1.17 megatonnes (Mt) of ammonia) per year. The hydrogen produced by the Project will be converted into liquid ammonia and exported to international markets by ship. The hydrogen / ammonia plant, and associated storage and export facilities, will be located at the Port of Stephenville (in the Town of Stephenville, NL) on a privately owned brownfield site and at an adjacent existing marine terminal, both of which are zoned for industrial purposes. The facility will occupy approximately 50 hectares (ha) at full capacity (20 ha for the hydrogen plant and 30 ha for the ammonia plant).

At 100% capacity, the facility will require an average of 1,668 cubic metres (m^3) of water per hour for hydrogen electrolyzer feedwater, cooling water, and other industrial water requirements. Water for the Project will be sourced from the existing industrial water supply present near the Port of Stephenville. The Project will use approximately 75% of the water that was used by the paper mill which formerly occupied the area where the hydrogen / ammonia plant will be located. Water treatment will demineralize the water before it can be fed into the electrolyzer system to produce hydrogen and will then be processed into liquid ammonia through ammonia synthesis equipment.

The electricity demand for hydrogen production is anticipated to be 600 megawatts (MW) to 1.2 gigawatts (GW), depending on Project development. Renewable energy from two, approximately 1 GW, onshore wind farms located on the southwest coast of Newfoundland, will be used to power the hydrogen and ammonia production processes. The Port au Port Wind Farm will include up to 164 wind turbines, with up to 171 sites that are being studied for the EIS, on the Port au Port Peninsula, NL, and adjacently on the

Newfoundland “mainland” (i.e., northeast of the isthmus at Port au Port). The Codroy Wind Farm will also consist of up to 164 wind turbines located on Crown land in the Anguille Mountains. Final wind farm layouts will be dependent on results of detailed field investigations, including a wind measurement campaign.

Both wind farms will require a network of new and upgraded access roads for transportation of Project components and equipment, as well as interconnection of the wind turbine locations within the respective wind farm sites. An electrical collector system (i.e., a network of 34.5 kilovolt [kV] transmission lines) will interconnect the wind turbines at each of the wind farm sites to transformer substations owned by the Project. High-voltage (230-kV) transmission lines, including the option of a subsea cable crossing Port au Port Bay, will connect the substations associated with each wind farm to a terminal station at the hydrogen / ammonia plant. The total length of these high-voltage transmission lines will be approximately 145 kilometres (km). In addition, one new 230-kV transmission interconnection will be required to connect the hydrogen / ammonia plant terminal station to the NL Hydro facility at Stephenville, NL (approximately 0.08 km north of the hydrogen / ammonia plant).

This Environmental Impact Statement (EIS) has been prepared in accordance with the requirements of the provincial *Environmental Protection Act* (NL EPA) and *Environmental Assessment Regulations*. The methods used to prepare this EIS have been developed in consideration of the NL EPA, as well as by the requirements of the provincial EIS Guidelines.

This chapter provides a summary of the following:

- Project-related residual environmental effects, including cumulative effects and accidental events
- Mitigation, monitoring, and follow-up commitments
- Capacity of renewable resources likely to be affected by the Project to meet present and future needs
- Engagement conducted to date
- Conclusions

26.1 Summary of Potential Environmental Effects

The EIS includes an evaluation of the potential environmental effects for each valued environmental component (VEC) that may result from routine Project activities and potential accidental events. The EIS also includes an evaluation of potential cumulative effects, considering whether residual environmental effects of the Project could interact cumulatively with the residual environmental effects of other past, present, or future (i.e., certain or reasonably foreseeable) physical activities near the Project.

Environmental effects were assessed for the following VECs:

- Atmospheric Environment
- Acoustic Environment
- Groundwater Resources
- Surface Water Resources

- Freshwater Fish and Fish Habitat
- Marine Environment
- Wetlands and Vegetation, including Rare Plants
- Avifauna
- Bats
- Other Wildlife
- Areas of Conservation Concern
- Economy, Employment and Business
- Communities
- Human Health and Quality of Life
- Land and Resource Use
- Indigenous Fisheries
- Heritage and Cultural Resources

The assessment included a characterization of the existing conditions within the spatial boundaries of each VEC, including a discussion of the influences of past and present physical activities on the VEC, leading to the current conditions. Potential environmental effects from routine Project activities were assessed for each phase of the Project, including construction, operation and maintenance, and decommissioning and rehabilitation. For each potential effect, the physical activities that may interact with the VEC, and therefore result in an environmental effect, were identified, and assessed.

