PROJECT NUJIO’QONIK GH2

ENVIRONMENTAL ASSESSMENT REGISTRATION

Project Nujio'qonik GH2

Environmental Assessment Registration

World Energy GH2 Inc.
87 Water Street
St. John's, NL A1C1A5

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Abbreviations

°C	degree Celsius
AC CDC	Atlantic Canada Conservation Data Centre
A/cm^2	Ampere per square centimetre
AEC	Alkaline Electrolysis Cell
ASU	Air Separation Unit
ATV	All-terrain Vehicle
Co	Cobalt
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DME	Distance Measuring Equipment
DNV	Det Norske Veritas
EA	environmental assessment
ECCC	Environment and Climate Change Canada
EMS	Environmental Management System
EPP	Environmental Protection Plan
GPD	gallons per day
GPM	gallons per minute
GW	gigawatt
GWh	gigawatt hour
H_2	hydrogen
ha	hectare
HSE	Health, Safety and Environment
IMS	Integrated Management System
INAC	Indigenous and Northern Affairs Canada
Fe	Iron
IrO2	Iridium Oxide
JWEL	Jacques Whitford Environment Limited
km	kilometre
km/hr	Kilometre per hour
km^2	square kilometre
KOH	Potassium Hydroxide
kV	kilovolt
LiDAR	Light Detection and Ranging
m	metre
m^3	cubic metre
m^3/d	cubic metre per day
MBCA	*Migratory Birds Convention Act, 1994*
MFN	Miawpukek First Nation
mg/L	Milligrams per litre
mm	millimetre
m/s	metre per second
Mt	metric tonne
MW	megawatt
N_2	Nitrogen
NDB	Non-directional beacon
NFPA	National Fire Protection Association
Ni	Nickle
NL	Newfoundland and Labrador
NLDECC	Newfoundland and Labrador Department of Environment and Climate Change
NLDFFA	Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture

NL ESA	Newfoundland and Labrador *Endangered Species Act*
O_2	Oxygen
O&M	Operation and Maintenance
PAANL	Protected Areas Association of Newfoundland and Labrador
PEM	Proton Exchange Membrane
Qalipu	Qalipu First Nation
QRA	Quantitative Risk Assessment
RO	Reverse Osmosis
RoW	Right-of-Way
RuO2	Ruthenium(IV) Oxide
SAF	Sustainable Aviation Fuel
SAR	species at risk
SARA	*Species at Risk Act*
SCR	Short Circuit Ratio
SOCC	Species of Conservation Concern
TDS	Total Dissolved Solids
The Project	Project Nujio'qonik GH2
USGS	U.S. Geological Survey
VC	Valued Component
VMD	Virtual Met Data
VOR	Very High Frequency Omni-Range

1.0 INTRODUCTION

World Energy GH2 is a consortium of four Canadian partners with strong local expertise. World Energy GH2 is proposing to construct and operate a cost-effective green hydrogen/ammonia from wind power on the west coast of the Island of Newfoundland, in the province of Newfoundland and Labrador (NL). This document is the environmental assessment (EA) Registration to initiate review of the hydrogen/ammonia and wind power Project under the provincial *Environmental Protection Act* and *Environmental Assessment Regulations*. Project Nujio'qonik GH2 (the Project) includes a 0.5 gigawatt (GW) hydrogen facility at the Port of Stephenville, up to 164 turbines for 1 GW of wind power generation on the Port au Port Peninsula, and associated transmission and supporting infrastructure.

Hydrogen is a zero-emission fuel produced by the electrolysis of water. Hydrogen production is categorized based on the source of the electricity used for electrolysis. Green hydrogen refers to hydrogen fuel that is produced using only renewable electric power, such as wind. Figure 1-1 provides an overview of the stages of a green hydrogen/ammonia project. Figure 1-2 indicates the Project location.

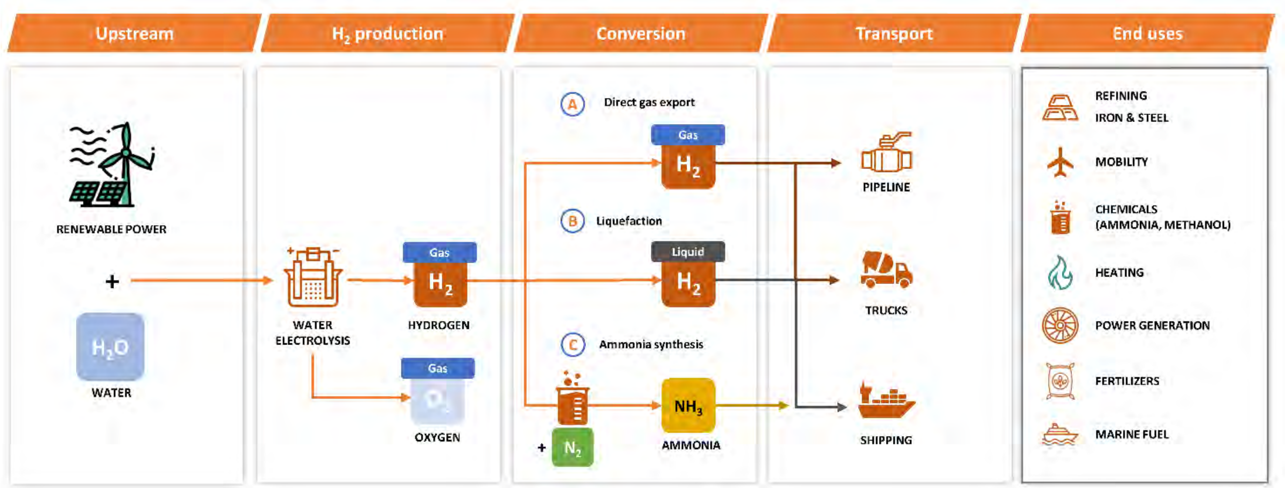


Figure 1-1 Overview of Green Hydrogen / Ammonia Project

To support the Project's need for skilled workers, we look forward to working closely and in cooperation with the College of the North Atlantic to provide local training opportunities. World Energy GH2 will also provide training opportunities specific to wind technology for Newfoundlanders and Labradorians to enhance job prospects and long-term employment through a partnership with DOB Academy and in collaboration with the Qalipu First Nation (Qalipu). Additional information on proposed training is provided in Section 2.7.

Figure 1-2 Project Location

World Energy GH2 intends to work closely with regulators, Indigenous groups and stakeholders to complete the environmental commitments outlined in this EA Registration, many of which are anticipated to be required as conditions of approval for the Project. World Energy GH2 are committed to completing a robust pre-construction baseline program as outlined in Appendix A and to developing a post-construction / operational environmental effects monitoring program in consultation with applicable regulators. Pre-construction surveys will inform final Project design with micro-siting of turbines and other Project infrastructure used to reduce potential environmental impacts and resource conflicts. Informed by the monitoring programs, an adaptive management approach will be adopted toward residual adverse effects for environmental components, such as avifauna and bats.

1.1 DESCRIPTION OF THE PROPONENT

Name of the Corporate Body	World Energy GH2
Address	87 Water Street St. John's, NL A1C1A5
Principal Contact for Environmental Assessment	John MacIsaac 87 Water Street, St. John's, NL A1C1A5 info@worldenergygh2.com

World Energy GH2 is a newly established company focused on sustainability and the transition to green energy sources. Through its partnership with CFFI Ventures, World Energy GH2 will lead the development of this Project. The members of World Energy GH2 (Figure 1-3) bring in a wide range of specialized expertise, such as strong local knowledge and local network, expertise in marine transportation for the export and logistics component, the manufacturing of sustainable fuels, and provision of training in the wind industry.

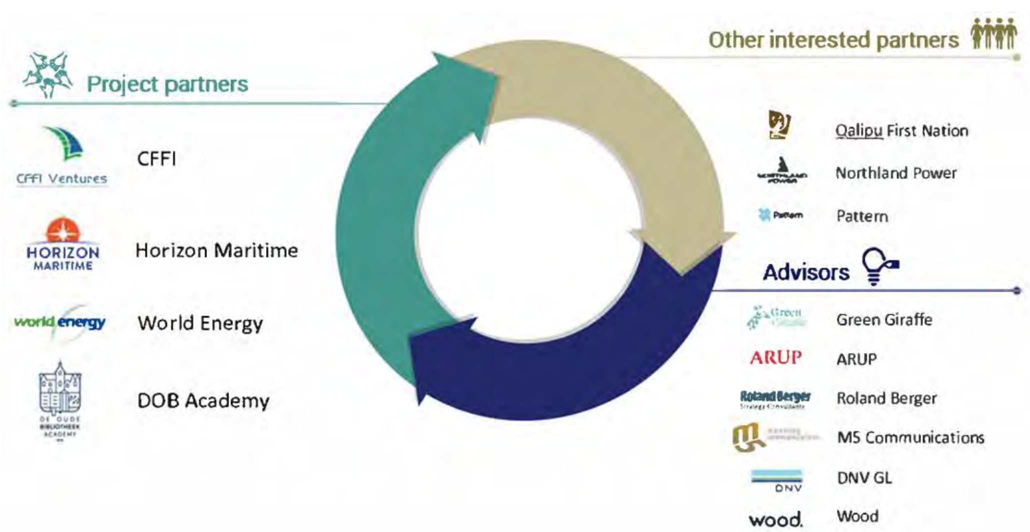


Figure 1-3 World Energy GH2, Partners and Advisors

With a major focus on collaborating with local stakeholders to create shared value, we have engaged key Indigenous communities, Miawpukek First Nation (MFN) and Qalipu, from very early stages and we are committed to involving them throughout the process. The Qalipu have provided a letter of support for the Project. The Project also has support from the Towns of Stephenville, Stephenville Crossing, and Kippens and the Towns of Cape St. George, Lourdes, and Port au Port West-Agathuna-Felix Cove on the Port au Port Peninsula. Letters of support for the Project are included in Appendix B.

We also have the support from a team of world-class advisors (Figure 1-3) providing comprehensive capabilities and services including financial, technical, and communication. World Energy GH2 is poised to lead the energy transition in NL, in Canada, and globally. The track record of our cooperation partners includes leading services across a variety of industries, including full renewable energy project development at the stages of a project's life cycle and technical designs. Together we have complete capabilities to bring the Project to realization.

Northland Power and Pattern Energy are also interested in participating in the Project as co-developers. Discussions are at advanced stages with both companies. The Project would then benefit from their onshore wind development experience and local knowledge and relationships. Table 1.1 provides further information on the capabilities of each of the Project Partners.

Table 1.1 Capabilities and Experience of World Energy GH2 Partners

Project Partner	Capabilities and Experience
CFFI Ventures	• CFFI Ventures is an Atlantic Canadian based private investment firm with global investments. The company has portfolio of carefully developed impact investments spanning a range of industries from renewable energy to extensive involvement in the ocean economy, banking, and a leading role in Canadian space exploration. • With a philosophy of investing in world-class management teams and companies that have a focus on shaping the future, CFFI has over one billion dollars in assets under management and plays an active role in strategic guidance and governance with investments. • John Risley is the CFFI Chairman and Brendan Paddick is an active co-investor. • CFFI has pioneered Indigenous engagement initiatives in accordance with the Truth & Reconciliation Commission Call to Action #92 and the companies CFFI invested in are broadly recognized as leaders in First Nations inclusion & diversity. • CFFI leads the Project's vision and strategy, combining the expertise and resources of its various investments and external partners to build a team that is able to execute on the opportunity at hand and position NL as a world leader in green hydrogen production and renewable energy.
Horizon Maritime	• Horizon Maritime is headquartered in St. John's, NL, and is a prominent marine services company operating throughout the Atlantic Basin; with offices across Canada and in Norway. • Horizon Maritime is a diverse company with strong First Nations engagement across the country and a focus on innovation and driving local competitiveness on a global level. With a long-term vision toward sustainability, the company is continually investing in the future through various innovations such as the Connected Worker Project, bringing Ampelmann offshore walk-to-work technology to Canada and a range of initiatives with Canada's Ocean Supercluster. • Horizon Maritime has become the preferred contractor for multi-faceted marine projects for major customers such as Equinor, ExxonMobil and Emera. An industry leading Integrated Management System driven by a strong and dedicated team is the backbone of the company's success. Strategic support and guidance from CFFI Ventures has been a key factor in Horizon Maritime's growth and ability to secure some of the most valuable assets in the marine sector. • In conjunction with our First Nations partners, Horizon Maritime will play a key role in the construction and long-term operations of the Project, leading construction staging & logistics, operations shore base development and processes and coordination of shipping activities.

Table 1.1 Capabilities and Experience of World Energy GH2 Partners

Project Partner	Capabilities and Experience
World Energy	• World Energy empowers leading companies committed to net-zero carbon to cut emissions in the hardest-to-abate sectors right now. World Energy solutions include sustainable aviation fuel, renewable diesel and green hydrogen. • Driving change can only come from people and teams committed to the relentless and passionate pursuit of better ways to power the work that needs to get done. World Energy is built on trust, authenticity, and transparency.
DOB Academy	• DOB-Academy offers wind energy education for professionals working in the wind energy industry. DOB-Academy is specialized in bridging the knowledge gap between onshore professionals, which is essential in realizing the energy transition. • DOB-Academy trains people new to the industry with introductory courses and expands the knowledge of experienced professionals with in-depth technical courses. • The main focus of the program has been to provide courses related to onshore wind. However currently, DOB-Academy is also developing courses on hydrogen. Next to open registration courses, DOB-Academy provides tailored/in-company courses and custom-built courses for international clients. • With academies in the Netherlands and Japan, DOB Academy looks forward to working with the Qalipu and providing training opportunities in NL.

1.2 NAME OF THE PROJECT

Project Nujio'qonik GH2 (the "Project"); it is the Mi'kmaq name for St. George's Bay meaning "where the sand blows".

1.3 PROJECT OVERVIEW

The Project involves the development of Canada's first commercial green hydrogen/ammonia production facility, created from 1 GW of renewable energy ("Site A", located on the Port au Port Peninsula as shown on Figure 1-4). Future expansion (not included within the scope of this Registration) includes potential to create up to 3 GW of renewable electricity through the addition of further onshore wind farms ("Site B" and "Site C", Figure 1-4). The Project is expected to produce the first green hydrogen by the end of Q2 2024.

The overall development plan (including future phases) includes three phases, as described in Table 1.2. As indicated above, this Registration Document is for Site A (Figure 1-4) (i.e., an onshore wind farm of up to 1 GW capacity and hydrogen production). This includes a 0.5 GW hydrogen facility at the Port of Stephenville, up to 164 turbines generating 1 GW of wind power (with a likely maximum hub height of 121 m, plus a rotor diameter of 158 m, for a likely total maximum height of 200 m) and associated transmission and supporting infrastructure. Site A is on the Port au Port Peninsula on the Island of Newfoundland. It offers unique characteristics including a steady wind resource, proximity to a deep-water port suited to facilitate logistics, hydrogen production and offloading, and interconnection to the existing electrical grid for the mutually beneficial exchange of green energy.

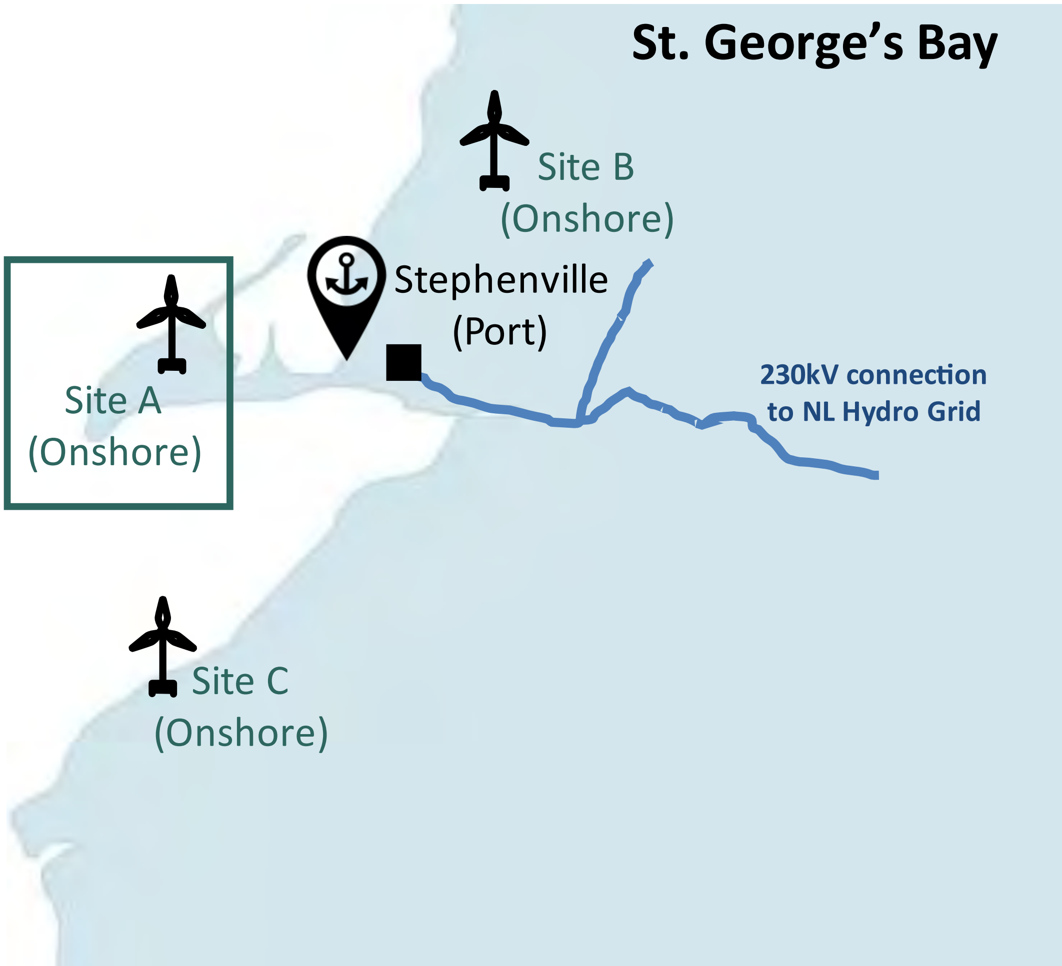


Figure 1-4 Site A Location on the Port au Port Peninsula

Table 1.2 Development Plan Phases

Phase of Development Plan	Description
Current Scope of Project	
Site A: Phase 1.0 - Onshore	• 1.0 GW Wind Generation • 0.5 GW Green Hydrogen (H_2) Production • 230 kV interconnection to electrical grid • 3 x 50 Megawatt (MW) Gas Turbine Generators (fuelled primarily by hydrogen) • 700 gallons per minute (GPM) Industrial Water Supply
Potential Future Expansion (subject to separate regulatory requirements)	
Site B: Phase 1.1 – Onshore – Expansion	• 1.0 GW Wind Generation • 0.5 GW Green H_2 Production • 350 GPM Industrial Water Supply • Switchyard expansion
Site C: Phase 1.2 – Onshore – Expansion	• 1.0 GW Wind Generation • 0.5 GW Green H_2 Production • 350 GPM Industrial Water Supply • Switchyard expansion

Figure 1-5 provides an overview of the Project layout; it also shows the locations of seven viewpoints used to provide illustrative simulations of Project infrastructure on the Port au Port Peninsula. Existing and proposed Project simulations for each of the viewpoints identified on Figure 1-5 are provided in Appendix C. These simulations assume the likely maximum turbine height described above. Figures 1-6, 1-7 and 1-8 provide examples of renderings from three of the seven viewpoints. The illustrative simulations were prepared using available data: publicly available U.S. Geological Survey (USGS) contour terrain information and Google street view imagery. The USGS terrain is 10 m contours and the available Google street view imagery is between 4 and 10 years old, with varying weather conditions.

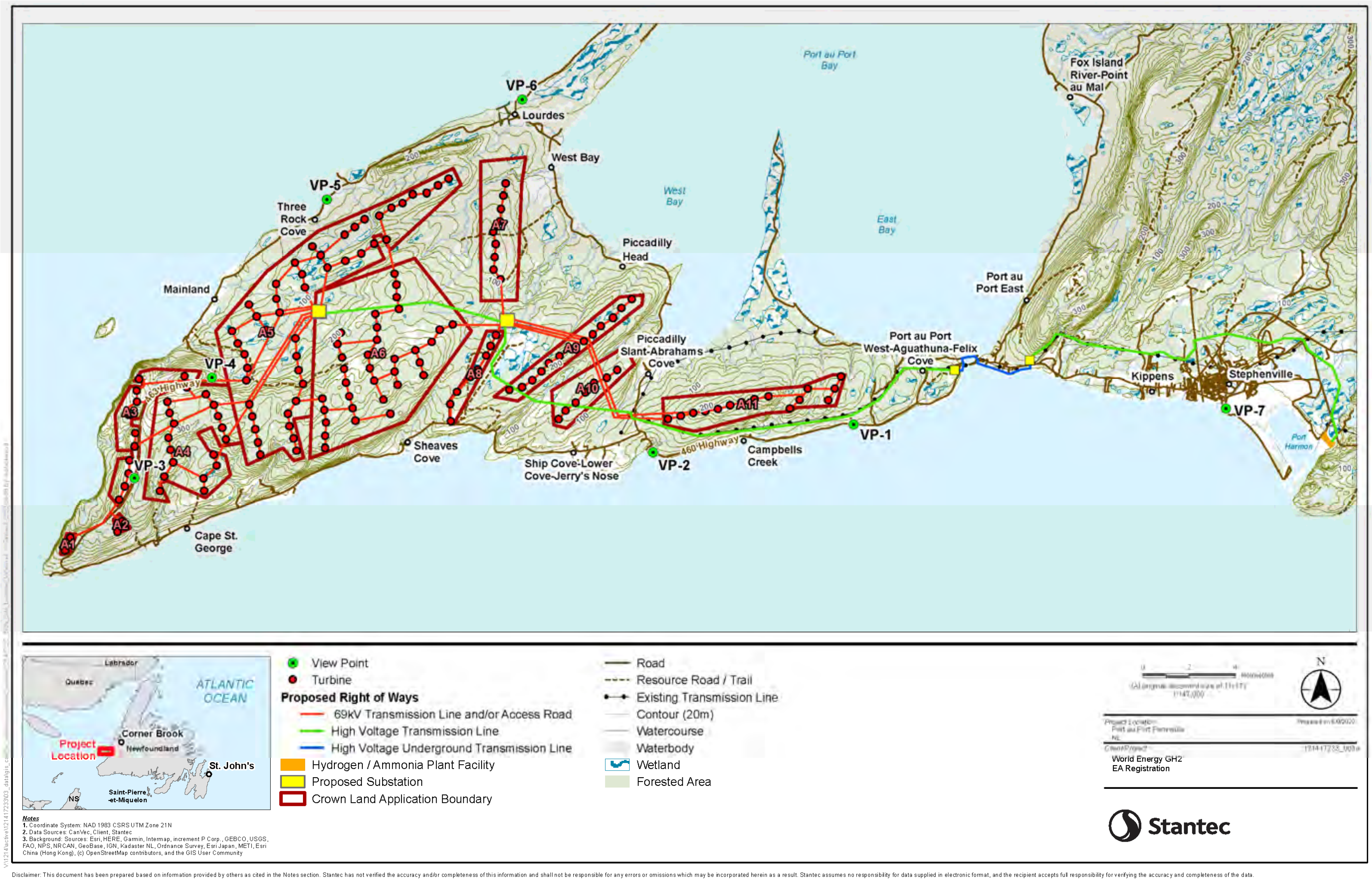


Figure 1-5 Overall Project Layout

Figure 1-6 Simulation of Project Infrastructure on the Port au Port Peninsula – Felix Cove Looking South

Figure 1-7 Simulation of Project Infrastructure on the Port au Port Peninsula – Abrahams Cove Looking West

Figure 1-8 Simulation of Project Infrastructure on the Port au Port Peninsula – Stephenville Looking Toward Port au Port Peninsula

The wind farm will be connected to one or more transformer substations owned by the Project. This substation will be connected to the hydrogen and ammonia plant, where the electricity will be used to convert water to hydrogen. The substation will also connect the wind farm to the NL Hydro Transmission System. Figure 1-9 illustrates the different interfaces between the onshore wind plant and the final ammonia / hydrogen delivery location.

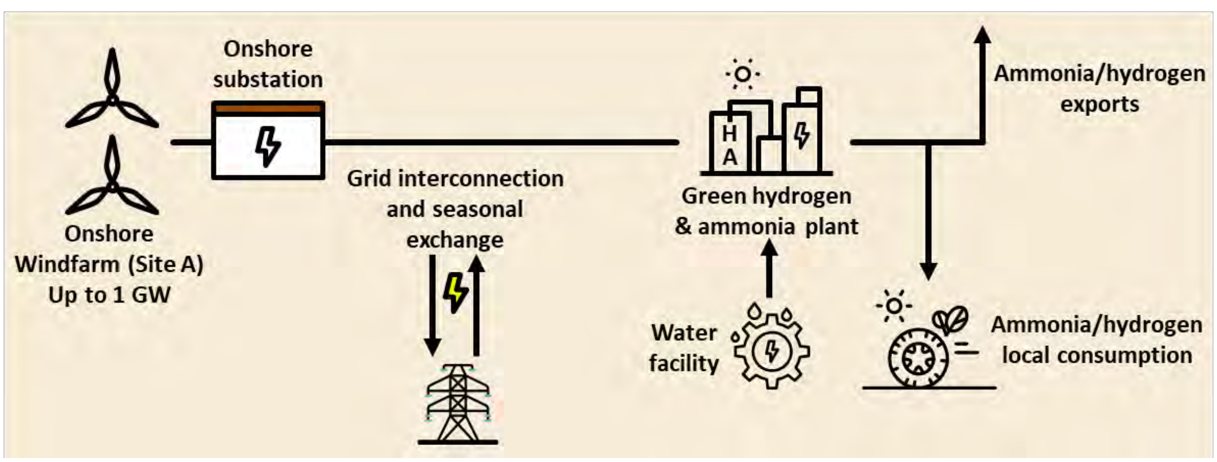


Figure 1-9 Illustration of the Interfaces for Site A Hydrogen Production

Export to international markets will be in the form of ammonia, as transporting hydrogen over long distances is most cost-effective in the form of green ammonia. The Project is also actively engaging in dialogues with local industries and NL Hydro to better understand local requirements for hydrogen and to work together to be able to support them in long-term decarbonization efforts.

Various activities have been initiated in support of the Project including stakeholder engagement, feasibility studies, and high-level technical surveys. We will continue to facilitate dialogue with relevant partners and local stakeholders as the detailed design of the Project and required supporting studies progress. This includes consultation with regulators to address concerns and refine proposed mitigation measures and Project design as appropriate.

1.4 NEED / PURPOSE / RATIONALE

The purpose of the Project is to produce cost-effective green hydrogen/ammonia from wind power. The Project is positioned to become Canada's first commercial green hydrogen and ammonia production facility powered by wind energy. Our advanced studies and market analysis confirm a world class wind resource in the area, that can be used both for electricity generation and cost-effective production of hydrogen and ammonia. These markets are expected to see significant growth within the next few years due to an increasing push towards decarbonization efforts, as well as energy independence and security, and diversity of supply concerns. Being at the forefront of these developments will position NL and Canada as a global leader in the production of green hydrogen.

Canada has the longest coastlines in the world and abundant wind resources in coastal areas, giving the country potential to grow the wind energy sector. For NL, the opportunity is even greater given the area's world-class constant wind. With NL's existing workforce with relevant skills in the marine, fishery, hydro, and offshore oil and gas sectors, the province has the best position to help reach not only national but international carbon emission-reduction targets while boosting the economy and creating jobs.

Globally, renewable technologies are now in different phases of development – while the solar and other technologies have reached large-scale commercial deployment and are already supplying clean energy in Canada, the development of large-scale green hydrogen production facilities is just starting, providing NL and Canada with the opportunity and advantages of being a first mover in the green energy sector. NL's unique geography, strong wind resource and proximity to large centres of demand, will make it a globally competitive green hydrogen producing region.

The Project plans to generate clean electricity from onshore wind farms and produce zero-carbon hydrogen and ammonia at scale. As green hydrogen and ammonia are critical solutions for difficult-to-decarbonize industries, the Project will play a key role in enabling other industries to decarbonize.

1.4.1 Wind Resource Opportunity in Western Newfoundland

As shown in Figure 1-10 from the Global Wind Atlas, the Project site benefits from excellent wind resources with onshore wind speeds equivalent to those observed at some offshore sites globally.

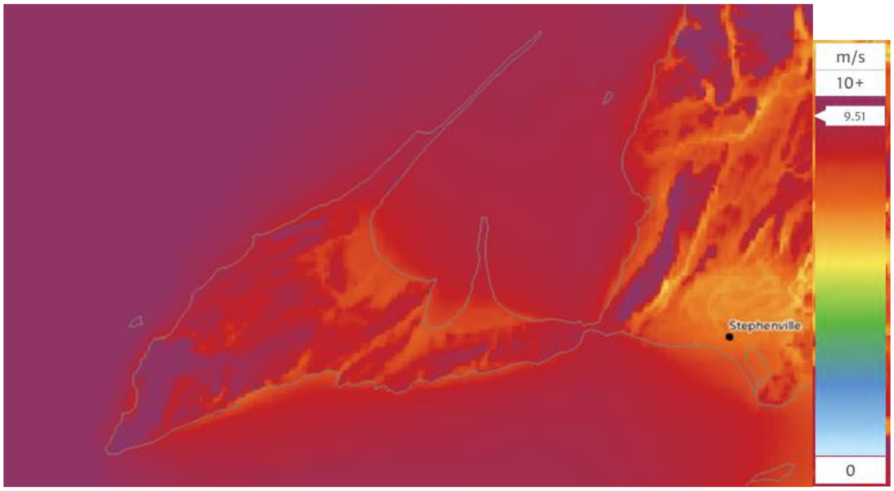


Figure 1-10 Wind Speed Distribution at the Site (source: global wind atlas)

The Project has engaged the world's wind energy leading technical advisor, Det Norske Veritas (DNV), to conduct an initial desktop study and analysis of the wind resources at the Project wind farm site. This study yielded the following results:

- The Average Turbine Wind Speed is estimated at 9.7 metres per second (m/s) at 121 m hub height
- The Gross Energy Output for a 1 GW onshore wind project is expected to be 4,841.7 GWh/annum
- This promising analysis suggests robust Project performance

More details on the wind assessment and resource can be found in Section 2.2.2.1.

1.4.2 Canada's Role in the Global Green Hydrogen Market

Green hydrogen, a zero-carbon energy carrier and feedstock produced from renewable electricity and water, is anticipated to play a critical role in the decarbonization of the global economy. Today, the vast majority of hydrogen production is "grey hydrogen" produced from natural gas or coal, with global hydrogen consumption of 118 metric tonnes (Mt) per year being responsible for 2% of global carbon emissions. This hydrogen is mainly consumed in heavy industry applications such as oil refining and steel, methanol, and ammonia production (Energy Transition Institute n.d.).

In addition to the existing hydrogen demand, green hydrogen can be used to decarbonize sectors that are difficult or uneconomical to electrify, such as heavy industry and long-distance transport. Ammonia produced from green hydrogen can be used for fertilizer, energy storage, transport fuel, and other end uses. Conversion to ammonia is also considered the most economical way of transporting green hydrogen over large distances. By 2050, global hydrogen consumption is forecasted to grow to over 500 Mt per year as industries shift to green hydrogen use to decarbonize (see Figure 1-11). While industrial applications will likely still account for almost 50% of 2050 hydrogen consumption, new hydrogen applications in gas energy, mobility, power generation, and new industrial uses will account for most of the consumption growth.

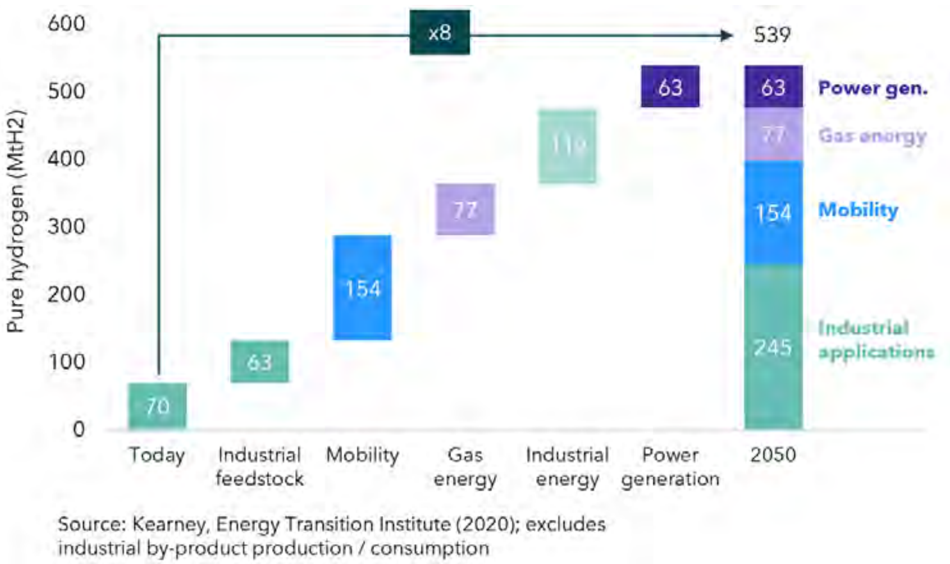


Figure 1-11 Forecasted Global Hydrogen Consumption By 2050 (MtH_2)

Countries around the world have recognized the importance of green hydrogen and formalized hydrogen strategies with set national targets. For example, in 2020 the European Union set electrolyzer capacity targets of 6 GW by 2024 and 40 GW by 2030, as well as production targets of 1 million and 10 million tonnes of renewable hydrogen per year for those two milestone years (European Commission 2020). In the US, nearly $10 billion in federal funding has been allocated to clean hydrogen research and development and infrastructure (United States Department of Energy 2022). Large industrial players have recognized green hydrogen as a major way of reducing their carbon emissions. Companies such as European fertilizer producer Yara, steel producer ArcellorMittal and chemical company Ineos, are already integrating green hydrogen in their operations.

