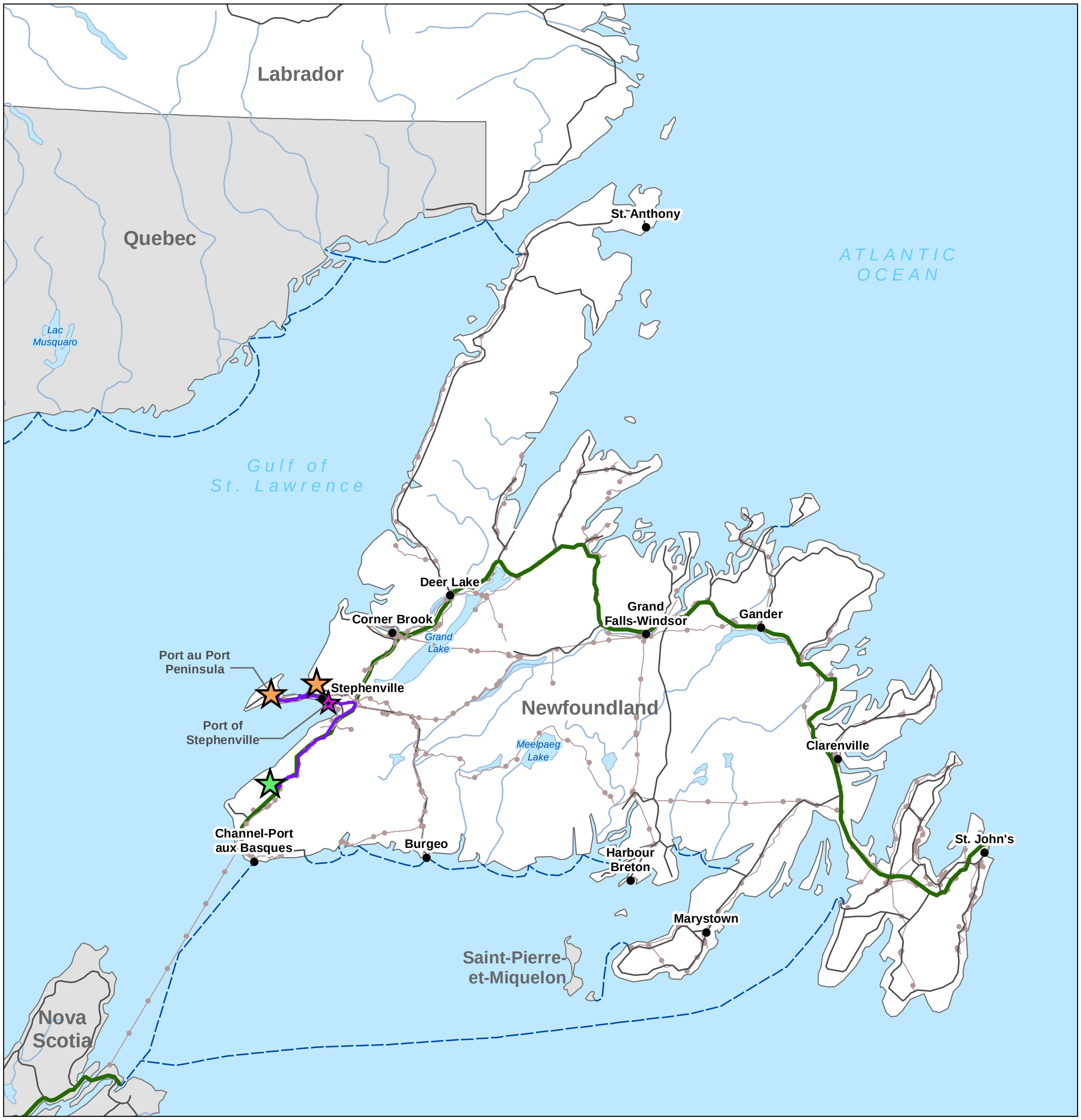
1.0 Introduction

Project Nujio'qonik (pronounced *new-geo-ho-neek*; the "Project") is named after the Mi'kmaw term for St. George's Bay, Newfoundland and Labrador (NL), which means "where the sand blows", to pay homage to the Mi'kmaq First Nations people who are among the original inhabitants of Atlantic Canada. The Project, as proposed by World Energy GH2 Inc. (WEGH2), involves the development, construction, operation and maintenance, and eventual decommissioning and rehabilitation of two onshore wind farms and one of the first Canadian commercial-scale, "green hydrogen"[1] and ammonia production plants powered by renewable wind energy.

Located on the western coast of the Island of Newfoundland, NL (Figure 1.1), key components of the Project will include onshore wind farms, situated on Crown lands in the Port au Port and Codroy areas of NL, and a hydrogen / ammonia plant, situated on a privately-owned brownfield site at the Port of Stephenville (in the Town of Stephenville, NL) that is zoned for industrial use. The wind farms will each generate approximately 1 gigawatt (GW) of renewable power that will be transmitted to the hydrogen / ammonia plant and used to produce up to approximately 206,000 metric tonnes (t) of green hydrogen (equivalent to approximately 1.17 megatonnes [Mt] of ammonia) annually via electrolysis. The hydrogen / ammonia plant will have an installed electrolyzer capacity of 1,200 megawatts (MW) and will have the ability to be expanded in the future. The hydrogen produced by the Project will be converted into ammonia and exported to international markets by ship from an existing marine terminal in the Port of Stephenville. The Project also includes civil works and supporting infrastructure and facilities associated with the two wind farm sites, the hydrogen / ammonia plant, and the hydrogen / ammonia storage and export facilities. The Project is anticipated to generate clean electricity from onshore wind farms and produce green hydrogen and ammonia at scale, thereby positioning Canada as a global leader in clean hydrogen production, use, and export.

The Project is subject to provincial environmental assessment (EA) requirements under the NL *Environmental Protection Act* and associated *Environmental Assessment Regulations* (EA Regulations). This document is the Environmental Impact Statement (EIS) for the Project and has been prepared in accordance with the provincial EIS Guidelines that were issued for the Project in December 2023. A table of concordance with the EIS Guidelines is provided as Appendix E-1. The Project does not include any activities requiring federal assessment as listed in the *Physical Activities Regulations* under the *Impact Assessment Act*.

[1] "Green hydrogen" is produced via electrolysis using renewable electricity to split water into hydrogen and oxygen. This type of hydrogen, which is referred to by the European Commission (n.d.) as "renewable fuel of non-biological origin", is often called "green hydrogen" in industry.



General Location of Project Components

- Hydrogen / Ammonia Plant
- Codroy Wind Farm
- Port au Port Wind Farm
- Transmission Line, 230 kV

Existing Features

- Municipality
- Trans-Canada Highway
- Secondary Highway
- Ferry Route
- Transmission Line

0 40 80 Kilometres

(At original document size of 8.5x11)
1:4,000,000

N

Stantec

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

Project Location
Stephenville
NL

Prepared by MB on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_010a REVA

Figure No.
1.1

Title
Project Location

V:\1214\active\121417233\03 data\gis cad\gis data\mapping\mxd\general\Intro ProjectDescription\121417233 010a Provincial Location AllSites REVA.mxd Revised: 2023-07-20 By: mblackwood

1.1 Project Overview

The following is an overview of key Project components and activities, as well as the planned phases of Project development and key dates in the Project schedule. A complete Project description, including additional Project phasing and scheduling details, is provided in Chapter 2.

1.1.1 Project Components

Hydrogen / Ammonia Plant

The Project entails development and operation of a hydrogen / ammonia plant with an electrolyzer capacity of 1,200 MW (i.e., electrolytic hydrogen and ammonia production facility), located at the Port of Stephenville (in the Town of Stephenville, NL) on privately owned land that is zoned for industrial use and is adjacent to existing grid connection infrastructure. The facility will produce green hydrogen via electrolysis, using renewable electricity to split water into hydrogen and oxygen. The hydrogen produced at the facility will then be converted into ammonia and exported to international markets by ship, as transporting hydrogen over long distances is most cost-effective in the form of green ammonia. Given the intermittent nature of wind power, the hydrogen / ammonia plant is expected to run at a capacity factor of approximately 50%, resulting in maximum production of up to approximately 206,000 t of green hydrogen (equivalent to approximately 1.17 Mt of ammonia) per year. The 1,200 MW hydrogen / ammonia plant will have the ability to be expanded in the future to approximately 1,800 MW, thereby resulting in maximum production of up to approximately 309,000 t of green hydrogen (equivalent to approximately 1.75 Mt of ammonia) per year. The facility will occupy approximately 50 hectares (ha) at full capacity (20 ha for the hydrogen plant and 30 ha for the ammonia plant).

The hydrogen / ammonia plant will require water and electricity as process inputs, as described below:

- At 100% capacity, the facility will require an average of 1,668 cubic metres (m^3) of water per hour for hydrogen electrolyzer feedwater, cooling water, and other industrial water requirements. Water for the Project will be sourced from the existing industrial water supply present at the Port of Stephenville. Water treatment will be required in order to demineralize the water before it can be fed into the electrolyzer system to produce hydrogen.
- The electricity demand for hydrogen production is anticipated to start at approximately 600 MW and increase to approximately 1,800 MW, due to the installation of additional electrolyzer capacity (i.e., additional nameplate capacity of 600 MW) as Project development progresses. Renewable energy from two onshore wind farms on the western coast of Newfoundland, each with a capacity of approximately 1 GW, will be used to power the hydrogen and ammonia production processes. These wind farms (referred to herein as the "Port au Port wind farm" and the "Codroy wind farm") will collectively produce 2 GW of renewable electricity.
- The Port au Port wind farm will include up to 164 wind turbines, with up to 171 sites that are being studied for the EIS, on the Port au Port Peninsula, NL and adjacently on the Newfoundland "mainland" (i.e., northeast of the isthmus at Port au Port).

- The Codroy wind farm will also consist of up to 164 wind turbines located on Crown land in the Anguille Mountains of the Codroy Valley, NL.
- The modelling and assessment work is based on preliminary layouts for both wind farm sites (i.e., 171 potential turbine locations at the Port au Port wind farm and 143 potential turbine locations at Codroy wind farm). Final wind farm layouts will be dependent on results of the wind campaign and more detailed field investigations. Once the layout and number of turbines are finalized, the results of models will be reviewed and updated as required
- Each wind turbine will require a cleared area of approximately 1.25 ha, including a prepared footprint for temporary laydown to store wind turbine components during construction.

Road Access

The Port au Port and Codroy wind farms will each require a network of new and upgraded access roads for transportation of Project components and equipment, as well as interconnection of the wind turbine locations within the respective wind farm sites. An electrical collector system (i.e., a network of 34.5 kilovolt [kV] transmission lines) will interconnect the wind turbines at each of the wind farm sites to transformer substations owned by the Project.

Construction Infrastructure

Construction of the Port au Port wind farm will be supported by the option of barging wind turbine components and other bulk materials and equipment across Port au Port Bay from the Port of Stephenville, or transporting by road. Temporary marine landing sites will be constructed on the Port au Port Peninsula (at Aguathuna and West Bay) for this purpose. The Project will also include the construction and operation of temporary workforce accommodations in the Town of Stephenville (to house approximately 1,200 to 1, 500 workers) and in the Codroy area (to house approximately 300 to 500 workers) during the construction phase. Both camp sites are temporary and will be dismantled and removed and the site decommissioned.

Electrical Infrastructure

High-voltage (230-kV) transmission lines, including the option of a subsea cable crossing Port au Port Bay, will connect the substations associated with each wind farm to a terminal station at the hydrogen / ammonia plant. The total length of these high-voltage transmission lines will be approximately 145 kilometres (km). In addition, one new 230-kV transmission interconnection will be required to connect the hydrogen / ammonia plant terminal station to the NL Hydro facility at Stephenville, NL (approximately 0.08 km north of the hydrogen / ammonia plant).

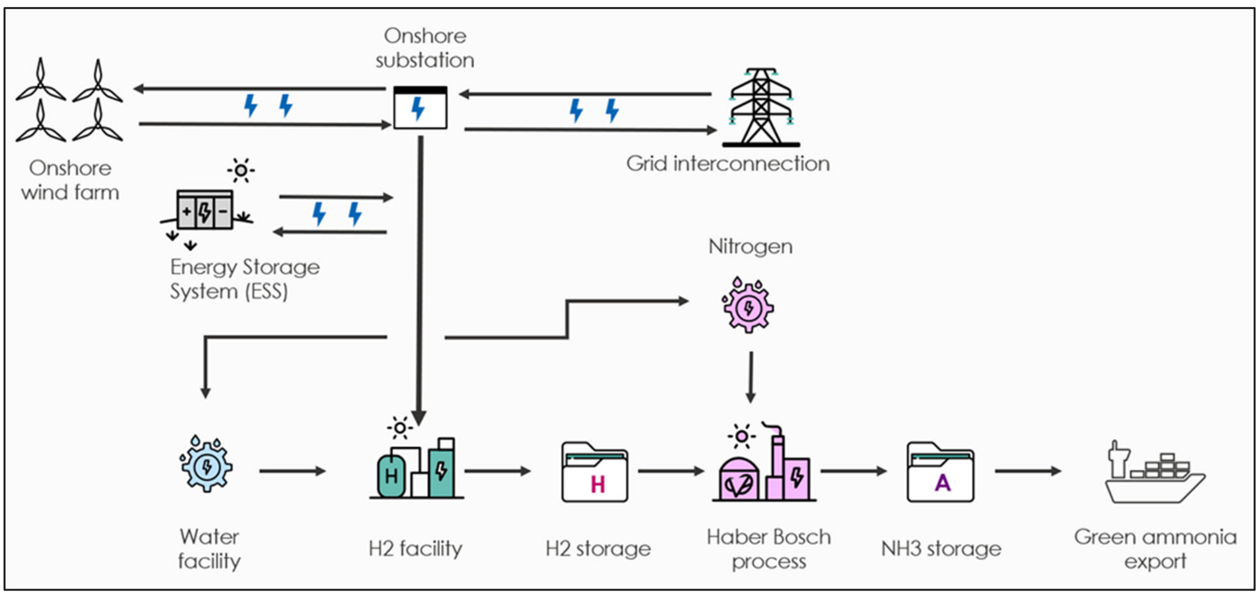
The Project will use power storage and/or back-up power supplies to manage seasonal and intra-day wind energy generation variations, acting as a buffer between power generation and the hydrogen / ammonia plant. Various power storage and back-up power supply options are being pursued in parallel to deliver the most optimal solution for the Project. The following four primary technologies are under consideration for the Project: subterranean compressed air energy storage; thermal battery storage; electric battery energy storage; and renewable diesel or bio-diesel. More details on potential power storage and back-up power supply technologies are provided in Section 2.3.3 (Appendix 2-G).

Ammonia Storage and Export

The electricity that is transmitted from the Port au Port and Codroy wind farms to the hydrogen / ammonia plant will be used to convert demineralized water to hydrogen via electrolysis. A Haber-Bosch reactor will then be used to convert the hydrogen into ammonia for export to international markets. Pressurized vessels will be installed onsite for the temporary above-ground storage of gaseous hydrogen and storage tanks will be installed onsite for the temporary above-ground storage of liquified compressed ammonia .

The Port of Stephenville, where the hydrogen / ammonia plant and associated storage, and export facilities will be located, offers deep-water shipping access suitable for ammonia export. The ammonia offloading system design at the marine terminal is currently being evaluated. As described in Section 2.5.6 (Restoration of Existing Port Facilities), options under consideration include a conventional Liquefied Petroleum Gas loading dock and a jettyless floating offloading system.

Figure 1.2 schematically depicts the key Project components.



Note: H_2 = hydrogen; NH_3 = ammonia

Figure 1.2 Project Energy and Storage Process Flow Chart

1.1.2 Development Sequence

Development of the Project will follow a phased approach, with a staggered schedule for the construction and commissioning, operation and maintenance, and decommissioning of the two wind farms and the hydrogen / ammonia plant:

- The Project will initially be operated using the Port au Port wind farm as the primary power source. Approximately 1,000 MW of wind energy will be installed in the Port au Port wind farm, and the electrolysis plant will be sized to accommodate the maximum input of 600 MW. It is estimated that an average of approximately 70,000 tonnes per annum of hydrogen will be produced during this period of Project operations, which amounts to approximately 360,000 tonnes per annum of ammonia (when fully converted to ammonia). Civil works associated with the Port au Port wind farm is scheduled to commence in 2023, with operations commencing in Q1 2026.
- Renewable energy generation will be expanded by approximately 1,000 MW to an estimated total of 2,000 MW of installed wind generation with the Codroy wind farm coming online. Accordingly, the hydrogen / ammonia plant will be sized to accommodate the maximum production of 1,200 MW. It is estimated that an average of approximately 140,000 tonnes per annum of hydrogen will be produced during this period of Project operations, which amounts to approximately 720,000 tonnes per annum of ammonia (when fully converted to ammonia).

Table 2.2 (in Chapter 2) provides a summary of the anticipated cumulative estimated average and maximum hydrogen and ammonia capacities and production levels for the Project when the Port au Port wind farm is operating in isolation and when the Port au Port and Codroy wind farms are both operating simultaneously.