The environmental effects assessment used a precautionary, conservative approach. Conservative assumptions were made, so that potential adverse effects were generally overestimated rather than underestimated. Furthermore, the effects assessment was conducted using a 300 m buffer around the proposed road and wind turbine footprints, and a very conservative 350 m right-of-way for the transmission lines. Mitigation and environmental protection measures were identified to reduce or eliminate adverse environmental effects and the residual environmental effects were characterized by including a determination of their significance. For example, the project layout has been designed to avoid infrastructure within public protected water supply areas and proposed ecological reserves.

26.1.1 Routine Project-related Environmental Effects

The residual environmental effects for construction, operation and maintenance, and decommissioning and rehabilitation for each VEC are presented in Chapters 6 to 22. Table 26.1 summarizes the residual effect findings for each VEC and indicates the significance of these effects. Where an effect was predicted to be significant (refer to Chapters 6 to 22 for significance criteria for each VEC), the likelihood of that effect occurring was also presented. As shown in Table 26.1, the residual environmental effects of routine Project activities were assessed to be not significant for all VECs, with the exception of the change in species diversity for wetlands and vegetation, including rare plants.

Project-related changes may threaten the long-term persistence or viability of a vegetation species in the Regional Assessment Area, including resulting in effects that are contrary to, or inconsistent with, the goals, objectives, or activities of provincial or federal recovery strategies, action plans and management plans. To help manage the potential significant effects on plant species at risk and species of conservation concern, a Species at Risk Impact Mitigation and Monitoring Plan will be prepared and submitted to the NL Department of Fisheries, Forestry and Agriculture – Wildlife Division.

26.1.2 Cumulative Environmental Effects

Cumulative environmental effects were assessed using a two-step process that involved an initial screening, with a detailed assessment where warranted. Potential effects were first screened to identify any potential cumulative effects of a substantive nature and for which adequate information was available to conduct further assessment. Where the Project's contribution to cumulative effects and/or potential degree of overall cumulative interaction were ranked as low, cumulative effects were considered relatively minor and adequately managed by standard mitigation measures. Where these aspects were considered moderate or high, a more detailed assessment was undertaken.

Other past, present, and certain or reasonably foreseeable projects and activities considered in the cumulative effects assessment included the following:

- Electrical infrastructure
- Mining, quarrying, mineral and petroleum exploration
- Fishing and aquaculture
- Forestry and agriculture
- Tourism / culture / recreation
- Protected areas / parks / recreational areas
- Other miscellaneous activities

The screening level assessment of potential cumulative effects conducted for the 17 VECs concluded the Project's contribution to cumulative effects and overall regional cumulative effects is low (i.e., long-term sustainability of the VEC is not anticipated to be compromised and conventional Project-specific mitigation remains adequate). As such, further detailed assessment was not required.

VEC-specific mitigation and management measures identified in Chapters 6 to 22 will be applied during Project activities to reduce and/or avoid adverse environmental effects resulting from the Project. It is assumed that other projects and activities in the Regional Assessment Area, including future projects and activities, will also be required to comply with various mitigation measures and regulatory requirements, therefore also reducing cumulative effects. No additional or revised monitoring or follow-up is required or proposed specifically for potential cumulative environmental effects beyond the mitigation and monitoring proposed for the Project, and those assumed to implemented as part of the regular course of operations for other projects and activities.