Developers are responding to the hydrogen demand signal. By the end of 2020, the total global installed electrolyzer capacity was only around 0.3 GW. The current global projects pipeline suggests that this capacity will grow to nearly 80 GW by the end of 2030. Large scale projects are expected to be located where cost efficient renewable energy is available, such as Chile, Namibia and Australia, which have an excellent combination of solar and wind resources. Canada can additionally play a major role, given its unique combination of abundant hydro and wind power.

1.4.3 Offtake

Green hydrogen is an important low-carbon energy carrier and feed stock for hard to abate sectors, but is not widely available. Without a liquid market in place, having a robust offtake strategy is key for the success of a hydrogen project.

World Energy GH2 has developed a robust and scalable offtake strategy for the Project, based on World Energy's extensive experience in helping companies to achieve their net-zero goals. The team has enabled corporations to reduce their aviation-related greenhouse gas emissions by producing the first low-carbon Sustainable Aviation Fuel (SAF) at scale and subsequently pioneered the SAF market. As World Energy expands its SAF production, companies seeking to reduce their supply chain carbon footprint continue to have high demand for the product. This model to deliver low-carbon energy solutions can be replicated with clean hydrogen.

A key part of the SAF model is World Energy’s access to corporations with industry leading Environmental, Social and Governance goals and net zero greenhouse gas emissions targets. These corporations have demonstrated a willingness to transition their businesses to a lower-carbon energy such as SAF or green hydrogen. Their ambitious environmental, social and governance goals will contribute to an overall demand for green hydrogen that is expected to reach 75 million tons/year by 2030. Of this volume, approximately 30 million tons/year will be immediately economical in the near term. However, the green hydrogen available supply is still very low at the moment.

To benefit from the strong demand and low supply of alternatives, moving quickly and hence capturing the first-mover advantage is also key to the offtake strategy. World Energy GH2 is currently developing offtake agreements with companies that can significantly reduce their production’s or supply chain’s carbon footprint by using green hydrogen and green ammonia.

The Project will convert most of its hydrogen to ammonia, since transporting hydrogen over long distances is most economical in the form of liquid ammonia. The Port of Stephenville provides the ability to transport green ammonia fuel to meet overseas demand. The produced ammonia can also be used to power marine engines which have been developed recently and are widely viewed to be the future of powering the global shipping fleet. The Project also has the potential upside to enable local industries looking to pursue decarbonization effort.

Overall, the Project is well-positioned in terms of its offtake strategy. It has access to markets that are willing to pay the true cost of low-carbon energy and has the additional option to contribute to decarbonization of NL’s industry.

1.5 PROJECT SCHEDULE

The Project schedule is shown in Figure 1-12. Construction of the wind farm is planned for Q4 of 2023 and Q2 of 2023 for the hydrogen facility, pending EA approval and receipt of other required permits and approvals. Construction is anticipated to be completed over a two-and-a-half-year period. The wind farm would be operational in Q3 of 2025. First hydrogen production is planned for Q2 of 2024 (with electricity to the facility to be supplied by the existing electrical grid until the wind farm is operational), with full production achieved by the end of Q3 2025. The wind farm's nominal design life is 35 years.

As the global wind market continues to grow, demand for key wind components will increasingly constrain supply. It is critical that the Project moves quickly to avoid supply chain pressure expected to escalate in the near future due to the number of projects anticipated to be constructed at this time. The Project is already engaging in initial soundings with key equipment suppliers to identify potential opportunities and major constraints in the timeframe. Another critical timing aspect is securing first mover advantage with customers. End product customers will only enter into contracts when permit and supply assuredness can be confirmed.

World Energy GH2 is committed to completing a number of environmental field surveys and desktop studies as outlined in Appendix A. A schedule for completion of these surveys and anticipated federal and provincial permitting is provided in Figure 1-13.

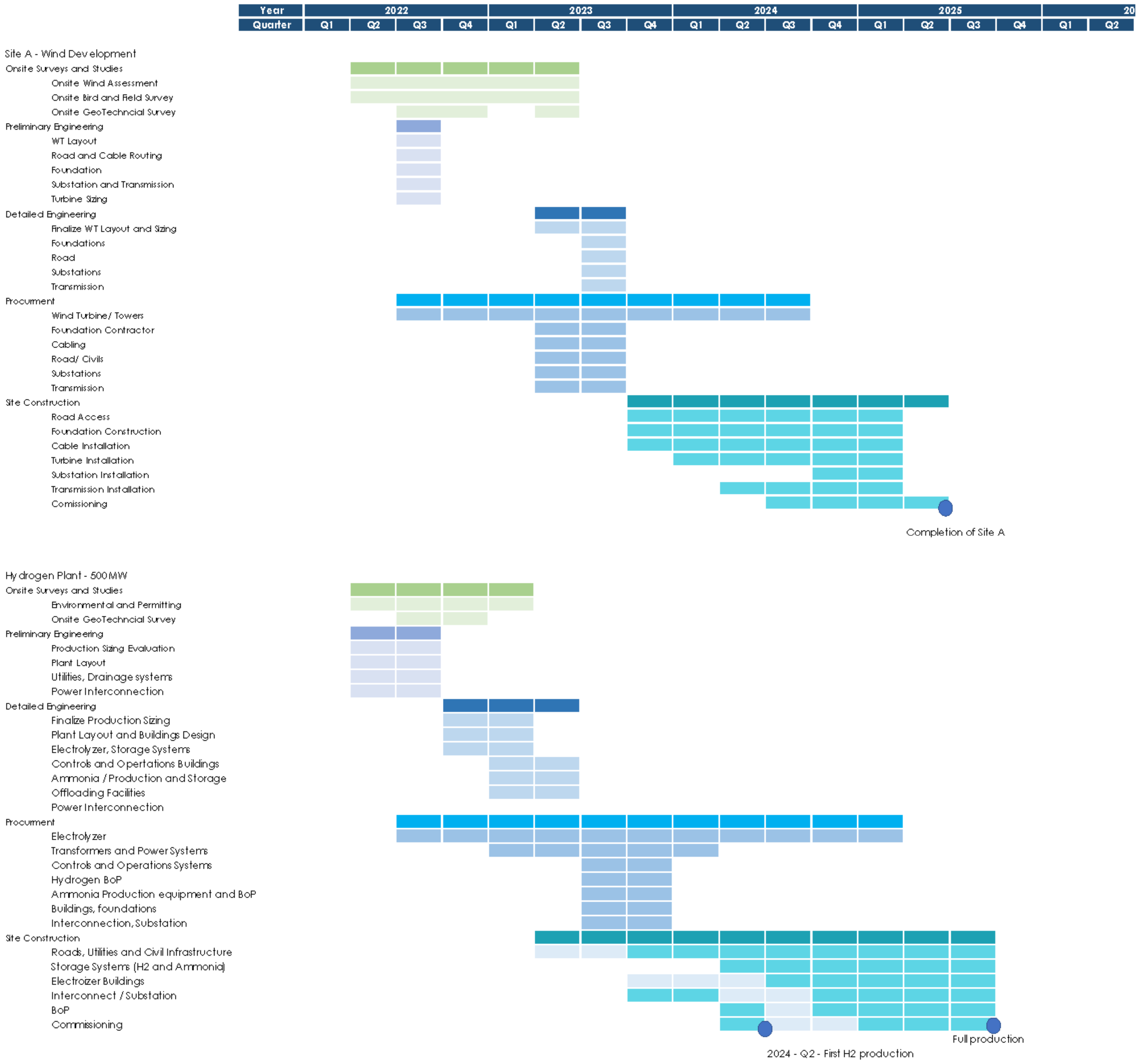


Figure 1-12 Proposed Project Schedule

ID	Task Name	Start	Finish
1	**Project Nujio'qonik**		
2	**Project Summary**	**Wed 6/1/22**	**Mon 7/3/23**
3	Environmental Characterization Studies Start	Wed 6/1/22	Mon 7/3/23
4	Provincial Regulatory and Permitting Process	Wed 6/1/22	Fri 6/2/23
5	Municipal Permitting Process	Wed 6/1/22	Fri 6/2/23
6	Federal Permitting Process	Wed 6/1/22	Fri 6/2/23
7	**Environmental Characterization Studies**	**Wed 6/1/22**	**Mon 7/3/23**
8	Desktop Research	Mon 7/4/22	Fri 9/2/22
9	Atmospheric and Acoustic Environment (Desktop)	Mon 7/4/22	Fri 9/30/22
10	Noise Assessment (Noise Monitoring and Modelling)	Mon 7/4/22	Fri 12/30/22
11	Surface and Groundwater Resources	Wed 6/1/22	Fri 9/30/22
12	Aquatic Environment	Mon 8/1/22	Mon 7/3/23
13	Avian Field Survey 1 (Fall Migration Survey)	Fri 7/15/22	Wed 11/30/22
14	Avian Field Survey 2 (Winter Birds Survey)	Mon 1/2/23	Tue 2/28/23
15	Avian Field Survey 3 (Spring Migration / Raptor Survey)	Mon 4/3/23	Wed 5/31/23
16	Avian Survey 4 (Breeding / Nesting Birds Field Survey)	Mon 5/15/23	Fri 6/30/23
17	Bat Field Monitoring 1 (Resident population)	Mon 7/4/22	Fri 7/29/22
18	Bat Field Monitoring 2 (Fall Migration)	Mon 10/3/22	Fri 10/28/22
19	Bat Field Monitoring 3 (Spring Migration)	Mon 5/15/23	Fri 6/2/23
20	Terrestrial Wildlife (Incidental Observations)	Mon 7/4/22	Mon 7/3/23
21	Rare Plants Late Season Field Survey	Mon 8/1/22	Fri 9/2/22
22	Rare Plant Spring Ephemeral Field Survey	Mon 5/22/23	Fri 6/30/23
23	Wetland Validation	Mon 8/1/22	Fri 9/2/22
24	Historic Resources	Mon 7/4/22	Fri 11/4/22
25	Viewscape Survey / Viewshed Analysis	Mon 7/4/22	Mon 10/3/22
26	**Electromagnetic Interference Study**	**Mon 7/4/22**	**Fri 12/30/22**
27	Receptor Survey	Mon 7/4/22	Fri 12/30/22
28	Radiocommunication and Radar System Study	Mon 7/4/22	Fri 12/30/22
29	Shadow Flicker Study	Mon 7/4/22	Fri 10/28/22
30	Quantitative Risk Assessment	Mon 7/4/22	Fri 12/30/22
31	**Provincial Regulatory Requirements**	**Wed 6/1/22**	**Wed 5/31/23**
32	EA Registration	Wed 6/1/22	Fri 7/29/22
33	Licence to Lease (or Grant) Crown Lands	Wed 6/1/22	Wed 5/31/23
34	Endangered Species Act Permission	Wed 6/1/22	Wed 5/31/23
35	Application for Water Use Licence	Mon 8/1/22	Wed 11/30/22
36	Watercourse / Wetland Alteration	Mon 8/1/22	Wed 11/30/22
37	Highway Access Permit	Mon 1/2/23	Fri 4/28/23
38	Certificates of Approval (Construction, Operation)	Wed 2/1/23	Fri 4/28/23
39	Cutting Permit and Operating Permit	Wed 2/1/23	Fri 3/31/23
40	Building Accessibility Exemption Registration	Wed 2/1/23	Fri 3/31/23
41	Fuel Storage Tank Registration	Wed 2/1/23	Fri 3/31/23
42	Electrical Permits	Wed 2/1/23	Fri 3/31/23
43	**Municipal**	**Wed 6/1/22**	**Wed 5/31/23**
44	Land Use / Zoning	Wed 6/1/22	Wed 5/31/23
45	Municipal Construction Permit	Mon 1/2/23	Wed 5/31/23
46	Approval for Waste Disposal	Mon 1/2/23	Wed 5/31/23
47	Licence to Operate a Temporary Work Camp	Mon 1/2/23	Wed 5/31/23
48	**Federal Regulatory Requirements**	**Wed 6/1/22**	**Wed 5/31/23**
49	Wildlife / Birds Permits 1	Wed 6/1/22	Thu 6/30/22
50	Fisheries Act Authorization	Wed 6/1/22	Wed 5/31/23
51	Land Use Approval	Wed 6/1/22	Fri 9/30/22
52	Aeronautical Assessment Obstacle Evaluation	Wed 6/1/22	Fri 9/30/22
53	Wildlife / Birds Permits 2	Mon 4/3/23	Fri 4/28/23

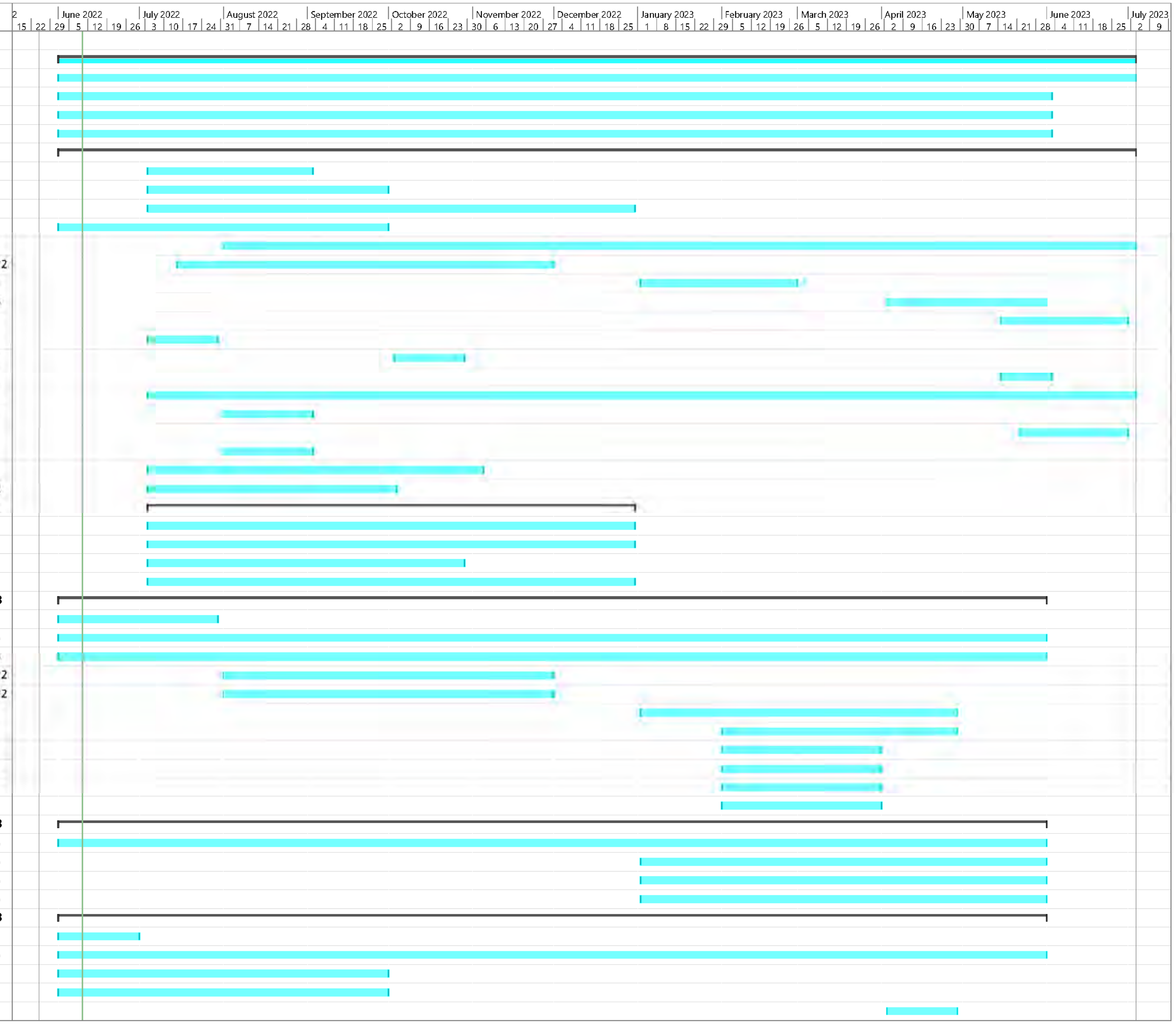


Figure 1-13 Environmental Work Plan and Regulatory Schedule

1.6 APPROVAL OF THE PROJECT

In 2006, the NL government issued Order in Council OC2006-026, restricting the commercial development of wind energy in the province. The Order specifically restricted granting of crown land requests and EA registration for development of commercial wind energy generation projects which propose to produce energy for sale. Aside from small test projects and isolated systems, there has been no large-scale wind energy projects developed in the province due to this Order. However, in April 2022, the provincial Minister of Industry, Energy, and Technology announced that the Order will be lifted, and that proponents may now proceed through the approvals processes for resource development projects.

The Project will require a variety of environmental approvals from municipal, provincial and federal regulators. The initial approval required will be from the EA process under the provincial *Environmental Protection Act, 2002*, and associated *Environmental Assessment Regulations*. This document serves as the Registration to initiate the EA process.

Upon receipt of a provincial EA approval, the Project will be required to obtain approvals and permits from various regulatory bodies at the municipal, provincial, and federal levels. The Project will also be subject to provisions of federal legislation that may not have specific permits and approvals including:

- *Canadian Environmental Protection Act, 1999*
- *Fisheries Act*
- *Migratory Birds Convention Act, 1994* (MBCA)
- *Species at Risk Act* (SARA)
- *Aeronautics Act*

The federal and provincial governments are responsible for upholding legislation and regulations related to species at risk (SAR) and species of conservation concern (SOCC), as well as protecting migratory birds along with their eggs, nests, and young.

Table 1.3 provides a preliminary list of approvals, authorizations, and permits that may be required for the Project. It is not considered an exhaustive list, and we will work with regulators to confirm and adjust the list as necessary.

Table 1.3 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Municipal		
Municipal Construction Permit	*Urban and Rural Planning Act*, 2000; Municipal Plan and Development Regulations	Municipal Council(s)
Approval for Waste Disposal	*Urban and Rural Planning Act*, 2000; Municipal Plan and Development Regulations	Municipal Council(s)
Licence to operate a temporary work camp	*Urban and Rural Planning Act*, 2000; Municipal Plan and Development Regulations	Municipal Council(s)

Table 1.3 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Provincial		
Environmental Assessment Approval	*Environmental Protection Act*	Department of Environment and Climate Change (NLDECC), EA Division
Certificate of Approval for Construction and/or Operation of industrial facilities	*Environmental Protection Act*	NLDECC, Pollution Prevention
Permit to engage in an Economic Activity under the Endangered Species Act	*Endangered Species Act*	Newfoundland and Labrador Department of Fisheries, Forestry, and Agriculture (NLDFFA), Wildlife Division
Permit to Control Nuisance Animals	*Wild Life Act*	NLDFFA, Wildlife Division
Certificate of Approval for Generator Operation	*Environmental Protection Act, Air Pollution Control Regulations*	NLDECC; Pollution Prevention Division Industrial Compliance Section
Application for Environmental Permit for Alterations to a Body of Water	*Water Resources Act*	NLDECC, Water Resources Management Division
Certificate of Approval for Transportation of Waste Dangerous Goods / Hazardous Waste	*Environmental Protection Act*	NLDECC; Pollution Prevention Division, Waste Management Section
Certificate of Approval for construction / operation of an industrial facility	*Environmental Protection Act*	NLDECC; Pollution Prevention Division Industrial Compliance Section
Application for Water Use Licence	*Water Resources Act*	NLDECC, Water Resources Management Division
Permit to engage in an Economic Activity under the Endangered Species Act	*Endangered Species Act*	NLDFFA, Wildlife Division
Permit to Control Nuisance Animals	*Wild Life Act*	NLDFFA, Wildlife Division
Permit to Cut	*Forestry Act*	NLDFFA, Forestry Division
Permit to Burn	*Forestry Act*	NLDFFA, Forestry Division
Licence to Lease (or Grant) Crown Lands	*Lands Act*	NLDFFA, Crown Lands
Highway Access Permit	*Works, Services and Transportation Act*	Department of Transportation and Infrastructure, Government Services Centre
Quarry Development Permit	*Quarry Materials Act*	Department of Industry, Energy, and Technology, Mining and Mineral Development
Certificate of Approval for a Sewage / Septic System	*Health and Community Services Act*	Digital Government and Service NL
Electrical System Interconnection	*Electrical Power Control Act*	NL Hydro / Public Utilities Board of NL

Table 1.3 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Fuel Storage Tank Registration	*Environmental Protection Act, Storage and Handling of Gasoline and Associated Products Regulations, 2003*	Digital Government and Service NL
National Building Code –Fire, Life Safety and Building Safety	*Buildings Accessibility Act*	Digital Government and Service NL
Buildings Accessibility Registration and Permit or Building Accessibility Exemption Registration and National Building Code of Canada Plans Review	*Buildings Accessibility Act*	Digital Government and Service NL
Food Establishment License	*Food Premises Act*	Digital Government and Service NL
Fuel Storage Tank Registration	*Storage and Handling of Gasoline and Associated Products Regulations, 2003*, under the *Environmental Protection Act*	Digital Government and Service NL
Electrical Permits	*Public Safety Act*	Digital Government and Service NL
Blasters Safety Certificate	*Occupational Health and Safety Act*	Digital Government and Service NL
Federal		
Permits Authorizing an Activity Affecting Listed Wildlife Species	SARA	Environment and Climate Change Canada (ECCC), Parks Canada
Nest Removal Permit	MBCA	ECCC; Canadian Wildlife Service (CWS)
Authorization pursuant to Section 35(2) of the *Fisheries Act*	*Fisheries Act*	Fisheries and Oceans Canada
License to Store, Manufacture, or Handle Explosives	*Explosives Act*	Natural Resources Canada
Land Use Approval	*Civil Air Navigation Services Commercialization Act*	NAV Canada*
Aeronautical Assessment Obstacle Evaluation	*Aeronautics Act*; *Canadian Aviation Regulations*	Transport Canada
Notes: * Nav Canada is a private, not for profit corporation that manages Canada's civil air navigation.		

There are navigation aids (a VOR [VHF Omni-Range] and DME [Distance Measuring Equipment]) associated with the Stephenville airport and collocated approximately 8 km of Stephenville, which could require NAV Canada to conduct an air navigation degradation study for the proposed windfarm. It is also understood, however, that the Stephenville VOR and the Stephenville (Harmon) NDB (non-directional beacon) are to be decommissioned in July 2022 as part of the National – NAVAID Modernization Program Phase 8 (NAV Canada, n.d.). World Energy GH2 will consult with NAV Canada as part of the detailed design process to confirm that turbine siting is appropriate and to receive required approvals.

Once approved through the EA process, in addition to permit / approval applications, proponents are typically required to submit environmental management plans for review by EA Division as a condition of approval. The specific plans for the Project will be determined in consultation with regulators and would include at a minimum:

- Environmental Protection Plan(s) (EPPs), including environmental contingency plans (a preliminary table of contents for the EPP is included in Section 2.8.1)
- Gender Equity and Diversity Plan (Appendix D contains a preliminary plan that will be further developed through consultation with the appropriate provincial regulators and in consideration of Indigenous and stakeholder feedback)
- Waste Management Plan (this may be stand-alone or included within the EPP; refer to Section 2.8.1)
- Air Quality Management Plan (this plan would be included within the EPP; refer to Section 2.8.1)
- Explosives and Blasting Management Plan (if it is determined that blasting will be required during construction)
- Emergency Response Plan

World Energy GH2 is committed to developing these plans in consideration of consultation with applicable regulators and stakeholders and it is assumed that the requirement for these plans would be a condition of approval from the EA process.

In addition to the items listed in Table 1.3, an application for the occupation of crown land on the Port au Port Peninsula for the wind farm has been submitted.

2.0 PROJECT DESCRIPTION

2.1 LOCATION

As indicated in Figure 1-5 and Section 1.3, the Project is comprised of a wind farm located on the Port au Port Peninsula and a 0.5 GW hydrogen facility at the Port of Stephenville. The Port of Stephenville is a deep-water port located on the north shore of Bay St. George, which is uniquely suited to marine transport for international export sale, as well as importing industrial equipment. The Project sites, which are further described below, are ideal for their proximity to the existing electrical grid for the mutually beneficial exchange of green energy in the future. The site's access to available industrial freshwater makes the Project suitable for hydrogen production without the requirement to develop new water resources. The location also offers easy access to international markets.

2.1.1 Wind Farm Site

The wind farm is located on the Port au Port Peninsula (Figure 1-5) with the Project's proposed boundaries covering an area of approximately 13,538 ha or 135 square kilometers (Center of Peninsula: latitude 48.572987, longitude -59.056757). Coordinates for the turbines are provided in Table 2.1 (note that figures showing corresponding turbine numbering are provided in Section 2.3). A crown lands application has been made for the areas indicated on Figure 2-1.

Table 2.1 Turbine Location Coordinates

Turbine #[a]	Easting	Northing	Turbine #[a]	Easting	Northing
1	333376.0011	5371447.00466	83	348571.0008	5380134.003
2	333600.998	5372009.999	84	348768.0025	5379604.998
3	335652.9092	5372263.713	85	348938.0006	5379048.997
4	335851.5929	5372715.003	86	346911.9962	5380582.995
5	335729.0022	5373655.997	87	346918.0018	5381139.003
6	335956.0002	5374237	88	346845.9979	5381694.996
7	336138.9973	5374800.998	89	347670.9978	5383457.999
8	336176.0004	5375362.995	90	347754.9999	5382979.999
9	336394.0001	5375966.998	91	347767.0007	5382430.001
10	336416.9983	5376529.002	92	347867.9975	5381915.997
11	336146.0027	5377317.998	93	350117.0007	5377050.003
12	336490.9983	5377893.999	94	350087.1287	5377800.491
13	336483.9977	5378371.998	95	350373.7472	5378317.264
14	336589.0005	5378884.995	96	350960.7642	5378987.873
15	338558.9963	5379004.996	97	351289.8736	5379289.266
16	338663.0009	5378519.994	98	351652.7272	5379908.799
17	337812.0013	5377894.001	99	351833.9982	5380323.996
18	337910.9984	5377408.995	100	352077.0005	5380797.995

Table 2.1 Turbine Location Coordinates

Turbine #[a]	Easting	Northing	Turbine #[a]	Easting	Northing
19	339482.0005	5378225	101	354364.0029	5379577.996
20	339835.9967	5377763.998	102	354838.9975	5379874
21	340020.0034	5377265.002	103	355296.003	5380215.003
22	340195.0012	5376766.002	104	355897.0028	5380520.004
23	338103.0023	5376937.998	105	356273.9982	5380842.996
24	337864.9975	5376328.996	106	356632.9985	5381201.994
25	337957.0024	5375825.997	107	357152.9993	5381551.002
26	338063.0021	5375282.998	108	357510.9988	5381954.998
27	337679.0007	5374661.004	109	357977.9981	5382340.997
28	337493.9964	5374025.996	110	355099	5377516.005
29	340354.0026	5376256.994	111	355529.9997	5377857.001
30	339823.9984	5375622.003	112	355950.9971	5378296.002
31	339954.0024	5375139.003	113	356327.9991	5378709.003
32	339388.0032	5374582.999	114	356883.9964	5378950.996
33	339414.997	5374044.996	115	357337.9978	5379280.004
34	340612.0029	5380973.004	116	354803.0235	5377138.173
35	340866.9985	5380435.005	117	354050.0004	5379213.996
36	341162.9989	5379963.996	118	353654.9988	5378836.999
37	341284.0023	5379372	119	347009.9967	5385962.997
38	341244.0018	5378821	120	347539	5386312.996
39	341379.002	5377785	121	348023.998	5386518.998
40	341503.997	5377256.005	122	348463.0007	5386886.995
41	341629.9976	5376700.001	123	349072.0033	5386947.004
42	341754.9987	5376134.997	124	349560.997	5387270.995
43	341853.9977	5375623.996	125	350022.9988	5387555.003
44	341352.0028	5382103	126	359538.0026	5377152.999
45	341687.9995	5381592.001	127	360089.9989	5377274.003
46	342114.0021	5381021.997	128	360640.9963	5377407.997
47	343395.9995	5377918.994	129	361152.0018	5377488.998
48	343046.9994	5377381.005	130	361704.0033	5377569.997
49	343109.0032	5376833.995	131	362227.9995	5377744.997
50	343297.999	5376304.996	132	362725.9999	5377878.994
51	343413.9967	5375785.003	133	363290.997	5378014.002
52	342548.999	5382357.997	134	363895.999	5378134.998
53	342682.9995	5381753	135	353201.9966	5378538.002
54	343368.9988	5380649.999	136	352654.174	5378404.056
55	343423.0029	5379883.004	137	352489.9968	5387361.995

Table 2.1 Turbine Location Coordinates

Turbine #[a]	Easting	Northing	Turbine #[a]	Easting	Northing
56	343504.0008	5379265.004	138	352400.0029	5386841.994
57	343705.9968	5378672.996	139	352291.9987	5386268.001
58	342535.0003	5383017.997	140	352246.999	5385720.994
59	343355.9999	5383932.004	141	351960.0029	5385255.003
60	343664.9991	5383420.998	142	352059.0018	5384735
61	343773.0016	5382855.995	143	352023.0007	5384169.996
62	344108.9993	5384617.994	144	351969.0014	5383641.003
63	344458.9979	5384255.004	145	352273.9984	5383210.004
64	344767.9965	5383730.002	146	345531.0022	5384025.998
65	344540.002	5378040.998	147	346230.0012	5384322.005
66	344619.9978	5377543.003	148	346794.9994	5384743.995
67	344700.9998	5376991.002	149	347324.0032	5384922.996
68	344660.9986	5376413	150	349288.0034	5380501.994
69	344660.9983	5375902.005	151	349634.406	5381034.276
70	345480.9975	5379331.995	152	350203.0009	5381255.001
71	345562.0031	5378726.995	153	364837.9965	5377596.997
72	345709.9999	5378135.002	154	365255.001	5377972.998
73	345858.0007	5377609.999	155	365604.9992	5378457.999
74	345965.9965	5377072	156	366492.998	5377960.001
75	346517.0005	5379937.001	157	366775.0028	5378471.002
76	346610.9997	5379358.995	158	367043.9983	5378996.001
77	346785.9973	5378807	159	345399.0033	5379817.997
78	347674.0001	5379758	160	345184.002	5380408.996
79	347674.0002	5379210.999	161	345338.9992	5380899.998
80	347798.9966	5378636.999	162	346373.9985	5385819.995
81	347190.0019	5377990.997	163	345949.0032	5385485.004
82	347494.9984	5377380.997	164	345507.0002	5385144.003

Notes:
[a] Refer to figures in Section 2.3 for corresponding turbine numbering

Figure 2-1 Area A Crown Land Application Map with Proposed Boundaries (red)

A narrow isthmus connects the Port au Port Peninsula to Newfoundland, with the Peninsula bounded by the Gulf of St. Lawrence to the west, Bay St. George to the south and Port au Port Bay to the northwest. The total population of the Port au Port Peninsula in 2021 was 4,734, with the population spread amongst several small communities along Route 460 to the south and Route 463 to the north. The Peninsula's coastal areas are relatively even and gently sloping, with rugged coastal cliffs and rocky beaches along the western and southern sides of the Peninsula, with elevations rising to 350 m above sea level in the White Hills area (Jacques Whitford Environment Limited [JWEL] 2008, in Stantec 2016). Deposits of limestone and dolostone cover most of the Peninsula and the underlying bedrock is often exposed, with shallow soil cover, resulting in limestone barrens plant communities and reduced forest growth (Protected Areas Association of Newfoundland and Labrador [PAANL] 2008; Stantec 2016). Further information on both the biophysical and human environments on the Port au Port Peninsula are found in Section 4.0. A discussion of existing land use considerations is provided in Section 2.3.

2.1.2 Hydrogen Facility Site

The hydrogen facility will be located on a brownfield site at the Port of Stephenville as shown on Figure 2-2 (latitude 48.528247, longitude -58.514278). The total required area for the facility is 15 to 20 ha depending on the final design of the ammonia unit and storage. The port is located in Stephenville and is suitable for the implementation of hydrogen production and export, as it has the advantage of a large lay down space, and deep-water access for large ships.