Depending on market demand and use, there may be potential for future expansion of the Project through additional wind power generation. Accordingly, the hydrogen / ammonia plant will be developed so that additional capacity could be added as part of a future development stage of the Project. However, such a potential future development stage is excluded from the scope of the Project currently under assessment, and would be subject to a separate assessment and regulatory approvals.

The scope of the Project includes the following three activity phases which are described in further detail in Chapter 2:

- **Construction** – This phase entails site preparation and the build-out of the hydrogen / ammonia plant and associated storage and export facilities, wind farms, and transmission infrastructure, as well as civil works and other supporting infrastructure and facilities.
- **Operation and Maintenance** – This phase entails the management of continuous wind energy generation and subsequent use in the production of green hydrogen and green ammonia. The Project's operation and maintenance strategy will be formulated to maximize the wind farms' and hydrogen / ammonia plant's production over the entire lifetime of the assets, in a safe, qualitative, and environmentally friendly manner.

- **Decommissioning and Rehabilitation** – This phase encompasses decommissioning and rehabilitation activities to restore the site, including removal of equipment, dismantling / demolition and removal of infrastructure, removal and appropriate disposal of non-hazardous demolition debris, re-contouring, overburden and topsoil replacement, and revegetation.

Pending EA approval and receipt of other required permits and approvals, the construction phase of the Project will take place from Q4 2023 through Q2 2027. Early civil works are planned to start Q4 2023. Construction of the Port au Port wind farm is planned to begin in Q4 2024. The hydrogen / ammonia plant (with an initial electrolyzer nameplate capacity of 600 MW) and associated storage and export facilities are scheduled to be constructed throughout Q2 2024 to Q1 2026. As described below, the hydrogen / ammonia plant will be subsequently upgraded in 2027 as Project development progresses. First hydrogen production is planned for Q4 2025 (with electricity to the hydrogen / ammonia plant to be supplied by the existing electrical grid until the Port au Port wind farm is operational) and first ammonia production is planned for Q1 2026. For the Codroy wind farm, construction is expected to begin in Q4 2025 and be completed in Q1 2027. An additional 600 MW electrolyzer will be added to the hydrogen / ammonia plant configuration (thereby bringing the electrolyzer nameplate capacity of the hydrogen / ammonia plant to 1,200 MW), and is expected to be commissioned in Q2 2027. The operational life of the Project is 30 years, with an additional year for decommissioning for each site. Accordingly, production from the Port au Port wind farm is scheduled to end in Q1 2057 and production from the Codroy wind farm is scheduled to end in Q3 2058. A detailed Project schedule is provided in Section 2.4.

1.2 Proponent Description and Project Team

The proponent of the Project is WEGH2, a newly established company based in St. John's, NL that is focused on sustainability and the transition to renewable ("green") energy sources.

Contact information for WEGH2 and the primary proponent contact for the environmental assessment is provided in Table 1.1. A list of key personnel responsible for preparing the EIS, including roles and qualifications, is provided in Appendix 1-A. Contact information for the environmental assessment study team is provided in Table 1.2.

Table 1.1 Proponent Information

Name of the Corporate Body	World Energy GH2
Proponent Address	87 Water Street St. John's, NL A1C 1A5
Chief Executive Officer	**Sean Leet**
Principal Contacts for Environmental Assessment	Sean Leet 87 Water Street, St. John's, NL A1C 1A5 info@worldenergygh2.com
	David Pinsent 87 Water Street, St. John's, NL A1C 1A5 dpinsent@worldenergygh2.com

Table 1.2 Environmental Consultant Information

Name of the EA Consultant	Stantec Consulting Limited
EA Consultant Address	141 Kelsey Dr, St. John's, NL A1B 0L2
EA Project Manager	Trion Clarke trion.clarke@stantec.com
EA Key Consultant Contact	Katherine Fleet katherine.fleet@stantec.com

Formally established in mid-2022, WEGH2 was developed as a vehicle to advance the Project. The current shareholders include: CFFI Ventures (24%); Brendan Paddick (24%); GH2 Holdings LLC (24%); Horizon Atlantic Capital (8%), SK Group (SK ecoplant (10%) and SK engineering (10%)). The formation of the ownership group came from World Energy LLC's search to find partners in the large-volume procurement of green hydrogen for use in the company's production of sustainable aviation fuel. CFFI is a 50% shareholder in World Energy LLC. As part of its continued investment in the Project, WEGH2 recently finalized the acquisition of the Port of Stephenville in June 2023. The Project ownership consortium and shareholding structure is shown in Figure 1.3.

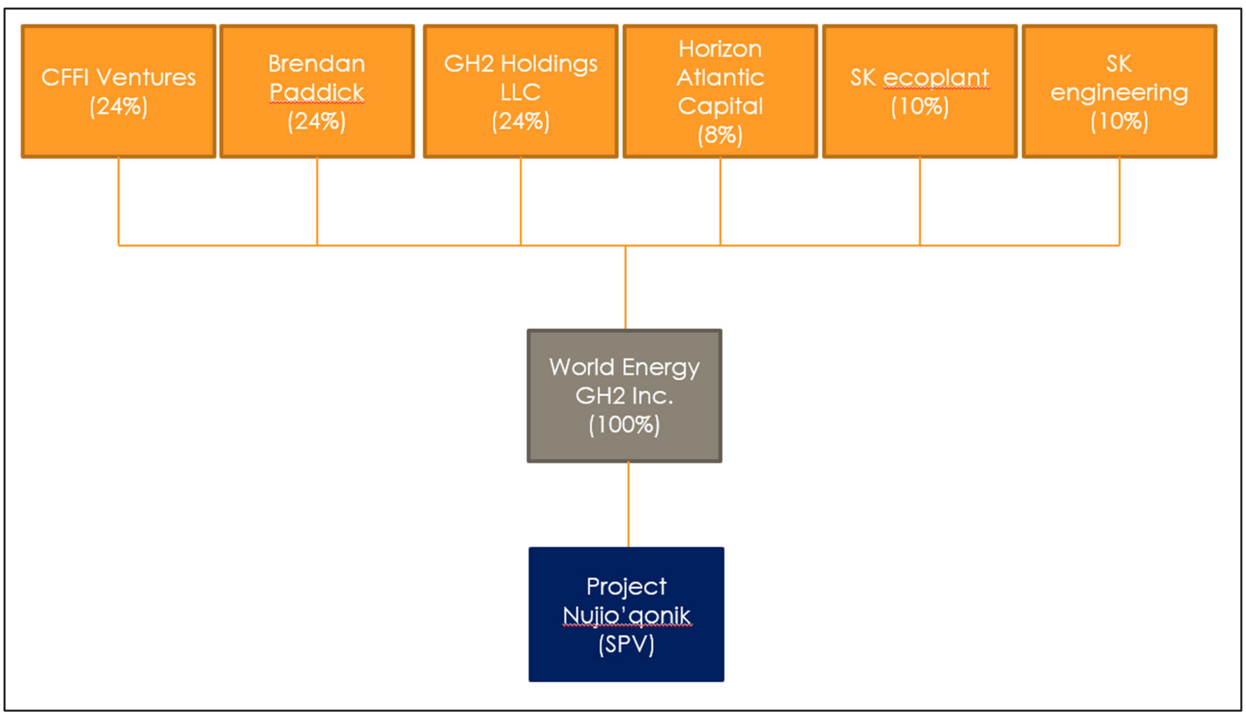


Figure 1.3 Project Ownership and Shareholding Structure

Implementation of the Project will advance the sustainable energy transition in NL, Canada, and globally. The Project owners have collaborated in various capacities in the past and collectively possess a wide range of specialized proficiencies, including strong local knowledge and local relationships, expertise in marine transportation for the export and logistics component, and extensive experience in project development, the production and distribution of sustainable fuels, and the structuring and operation of utility-scale wind farms and hydrogen and ammonia plants.

The Project owners are recognized for leading service delivery across a variety of industries, including full renewable energy project development at the stages of a project's life cycle and technical design. The group has a deep history of bringing projects online, while being on time and on budget. This history has provided the group with valuable knowledge in developing, financing, securing offtake, constructing, operating, and decommissioning large-scale projects. A combination of extensive diligence and applied experience makes WEGH2 well-positioned to execute plans and set up projects for long-term success – not only in offering positive financial returns to investors, but also in capitalizing on renewable resources and offering long-term benefits to the communities in which these projects operate. The group has strong local ties with Indigenous stakeholders, local communities, and the province of NL, which has presented the opportunity to leverage the deep local roots of multiple Atlantic Canadian partners. Our project owners are mainly homegrown Atlantic Canadian companies and individuals. Together, this team has complete capabilities to bring the Project to realization. Further details of the key capabilities and experience of the WEGH2 Project owners is provided in Table 1.3, as those who are sponsoring the Project.

Table 1.3 Key Capabilities and Experience of WEGH2

Project Sponsor	Capabilities and Experience
GH2 Holdings, LLC / World Energy	• Gene Gebolys founded World Energy LLC 25 years ago and pioneered the production of biodiesel in North America. Gene has guided World Energy LLC to an industry-leading position as the world's first and largest producer of sustainable aviation fuel. Attracting CFFI Ventures as an investor to enable growth, World Energy LLC is a low-carbon solutions provider empowering leading companies committed to net-zero carbon to cut emissions in the hardest-to-abate sectors. • The company delivers ever-better solutions at an ever-greater scale to efficiently cut, accurately account, and transparently report carbon emissions reductions in operations based in air and on water, rail, and road. • World Energy operates five biodiesel plants throughout the United States and has successfully managed numerous acquisitions and capital projects related to developing, managing, and operating these plants. For example, World Energy recently converted its biodiesel plant in Natchez, Mississippi, to produce premium free fatty acid feedstock for a performance chemicals company. The conversion involved modifying the bio-reaction to preferentially convert triglyceride feed to a product with a high concentration of free fatty acid and glycerin. The converted process required a new enzyme and the world's first large-scale continuous flow hydrolysis section. This process exemplifies that the Project Sponsors have substantial experience managing complex chemical projects, a crucially important track record for developing a green hydrogen / ammonia plant. • World Energy's Los Angeles-based renewable fuels refinery will be the first producer of green hydrogen at scale in California and one of the largest in North America.

Table 1.3 Key Capabilities and Experience of WEGH2

Project Sponsor	Capabilities and Experience
GH2 Holdings, LLC / World Energy (cont'd)	• Founded on Earth Day in Boston in 1998, the company has been commercializing, producing, and distributing low-carbon fuels for over two decades. Over the past five years, World Energy has added renewable diesel, sustainable aviation fuel, and other renewable biofuels to its traditional biodiesel product portfolio. World Energy's production process turns inedible waste products from the food and agricultural industries into clean energy for planes, heavy-duty vehicles, and public transit. Given the strong experience in the biogas and sustainable aviation fuel sector, the Project Sponsors already maintain a strong level of knowledge related to offtake arrangements in the fuel sector as well as a deep network of parties interested in agreeing to these offtake contracts.
Brendan Paddick	• Brendan Paddick is the Chief Executive Officer of Columbus Capital Corporation. • Brendan Paddick has extensive capital market experience, having participated in transactions with a cumulative value in excess of USD 50 Billion over a 35+ year professional career. These transactions have ranged from debt and equity financings including initial public offerings, private debenture placements, rights offerings, private equity placements, syndicated banking facilities, subordinated debt, public bond issues, preferred share offerings, mergers, joint ventures and acquisitions. Between 2005 and 2014, he negotiated, financed, closed and integrated some 50 acquisitions in the Caribbean-Latam region alone. Over the course of his career, Paddick has financed and overseen billions of dollars of capex infrastructure projects ranging from subsea fibre optic cable networks to large scale hydro electrical utility and transmission projects, to terrestrial telecom networks, to international data centers. Through his career, he has consistently ensured that projects were accomplished on time and on budget. • Born and raised in Grand Falls, Newfoundland, Canada, Brendan Paddick has strong local ties to the community where the Project is proposed. • Paddick's extensive experience related to capital raising, infrastructure, and as Chairman of the Newfoundland and Labrador energy company, Nalcor, will prove extremely valuable in successfully bringing this large-scale renewable infrastructure through financing and execution.
CFFI Ventures	• CFFI is an Atlantic Canadian based private investment firm with global investments. Founded in 2001, the company has a 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. • 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 and 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. • John Risley is the CFFI Chairman, and his long-time business partner, Brendan Paddick is an active co-investor.

Table 1.3 Key Capabilities and Experience of WEGH2

Project Sponsor	Capabilities and Experience
Horizon Atlantic Capital/Horizon Maritime	• Headquartered in St. John's, NL, Horizon Maritime is a prominent marine services company operating on Canada's three coastlines and around the Atlantic Basin, with an office 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. • Since 2015, the company has become the preferred contractor for major energy industry customers such as Equinor, BP, ExxonMobil, Suncor and Emera. The company is currently performing term-contracts offshore Newfoundland & Labrador with specialized, high-value equipment, for ExxonMobil and BP Energy. • 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 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 its First Nations partners, Horizon Maritime will play a key role in the construction and long-term operations of the Project, leading construction staging and logistics, operations shore base development and processes and coordination of shipping activities. • Sean Leet is the Chair of Horizon Maritime Services, and formerly served as the company's CEO. Sean lives in St. John's and, together with a strong team of partners, including John Risley, guides the company with exemplary First Nations engagement across the country and a focus on innovation and driving local competitiveness on a global level.
SK Group	• The SK Group is the second largest conglomerate in Korea, operating more than 200 companies across the energy, life sciences, advanced materials, mobility and semiconductors industries. • In mid-May, the SK Group took a 20% interest in World Energy GH2 for a total price of USD 50 million. Most notably, after eight months of extensive due diligence, this conglomerate selected the Project for their first investment globally in a green hydrogen production project.

WEGH2 also has the support from a team of world-class advisors providing comprehensive capabilities and services including financial, technical, and communication. Five of these crucial advisors are as follows:

- **Cormorant Utility Services** – Cormorant is a full-service power solutions company providing end-to-end engineering, procurement, construction and operations and maintenance services to the power sector, with extensive experience in onshore wind. Cormorant was one of the leading players in the Ontario Feed-In-Tariff Renewable Energy Program, participating in the design and construction of over 3,500 MW of Windfarm collector systems, substations and interconnect switchyards. To date, Cormorant maintains over 70% of the wind and solar infrastructure in Ontario for major clients such as OPG, Blue Earth, Kruger Energy and Hydro One. The leadership team at Cormorant has designed, built and operated over 20,000 MW of power related infrastructure in the most challenging parts of the world.

- **DOB Academy** – DOB Academy offers wind energy education for professionals working in the wind energy industry. It has academies located in the Netherlands and Japan. In relation to the Project, WEGH2 intends to build North America's first Wind Industry Training Institute.
- **Det Noske Veritas (DNV)** – Det Noske Veritas is an independent expert in assurance and risk management. The company delivers world-renowned testing, certification and technical advisory services to the energy value chain including renewables, oil and gas, and energy management.
- **ARUP** – ARUP provides support across the spectrum of hydrogen projects, including assessment and optimization, system concept engineering, owner's engineering, and independent engineering.
- **Green Giraffe** – Green Giraffe is a specialist advisory firm focused on the energy transition. It is expected to play a key role in the financing of the Project. The company, based in the Netherlands and with offices around the world, including North America, specializes in non-recourse debt structuring, project equity advice, mergers and acquisitions advice, development support, tender support, purchase price allocation advice, market intelligence, and modelling. Green Giraffe has been involved in a large quantity of renewable energy projects, advising on over 250 transactions totaling more than 180 GW of total capacity and raising funding in excess of 32 billion Euros. Green Giraffe has been evaluating the interest and offers from various potential investment partners in the Project and it was through these efforts that the SK Group became investors in the Project.

Since October 2022, the Project has received multiple Licenses to Occupy from the Crown Lands Division to begin installing Meteorological Evaluation Towers (METs) for the purpose of validating the wind energy resource. Validation of the energy resource is a critical aspect of the project development. The Project has invested, and continues to invest heavily, in this activity that has been authorized by the Government of Newfoundland and Labrador.

To date, the Project has expended more than CAD 65 million specifically to support the development of Project Nujio'qonik. . WEGH2's financial capabilities are evidenced by its significant actions and investments to date; investment commitments made without the de-risking benefits of site security (through a grant of Crown lands for the full project area) or environmental permitting.

WEGH2 is actively involved in advanced offtake discussions with parties looking to sign long-term contracts in the form of ammonia purchase agreements. These long-term agreements will include pricing details and requirements for the green certification of the hydrogen / ammonia. The targeted consumers and traders are located in the United States and Europe and include industrial users (e.g., fertilizer and steel manufacturers), commodity traders, power utilities, oil and gas companies, and ports and maritime fuel providers. These advanced discussions are expected to lead to agreements on detailed letters of intent and negotiated term sheets that will largely mitigate the risks associated with securing revenues from the sale of ammonia produced.

1.3 Regulatory Framework

1.3.1 Crown Land Bid Process

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 that propose to produce energy for sale. Aside from small test projects and isolated systems, there have been no large-scale wind energy projects developed in the province due to this Order. In December 2021, the Government of NL released its Provincial Renewable Energy Plan (Government of NL 2021), which recognized the potential for wind resources and the opportunities to export energy surplus. In April 2022, the provincial Minister of Industry, Energy, and Technology announced that the Order would be lifted, and that proponents could now proceed through the approvals processes for resource development projects.