Table 26.1 Summary of Residual Effects for Routine Operations

Valued Components	Potential Effect	Project Phase	Mitigation Reference	Residual Effect Characterization: Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
Atmospheric Environment	Change in Air Quality	C	Section 6.4	A	M	LAA/RAA	NS	ST	R	R	U	N	N/A
		O&M		A	M	LAA/RAA	NS	MT	C	R	U	N	N/A
		D&R		A	L	LAA/RAA	NS	ST	R	R	U	N	N/A
	Change in Greenhouse Gases	C		A	L	Global	NS	ST	R	I	U	N	N/A
		O&M		A	L	Global	NS	MT	C	I	U	N	N/A
		D&R		A	L	Global	NS	ST	R	I	U	N	N/A
	Change in Light	C		A	L	LAA/RAA	NS	ST	R	R	U	N	N/A
		O&M		A	L	LAA/RAA	NS	ST	R	R	U	N	N/A
		D&R		A	L	LAA/RAA	NS	ST	R	R	U	N	N/A
Acoustic Environment	Change in Sound Quality	C	Section 7.4	A	M	LAA/RAA	NS	ST	C	R	U	N	N/A
		O&M		A	M	LAA/RAA	NS	LT	C	R	U	N	N/A
		D&R		A	M	LAA/RAA	NS	ST	C	R	U	N	N/A
	Change in Vibration	C		A	L	PA	NS	ST	C	R	U	N	N/A
		O&M		A	L	PA	NS	LT	C	R	U	N	N/A
		D&R		A	L	PA	NS	ST	C	R	U	N	N/A
Groundwater Resources	Change in Groundwater Quantity	C	Section 8.4	A	M	LAA	MS	ST	IR/C	R	U	N	N/A
		O&M		A	L	LAA	MS	MT	C	R	U	N	N/A
		D		A	M	LAA	MS	ST	C	R	U	N	N/A
	Change in Groundwater Quality	C		A	M	LAA	NS	ST	C	R	U	N	N/A
		O&M		A	M	LAA	NS	MT	C	R	U	N	N/A
		D&R		A	M	LAA	NS	ST	C	R	U	N	N/A
Surface Water Resources	Change in Surface Water Quantity	C	Section 9.4	A	M	LAA	MS	ST	C	R	U	N	N/A
		O&M		A	M	LAA	MS	MT	C	R	U	N	N/A
		D&R		A	L	LAA	MS	ST	IR	R	U	N	N/A
	Change in Surface Water Quality	C		A	M	LAA	MS	ST	C	R	U	N	N/A
		O&M		A	L	LAA	MS	ST	IR	R	U	N	N/A
		D&R		A	L	LAA	MS	ST	IR	R	U	N	N/A

Table 26.1 Summary of Residual Effects for Routine Operations

Valued Components	Potential Effect	Project Phase	Mitigation Reference	Residual Effect Characterization								Significance of Residual Effect	Likelihood of Significant Effect
				Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context		
Freshwater Fish and Fish Habitat	Change in Fish Habitat Quantity	C	Section 10.4	A	L	PA	MS	ST	S	R	U	N	N/A
		O&M		A	M	LAA	MS	LT	C	R	D	N	N/A
		D&R		N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Change in Fish Habitat Quality	C		A	M	PA	MS	ST	S	R	U	N	N/A
		O&M		A	M	PA	MS	ST	IR	R	U	N	N/A
		D&R		A	L	PA	MS	ST	S	R	U	N	N/A
	Change in Fish Health and Survival	C		A	M	LAA	MS	LT	C	R	U	N	N/A
		O&M		A	M	LAA	MS	LT	C	R	U	N	N/A
		D&R		A	L	LAA	MS	LT	C	R	U	N	N/A
Marine Environment	Change in Marine Habitat Quantity	C	Section 11.4	A	L	LAA[1]	MS	ST	S	R	U/D	N	N/A
		O&M		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		D&R		P	L	LAA[1]	MS	ST	S	R	D	N	N/A
	Change in Marine Habitat Quality	C		A	L	LAA[1]	MS	ST	S	R	U/D	N	N/A
		O&M		A	L	LAA[1]	MS	MT	C	R	U/D	N	N/A
		D&R		A	L	LAA[1]	MS	ST	S	R	D	N	N/A
	Change in Marine Species Health and Survival	C		A	L	LAA[1]	MS	ST	S	R/I	U/D	N	N/A
		O&M		A	L	LAA[1]	MS	MT	C	R/I	U/D	N	N/A
		D&R		A	L	LAA[1]	MS	ST	S	R	D	N	N/A
	Change in Fishing / Aquaculture Grounds or Productivity	C		A	L/M	LAA[1]	MS	ST	S	R/I	U/D	N	N/A
		O&M		A	L	LAA[1]	MS	MT	C	R/I	U/D	N	N/A
		D&R		A	L	LAA[1]	MS	ST	S	R	D	N	N/A
	Change in Other Ocean Users	C		A	L	LAA[1]	MS	ST	S	R	U/D	N	N/A
		O&M		A	L	LAA[1]	MS	MT	IR	R	U/D	N	N/A
		D&R		A	L	LAA[1]	MS	ST	S	R	D	N	N/A
Wetlands and Vegetation, including Rare Plants	Change in Community Diversity	C	Section 12.4	A	M	LAA	HS	LT	S/IR	R	U/D	N	N/A
		O&M		A	L	LAA	HS	LT	IR/C	R	U/D	N	N/A
		D&R		N	L	LAA	HS	LT	IR/C	R	U/D	N	N/A
	Change in Species Diversity	C		A	H	LAA	HS	LT	S/IR	I	U/D	S	L
		O&M		A	L	LAA	HS	LT	IR/C	R/I	U/D	S	L
		D&R		N	L	LAA	HS	LT	IR/C	R/I	U/D	S	L
	Change in Wetland Function	C		A	M	LAA	HS	LT	S/IR	I	U/D	N	N/A
		O&M		A	L	LAA	HS	LT	IR/C	R/I	U/D	N	N/A
		D&R		N	L	LAA	HS	LT	IR/C	R/I	U/D	N	N/A