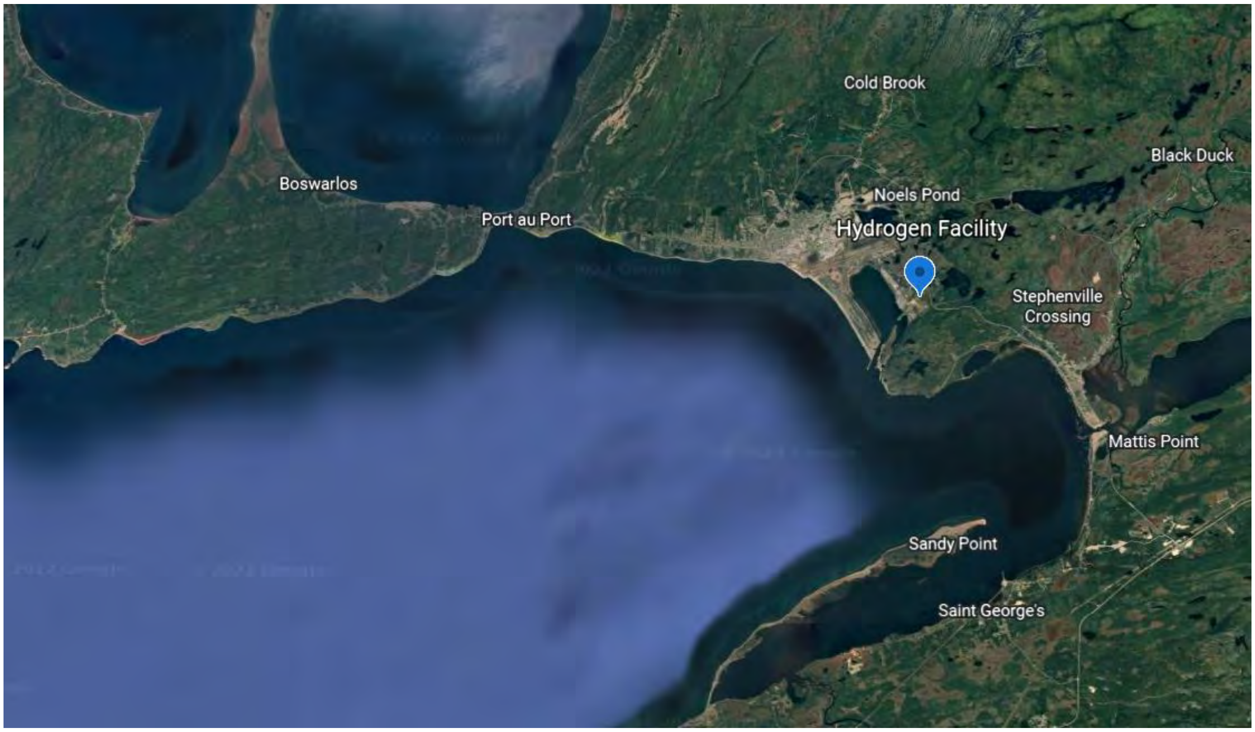


Figure 2-2 Location of Hydrogen Facility at the Port of Stephenville

The port currently provides a variety of services to accommodate fishing, aggregate, container, and project cargo fleets. Its services include warehousing services, berthage, pilotage, a customs bonded warehouse and general port services. The port operates year-round in a naturally sheltered and ice-free basin with a maximum depth of 10 m. The navigational channel (71 m x 2,100 m) and large turning basin (450 m radius) allows for vessels up to 385 m in length. However, this will be confirmed through a navigation study and possible vessel simulation.

The port is ideally located for shipping to and from destinations in Atlantic Canada, North America, Europe and the Arctic region. It operates in compliance with the International Ship and Port Facility Security Code and is also a Marsec Level 1 security facility with 24-hour security. The Port of Stephenville is designated as a compulsory pilotage area under the authority of the Atlantic Pilotage Authority. Ships meeting specific criteria are boarded by qualified harbour pilots and provide safe navigation between the Port and approximately 1 nautical mile (3.7 km) west of the Port entrance. The Pilot provides safe navigation into and out of the Port.

The quay has a berthing area of 293 by 19 m with a depth of 9.8 to 10 m accommodating ships up to 385 m in length. The basin has a turning radius of 450 m. Facilities and equipment on site include two boom cranes and a jib crane. The port has multiple acres of prepared laydown space, and numerous additional acreage of cleared land is available. The port is able to accommodate vessels to transport hydrogen/ammonia without the construction of additional berthage. As discussed in Section 2.2.1.4 and as part of detailed engineering for the Project, the existing quay will be inspected and load rated to verify that it can accommodate the berthing and mooring loads from the maximum anticipated size ship.

2.1.3 Existing Land Use Considerations

A preliminary study has been conducted to identify possible land use constraints and challenges. The Crown Lands database was accessed to identify potential land use restrictions for areas that overlap with Project infrastructure (Table 2.2); these are illustrated in Figures 2-3 to 2-8 (see Table 2.1 for location coordinates). There are four receptors (identified through Natural Resource Canada's CanVec database) within 1 km of a turbine (the nearest, a barn-machinery shed, is 583 m; the other three buildings are not identified by use). The potential presence of other human receptors (e.g., seasonal cabins) will be confirmed through detail Project design. Noise modelling will be conducted as described in Appendix A and micro-siting will be conducted to adjust the locations of turbines and other Project infrastructure, if needed. Further information on wind turbine siting is provided in Section 2.2.2.2 and the potential for resource conflicts is further discussed in Section 4.0.

Table 2.2 Land Use Zones and Restrictions

Land Use Zones	Land Use Restrictions as Identified in the Crown Lands Database
Cape St. George Transitional Reserve	In crown lands data base as a Natural Area. No crown lands applications accepted, and no development permitted or approved within defined area.
Domestic Water Supply Areas	Protected Surface Water Legal Boundary - Area defined on a map which closely represents all or part of the catchment area for a water supply. Referral to Water Resource Management Division.
Dump Site and Buffer	Referral to Service NL
Municipal Boundaries	No restrictions. Referral to municipal affairs for development within boundaries.
Sensitive Wildlife Area – Plants	Surface level restrictions may prevent development. Referral to Wildlife Division.
Mineral Claim	A mineral licence gives the licensee the exclusive right to explore for minerals in, on or under the area of land described in the licence. A licence holder has the right to convert any part of a mineral licence to a mining lease provided the provisions of Section 31 of the *Mineral Act* are met.

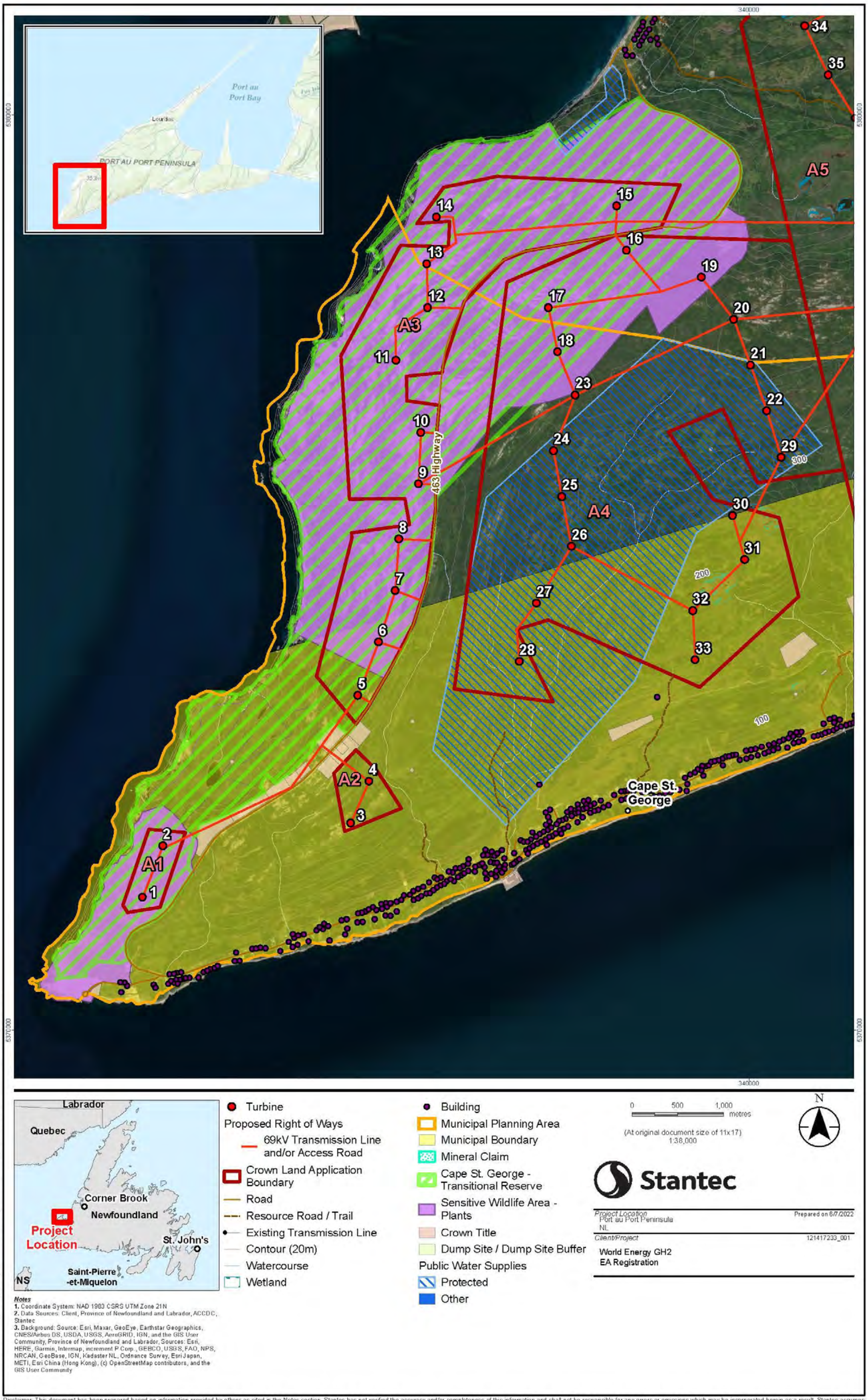


Figure 2-3 Locations of Project Components in the Cape St. George Area

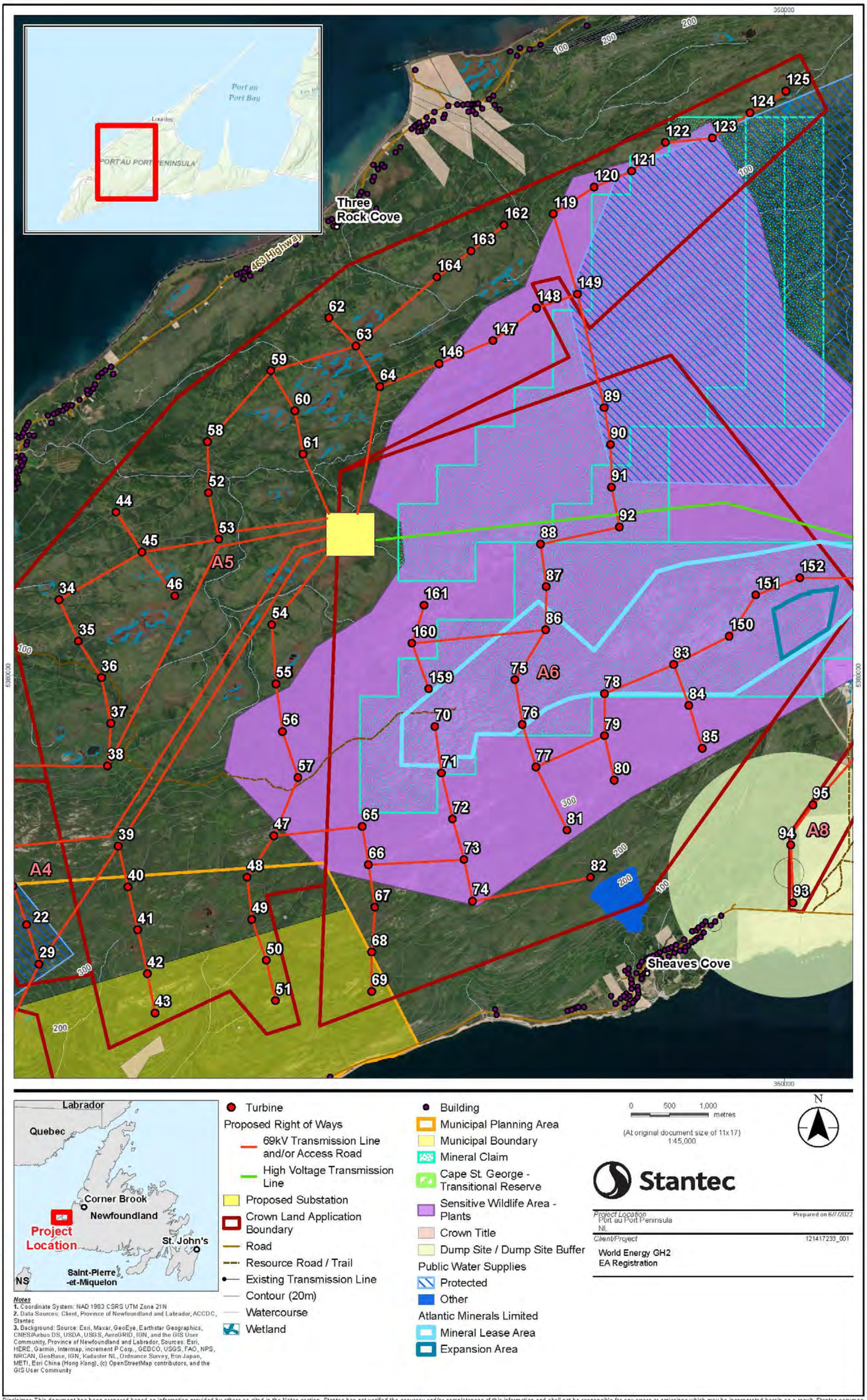


Figure 2-4 Location of Project Components in Three Rock Cove / Sheaves Cove Area

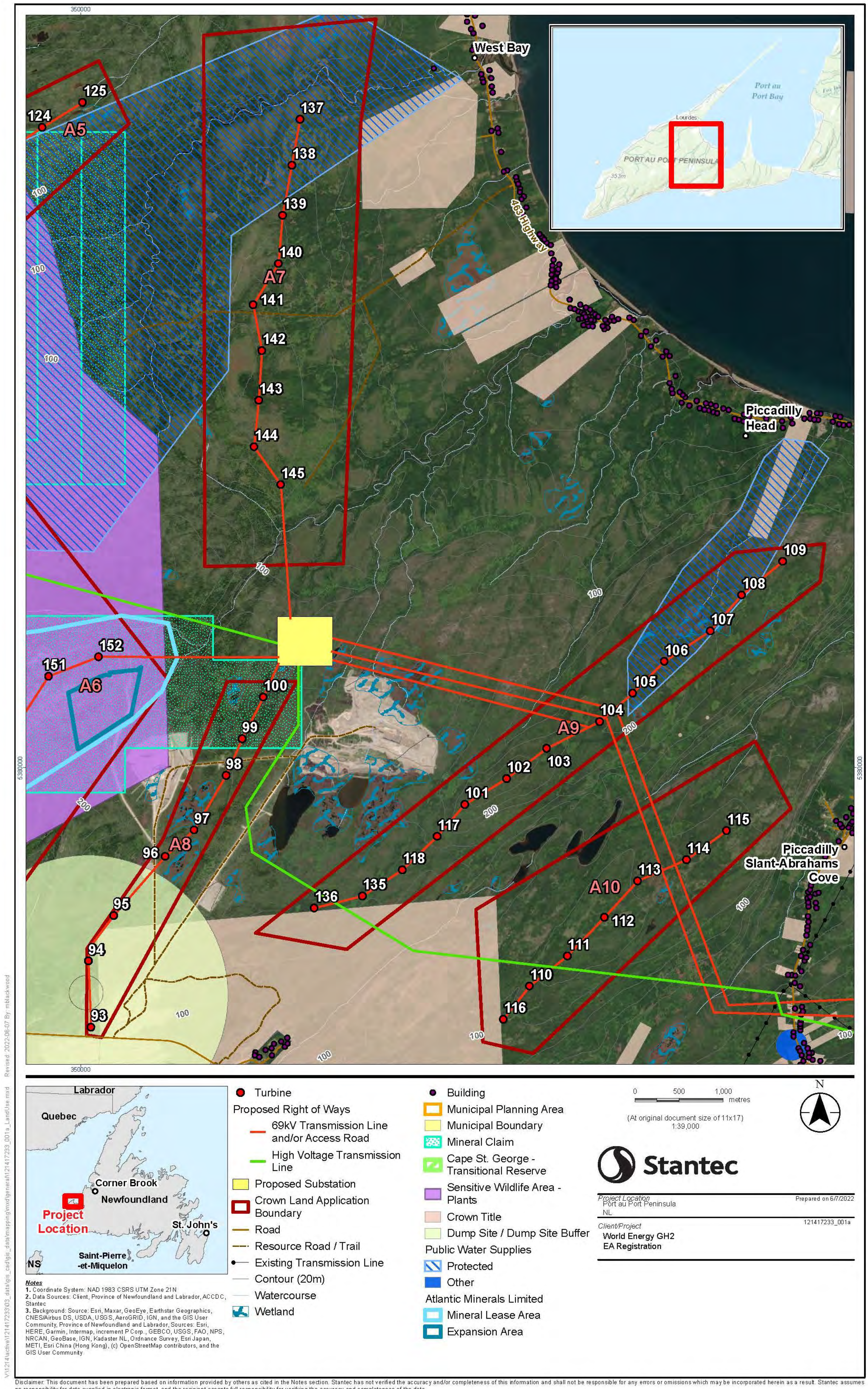


Figure 2-5 Location of Project Components in Piccadilly Head / Piccadilly-Slant Abrahams Cove Area

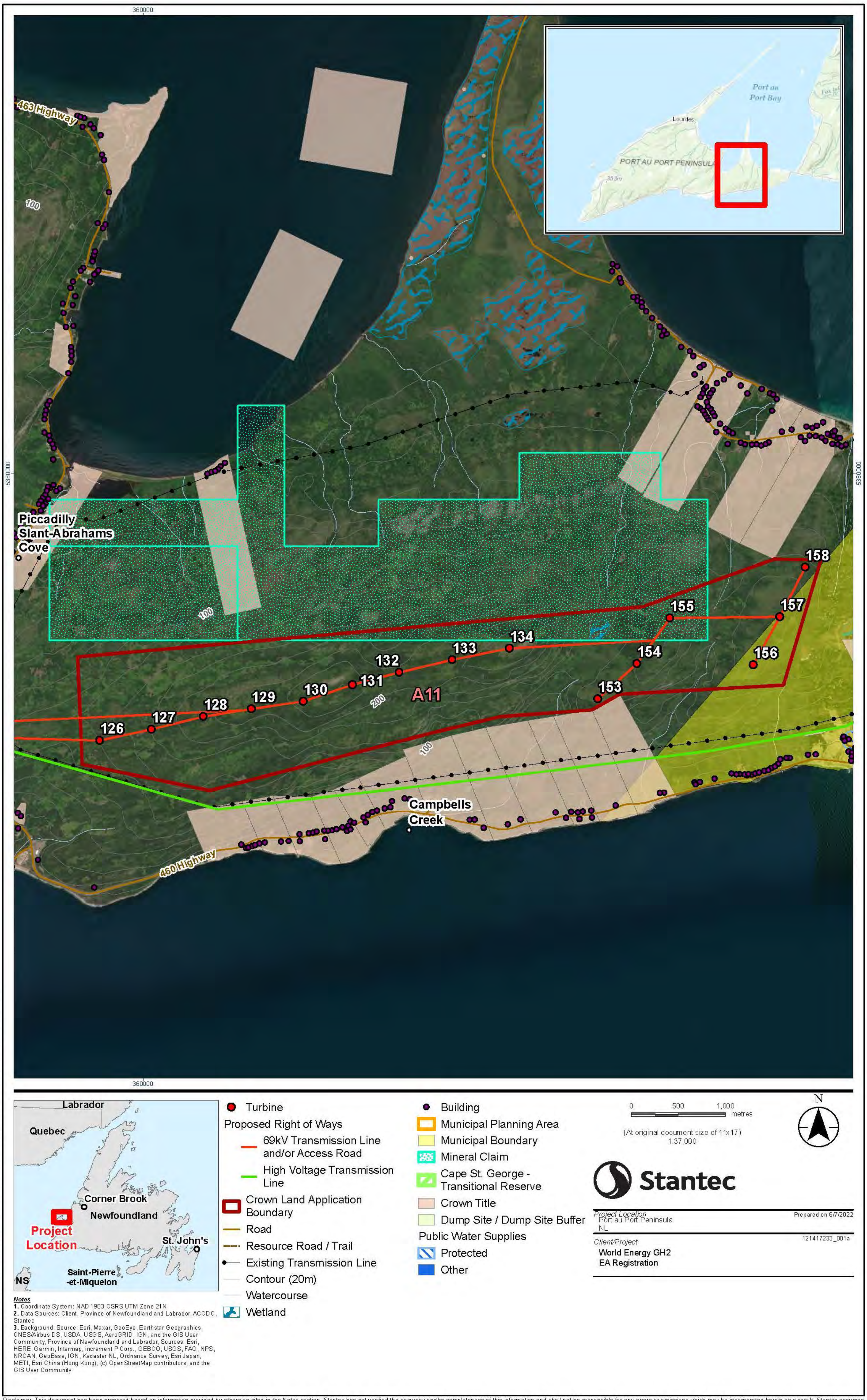


Figure 2-6 Location of Project Components in Piccadilly-Slant Abrahams Cove / Campbells Creek Area

Figure 2-7 Location of Project Components in Port au Port West-Aguathuna-Felix Cove / Port au Port East Area

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 2-8 Location of Project Components in Stephenville / Kippens Area

2.2 COMPONENTS OF THE PROJECT

The Project includes construction, operation and maintenance, and eventual decommissioning of a hydrogen production facility at a brownfield site at the Port of Stephenville, a wind farm on the Port au Port Peninsula, and supporting infrastructure and facilities. Further information on the design of these components is provided in the following sections.

2.2.1 Hydrogen Facility

The hydrogen production facility will be located on land already designated for industrial use, adjacent to the grid connection infrastructure and will require approximately 20 - 30 ha at full capacity. The size of the plant will allow siting on the southeast end of the available land to avoid areas with known contamination and remediation requirements. The total area requirement will be dependent on the final technology selection, ammonia production and storage capacity, and water handling requirements.

The hydrogen production facility will have an electrical demand of approximately 500 MW (Table 2.3). The facility is expected to run at a capacity factor of approximately 50%, resulting in a maximum annual production of approximately 30,000 tonnes of hydrogen, which will be converted to a maximum production of 100,000 tonnes of ammonia. The 500 MW hydrogen plant will have the ability to be expanded in the future to more than 1,500 MW.

Table 2.3 Hydrogen Facility Capacity, Hydrogen and Ammonia Production Rates and Water Requirements

Site A Plant Name-Plate Capacity, MW	Utilization Factor, % Note 1	Max H2 Production, tons per annum Note 2	Max Ammonia Production, tons per annum Note 3	Water Requirement, Million GPD Note 4	Cost, Billion USD Note 5
500	100	60,000	200,000	0.85	0.9
500	50	30,000	100,000	0.43	0.75

Notes:

1. Utilization factor considers hydropower supply and energy buffering storage in addition to onshore wind energy. The utilization factor represents an annualized utilization of the electrolyzer facilities. 100% utilization factor represents the maximum capacity that could be achieved by the plant. 50% utilization factor represents the likely actual production based on the variability of wind energy generation.
2. Maximum hydrogen production based on capacity and utilization factor that could be exported or converted to ammonia. The production rate will vary on a daily and seasonal basis.
3. Maximum ammonia capacity if all hydrogen is converted to ammonia. Assumes that the capacity of the ammonia production plant is sized to convert all produced hydrogen at a steady state rate. High pressure gas hydrogen storage has been included in the analysis to allow steady state supply to the unit.
4. Total pre-treatment volume of water required for electrolysis and cooling. Approximately 30% of the water stream will be discharged from the treatment system and the remainder will be converted to hydrogen or utilized in the cooling system.
5. Includes port development allowance of $20 million USD for retrofit and installation of ammonia loading arms and safety equipment.

The facility will consist of the following main components, with a preliminary layout as shown in Figure 2-9:

1. High Voltage Substation with Transformers
2. Medium Voltage Substation and Rectifier
3. Electrolyzer Building, Separators, Pipe Racks
4. Cooling System and Oxygen Handling
5. Hydrogen Purification and Surge Storage
6. Ammonia Production
7. Water Purification
8. Offices, Controls, and Security
9. Possible Truck Loading Rack for Local Distribution
10. Ammonia Storage
11. Flare Radius

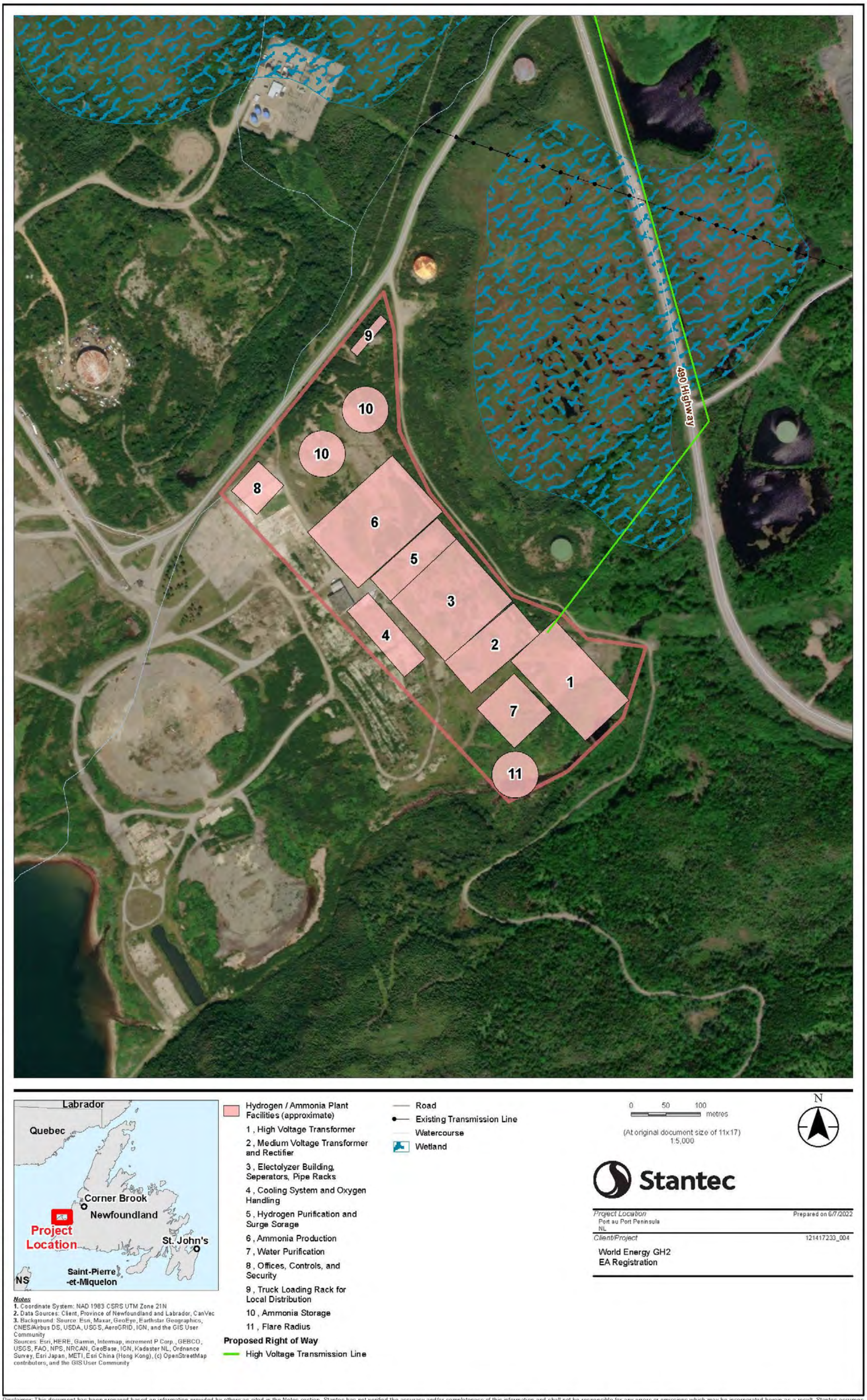
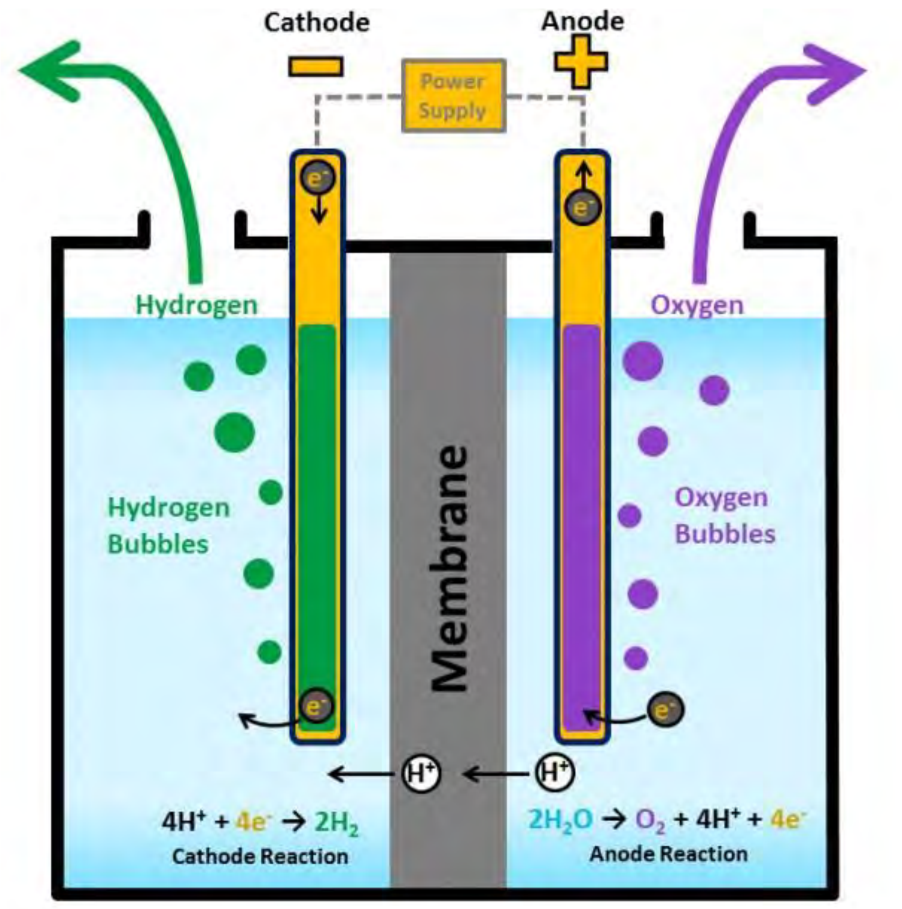


Figure 2-9 Layout of Hydrogen / Ammonia Plant Facilities

2.2.1.1 Hydrogen Production (Electrolyzer)

Electrolysis is the process of using electricity to split water into its component parts of hydrogen and oxygen (Figure 2-10). There are different types of electrolyzers available in the market, with two main types dominating:

- Alkaline: most proven technology with long lifetime, using potassium hydroxide (KOH) as the electrolyte
- Proton-exchange membrane: widely considered to have the largest market share in the coming decades, well-suited to generation profile of renewable energy



Source: US Department of Energy (DOE)

Figure 2-10 Electrolysis Process (Polymer Electrolyte Membrane)

The final design, chosen electrolyzer technology, capacity and annual production are subject to more detailed wind study on the hourly wind speeds and engineering and design work. Further discussion of the electrolyzer technology selection is found in Section 3.1.5.

2.2.1.2 Ammonia Production

Ammonia will be produced in the ammonia plant using hydrogen from the hydrogen plant through the Haber-Bosch process. The Haber-Bosch process uses nitrogen and hydrogen for the production of ammonia (see Section 2.2.1.3). An air separation unit (ASU) will be utilized to produce nitrogen for the ammonia synthesis.

The ammonia plant will be located adjacent to the hydrogen plant and requires approximately 1.72 ha of area and will consist of the following main components:

- The Haber-Bosch reactor
- Heat exchanger
- Condenser

2.2.1.3 Project Inputs and Outputs

Figure 2-11 displays the flows of the hydrogen and ammonia production plant, including the relevant in and outflows from the system. Planned inputs and outputs from the hydrogen facility are summarized in Table 2.4.