On July 26, 2022, NL Department of Industry, Energy and Technology (NLDIET) announced a Crown Lands Nomination and Bid Process for Wind Energy Projects. The *Guidelines: Nominating Crown Lands for Wind Energy Projects* (NLDIET 2022) document outlines the new land nomination and bid process for wind energy projects. Similar to the offshore land bid system, the process has two stages. Companies had until October 1, 2022, to submit Nominations of Areas of Interest for wind projects on Crown land (with no limits on geographic size or number of submissions). The Province then issued a Call for Land Bids in mid-December 2022, a competitive process with the goal of awarding Crown land leases for wind development accompanied by a defined evaluation process.

The Nominated Crown Lands for the Port au Port and Codroy wind farms are shown in Figures 1.4 to 1.6. The EA process for the Project (Section 1.3.2) is occurring concurrently with the Crown land bid process. While WEGH2 had previously submitted a Crown land application to the Government of NL in May 2022, Crown land approval will now be subject to the updated process as outlined above.

The province has received bids from 19 companies and is in the process of reviewing the bids against criteria such as the bidder's experience, the project, and their financial capacity to plan, construct, and operate the proposed project. On July 6, 2023, the Government of Newfoundland and Labrador advised WEGH2 that the company's bid had successfully completed the first phase of review. Companies that pass this review will proceed to the next phase, expected to be completed in late-August 2023, with successful bidders granted an exclusive right to pursue the development of their project through the Government of NL's Crown land application and approval process (these lands will be held in reserve until that process is completed). Those companies that proceed with a wind project over 1 MW will be required to submit an EA prior to final award of Crown land (Government of NL 2023a).

Due to the large number of submissions in the Crown Land Bid Process, the Province of NL released the first industry-specific EA guidance in April 2023: *Guidance for Registration of Onshore Wind Energy Generation and Green Hydrogen Production Projects* (Government of NL 2023b).

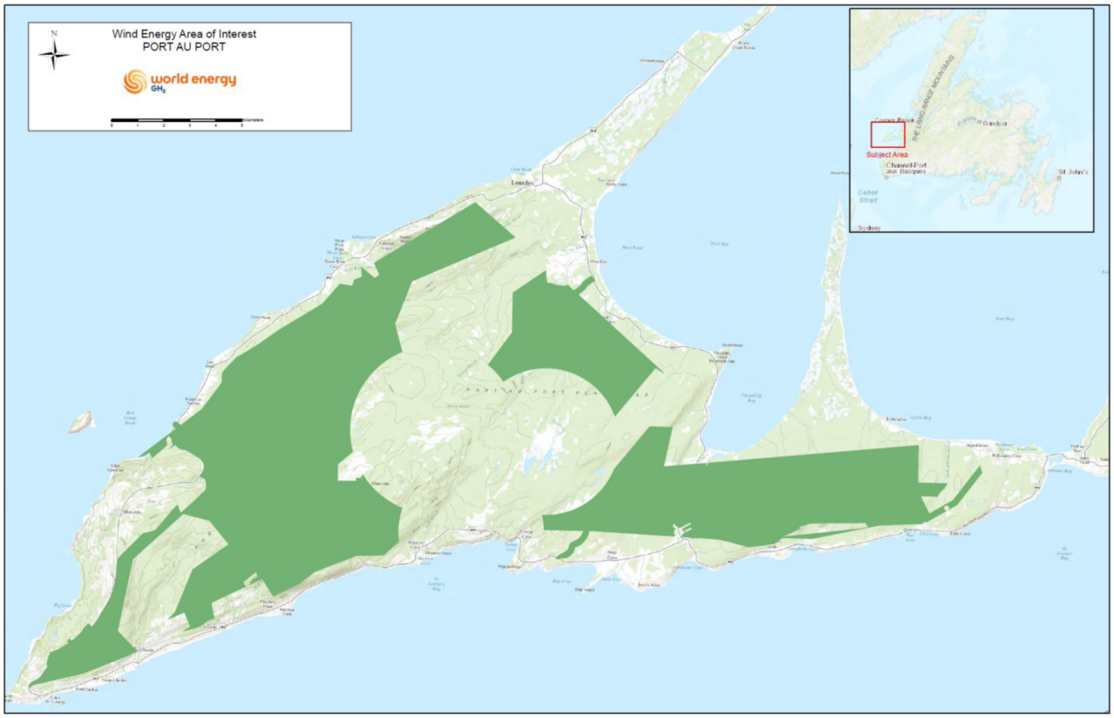


Figure 1.4 Nominated Crown Lands for the Peninsular Portion of the Port au Port Wind Farm

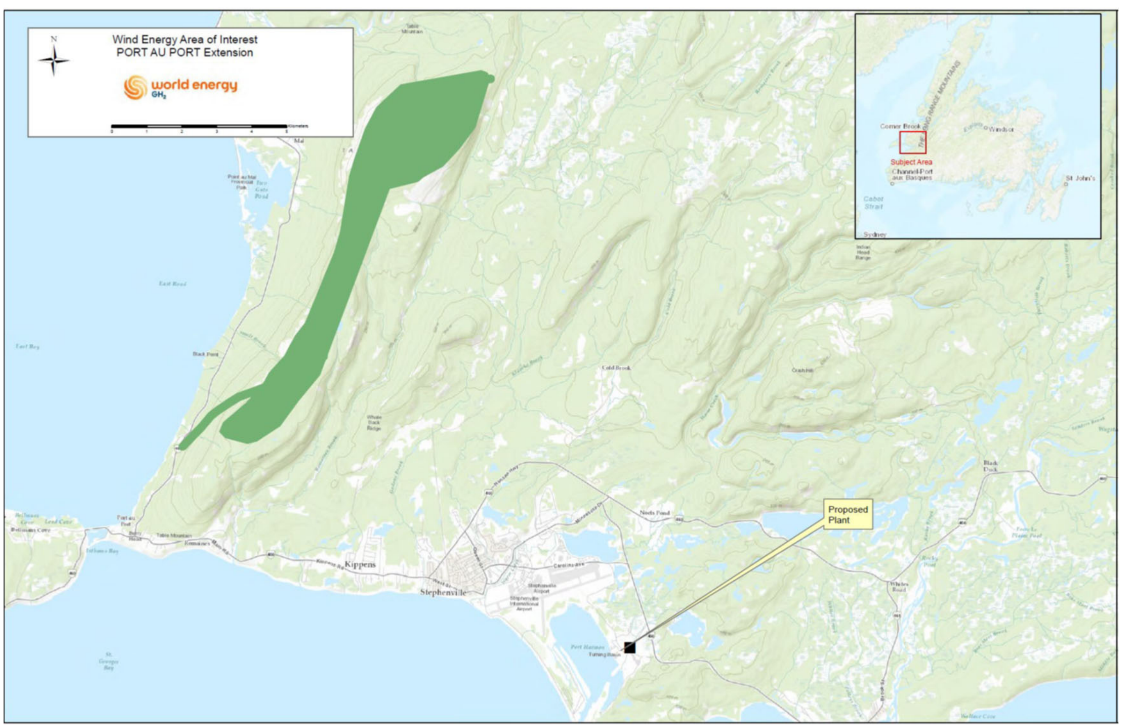


Figure 1.5 Nominated Crown Lands for the Mainland Portion of the Port au Port Wind Farm

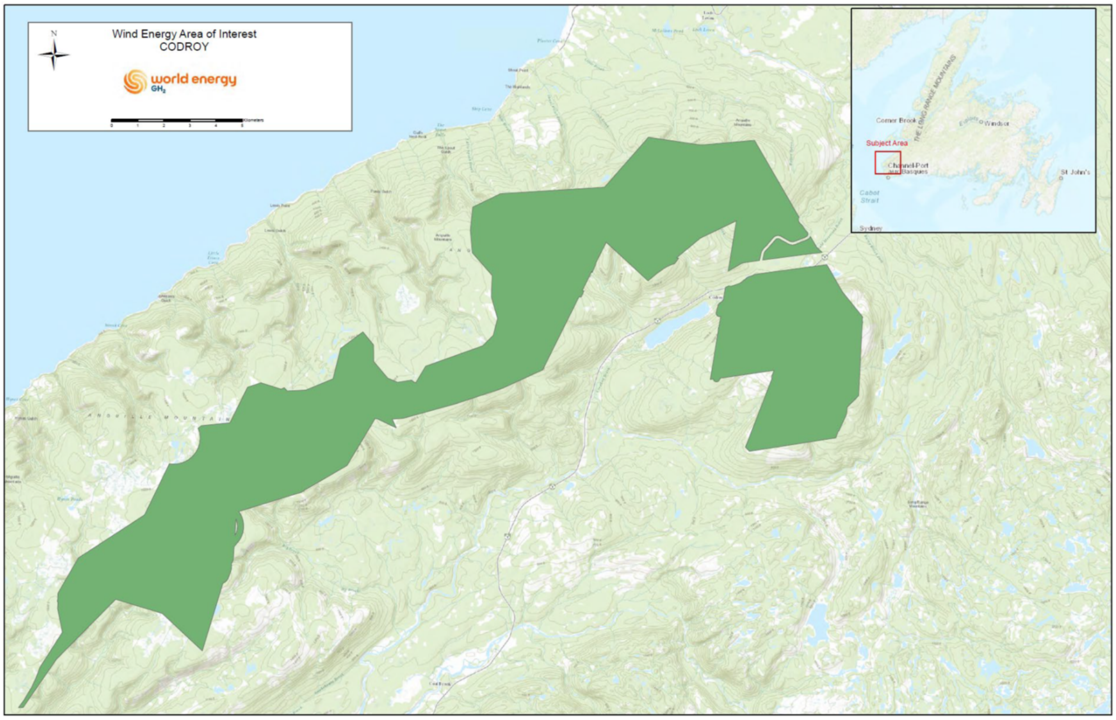


Figure 1.6 Nominated Crown Lands for the Codroy Wind Farm

1.3.2 Environmental Assessment Requirements and Change in Scope of Project to be Assessed

As per the NL *Environmental Protection Act* and associated EA Regulations, an EA registration document regarding the Project (WEGH2 n.d.) was submitted to the NL Department of Environment and Climate Change (NLDECC) Environmental Assessment Division (EA Division) on June 21, 2022.

On August 5, 2022, following public and regulatory review of the EA registration document, the Minister of Environment and Climate Change informed WEGH2 that an Environmental Impact Statement (EIS) is required in support of the Project. Draft EIS Guidelines were issued for public review on September 29, 2022, with a deadline for public comment by November 8, 2022. Final EIS Guidelines were issued for the Project on December 13, 2022. Concordance with the EIS Guidelines is shown in Appendix E-1.

The Project does not include any activities requiring federal assessment as listed in the Physical Activities Regulations under the *Impact Assessment Act*.

As part of the Project planning process, Project components and activities have been modified, refined, and adapted due to engineering optimization, and in response to feedback during regulatory and public engagement activities completed to date in support of the EA (refer to Chapter 4). Project engineering has progressed substantially following EA registration in June 2022, and the Project will continue to be refined during detailed design. Furthermore, following the release of the final EIS Guidelines in December

2022, and in consultation with regulators, the scope of the EA has been expanded to include additional components and sites required to make the Project operational and viable.

Appendix 1-B summarizes the key Project refinements that have been made subsequent to EA registration. WEGH2 understands that these proposed changes to the Project do not negate the outcome of the provincial EA registration process or the Minister's determination that an EIS is required in support of the Project. The Project Description provided in Chapter 2 is representative of the design basis for the EA and is inclusive of the changes to the Project that are being proposed following submission of the EA registration (i.e., in this EIS). Additional details on Project alternatives, including the rationale for rejecting and selecting alternatives, are provided in Chapter 3.

1.3.3 Other Environmental Regulatory and Permitting Requirements

Upon release from the provincial EA process, 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, 2019*
- *Canadian Navigable Waters Act, 2019*
- *Migratory Birds Convention Act, 1994*
- *Species at Risk Act*
- *Aeronautics Act*
- *Environmental Emergency Regulations, 2019*

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

Table 1.4 includes a preliminary list of approvals, authorizations, and permits that may be required for the Project. It is not considered an exhaustive list, and WEGH2 will work with regulators to confirm and adjust the list, as necessary.

Table 1.4 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)
Development of Transmission Lines	*NL Public Utilities Act, 1990* *Towns Development Regulations*	Town of Stephenville
Discretionary Use Application(s) Municipal Approval	*Town of Stephenville Municipal Plan and Development Regulations*	Town of Stephenville
Discretionary Use Application(s) Municipal Approval	*Kippens Development Regulations*	Town of Kippens
Discretionary Use Application(s) Municipal Approval	*Town of Cape St. George Municipal Plan and Development Regulations*	Town of Cape St. George
Provincial		
Environmental Assessment Approval	*Environmental Protection Act*	NLDECC, EA Division
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
Environmental Approval for a Waste Management System	*Environmental Protection Act, Air Pollution Control Regulations, Storage of PCB Wastes Regulations and Waste Management Regulations, 2003*	Digital Government and Service NL
Development Activity in a Protected Water Supply Area	*Water Resources Act*	NLDECC, Water Resources Management Division

Table 1.4 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Permit for Constructing a Non-domestic Well	*Water Resources Act*	NLDECC, Water Resources Management Division
Application for Water Use Licence	*Water Resources Act*	NLDECC, Water Resources Management Division
Permit to Cut	*Forestry Act*	NLDFFA, Forestry Division
Permit to Burn	*Forestry Act*	NLDFFA, Forestry Division
Operating Permit	*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*	NL Department of Transportation and Infrastructure (NLDIET), Government Services Centre
Protected Road / Area	*Protected Road Zoning Regulations*	NLDIET, Government Services Centre
Quarry Development Permit	*Quarry Materials Act*	NLDIET, 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
Fuel and Associated Products 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 / Smoke-Free Environment 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, Electrical Regulations*	Digital Government and Service NL
Blasters Safety Certificate	*Occupational Health and Safety Act*	Digital Government and Service NL
Pressure Piping System Registration	*Public Safety Act, Pressure Vessel and Compressed Gas Regulations*	Digital Government and Service NL

Table 1.4 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Pressure Plan Registration	*Public Safety Act, Pressure Vessel and Compressed Gas Regulations*	Digital Government and Service NL
Pressure System Permits (including Pressure Plan and, Pressure Piping System Registrations)	*Public Safety Act, Pressure Vessel and Compressed Gas Regulations*	Digital Government and Service NL
Electrical Connection to Provincial Grid	*Public Utilities Act*	NL Hydro / Board of Commissioners of Public Utilities
Federal		
Permits Authorizing an Activity Affecting Listed Wildlife Species	*Species at Risk Act*	ECCC, Parks Canada
Migratory Bird Permit	*Migratory Birds Convention Act*	ECCC - Canadian Wildlife Service
Nest Removal Permit	*Migratory Birds Convention Act*	ECCC - Canadian Wildlife Service
Authorization or Letter of Advice pursuant to section 35(2) of the *Fisheries Act*	*Fisheries Act*	Fisheries and Oceans Canada
Marine Terminal Approval	Technical Review Process of Marine Terminal Systems and Transshipment	Transport Canada / Canadian Coast Guard, ECCC, Fisheries and Oceans Canada, Natural Resources Canada, Port Authorities and Pilotage Authorities
License to Store, Manufacture, or Handle Explosives	*Explosives Act*	Natural Resources Canada
Land Use Approval	*Civil Air Navigation Services Commercialization Act*	Nav Canada[1]
Aeronautical Assessment Obstacle Evaluation	*Aeronautics Act*; *Canadian Aviation Regulations*	Transport Canada
Emergency Response Assistance Plan	*Transport of Dangerous Goods Act*	Transport Canada
Review or approval pursuant to section 4 or 5 under *Canadian Navigable Water Act*	*Canadian Navigable Water Act*	Transport Canada
Dredging of Harbour	*Canadian Environmental Protection Act, 1999* (Schedule 5, Waste or Other Matter)	ECCC
Storage Tank Regulations	*Canadian Environmental Protection Act, 1999, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*	ECCC
Notice Regarding Substances Located at a Facility and Preparation of an Environmental Emergency Plan[2]	*Environmental Emergency Regulations, 2019*	ECCC

Table 1.4 List of Potential Permit / Approval / Licence Requirements for the Project

Permit / Approval / Licence	Legislation / Regulation	Authority / Department
Reporting Requirements of the National Pollutant Release Inventory (NPRI)[3]	*Canadian Environmental Protection Act, 1999*	ECCC

Notes:
[1] Nav Canada is a private, not for profit corporation that manages Canada's civil air navigation.
[2] May be excluded if it is a substance that is regulated under the *Transportation of Dangerous Goods Act, 1992* or the *Canada Shipping Act, 2001*, which applies to anhydrous ammonia
[3] Ammonia is a NPRI Core Substance.