Table 26.1 Summary of Residual Effects for Routine Operations

Valued Components	Potential Effect	Project Phase	Mitigation Reference	Residual Effect Characterization								Significance of Residual Effect	Likelihood of Significant Effect
				Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context		
Avifauna	Change in Habitat	C	Section 13.4	A	L/M	LAA	NS-HS	ST-LT	C	R/I	U/D	N	N/A
		O&M		A	L	LAA	MS-HS	LT	C	R	U/D	N	N/A
		D&R		A/P	L	LAA	NS-HS	ST	C	R	U/D	N	N/A
	Change in Mortality Risk	C		A	L	LAA	NS-HS	ST	IR	R	U/D	N	N/A
		O&M		A	L	LAA	NS-HS	LT	C	R	U/D	N	N/A
		D&R		A	L	LAA	NS-HS	ST	IR	R	U/D	N	N/A
Bats	Change in Habitat	C	Section 14.4	A	M	LAA	HS	ST	C	R	U/D	N	N/A
		O&M		A	L	LAA	HS	LT	C	R	U/D	N	N/A
		D&R		A/P	L	LAA	HS	ST	C	R	U/D	N	N/A
	Change in Mortality Risk	C		A	L	PA	HS	ST	IR	R	U/D	N	N/A
		O&M		A	M	PA	HS	LT	C	R	U/D	N	N/A
		D&R		A	L	PA	HS	ST	IR	R	U/D	N	N/A
Other Wildlife	Change in Habitat	C	Section 15.4	A	L/M	LAA	HS	ST	C	R	U/D	N	N/A
		O&M		A	L	LAA	HS	LT	C	R	U/D	N	N/A
		D&R		A	L	LAA	HS	ST	C	R	U/D	N	N/A
	Change in Mortality Risk	C		A	L	PA	HS	ST	IR	R	U/D	N	N/A
		O&M		A	L	PA	HS	LT	IR	R	U/D	N	N/A
		D&R		A	L	PA	HS	ST	IR	R	U/D	N	N/A
Areas of Conservation Concern	Change in Habitat in Areas of Conservation Concern	C	Section 16.4	A	L	PA	MS	ST	C	R	U/D	N	N/A
		O&M		A	L	PA	MS	LT	C	R	U/D	N	N/A
		D&R		A	L	PA	MS	ST	C	R	U/D	N	N/A
Economy, Employment and Business	Change in Regional Labour Force	C	Section 17.4	P	H	LAA/RAA	NS	ST	C	R	R	N	N/A
		O&M		P	H	LAA/RAA	NS	MT	C	R	R	N	N/A
		D&R		A	M	LAA/RAA	NS	ST	C	IR	R	N	N/A
	Change in Regional Business	C		A/P	M	LAA/RAA	NS	ST	C	R	R/NR	N	N/A
		O&M		A/P	M	LAA/RAA	NS	MT	C	R	R	N	N/A
		D&R		A/P	L	LAA/RAA	NS	ST	C	IR	R	N	N/A
	Change in Regional Economy	C		P	L	LAA/RAA	NS	ST	C	R	R	N	N/A
		O&M		P	M	LAA/RAA	NS	MT	C	R	R	N	N/A
		D&R		P	L	LAA/RAA	NS	ST	C	IR	R	N	N/A