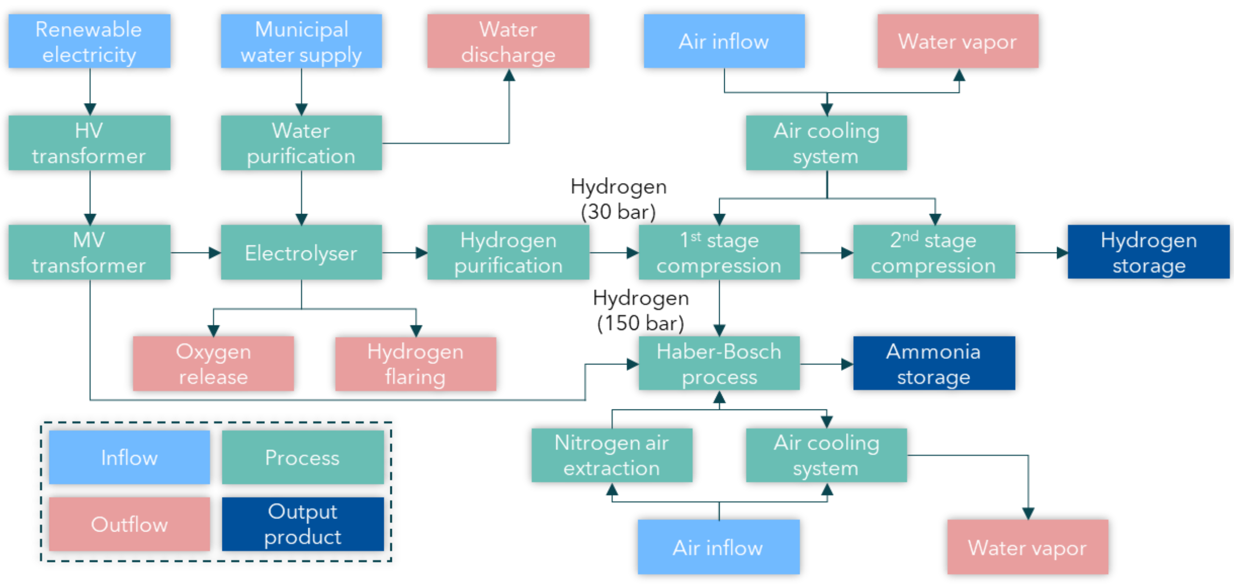


Figure 2-11 Single-line Diagram of Hydrogen and Ammonia Plant

Table 2.4 Hydrogen Facility Inputs and Outputs

Inputs	Outputs
Hydrogen Plant	
• Renewable electricity: The hydrogen plant will be powered completely with green electricity (from the Project's wind farm and from NL Hydro's generation assets) and will not have substantial carbon emissions. Electricity is used for hydrogen production (water electrolysis), water purification, ammonia production and compression. • Industrial water supply: The plant will use water from an industrial water source and will purify water for the electrolysis process (Section 2.2.1.1) using reverse osmosis. At 100% capacity, the plant will require 3,218 m³ (0.85 million gallons) per day (Table 2.3). At 50% capacity, the plant will require 1,627 m³ (0.43 million gallons) per day. Pending approval, the existing industrial water supply to the site (a 36-inch main) can be uncapped for the purposes of the Project and has the capacity to supply approximately 138 m³ (10,000 gallons per minute) (J. Gale, pers. comm.). Appendix E further contains an assessment of the potential to obtain an industrial water supply for the Project. It concludes that based on the average precipitation data, the Mine Pond drainage basin, with a functioning water outflow control structure, can supply the 700 US GPM water supply required for the Project.	• Water discharge: The plant will discharge water from the purification facility. The effluent will contain minerals which are already present in the water source concentrated to approximately three times the initial concentration. For a typical treatment plant, the effluent will be within allowable tolerances without dilution. This "mineralized" water may be suitable for use in other industrial processes or returned to the industrial water system for treatment and re-use. Refer to Section 2.6.6.4 for further information on wastewater discharge. • Oxygen: The plant will emit oxygen to the atmosphere as a byproduct of the electrolysis process. The oxygen can be safely vented to the atmosphere or captured and utilized in industrial processes or wastewater treatment. Refer to Section 2.6.4.2 for further information. • Hydrogen: There is the potential for hydrogen to be released in an upset condition. It would be either safely vented or flared, depending on the final safety case for the plant. Refer to section 2.6.4.1 for further information. • Water vapor: The electrolyzer facility will require a cooling system which may emit water vapor to the air. Refer to Section 2.6.4.3 for further information.
Ammonia Plant	
• Hydrogen: Hydrogen from the hydrogen plant is fed into the plant. • Renewable electricity: The required electricity for the plant will be from the Project's wind farm or the NL Hydro generating assets and supplied through the Project's high transformer station. Electricity is used for the air extraction and the Haber-Bosch process. • Air: Nitrogen, which makes up approximately 80% of the air, is extracted from the air to be fed into the Haber-Bosch process. • Water: Required for maintenance flushes and purge of cooling system	• Water vapor: The ammonia plant will require a cooling system which may emit water vapor to the air. Refer to Section 2.6.4.3 for further information. • Oxygen: An air separation unit (ASU) will be utilized to produce nitrogen for the ammonia synthesis. The ASU will separate the nitrogen from air and safely exhaust the remaining air fraction which will consist of 95% oxygen to the atmosphere. Refer to Section 2.6.4.2 for further information. • Nitrogen: Boil-off nitrogen from liquid nitrogen storage • Particulates: Molecular sieve regeneration gas (N_2) with contaminants that originated from ambient air. Recovered from atmospheric air intake filtration system during maintenance cleaning.

2.2.1.4 Handling, Storage and Transportation of Hydrogen and Ammonia

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 ensure the design and operations of the facilities. The facility will be designed to safely produce and store hydrogen and ammonia. The plant will be designed to applicable Canadian codes as well as applicable international codes, such as ASME B31.3 Process Piping, ASME B31.12 Hydrogen Piping and Pipelines, ASME STP-PT-006 Design Guidelines for Hydrogen Piping and Pipelines, 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 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 (refer to Section 2.8). Techniques, such as vapor dispersion modeling, will be protective of surrounding communities, wildlife, and the environment. As design progresses, a hazard identification study will be conducted to determine high-level risks and suitable mitigations. 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.

Hydrogen can be stored in various methods, with options available for both above-ground or below-ground. Stationary aboveground storage for gaseous hydrogen generally consists of multiple cylindrical pressure vessel(s) which may be mounted in a frame and installed on a concrete foundation. Hydrogen and ammonia above-ground storage vessels are pressurized vessels that are constructed to meet pressure boundary codes. These vessels are constructed to industry standards, such as the ASME Boiler and Pressure Vessel Code (BPVC). These vessels require pressure and/or thermal relief valve design and sizing to ensure adequate overpressure protection.

For underground options, geological formations such as saline aquifers and salt caverns can serve as permanent CO2 storage options and potentially for storing hydrogen at large scale. A geological study to understand sequestration capabilities in the area is required to understand underground storage capabilities. There are several salt caverns within the vicinity of the Project site, including Fischells Brook, St Teresa – Flat Bay, Barachois Brook, and Harry's River, which could be used as storage facilities for the hydrogen. The Project is currently investigating the suitability and overall proposition for this as it would significantly increase flexibility of the plant.

The hydrogen and ammonia can be exported from the plant in two methods: 1) by truck for local distribution and 2) by marine vessel for export. Local hydrogen distribution would likely occur using high pressure tube-trailers which could deliver hydrogen for industrial use or vehicle fueling. Transportation of hazardous materials will be conducted in compliance with the federal *Transportation of Dangerous Goods Act*.

Approximately 80% of the hydrogen produced will be used to produce ammonia. Ammonia can be delivered locally by industry standard tank trucks, but most of the product will be delivered to existing marine facilities by pipelines placed underground or on pipe racks. Ammonia is transported globally by dedicated ammonia carriers and by standard liquefied petroleum gas capable vessels. There is currently a robust international trade in ammonia and an emerging focus on sustainable, low emission ammonia carriers dedicated to green ammonia transport. In addition to dedicated ammonia vessels, either ammonia or hydrogen could be transported by marine vessel in special built, multi-modal containers. As per the International Maritime Organization, vessels carrying liquified gas can only operate in international waters if they comply with international codes (e.g., International Gas Carrier 1986 code) and standards. These requirements pertain to items including safety arrangement requirements, cargo containment and cargo handling procedures, material of construction for containment and carriage facility, requirements for cargo loading and discharging, fire protection requirements, and pollution control requirements. In addition, ammonia carriers require a number of operational certificates to operate in Canadian waters, based on the standards that apply under the international maritime conventions to which Canada has acceded. Vessels would also be subject to Canadian laws and regulations in relation to emissions and discharges.

The ships are typically in the range 15,000 m³ to 85,000 m³, with three common sizes for Ammonia carriers of 30,000 m³, 52,000 m³, and 80,000 m³. It is understood that the port is able to accommodate vessels to transport hydrogen/ammonia without the construction of additional berthage. Prior to construction, this will be confirmed through the completion of a desktop navigation assessment and potentially a vessel navigation simulation, if necessary. In addition, as part of detailed engineering for the Project, the existing quay will be inspected and load rated to verify that it can accommodate the berthing and mooring loads from the maximum anticipated size ship.

2.2.2 Wind Farm

The wind farm will consist of the following key components:

- Onshore wind turbines
- Electrical Collector System and Substation
- New transmission lines (interconnection to the grid)
- Access roads interconnecting site and turbine locations
- Cleared areas at each turbine location for crane pads and temporary laydown
- Pads and foundations for equipment

Further information on these components is provided in Section 2.2.2.2 to 2.2.2.6. Figure 1-5 and Table 2.1 provide the proposed locations / layout of the wind turbines (up to 164 turbines) and access roads (approximately 120 km in total length). The turbine locations are based on the initial desktop study by DNV, which was done for the initial wind assessment (detailed in Section 2.2.1). The exact locations for the turbines will be confirmed through further studies, including a full geotechnical assessment and the environmental studies as outlined in Appendix A. Final placement of turbines would be completed in consideration of potential environmental effects such as avoidance of rare plants and other sensitive ecological features, reduction of potential resource conflicts, the results of noise modelling and the viewshed analysis, and consultation with NAV Canada on hub heights and turbine locations.

Engineering planning and analyses have been conducted using an assumed turbine unit from GE with an energy production capacity of 6.1 MW, a 121 m hub height and a 158 m rotor diameter. While it is likely that the Project will use multiple turbines with varying capacities, the likely maximum total height will be 200 m, which corresponds to the hub height and rotor diameter provided above. Economic, schedule, and environmental impact considerations favor keeping turbine height in harmony with the wind resource, as determined through the wind resource assessment.

2.2.2.1 Assessment of Wind Resource

DNV was engaged for an initial desktop study to analyze the wind resources at proposed wind farm location using mesoscale data from DNV's Virtual Met Data (VMD) and Vortex, further described below.

Virtual Met Data

The DNV VMD is developed from a mesoscale-model-based downscaling system that provides high-resolution long-term reference time series data for any location in the world. DNV VMD is primarily based on the Weather Research and Forecasting Model, a mesoscale model developed and maintained by a consortium of more than 150 international agencies, laboratories, and universities. VMD is driven by a number of new high-resolution inputs, such as MERRA-2, global 25 km resolution 3-hourly and daily analyses of soil temperature and moisture, sea surface temperature, sea ice, and snow depth. A sophisticated land surface model predicts surface fluxes of heat and moisture to the atmosphere, reflected shortwave radiation, and longwave radiation emitted to the atmosphere. Data are typically produced as a virtual hourly time series on a 2 km horizontal resolution grid, centred on the subject wind farm site.

Vortex Data

Vortex SERIES is a commercially sold long-term reference data source, primarily based on the Weather Research and Forecasting Model, a mesoscale model developed and maintained by a consortium of more than 150 international agencies, laboratories, and universities. Its downscaling system uses a number of high-resolution inputs such as MERRA-2 or ERA5, as well as analyses of soil temperature and moisture, sea surface temperature, sea ice, and snow depth. Data are typically produced as a virtual hourly time series on a 3 km horizontal resolution, centred on the subject wind farm and at heights between 50 and 300 m above ground.

DNV used the VMD data to create a wind speed frequency distribution for the site and scaled this frequency distribution to the long-term hub-height annual average wind speed from a combination of the VMD and Vortex time series data. The variation in wind speeds across the site was further established from a VMD based wind speed map of the Project area.

Based on the determined wind resource, DNV calculated the expected energy production and net capacity factor at the site, also considering a prediction of air density at the site, a high-level estimation of gross energy considering the wind farm layout, and a brief review of sources of possible energy production loss.

The initial results from this analysis are displayed in Table 2.5. The Average Turbine Wind Speed is estimated at 9.7 m/s at 121 m hub height (Figure 2-12), and the Gross Energy Output for a 1 GW onshore wind project is expected to be 4,841.7 GWh/annum. These initial analyses are promising, would enable the Project to perform well, and be economically viable.

Table 2.5 Energy Loss Factors and Project Net Energy Output

Site A: 164 x GE 6.1-158 (Onshore)			
Project Life		25	years
Wind Farm Rated Power		1000.4	MW
Average Turbine Wind Speed		9.7	m/s
Gross Energy Output		4878.6	GWh/annum
1	**Turbine interaction effects**	**93.3**	**%**
1a	Internal wake and blockage effects	93.3	%
1b	Wake effect external	100.0	%
1c	Future wake effect	100.0	%
2	**Availability**	**93.9**	**%**
2a	Turbine availability	94.8	%
2b	Balance of Plant availability	99.3	%
2c	Grid availability	99.8	%
3	**Electrical efficiency**	**97.5**	**%**
3a	Operational electrical efficiency	97.5	%
3b	Wind farm consumption	100.0	%
4	**Turbine performance**	**94.1**	**%**
4a	Power curve adjustment	99.4	%
4b	High wind speed hysteresis	99.9	%
4c	Site-specific power curve adjustment	97.5	%
4d	Sub-optimal performance	99.0	%
4e	Turbine degradation	98.7	%
4f	Aerodynamic device degradation	99.5	%
5	**Environmental**	**97.0**	**%**
5a	Performance degradation – icing	99.0	%
5b	Icing Shutdown	98.0	%
5c	Temperature shutdown	100.0	%
5d	Site access	100.0	%
5e	Tree growth	100.0	%
6	**Curtailments**	**100.0**	**%**
6a	Wind sector management	100.0	%
6b	Grid curtailment	100.0	%
6c	Noise, visual, and environmental curtailment	100.0	%
	Total Losses	**78.0**	**%**
	Effect of asymmetric distributions	**99.7**	**%**
	Net Energy Output	**3805.9**	**GWh/annum**
	Net Capacity Factor	**43.4**	**%**

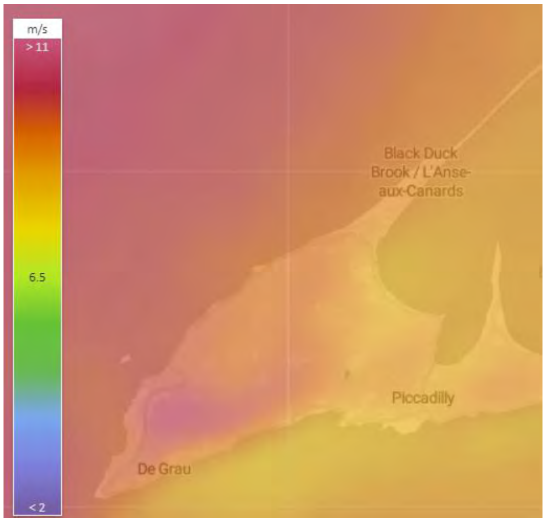


Figure 2-12 Site A Wind Speed at 1 km Resolution and 100 m Height (Vortex data)

Following this initial desktop-based analysis, the quality of the wind resource will be further characterized, to assess the strength of the wind resource. This information is important to the Project proponents, stakeholders and investors to determine the profitability / feasibility of the proposed wind farm. A site wind monitoring campaign will be conducted using in-field wind sensors. The wind speed and direction will be measured at multiple heights, including the anticipated wind turbine hub height. Data will be gathered for approximately 12 months to capture seasonal effects.

The industry standard approach for collecting wind data is to erect a met-tower that is instrumented with multiple wind measurement sensors. This tower is usually tall enough to measure the wind values at the anticipated wind turbine hub height. It is important that the location of the met-tower is properly selected to be representative of the entire wind farm location. For multiple wind farms or locations, or for large wind farm projects, it is generally necessary to collect wind data at multiple locations. A site visit will be conducted to assess the site conditions and to identify the location(s) for the monitoring systems. The site visit will also help determine if multiple monitoring sites are required to properly characterize the wind resource. The tower location suitability is impacted by:

- How well the tower location represents the rest of the wind farm conditions
- Proximity to obstructions
- Accessibility to the site
- Communications (cell phone coverage, or other sources)

A met tower will feature multiple sensors to collect wind data, as well as other meteorological information. The met tower will include multiple wind anemometers that will record the wind speed (and in some cases wind direction). Anemometers will be placed at different heights to determine the wind shear for the site, and to provide redundancy in case of sensor failure. Using sensors at multiple heights will allow extrapolation of wind values to other heights, including potential hub heights, allowing flexibility in subsequent selection of turbine designs. Since this location is subject to atmospheric icing, some heated instruments may be included to collect ice-free measurements. Air temperature, relative humidity and barometric pressure will also be measured, which will help determine the air density, which is needed to predict the potential power generated.

The data from the met tower will be downloaded continuously or on a pre-determined schedule, via a real-time communications link. This will allow real-time monitoring and detection of problems with the monitoring system. Alternatively, the data may be retrieved, physically from the site at regular intervals. The monitoring data will be reviewed and analyzed to determine the characteristics at the site. Further analysis will compare the measured wind data with specific long-term records to determine the measured data's representativeness of long-term trends. This analysis will reduce the uncertainty of the energy estimates and provide "bankable" data.

As an alternative, or supplement, to a tall met tower, the wind monitoring campaign can make use of a Light Detection and Ranging (LiDAR), when paired with a met tower. The LiDAR anemometer is based on the Doppler effect. It uses a vertically pointing light beam to measure wind speed by detecting the Doppler shift of radiation scattered by natural aerosols carried by the wind. LiDAR can simultaneously measure wind speed and direction at several heights using a ground-based instrument. The LiDAR is located near the met tower so that the tower can be used to verify and validate the measured data from the LiDAR. In this configuration, a met-tower that is shorter than the wind turbine hub height (thus making the tower less expensive) can be used. Once validated, the LiDAR can be readily transported to different areas of the candidate wind farm site and gather additional data, without needing to erect another tall met-tower. This option is useful for large or complex candidate locations because it reduces the need for erecting multiple met-towers.

2.2.2.2 Wind Turbines

World Energy GH2 has started discussions with wind turbine generator manufacturers and balance of plant suppliers. The goal is to understand the timing constraints of the key suppliers to accommodate Project development planning and build strong relationships with these suppliers as they are of paramount importance for the successful completion of the Project. Turbine size and model are therefore still being finalized, and a proven and bankable wind turbine technology that is suitable for utility-scale wind generation projects and location specifics will be selected. Refer to Section 3.1.2 for further discussion of wind turbine selection.

Wind turbines (Figure 2-13) and supporting infrastructure typically consist of the following components:

- Tower foundations
- Three or four steel or concrete tower sections with service access provided by stairs and/or service person lifts
- Stainless steel nacelle which houses the main shaft and generator
- Three fiberglass or carbon fiber rotor blades
- Cast iron hub
- Tower mounted transformer
- Electrical and grounding wires
- Buried grounding grid at perimeter of foundation

Figure 2-13 Typical Wind Turbine Components

2.2.2.3 Connection to the Grid

Wind Farm Collector Line Configuration and Routing

Each wind turbine is required to be connected to the electrical grid for its operation. Due to the relatively large turbine capacity and overall numbers of units, a transmission voltage of 66 kV has been selected for the wind farm collection system. Based on preliminary estimates, the wind farm will require fourteen (14) separate 66 kV collector lines/circuits, each connected to twelve (12) or more wind turbines. These 66 kV transmission lines would be routed to the expected 164 turbines from one or more new substations, with routing and locations to be optimized during detailed design. A preliminary layout is provided in Figure 1-5. The total length of the collector lines will be approximately 165 km.

These 66 kV collector lines are proposed to be single wood pole construction, consisting of post type insulators with a wooden cross arm for the outer two phases. In general, the 66 kV line routing will follow the access roads to each turbine, and terminate at a riser pole, approximately 100 to 150 m from each turbine with transition to underground cabling for the final termination at the base of each turbine tower.

Transmission Line Configuration and Routing

The preliminary design for the Project transmission lines (Figure 1-5) is based on 230 kV construction with two transmission lines required from the wind farm substation(s) to the hydrogen plant substation to transmit the full output of the wind farm. Two additional 230 kV transmission lines will be required from the hydrogen plant substation to connect to NL Hydro facilities, at Stephenville and/or Massey Drive Terminal Stations. The total length of these lines will be approximately 55 km.

Dependent on the transmission line routing and proximity to nearby residential areas, the following designs are proposed for the transmission line construction:

- Steel lattice structures: for usage in remote cross-country locations, to optimize/reduce number of required structures, with longer spans (200 to 300 m)
- Monopole steel or wood structures: for usage in/near residential and commercial areas to mitigate visual impacts; however, will require more structures than steel lattice design, due to shorter spans (100 to 200 m)
- Underground conductors: due to the residential congestion at the isthmus and limited space for new overhead transmission rights-of-way (RoWs), buried conductors are proposed for usage through the town of Port au Port, for an approximate distance of 4.25 km, generally following roadways and the existing Newfoundland Power 66 kV transmission line RoW.

Selection of the transmission line operating voltages (230 kV or 315 kV), line configuration and routing will be optimized during detailed design and power system analysis, with considerations for reducing visual impacts to nearby communities where required.

The Project has conducted an initial investigation of the grid capacity and connection possibilities to consider constraints of the Island Interconnection System. A full investigation will follow to meet NL Hydro requirements. Appendix F contains a Preliminary Island Isolated Customers Interconnection Mitigation Strategy.

2.2.2.4 Access Roads

New roads will be designed with safety, operation, and maintenance in mind. The road design will be based on standard design, turbine requirements and industry best practices. As access roads will be used to move equipment and workers to the Project site, the roads must provide adequate bearing capacity to support the heavy trucks transporting materials and tower sections and turbine blades to the site, as well as the cranes lifting the turbines into position. This will include considerations such as road curves and incline. They will also be built to a standard to provide longer-term access for maintenance vehicles. The preliminary layout for the access roads is provided in Figure1-5, with approximately 120 km of total road length. Within this total length of road, there will be two to three classes of gravel roads depending on transport requirements. The requirements for ditching, culverts and/or bridges will be determined during detailed Project design but will comply with industry standards.

In finalizing the road layout and design, the road horizontal and vertical alignments will consider the turning radius requirements and maximum vertical grade requirements of the equipment transportation vehicles. Existing gravel road corridors will be used where practical to limit the length of new linear corridors on the Port aux Port Peninsula. The road network layout will reduce or eliminate the use of turnarounds that would be required at a dead-end road location. As well, pull-offs will be constructed at various locations in the network, and curve widening will be considered if required to allow for transportation.

World Energy GH2 will enter into a Mutual Use and Mutual Access Agreement with local snowmobile trail association to allow continued snowmobile / all-terrain vehicle (ATV) use of the Port au Port Peninsula.

As indicated above, a total of approximately 100 km of new access roads will be required for interconnection of the turbines within the wind farm boundaries, with an estimated additional 20 km for connection to local highways. The approximate area to be developed for these components is 121 ha.

2.2.2.5 Laydown Areas

A laydown area of approximately 1.5 to 2.5 ha will be cleared at each turbine site to allow room for laydown of components and installation of the foundation. Based on the assumed number of turbines to be installed (164), the total area to be cleared during construction is estimated to be approximately 263 to 405 ha.

After installation, excess cleared area will be rehabilitated and the operation al footprint of each turbine will be approximately 0.4 to 1.2 ha.

2.2.2.6 Pads and Foundations

It is anticipated that the wind turbines will use the Shallow Matt Foundation, pending field confirmation of site-specific geotechnical conditions. Shallow Matt Foundations are typically reinforced concrete, with a diameter of 10 to 15 m. Figures 2-14 and 2-15 show a wind turbine Shallow Matt Foundation during construction. The area for the foundation is excavated to a depth of 2 to 5 m, depending on the strength of soils and size of foundation. In locations where the ground is mainly rock, the excavation and foundation size can be reduced, with excavation by drilling or localized blasting. The reinforcement is then placed and the concrete is poured. After completing, the foundation is backfilled to restore the grade to original level, burying much of the foundation. Only the base for the turbine tower connection is left exposed.

Figure 2-14 Shallow Matt Foundation During Construction

Figure 2-15 Shallow Matt Foundation with Concrete Poured – Prior to Backfilling

2.2.3 Temporary Workforce Accommodations

Temporary workforce accommodations capable of housing up to 600 workers with associated services will be built to support construction of the Project. The temporary workforce accommodations will be located in or near Stephenville. The location of the temporary workforce accommodations is not yet known. Once the site for the temporary workforce accommodations is selected, World Energy GH2 will consult with the appropriate levels of government (municipal and provincial) and will acquire proper permitting when the site is finalized. Workers will operate on a rotational schedule and will likely arrive at the temporary workforce accommodations by air and bus from pre-determined pick-up locations. Once at the temporary workforce accommodations, workers will travel to the work sites in Stephenville and on the Port au Port Peninsula by bus to limit the volume of Project-related traffic on local roads. It is anticipated that the electricity for the temporary workforce accommodations would be supplied through the provincial grid (i.e., generators would only be required for emergency back-up purposes). Workforce planning and temporary accommodations will be developed in consultation with local planners to reduce adverse impacts associated with the introduction of non-local workers on the local communities.

The temporary workforce accommodations will be decommissioned once construction activities are complete.

2.3 SITE PREPARATION AND CONSTRUCTION ACTIVITIES

The construction phase will be split into two key stages – site preparation and construction. The following section outlines some of the key consideration, which will be further detailed and built upon as the Project progresses. Main activities include the following:

- Site preparation
- Access roads
- Temporary facilities
- Site clearing and grading
- Plant construction
- Wind turbine transportation
- Wind turbine installation
- Hydrogen and ammonia plant construction

The initial plan would be for construction to occur during daylight hours, six days a week, although a second shift and seventh day of construction would be added if required. An integrated management system (IMS) will be developed to implement health and safety procedures to reduce risks. This IMS will be based on Horizon Maritime's industry-leading IMS that has been extensively audited by numerous global industry leading companies.

Along with professional advisors, World Energy GH2 is forming a focus group for construction activities and will continue to analyze potential risks and red-flags during each phase and activity. Prior to construction, considerations of key stakeholders also will be taken into account and carefully discussed. Concerns that arise over course of the construction phase would be addressed as they arise through a grievance redress mechanism (refer to Section 2.8.3).

2.3.1 Access Roads

As described in Section 2.2.2.4, approximately 120 km of construction grade roads will be required. There will be two to three classes of roads to facilitate safe, long-term sustainable operation. Roads will be constructed from clean fill sourced from existing quarries and borrow pits.

Functional points will be connected by the shortest possible route and will establish positive drainage by following the natural ground slope to the extent possible, with required ditching designed to reduce disturbance to the natural drainage pattern. Ditches will be lined to reduce erosion in the areas where flow velocity is high. Fill requirements and RoW widths will be included in the selection of road gradients, to maximize road use and meet design parameters.

2.3.2 Temporary Facilities

Temporary facilities will include a temporary workforce accommodations (Section 2.2.3), offices, and temporary drainage systems.

2.3.3 Site Preparation

Site preparation includes site clearing (vegetation removal and grubbing), excavation, grading and compaction installation of temporary drainage systems, stabilization, and dirt preparation and implementation of erosion control measures prior to the commencement of construction activities within the areas of the wind turbine platform and access roads. Site grading and land clearing activities will be limited to only the necessary area and will be conducted consistent with the mitigation measures identified in Section 2.8.3. A site assessment will first be performed to determine the type, extent, depth, location, and quality of soils on the site. During this phase, a comprehensive site preparation plan will also be developed. Preliminary guidelines for this stage include:

- Removing or securing boulders and similar objects near excavation sites for the safety of workers and/or machinery
- Substituting suitable construction material for existing unsuitable soils (i.e., overburden)
- Placing and compacting fill materials over the proof-rolled subgrade to achieve adequate bearing capabilities
- Implementing dust control measures
- Encouraging sound soil conservation throughout the process for use in rehabilitation activities

Earthworks includes cut and fill for access roads and wind turbine foundations, and the construction of ditches, diversion channels and berms, and dikes. Generally, earthworks will be carried out in accordance with the following guidelines:

- Clearing vegetation, stripping topsoil, grading, and/or placement of soil stockpiles. Soil conservation practices will be implemented in accordance with site practice.
- Existing unsuitable soils (i.e., overburden) will be removed and replaced with suitable construction material.
- Fill materials will be placed and compacted over the proof-rolled subgrade in order to achieve adequate bearing capacities, as required for specific construction activities.
- Rocks / boulders and similar objects adjacent to areas undergoing excavation must be removed or secured if they potentially endanger workers / machinery.
- Dust control measures will be put in place.

The size of the lay-down, storage and staging area footprint will be reduced to the extent possible to provide sufficient area for storage of material / equipment and movement of mobile cranes / vehicles while limiting the effect to the surrounding environment. The subgrades will be prepared via cut / fill activities prior to final grading.

Should blasting be required as part of site preparation for the turbine foundations, blasting for site development will be done by a certified blasting contractor (holding a valid blasters certificate issued by the NLDECC), who will develop a conservative blast design for review and approval prior to carrying out the work. The blast design will be required to meet vibrational limits at appropriate distances from existing infrastructure and buildings and fish habitat. Should a temporary explosives storage facility be required, it will meet government regulations including required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada, with explosives and accessories stored at the approved explosive storage facility. If blasting is required, an Explosives and Blasting Management Plan would be developed by the licenced blasting contractor to provide direction for the safe storage, handling and use of explosives and explosive components, to address the safety of the public and Project personnel, and protection of both the environment. Wind Farm Construction

Following the site preparation, the different workstreams to be done during the construction phase include:

- Balance of plant construction: The balance of plant includes the infrastructure and components of a wind turbine installation except for the turbines, including project management, foundation, and transmission assets of the wind farm.
- Cable installation: The power output from the wind turbines is delivered to the grid via the cables. The routes will be selected following a thorough examination assessment of the environment, local communities, and technical challenges.
- Foundation installation: This process involves the transport and fixing of the foundation in position. Key tasks include:
  - Ground investigations and site preparation works, such as geotechnical calculations, boreholes, and laboratory sample testing, taking into account diverse soil conditions and informing the foundation design.
  - Remove the soils from the site, and build the foundation. At this stage, we aim to reduce the excavation of materials and focus on the potential environmental impacts such as possible effect on the water resources and drainage on the type of vegetation.
- Substation construction: A substation allows energy to be transformed and distributed over long distances, reducing power loss and distribution costs. Key tasks include:
  - Select a suitable site, taking into account factors such as the proximity to water supply and sewage, proximity to roads (if possible), being reliably protected from potential flooding, human habitation and activities, local communities, environment, and landscape.
  - Carry out electrical design, which includes developing the plans for connecting the substation to the Newfoundland electricity grid, selecting electrical equipment and electrical calculations, and selecting devices such as transformers, circuit breakers, disconnect switches, cables, and protection equipment.
  - Develop monitoring and control system including Supervisory Control and Data Acquisition, the relay protection, automation, electricity metering, and substation lighting system.
  - Carry out the civil engineering and construction.

2.3.3.1 Wind Turbine Transportation

The wind turbine components, including nacelle, towers and blades will be received at the Port of Stephenville where they will be temporarily staged. They will then be transported by truck and trailer to the turbine location within the site development area on the Port au Port Peninsula. These components are large and will require extended trailers. Turbine wind blades are anticipated to be 70 to 85 m in length, and the weight of turbine nacelle can be up to 60 tonnes.

It is anticipated that from 6 to 10 truck trips will be required daily, including those for blades, tower components and turbine components. Additionally, there would be trucks associated with the construction of the access roads, development of the 164 sites and for the construction of the concrete foundations.

The vehicle presented in Figure 2-16 is the anticipated transporter vehicle (or similarly Figure 2-17) that will bring the larger and longer equipment (blades) from the port to the wind farm location. The other vehicle depicted in Figure 2-18 is a standard tractor trailer float arrangement that is anticipated to carry the turbines, nacelles, towers, hubs and rotors, transformers and other overweight materials and equipment.