When the Project was registered in June 2022, there were navigation aids (i.e., a VHF Omni-Range and Distance Measuring Equipment) known to be associated with the Stephenville airport and co-located approximately 8 km west of Stephenville; however, these navigation aids were scheduled to be decommissioned in July 2022 (WEGH2 n.d.). The potential presence of navigation aids could require Nav Canada to conduct an air navigation degradation study for the proposed wind farm. The navigation aids in question, if still present, are located approximately 3.5 km away from the nearest turbine at the Port au Port wind farm and approximately 47 km away from the nearest turbine at the Codroy wind farm. WEGH2 will consult with Nav Canada as part of the detailed design process to confirm that turbine siting is appropriate and to determine which approvals are required.

Proponents are typically required to submit environmental management plans for review by the EA Division prior to construction. In accordance with EIS Guideline requirements, the following Project-specific environmental management plans are appended to this EIS:

- Transportation Impact Study and Traffic Management Plan (Appendix 2-E, 2-F)
- Preliminary Emergency Response / Contingency Plan (Appendix 2-J)
- Waste Management Plan (Appendix 2-K)
- Hazardous Materials Response and Training Plan (Appendix 2-L)
- Workforce and Employment Plan, including a commitment to develop a Benefits Agreement and Gender Equity, Diversity, and Inclusion Plan (Appendix 2-M)
- Public Participation Plan (Appendix 4-A)
- Domestic Wood Cutting Consultation Plan (Appendix 4-B)

1.3.4 Applicable Policies, Guidelines, and Resources

In addition to the Provincial EIS Guidelines, the EIS preparation also considered various Health Canada guidance in considering the effects of water and air quality and noise on Indigenous health including:

- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality (Health Canada 2016a)
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Drinking and Recreational Water Quality (Health Canada 2016b)

- Useful Information for Environmental Assessments (Health Canada 2010)
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (Health Canada 2017)
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Country Foods (Health Canada 2018)
- Guidance for Evaluating Human Health Impacts in Environmental Assessment: Human Health Risk Assessment (Health Canada 2019)

Other pertinent guidance that influenced the EA process with respect to Indigenous engagement includes the Government of NL's Aboriginal Consultation Policy on Land and Resource Development Decisions (Government of NL 2013).

Additional policies, guidelines, and resources are identified in Section 6.1 to Section 22.1 of this EIS, where specifically relevant to the assessment of potential Project-related effects on valued environmental components.

1.3.5 Non-Governmental Participants in the Environmental Assessment

Other non-governmental participants involved in the EA include Indigenous groups, local communities, stakeholders, and the general public. WEGH2 has initiated engagement with the potential participants in the EA (Chapter 4 provides details on the engagement and consultation to date). These include:

- Qalipu First Nation
- Miawpukek First Nation
- Town of Stephenville
- Town of Stephenville Crossing
- Town of St. George's
- Town of Lourdes
- Town of Port au Port East
- Town of Port au Port West – Aguathuna – Felix Cove
- Town of Kippens
- Town of Cape St. George
- Local service districts (LSDs) in the Project area
- Bay St. George Chamber of Commerce
- Stephenville Business Improvement Association
- Bay St. George South Area Development Association
- Codroy Valley Area Development Association
- Local residents
- Local band councils

- Local associations (e.g., ATV Association)
- Local outfitters

1.4 Benefits of the Project

The Project aligns its goals with those of the Canadian government to execute on a strategy that will set the country on the path to meet climate change goals of achieving net-zero greenhouse gas (GHG) emissions by 2050 (Government of Canada 2023). The Project will generate clean electricity from onshore wind farms and produce zero-carbon hydrogen and ammonia at scale, thereby positioning Canada as a global leader in clean hydrogen production, use, and export. As renewable hydrogen and ammonia are critical solutions for difficult-to-decarbonize industries, the Project has the potential to transform the path to global net-zero across a number of key emitting sectors and industries in Canada and beyond. Thus, by contributing to the displacement of GHG-generating power production and end use, the Project offers national and international benefits.

Locally, WEGH2 is committed to providing the Province of NL and its residents with economic and social benefits from the Project. The Project will be particularly impactful to the communities of western NL, and WEGH2's commitments will be reflected in a Project benefits agreement. Overall, WEGH2 will remain committed throughout the Project to increase benefits that will flow to the Province through employment and skills development, contracting and participation for traditionally underrepresented groups, opportunities for NL suppliers and contractors, as well as substantial planned community investment and First Nations partnerships.

Given that NL's existing workforce has relevant skills in the marine, fishery, hydro, and offshore oil and gas sectors, the Project can help position NL as a leader in achieving national and international carbon emission-reduction targets while simultaneously boosting the economy and creating jobs. WEGH2 is providing training, in collaboration with Qalipu First Nation, to support the Project's need for a skilled workforce and to enhance Project-related employment opportunities for local residents. Training programs will be targeted to develop the skill sets required by the renewable energy industry, thereby supporting the provincial workforce in the transition to low-carbon renewable energy. As part of this effort, WEGH2 is facilitating a wind Industry training partnership with DOB Academy (Netherlands) and Qalipu First Nation.

WEGH2 has contracted Jupia Consultants Inc. (Jupia) to develop an economic report (Jupia 2023a; Appendix 1-C), of which a portion is comprised of a labour capacity / demand study for the Project (Jupia 2023b; Appendix 1-D). This study identifies workforce and supply chain capacity limitations, thereby complementing the knowledge WEGH2 has gained from conversations with local industry partners. The insights from the Jupia study will help WEGH2 better understand which workforce elements can be employed locally, and where it may be necessary to rely on employment from other parts of the province, from Canada, and internationally. It will also help WEGH2 identify how much of the permanent workforce will require training related to Project operations, maintenance, and related downstream activities. The study estimates current labour capacity in the Province, provides a gap analysis outlining what occupations and skills will need to be developed, and considers how the Province can maximize the workforce and income benefits of the Project by addressing workforce demand.

The Project is expected to stimulate the local economy and benefit the region through job creation and other forms of economic stimulus. Based on direct labour costs, a total of 11,730 person-years of direct employment for operations are estimated over the life of the Project. Total direct and indirect labour costs are estimated at $2.8 billion and support 27,480 full-time equivalents (FTE) person-years of employment over the life of the Project. The Project will also provide opportunities to build relationships with local businesses and suppliers, leverage local ties, and offer other economic and community benefits. Notably, the first Project-related meetings with local communities and Indigenous groups started in May 2022, and a $10 million Community Vibrancy Fund has been created for the construction phase of the Project to demonstrate WEGH2's commitment to the people who live and work in the vicinity of the Project. Community Vibrancy Fund was announced in Sept 2022.

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2.0 Project Description

2.1 Project Location and Associated Study Areas

2.1.1 Project Location

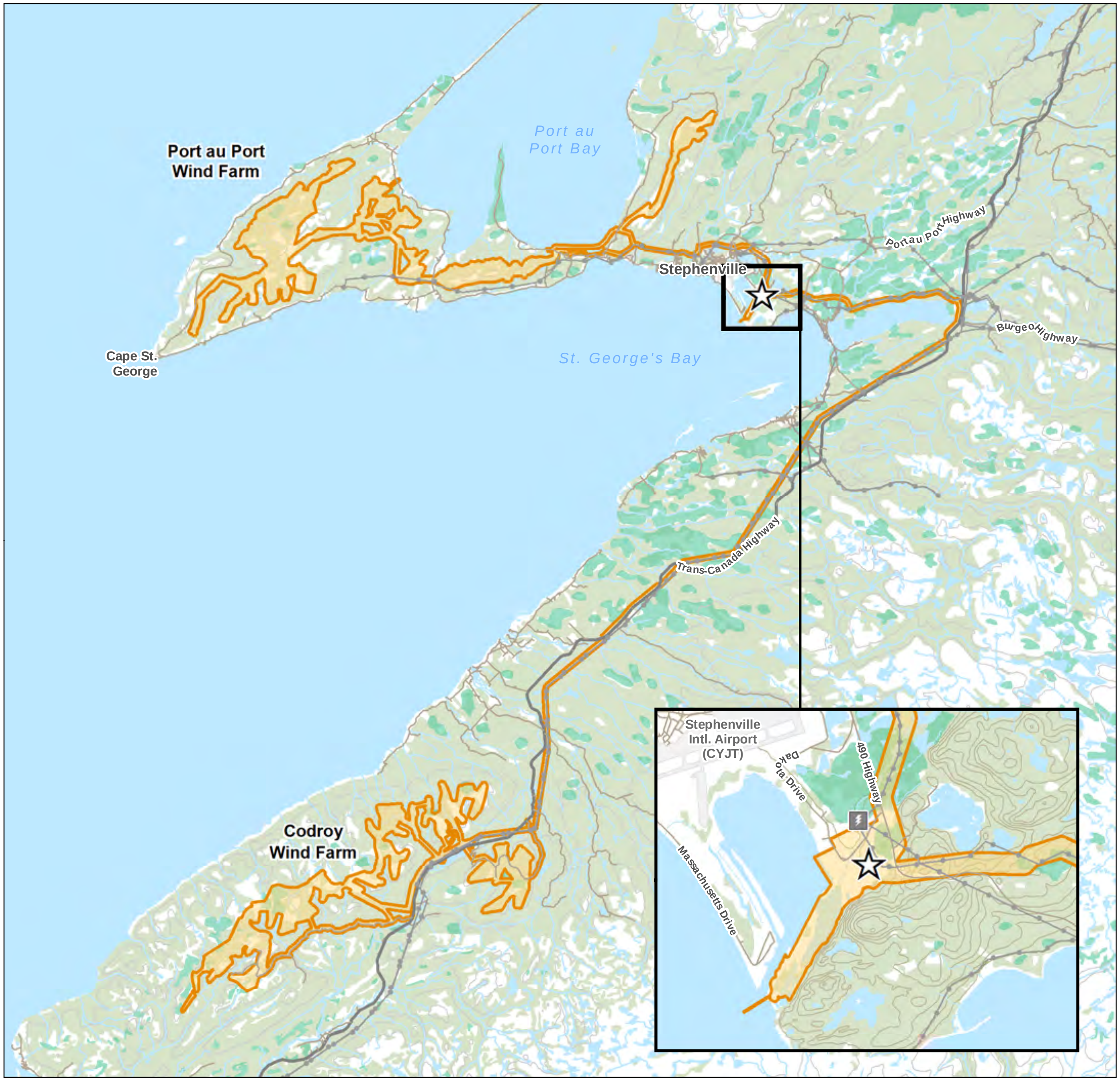
The Project includes the construction, operation and maintenance, and decommissioning of the Port au Port Wind Farm, Codroy Wind Farm, and transmission line connections to a hydrogen / ammonia plant in Stephenville, as well as upgrades to the existing port at Stephenville (Figure 2.1).

The Project Area (totaling 281.49 hectares) shown on Figure 2.1 is a conservative (i.e., larger-than-expected) representation of the spatial extent of potential Project-related direct physical disturbance (i.e., the Project footprint). In addition to encompassing the immediate area in which Project components and activities will occur, the Project Area also includes a buffer of up to 300 m for access roads and turbines and a 350 m corridor to accommodate the 70 to 75 m wide right-of-way (RoW) for the transmission line. These buffers allow flexibility for the micro-siting of Project components during detailed design, based on technical considerations as well as the avoidance of environmentally sensitive areas, where practicable.

The proposed hydrogen / ammonia plant and export facilities at the Port of Stephenville are located approximately 5 kilometres (km) west of the Town of Stephenville, Newfoundland and Labrador (NL). The Port au Port Wind Farm (comprised of portions of the Port au Port Peninsula extending eastward to Port au Port East) is located west and north of Stephenville and the Codroy Wind Farm is located 75 km south of Stephenville; both are connected to the hydrogen / ammonia plant by a collector system / transmission lines.

The Port au Port Wind Farm is comprised of two areas, the majority of the farm being located on the)ort au Port Peninsula and a smaller area on Port au Port East, along the Tabletop Mountain. A narrow isthmus connects the Port au Port Peninsula to Newfoundland, with the peninsula bounded by the Gulf of St. Lawrence to the west, St. George's Bay to the south and Port au Port Bay to the northwest. The Port au Port West wind farm is located west of Stephenville. The peninsula is accessible via NL Routes 460 and 463, both of which are paved two-lane highways. Using Routes 460 and 463, there is an 80 km loop around the perimeter of the roughly triangular peninsula. Both highways are maintained year-round by the NL Department of Transportation and Infrastructure (NLDTI).

The Port au Port Wind Farm is on the Port au Port Peninsula and extends to the mainland on the east side of Port au Port Bay, a subregion in the Southwestern Newfoundland Ecoregion. The terrain on the Port au Port Peninsula is generally hilly, with many steep slopes and cliffs along the coastline. There are several areas with exposed, weathered bedrock and barrens with low-lying shrubs. There are forested areas, as well as some wetlands. Surface water is limited to several small ponds.



Stantec

Proposed Project Features

- Hydrogen / Ammonia Plant Location
- Project Area

Other Features

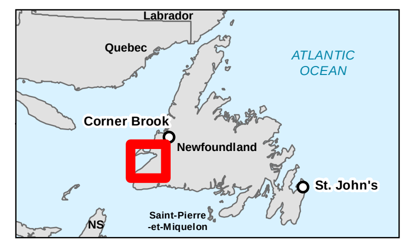
- Electrical Generation, Existing
- Transmission Line, Existing
- Trans-Canada Highway
- Road
- Contour (100 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

0 10 Kilometres
(At original document size of 8.5x11)
1:550,000

Notes

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



Project Location
Stephenville
NL

Prepared by MB on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_038b

Figure No.
2.1

Project Area

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The total population of the Port au Port Peninsula in 2021 was 4,734 (Statistics Canada 2022), 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. 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 limited forest growth.

The Codroy Wind Farm is located in the Codroy subregion in the Southwestern Newfoundland Ecoregion. The Codroy Wind Farm is located in the Anguille Mountains (a section of the Long Range Mountains from Cape Anguille along St. George's Bay). The terrain is generally hilly, with steep slopes and river valleys. There are exposed areas at elevation, forested areas, barrens, wetlands, and low-lying shrubs. Surface water is limited to several small ponds. Compared to the Port au Port Wind Farm, there is less exposure and more forested areas, with less exposed bedrock and rocky outcrops. The Codroy subregion is considered the most favourable for plant growth on the Island of Newfoundland as a result of the relatively warm summers and nutrient-rich soils from glacial deposits and runoff. This subregion is known for its lush vegetation and thick forests.

The Port of Stephenville (the Port) is a sheltered, deep sea and ice-free port located on the north shore of St. George's Bay. The Port currently provides a variety of services to accommodate fishing, aggregate, container, and 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 10.1 m at dockside and a maximum tidal range of 1.6 m. The Port 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 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 3.7 km (1 nautical mile) west of the Port entrance. The Pilot provides safe navigation into and out of the Port.

An overview of the individual study areas that comprise the Project Area is provided below.

2.1.2 Study Areas

The Project Area totals 281.52 km² (Table 2.1) (note: components are not additive because there is overlap. For example, the Transmission line overlaps every other component). The total cleared area will be approximately 41 km² (14.6% of the Project Area).

Though not an official Project Boundary, the assessment references the "Project footprint", which is the anticipated area of direct physical disturbance associated with construction, operation and maintenance, and decommissioning within the Project Area. The Project footprint is likely to change in some parts of the Project Area as a result of micro-siting, following biophysical surveys. The Project footprint represents 5.29% of the Local Assessment Area (LAA) and 1.12% of the Regional Assessment Area (RAA). The Project Area, which is not expected to be completely directly disturbed but represents the extent where clearing is possible, represents 36.56% of the LAA and 7.71% of the RAA.

Table 2.1 Project Area Components

Component	Area (km²)
Port au Port Wind Farm (west)	104.20
Port au Port Wind Farm (east)	13.42
Codroy Wind Farm	121.05
Plant Site	1.97
230 kV Transmission Line - Proposed and Alternate Route	56.95

Port au Port Wind Farm

The Port au Port Wind Farm is comprised of up to 164 turbines, maximum 200 metres (m) in height, with each turbine location connected by access roads and collector lines. The Port au Port West collector system consists of approximately nine circuits, totaling approximately 186 km. The Port au Port East collector system consists of two circuits totaling approximately 27 km. The 35 kilovolt (kV) collector lines transfer the energy created by the turbines to a substation, where it is stepped up for eventual transmission to the hydrogen / ammonia plant.

The proposed layout of the Port au Port Wind Farm is illustrated in Figure 2.2.

Two marine access points have been identified for the Port au Port Wind Farm to allow wind turbine components to be barged from the Port of Stephenville to the wind farm. Further information on these marine landing sites is found in Section 2.5.1.4 (including Figures 2.29 and 2.30).

Codroy Wind Farm

The Codroy Wind Farm is comprised of up to 164 turbines, maximum 200 m in height, with each turbine location connected by access roads and collector lines. The Codroy collector system consists of multiple circuits totaling approximately 271 km. The 34.5 kV collector lines transfer the energy created by the turbines to a substation, where it is stepped up to 230 kV for eventual transmission to the hydrogen / ammonia plant.

The Codroy Wind Farm is 75 km south of Stephenville via NL Route 490 and Route 1 – Trans-Canada Highway (TCH). Highways are maintained year-round by the NLDTI. The proposed layout of the Codroy Wind Farm is illustrated in Figure 2.3.