Table 26.1 Summary of Residual Effects for Routine Operations

Valued Components	Potential Effect	Project Phase	Mitigation Reference	Residual Effect Characterization: Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context	Significance of Residual Effect	Likelihood of Significant Effect
Communities	Change in Accommodations	C	Section 18.4	A/N	L	LAA/RAA	NS	ST	C	R	R	N	N/A
		O&M		A	L	LAA/RAA	NS	LT	C	R	R	N	N/A
		D&R		A/N	L	LAA/RAA	NS	ST	C	R	R	N	N/A
	Change in Community Infrastructure and Services	C		A/P	M	LAA/RAA	NS	ST	C	R	R/NR	N	N/A
		O&M		A	L	LAA/RAA	NS	LT	C	R	R/NR	N	N/A
		D&R		A/P	L/M	LAA/RAA	NS	ST	C	R	R/NR	N	N/A
	Change in Transportation Infrastructure and Services	C		A/P	L/M	LAA/RAA	NS	ST	C	R	R	N	N/A
		O&M		A	L	LAA/RAA	NS	LT	C	R	R	N	N/A
		D&R		A	L	LAA/RAA	NS	ST	C	R	R	N	N/A
	Change in Community Well-being	C		A/P	L	LAA/RAA	NS	ST	C	R	R	N	N/A
		O&M		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		D&R		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Human Health and Quality of Life	Change to Human Health	C	Section 19.4	A	M	LAA/RAA	NS	ST	R	R	U/D	N	N/A
		O&M		A	M	LAA/RAA	NS	MT	C	R	U/D	N	N/A
		D&R		A	M	LAA/RAA	NS	ST	R	R	U/D	N	N/A
	Change in Quality of Life	C		A	L	LAA/RAA	NS	ST	C	R	U/D	N	N/A
		O&M		A	L	LAA/RAA	MS	MT	C	R	U/D	N	N/A
		D&R		A	L	LAA/RAA	NS	ST	C	R	U/D	N	N/A
	Change to Public Safety	C		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		O&M		A	L	LAA/RAA	MS	MT	IR	R	U	N	N/A
		D&R		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Land and Resource Use	Change in Designated Land Use	C	Section 20.4	A	L/M	PA/LAA/RAA	NS	ST/MT	C/IR	R	U/D	N	N/A
		O&M		A	L/M	PA/LAA/RAA	NS	MT	C	R	U/D	N	N/A
		D&R		A	L	PA/LAA	NS	ST	C/IR	R	U/D	N	N/A
	Change in Commercial / Industrial Resource Use	C		A	N/L	PA/LAA	NS/MS/HS	ST	C/IR	R	U/D	N	N/A
		O&M		A	N/L	PA/LAA	NS	MT	C	R	U/D	N	N/A
		D&R		A	N/L	PA/LAA	NS	ST	C/IR	R	U/D	N	N/A
	Change in Recreational / Subsistence Land and Resource Use	C		A	N/L/M	PA/LAA/RAA	HS	ST/MT	S/C	R	U/D	N	N/A
		O&M		A	N/L/M	PA/LAA	HS	MT	IR/C	R	U/D	N	N/A
		D&R		A	N/L/M	PA/LAA/RAA	HS	ST	S/C	R	U/D	N	N/A

Table 26.1 Summary of Residual Effects for Routine Operations

Valued Components	Potential Effect	Project Phase	Mitigation Reference	Residual Effect Characterization								Significance of Residual Effect	Likelihood of Significant Effect
				Nature	Magnitude	Geographic Extent	Timing	Duration	Frequency	Reversibility	Ecological / Socio-Economic Context		
Indigenous Fisheries	Change in Indigenous Commercial and Food, Social, and Ceremonial Fisheries	C	Section 21.4	A	L/M	PA/LAA	MS	ST	S	R	U/D	N	N/A
		O&M		A	L/M	PA/LAA	MS	MT	C/IR	R	U/D	N	N/A
		D&R		A	L	PA/LAA	MS	ST	S	R	U/D	N	N/A
Heritage and Cultural Resources	Loss or Disturbance of Heritage and Cultural Resources	C	Section 22.4	A	L/M	PA	NS	P	S	I	U/D	N	N/A
		O&M		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		D&R		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Key / Note: 1 No defined Project Area for Marine Environment and Use VEC. Geographic extent is limited to localized areas where Project activities occur within the LAA. * Indicates a positive effect VEC-specific definitions included for each VEC in Chapters 6 to 22. C = Construction O&M = Operation and Maintenance D&R = Decommissioning and Rehabilitation				**Nature:** P: Positive A: Adverse N: Neutral	**Magnitude:** N: Negligible L: Low M: Moderate H: High	**Geographic Extent:** PA: Project Area LAA: Local Assessment Area RAA: Regional Assessment Area	**Timing:** NS: No Sensitivity MS: Moderate Sensitivity HS: High Sensitivity	**Duration:** ST: Short-term MT: Medium-term LT: Long-term P: Permanent	**Frequency:** S: Single event IR: Irregular event R: Regular event C: Continuous	**Reversibility:** R: Reversible I: Irreversible	**Ecological / Socio-Economic Context:** D: Disturbed U: Undisturbed R: Resilient NR: Not resilient	**Significance:** S: Significant N: Not Significant	**Likelihood:** U: Unlikely L: Likely N/A: Not applicable