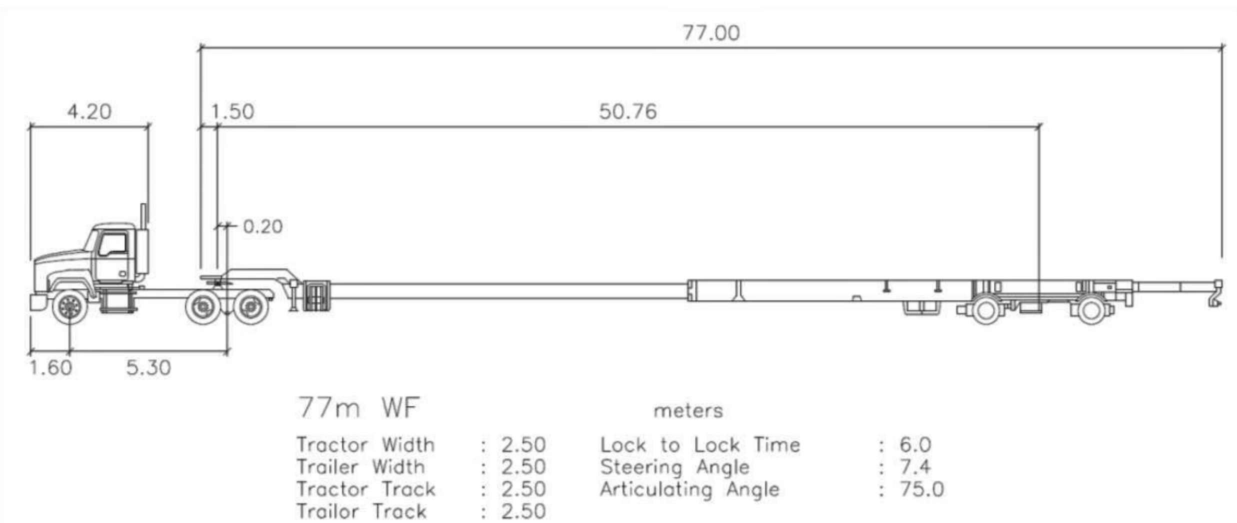


Figure 2-16 82 m Wind Farm Transporter Vehicle (77 m Blade)

Figure 2-17 Wind Farm Blade Transporter Vehicle

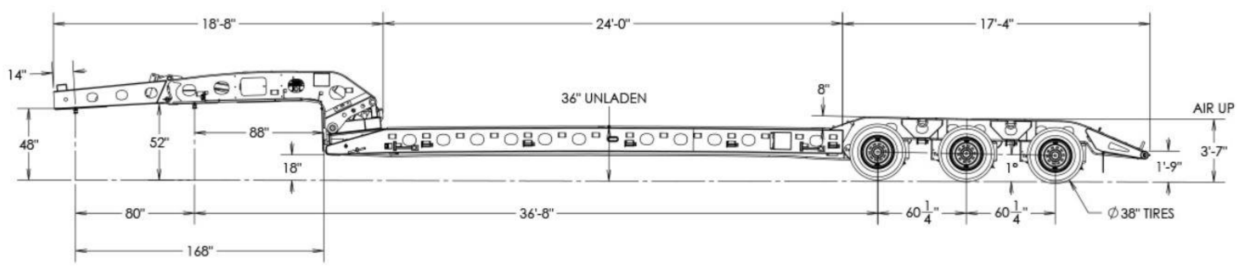


Figure 2-18 53' Gooseneck Float Trailer (Imperial Measurements)

Safe transport of this equipment requires consideration of:

- Horizontal and vertical clearances
- Roadway grades
- Loadings on bridges and culverts
- Increased traffic volumes on existing urban and rural roadways

As the Project will involve the transport of large equipment and wind farm components starting at the deep port in Stephenville and ending at the proposed wind farm development area on the Port au Port peninsula west of Stephenville, much of the intended route traverses through both rural and urban areas on both provincially designated roadways and municipal streets. Proper assessment and planning of the transportation of this infrastructure is required to avoid potential pinch points where the longer, larger vehicles may not be able to navigate due to tight turns or physical obstacles, such as overhead power lines, buildings or narrow roadway widths.

To reduce the potential adverse effects on road infrastructure and public health and safety, a traffic assessment conducted prior to construction and a traffic management plan will be developed. Both are further described below.

The transportation assessment will be a desktop study consisting of two primary review aspects: an alignment assessment and a load rating assessment. These include a detailed routing review of the horizontal and vertical clearances that are required for the transporter vehicle(s) and identifying the bridge and overpass structures that will be encountered along the route to determine which are recommended for load rating calculations to understand which structures can withstand the oversize loads and others that may require structural intervention to increase their load capacity.

Alignment Assessment

The review will include an alignment assessment of the horizontal and vertical clearances and will identify potential physical obstacles, such as insufficient roadway and shoulder widths, clearing requirements, and clearance issues at structures and overhead utilities.

It is assumed that oversized and overweight equipment and materials will arrive at the Port of Stephenville and be transported to the development site in the Abrahams Cove area. The transport route to Abrahams Cove is approximately 40 km in length using the existing road network which primarily follows Harbour Drive, Route 490, Route 460 and Route 463. It is understood that the transportation route will continue north from Abrahams Cove along Route 463 and west of Abrahams Cove along Route 460 to the various sites. The alignment assessment will be conducted along this route and to the locations west and north of Abrahams Cove. Figure 2-19 depicts the anticipated transportation route from the Port of Stephenville to Abrahams Cove.

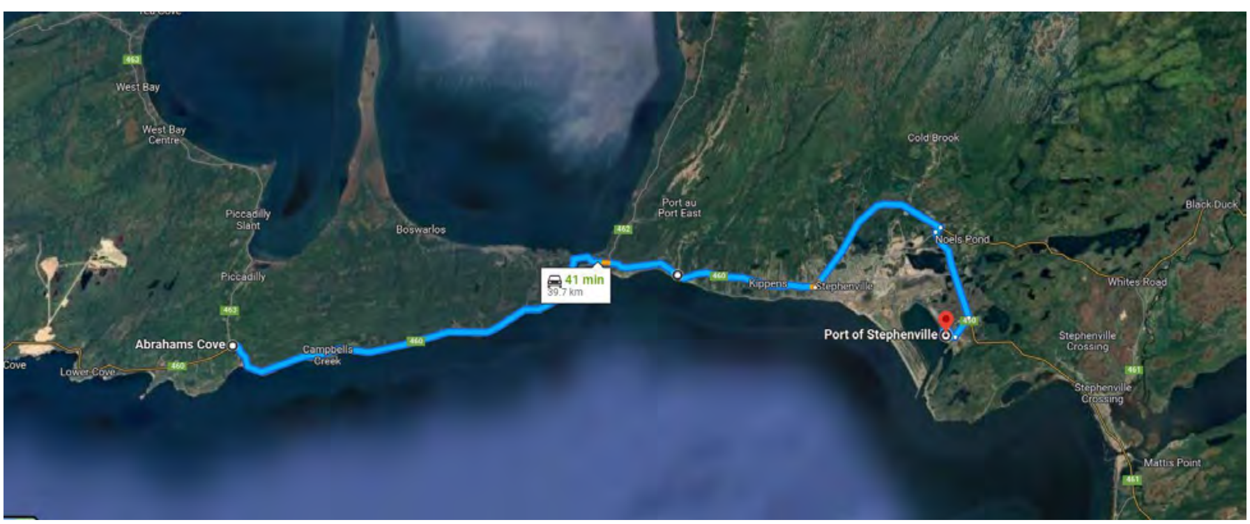


Figure 2-19 Transportation Route

There are several horizontal and vertical alignment elements that will need to be assessed to confirm if the transporter vehicles have the appropriate clearances for height and width. Thel 90-degree turns at intersections and tight radius locations along the route will be reviewed to determine if the maneuver can be made and if not, what modifications would be required, such as clearing, additional extra roadway and shoulder width, lengthening culverts and other potential temporary upgrades. The clearances will be assessed at the overhead utility locations and overpass structures that the transporter vehicle will pass under, if applicable.

The alignment assessment will include a summary of challenges or problem areas along the route and provide recommendations for mitigation (which could include clearing, roadway widening or culvert extensions), and a review of the roadway elements based on the transport vehicle width, height, length and weight.

Load Rating Assessment

The transportation assessment will also include a load rating assessment of relevant bridge structures (currently assumed to be located at Blanche Brook, Mill Brook and Romaines River but subject to confirmation) to identify potential challenges with respect to the load ratings and capacity of these structures. As there are no overpass structures along the anticipated route, the assessment will consider these three structures and several large diameter culverts that the transport vehicles will travel over. It is understood that the bridge at Romaines River is to be rehabilitated or replaced in the near future, so considerations will include the construction schedule, temporary bridge configuration and associated design capacity at this location. There are also several overhead power and utility lines that cross the route that will need vertical clearance review and measurement.

Mitigation and Management of Traffic

To mitigate and manage the traffic related aspects of this Project, World Energy GH2 will coordinate and consult with the local municipality, regulatory agencies and other stakeholders. This will help keep the public informed of increases in traffic, road closures and potential delays. Communication protocols will be outlined in a Project-specific Traffic Management Plan to be developed prior to construction. This will include sharing information on the proposed transportation schedule and routes to be avoided. Depending on the delivery of components to the port and the availability and number of transporter vehicles, World Energy GH2 will develop a strategy with the municipality, regulatory agencies and stakeholders to reduce the impact to local residents and businesses. In addition, World Energy GH2 will conduct a pre- and post-construction inspection and condition assessment of the transportation route to identify requirements for repair, including paving/resurfacing.

2.3.3.2 Wind Turbine Installation

The turbine's power rating, height of tower, energy output, rotor diameter, cut-in wind speed and rated wind speed will need to be chosen based on the site specifics. World Energy GH2 is working to finalize turbine types and is reviewing various turbine manufacturer models based on site specifics, track record and availabilities.

The following tasks are expected to be carried out during the turbine installation phase:

- Construction of power pole and power lines
- Turbine installation
- Commissioning of the wind turbine generator
- Removal of temporary works and restoration of the site

World Energy GH2 is in discussion with the leading turbine suppliers to understand their capabilities as early as possible in order to select the most suitable type of turbine for the Project.

2.3.4 Hydrogen and Ammonia Plant Construction

The hydrogen and ammonia plant will be constructed by an experienced Engineering, Procurement and Construction contractor. The Project will select a manufacturer of electrolyzers, which will be integrated in the hydrogen plant by the Engineering, Procurement and Construction contractor. There is ample of experience within the industry to design, construct and commission hydrogen and ammonia plants.

The following tasks are expected to be carried out during the hydrogen plant construction:

- Preparation of the site
- Construction of housing for the hydrogen and ammonia plant components
- Construction of the balance of plant (electric infrastructure, pipelines, compressors)
- Installation of the Haber-Bosch reactor
- Installation of electrolyzers
- Commissioning the hydrogen and ammonia plant

2.4 OPERATION AND MAINTENANCE ACTIVITIES

A detailed Operation & Maintenance (O&M) strategy and guidelines will be defined at a later stage, as it will also depend on the shareholder and contracting set-up of the Project. Factors that will determine the strategy will include the length and requirements of the performance warranties of the equipment / components, lender requirements, sponsor preferences, and location specifics. The Project will operate 24 hours a day, 7 days a week, except for scheduled maintenance events.

The risk management system for the operations phase will include the key items in Table 2.6.

Table 2.6 Risk Mitigation Measures during Operation

Risk Category	Risk Factors	Mitigation Measures
Wind	• Resource level below estimates • Add-on effect of electrolyzer utilization rate	• Analysis of operating margins and financial buffers to accommodate variations in wind • Thorough selection and smart use of the electrolyzer
Technical	• Lower turbine performance • Higher costs • Gaps in guarantees • Component failures	• Human resources ensuring the availability of qualified O&M personnel • Design choices which optimize the wind farm's availability • Replacement equipment easily accessible in case of component failures • Suppliers availability guarantee

Table 2.6 Risk Mitigation Measures during Operation

Risk Category	Risk Factors	Mitigation Measures
Human Resources	• Adequate number of qualified workers to operate and maintain facilities • Health and safety considerations including noise / hearing issues	• Work with local and specialized non-local service providers • Work with local training institutions, including the renewable energy training to be provided for the Project • Implement noise monitoring protocols for worker exposure to industrial noise on-site
Insurance	• Cost of annual premiums • Limits of coverage • Gaps in coverage or self-insurance	• Long-term insurance contracts to limit the risk of increasing premium • Thorough drafting of the insurance contract to mitigate operating risk
Counterparty	• Bankruptcy of offtaker • Creditworthiness of supplier	• Selection based on financial quality of offtaker • Know Your Customer requirements • Additional financial guarantees if needed • Compensation agreement and adequate insurance package
Offtake Prices	• Price drop for proportion of revenue not contracted under a fixed price	• Nature of offtake and payment obligations to be drafted smartly.

A Project-specific Quantitative Risk Assessment (QRA) (Appendix A) will be conducted to examine the potential consequences of Project failures and accidental event scenarios such as an accidental loss of control of flammable vapours, hydrogen gas, or ammonia from the facility during the operation and maintenance phase of the Project. Completion of the QRA will involve the following tasks:

- Source characterization of several Loss of Containment scenarios, including the following:
  - Estimated time-varying hydrogen release rates in the event of storage, piping, or electrolyzer, ruptures or leaks
  - Flammable or toxic gas releases due to upset conditions
- Consequence modelling to determine the extents of hazard zones for various combinations of release types, hazards, and meteorological conditions
- Risk modelling, which combines the results of the consequence modelling with the probability of a release occurring, to provide an estimate of the likelihood of harm on individual or societal bases

2.4.1 Operation and Maintenance of the Hydrogen Facility

The Project will have an estimated 500 MW (0.5 GW) of electricity demand required for hydrogen production as outlined in Table 2.1. This level of production will be facilitated using electricity generated by the Project wind farm and water sourced from the industrial water system.

The hydrogen facility will have the capacity to process approximately 2.2 m³ of water per minute. Water will be sourced from the existing industrial water supply present at the Port of Stephenville. As indicated in Table 2.3, at 100% capacity, the plant will require 3,218 m³ (0.85 million gallons) per day. At 50% capacity, the plant will require 1,627 m³ (0.43 million gallons) per day. Pending approval, the existing industrial water supply to the site (a 36-inch main) can be uncapped for the purposes of the Project and has the capacity to supply approximately 138 m³ (10,000 gallons per minute) (J. Gale, pers. comm.). Appendix E further contains an assessment of the potential industrial water supply for the Project and concludes that, based on the average precipitation data, the Mine Pond drainage basin, with a functioning water outflow control structure, can supply the 700 US GPM water supply required for the Project. Project requirements are less than 5% of the available industrial water supply.

A dedicated team of Project personnel will be responsible for carrying out Project operation and maintenance activities, with support from subcontractors as needed. Given that most systems within the hydrogen facility will be automated, the primary job of the operators will be to monitor the infrastructure (including associated cooling, fire safety, security, and fault detection systems) to support their safe, secure, and efficient operation. A control system will be implemented to provide ongoing access to activities via detailed real-time and historical data from the facilities. This will also be used to analyze when to schedule maintenance before failure occurs.

Operation and maintenance of the hydrogen facility will entail: regular visual inspections of the components, cables, substations, and other equipment; infrared assessment of substation equipment and overhead transmission lines, transformer oil sampling and testing; control of water quality (electrolysis input and output) through filtration, treatment, and product changing when necessary; and waste management. Specialized third-party contractors will be engaged to support maintenance activities as necessary.

Maintenance activities will also include corrective or preventative replacement of components such as electrolyte solution, inverters, and fuel cell stacks. If an alkaline process is chosen for the electrolyzer, solutions will need to be replaced during the operational lifetime of the Project (i.e., approximately every 10 years). Other components, such as electrolyzer stacks, will also require replacement during the operational lifetime of the Project.

Emissions and discharges from the hydrogen facility will be sampled and analyzed on a regularly scheduled basis. This will include wastewater with increased mineral content and atmospheric emissions of oxygen (see Section 2.6). It is anticipated that the specific sampling frequency and analysis parameters will be laid out in a Certificate of Approval issued to the Project by the Industrial Compliance Section of NLDECC.

Existing berthing infrastructure at the Port of Stephenville will require maintenance over the operation life of the Project. World Energy GH2 will work with the Port to identify maintenance requirements and facilitate work.

2.4.2 Operation and Maintenance of the Wind Farm

The wind farm will be remotely monitored and controlled 24 hours per day using wind farm control software including alarm call-outs, which will be monitored by trained personnel. Regular maintenance activities will include:

- Maintenance of roads and access: Snow clearing, road maintenance and repair as required
- Servicing of wind turbines: Inspection and maintenance in accordance with wind turbine supplier recommendations will be performed by approved technicians, including replacement of worn components, lubricants, and drone inspection of turbine blades
- Servicing of electrical equipment: Inspection of components, transformer oil, periodic replacement of minor components and testing

A plan and preliminary timeline of scheduled and unscheduled maintenance activities, including constant asset monitoring, will be carefully designed.

The operation of wind turbines has the potential to interfere with communications infrastructure, including radio and microwave, result in noise, and will be visible on the landscape. An Electromagnetic Interference study, including analysis of potential interference with communications on the Port au Port will be completed prior to construction and will provide guidance to Project planning and design (see Appendix A). A Noise Impact Study will be conducted prior to construction. It will review baseline noise conditions, model noise emissions from the Project, and determine noise levels at sensitive receptors (see Appendix A). This will support planning and design mitigation for noise, and will support consultation with local residents. A visual study will be conducted to determine the visibility of the turbines from various viewpoints across the Peninsula, and will be used to support consultation with local residents (see Appendix A).

In the event that there is electricity production beyond what is needed for hydrogen production, it will be sold to customers and delivered through the Island Interconnection System through agreements with NL Hydro and electricity regulators.

2.5 DECOMMISSIONING AND REHABILITATION

A project's decommissioning and rehabilitation activities aim to restore the site and typically include:

- Removal and appropriate disposal of equipment, materials, and supplies, including recyclable and non-recyclable ones
- Demolition and removal of infrastructure including buildings and foundations
- Removal and appropriate disposal of non-hazardous demolition debris
- Re-contouring
- Overburden and topsoil replacement
- Re-vegetation

A high-level decommissioning strategy has been developed and key activities are outlined as below. It is recognized that the Project is in its early stage, and that it will take at least 35 years for it to reach the end of the wind farm's nominal design life. As a result, despite the preliminary plan, we will continue to seek solutions and improve our strategy considering available technologies. Decommissioning activities would comply with environmental regulations and requirements in place at the time of decommissioning.

Turbine decommissioning: Decommissioning a turbine entails removing the entire structure, including the turbine and turbine base. Components such as nacelle and tower components have an established practice of recycling, and appropriate plans will be implemented. Some turbine manufacturers have recently introduced recyclable wind blades; these new products will be factored into our overall strategy.

For components that do not currently have a mature recycling method, at the time of decommissioning, it will be determined whether they can be resold entirely or in part.

Transmission line decommissioning: Steel towers, wood poles and conductors will be removed as efficiently as possible, and the trenches for any underground sections will be filled with appropriate soils. Materials such as copper, steel, aluminum, and other materials will be recycled off-site.

Substation decommissioning: Components to be decommissioned include switchgear/cabling and transformer. The procedure entails carefully removing the equipment using cranes and a specialist contractor. For switchgear / cabling and transformers, the materials will be removed from the site; for civil works, areas will be re-graded and covered with reinstatement soils.

Most components from the dismantled substation can be reused off site.

2.6 HAZARDOUS MATERIALS, WASTES, DISCHARGES, AND EMISSIONS

2.6.1 Hazardous Materials and Hazardous Waste

Hazardous materials used during the construction / operation of the wind farm include diesel, petroleum, oil, and lubricants, which will create hazardous waste, such as used oil and oil filters. These materials and subsequent wastes will be transported, stored, and handled as per regulatory requirements and disposed of at an approved hazardous materials recycling / disposal facility.

Depending on the technologies selected for the hydrogen plant, a list of hazardous chemicals will be developed as part of detailed Project design, and appropriate chemical management procedures included in the operational EPP. For example, the water facility will require chemical disinfectants such as chlorine, chloramine, or chlorine dioxide for treatment. More detail can only be provided when proper water intake composition is incorporated into the design of the plant.

Ammonia-based catalysts are not formulated with expensive or rare metals. These usually consist of iron-based matrices, but they need to be changed out regularly, due to reduced operating activity. It is important to use proper unloading and loading procedures to reduce opportunities for spills. These catalysts can contain formulations using calcium, aluminum, potassium, and silicon. Cobalt additives may be used in specific catalyst formulations.

Hazardous waste materials, such as fuel or oil, will not be generated in large quantities and will be disposed of through conventional waste-oil and hazardous waste disposal streams, as per the Waste Management Plan. There are limited hazardous waste by-products created from the wind energy generation process, such as lubricant and hydraulic oils, from ongoing turbine maintenance, and limited hazardous waste by-products from the operation of the hydrogen facility.

Further information on management of hazardous materials and wastes is provided in Section 2.8.3. Further information on management of hydrogen and ammonia specifically is provided in Section 2.2.1.4.

2.6.2 Waste Management Plan

A Project-specific Waste Management Plan will be developed for collection and disposal of waste generated during construction and operation and maintenance phases. As described in Section 1.6, this plan would be developed prior to Project construction, and it is assumed that the requirement for this plan will be a condition of EA approval. Some of the environmental protection procedures that would be included in this plan are provided in Section 2.8.3.

2.6.3 Windfarm Emissions and Discharges

During the construction phase, noise and contaminant emission sources will include mobile equipment (e.g., trucks), blasting if required during turbine installation, and back-up generators (if required). Equipment will have exhaust systems regularly inspected and mufflers will be operating properly. Equipment will meet the requirements of the provincial *Air Pollution Control Regulations* under the *Environmental Protection Act* and will meet the *Canadian Environmental Protection Act, 199*9 - Fuel Quality and Vehicle and Engine Emissions. Dust from Project activities will be controlled where required by using applications of water. Waste oil will not be used for dust controls.

An Air Quality Management Plan will be developed and implemented as part of the EPP. The Plan will specify the mitigation measures for the management and reduction of air emissions during Project construction and operation. As described in Section 1.6, this plan would be developed prior to Project construction, and it is assumed that the requirement for this plan would be a condition of EA approval. Some of the environmental protection procedures that would be included in this plan are provided in Section 2.8.3. The Air Quality Management Plan will include mitigation measures for the management and reduction of noise generated by the operation of the turbines.

Stormwater management and erosion and sediment control plans and procedures will be developed prior to construction as part of detailed Project design to properly manage site runoff during the construction and operation phases of the Project. These will be stand-alone or included within the EPP. The erosion and sediment control plan will detail recommendations to reduce sediment generation from construction activities on the site, including construction phasing and strategic grubbing of site vegetation. Erosion and sediment control mitigation measures will be used to limit sediment transport from exposed areas of the site. The plan will include installation details and locations of typical erosion and sediment control mitigation measures, such as silt fencing, check dams and sediment ponds, if deemed necessary. The stormwater management plan will focus on management of stormwater runoff and site drainage in the post-construction scenario with the intent to maintain existing drainage pathways through the installation of road culverts within the access roads, where necessary.

2.6.4 Hydrogen Facility Emissions and Discharges

An initial review of potential emission and discharge sources from the hydrogen facility was conducted (refer to Table 2.4). The hydrogen plant will be powered completely with green electricity and will not have substantial carbon emissions. The following emission and discharge sources were identified and will continue to be further investigated and mitigated as appropriate.

2.6.4.1 Hydrogen Emissions

Operations-based emissions would occur due to sudden unplanned shutdowns. ASU(s) can be shutdown fairly safely with no toxic emissions. Electrolyzers need to be emptied of any high concentrations of oxygen and hydrogen, which are usually sent to flares or to the atmosphere. Ammonia plants also need to be emptied of hydrogen, nitrogen, and ammonia, safely, which is usually sent to the flare systems. There is the potential for hydrogen to be released from the electrolyzer in an upset condition. It would be either safely vented or flared, depending on the final safety case for the plant. During the permitting process, quantities of hydrogen emissions will be verified. Hydrogen volumes following a process upset, such as an overpressure event, will be determined during process safety design engineering. Equipment such as compressor, intercooler design, turn down systems, and pressure relief systems will need to be specified to meet multiple overpressure conditions. Hydrogen vented during normal operation and upset conditions (such as emergency depressurization events) will be directed to a common relief header, which will be directed to a common vent stack. Appropriate relief loads, vent piping, and stack sizing will completed in engineering design phase.

2.6.4.2 Oxygen Emissions

The plant will emit oxygen to the atmosphere as a byproduct of the electrolysis process; this byproduct will be discharged safely to the atmosphere or captured as a value stream. In the event that a market is identified for the oxygen generated during the process, a capture, storage, and re-use facility will be incorporated into the hydrogen facility. Releasing oxygen to the atmosphere creates an oxygen-enriched atmosphere that increases susceptibility to fire hazards. If the oxygen by-product cannot be monetized through an offtake agreement, proper design of oxygen dispersion (venting at a safe elevation) from the electrolyzer will be conducted. Vapour dispersion modeling will be protective of surrounding communities, wildlife, and the environment. Initial estimates of the oxygen emission quantities are provided in Table 2.7; these oxygen production rates are from the electrolyzer and do not include the oxygen emissions from the ASU.

Table 2.7 Oxygen Production Rates

Site A Plant Name-Plate Capacity, MW	Utilization Factor, % Note 1	Max O2 Production, tons per day Note 2	Max O2 Production, tons per annum Note 2
500	100	1,300	480,000
500	50	650	240,000

Notes:

1. Utilization factor considers hydropower supply and energy buffering storage in addition to onshore wind energy. The utilization factor represents an annualized utilization of the electrolyzer facilities. 100% utilization factor represents the maximum capacity that could be achieved by the plant. 50% utilization factor represents the likely actual production based on the variability of wind energy generation.
2. Maximum oxygen by-product production based on capacity and utilization factor. The production rate will vary on a daily and seasonal basis.

2.6.4.3 Water Vapor Emissions

The electrolyzer facility will require a cooling system which may emit water vapor to the air. There is a selection of cooling utilities that can be deployed, such as motorized air coolers (i.e., fin fan coolers) or cooling water. Cooling water is derived from a closed-loop water system consisting of cooling towers, piping, and cooling water exchangers. The cooling tower will emit water vapors which will include potential contaminants, such as bacteria, which will require proper management. Appropriate cooling tower design and development of maintenance procedures will be required to meet the requirements of the provincial *Air Pollution Control Regulations* under the *Environmental Protection Act* if cooling towers are selected as the cooling utility. An Air Quality Management Plan will be developed and implemented as part of an EPP.

2.6.4.4 Gas Turbine Emissions

The facility is planned to have three LM6000 aero-derivative 5 3 MW gas turbines as supplementary power sources. These units would be initially started using distillate (diesel) fuel, then switched to hydrogen fuel after reaching full power, resulting in limited emissions during the start-up phase. The gas turbines would be equipped to meet the requirements of the provincial *Air Pollution Control Regulations* under the *Environmental Protection Act* while operating on either diesel or hydrogen fuels. An Air Quality Management Plan will be developed and implemented as part of an EPP.

2.6.4.5 Wastewater Discharge

The hydrogen production process in this project requires high purity water, which can be achieved using a Reverse Osmosis (RO) system. RO systems are widely used for achieving high purity water by passing a water stream with contaminant through a semi permeable membrane, resulting in high purity water passing through while contaminants are concentrated and rejected as waste. It is anticipated that the volume of wastewater will be approximately one third the volume of intake water for the hydrogen facility. At 100% production, it is estimated that the wastewater discharge volume will be 965 m^3 per day. At 50% production, it is estimated the wastewater discharge volume will be 488 m^3 per day (to be confirmed during later engineering stages of the Project). ROs typically have some type of filtration or physical-chemical treatment systems installed up front and require pre-treatment chemicals for de-chlorination, anti-scaling, or anti-corrosion. Wastewater discharged from an RO facility will include rejected constituents from both added chemicals and source water. The constituents from the rejected waste may include suspended solids, minerals, naturally occurring metals, and natural organics, which may vary in concentration depending on treatment equipment design and operating conditions. The water purification facility will also produce intermittent higher strength wastewater streams with chemical residuals, as needed, for Clean-In-Place operations, backwashes, regenerations, and maintenance activities. These streams combined should be within allowable tolerances, without dilution or treatment, to the municipal sewage system.

Publicly available data from NLDECC provides monitoring and characterization of drinking water surface and ground water source waters in the province. Some of this data was used in Table 2.8 to develop two potential wastewater concentration discharge profiles from the facility, focusing primarily on dissolved minerals, metals, and suspended solids (assuming RO treatment). The discharge profiles were calculated using a typical RO concentration factor of 3 times source concentration. The parameters available from the NL drinking water monitoring and ground water databases are not fully reflective of parameters that will be monitored for wastewater discharge compliance. They also do not include site specific differences that the local source water, or plant may contribute to the wastewater. Additional sampling and water quality analysis of the final source water will be required to compare to the provincial Environmental Control Water and Sewage Regulations, 2003 (Schedule A or B), and any other discharge regulations applicable by federal requirements (if discharging to natural environment).

Table 2.8 Potential Discharge Concentrations for a Reverse Osmosis Reject Stream[1]

Parameter	Surface Water Example, Corner Brook	Discharge Example 1 – (Corner Brook x 3)	Ground Water Example Western NL Avg	Discharge Example 2 – (Western NL x 3)	NL Sched. A Limits (Discharge to Env.)	NL Sched. B Limits (Discharge to Sewer)
TDS	35 mg/L	105 mg/L	292.3 mg/L	875 mg/L	1,000 mg/L	
Boron	-	-	0.05 mg/L	0.15 mg/L	5 mg/L	5 mg/L
Turbidity	0.62 NTU	2 NTU	1.12 NTU	3 NTU	No Limit (TSS – 30 mg/L)	No Limit (TSS – 350 mg/L)
Chromium (Total)	-	-	0.001 mg/L	0.003 mg/L	Cr6 0.05 mg/L Cr3 1 mg/L	Cr6 0.05 mg/L Cr3 1 mg/L
Copper	-		0.004 mg/L	0.012 mg/L	0.3 mg/L	0.3 mg/L
Iron	0.057 mg/L	0.2 mg/L	0.1 mg/L	0.3 mg/L	10 mg/L	15 mg/L
Lead	-		0.002 mg/L	0.006 mg/L	0.2 mg/L	0.2 mg/L
Mercury	-		0.00002 mg/L	0.00006 mg/L	0.005 mg/L	0.005 mg/L
Nickel	-		0.001 mg/L	0.003 mg/L	0.5 mg/L	0.5 mg/L

Note:

[1] Representative of a concentration factor of 3 applied to source waters in Corner Brook and Western NL (not Project or site specific). Does not include intermittent cleaning chemical wastes such as caustic, acids, detergents, or solvents. Does not include chemicals injected upstream of RO for protection from corrosion, scale, or de-chlorination.

The discharge from this facility is anticipated to be directed to a municipal collection system owned and operated by the Municipality of Stephenville. The municipality has a subsurface engineered wetland, rated at 4,555 m^3/d capacity. Based on Table 2.8, it is our understanding that the wastewater concentrations directed to the municipality would not be greater than the current municipal outfall. Based on the Project effluent flows, the municipality and industrial wastewater source could receive the benefit of co-mixing and dilution. A study can be conducted with the Municipality to assess the impact of the industrial source wastewater flow and concentration on the town collection and/or treatment system. However, it is at the Municipality's discretion to approve discharges to their sewer. Regardless, the Project will comply with provincial regulations for discharges to sewer as well (*Environmental Control Water and Sewage Regulations*, 2003 - Schedule B).

As noted above, the selected water source will require characterization to allow for an updated wastewater concentration profile to be developed and compared with applicable legislation for discharge to either municipal or natural receiving environments. This will be conducted prior to construction. The reference source waters cited in Table 2.8 do not have predicated values above the NL discharge criteria presented, however this data is not specific to the actual water sources available.

If following revised sampling/data analysis, the predicted water purification plant discharge is not acceptable for discharge into the municipal collection system or the natural receiving environments, treatment can be explored prior to discharge. Water reuse can also be explored within the Project production facility to reduce wastewater volumes discharge; this is typically to be undertaken as part of best practices in design regardless of wastewater discharge compliance. The source water and water treatment facility are not yet defined enough at present to predict what treatment options may be best suited for this wastewater stream. Some examples of treatment to polish wastewater with elevated minerals, metals and trace contaminants include:

- Adsorptive media e.g., activated carbon
- Sacrificial resin beds
- Chemical precipitation of metals, physical-chemical solids separation
- Evaporation/settling ponds
- Engineered wetlands

The cost of such treatment systems are challenging to confirm at early stages of Project design. Polishing systems can require an order of magnitude investment of $1-10 million or greater.

2.7 EMPLOYMENT, EXPENDITURES AND BENEFITS

This Project will have a substantial positive impact on the local economic activity by dramatically increasing the number of jobs locally (direct and indirect). Table 2.9 provides an initial estimate of the potential number of jobs created as a result of the Project. These numbers are based on initial estimates. Further analysis including the construction execution strategy, the contracting strategy for operations, and the results of the supply chain studies will refine these estimates. Given the preliminary stage of Project planning, National Occupation Codes for jobs cannot be provided at this time.

Table 2.9 Estimated Direct and Indirect Job Creation Resulting from the Project

	Direct Construction Employment	Operation and Maintenance Employment	Indirect Employment
H_2 Facility	600	50	200
Site A	400	50	1,100
Total	**1,100**	**100**	**1,300**

In addition, training opportunities specific to renewable energy will be offered to train and hire employees from NL (see further detail in Section 2.7.1). The goal will be to re-train local experts, create new jobs, and also export leading-edge knowledge and skills that will be required globally for decades to come. World Energy GH2 is committed to leveraging NL's existing relevant skills (marine, fisheries, offshore oil and gas, energy / hydro) to build a high-quality, future-proof new industry. This best-in-class local team will function as a "centre of excellence" for Canada and North America. Development of the Project will attract experts in windfarm and hydrogen plant development, as well as harbour and shipping industry experts. The region will also attract highly skilled immigrants, which will have an indirect and positive impact on local businesses.

Positive regional returns are anticipated due to indirect regional influx related to tourism, hotels, and restaurants. World Energy GH2 is also committed to procuring components locally and use the local supply chain to foster the positive economic returns in the region.

2.7.1 Renewable Energy Training

To engage the local communities and strengthen the positive economic impact of this Project on the local economy, World Energy GH2 is committed to offer training programs and new local jobs (refer to Section 2.2.4). To support the Project's need for skilled workers, we look forward to working closely and in cooperation with the College of the North Atlantic to provide local training opportunities. World Energy GH2 will also provide training opportunities specific to wind technology for Newfoundlanders and Labradorians to enhance job prospects and long-term employment through a partnership with DOB Academy and in collaboration with the Qalipu.