Access points off the TCH have been identified for the Codroy Wind Farm and are described in more detail in Section 2.5.1.5.

Stantec

Proposed Project Features

- Turbine Location
- Substation
- Hydrogen / Ammonia Plant Location
- Transmission Line 230 kV

Port au Port Interconnection

- Proposed Route
- Alternate Route
- Collector Line
- Access Road
- Project Area

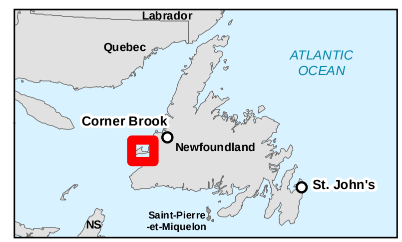
Other Features

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

N

0 8 Kilometres
(At original document size of 8.5x11)
1:350,000

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



Project Location
Stephenville
NL

Prepared by NW on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

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Figure No.
2.2

Port au Port Wind Farm Infrastructure Layout

Stantec

Proposed Project Features

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

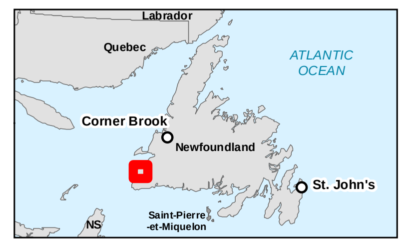
Other Features

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

N

0 5 Kilometres
(At original document size of 8.5x11)
1:230,000

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



Project Location
Stephenville
NL

Prepared by NW on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_038e

Figure No.
2.3

Codroy Wind Farm Infrastructure Layout

Electrical Infrastructure

The electrical infrastructure includes 484 km of 34.5 kV collector lines that transit the energy created by the turbines to the substation, where it is stepped up to 230 kV and then transferred to the station at the hydrogen / ammonia plant. The Port au Port West collector system consists of multiple circuits totaling approximately 186 km with no more than 20 turbines per circuit (Figure 2.2). The Port au Port East collector system consists of two circuits totaling approximately 27 km, with no more than 20 turbines per circuit (Figure 2.2). The Codroy collector system consists of multiple circuits totaling approximately 271 km, with no more than 20 turbines per circuit (Figure 2.3).

Port of Stephenville Hydrogen / Ammonia Plant and Port Facilities

The hydrogen / ammonia plant will be located on privately-owned land at the Port of Stephenville (in the Town of Stephenville) on a brownfield site already designated for industrial use (Figure 2.4), adjacent to the existing grid connection infrastructure. The existing infrastructure at the site includes industrial water supply infrastructure and existing outfall (which aligns with Project requirements [i.e., creating green hydrogen requires water and electricity and creates water discharge]). The Port is suitable for the implementation of ammonia production and export, as it has the advantage of a large lay down space and deep-water access for large ships.

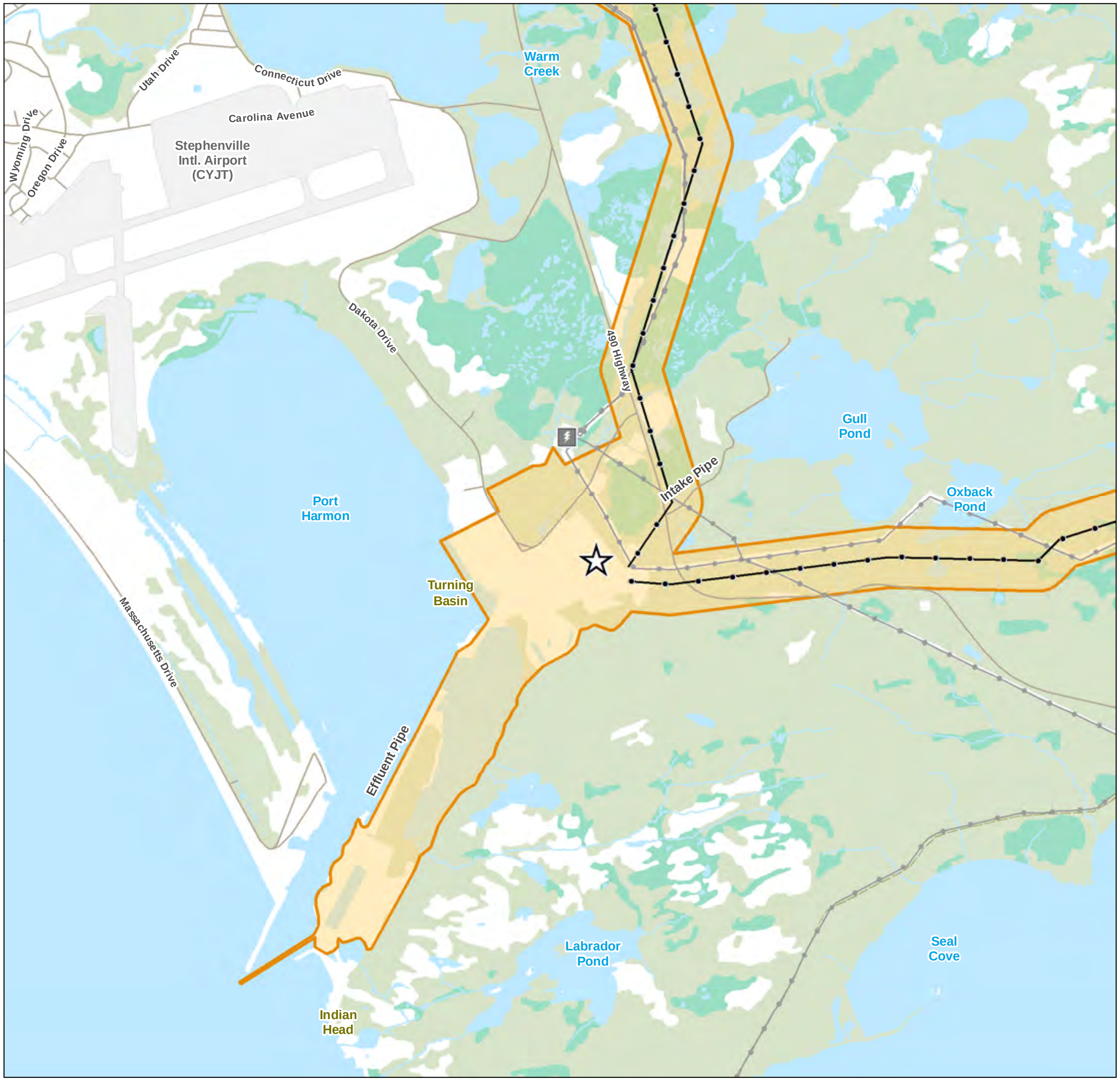
2.2 Rationale for the Undertaking

The Project's purpose is to produce cost-effective renewable (green) electrolytic hydrogen and ammonia for export to meet growing market demand, supporting the reduction in greenhouse gas (GHG) emissions and the global energy transition. Hydrogen will be converted to ammonia to facilitate efficient marine transportation to export markets.

2.2.1 Need For and Purpose of the Project

Need for the Project

Green hydrogen (in the form of ammonia) produced from electrolysis using renewable energy is widely recognized as having the potential to play a pivotal role in meeting international energy and future climate goals (IEA [International Energy Agency] 2022). Renewable hydrogen / ammonia can also help support energy security and self-sufficiency for importing countries by decreasing their dependency on imported fossil fuels. Renewable hydrogen / ammonia provides a solution for decarbonizing sectors where direct electrification is not feasible and/or there is no low-carbon alternative.



Stantec

Proposed Project Features

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

Other Features

- Electrical Generation, Existing
- Transmission Line, Existing
- Road
- Resource Road / Trail
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

0 0.8 Kilometres
(At original document size of 8.5x11)
1:35,000

Notes

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

Project Location
Stephenville
NL

Prepared by MB on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_038c

Figure No.
2.4

Hydrogen and Ammonia Plant Facility, Port of Stephenville

V:\1214\active\121417233\03_data\gis_cad\gis_data\mapping\mxd\general\Intro_ProjectDescription\121417233_038c_Project_Area_Plant_Location_REVA.mxd Revised: 2023-07-20 By: mblackwood

The application of renewable hydrogen has been recognized in government policy with more than 26 national governments worldwide developing national hydrogen strategies to-date, including the federal Government of Canada, which released a national hydrogen strategy in 2020 (IEA 2022). The Hydrogen Strategy for Canada (the Canadian Strategy) (Natural Resources Canada (NRCan 2020)) provides a framework of actions to position Canada as a global hydrogen leader, including key objectives to help Canada achieve the goal of net-zero carbon emissions by 2050. Further, the Canadian Strategy identifies the considerable opportunities for Canada to produce more renewable and low-carbon hydrogen / ammonia than domestic demand and become a major exporter of hydrogen to other countries. Most European countries have recognized that they will be unable to meet renewable hydrogen and ammonia demand and national emission targets by domestic production only. As such, European countries are supporting both local hydrogen / ammonia projects and hydrogen / ammonia export projects from outside of Europe to meet their anticipated consumption and GHG reduction targets.

Since publication of the Canadian Strategy, the Government of Canada has signed a memorandum of understanding with the Government of the Netherlands for cooperation in the field of hydrogen energy (NRCan 2021) and a joint declaration of intent with the Government of Germany establishing a Canada-Germany Hydrogen Alliance (NRCan 2022). Both documents established trade corridors between Canada and Europe for clean hydrogen exports as priority areas of cooperation; the declaration of alliance with Germany targets initial exports of hydrogen to begin in 2025 (Government of Canada 2021). The Government of German expects approximately 2.7 to 3.3 million tonnes (of hydrogen) will be needed by 2030, with considerable upside growth anticipated from 2030 to 2050 timeframe, when hydrogen is expected to be more fully integrated in the energy system (Government of Canada 2021). Further, the European Union has proposed a wider import target of 10 million tonnes of renewable and low carbon hydrogen by 2030 (European Commission 2022). 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).

The abundant potential for wind resources in NL is recognized in the Province's Renewable Energy Plan; this Plan recognizes the potential for wind resources and the opportunities to export energy surplus to provincial needs (Government of NL 2021). The Plan states that: "Newfoundland and Labrador is well positioned from a green hydrogen perspective due to the abundance of developed and undeveloped hydro resources; surplus energy; strong wind resources; available crown land; available fresh water; deep marine ports; and proximity to US and European markets" (Government of NL 2021). Further, the Plan identifies that renewable wind energy can be harnessed to produce green hydrogen which can be converted to ammonia (a compound of nitrogen and hydrogen) to facilitate marine shipping. A short-term commitment of the Plan was to rescind the NL wind moratorium policy, which was implemented on April 5, 2022, for customers seeking to self-generate wind energy for their own consumption, and industrial customers or retailers seeking to generate wind energy for export. The moratorium on wind development had been in place since 2007 and was a major barrier to wind investment and development in the province. Following this announcement, the NL Department of Industry, Energy and Technology announced a Crown Lands Nomination and Bid Process for Wind Energy Projects on July 26, 2022; this process is discussed further in Section 1.4.1.

Purpose of the Project

The Project's purpose is to produce cost-effective renewable electrolytic ammonia, using off-grid wind energy for electricity and treated freshwater as process inputs while supporting carbon emission reduction and generation of long-term benefits for the province of NL (grid power sources are planned for hydrogen production in 2025 until March 2026, when the electrolyzer is commissioned). Delivering on that purpose gives rise to the potential to become Canada's first commercial green hydrogen and ammonia production facility powered by wind energy.

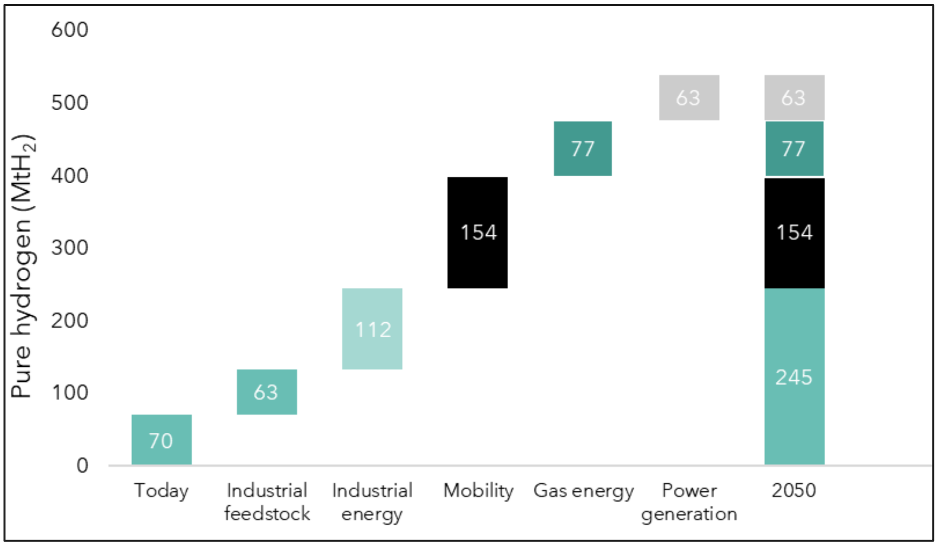
The Project fully aligns with renewable energy policy and carbon neutrality objectives at provincial, national, and international levels and will help position NL and Canada as a global leader in the production of renewable hydrogen. NL's unique geography, strong wind resource and proximity to large demand centres make the region globally competitive. The Project can capitalize on NL's experience in safe handling, storage and shipping of energy products, existing energy sector's skilled workforce and diversify Canadian energy exports beyond traditional energy products (e.g., crude oil, natural gas etc.) towards renewable energy exports which positioned for exponential future growth.

The Project is positioned as Canada's first commercial renewable hydrogen and ammonia production facility powered by renewable wind energy with the capability to ship ammonia via deep-water port to meet increasing global market demand.

2.2.2 Green Hydrogen Market

Currently, 118 million metric tonnes (Mt) of hydrogen is produced worldwide each year, approximately 70 million Mt is produced through dedicated fossil fuel-based hydrogen production plants (classified as "grey hydrogen), accounting for 2% of global carbon emissions. Approximately 80% of hydrogen produced today is consumed by the chemicals, oil refining, and steel industries and less than 0.03% of the produced hydrogen can be considered green (Kearney Energy Transition Institute 2020).

Given the need to reduce GHG emissions globally, worldwide demand of green hydrogen is forecasted to exponentially increase to over 500 million Mt per year by 2050 (Kearney Energy Transition Institute 2020) (Figure 2.5). While industrial applications will likely still account for almost 50% of 2050 hydrogen consumption, new hydrogen applications in gas energy, mobility, power generation, and industrial uses will account for most of the consumption growth. Further, several hydrogen use cases have no low-carbon alternative, which makes green hydrogen the only option for decarbonization. Examples of hydrogen use cases where no real low-carbon alternative exists include fertilizer, methanol, hydrogenation, hydrocracking, desulphurization, shipping fuel, steel, long-term storage, long-haul aviation, and remote trains. Green hydrogen can also be used as an option where biofuels and/or battery energy storage systems are currently used including, but not limited to, short- or medium-haul aviation, automobiles, domestic, industrial and/or commercial heating, island grids, and clean power imports.



Source: Kearney Energy Transition Institute 2020

Figure 2.5 Forecasted Global Hydrogen Consumption By 2050 (MtH_2)

2.2.3 Green Ammonia Market

Ammonia is the second-most produced chemical worldwide, with approximately 200 million Mt of ammonia currently consumed each year, mostly by the fertilizer and chemical industries (Kearney Energy Transition Institute 2020). Less than 0.01% of the ammonia currently produced can be considered green. Of the 183 million Mt of ammonia produced annually, 72% is generated from natural gas, 22% generated from coal, and naphtha and heavy fuel oil generates the remainder; this represents 1% of total global carbon emissions (IRENA [International Renewable Energy Agency] and AEA [Ammonia Energy Association] 2022). Greater than 50% of ammonia production and consumption is in Asia. The two other large consumers are the United States of America and Europe.

Given the low volumetric energy density of hydrogen both compressed as a gas, and in liquid form, ammonia is recognized as being a much more efficient carrier over long distances, as it is more cost effective for transporting large volumes of hydrogen (as liquid ammonia) to export markets. Ammonia can then be cracked over a catalyst to produce hydrogen and nitrogen to meet application requirements. In addition, green ammonia is recognized as an important transition fuel for the transportation and maritime industries as it can be burned directly in internal combustion engines producing zero-carbon emissions. As such, the worldwide green ammonia market is expected to parallel the exponential growth in demand worldwide expected for green hydrogen; it is forecasted that annual demand will reach approximately 250 million Mt by 2030 and 700 million Mt by 2050. Existing markets are expected to increase demand to 223 million Mt by 2030 and reach million 333 Mt by 2050. Ammonia demand for fertilizer will grow from 156 million Mt in 2020 to 267 Mt in 2050, mainly due to population growth (IRENA and AEA 2022).

In 2020, Canada accounted for 26.9% of the North American ammonia market. To meet commitments under the Paris Climate Agreement and to facilitate the transition from fossil fuels to renewables, the Canadian industrial sector is searching for innovative ways of reducing GHG emissions associated with the production of ammonia. In 2018, Canada announced the Life Cycle Clean Fuels Policy, which requires fuels to be carbon-free. These combined policies to cut down carbon emissions create opportunities for the rapid deployment of green ammonia in Canada.