26.1.3 Accidents and Malfunctions

In accordance with section 6.3 of the EIS Guidelines, this EIS assesses environmental effects of accidents or malfunctions that may occur as a result of the Project. Accidents and malfunctions were assessed using the approach outlined in Section 24.1 and the same spatial boundaries, residual effects criteria, and methods as were used for the assessment of environmental effects resulting from routine Project activities. The following potential accidents or malfunction scenarios have been identified as having the potential to occur during the Project:

- Unplanned hydrogen / ammonia release
- Fuel / hazardous materials spill
- Fire and explosions
- Vehicle accident
- Collapse of a wind tower or dislodging of a turbine blade

Potential effects and key mitigation measures are summarized in Table 26.2.

Table 26.2 Summary of Potential Effects and Mitigation Measures for Accidents and Malfunctions

Accident / Malfunction	Summary of Potential Adverse Effects	Key Mitigation / Project Design
Unplanned Hydrogen / Ammonia Release	• A release of hydrogen or ammonia could lead to flammable hazards. Additionally, a release of ammonia could lead to toxicity hazards. Therefore, offsite members of the public could be at risk of harm. • A release of ammonia into the marine water would lead to toxicity hazards and could be harmful to aquatic life depending on the concentration of ammonia in water.	• Ammonia storage tanks will be designed as double-walled, full containment systems that provide two shells which are independently able to contain the liquid and vapours. Additionally, there will be a berm around the storage tanks. • Robust instrumented systems designed to detect the release of ammonia or hydrogen and to initiate shutdown procedures. • Water curtains/monitors to contain the spread of ammonia vapours in the event of a release.
Fuel / Hazardous Materials Spill	• A large spill may contaminate soil, groundwater and surface water resources, thereby potentially adversely affecting the quality of fish and fish habitat, and vegetated habitat, and resulting in the ingestion / uptake of contaminants by wildlife.	• Meet or exceed federal and provincial regulations including federal *Sulphur in Diesel Fuel Regulations*, and provincial *Storage and Handling of Gasoline and Associated Products Regulations, 2003*. • Transportation of hazardous materials will be conducted in compliance with the federal *Transportation of Dangerous Goods Act, 1992* and the provincial *Dangerous Goods Transportation Act*. • WEGH2 will regularly inspect and monitor Project infrastructure and equipment and take required action to maintain, repair and upgrade infrastructure / equipment as needed.

Table 26.2 Summary of Potential Effects and Mitigation Measures for Accidents and Malfunctions