DOB-Academy will partner with World Energy GH2 to develop the renewable energy training. Training courses will vary based on industry experience and will be provided in the city of Stephenville, as well as in Corner Brook. DOB-Academy has ample experience in teaching international groups, tailoring courses for specific demographics and engaging the youth for offshore renewable energy:

- Several open registration courses on offshore wind in Japan.
- Teach the Teacher sessions for Nagasaki Ocean Academy; we have trained their teachers to give our courses in Japan.
- Tailored courses for Lebanese and Tunisian government officials and university teachers on offshore wind. The content was tailored specifically to the opportunities for offshore wind in their regions.
- Summer school for Japanese Master students. Summer 2022 the third summer school will be organized where about 20 MSc students from Japan will join a four-week program on offshore wind.
- Teach the Teachers sessions on offshore wind and (new in 2022) on hydrogen for teachers of higher and vocational education. We inform teachers of the latest technologies and trends of the industry and provide them with course materials that they can use in their curriculum.
- Renewable roadshow is a dedicated program where we visit higher and vocational educational institutes to motivate the students for a career in offshore renewable energy. The goal of this program is to fill the numerous vacancies that we have and foresee in the future in offshore energy.
- DOB-Academy Kids is a new program focused on primary education to teach the children the basics of wind energy and to inspire them to choose the technical courses at secondary school.
- DOB-Academy has delivered several custom-made courses, two large projects involved training mechanics to build a specific type of turbine and teaching tugboat captains the fundamentals of a new and innovative way of assisting vessels.

2.7.2 Employment Equity, Diversity and Inclusion

World Energy GH2 is committed to promoting equal opportunity and diversity within a workplace that is free of discrimination. We will consult with the Minister of Industry, Energy and Technology and the Minister Responsible for the Status of Women prior to Project construction to develop a Gender Equity and Diversity Plan that meets with their approval. A preliminary Plan is included in Appendix D. The Gender Equity and Diversity Plan will specifically consider business and employment access for members of underrepresented populations. Renewable energy training (Section 2.7.1) will be offered to provide local workers with training appropriate to the growing renewables industry in eastern Canada. The cornerstone of the Gender Equity and Diversity Plan will be World Energy GH2's Equity, Diversity and Inclusion Policy (Appendix D), which states that World Energy GH2 maintains a policy of inclusion in support of disadvantaged persons in society, particularly women, Indigenous peoples, members of visible minorities, and persons with disabilities.

2.8 ENVIRONMENTAL MANAGEMENT

Our guiding principle is that we believe in zero incidents and no negative impact to our stakeholders and the environment. The Project is committed to:

- Pursuing the goal of no harm to people
- Protecting the environment
- Making effective use of materials, energy and best practices
- Pursuing the goal of no incidents with our neighbours and in the community we work in
- Designing, constructing and installing the Project consistent with these aims
- Ensuring that the Health, Safety and Environment (HSE) risks are successfully eliminated or reduced to acceptable levels
- Embedding HSE in main business processes
- Promoting a safety culture in which persons working on the Project share this commitment

The following sections provide additional information on both environmental management and health and safety standards that would be applicable to the Project, and also provides a high-level list of mitigation measures that will be implemented during Project construction and operation. Mitigation will be refined in consultation with regulators and stakeholders as the Project design progresses.

2.8.1 Environmental Management System

An Environmental Management System (EMS) will be developed specifically for the Project. The EMS will include protocols to facilitate the execution of Project construction and operation in an environmentally responsible and safe manner.

As part of the EMS, an EPP will be developed prior to construction and implemented, providing guidance on management practices and requirements to on-site and corporate team members, as well as outlining roles and responsibilities and reporting procedures. Table 2.10 provides an annotated table of contents for the EPP. The EPP will be reviewed and approved by government regulators prior to the start of construction activities and is anticipated to be required as a condition of EA approval. Prior to the start of operations, an operations and maintenance EPP will be drafted and implemented. Table 2.10 also includes the likely contents of the operational EPP. The EPPs will be inclusive of both the hydrogen and wind farm facilities and activities. EPP documents will also contain emergency response contingency plans and provide direction to on-site workers in the event of accidents, malfunctions, or incidents. A stand-alone Emergency Response Plan would also be developed for operation of the hydrogen and ammonia facility.

Table 2.10 Preliminary Annotated Table of Contents for the Environmental Protection Plan (Construction and Operation Phases)

Section	Description
Introduction	An EPP is intended to be a field-usable and living document that operationalizes implementation of both regulatory requirements and environmental commitments of World Energy GH2 by those personnel and contractors responsible for carrying out Project activities. An EPP would be developed for Project construction and would be updated and revised as required to address Project operation. Given the differences in Project activities associated with the wind farm component and the hydrogen facility, either separate EPPs will be developed to address each of these components or they will be distinct sections within a single EPP. The introduction of the EPP would provide a brief overview of the Project and its activities and would also include subsections to outline the: • purpose and scope of the EPP • objectives of the EPP • organization of the EPP • World Energy GH2's environmental policy • roles and responsibilities for staff, contractors, site contractors and site personnel • environmental orientation and any ongoing training
Regulatory Requirements and Commitments	This section will list the approvals, authorizations and permits that may be required (along with their current status) and will provide an overview of required site inspection and environmental compliance monitoring, as specified in any relevant permits, authorization and/or approvals.
Reporting and Communication	This section would describe internal and external communication procedures for addressing environmental concerns, issues and/or incidents. This will include any reporting requirements to federal and provincial regulators.
Environmental Protection Measures	Potential environmental concerns and the environmental protection procedures implemented during Project activities will be described in detail for the applicable Project phase. The following rows provide an initial list of environmental protection procedures likely to be required for each Project phase and component.
Construction	The following is an initial list of activities that would require specific environmental protection procedures during Project construction: • Sensitive Time Periods • Buffer Zones • Laydown and Storage Areas • Borrow Areas and Quarries • Trenching and Excavation • Site Clearing and Site Preparation • Erosion and Sediment Control • Soil Management • Watercourse Crossings and Works In or Near Fish Habitat • Working in or Near Wetlands • Blasting (if required during construction) • Air Emissions (Including Dust Control) • Use of Vehicles, Equipment and Roads, including Road Maintenance • Lighting • Noise Control • Site Water Management • Traffic Management • Management of the temporary accommodations camp • Materials Handling and Waste Management (including Storage, Handling and Transfer of Petroleum Products and Other Hazardous Materials; Non-Hazardous Waste Management and Recycling; Hazardous Waste Disposal and Sewage Disposal)

Table 2.10 Preliminary Annotated Table of Contents for the Environmental Protection Plan (Construction and Operation Phases)

Section	Description
Operation – Wind Farm	The following is an initial list of Project activities that would require environmental protection procedures during operation and maintenance of the wind farm: • Vegetation management along access road and transmission line RoWs • Road maintenance (including snow clearing) • Air emissions (including dust control on access roads) • Lighting • Noise control • Site water management • Periodic visual inspection of turbines • Periodic maintenance of turbines • Remote monitoring of wind turbine operation • Monitoring program for avifauna and bats and adaptive management as required
Operation – Hydrogen/ Ammonia Facility	The following is an initial list of Project activities associated that would require environmental protection procedures during operation and maintenance of the hydrogen/ammonia facility: • Management of wastewater • Emissions and flaring • Storage of hydrogen and ammonia • Noise control • Lighting • Fire protection and deluge systems • Inspection and maintenance of major equipment (water treatment, electrolyzer, ASU, ammonia loading, and marine terminal) • Transfer of ammonia to carriers at the marine facilities • Materials Handling and Waste Management (including Storage, Handling and Transfer of Petroleum Products And Other Hazardous Materials; Non-Hazardous Waste Management and Recycling; Hazardous Waste Disposal and Sewage Disposal)
Resource Specific Protection Procedures	This section of the EPP will outline any resource specific protection procedures that will be required, which at a minimum would include: • Historic Resources (this would constitute a Heritage and Cultural Resources Protection Plan) • Avifauna (including conduct of pre-clearing surveys for active migratory bird nests if clearing is required during the breeding bird season and buffer / set-back distances from active nests). • Bats (Myotis) • Rare Plants • Other Wildlife
Contingency Plans	This section will outline the contingency plans to be in place for fuel and hazardous material spills, wildlife encounters, failure of erosion and sediment control measures, forest fires, extreme weather, and discovery of historic resources.
EPP Revision Procedures	This section will outline the process for revising the EPP.
Contact List	This section will contain a list of key contacts relevant to the EPP.

The Project team will develop and implement a detailed risk management plan with a risk matrix to identify, rate, and mitigate risks during the development, construction, and operation phases. Key items for Project construction are listed in Table 2.11.

Table 2.11 Risk Mitigation Measures During Construction

Risk Category	Risk Factors	Mitigation Measures
Weather	• Delays due to reduced accessibility	• Design choices that optimize the wind farms availability during construction
Technical Incidents	• Accidents leading to damaged equipment or construction schedule delays	• Contingency budget • Detailed construction schedule including buffer • Replacement equipment easily accessible in case of component failures • Suppliers' availability guarantees
Interfaces	• Unclear responsibility for tasks • Quality checks during handovers • Disputes over allocation of incident costs • Unavailability of rare equipment beyond planned window	• Clear contracting structure and risk/responsibility allocation • Thorough due diligence from lenders due to the Project finance aspect of the Project • Replacement equipment easily accessible in case of component failures • Suppliers' availability guarantees
Counterparty	• Bankruptcy of contractor or subcontractor • Decrease in value or strength of guarantees	• Selection based on financial quality of contractors • Know Your Customer requirements • Additional financial guarantees if needed • Compensation agreement and adequate insurance packages
Socio-economic Disruption	• Unavailability of skilled workforce • Border and visa regulations	• Training programs will develop a pool of qualified personnel • Human resources will develop a pool of qualified personnel

2.8.2 Health and Safety

In order to achieve the guiding principles described above, the Project will manage HSE by (i) focusing on design aspects, (ii) influencing human behaviour and safety awareness and (iii) set HSE criteria for staff and (sub)contractors by:

- The HSE strategy will be reviewed by the Project team and implemented
- Having clear HSE responsibilities for team members
- Following a Safe by Design philosophy in Project design aspects and choices
- Carrying out, maintaining and communicating a suitable Project HSE risk assessment with mitigation measures in place
- Encouraging the identification and notification of hazardous situations
- Describing and communicating Project emergency communication lines
- Building a team culture where HSE is integrated in the daily work processes
- Preparing and implement high standard Project HSE requirements, which are part of contract agreements between (a) World Energy GH2 partners and (b) with external parties hired by the Project

A brief summary of the HSE policy in practice during the development phase up to financial close is provided in Table 2.12.

Table 2.12 HSE Implementation During Development Phase up to Financial Close

	Strategy	Activity
1	Ensure that this HSE strategy is known by the Project Team	• Meeting with the Project management • Presentation in team meetings
2	Have clear HSE responsibilities for team members	• Describe roles and responsibilities • Share with the team members individually
3	Follow a Safe by Design philosophy in design aspects and choices	• Identify HSE standards relevant for the design • Have workshop(s) with engineers to identify HSE-critical design choices and prepare design risk assessment • Keep track of critical design choices
4	Carry out risk assessments	• Carry out, maintain, and communicate a suitable Project HSE risk assessment with mitigation measures in place • Define what "tolerable level" is for risk mitigation
5	Encourage the identification and notification of hazardous situations	• Discuss during team meetings • Include in toolbox meetings • Lead by example • Have easy to use reporting system
6	Describe and communicate Project emergency communication lines	• When an incident happens, how and where to notify • When site works are being carried out, make sure 2/7 duty rotation is in place • Alignment with shareholders emergency procedures • Emergency numbers will be known and available
7	Build a team culture where HSE is integrated in the daily work processes	• Each meeting will start with a safety moment • Safety alerts will be shared and discussed during team meetings • Roll out a preliminary safety program consisting of a number of toolboxes designed to reduce risk acceptance behaviour • Define and implement Project safety rules
8	Prepare and implement high standard Project-HSE requirements which are part of contract agreements	• Between World Energy GH2 partners • With external parties hired by the Project
9	HSE commitment	• HSE steering committee / HSE leadership sessions

2.8.3 Environmental Mitigation Measures

To reduce the environmental impact of Project-related activities, mitigation and management measures will be implemented during Project construction, operation and maintenance, and decommissioning. Table 2.13 provides a preliminary list of proposed mitigation measures that will be further refined through consultation with regulators and as the Project design progresses.

Table 2.13 Preliminary List of Proposed Mitigation Measures

Construction
Waste Management
• Project staff and contractors will adhere to the waste management procedures to be included in the EPP. • Construction areas will be kept clear of rubbish and debris, unless appropriately stored and managed. • Waste materials and debris will be collected and stored in acceptable containers on-site and disposed of off-site in an environmentally acceptable and approved site. Materials that can be recycled will be sorted and taken to an approved facility. • 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. • Where portable toilets are required, waste will be removed from the site by the supplier in a timely manner for appropriate disposal. • Burning of rubbish and waste materials on-site will not be permitted. Rubbish and waste materials will not be buried on-site.
Management of Fuel and Other Hazardous Materials
• Bulk fuel and lubricants will be stored in secure areas (i.e., with bund walls and impervious flooring) that have the capacity to trap more than the volume of petroleum hydrocarbons being stored; this will serve as a secondary containment should the primary containment fail. Other petroleum hydrocarbon products will not be stored in large quantities on-site, and secondary containment (e.g., drip trays) will be used in areas of storage and transfer. • 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. • 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.
Site Preparation and Dust / Noise Control
• Project footprint and disturbed areas will be limited to the extent practicable. • The limits for approved clearing, grubbing and topsoil overburden removal will be clearly identified (flagging/survey stakes) in the field prior to the commencement of work. • Existing riparian vegetation will be maintained to the extent practicable. Merchantable timber will be salvaged and used, or it will be made available to local communities for fuelwood. • Clearing for road construction will be limited to the width required for road embankment, drainage requirements, and safe line of sight requirements. Trees will be cut close to ground level, and only large tree stumps will be removed, where practicable. Low ground shrubs will be left in place for soil stability and erosion protection purposes. • An Air Quality Management Plan will be developed and implemented as part of the EPP. The Plan will specify the mitigation measures for the management and reduction of air emissions during Project construction and operation. • Where practical, Project vehicles, heavy equipment, and machinery will be sized to the smallest needed to perform the work. • Project vehicles, heavy equipment, machinery, and associated exhaust systems and mufflers (and/or other appropriate sound attenuation devices) will be regularly inspected and maintained so that they remain operating in accordance with manufacturer's recommendations. • Project vehicles, heavy equipment, and machinery will be shut down when stationary for long periods of time. The idling of vehicles and equipment will be avoided whenever practical. • Dust from Project activities will be controlled where required by using applications of water. Waste oil will not be used for dust controls.

Table 2.13 Preliminary List of Proposed Mitigation Measures

• Project-related fugitive road dust will be controlled through measures such as: – Establishing appropriate speed limits on Project-controlled gravel roads – Conducting road watering on an as-needed basis – Requiring trucks hauling material that can generate dust to have tarps to cover the load • Cleared areas will be revegetated, where possible. • Stockpiles of topsoil, overburden, and other potentially dust-generating materials will be kept covered and used as soon as practical. • Project activities will be timed to avoid undue nuisance to off-site receptors. • Nearby residents will be notified prior to potential blasting (if required). • Project vehicles will drive within the speed limit to reduce engine noises as vehicles travel on roadways within adjacent communities and horns will be used only as necessary for safety purposes. • With respect to potential vibration impacts, if blasting is required during construction, the contractor will have the required insurance policies in place to cover legitimate claims that may result from damage due to vibration during the construction phase. • Explosives storage and production facilities, if required, will meet government regulations including required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada. Explosives and accessories will be stored at the planned Natural Resources Canada approved magazine site and explosive storage facility. • Blasting activities (if required) will be included under a contract service agreement with the explosives supplier and who will have a valid blasters certificate issued by the NLDECC. • An Explosives and Blasting Management Plan will be developed by the blasting contractor to provide direction for the safe storage, handling and use of explosives and explosive components at the Project site, to address the safety of the public and Project personnel, and protection of both the environment and Project components.
Measures to Mitigate Impacts on Surface Water and Groundwater Resources
• 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. • Work operation will be conducted in a manner to protect watercourses and wetlands from siltation and disturbance. • Areas to be cleared will have sediment and erosion control measures implemented per the site-specific Erosion & Sediment Control Plan prior to the initiation of clearing activities. The sediment and erosion control measures will be adapted to suit the field conditions associated with the specific construction activities as construction proceeds. • Construction areas will be routinely monitored to identify areas of potential erosion and to apply appropriate mitigation. Progressive erosion and sediment control measures will be implemented, as required. • The drainage system for the site will be designed to appropriately manage stormflows considering impacts to on-site downstream watercourses and infrastructure. • Work completed in designated water supply areas will be completed in conjunction with or under guidance of the jurisdiction having authority.

Table 2.13 Preliminary List of Proposed Mitigation Measures

Measures to Mitigate Impacts on Biophysical Resources
• The mitigation measures identified above with respect to Site Preparation and Dust / Noise Control and for Surface and Ground Water Resources will also serve to mitigate the potential impacts of air, noise, vibration, and dust emissions on flora and fauna. • 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. • Where crossing of wetlands beyond the area to be cleared is unavoidable, protective layers such as matting or biodegradable geotextile and clay ramps or other approved materials will be used between wetland root / seed bed and construction equipment if ground conditions are encountered that create potential for rutting, admixing or compaction. • Grading will be directed away from wetlands, where possible, and will be reduced within wetland boundaries unless required for site specific purposes. • Site clearing and grubbing will be avoided during the breeding bird season, whenever possible. If this is not possible, pre-clearing surveys will be conducted for active migratory bird nests and buffer / set-back distances from active nests will be established. • The discovery of nests by staff will be reported to the Environmental Advisor at site and appropriate action or follow-up will be guided by a Project EPP. • Environmental personnel responsible for site monitoring during construction will receive training to recognize SAR / SOCC that may be present in Project Area. • World Energy GH2 will work with Wildlife Division to manage our interactions with identified sensitive areas. • Artificial lighting will be limited to the amount required for safety and security purposes and will be directional or otherwise designed to reduce spill-over light wherever feasible without compromising site safety or security. Lights will be side-shielded and directed downward to reduce the attraction of birds where possible. • Native plants will be used for landscaping, where practical. • To reduce the risk of introducing or spreading exotic and/or invasive vascular plant species, equipment will arrive at the construction site clean and free of soil and vegetative debris. Equipment will be inspected by Project personnel or designate and either approved for use or cleaned, re-inspected and approved for use. • Cleared areas will be revegetated, where possible. • To avoid attracting wildlife, wastes will be securely stored, frequently removed from site, and properly disposed of in an environmentally acceptable manner at an approved site. • Known occurrences of plant SAR / SOCC will be avoided through micro siting of Project infrastructure. If avoidance of plant SAR / SOCC is not possible, seed collection or transplant of the plant will be considered in consultation with the applicable regulators.
Measures to Mitigate Impacts Land and Resource Uses
• Project-specific sediment, dust control, and noise management measures described for Site Clearance and Dust / Noise Control and the Surface Water and Groundwater Resources Valued Components (VCs) will serve to reduce potential sensory/nuisance impacts to nearby land users, residents, businesses, and other off-site receptors. • Project activities will be timed to avoid undue nuisance to off-site receptors. • If complaints are received from land users regarding perceived Project-related impacts, World Energy GH2 will work with the affected land users to address their concerns through a grievance redress mechanism and the potential implementation of additional mitigation measures as needed.

Table 2.13 Preliminary List of Proposed Mitigation Measures

Measures to Mitigate Impacts on the Social Environment

- Workforce training will be provided to address topics such World Energy's EDI Policy and health and safety policies.
- Management of employees and the temporary accommodations camp will consider measures to reduce impacts on the local community and local infrastructure including timing of work schedules / rotations, limiting access and use of community resources through provision of services on site, and bussing.
- A Gender Equity and Diversity Plan will be implemented that meets the approval of the Minister of Industry, Energy and Technology and Minister Responsible for the Status of Women and World Energy GH2 will engage with both Indigenous groups during the development of the Plan. A business access strategy for members of underrepresented populations will be included in the plan.
- World Energy GH2 will communicate employment information to local communities and Indigenous groups in a timely manner so that local and Indigenous residents have an opportunity to acquire the necessary skills to qualify for potential Project-related employment.
- World Energy GH2 will work with the province, educational and training institutions, Indigenous groups and stakeholders to identify skilled trade shortages relative to the Project and to identify training needs and opportunities to contribute to a sustainable Project workforce.
- World Energy GH2 will implement COVID-19 protocols, as necessary.
- World Energy GH2 will engage with local resource users regarding the overlap of the Project with land use areas in the Project Area. This will include the communication of Project information, updates on ongoing and planned activities, and a discussion of issues and concerns and a potential means of addressing them.
- World Energy GH2 will enter into a Mutual Use and Mutual Access Agreement with local snowmobile trail association to allow continued snowmobile / ATV use of the Port au Port Peninsula.
- Project activities, locations, and timing will continue to be communicated to Indigenous groups, affected land and resource users, environmental non-government organizations, the provincial government, and local authorities throughout the life of the Project. In particular and as part of a Traffic Management Plan, World Energy GH2 will communicate in advance with respect to Project activities that may limit / affect use of access roads (i.e., upgrading activities or transport of large loads or equipment). This information will be communicated through local town councils, local radio stations and social media.

<u>Health and Safety</u>

- Measures to mitigate potential impacts on the health and safety of Project personnel (including contractors and employees) and site visitors include:
  - Project personnel will conduct daily occupational health and safety meetings.
  - Occupational health and safety plans will be developed and approved, detailing appropriate operating procedures and safety provisions based on the type of machinery and materials being used, and contractors will be required to operate in compliance with these plans.
  - The Project will be compliant with the legal and statutory labour requirements, to safeguard community and worker safety and health.
  - Personnel will be required to use protective gear to guard against on-the-job injuries.
  - Only trained and/or certified persons will use specialized equipment and handle dangerous chemicals.
  - There will be appropriate supervision to prevent workers from causing harm to themselves or others on the site.
  - Hazardous products will be stored according to industrial requirements and standards and safely secured so that access is limited to authorized personnel.
  - An emergency response plan will be developed and implemented
  - 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.
  - There will be adequate security to prevent unauthorized entry into restricted Project areas.
- Measures to mitigate potential impacts to public health and safety include the following:
  - Adequate signage, fencing, guardrails, and/or warning tape will be installed so that members of the public cannot wander into restricted Project areas, and sufficient security will be in place to monitor and enforce these restrictions.
  - Safety warning signs will be strategically placed near construction works to inform the public of prohibited activities.

Table 2.13 Preliminary List of Proposed Mitigation Measures

– Potentially hazardous areas within and adjacent to the site will be left in a safe condition. – Project drivers will be cautioned to obey the speed limit and other traffic laws. – Unauthorized persons who enter the site will be escorted off the site as soon as they are discovered. – The area will be appropriately lit and the public advised on site restrictions. <u>Infrastructure and Services</u> • Traffic management measures will be put in place and consistently implemented to control on-site traffic, as well as the practices of construction drivers to and from the construction site. • Measures to mitigate potential impacts on the use of public roadways include: – Transport of material and equipment will be scheduled for off-peak hours, to the extent practical. – The use of long convoys or trucks during construction and operation will be avoided. – Flag-persons will be used where single lane traffic is created during construction. – Signs will be used to indicate construction zone and movement of trucks and equipment. – Appropriate consultation will be carried out with utility providers and operators and arrangements will be made for addressing conflicts. – As part of the Traffic Management Plan, consultation will be conducted with local police, fire and health services, as well as local municipalities to discuss proposed activities and possible implications for community services.
Measures to Mitigate Impacts on Historic Resources
Prior to the onset of construction, personnel will be made aware of potential historic resources in the area and understand their responsibility should they identify potential historic resources. In the event of an accidental discovery of historic resources during construction, the following mitigation measures will be implemented as part of the Heritage and Cultural Resources Protection Plan to mitigate the potential for adverse effects: • Unusual findings will be reported to the Site Supervisor and personnel will be instructed not to touch such findings. • Should a potential resource be identified, work will be suspended in the immediate area. • Historical features found during the use of heavy equipment will require the heavy equipment not be moved so that historical information and evidence is left intact and not further disturbed. • Historical features will be flagged to protect it from further disturbance and looting. • The Site Supervisor will contact a qualified archaeologist or historic resources professional to conduct an assessment of the site.
Operation and Maintenance
Waste Management
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities. Additional measures to be implemented during the operation and maintenance phase of the Project include: • Waste generated on-site will be removed on a regular basis and disposed of appropriately at an approved facility. • A waste inventory will be developed to support the management of general and hazardous operational waste streams.
Dust / Noise Control
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities.
Measures to Mitigate Impacts on Surface Water and Groundwater Resources
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities.

Table 2.13 Preliminary List of Proposed Mitigation Measures

Measures to Mitigate Impacts on Biophysical Resources
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities. Additional measures to be implemented during the operation and maintenance phase of the Project include: • Turbine lighting will be the minimum allowed by Transport Canada for aeronautical safety, and white or red strobe lights may be used with the minimum intensity and flashes per minute allowable. • A post-construction wildlife mortality monitoring program will be established, and carcass searches will be conducted at the turbines between April and October. Surveys will be designed to account for searcher efficiency and scavenger rates. The mortality monitoring program will be developed in consultation with the Government of NL Wildlife Division and the CWS. • An adaptive management framework will be used to introduce new mitigation measures if high fatality rates are observed. Additional mitigation may include an increase in cut-in speeds, which would be expected to reduced fatality rates.
Measures to Mitigate Impacts on Land and Resource Use
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities.
Measures to Mitigate Impacts on the Social Environment
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project operation and maintenance activities. • When operational, the Project will meet applicable national and provincial standards to protect the health and safety of workers and the surrounding communities. In addition to addressing the impacts of noise, air quality, worker health and safety, and public health and safety, a grievance redress mechanism will be developed to allow the best interests of relevant stakeholders to be considered during the Project.
Decommissioning
• Relevant construction-related mitigation measures will be implemented where applicable and as necessary during Project decommissioning activities.
Accidents and Malfunctions
• 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. • World Energy GH2 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. • Mandatory safety orientations will be provided for employees. • Emergency response plans will be developed, including 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. • Fire prevention and suppression systems will be maintained on site, including fire response equipment, fire water distribution, sprinklers, fire extinguishers and other firefighting equipment. • 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 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. • Spilled material and spent lubricants will be collected and removed from site for disposal at an approved location. • 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.

Table 2.13 Preliminary List of Proposed Mitigation Measures

Extreme Weather Events
• 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. • World Energy GH2 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 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 favourable weather conditions. • Weather forecasts will be regularly monitored. 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 identify risks (for wind events).

2.8.4 Extreme Weather Considerations

Wind power projects are vulnerable to global climate change and extreme weather, including hurricanes, cyclones, freezing rain, and thunder and lightning storms. These weather events can result in damages to existing wind farms and tower structures (Zhang et al. 2019), washouts to access roads, and damage to transmission infrastructure. Storm surges and extreme minimum temperatures could also be heightened with an increase in global temperatures and result in flooding, sea-level rise and coastal erosion.

Severe storms can occur throughout the year on the Island of Newfoundland, and can result in threats to public safety, disruptions to transportation systems, and damage to utilities and/or property. Winter storm events can consist of high winds, snow, ice, and freezing rain. During the summer and fall months, the Island may experience hurricanes and tropical storms, which can bring strong winds and heavy rains. Other forms of severe weather can develop during warmer months including thunder, lightning, hail, and occasionally tornadoes. It is expected that future climate change could result in increased temperatures, increased frequency and intensity of precipitation, an increase in the frequency and magnitude of storm events, and increased incidence of flooding and erosion in the Project area.

Potential effects of the environment on the Project have been and will continue to be considered in the Project planning, design, and operation and maintenance strategies, including the selection of materials and equipment, and design of components. These considerations will limit damage resulting from extreme weather and losses to productivity. For instance, the regional wind pattern will be considered when selecting wind turbines as blades in high wind sites and low wind sites require different designs to optimize performance. In addition, turbines will be located on land high enough to accommodate a sea-level increase. In addition to consideration of extreme weather in Project design, mitigation and management measures for extreme weather would include routine maintenance, inspections, and monitoring of Project facilities and infrastructure (Table 2.13). Maintenance and inspection serves to prevent deterioration and support Project compliance with applicable design criteria, codes and standards, as well as identifying potential problems and the need for additional mitigation measures.

One of the methods for exporting the hydrogen and ammonia will be marine vessel. Impacts associated with extreme weather events on this activity could include reduced visibility and unstable sea conditions for vessels. Extreme wind and waves have the potential to increase stress on surfaces, superstructures and vessels and disrupt scheduling of marine operations. Marine icing is an important design consideration as it can cause a significant increase in a vessel's weight and can alter its center of gravity, which in turn can impact vessel speed, maneuverability and cause problems with cargo-handling equipment (DFO 2012).

Loading of hydrogen and ammonia to marine vessels will only occur when safe to do so. Vessels will be operated by third parties and will require appropriate certification and approval in order to work in Newfoundland waters and will be equipped with obstruction lights, navigation lights, and/or foghorns. Radio communication systems will be in place to contact other marine vessels and shore base.

3.0 ALTERNATIVES TO THE PROJECT

There are a number of alternatives that have been and still are being considered with respect to this Project. One of the first alternatives considered was with respect to Project location. The site selection process is described further below. In addition, a number of alternatives are still being considered with respect to technology selection. These are also described below with preferred technology to be finalized during detailed Project design. World Energy GH2 will continue to consult with applicable regulators as the Project design progresses and will obtain required permits and approvals prior to construction.

3.1.1 Site Selection

A site selection review was conducted for the location of the wind farm. Engineers reviewed wind resources across Atlantic to determine preferred wind regimes. Two potential sites were determined to be acceptable from a wind perspective: an on-land site on the west coast of Newfoundland, and an offshore wind site near Sable Island.

The Sable Island location was reviewed at a high level for wind resource, constructability, and potential environmental concerns. The site was determined to be a robust wind resource. However, the site was determined to have interconnection, logistical and permitting challenges and was not selected at this time in favor of the western Newfoundland option.

The Port au Port Peninsula was determined to have a world class wind resource (see Section 1.4.1) that is adjacent to an ice-free deep-water port at the Port of Stephenville. The deep-water port at Stephenville also provided substantial advantages for development of the hydrogen facility including the ability to acquire an additional 360 acres of industrial land within the port site, a reliable existing supply of freshwater through the industrial water system for the former mill site, and adjacent connection to the provincial electrical grid. Based on these factors, it was determined that the location on the Port au Port Peninsula would be carried forward for the wind farm.

3.1.2 Selection of Turbines

With respect to turbine selection, a number of factors are being considered, including the turbine's power rating, height of tower, energy output, rotor diameter, cut-in wind speed, and rated wind speed. In addition, economic and schedule considerations will affect turbine selection, with the final selection being suitable to the specific site.

In general, turbine towers are becoming taller to capture more energy, since winds generally increase as altitudes increase. At higher heights above the ground, wind can flow more freely, with less friction from obstacles on the earth's surface such as trees and other vegetation, buildings, and mountains.

The overall development plan includes up to 164 turbines for wind power generation, with a likely maximum height of 200 m (hub height of 121 m, plus a rotor diameter of 158 m). It is likely that the Project will use multiple turbines with varying capacities. As described in Section 2.2.2.2, World Energy GH2 is working to finalize turbine types and is reviewing various turbine manufacturer models based on site specifics, track record and availabilities. World Energy GH2 is in discussion with the leading turbine suppliers to understand their capabilities as early as possible in order to select the most suitable type of turbine for the Project.

3.1.3 Siting of Turbines and Linear Features

A preliminary site layout has been provided in Figure 1-5. Refinement of turbine locations and routing for linear features, including access roads and transmission infrastructure, will be conducted as part of detailed Project design and in consideration of the following:

- The results of the environmental studies proposed in Appendix A
- The results of noise modelling and viewshed analysis
- Consultation with local communities and resource users
- Consultation with regulators relevant to applicable land use restrictions

Objectives of final design will be to limit new linear features and corridors where possible, avoid sensitive ecological features (such as occurrences of rare plants), and to reduce visual impacts to nearby communities.

3.1.4 Shipment of Product as Ammonia

There are several methods of hydrogen distribution that do not use intermediate processes (e.g., ammonia, methanol or liquid organic hydrogen carriers) to reach their markets (Table 3.1). Transportation of liquid or cryogenic hydrogen is still in very early stages of large-scale deployment soon, due to low levels of infrastructure available to support the supply chain. Alternatively, hydrogen can be converted to ammonia which provides an alternative liquid energy carrier with a higher degree of infrastructure readiness. The toxicity of ammonia is a consideration, although as indicated in Section 2.2.1.4, the Project will follow applicable codes and standards. Market demand ultimately motivate modes of distribution, and as indicated in Section 2.2.1.4, approximately 80% of the hydrogen produced will be used to produce ammonia for shipment.