2.2.4 Project Opportunities in the Global Hydrogen Economy

The substantial supply-demand imbalance for green hydrogen and ammonia is an important opportunity for the Project as demand from Europe is expected to increase considerably in the next few years. Most European countries have recognized that they will be unable to meet renewable hydrogen and ammonia demand and national emission targets by domestic production only. As such, European countries are supporting both local hydrogen projects, and hydrogen imported from projects from outside of Europe to meet their anticipated consumption and GHG reduction targets. The German National Hydrogen Strategy, published in 2020, recognizes that domestic production of renewable and low-carbon hydrogen will not be sufficient to cover new demand and most of the hydrogen needed will have to be imported from cost-effective sources elsewhere (Government of Germany 2020). As such, the German National Hydrogen Strategy focuses on developing collaborations dependent on imports of hydrogen.

The European Commission published the REPowerEU plan in May 2022 to further recognize hydrogen as an important energy carrier, identifying a plan to move away from Russian fossil fuel imports (European Commission 2022). In addition, the European Commission published the Clear Hydrogen Mission to advance the development of the clean hydrogen economy worldwide, including establishing joint agreements with Australia, Austria, Canada, Chile, Germany, India, Italy, Morocco, Norway, Saudi Arabia, South Korea, the United Kingdom, and the United Sates.

The IEA recognizes that to keep up with demand, an international energy market for renewable hydrogen and ammonia will likely develop, and large volumes could be traded (IEA 2022). An increasing number of countries with abundant low-cost renewable energy potential and low political risk are competing to establish renewable hydrogen supply corridors. In addition to the partnership formed with Canada in 2021, the Government of Germany has also initiated partnerships with Australia, Chile, Morocco, Saudi Arabia, and South Africa, with a further objective to explore the potential for the production of renewable hydrogen in western and southern Africa.

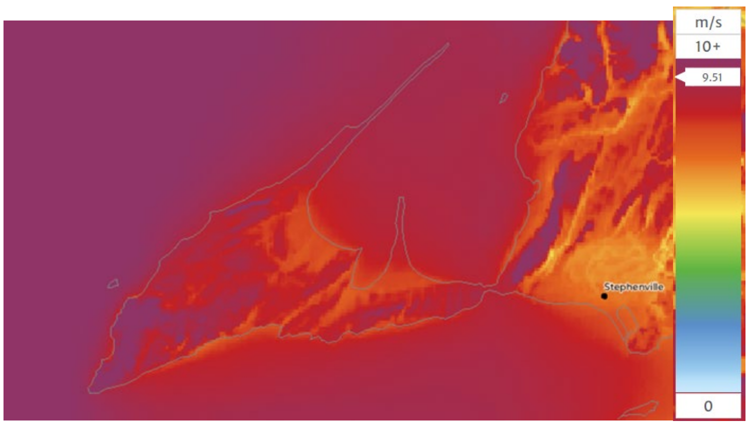
The Project is uniquely placed to support a transition to a low-carbon hydrogen economy. The Project's proposed location in NL enables easy access to established marine shipping routes for effective marine exports of green ammonia to Europe and the east coast of the United States. Currently, the intention is to export the full ammonia output; however, several opportunities exist to support local industries with long-term decarbonization efforts that are being explored, including the potential of using ammonia as a carbon-neutral alternate fuel for shipping and supporting other local industries to decarbonize. Overall, the Project is well positioned to satisfy the opportunity for current and future markets. It has access to a growing market for low-carbon energy imports and has the additional option to contribute to decarbonization of NL's industry.

2.2.5 Wind Resource Opportunity in Western Newfoundland

Green hydrogen production is recognized as being the most efficient and economical in locations that have the optimal combination of abundant renewable power resources and deep-water port access enabling connections to key demand centers (IRENA 2022).

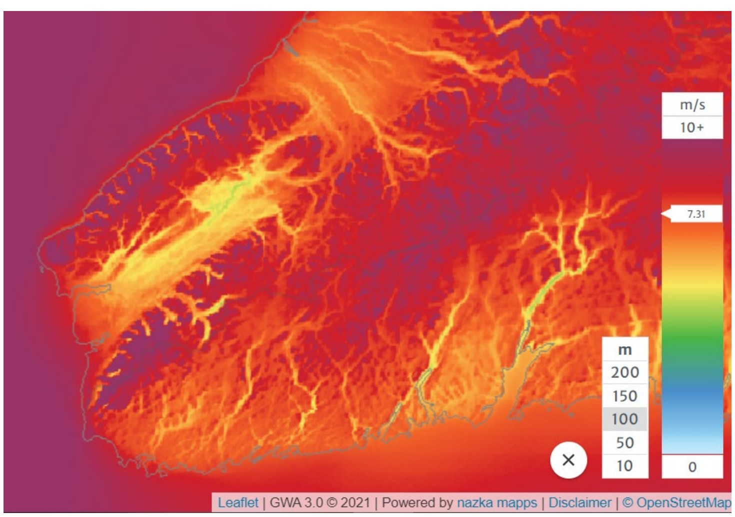
Canada has the longest coastlines in the world, and abundant wind resources in coastal areas, giving the country potential to grow the wind energy sector. For NL, the opportunity is even greater given the area's world-class, constant wind and strategic location between the North American and European markets.

The Project's wind farm sites benefit from excellent wind resources with onshore wind speeds equivalent to those observed at some offshore sites globally. Figures 2.6 and 2.7 show the wind speed distribution at Port au Port and Codroy Wind Farms, respectively.



Source: Global Wind Atlas

Figure 2.6 Wind Speed Distribution at Port au Port Wind Farm



Source: Global Wind Atlas

Figure 2.7 Wind Speed Distribution at Codroy Wind Farm

The Project has engaged the world's leading wind energy technical advisor, Det Norske Veritas (DNV), to conduct an initial desktop study and analysis of the wind resources at the Project wind farm sites using mesoscale data from DNV's Virtual Met Data and Vortex. With average turbine wind speeds estimated to be 9.7 metres per second (m/s) at the Port au Port Wind Farm and 10.8 m/s at Codroy Wind Farm, the gross energy output for a 2 gigawatts (GW) (combined wind farms) onshore wind project is expected to be up to 4,841.7 gigawatt-hour (GWh)/annum at Port au Port Wind Farm and up to 5,678.6 GWh/annum at Codroy Wind Farm, suggesting robust Project performance.

2.3 Project Components

This section of the Environmental Impact Statement (EIS) describes the physical features of the Project which include:

- Temporary workforce accommodations
- Onshore wind farms (Port au Port and Codroy Wind Farms) including access roads
- Electrical infrastructure, including collector systems, substations, high-voltage transmission lines (including a subsea cable crossing across Port au Port Bay), and a terminal station
- A 1.2 GW green hydrogen / ammonia plant for the production and storage of green hydrogen / ammonia (with potential for expansion to 1.8 GW), located at the Port of Stephenville, NL, including industrial water supply and treatment infrastructure; industrial wastewater marine outfall; administrative / office, fire and emergency response, control, security
- Port facilities (requiring upgrades) to enable the export of green hydrogen (in the form of ammonia) to international markets (and receipt of construction materials)

This section of the EIS describes the physical features of the Project.

2.3.1 Temporary Workforce Accommodations and Associated Infrastructure

Up to two temporary workforce accommodation camps will be constructed to accommodate workers during Project construction and decommissioning activities in the Port au Port and Codroy areas. Purpose-built worker accommodation camps would include:

- Accommodation
- Recreational facilities
- Canteen services
- Welfare services
- Laundry
- Transportation to and from site
- Utility services (e.g., emergency power, water, waste management, telecommunications)

It is anticipated that an accommodations facility will be constructed to house approximately 1,200 to 1,500 workers during the Project's construction phase of the Port au Port Wind Farm and hydrogen / ammonia plant. The accommodations facility will be located near the Port of Stephenville and workers will likely travel to Port au Port via bus. The facility will be connected to the Town of Stephenville's potable water supply and wastewater system. For a facility accommodating approximately 1,200 to 1,500 workers, the increase in potable water demand is expected to be approximately 240 m³ per day. This increased demand will require WEGH2 to provision for two additional groundwater wells to meet peak demand. Both camp sites are temporary and will be dismantled and removed and the site decommissioned.

Due to the distance and remote nature of the Codroy Wind Farm, a separate workforce accommodations camp may be required to house the approximately 300 to 500 workers during construction and decommissioning of the Codroy Wind Farm. Potable water supply will be from groundwater, and wastewater will be discharged in compliance with the NL *Water and Sewer Regulations*. Power supply will be from the grid.

2.3.2 Wind Farms

The Project will have an estimated 1,200 MW (1.2 GW) of electricity demand required for hydrogen production, which will be supplied by the Port au Port and Codroy Wind Farms. Collectively, these wind farms will have the capacity to generate up to 2 GW of wind power for the Project. In addition to wind turbines, the Port au Port and Codroy Wind Farm sites will each include the following infrastructure and facilities:

- Civil works include the road network, construction access points, and water crossings
- Access roads interconnecting the site and wind turbine locations
- Cleared areas at each turbine location for crane pads and temporary equipment laydown
- Temporary infrastructure required during construction (e.g., quarries and concrete batch plants)
- An operation and maintenance facility at each wind farm

Land Use

The total wind turbine base area represents less than 2% of the overall total footprint of each wind farm site, which also includes access roads, collection system, and transmission lines. Each individual wind turbine will occupy approximately 1.25 ha (0.0125 km²). The Port au Port Wind Farm will occupy a total of approximately 15,863 hectares (ha) (approximately 159 km²) and the Codroy Wind Farm site will occupy a total of approximately 14,665 ha (approximately 147 km²). This "Total Project area" assumes to cover the full nominated areas included within the Call for Bids; the effective physical footprint of the wind turbines bases and balance of plant of the Project area is much smaller (2.2% of total 281.52 km²).

The access road network is expected to occupy approximately 2.3% of the total footprint area associated with each wind farm site. The spatial extent (i.e., physical footprint) of the access road network will be limited to the minimum required to safely meet its intended purpose and in consideration of other design and construction requirements and constraints, which will be determined in consultation with equipment manufacturers and civil contractors. Based on preliminary design, it is anticipated that the access road network will occupy approximately 377 ha of the 15,863-ha Port au Port Wind Farm nominated areas and approximately 341 ha of the 14,665-ha Codroy Wind Farm nominated area.

Access Roads

The Port au Port and Codroy Wind Farms will each require a network of new and upgraded access roads for transportation of Project components and equipment into the Project Area, as well as interconnection of the wind turbine locations within the respective wind farm site. As summarized in Table 2.2, approximately 197 km of new access roads (including turbine road network) will be required within the boundaries of the Port au Port Wind Farm site, approximately 152 km of new access road (including turbine road network) will be required within the boundaries of the Codroy Wind Farm site, and approximately 37.4 km of upgraded access roads will be required to connect the wind farm sites to local highways (i.e., 5.3 km of road upgrades to connect the Port au Port Wind Farm and 32.1 km of road upgrades to connect the Codroy Wind Farm). The preliminary design of the access road network is based on a proposed road cross-section with targeted surface width of 7 m; this width may range from approximately 7 to 9 m, depending on the road location in the network. The preliminary layouts of the proposed access road network for each wind farm are shown on Figures 2.2 and 2.3, respectively, and are intended to provide an estimate of the order of magnitude of the access roads required in support of the Project.

Table 2.2 Wind Farm Access Road Requirements

Type of Access Road	Port au Port Wind Farm	Codroy Wind Farm	Total
New Access Road Construction (km)	8	8	16
Repurposed Access [1] (km)	5	32	37
Turbine Road Network[2] (km)	189	143	332.

Notes:
[1] "Access road upgrades" refers to existing gravel roads from the existing public road network that provide access to the general area of the turbines.
[2] "Turbine road network" refers to service roads that provide access to an individual wind turbine.

The quantity of each type of access road was established based upon approximate wind turbine locations, complemented by both a desktop study and multiple field visits. Existing roads within the Project Area (i.e., forestry access roads, cabin roads, trails) were prioritized for access.

Wind Turbines

Each wind turbine typically consists of the following components (Figure 2.8):

- Tower
- Nacelle
- Three rotor blades
- Hub assembly

Source: WEGH2 2023

Figure 2.8 Typical Wind Turbine Components

The towers are supported by the following infrastructure:

- Generator Step up transformer
- Electrical and grounding wires
- Buried grounding grid at perimeter of foundation

Number of Wind Turbines and Wind Turbine Type

The Project will be developed in stages, with a staggered construction schedule for the Port au Port and Codroy Wind Farms. The Port au Port Wind Farm is currently planned to consist of up to 164 wind turbines, with up to 171 sites that are being studied for the EIS, on the Port au Port Peninsula, NL and adjacently on the Newfoundland "mainland" (i.e., northeast of the isthmus at Port au Port). The Codroy Wind Farm is currently planned to consist of up to 164 wind turbines located on Crown land in the Anguille Mountains. The modelling and assessment work is based on preliminary layouts for both wind farm sites (i.e., 171 potential turbine locations at the Port au Port Wind Farm and 143 potential turbine locations at Codroy Wind Farm). Final wind farm layouts will be dependent on results of the wind campaign and more detailed field investigations. Once the layout and number of turbines are finalized, the results of models will be reviewed and updated as required. The number of turbines at each site will be determined by the power generation capacity of the selected turbines and a thorough study / optimization of the yield based on wind speed data gathered from a meteorological program conduct at each wind farm site.

The rated capacity of the wind turbines will be between 6.1 to 7.2 MW. WEGH2 has started discussion, design, and evaluation of wind turbine suppliers. The goal is to establish an optimal design / layout of the wind farms based on commercially available technology, as well as understand the delivery capability of the key suppliers to accommodate Project development planning. Turbine size and model are therefore still being finalized; a proven and bankable wind turbine technology that is suitable for utility-scale wind generation projects and location specifics will be finalized in 2023 using site-specific wind speed data. The current base case assumption for the Project is to use the Siemens Gamesa SG 6.6-155 wind turbine type (SG-155 WTG). These wind turbines will consist of three-blade rotors, and tubular towers. The SG-155 WTG have a nominal rated capacity of 6.6 MW, maximum hub heights of 122.5 m, and a blade rotor diameter of 155 m.

Wind Turbine Dimensions

Each of the Siemens Gamesa SG 6.6-155 turbines will stand at an approximate height of 102 m from its base to hub (pending final design configuration) and use 76-m blades, allowing the 155-m rotor diameter to provide an installed capacity of 6.6 MW. This gives a tip height of approximately 180 m. WEGH2 is also evaluating turbine types with longer blades or higher hub, but the total tip height will be limited to 200 m above ground elevation. The towers' section lengths will be designed in compliance with local logistics requirements.

Wind Turbine Foundations and Anchoring Details

Wind turbine foundations are generally divided into two types:

- Gravity foundations, which rely on the mass of foundation concrete, steel reinforcing, and larger bearing area to provide a solid foundation for the wind turbine
- Rock anchor foundations, which use a combination of concrete mass, steel reinforcement, and anchor rods drilled and grouted into the rock.

As local geotechnical conditions dictate the optimal foundation style in each case, it is anticipated that both types will be required for the Project. Wind turbine foundations will include an envelope of engineered gravel to provide positive drainage away from the foundation. Surface grading will provide positive runoff and avoid ponding of rainfall.

2.3.3 Electrical Infrastructure

Electrical infrastructure includes:

- Electrical collector system (i.e., network of 34.5 kV collector lines), including three substations (two collector substations and one terminal substation) in total for the Port au Port and Codroy Wind Farms
- Transmission line to Port au Port Peninsula, using a proposed submarine cable crossing Port au Port Bay (including a transition compound stations beside each shore landing site) or an alternate land corridor crossing the isthmus
- Buried high-voltage cables to connect the submarine cable from the transition compounds to the above-ground transmission lines
- High-voltage (230 kV) transmission lines for interconnection from the wind farm collector system to the hydrogen / ammonia plant terminal substation
- One terminal substation at the hydrogen / ammonia plant

The preliminary design for the Project transmission lines is based on twin single-circuit 230 kV construction, with two transmission lines from the Codroy Wind Farm substation, and two transmission lines from the Port au Port West substation to Port au Port East wind farm substation, and continue to the hydrogen / ammonia plant terminal station. The Port au Port and Codroy Wind Farms will each have a 1,000 MW capacity that will be transmitted back to the terminal station via 230 kV transmission lines, with a combined output of 2,000 MW. The total length of these lines will be approximately 145 km.