Accident / Malfunction	Summary of Potential Adverse Effects	Key Mitigation / Project Design
Fire and Explosions	• A fire could result in release of emissions to the atmosphere and adversely affect surface water quality and fish habitat, and forests and wildlife habitat adjacent to the Project Area, and wildlife and/or members of the public in the vicinity of the fire. • Fires arising from other causes and potentially affecting the Project are assessed as an Effect of the Environment on the Project (Chapter 25).	• Fire and explosion prevention measures and management, including on-site equipment and trained personnel, as described in the Emergency Response / Contingency Plan (Appendix 2-F).
Vehicle Accidents	• A vehicle collision could adversely affect wildlife and/or members of the public using the access road. • Potential effects resulting from a spill from a vehicle accident are discussed in the assessment of a fuel or hazardous material spill (Section 24.4.2). Potential adverse effects caused by vehicle collisions with wildlife are assessed in Avifauna, Bats, and Other Wildlife Chapters (Chapters 13, 14, and 15, respectively).	• WEGH2 has developed and will implement a Traffic Management Plan (Appendix 2-C) to manage transportation of workers and materials to site and the number of vehicles accessing the site. • Several traffic safety measures will be implemented to reduce the potential for vehicle malfunctions or accidents.
Collapse of a Wind Tower or Dislodging of a Turbine Blade	• The collapse of a wind tower or the dislodging of a turbine blade could adversely affect members of the public and/or wildlife during the operation phase of the Project.	• Geotechnical surveys will be conducted to help determine the optimal foundation style (i.e., gravity foundations or rock anchor foundations) for the wind turbines and will be properly designed to account for long-term wind speeds modelled/extrapolated from greater than 12 months of measured data at each wind farm site. • During the operations and maintenance phase, weather forecasts will be regularly monitored and, prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Project. • WEGH2 will establish sufficient setback of wind turbines to mitigate risks to surrounding residences.

WEGH2's environmental management policy is based on evolving best-practice standards for environmental performance in the wind turbine industry. WEGH2 understands the importance of preventing accidents and planning for emergencies before they occur and will achieve this using the following framework:

- Review the individual steps involved in Project construction, operation and maintenance, and decommissioning and rehabilitation activities prior to the start of each phase
- Analyze each step in the process to verify and update, if needed, the accident and/or malfunction scenarios identified in this assessment of accidental and malfunction events
- Review available best practice documents for each potential accident and/or malfunction scenario
- Prepare site-specific accident prevention and emergency response plans with tactical plans, to be maintained on-site, and reviewed annually

There is a potential for residual adverse effects to VECs in the unlikely event of a major industrial accident or malfunction that results in a large-scale release into the environment or, in the worst-case, a major accident resulting in loss of life (e.g., vehicle accident). Given the Project design and safety measures in place to reduce the likelihood of an accident or malfunction, the risk of such an effect occurring is low. In addition, emergency response plans and contingency measures will be in place that will limit the extent and nature of potential environmental effects in the event of an accident or malfunction. For minor incidents with a higher likelihood of occurrence, the residual effects are not likely to be substantial (e.g., small hydrocarbon spills from equipment that will be readily cleaned up).

26.2 Summary of Commitments

A summary of Project commitments made by WEGH2 is provided in Appendix 26-A and is organized by VEC, using the overall categories of: Design, Mitigation, Monitoring, Management and Engagement. The categories of commitments are defined as follows:

- Design commitments are engineered features of the Project that are optimized or intentionally selected to reduce, eliminate, or control adverse effects. Design commitments are a type of mitigation that reflect the standards, criteria, objectives, and methods to be used to design the Project. Design commitments are used in part to define the scope of the Project to be assessed and to reduce potential adverse effects of the Project on VECs.
- Mitigation commitments are specific Project actions that help to reduce, eliminate, or control adverse effects that are associated with the Project. Throughout the EIS, potential effects of the Project on VECs have been assessed. The assessment of residual effects on a VEC relies on implementing the mitigation measures identified for each potential effect. These mitigations are commitments that WEGH2, as the proponent of the Project, will uphold.
- Monitoring commitments are activities to characterize the quality of the environment relative to Project effects or compliance. The EIS includes commitments to undertake compliance and effects monitoring, and to undertake a review of findings as part of an adaptive management framework.

- Management commitments are specific plans (i.e., methods, procedures, approaches) that are used to reduce environmental impacts. Management Plans have been proposed in the EIS. These include specific commitments for actions, monitoring and reporting relevant to the subject of each Management Plan.
- Engagement commitments are established through public and Indigenous engagement feedback. These commitments are not based on regulatory requirements, published guidance, best practice or professional experience. Primarily, these commitments relate to traditional knowledge and other input from public and/or Indigenous perspectives.

These Project commitments are based on several factors such as:

- Regulatory requirements (i.e., legislation, regulations, permit conditions)
- Published guidance or management plans (i.e., guidelines, policies, manuals)
- Standard best practices for this area (i.e., accepted commercial or professional procedures)
- Traditional knowledge or engagement input (i.e., engagement collaboration)
- Professional experience (i.e., learned through Project experience)

The commitment summary in Appendix 26-A is further organized based on which Project component a mitigation is to be applied, and during which phase(s) of development. The Project components found in the EIS include: Port au Port wind farm, Codroy wind farm, hydrogen / ammonia plant facility, port facility, 230 kV facility. The Project phases for which a commitment may apply includes construction, operations and maintenance, and decommissioning and rehabilitation.