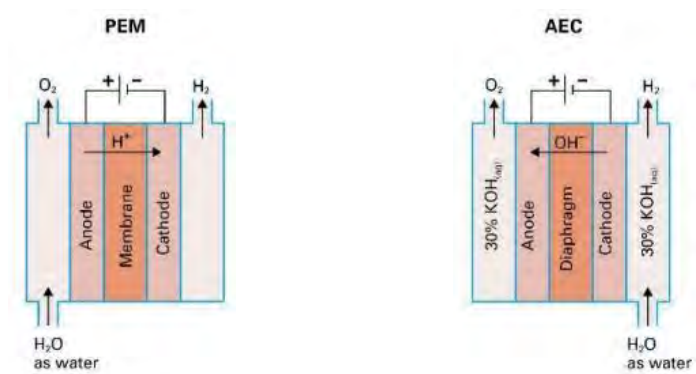
Table 3.1 Liquid Ammonia and Liquid Hydrogen Transportation Considerations

	Liquid Ammonia	Liquid Hydrogen
Temperature for transport and storage	-33.3°C	-253°C
Infrastructure readiness for large scale deployment in mid-term	High	Low
Commercialization status / References	Many commercial liquid ammonia production, distribution, and storage assets worldwide with 120 port locations able to handle ammonia	HySTRA-Hydrogen Energy Supply-chain Technology Research Association (Australia to Japan LH2 shipping)

3.1.5 Electrolyzer Technology Selection

Electrolysis of water to hydrogen is possible through a variety of electrolyzer technologies, each having technical and commercial pros and cons. The two prominent technologies applied at commercial scale are alkaline electrolysis cells (AECs) and proton exchange membrane (PEM) (Table 3.2). There are other electrolyzer technologies, such as Solid Oxide Electrolysis Cell that offer unique advantages such as operating close to atmospheric pressure, and high temperatures (~750-800°C), but these technologies are not applied to projects larger than 0.5 MW.

Table 3.2 Technical Overview of Alkaline Electrolysis Cells (AEC) and Proton Exchange Membrane (PEM)



	Proton Exchange Membrane	Alkaline Electrolysis Cell
Electrode Material	Cathode: Pt/Pd Anode: IrO2/RuO2	Cathode: Ni, Co or Fe Anode: Ni
Electrolyte	Fluoropolymer ionomer	25-30% KOH solution in water
Current Density	Up to 3 A/cm²	Up to 0.5 A/cm²
Gas Outlet Pressure	Up to 40 bar	Up to 40 bar
Cell Temperature	~60°C	~80°C
Key Attributes	More flexible Smaller footprint	Most mature Cheapest
Start/Stop Flexibility	H	L
Turndown Flexibility	H	H
Scalability	M	H

Current electrolyzer stack technologies do not offer scale as they are built up on a modular level. The largest operating single-stack is an alkaline electrolyzer with a 10 MW capacity in Fukushima, Japan. The largest electrolyzer site in the world is presently being operated by Baofeng Energy in Ningxia, China; the 150 MW alkaline electrolyzer – powered by a 200 MW solar array – is seven times larger than the previous record holder, Air Liquide's 20 MW PEM electrolyzer project in Becancour, Quebec, Canada.

Currently, pressurized alkaline battery stacks are the most selected technology for large projects. This is a proven technology with over 200 years of service and long-term reliability. PEM technology has a higher number of projects overall but to date have been typically selected for smaller plants. PEM offers higher current density, and better cold start flexibility (can start up in minutes, whereas AEC requires 1 to 2 hours). As projects are becoming larger and more complex, it is becoming evident that the proper selection of the electrolyzer technology must be applied. Technological readiness, overall power consumption (for electrolyzers and for the project as a whole), costs, equipment configuration and plot space, cooling needs, reliability, availability, and maintainability are just some criteria that require consideration. The final selection of electrolyzer technology will be made as detailed engineering and design of the Project progress.

4.0 ENVIRONMENTAL SETTING AND POTENTIAL RESOURCE CONFLICTS

The following sections provide an overview of the natural and human environments in the areas of Stephenville and the Port au Port Peninsula. Understanding the existing environment is a key component to the successful implementation of a proposed development and the management of potential environmental impacts. Appendix A outlines the comprehensive program of field studies and desktop models that are planned to be conducted in support of Project development.

4.1 PORT OF STEPHENVILLE

The Port of Stephenville is a sheltered, deep sea and ice-free port located on the north shore of St. George's Bay. It is underlain by shallow marine and non-marine sedimentary rocks of the Barachois Group comprising the Carboniferous-aged bedrock. Several surface water bodies surround Stephenville, including Mine Pond. The surface drainage in the Mine Pond area is located on the east side of the overburden aquifer where water from Mine Pond flows as a perched stream southeast down to the main highway and then through the old Abitibi plant site and discharges to the Port of Stephenville. A smaller stream is located to the west of the old Abitibi plant site and to the immediate west of the NL Hydro electrical generation station (Appendix E). Regional groundwater flows southwest to west towards Port Harmon and Inner Pond; groundwater is the source of potable water for the Town of Stephenville (Conestoga-Rovers & Associates 2009).

The mean monthly precipitation varies from 69.51 millimetres (mm) (April) to 122.37 mm (January). Stephenville had a mean yearly precipitation of 1,240.67 mm between 1942 and 2021. The snowfall component of the mean annual precipitation is 374.60 mm (equivalent rainfall), typically occurring between November and April, with the highest monthly snowfall occurring in January (101.68 cm). The annual mean temperature for the area is 4.96°C. The mean monthly temperatures were highest during July (16.19°C) and August (16.51°C) and decreased to the lowest values during February (-6.34°C). The temperature statistics indicate that the mean monthly temperature between December and March is below 0°C.

4.2 PORT AU PORT PENINSULA

The Port au Port is a subregion in the Southwestern Newfoundland Ecoregion.

4.2.1 Regional Geology

Various upland regions in the north, east, and south bound the Port au Port Peninsula, a low-lying coastal plain located within the West Coast Lowlands. The Peninsula's coastal areas are relatively even and gently sloping, with rugged with coastal cliffs and rocky beaches along the western and southern sides of the Peninsula, with elevations rising to 350 m above sea level in the White Hills area (JWEL 2008, in Stantec 2016). The Port au Port Peninsula lies within the Humber (Tectonostratigraphic) Zone (Stantec 2016). Deposits of limestone and dolostone cover most of the Peninsula and the underlying bedrock is often exposed, with shallow soil cover, resulting in limestone barrens plant communities and reduced forest growth (PAANL 2008; Stantec 2016).

4.2.2 Atmospheric Environment

The Southwestern Newfoundland Ecoregion is characterized by cool summers and snowy winters, with an average annual temperature of approximately 4°C (averaging 12°C in the summer and -3.5°C in the winter) (Stantec 2016). The Port au Port subregion is influenced by the surrounding marine environment, resulting cooler summers and warmer winters compared to other subregions (e.g., Corner Brook and St. George's Bay) within this ecoregion (PAANL 2008). Annually, 1,000 and 1,200 mm of precipitation falls in the southwestern region of Newfoundland (Stantec 2016).

According to the 2021 Ambient Air Monitoring Report (NLDECC 2022), air quality in communities across the Island of Newfoundland is generally considered to be good as ambient air quality standards are rarely exceeded for the pollutants being measured. Corner Brook is the nearest designated National Air Pollution Surveillance Network site, continually monitoring ambient levels of sulphur dioxide, nitrogen oxides, nitrogen dioxide, nitric oxide, carbon monoxide, ozone, and particulate matter (less than or equal to 2.5 microns and less than or equal to 10 microns). None of the pollutants exceeded ambient air standards in 2021, except for 10-micron particulate matter (once) and ozone (17 times) (NLDECC 2022).

Prevailing winds from the west, west-southwest, east-northeast, and east are dominant on the Port au Port Peninsula and tend to average between 10 and 30 km/hr (excluding extreme weather events) (Stantec 2016). In the summer, winds generally blow from the south and southwest in the summer and in a west to northwest direction in the winter (LGL 2007, in Stantec 2016).

The Project wind farm is planned for an area where the wind resource is particularly good. Further information on the assessment of the wind resource is provided in Section 2.2.2.1.

4.2.3 Acoustic Environment

In rural areas the acoustic environment is dominated by the sound of nature - wildlife sounds (e.g., bird calls), wind through trees, and the sound of running water in the vicinity of streams. In the Port au Port Peninsula, ocean waves on the shore would also contribute to the natural acoustic environment. Anthropogenic sound (including industry) on the Peninsula, although limited, would also contribute to the acoustic environment. Wind farms can increase the ambient noise in the area during construction, operation and decommissioning. Vibration is not anticipated to be a concern from wind farm operation, and as such, vibration modelling should not be required.

4.2.4 Water Resources and Fish and Fish Habitat

The following sections provide an overview of groundwater and surface water resources and fish and fish habitat on the Peninsula. Project activities, particularly during construction, have the potential to interact with water resources, resulting in a potential change in groundwater quality and quantity, surface water quality and quantity or harmful alteration, disruption of destruction of fish habitat. Given the nature of planned activities associated with the construction and operation of the wind farm, it is anticipated that potential adverse effects could be addressed through standard mitigation measures, some of which have been identified in Section 2.8.2.

4.2.4.1 Groundwater Resources

Two groundwater supplies (Lower Cove and Sheaves Cove) and a number of private dug and drilled water wells are present on the Peninsula. Given the predominance of limestone, groundwater can be classified as a calcium-bicarbonate type water. The karstic nature of this underlying carbonate bedrock contributes to a large range in the depth to water table (measured from approximately 5 m to greater than 90 m below ground surface in a number of wells) (Stantec 2016).

4.2.4.2 Surface Water Resources

Surface water is represented by numerous ponds, as well as several unnamed small tributary streams and brooks. Surface water serves as municipal water supply for several communities on the peninsula, including Victors Brook, Port au Port West / Aguathuna / Felix Cove, Cape St. George, Mainland, and Piccadilly Head, Sheaves Cove (Stantec 2016). The quality of surface water supplies on the Port au Port Peninsula is generally considered good to excellent and is moderate to very hard, basic, and of moderate alkalinity (JWEL 2008, in Stantec 2016). Domestic water supply areas are indicated in Figure 4-1, showing the protected surface water legal boundary that closely represents all or part of the catchment area for a water supply.

Figure 4-1 Domestic Water Supply Areas

4.2.4.3 Fish and Fish Habitat

Fish and fish habitat on the Port au Port Peninsula is associated with some of the 59 identified watersheds on the Peninsula including several first order streams that do not have direct inflow from streams or rivers. As their water source is intermittent due to inflow from drainage of marshes or bogs or groundwater, many of these watersheds do not contain fish or provide suitable fish habitat (LGL 2007, in Stantec 2016).

4.2.5 Terrestrial Environment

4.2.5.1 Vegetation

The Port au Port subregion is dominated by wind-exposed limestone barrens, bedrock and shallow soils. These have restricted vegetation that have adapted to shallow soil conditions and can survive on the limestone barrens, such as mosses, shrubs, and other calciphile plants (PAANL 2008). The forest floor on the Peninsula has a covering of mosses and light ferns. Balsam fir (*Abies balsamea*), typically restricted to rocky slope areas, is the predominant forest cover on the Peninsula, with black spruce (*Picea mariana*) sparsely located in poorly drained areas or areas with exposed bedrock. Yellow birch (*Betula alleghaniensis*), at its northern limits, has also been known to exist in some parts of the Peninsula (PAANL 2008). A total of 3337 plants have been recorded within the area of interest (ACCDC 2022).

The Port au Port subregion is home to several sensitive plant species in the province. Sensitive plant species that have been recorded on the Port au Port Peninsula (Stantec 2016; ACCDC 2022) include:

- Lindley's aster (*Symphyotrichum ciliolatum*) – S2 / may be at risk;
- Mackenzie's sweetvetch (*Hedysarum boreale* subsp. *mackenziei*) - S1 / may be at risk;
- Crantz's cinquefoil (*Potentilla crantzii*) - S2S3 / may be at risk; and
- Dwarf tansy (*Tanacetum bipinnatum* subsp. *huronense*) - S3 / sensitive.
- Western thread-leaf pondweed (*Stuckenia filiformis* subsp. *occidentalis*) - S2; may be at risk;
- Broad-fruit bur reed (*Sparganium eurycarpum*); S2 / may be at risk;
- Northern holly fern (*Polystichum lonchitis*); S3 / may be at risk;
- Pulvinate pussytoes (*Antennaria rosea* subsp. *pulvinata*) - S3S4 / unranked;
- Drooping bluegrass (*Poa saltuensis*) - S3S4 / sensitive; and
- Limestone oak fern (*Gymnocarpium robertianum*) - S3; sensitive.
- Rock dwelling Sedge (*Carex petricosa* var. *misandroides*) - S1; may be at risk
- Wooly arnica (*Arnica angustifolia* subsp. *Tomentosa*) – S1S2; may be at risk

From the 3337 plants recorded, 1437 of the records were for rare species. Of these, 415 were for Lindley's aster (found in the Stephenville-St. George's Bay area in addition to a broad locality on the central portion of the Port au Port Peninsula), 183 records were for Mackenzie's sweetvetch (found only at two sites separated by about 7 km on the west coast of the Port au Port Peninsula), and one record for Rock dwelling Sedge and Wooly arnica. These are the only plant species listed as endangered under the Newfoundland and Labrador *Endangered Species Act* (NL ESA) (NLDFFA n.d.; ACCDC 2022). While not observed, at-risk Boreal felt lichen may be present in the area of interest but is unlikely to occur (ACCDC 2022). Figure 4-2 indicates the locations of rare fauna and rare flora based on data provided by the Atlantic Canada Conservation Data Centre (AC CDC).

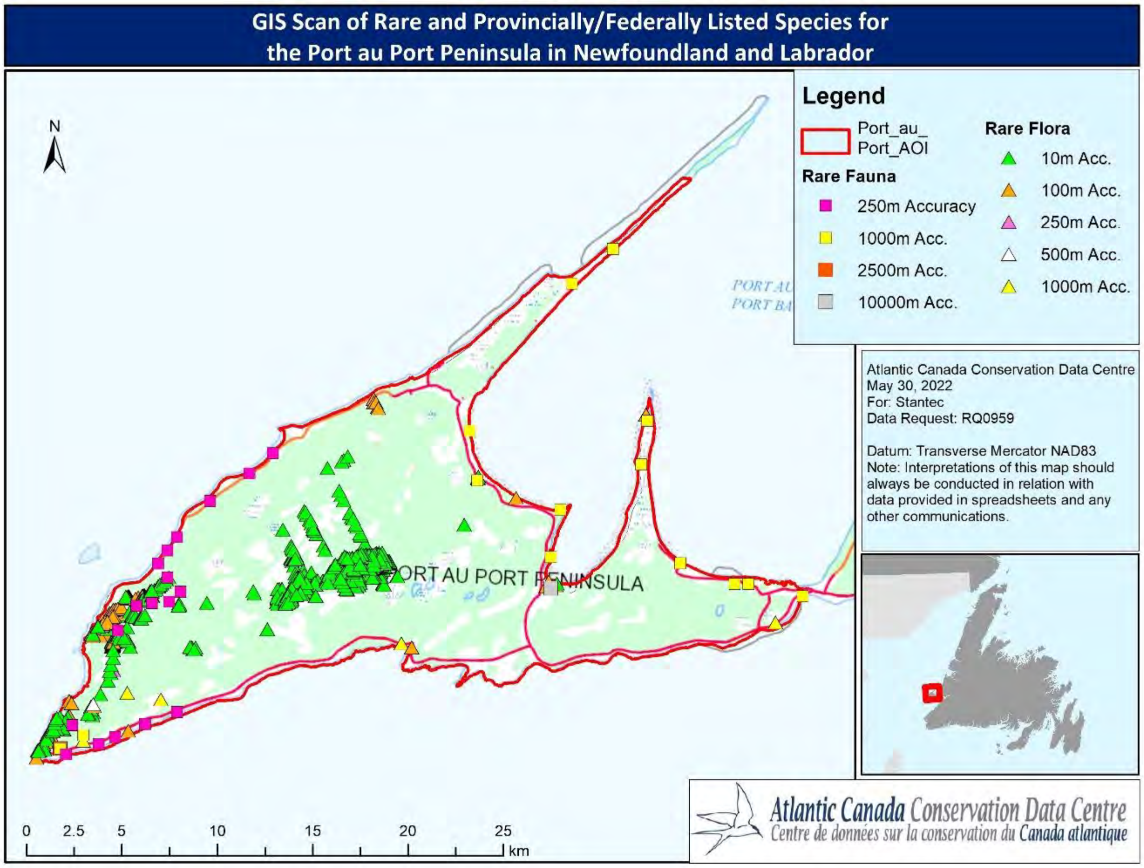


Figure 4-2 GIS Scan of Rare and Provincially / Federally Listed Species (ACCDC 2022)

Sensitive areas known to have rare plants are indicated in Figure 4-3 as designated by Wildlife Division; surface level restrictions may apply to development in these areas. Section 2.1.3 provides figures indicating the overlap of Project features with these areas.

Project construction could affect rare plants through direct or indirect disturbance / loss or a change in species or community diversity. As indicated in Appendix A, rare plant surveys will be undertaken prior to construction. Should rare plants be identified within the planned Project footprint, mitigation measures would be discussed with Wildlife Division. The mitigation measures could include relocation of Project components (refinement of turbine locations) and/or seed collection or transplant of the plant conducted in consultation with the applicable regulators.

Figure 4-3 Sensitive Rare Plant Areas

4.2.5.2 Wetlands

Wetlands occur throughout the Port au Port Peninsula. Atlantic plateau bogs occur on the coastal lowlands on the surface raised above the surrounding terrain, often consisting of large, scattered pools. Slope fens occur in forested areas and are meadow-like pools of nutrient-rich waters from seepages developed on poorly draining land (LGL 2007, in Stantec 2016).

Project construction could result in a change in wetland function (either through direct disturbance or changes in hydrology). Prior to construction, wetlands will be delineated as indicated in Appendix A. Standard construction mitigation (Section 2.8.3) will be in place to reduce potential impacts on wetlands identified in the area.

4.2.5.3 Sensitive Areas

In addition to the sensitive areas identified as rare plant habitat (Figure 4-3), the Cape St. George Transitional Reserve is located on the Port au Port Peninsula (Figure 4-4) and incorporates two of the rare plant sensitive areas identified in Figure 4-4. This proposed transitional reserve is 18 km² in size and is located at the southwestern tip of the Port au Port Peninsula. It is considered an extremely important limestone barrens site. Three endangered plant species (Mackenzie's sweetvetch, Rock-dwelling sedge, and Wooly Arnica) are found within the area, along with 20 other rare species. The proposed reserve also provides habitat to several colonies of Black-legged kittiwakes (WERAC 2020).

Figure 4-4 Cape St. George Transitional Reserve

This natural area is in the process to becoming a Wilderness Reserve; no Crown lands applications are accepted, and no development is permitted or approved within the defined area. The designation does allow petroleum exploration to continue for a period of 10 years, after which the area is intended to be protected as an ecological reserve (WERAC 2020). World Energy GH2 will work with Wildlife Division to manage Project interactions with the Transitional Reserve.

The potential effects of the Project on sensitive areas would be similar to the effects identified above for the terrestrial environment. World Energy GH2 will develop the Project in compliance with land-use restrictions identified by applicable regulators and work with the province on potential enhancements and offsetting initiatives either in the vicinity of the Project or elsewhere in the province.

4.2.5.4 Avifauna

Warbler species such as blackpoll (*Setophaga striata*), and black and white (*Mniotilta varia*) and yellow (*Setophaga petechia*) warblers are known to occur in forested areas of the Peninsula. Song (*Melospiza melodia*) and savannah (*Passerculus sandwichensis*) sparrows, mourning warblers (*Geothlypis philadelphia*), and northern flickers (*Colaptes auratus*) can be found in marshes and shrublands. Shorebirds such as ruddy turnstone (*Arenaria interpres*), semipalmated sandpiper (*Calidris pusilla*), and killdeer (*Charadrius vociferus*) use the sandy and coastal areas around the Peninsula as a stopover point during their annual migration patterns (LGL 2007, in Stantec 2016; PAANL 2008).

There are a total of 919 animal records within the area of interest (and a 5 km buffer), where 51 of these records are for rare species (ACCDC 2022). Of these, four were for Harlequin duck (*Histrionicus histrionicus*), three for Peregrine falcon (*Falco peregrinus*; both are Special Concern under Committee on the Status of Endangered Wildlife in Canada [COSEWIC], Vulnerable under the NL ESA*),* one for Common nighthawk (*Chordeiles minor*), two for Olive-sided flycatcher (*Contopus cooperi*; both are Special Concern under COSEWIC, Threatened under NL ESA), four for Bank swallow (*Riparia riparia;* threatened under COSEWIC), and seven records for Gray-cheeked thrush (*Catharus minimus*; Threatened under NL ESA).

While no sightings have been observed, at-risk Red Crossbills (*Loxia curvirostra*), Rusty blackbirds (*Euphagus carolinus*) may be possible throughout the area of interest. Ivory gulls (*Pagophila eburnea*) may also be present but is unlikely to occur. Barrow's Goldeneyes (*Bucephala islandica*) are possible in surrounding oceanic waters (ACCDC 2022).

Operating wind farms are known to have potential negative effects on avifauna, including direct and indirect habitat loss (e.g., through visual and noise impacts), as well as potential mortality due to collision. The pattern and scale of disturbance depends on the species, life cycle stage, availability of alternate habitats, as well as siting of the wind turbines with respect to important habitat areas. Avifauna surveys will be conducted prior to construction as described in Appendix A. Mitigation will be undertaken to reduce impacts of the Project on avifauna and will be developed in consultation with CWS and the provincial Wildlife Division (refer to Section 2.8.2 for additional information).

4.2.5.5 Bats

Little brown bat (*Myotis lucifugus*) can occur on the Port au Port Peninsula (PAANL 2008). The little brown bat is listed as Endangered under the federal SARA and ECCC issued a recovery strategy for this bat. The primary threat to the little brown bat is white-nose syndrome; other threats include residential and commercial development, energy production and mining, biological resource use, human intrusions and disturbance, natural system modifications and pollution. The only proposed critical habitat on the Island of Newfoundland is in the White Bay area (Baie Verte – Northern Peninsulas) (ECCC 2018).

Operating wind farms are known to have potential negative effects on bats, including direct and indirect habitat loss (e.g., through visual and noise impacts), as well as potential mortality due to collision. The pattern and scale of disturbance depends on the species, life cycle stage, availability of alternate habitats, as well as siting of the wind turbines with respect to important habitat areas. Baseline surveys for bats will be undertaken prior to construction as described in Appendix A. As with avifauna, we will work with provincial Wildlife Division to develop mitigation measures to reduce potential Project impacts on bats.

4.2.5.6 Mammals

In addition to bats, discussed above, a variety of mammals can occur on the Port au Port Peninsula, including snowshoe hare (*Lepus americanus*), fox (*Vulpes vulpes*), moose (*Alces alces*), black bears (*Ursus americanus*), lynx (*Lynx canadensis*), beaver (*Castor canadensis*), mink (*Mustela vison*), and muskrat (*Ondatra zibethicus*), red squirrels (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), and masked (or common) shrew (*Sorex cinereus*) (LGL 2007, in Stantec 2016; PAANL 2008).

While no sightings have been observed, it is possible that the at-risk Newfoundland Marten (*Martes americana atrata*) may be found in the area of interest but is unlikely to occur (ACCDC 2022).

Project construction would result in alteration or loss of habitat (through site clearing and sensory disturbance), as well as an increased risk or mortality (associated primarily with Project-related vehicle traffic). Sensory disturbance would continue through Project operation and maintenance. None of the species listed above (with the exception of Newfoundland Marten) are considered SAR or SOCC.

4.3 HUMAN ENVIRONMENT

4.3.1 Demographics

Table 4.1 summarizes population and labour force characteristics for the total and Indigenous populations of Port au Port Peninsula, Stephenville, and NL. The total population of Port au Port Peninsula in 2021 was 4,734 (51.8% female and 48.2% male), a 4.6% decrease since 2016 (Table 4.1). Stephenville's population was 6,540 (50.5% female and 49.4% male) in 2021, a 1.3% decrease since 2016. The Indigenous population of Port au Port Peninsula and Stephenville accounted for 47.1% and 33.0% of their total populations respectively, compared to the provincial average of 9.0% (Table 4.1).

Table 4.1 Demographic and Labour Force Characteristics

Geography	Total Population 2021	Total Population 2016	Change in Population (%) 2016 – 2021	Labour Force 2016	Participation Rate (%) 2016	Employment Rate (%) 2016	Unemployment Rate (%) 2016
Total Population							
Port au Port Peninsula	4,374	4,584	-4.6	1,680	42.4	28.4	33.5
Stephenville	6,540	6,623	-1.3	2,765	52.8	40.1	24.2
Newfoundland and Labrador	510,550	519,716	-1.8	256,855	58.7	49.5	15.6
Indigenous Population							
Port au Port Peninsula	2,060	2,080	-1.0	840	46.9	31.7	35.2
Stephenville	2,155	2,205	-2.3	940	52.4	41.8	21.3
Newfoundland and Labrador	45,730	35,800	0.3	22,055	60.8	47.8	21.4

Source: Statistics Canada 2017, 2022

Note: The Port au Port Peninsula includes Census Subdivision 4D, 4E, Lourdes, Cape St. George, and Port au Port West- Aguathuna-Felix Cove

Note: Due to data or confidentiality reasons, labour force data for Port au Port West-Aguathuna-Felix Cove has been suppressed and is unavailable to the public.

Note: Numbers are rounded by Statistics Canada and are reported herein exactly as they are reported by Statistics Canada. Totals may not necessarily add up as a result of rounding.

4.3.2 Economic and Labour Force Characteristics

Historically, the economy of western Newfoundland was built on natural resource-based industries particularly fishing and mining. As of 2010, commercial fisheries were the most important economic base for most small communities within the area (Intervale Associates, Inc. 2010). Several mine and quarry sites located in the area contributed to its development, including Atlantic Minerals Limited's mine site, processing facilities and marine terminal on the Port au Port Peninsula, and gypsum and salt operations in the Bay St. George's area.

In 2016, the labour force participation rate on the Port au Port Peninsula was 42.4%, substantially lower than the provincial participation rate of 52.8% (Statistics Canada 2017). The total unemployment rate for the Port au Port Peninsula in 2016 was 33.5% and the unemployment rate of the Indigenous population was 35.2%. The male unemployment rate was higher than both the total and Indigenous unemployment rate at 41.2% (Statistics Canada, 2017). The female unemployment rate was lower than the total and Indigenous unemployment rates at 17.8% (Statistics Canada, 2017).

In 2015, the mean total income in Port au Port Peninsula was $30,909. For men, the mean total income was $38,940 and for women it was $22,580. Among the Indigenous population in the Area, the mean total income was $31,716, with Indigenous men averaging $38,842 and Indigenous women averaging $23,988 (Statistics Canada 2017, 2018).

In 2016, trades; transport and equipment operators and related occupations and sales and service occupations were the two main sources of employment in Port au Port Peninsula. Trades; transport and equipment operators and related occupations accounted for approximately 27.5% of employment on the Peninsula with 91.0% of these positions held by males. Sales and service occupations accounted for approximately 19.8% with 78.1% of these positions held by females.

Stephenville is one of the largest communities within western NL. Changes in the economic activities in Stephenville affects the region of western NL because it acts as a service hub for several communities within the area. In 2019, Stephenville developed a Strategic Community Economic Plan integrated with steps for regional collaboration. The collaborative strategies included a tourism plan with the Port au Port Peninsula (Conach Consulting, 2019).

Some parts of western Newfoundland, including the Port au Port Peninsula, have experienced an ageing population, high unemployment, and low participation rates relative to other areas of the province. Due to a lack of education opportunities, a large majority of Port au Port's young adults are leaving the area for post-secondary studies, and many are not returning. For those who do return, they often become part of the 'fly in-fly out' community, travelling back and forth between the Peninsula and other areas such as St. John's and Alberta for work.

In 2016, Stephenville had a total labour force of 2,765, of whom 48.6% were male and 51.5% were female. Indigenous persons comprised 34.0% of Stephenville's total labour force. The total unemployment rate for Stephenville was 24.2% and the unemployment rate of the Indigenous population was 21.3%. The male unemployment rate (24.2%) (Statistics Canada, 2017) was the same as the total unemployment rate and higher than the Indigenous unemployment rate of 21.3%. The female unemployment rate was lower than the total and indigenous unemployment rates at 12.6% (Statistics Canada, 2017).

In 2015, the mean total income in Stephenville 2015 was $35,398. For men, the mean total income was $42,127 and for women it was $29,677. Among the Indigenous population in the Area, the mean total income was $33,164, with Indigenous men averaging $38,375 and Indigenous women averaging $29,083 (Statistics Canada 2017, 2018).

In 2016, trades; transport and equipment operators and related occupations and sales and service occupations were the two main sources of employment in Stephenville. 26.5% of Stephenville’s labour force was employed in sales and service occupations, with 77.8% of these positions held by women. 29.7% of Stephenville’s labour force were employed in trades, transport, equipment operators and related industries with the entirety (100%) of positions being occupied by men. Most occupations among the Indigenous population were also in sales and service, and trades, transport, equipment operators and related (18.9% and 30.9%, respectively).

Project activities have the potential to both beneficially and adversely affect the regional labour force and the local economy. Positive effects stem from increased local employment, increased business revenue, which can support capital investment and hiring (indirect employment), resulting in increased capabilities and capacity among local businesses. Spending of income by direct and indirect workers further contributes to beneficial effects on local businesses, primarily within the service sector, resulting in induced employment effects. Adverse effects may stem from losses in local employment due to decreased labour demand as the Project transitions into the operations phase and from anticipated upward pressure on wages and increased difficulty of local employers to recruit or retain workers who may be qualified for employment with the Project. Standard mitigation measures will be in place to reduce potential impacts to employment and economy.

4.3.3 Community Infrastructure

Health care in Stephenville and on the Port au Port Peninsula is managed by Western Health, which offers acute, long-term care, and community-based services throughout the province’s Western Region. Sir Thomas Roddick Hospital in Stephenville has 44 beds and provides the essential health care services for the Area. In addition to the hospital, there are seven rural medical clinics in Bay St. George (Western Health 2016).

There is an RCMP detachment in Stephenville with 20 officers. Stephenville has a fire department eight full-time firefighters, a fire chief, and a deputy fire chief. The fire department also has an agreement with Kippens, which has a staff of about 20 firefighters (Rose, pers. comm.).

The Port of Stephenville services international and national ships, fishing, aggregate, container, and special freight. It operates year-round and is a sheltered, deep sea and ice-free port. The Port can accommodate ships up to 385 m in length. Stephenville is 200 km from the Marine Atlantic Terminal at Port aux Basques, which is the terminal for passengers and motor vehicles en route from North Sydney, Nova Scotia and other mainland points. The Marine Atlantic ferry is the only shipping service operating from the harbour, with the Canadian Coast Guard, oil tankers, cruise ships, and other occasional shipping companies also using it.

The Stephenville Airport Corporation owns and administers the Stephenville International Airport. Stephenville Regional Airport received $1 million in upgrades to its instrument landing system, allowing it to remain an emergency or alternate landing site for transatlantic flights (Moore 2018). A proposal is in review for the sale of the Stephenville International Airport to Ottawa-based Dymond Group (Wreckhouse Press 2021). As indicated in Section 1.6, there are navigation aids (a VOR and DME) associated with the Stephenville airport and collocated approximately 8 km of Stephenville, which could require NAV Canada to conduct an air navigation degradation study for the proposed windfarm. It is also understood, however, that the Stephenville VOR and the Stephenville (Harmon) NDB to be decommissioned in July 2022 as part of the National – NAVAID Modernization Program Phase 8 (NAV Canada, n.d.). World Energy GH2 will consult with NAV Canada as part of the detailed design process to confirm that turbine siting is appropriate and to receive required approvals.

Waste management in Stephenville and on the Port au Port Peninsula is the responsibility of Western Regional Waste Management. Garbage is transferred from communities in the area to the Bay St. George Waste Disposal Site (Western Region Waste Management 2016). Garbage is collected from the waste disposal site and trucked to a landfill in Corner Brook.

Project activities can both beneficially and adversely affect community services and infrastructure. Positive effects stem from employment and economy benefits which results in increased capabilities and capacity among local businesses. Adverse effects may result if the Project activities and the non-local labour force place additional demands on community services and infrastructure, including housing, health and emergency services and infrastructure, utilities, as well as education, recreation, and transportation infrastructure. Standard mitigation measures will be in place to reduce potential impacts to community infrastructure.

4.3.4 Land and Resource Use

The Project is located on the Port au Port Peninsula, in a rural region, with approximately 20 insular communities. Nearby communities have been shaped primarily by natural resource-based industries including fishing, mineral extraction and some forestry. Commercial fishing remains the main economic base for many communities within the Port au port Peninsula and nearby Bay St. George. Due to its geological composition and setting, much of the interior of the Peninsula has been staked for mineral claims by mineral exploration and quarrying companies. The high concentrations of dolomitic and limestone deposits on the interior make this the primary activity in that area. There is a history of quarry operations on the peninsula for these high-calcium limestone and dolomite products. Atlantic Minerals Limited has been operating the Lower Cove Quarry since 1988 and is operating in the area. Minor agricultural activity is undertaken on the Port au Port Peninsula (LGL 2007). Stephenville and the Port au Port Peninsula are within Forest Management District 14, which is comprised predominantly of black spruce, balsam fir, and eastern larch, with stands occurring in sheltered valleys. Forest Management District 14 is part of Planning Zone 6. The current five-year management plan for Planning Zone 6 was scheduled from 2019 to 2023 and spearheaded by two proponents: NLDFFA and Corner Brook Pulp and Paper Limited (NLDECC 2021).