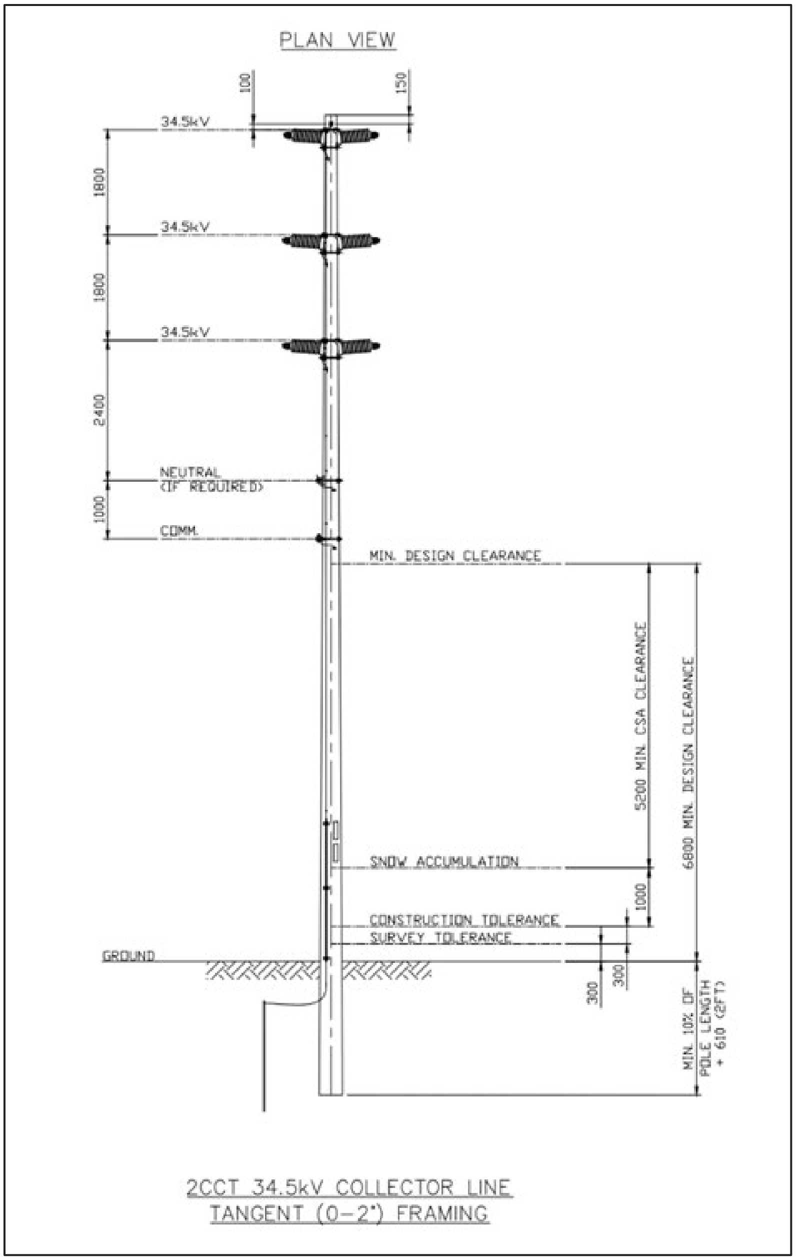
A 230 kV transmission interconnections will be required from the Stephenville Terminal Station to connect to NL Hydro facilities for the import of power from the grid.

34.5 kV Collector System

The wind farm collector systems will be comprised of 34.5 kV overhead distribution lines along 15- to 20-m RoWs connecting the wind turbines to the collector substations. Access corridors will be cleared where necessary for the construction of the lines and also allow for line maintenance after construction.

Each collector line will be of single pole design with two collector circuits carrying aluminum conductor steel reinforced conductors arranged in a parallel circuit configuration. Composite or steel poles are anticipated to range from 15.2 to 22.9 m (50 to 75 feet) in height; pole foundations are anticipated to consist of normal burying with log anchors, guying with some cribbing, and rock anchors as needed. Surge arresters will be installed along the overhead line to provide lightning protection of the collector circuits. An optical fiber cable is located below the circuit neutral to provide high-speed communications between the wind turbines and the control room at the terminal station. The configuration will be finalized during the detailed design phase so that the interconnection requirements of NL Hydro (155 MW maximum on a single 34.5 kV line) will be met. A typical 34.5 kV tangent structure layout is illustrated in Figure 2.9. The layout has been based upon a proposed 6.6 MW turbine size wind turbine.

Each turbine will have a buried grounding grid around the perimeter of the foundation, which will be interconnected to the collector neutral wire. The ground wire will be at the base and perimeter of the foundation within the foundation excavation limits. Grounding protection for each wind turbine will be determined by a detailed grounding study. The final ground wire configuration will be determined by this study. Typically, the ground wire is located 300mm outside of the foundation and within the foundation excavation. This ground wire will be connected to the ground conductor in the buried collector system cables and connected to the generator tie line ground wire.



Source: WEGH2 2023

Figure 2.9 Typical Double Circuit 34.5kV Collector Pole Line Framing

Approximately 18 to 20 34.5-kV collector feeder circuits will deliver power to the collector substations from the turbines. Configuration of the feeders are primarily overhead distribution lines with underground cables from the turbines to the overhead collector circuits for connection of the wind farms to the collector substations. Final configurations will be confirmed in the detailed design. The Port au Port Wind Farm will have two collector substations: Port au Port West and Port au Port East. The substations are based on a typical air insulated substation (pending final requirement).

The Port au Port West and Codroy collector substations will have a similar overall design and footprint and will include up to five main power transformers 230 kV to 34.5 kV, 3-Phase, 266megavolt (MVA) amperes (MVA) each and may have up to four synchronous condensers rated for approximately 167 megavolt ampere (MVAr) of reactive power each. The Port au Port East collector substation will have a reduced footprint compared to the other two, since only three collector circuits are connected to this substation. The substation design will include up to two main power transformers 230 kV to 34.5 kV, 3 Phase, 266 MVA each and associated breakers.

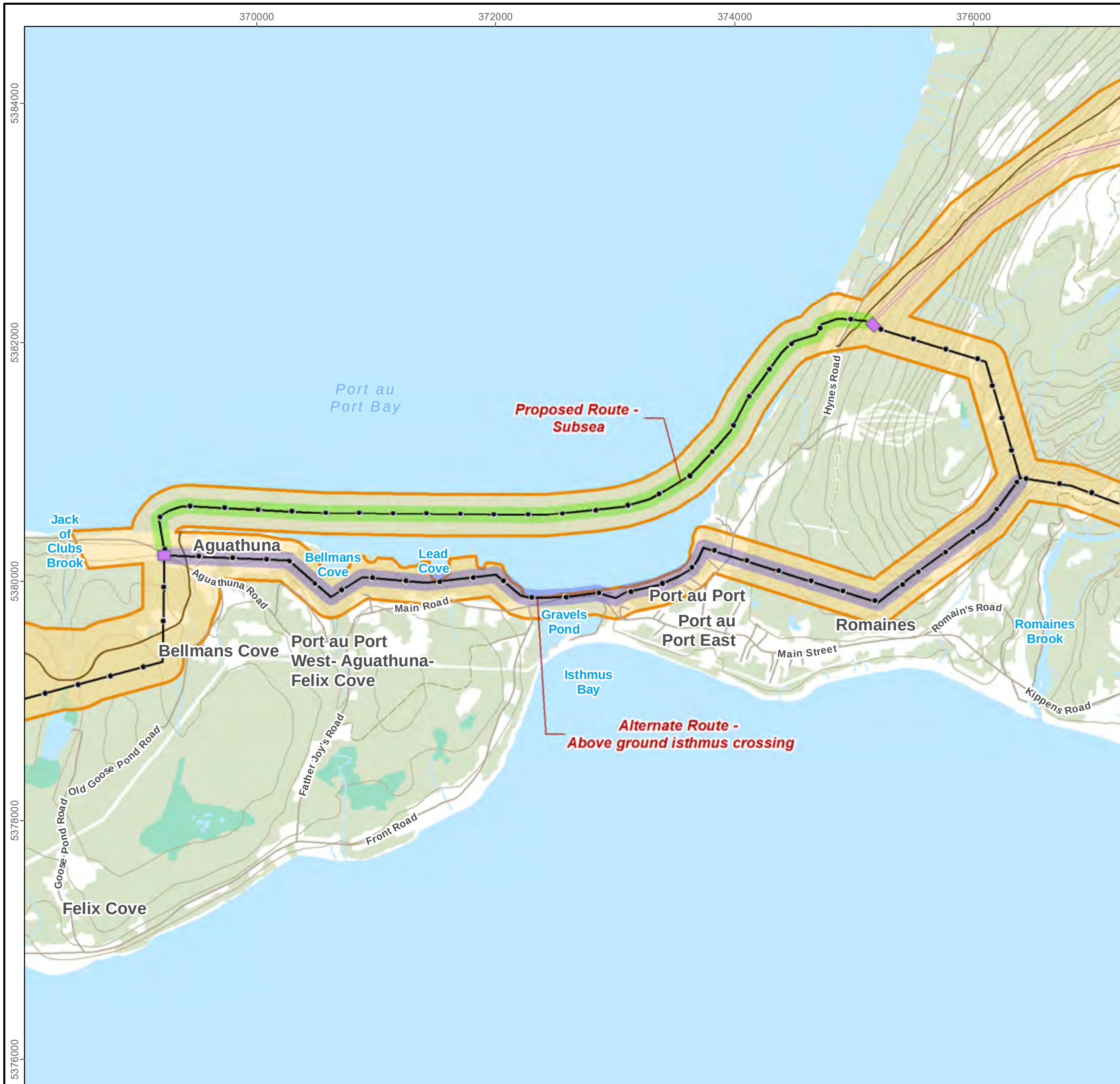
The three substations will also include:

- Associated electrical equipment for protection, isolation, and control such as conductors, circuit breakers, disconnect switches, capacitor banks, insulators and voltage transformers.
- Civil and structural design includes necessary control building, station grading, drainage, fencing, structure foundations, yard gravel, and steel structures for the installation of the collector substation equipment.

Submarine Cable Crossing

A submarine transmission system is one of the alternatives proposed between a transition compound station along the south shore of Port au Port Bay, approximately 1.3 km west of Bellmans Cove and the Port au Port East Collector Substation (Figures 2.10 and 2.2). The EIS also assesses an alternate on-land route across the isthmus of the Port au Port Peninsula (Figure 2.10), potentially using an existing RoW.

While the routing is pending a geotechnical investigation, the proposed system is to include two circuits of 230 kV submarine transmission lines and fibre optic cabling approximately 6.4 km in length from the transition compound to the Port au Port East collector Substation. The submarine cables are likely to be single-core 2,000 mm² 245 kV class cables. The cables will be able to carry up to 750 MW peak load, with a normal load of 500 MW. There will be two parallel circuits of three cables each separated by a minimum of 3 m and up to 20 m separation. This will enhance the reliability of the transmission system and decrease the probability of both circuits being possibly damaged.



Stantec

Proposed Project Features

- Transmission Line 230 kV
- Port au Port Interconnection
  - Proposed Route
  - Alternate Route
- Collector Line
- Access Road
- Substation
- Project Area

Other Features

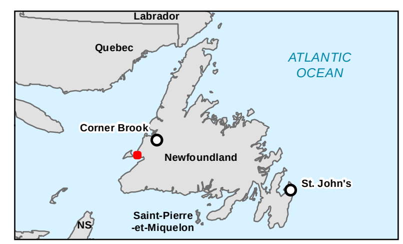
- Transmission Line, Existing
- Road
- Resource Road / Trail
- Contour (20 m)
- Watercourse
- Waterbody
- Wetland
- Forested Area

N

0 0.5 1 Kilometres
(At original document size of 8.5x11)
1:50,000

Notes

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



Project Location
Stephenville
NL

Prepared by MB on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_060

Figure No.
2.10

230 kV Submarine Cable Routing

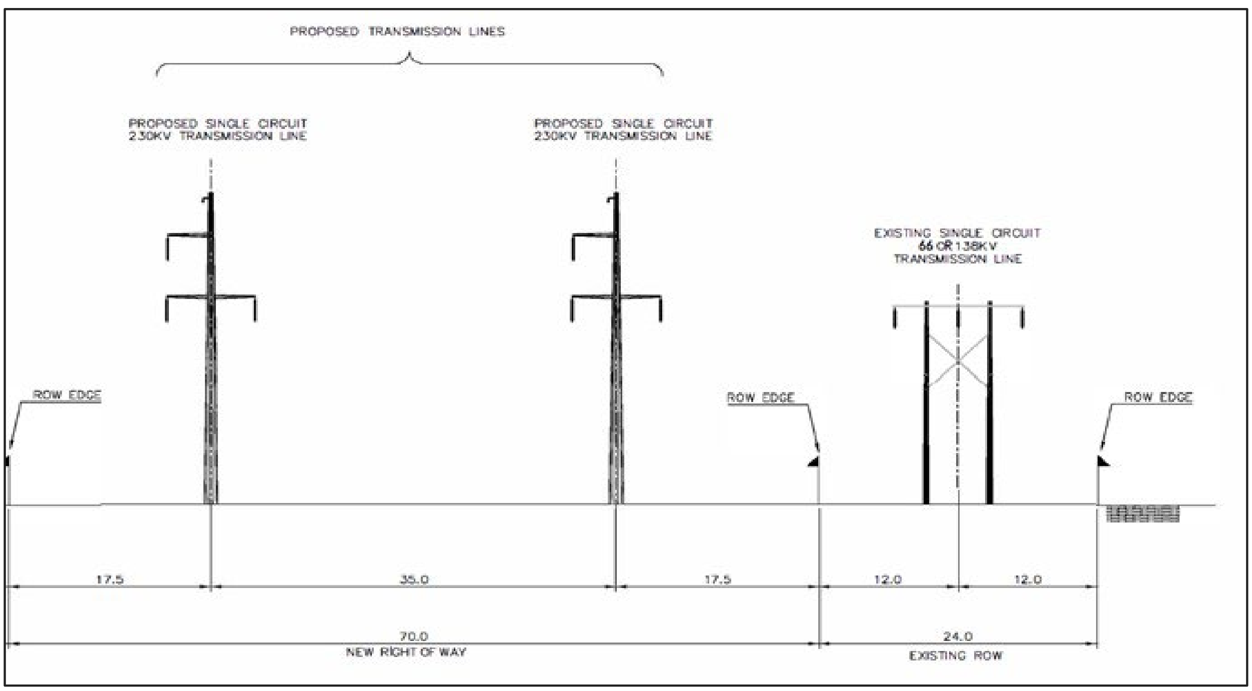
The proposed routing of the submarine transmission lines was based on the need to reduce the effect on the local community during the construction and operational phases of the Project since the connection between the peninsula and mainland is via a narrow isthmus. While options are being considered, the base case is trenching the submarine cable.

Interconnecting Transmission Lines

The proposed routing of the transmission lines has taken into consideration existing transmission corridors, private property boundaries, and the need to reduce routing through populated areas wherever possible.

Dependent on the final transmission line routing and proximity to adjacent residential areas, the following designs (Figure 2.11) are proposed for the transmission line construction:

- Monopole steel structures with bundled conductors (two per phase): structures will be equipped with overhead shield ground wire or overhead optical ground wire for lightning protection and control, and guy wires for additional support where required. Each circuit may be built on a separate structure to reduce the risk of concurrent multiple circuit outage, with 35 m spacing between adjacent circuits.
- As noted above, submarine cables are proposed to avoid the narrow isthmus to the Port au Port Peninsula, which has limited space for new transmission ROWs.



Source: WEGH2 2023

Figure 2.11 Two-circuits 230 kV Transmission Line Right-of-way

Port au Port Wind Farm

The proposed routes of the transmission lines from the Port au Port West and East Collector Substations are indicated in Figure 2.2. Both substations are connected to the hydrogen / ammonia plant terminal station located at the Port of Stephenville via 230 kV transmission lines.

The proposed configuration for the two Port au Port Wind Farm transmission lines includes:

- Approximately 19 km of overhead transmission lines from the east collector substation (located near Port au Port East) to the hydrogen / ammonia plant terminal station.
- Approximately 23 km of overhead transmission line between the transition compound and the west collector substation.

Codroy Wind Farm

The route of the 230 kV, transmission lines from the hydrogen / ammonia plant terminal station for connection to the Codroy Wind Farm collector substation located in the Anguille Mountains is shown in Figure 2.3. The proposed routing for these overhead transmission lines is approximately 107 km.

Hydrogen / Ammonia Plant Terminal Station

The 230 kV hydrogen / ammonia plant terminal station for interconnection to the NL Hydro grid will be located in the Port of Stephenville. The 250 m x 500 m hydrogen / ammonia plant terminal station (to be confirmed during detailed design) will include the following:

- Ten power transformers 230 kV – 34.5/34.5 kV, 3-Phase, 266 MVA each
- Concrete oil containment structures for power transformers (to contain an accidental hydrocarbon release)
- Associated electrical equipment for protection, isolation, and control such as conductors, circuit breakers, disconnect switches, capacitor banks, insulators, voltage transformers, and grounding transformers
- Control building, station grading, drainage, fencing, structure foundations, yard gravel, and steel structures to incorporate the terminal station equipment

Grid Connection Requirements

To enhance the hydrogen / ammonia plant operation and lifetime, it is anticipated that a grid connection of up to approximately 150 to 200MW is required. The purpose of the grid connection is to provide the hydrogen / ammonia plant with sustaining capacity, which will reduce shutdowns and ramp downs, improving the overall operational efficiency of the plant when wind power production is low (i.e., during summer).