26.3 Summary of Engagement to Date

Community (Indigenous and non-Indigenous) engagement and consultation on the Project began in March 2022. Community and stakeholder engagement has occurred concurrent with Indigenous engagement (including a familiarization tour of a wind farm in southern Ontario). To date, it has included a series of one-on-one and group meetings with members of the community and organizations, drop-in sessions within communities, opening a Community Information Office in Stephenville in July 2022, distributing brochures and household mailouts, launching a website and social media accounts, sharing a monthly e-newsletter, conducting media interviews, delivering speeches / presentations to communities and business leaders, and participating in community events and sponsorships.

Key concerns identified during engagement included, but were not limited to, potential impacts on the following:

- Cultural and traditional lifeways, practices and activities
- Indigenous commercial and/or food fisheries
- Cultural identity and quality of life, including the identity and lifeways of future generations
- Traditional knowledge transmission, and the ability to teach children to hunt, fish, trap, pick berries, cut wood, and worship the creator

- Food security and access to country foods
- Harvesting areas, activities (e.g., hunting, trapping, fishing) and harvested resources
- Socio-economic conditions and land value
- Domestic wood cutting practices and areas of harvest
- Local roadways
- Human health, including mental health and quality of sleep
- Sound / noise levels during the day and night in the Port au Port communities due to construction activities for the duration of the construction phase
- View scape / visual quality due to presence of wind turbines
- Marine environment
- Fish habitat, fishing activities, and fishing areas
- Hunting and trapping activities and areas
- Birds, wildlife and wildlife habitat and culturally important species
- Forests and plant life, including berries, mountain plants, and food and medicinal plants
- Watersheds and water supplies
- Potential accidents and malfunctions

IN addition to the above key concerns, additional comments were related to the inclusion of Indigenous Knowledge and historical data into the environmental effects assessment. There were also requests for continued information and communication with Indigenous groups and stakeholders. WEGH2 is committed to ongoing consultation and engagement with stakeholders and Indigenous groups and involving local stakeholders and Indigenous communities throughout the lifetime of the Project. WEGH2 will improve and expand upon previous engagement efforts to develop and operate the Project with tangible, demonstrable, and appropriate benefits to local stakeholders and Indigenous communities.

26.4 Conclusion

With the implementation of planned mitigation and monitoring programs, residual effects of the Project are predicted to be not significant for all VECs with the exception of the change in species diversity for the wetlands and vegetation VEC. Those effects on species diversity, including species at risk, will be further managed by impact avoidance, where possible, and by the Species at Risk Impact Mitigation and Monitoring Plan, which will be made and agreed upon in consultation with the NL Department of Fisheries, Forestry and Agriculture – Wildlife Division

In the unlikely event of a worst-case industrial accident or malfunction that results in a large-scale release into the environment or a fire or explosion, there is a potential for residual adverse effects to VECs. However, the risk of an effect occurring is low, given the Project design, maintenance and monitoring measures that will be in place to reduce the risk of an accident or malfunction occurring. In addition, emergency response plans and contingency measures will be in place to limit the extent and nature of potential environmental effects in the event of an accident or malfunction.

The Project will generate clean electricity from onshore wind farms and produce green hydrogen and ammonia at scale, thereby positioning Canada as a global leader in clean hydrogen production, use, and export. The Project has the potential to transform the path to global net-zero across a number of key emitting sectors and industries in Canada and beyond, thereby offering national and international benefits.

The Project will also bring economic and social benefits to the province of NL and its residents, and will be particularly impactful to the communities of southwest NL. WEGH2 will remain committed throughout the Project to increase benefits that will flow to the Province through employment and skills development, contracting and participation for traditionally underrepresented groups, opportunities for NL suppliers and contractors, as well as substantial planned community investment and First Nations partnerships.

WEGH2 is committed to the successful development and operation of the Project, and envisions balancing commercial success with a safe working environment, effective environmental management, and the creation of lasting social benefit. WEGH2 will implement high standards of environmental performance as part of its commitment to safe and responsible environmental, social, and economic development.