A variety of recreational land use activities are likely to occur within the natural areas of the peninsula, including hunting fishing, backcountry camping, hiking, snowmobiling, and ATV use. Walk-A-Ways Trail Network is composed of six gravel and sidewalk trails throughout Stephenville which extend 16.5 km. There are no federal or provincial parks on the Port au Port Peninsula. Due to its geological composition and setting, much of the interior of the Peninsula has been staked for mineral claims by mineral exploration and quarrying companies. The high concentrations of dolomitic and limestone deposits on the interior make this the primary activity in that area. The province's wildlife resources are an important component of NL's heritage and culture. Hunting is a highly valued recreational activity in NL for both residents and non-residents, providing subsistence as well as economic opportunities. The Port au Port Peninsula represents Moose and Black Bear Management Area #43. The hunting season for moose is from September 10 through December 10 each year. There is no caribou management area on the Port au Port Peninsula (LGL 2007).

As described in the sections above, the area on the Port au Port Peninsula is used primarily for recreational activities, as well as some commercial activity. Nearby communities have been shaped primarily by natural resource-based industries including fishing, mineral extraction and some forestry. Commercial fishing remains the main economic base for many communities within the Port au Port Peninsula and nearby Bay St. George. The area is dominated by wind-exposed limestone barrens, bedrock and shallow soils and areas along the coast have been cleared for subsistence farming. The high concentrations of dolomitic and limestone deposits on the interior make this the primary activity in that area. There is a history of quarry operations on the peninsula for these high-calcium limestone and dolomite products. The existing Lower Cove quarry operation is the primary resource development activity on the Peninsula. Atlantic Minerals Limited has been operating the Lower Cove Quarry since 1988. Resource conflicts on the peninsula are anticipated to be limited. Project footprint and disturbed areas will be limited to the extent practicable.

4.3.5 Indigenous Peoples

There are two Indigenous groups with the potential to be affected by Project activities, Qalipu and MFN. Further information on these groups is provided in the following sections. Project activities can affect activities, sites and resources identified as important by the Indigenous groups, as well as potential quality of life and socio-economic effects. This includes effects on Indigenous health and socio-economic conditions, Indigenous physical and cultural heritage and current use of lands and resources for traditional purposes. Standard mitigation measures will be in place to reduce potential impacts to Indigenous people, including ongoing communication and engagement with affected Indigenous groups.

4.3.5.1 Qalipu First Nation

Qalipu was established in 2011 as an Indigenous Band under the federal *Indian Act* and consists of approximately 22,000 members, including the nine Mi'kmaq Nations formerly represented by the Federation of Newfoundland Indians (Qalipu n.d.; 2021). While Qalipu does not currently manage reserve lands, members reside within 67 communities across the island.

Qalipu was officially formed on September 26, 2011, with its members being recognized as status Indians under the *Indian Act.* The Nation's governance structure includes an elected Chief and Council, nine electoral ward councillors, and two Vice-Chiefs representing western and central Newfoundland. To represent their members, Qalipu Council maintains a central administrative office in Corner Brook and four satellite offices in Glenwood, Grand-Falls Windsor, St. George's, and Stephenville (Qalipu n.d.).

The Mi'kmaq of Newfoundland, including Qalipu, continue to harvest traditional resources for subsistence, recreational, and food social ceremonial purposes. Contemporary land and resource management is undertaken by the Qalipu Natural Resource Division, who conduct research and monitoring on several species important to the community including the woodland caribou (*Rangifer tarandus)*, Arctic hare

(*Lepus arcticus)*, American eel (*Anguilla rostratea)*, glass eel (*Angulla)*, eelgrass (*Zostera marina)*, Atlantic salmon (*Salmo salar)*, European green crab (*Carnicus maenas)*, and the golden star tunicate (*Botryllus schlosseri)* (Qalipu n.d.).

4.3.5.2 Miawpukek First Nation

Members of MFN, also known as Conne River, have lived in the region continuously since the community became a permanent camp site around 1822. Prior to that time, it was one of many semi-permanent locations used by Mi'kmaq people as they seasonally travelled through the region (MFN n.d.). According to oral histories, the MFN reserve was unofficially established in 1870. However, it wasn't until 1976 that the Federation of Newfoundland Indians, an aggregate group representing several Indigenous groups, including the MFN, asserted a claim of Aboriginal rights and title to the land and resources of southern and central Newfoundland. In 1987, the MFN Reserve was officially designated under the *Indian Act* as the Samiajij Miawpukek Indian Reserve. The community is currently governed by a Chief and Council governance structure constituted under custom election provisions of the *Indian Act* and while land claims put forth in 1976 have not been accepted for negotiation by either the federal or provincial government, self-government framework agreements were negotiated in 2004 and signed in 2005 (Crown-Indigenous Relations and Northern Affairs Canada n.d.; Indigenous and Northern Affairs Canada [INAC] 2006).

MFN is accessible year-round by road from the Trans-Canada Highway, as well as by water through the Bay d'Espoir fjord (MFN n.d.). The 2,839-ha reserve is located at the mouth of the Conne River on the south coast of the Island of Newfoundland approximately 168 km southwest of Grand Falls / Windsor Newfoundland (Chan et al. 2017; INAC 2019). As of 2019, the total registered membership of the MFN was 3,056 with 818 members living on reserve (INAC 2019). Demographically, the MFN is relatively young, with 34% of residents under the age of 25 (Michelin 2019) and approximately 540 members being of voting age (MFN n.d.; INAC 2019; Michelin 2019).

MFN harvest resources from the land and sea extensively on the Island of Newfoundland following the principle of Netukulimk (MFN n.d.). 'Netukulimk' is the use of resources to support the nutrition and economic well-being of an individual and community without jeopardizing the integrity, diversity, or productivity of the environment (Unama'ki Institute. of Natural Resources n.d.). Commonly consumed traditional foods by MFN members include moose, caribou, beaver, rabbits (*Oryctolagus cuniculus)*, muskrats (*Ondatra zibethicus)*, grouse (*Tetraonini)*, geese (*Branta canadensis)*, ducks (*Anas)*, blueberry (*Canococcus)*, raspberries (*Rubus idaeus)*, Newfoundland tea berries (*Gaultheria)*, partridge berries (*Mitchella repens)*, and bakeapples (*Rubus chamaemorus)* (Marathon Gold 2020).

4.3.6 Historic Resources

Evidence of early European, Palaeoeskimo, and Recent Indian presence on the Port au Port Peninsula has been recorded at multiple archaeological sites located along the coast, as well as on an island off the west coast of the Peninsula (JWEL 2006, in Stantec 2016; LGL 2007, in Stantec 2016).

Heritage resources could be affected during Project construction activities that result in ground disturbance. Prior to construction, a desktop review will be conducted, followed by an archaeological reconnaissance of the study area as described in Appendix A. Appropriate mitigation measures will be taken to reduce the impact of an accidental discovery of a historic resource during construction or operation, wherever feasible.

Prior to the onset of construction, personnel will be made aware of potential historic resources in the area and understand their responsibility should they identify potential historic resources. In the event of an accidental discovery of historic resources during construction, the following mitigation measures will be implemented:

- Unusual findings will be reported to the Site Supervisor and personnel will be instructed not to touch such findings.
- Should a potential resource be identified, work will be suspended in the immediate area.
- Historical features found during the use of heavy equipment will require the heavy equipment not be moved so that historical information and evidence is left intact and not further disturbed.
- Historical features will be flagged to protect it from further disturbance and looting.
- The Site Supervisor will contact a qualified archaeologist or historic resources professional to conduct an assessment of the site.

The above procedures to be followed in the event of an accidental discovery will also be outlined in the Heritage and Cultural Resources Protection Plan included in the EPP.

4.4 SUMMARY OF ENVIRONMENTAL INTERACTIONS AND RESOURCE CONFLICTS

Potential Project interactions with Valued Components (VCs) are presented in Table 4.2. The interactions were identified based on professional judgment and a preliminary knowledge of the Project and the environmental characteristics of the Port au Port Peninsula and surrounding areas. These considerations contributed to the determination of the VCs. This analysis will be further developed as the Project progresses and will feed into the overall risk management planning.

Project activities can change land use, resource use and recreational activities, including restricted access to, or loss of areas used for resource activity and/or recreational use. Informal recreational activities, including recreational hiking, snowmobiling, ATV use, hunting, trapping, and fishing could be affected by Project construction activities. Resource and recreational users may consequently be displaced to other nearby areas, increasing competition for resource and recreational uses. Land and resource users could also be affected by a change in the visual landscape. As shown in Appendix C, visual simulations were developed to represent the wind turbines in place across the Project and to illustrate their visibility from various publicly accessible vantage points. A further viewshed analysis (Appendix A) will be conducted prior to construction. Standard mitigation measures will be in place to reduce potential impacts to land and resource use, including ongoing communication with affected land users.

Prior to construction, an environmental effects monitoring program will be developed in consultation with regulators and will at a minimum include programs for noise, avifauna, bats and rare plants. Environmental compliance monitoring would also be required in relation to the hydrogen / ammonia facility.

Table 4.1 Project Activities and Potential Interactions with Valued Components

Project Activities	Atmospheric Environment (including Acoustic Environment)	Water Resources (Groundwater and Surface Water)	Fish and Fish Habitat	Vegetation and Wetlands (including rare plants)	Avifauna (including SAR)	Bats	Other Wildlife (including SAR)	Employment, Economy and Business	Community Health and Infrastructure	Land and Resource Use (including viewscapes)	Indigenous Peoples	Historic Resources
Construction												
Site Preparation (clearing and grubbing)	●	●	●	●	●	●	●			●	●	●
Roadbed Preparation (including installation of bridges and culverts)	●	●	●	●	●	●	●			●	●	●
Foundation Installation (including blasting)	●			●	●	●	●			●	●	●
Substation Construction	●			●	●	●	●			●	●	
Turbine Installation	●				●	●	●			●	●	
Transmission Line Construction	●	●	●	●	●	●	●			●	●	●
Installation and Operation of the Temporary Workforce Accommodations	●	●	●	●	●	●	●		●	●	●	●
Project-related Traffic	●				●	●	●		●	●	●	
Employment and Expenditures								●	●	●	●	
Operation and Maintenance												
Turbine Operation	●				●	●	●			●	●	
Road and Infrastructure Maintenance	●	●	●		●	●	●		●	●	●	
Hydrogen Plant Operation	●				●	●	●			●	●	
Transmission Line Operation and Maintenance	●				●	●	●		●	●	●	

Table 4.1 Project Activities and Potential Interactions with Valued Components

Project Activities	Atmospheric Environment (including Acoustic Environment)	Water Resources (Groundwater and Surface Water)	Fish and Fish Habitat	Vegetation and Wetlands (including rare plants)	Avifauna (including SAR)	Bats	Other Wildlife (including SAR)	Employment, Economy and Business	Community Health and Infrastructure	Land and Resource Use (including viewscapes)	Indigenous Peoples	Historic Resources
Ammonia Transportation	●				●	●	●		●	●	●	
Project-related Traffic	●				●	●	●		●	●	●	
Employment and Expenditures								●	●	●	●	
Decommissioning												
Dismantling and Removal of Infrastructure and Facilities	●	●	●	●	●	●	●			●	●	
Site Rehabilitation	●	●	●	●	●	●	●			●	●	
Project-related Traffic	●			●	●	●	●		●	●	●	
Employment and Expenditures								●	●	●	●	
Accidents and Malfunctions												
Spills (ammonia or other hazardous materials)	●	●	●	●	●	●	●	●		●	●	●
Erosion and Sediment Control Failures		●	●	●			●	●		●	●	●
Explosion / Fire	●	●	●	●	●	●	●	●	●	●	●	●
Turbine Failure	●	●	●	●	●	●	●	●		●	●	

5.0 CONSULTATION AND ENGAGEMENT

We are committed to involving local stakeholders, and Indigenous communities, in the Project. We have well-established and effective communication and cooperation processes in place with relevant Indigenous governments and organizations, local communities, and other interested groups and individuals.

Various meetings and discussions have been held to understand inhabitants' and local industries' concerns. A summary of engagement activities conducted to date is provided in Table 5.1. We have gained broad support from municipal leadership who are very knowledgeable of the local environment, economy, and politics. Letters of support from several municipalities have been received and are provided in Appendix B. In particular, and as noted in Section 1.1, two Newfoundland-based First Nations communities have been identified with potential interest in the Project, MFN and the Qalipu. The Qalipu have expressed their support for the Project (Appendix B), and we are committed to involving them and working collaboratively throughout the process.

Table 5.1 Summary of Engagement Activities

Date / Location	Indigenous Group or Stakeholder	Purpose and Focus
March 28, 2022 Port of Stephenville	Qalipu First Nation	Initial meeting to introduce the Project concept.
	Miawpukek First Nation	
May 13, 2022 Stephenville	Town of Stephenville	Provided briefing on World Energy GH2 and the proposed Project in the Port au Port area. Provided power point presentation and engaged in a two-hour question and answer session about the Project.
	Town of Stephenville Crossing	
	Town of St. George's	
	Town of Lourdes	
	Port au Port East	
	Port au Port West	
	Town of Kippens	
	Qalipu First Nation	
May 30, 2022 Conne River	Miawpukek First Nation	Ongoing discussions to provide additional information and Project updates as they have been involved for several months
June 2, 2022 Stephenville	Qalipu First Nation	Provide briefing to Local First Nation Band Councils on World Energy GH2 and the proposed Project in the Port au Port area. Provided power point presentation and engaged in a two hour question and answer session about the Project.
	Benoit's Cove Indian Band	
	Three Rivers Mi'kmaq Band	
	Qalipu Development Corporation	
	Flat Bay Band	
	Benwah First Nation	
June 2, 2022 Port au Port East	Town of Port au Port East	Update meeting with Town of Port au Port East to answer specific questions about the possible route of transmission lines near their town. Answered questions related to route, proximity to town residences and services.

Table 5.1 Summary of Engagement Activities

Date / Location	Indigenous Group or Stakeholder	Purpose and Focus
June 2, 2022 Stephenville	ATV Association	Provided briefing to the ATV Association President on World Energy GH2 and the proposed Project. Provided an overview of planned development areas and answered preliminary questions.
June 2, 2022 Stephenville	Town of Stephenville	Continued discussions on cooperation with the town during the Project development process.

Our objective so far, has been to convey the message that as we progress and move through a phased approach to development, we will do that with the community and them in mind. These groups have provided feedback on the local realities and the local concerns, which have been incorporated into the design of the Project (Table 5.2). We fully believe that our early engagement process has positioned us well to work towards broader engagement. Appendix B provides the presentation that was provided to municipal leaders in May 2022.

Table 5.2 Issues and Concerns Raised During Engagement Activities

Issue / Concern	World Energy GH2 Response / Action / Mitigation	Registration Document Reference
Impact on recreational users in the Project Area	World Energy GH2 is committed to continue to work closely with local area groups to gain knowledge of special areas. As indicated in Appendix A of the EA Registration, noise and visual impact studies will be conducted prior to construction. The results of these studies, as well as continued consultation with recreational users on the Port au Port Peninsula, will be used to micro-site turbines as part of the detailed Project design to reduce potential impacts on other land and resource users. World Energy GH2 is also in the process of developing a Mutual Use and Mutual Access Agreement with local snowmobile and ATV trail associations. World Energy GH2 will continue to consult with recreational users and share Project information in a timely manner.	Section 4.3.4; Appendix A
Impact on wildlife	As outlined in Appendix A, World Energy GH2 is committed to completing a robust pre-construction baseline program for wildlife (including avifauna, bats, and other wildlife) and to developing a post-construction / operational monitoring program in consultation with applicable regulators. Pre-construction surveys will inform final Project design with micro-siting of turbines and other Project infrastructure used to reduce potential environmental impacts on wildlife. The monitoring programs will inform an adaptive management approach will be used in further mitigating residual adverse effects on wildlife. World Energy GH2	Appendix A

Table 5.2 Issues and Concerns Raised During Engagement Activities

Issue / Concern	World Energy GH2 Response / Action / Mitigation	Registration Document Reference
Impact on towns residential properties or services	World Energy GH2 will continue to consult with local communities to further understand specific concerns. As part of the studies that will be completed prior to Project construction, noise and visual impact studies will be completed and the results will be used in micro-siting turbines and other Project infrastructure to reduce impacts on local residents. A traffic assessment will also be conducted as outlined in Section 2.3.4.1 to reduce impacts to local infrastructure from transportation of Project infrastructure to the Port au Port Peninsula and to identify appropriate mitigation measures that are protective of public health and safety. In response to concerns from the Town of Port au Port East, regarding residential congestion at the isthmus and limited space for new overhead transmission RoWs, buried conductors are proposed for usage through the town, for an approximate distance of 4.25 km, generally following roadways and the existing Newfoundland Power 66 kV transmission line RoW. This will reduce visual impacts to the community.	Section 2.3.4.1; Section 5; Appendix A
Economic impact	As outlined in Section 2.8.4, World Energy GH2 will develop a Gender Equity and Diversity Plan (a preliminary plan is included in Appendix D). A business access strategy for members of underrepresented populations will be included in the plan. We will communicate employment information to local communities and Indigenous groups in a timely manner so that local and Indigenous residents have an opportunity to acquire the necessary skills to qualify for potential Project-related employment. As indicated in Section 2.7.1 World Energy GH2 will also provide training opportunities specific to wind technology for Newfoundlanders and Labradorians to enhance job prospects and long-term employment through a partnership with DOB Academy and in collaboration with the Qalipu.	Section 2.7.1; Section 2.8.4
Significant support for the Project	The groups that World Energy GH2 has consulted with to date have indicated overall support for the Project. Letters of support for the Project are included in Appendix B. With commitment to continued communications from World Energy GH2 on the Project, they see the value of investment in the area and they believe it is good for the younger residents to have future opportunities. World Energy GH2 is committed to providing training that will enhance employment opportunities for local residents.	Section 2.7; Appendix B
Continued information	Groups have expressed interest in continuing communications with World Energy GH2 on the Project. World Energy GH2 is committed to providing monthly email updates, opening a local community office with local staff, and frequent local presence from the Project team.	Section 5

To date, a stakeholder list and high-level analysis have been completed and a Stakeholder Plan is in place. Our Engagement strategy principles are:

- We will continue to do our homework to understand our stakeholders, with priority focus on Indigenous groups and local community
- We will continue to build trust with local communities
- We will communicate but we will also listen to locals
- We will create a two-way communication mechanism – feedback and ongoing dialogue is essential to success
- We will demonstrate that we have committed significant resources to evaluate the viability of the Project
- We will act, not just talk

Plans for future engagement activities are outlined in Table 5.3.

Table 5.3 Planned Engagement Activities

Activity / Phase	Intent	Specific Plan
Longer term consultation planning Consultation planned to begin June 2022	Provide opportunity for broader groups to receive contact and information with intended results: • Establish trust • Educate on the foundations of the Project • Create points of contact • Identify issues • Identify common ground • Establish method of ongoing communications • Develop brand	• Establish and staff a location in local area in June for semi-permanent set up, staffed with local hires. Rent a small office for a month or two where we can hold meetings with visuals. Invite groups in on a schedule when people can be present. Shows commitment to the area and also allows for many touchpoints that are consistent • Send letter to each identified stakeholder and invite them to visit our location • Hold regional open house(s) • Prepare video, and prepare wall boards that can be easily read and understood • Prepare take away summary document with contact information • Create tracking mechanism for comments and follow up requirements • Provide monthly email updates to interested parties.

6.0 FUNDING AND PROJECT EXPENDITURES

The Project will be funded through private investors, and there is no intention to apply for or seek federal or provincial funding for the Project.

As previously described, World Energy GH2 includes established, committed companies with strong balance sheets – CFFI Ventures, Horizon Maritime, World Energy, and DOB Academy. As indicated in Section 1.1, Northland Power and Pattern Energy are also both interested in participating in this Project as co-developers. The Project would benefit from their onshore wind development experience, local knowledge and good relationships with lenders. They both have a good track record of project finance in Canada and are experienced Canadian renewable energy companies.

6.1 PROJECT EXPENDITURES

Capital expenditure estimates for the Project are provided in Table 6.1. These are for the 500 MW hydrogen facility and 1 GW onshore wind farm and will be refined as Project planning and design progresses. Key assumptions used in developing the CAPEX estimate include:

- Costing norms from 2019 have been used
- Wind turbine sizing is based on 6.1 turbine, 164 locations and concept layout attached.
- Foundation sizing is based on 2019 norms - size/MW of turbine.
- Transmission based on 230 kV (voltage and configuration to be determined during detailed design) – overhead, includes construction and installation, route permitting or land rights are not included.
- Interarray cabling assumed to be either 33 kV and/or 66 kV
- Contingencies or risk evaluation is not included

Table 6.1 Concept-level CAPEX Estimate for the Project

	Unit	Cost per Unit	Quantity	Total Cost (USD)
Development and Project Management				
Development and consenting services			15%	$21,714,753
Engineering			20%	$28,953,004
Project and Contract Management			65%	$94,097,265
Procurement – Supply				
Turbine + Tower Costs	ea.	$7,500,000	164	$1,230,000,000
Turbine + Tower Installation	ea.	$250,000	164	$41,000,000
Foundations	ea.	$180,000	164	$29,520,000
Inner Array Distribution System – 33 and/or 66 kV – Supply and Install	km	$128,126	224	$28,700,224
Transmission Line – 230 kV – Supply and install	km	$942,000	25	$23,550,000
Inter Array Substation – supply and install	ea.	$31,880,000	1	$31,880,000
Road Access	km	$300,000	230	$63,000,000

Table 6.1 Concept-level CAPEX Estimate for the Project

	Unit	Cost per Unit	Quantity	Total Cost (USD)
Operation and Maintenance				
O&M annual costs – Annual	year	$48,000	164	$7,872,000
Decommissioning				
Turbine decommissioning	ea.	$250,000	164	$41,000,000
Foundation	ea.	$50,000	164	$8,200,000
Transmission Line Decommissioning	km	$100,000	224	$22,400,000
Substation	ea.	$2,500,00	1	$2,500,000
			Total	**$1,674,387,246**
Hydrogen + Ammonia Plant				
	Unit	**Cost per Unit**	**Quantity**	**Total Cost (USD)**
Development and Project Management				
Development and consenting services			15%	$13,500,000
Engineering			20%	$18,000,000
Project and Contact Management			65%	$58,500,000
Hydrogen + Ammonia				
Plant and Balance of Plant – 500 MW – UT 100%				$900,000,000
Decommissioning				
Plant Decommissioning				$15,000,000
			Total	**$1,005,000,000**

6.2 PROJECT FINANCING STRUCTURE

World Energy GH2 plans to fund the Project through Project financing structure (i.e., through a combination of equity and non-recourse debt). World Energy GH2 will own the Project company (World Energy GH2) that will raise non-recourse debt (i.e., recourse to the four partners is contractually limited, lenders will rely on Project revenues only). Project finance lenders will usually have priority access to cash-flows and security on assets, contracts and equity of the Project.

Project financing often entails very detailed contractual frameworks and extensive due diligence. Lenders need risks to be measurable and to have low probabilities of occurring for investment to make sense. Risks which are seen as well understood are thus easier to bear. This lenders' discipline will also support World Energy GH2 in developing thorough risk mitigation strategies – non-recourse finance increases a project's probability of success.

Figure 6-1 highlights the key interfaces of a project-financed onshore wind and hydrogen project. Banks will have a particularly thorough review of each contracts before allowing loans.

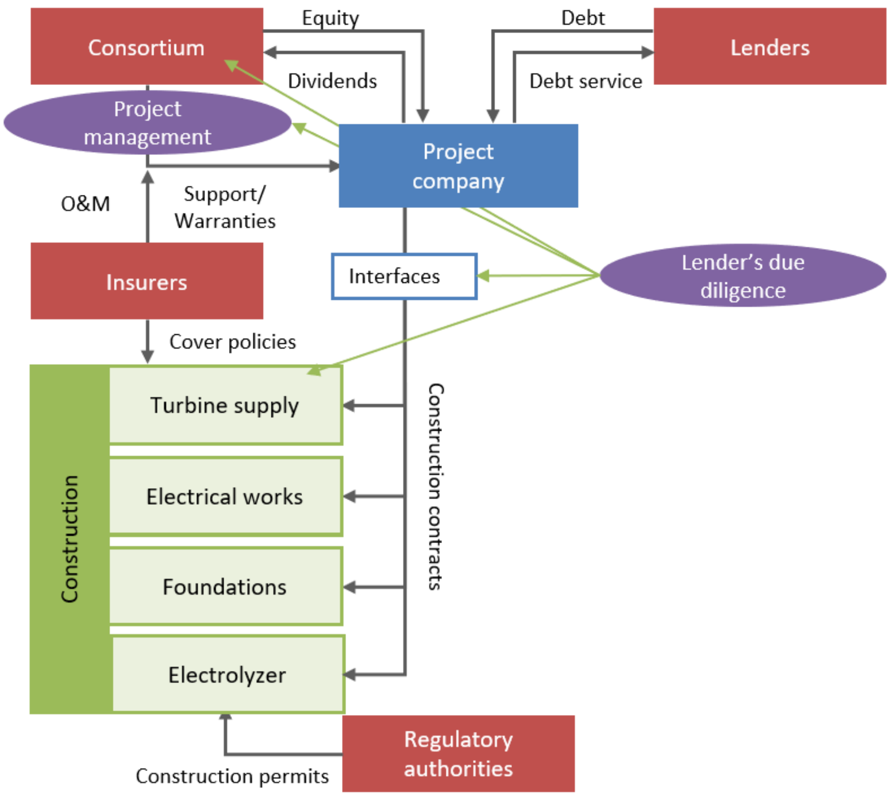


Figure 6-1 Key Interfaces of a Project Financed Onshore Wind and Hydrogen Project

6.3 POTENTIAL LENDERS AND GREEN GIRAFFE'S ROLE

A wide market approach using World Energy GH2 and Green Giraffe networks will be conducted in due time. As further described below, Green Giraffe has strong contacts with international lenders (commercial banks and institutions) that are keen to invest in renewable energy projects. We will also reach out to World Energy GH2 relationship banks (most of them are local Canadian banks).

We expect a strong interest for this Project from lenders as large-scale green hydrogen projects are still scarce in the market. Lenders will highly value the location (politically stable country with ambitious carbon-neutral targets), the experienced consortium, and the innovative aspect of the Project that will be de-risked with adequate mitigations solutions.

Green Giraffe is very experienced in arranging project financing for renewable energy projects worldwide, and has specialized expertise in fund raising and financial structuring, project development and contracting for complex transactions.

The company was founded 12 years ago and has raised more than EUR 30 bn of funding since then. Green Giraffe has already closed more than 200 transactions or projects with a total capacity of more than 100 GW, including 50 GW of wind. These transactions include the structuring of complex debt transactions – including multi-contracting, multi-currencies, and multiple parties, through its presence in the renewable energy market, Green Giraffe has an extensive and first class network with investors, contractors, banks, advisors and intermediaries.

Green Giraffe's track record (Table 6.2) covers many of the early offshore wind financings in Europe, as well as some of the most complex renewable transactions globally, including large scale onshore and hydrogen projects.

Table 6.2 Examples of Green Giraffe's Track Record

Year	Project	Technology	Country	Role
2014	Gemini 600 MW	offshore wind	NL	• Financial advisor to raise equity and construction debt • Support in contracting process and negotiations
2015	Veja Mate 402 MW	offshore wind	DE	• Financial advisor to raise equity and construction debt • Provision of key project resources, including the CEO and the CFO
2017	Hornsdale 309 MW	onshore wind	AU	• Financial advisor to raise construction debt for Phases 2 (100 MW) and 3 (109 MW)
2018	Blauwwind 730 MW	offshore wind	DE	• Financial advisor to World Energy GH2 to raise construction debt • Sizing the contingency budget for the lenders (Cross model)
2020	Björkvattnet 175 MW	onshore wind	SE	• Financial advisor to buy the project and raise construction debt
2021	Oya Energy 128 MW	onshore wind, PV and battery hybrid	ZA	• Full tender, contracting and financing (debt & equity) support

7.0 PROJECT RELATED DOCUMENTS

World Energy GH2 have engaged several specialist firms to support the Project through execution of on-going engineering and design planning, strategic planning, consultation and engagement planning, and environmental studies. Completed work includes detailed wind assessments for Sites A, B and C by DNV Energy, and a communications and engagement strategy.

8.0 SUMMARY AND CONCLUSIONS

World Energy GH2 is proposing to construct and operate a cost-effective green hydrogen/ammonia from wind power development on the west coast of the Island of Newfoundland. The Project would be Canada's first commercial green hydrogen/ammonia production facility, created from 1 GW of renewable energy. Being at the forefront of this industry will position NL and Canada as a global leader in the production of green hydrogen. World Energy GH2 represents a consortium of four Canadian partners with strong local expertise. This Registration document has been prepared to initiate review of the Project under the provincial *Environmental Protection Act* and *Environmental Assessment Regulations*.

We are committed to involving local stakeholders, and Indigenous communities, in the Project. We have well-established and effective communication and cooperation processes in place with relevant Indigenous governments and organizations, local communities, and other interested groups and individuals. The Project is anticipated to result in both 1,200 direct jobs (1,100 during construction and 100 during operation and maintenance) and 1,300 indirect jobs. To enhance employment opportunities for local residents, training will be offered, in collaboration with the Qalipu to support the Project's need for skilled workers. Training programs will be targeted to develop skill sets required by the renewables industry, and will support the provincial workforce in transitioning away from the oil and gas industry, towards an energy economy based on renewables.

The Project involves the construction and operation of a windfarm on the Port au Port Peninsula with up to 164 turbines (with a likely maximum hub height of 121 m, plus a rotor diameter of 158 m, for a likely total maximum height of 200 m), and supporting infrastructure, including access roads, transmission lines, and pads and foundations for the turbines. Temporary workforce accommodations will also be developed to house construction workers in or near Stephenville. The electricity generated from the wind farm will be used to produce hydrogen and ammonia at a 0.5 GW hydrogen facility to be built and operated on a brownfield site at the Port of Stephenville. The wind portion of the Project is anticipated to operate at a net capacity of 44-48%. The anticipated efficiency of the hydrogen facility is dependent on the final technology and can be as high as 98%. The 500 MW hydrogen plant will have the ability to be expanded in the future to more than 1.5 GW. Production of hydrogen requires a substantial water supply; the current industrial water supply at the site has the capacity to meet the Project's needs.

Approximately 80% of the hydrogen produced will be used to produce ammonia, with most of the ammonia delivered to existing marine export facilities at the Port by pipelines placed underground or on pipe racks. From there, ammonia will be transported globally by dedicated ammonia carriers and by standard LPG capable vessels. In addition to dedicated ammonia vessels, either ammonia or hydrogen could be transported by marine vessel in special built, multi-modal containers. There is currently a robust international trade in ammonia and an emerging focus on sustainable, low emission ammonia carriers dedicated to green ammonia transport. If a local market is developed, hydrogen distribution would likely occur using high pressure tube-trailers which could deliver hydrogen for industrial use or vehicle fueling. Ammonia can be delivered locally by industry standard tank trucks.

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 ensure the design and operations of the facilities. The facility will be designed to the applicable Canadian codes, as well as applicable international codes, to safely produce and store hydrogen and ammonia. The facility will be designed to flare both hydrogen and ammonia in the event of an emergency, and robust emergency response procedures will be established to respond to unplanned accidents and malfunctions. As design progresses, a hazard identification study, hazard and operability study, and a quantitative risk assessment will be conducted to further determine risks and identify mitigation.

As outlined in Appendix A, World Energy GH2 is committed to conducting a robust suite of environmental studies in support of the Project development. In addition to the mitigation measures proposed in Section 2.8.2, an EMS will be developed specifically for the Project, including protocols to facilitate the execution of Project construction and operation in an environmentally responsible and safe manner. As part of the EMS, construction and operation phase EPPs will be drafted and implemented, providing guidance on management practices and requirements to on-site and corporate team members, as well as outlining roles and responsibilities and reporting procedures. EPP documents will also contain emergency response contingency plans and provide direction to on-site workers in the event of accidents, malfunctions, or incidents. World Energy GH2 has developed a preliminary Gender Equity and Diversity Plan which will specifically consider business and employment access for members of underrepresented populations and will work with regulators to finalize the plan.

World Energy GH2 intends to work closely with regulators, Indigenous groups and stakeholders to complete the environmental commitments outlined in this EA Registration, many of which are anticipated to be conditions of EA approval. We are committed to completing a robust pre-construction baseline program and to developing a post-construction / operational environmental effects monitoring program in consultation with applicable regulators. Pre-construction surveys will inform final Project design with micro-siting of turbines and other Project infrastructure used to reduce potential environmental impacts and resource conflicts. Informed by the monitoring programs, an adaptive management approach will be adopted toward residual adverse effects for environmental components such as avifauna and bats. We are committed to working with regulators and stakeholders to further develop environmental protection procedures that reduce and mitigate the potential environmental effects and enhance the benefits of the Project.

9.0 SIGNATURE

June 10, 2022

Date: --

John MacIsaac

World Energy GH2 Inc.

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