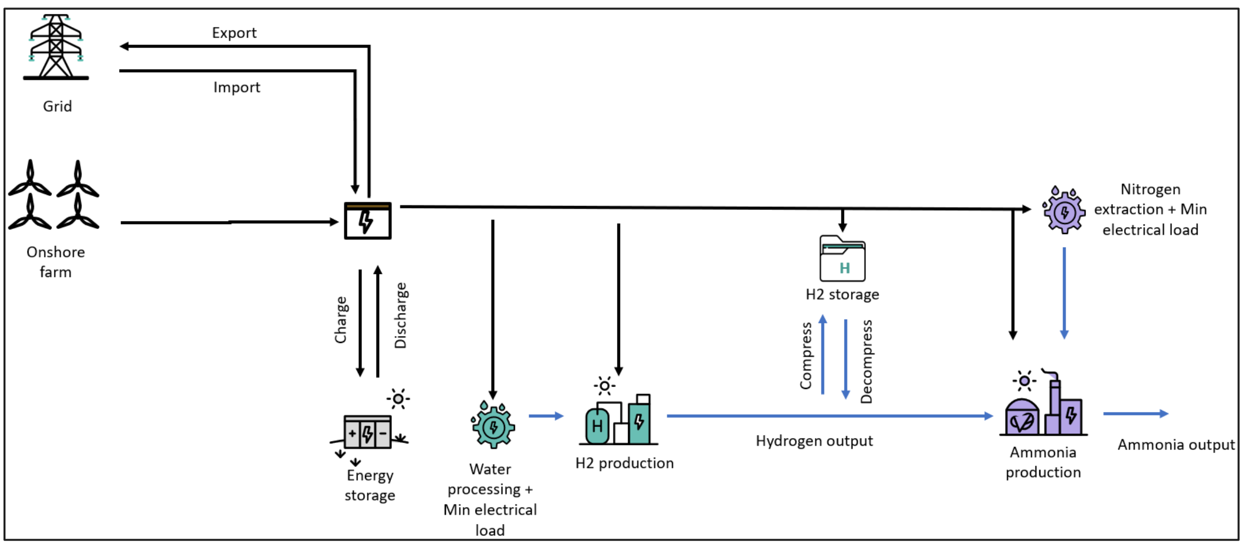
In addition to the grid imports, the plant will have a power storage solution to meet the minimum base power requirements to run the ammonia plant and electrolyzers at lowest loads when there is little or no wind. The grid connection will also enable the Project to reduce its power storage capacity (which is approximately 350 MWh annually).

An interconnection application to NL Hydro has requested a firm capacity of 10 MW ("firm load") and an additional capacity of up to 145 MW ("non-firm load") to be made available 24/7 during summer, and partially available during the four months in winter. A 230 kV interconnection is required for this exchange of power / energy with NL Hydro at the Stephenville Terminal station

Based on these assumptions, the Project expects to import 600 to 650 GWh annually. Higher power imports are expected during summer, when grid power demand in the region is relatively low.

2.3.4 Hydrogen / Ammonia Production and Storage Facilities

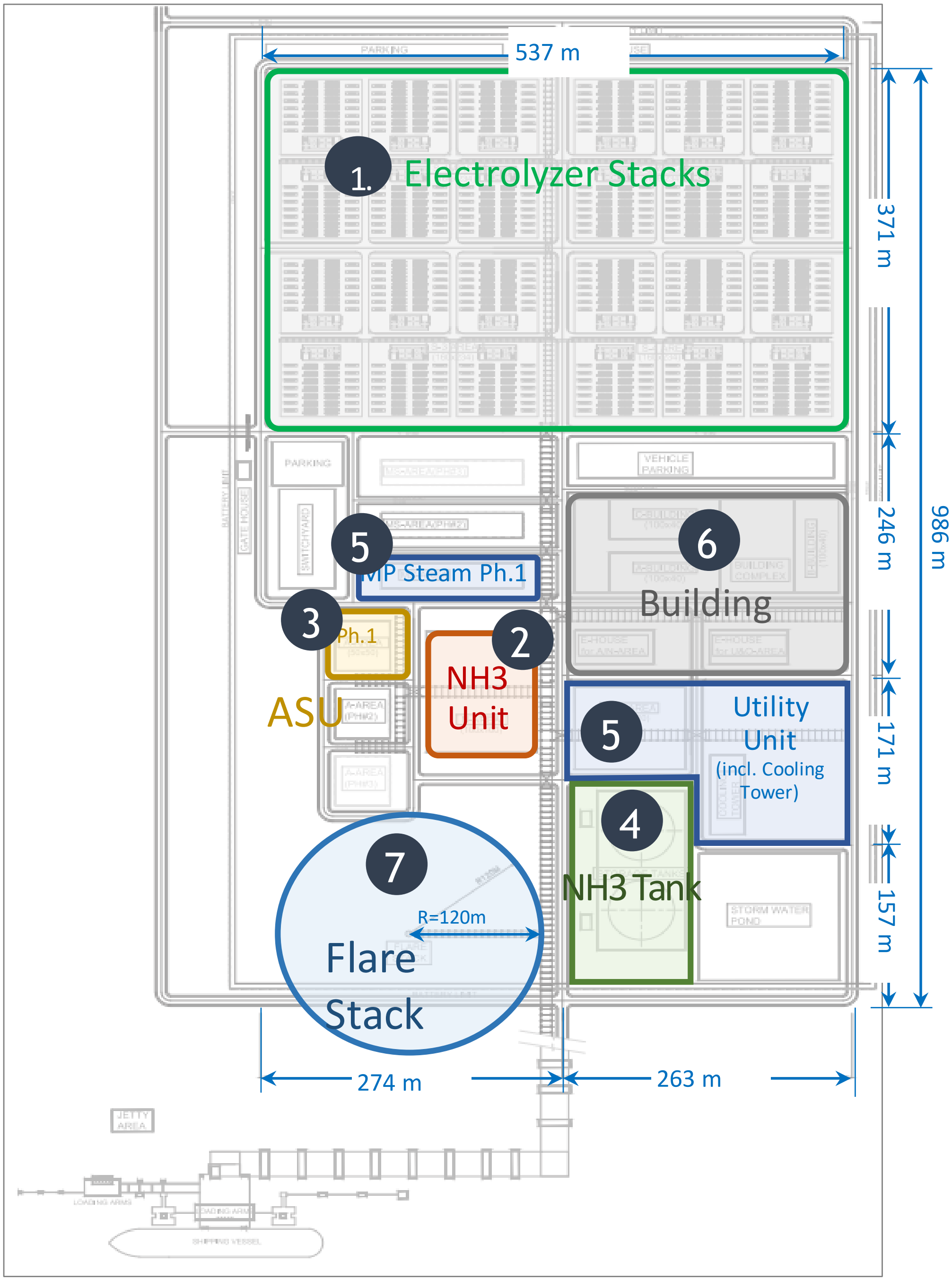
The wind energy generated by the Project is intended to be fully used on site to create green hydrogen, which will then be converted to green ammonia. Figure 2.12 illustrates a flow diagram of the Project process, indicating where the electricity from the wind farms is used.



Source: WEGH2 2023

Figure 2.12 Proposed Flowchart of Hydrogen / Ammonia Plant

Figure 2.13 shows a preliminary layout of the hydrogen and ammonia plant. The final plant layout will depend on the exact technology set-up and will be enhanced for production and storage processes taking into account the safety policies and requirements.



Source: WEGH2 2023

Note: NH_3 = ammonia; ASU = Air Separation Unit

Figure 2.13 Hydrogen and Ammonia Plant Layout

The hydrogen / ammonia plant (Figure 2.13) incorporates the following components:

1. Electrolyzer stacks: The electrolyzers produce hydrogen and oxygen from electricity and water using the electrolysis process. The hydrogen is then sent to the ammonia unit while the oxygen is safely returned to the atmosphere.
2. Ammonia unit: Hydrogen from the electrolyzers is combined with nitrogen from the Air Separation Unit to produce ammonia.
3. The Air Separation Unit (ASU): The ASU separates nitrogen from the air to be used to produce ammonia by the Haber Bosch process.
4. Ammonia tank: The ammonia produced in the ammonia unit is stored in the double walled "full containment" ammonia tanks.
5. Utility unit: The utility unit includes items of the plant that are not reactants or products but are still needed for the plant to run, such as steam and cooling water.
6. Building: The building includes an office / administrative building, lab, maintenance, fire brigade. The scope and design of those buildings will be further clarified in the pre FEED and FEED (Front End Engineering Design)
7. Flare stack: The flare stack is a gas combustion device that combusts and vents gas from the system, if needed. The flare stack will be sized for controlled safety release of hydrogen, ammonia, and nitrogen exhaust in non-routine situations. A conservative design has three stacks on the main flare, each approximately 91.4 to 121.9 m (300 to 400 feet).

The hydrogen / ammonia plant will have an electrical demand of approximately 1,200 MW. The wind yield is approximately 50% capacity factor (which is why 1000 MW wind required for 600 MW plant) . The 1,200 MW hydrogen / ammonia plant will have the ability to be expanded in the future to 1,800 MW. Ammonia production will be approximately 360,000 tonnes per year per phase.

The hydrogen facility currently envisaged will be a combination of a Proton Exchange Membrane (PEM) and Solid Oxide Electrolyzer Cell (SOEC) electrolyzers (Appendix 2-A). The ammonia facility is an industry standard ammonia production facility; various unit designs are provided in Appendix 2-B.

Although the hydrogen / ammonia plant will be located on a brownfield site, new roads will be required on site for Project construction and operations. A laydown area will be established quayside for plant construction components and wind equipment.

The approximate area for a hydrogen / ammonia plant is 1.3 ha per 70 MW (excluding storage or ammonia synthesis). All full capacity, the hydrogen / ammonia plant will occupy an area of approximately 100 ha (including facilities and infrastructure), depending on the final technology selection, ammonia production and storage capacity, and water handling requirements. A Project-specific environmental management plan will address how contaminated materials are handled, stored, and disposed of.

Hydrogen and Ammonia Production Facility Capacity and Production Quantities

The hydrogen and ammonia will be produced using electrical power produced by wind energy or supplied by the NL Hydro grid. More details on the production processes of the hydrogen and ammonia can be found in Sections 2.3.4.2 and 2.3.4.3.

The hydrogen and ammonia production facilities capacities take into account technological developments, supply chain capacities, and areas available, as well as the capacities of the wind farms, grid connection, and storage facilities. Table 2.3 provides an overview of the (cumulative) average and maximum capacities and production of the hydrogen and ammonia facilities corresponding to the Port au Port and Codroy Wind Farms coming online over two phases.

Table 2.3 Cumulative Estimated Average and Maximum Hydrogen and Ammonia Capacity and Production

Component	Unit	Port au Port Wind Farm Operational (~2026)	Codroy Wind Farm Operational (~2027)	Potential Future Expansion
Total Installed Electrolyzer Capacity	MW	600	1,200	1,800
Estimated Average Hydrogen Production	Tonnes per annum	70,000	140,000	210,000
	Tonnes per day	192	384	575
Estimated Average Ammonia Production	Tonnes per annum	360,000	720,000	1,080,000
	Tonnes per day	986	1,973	2,959
Maximum Hydrogen Production	Tonnes per annum	103,000	206,000	309,000
	Tonnes per day	282	565	846

The maximum annual production rate of hydrogen is based on the full power condition; however, because of the variability of wind speeds and the resulting generation, the approximate annualized production rate will be in line with the lower "average" rate. The actual annual production rate will vary from year to year depending on the actual wind conditions.

Hydrogen Production Process

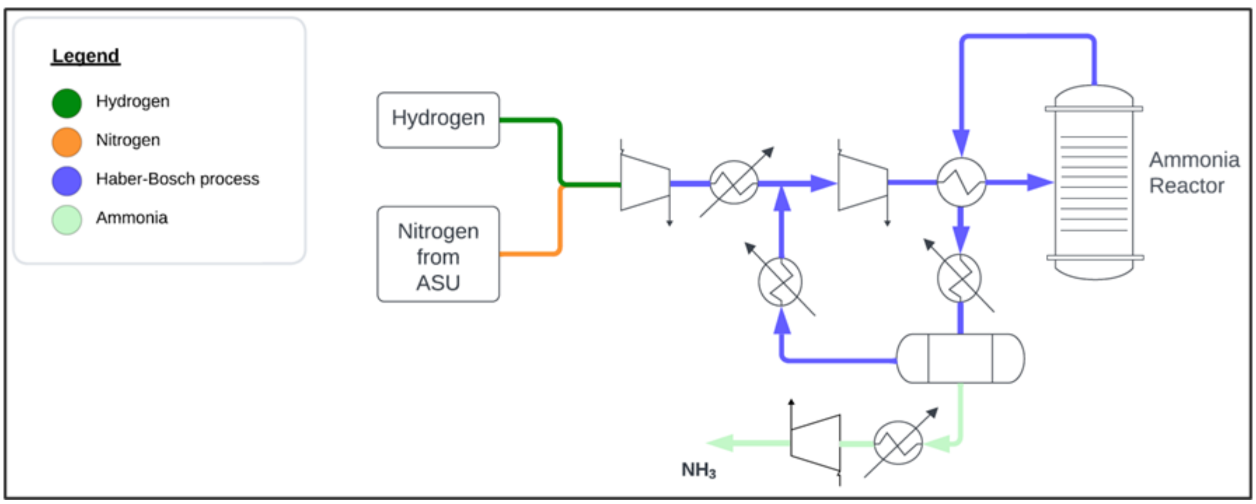
An electrolyzer plant uses renewable electricity to separate hydrogen from purified water. By applying an electrical current through water, the hydrogen and oxygen molecules split and hydrogen gas is then captured, purified, and compressed for direct use, storage, or distribution. The oxygen may be captured for other uses or safely vented to the atmosphere. There are four main technologies used for electrolysis: (i) Alkaline, (ii) Proton Exchange Membrane (PEM), (iii) Solid Oxide Electrolysis Cell (SOEC) and (iv) Anion Exchange Membrane.

The Project currently includes the combination of PEM electrolyzers with a capacity of approximately 540 MW and SOEC electrolyzers with a capacity of approximately 60 MW, summing up to a total electrolyzer capacity of 600 MW for the Port au Port Wind Farm. Designing the plant with this technology combination is beneficial for the Project due to the strong ramp-up capabilities and track record of the PEM electrolyzer and the efficiency of the SOEC.

The technology selection of the Project's hydrogen / ammonia plant is still under development, as such, specific equipment including make, model, and infrastructure has yet to be determined. The lessons obtained during the first 600 MW of electrolyzer capacity will be taken into account in the upscaling of the hydrogen / ammonia plant for the Codroy Wind Farm and future expansion. The preferred electrolyzer technology has not been finalized, but it is anticipated that 90% will be PEM and 10% SOEC.

Ammonia Production Process

Ammonia is synthesized in a processing unit known as a "Haber Bosch" unit; the process is shown in Figure 2.14. A Haber Bosch unit combines hydrogen produced from electrolyzers with nitrogen extracted from the air using the ASU. The ASU is a standard, known technology. The hydrogen and nitrogen are raised to high temperature and high pressure in the presence of an iron catalyst to form green ammonia. Haber Bosch units are the industry norm for producing ammonia and many units are operating globally.



Source: WEGH2 2023
Note: ASU = air separation unit

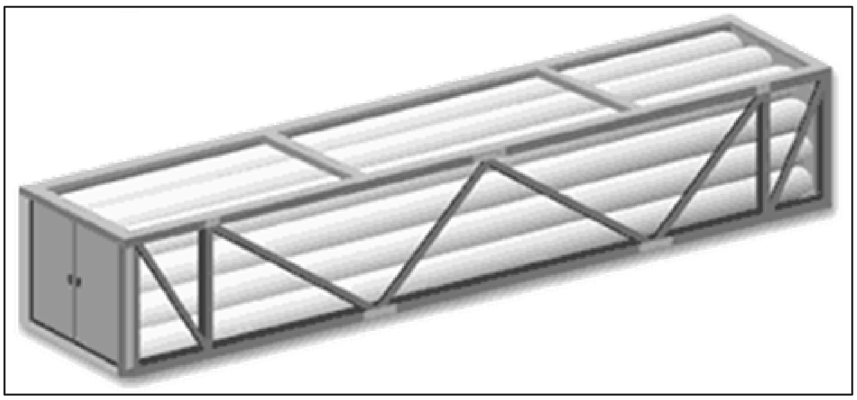
Figure 2.14 Typical Process Flow Diagram for an Ammonia Converter

Ammonia Unit Design

The design of the ammonia unit (which will use the Haber Bosh process) is under development, as such, specific equipment including make, model, and infrastructure has yet to be finalized. The ammonia units under consideration are described in detail in Appendix 2-B.

Hydrogen / Ammonia Storage Facilities

Stationary above-ground storage for gaseous hydrogen generally consists of multiple cylindrical steel composite pressure vessel(s), which may be mounted in a frame and installed on a concrete foundation (illustrated in Figure 2.15). The hydrogen is stored in a gaseous state in above-ground storage vessels that enable storage of up to 1 ton of hydrogen each, depending on the storage pressure. These containers are pressurized vessels that are constructed to meet pressure boundary codes (currently estimated to be approximately 193 bar, but ultimately sized depending on the format). The vessels require pressure and/or thermal relief valve design and sizing to provide adequate overpressure protection. These vessels are constructed to industry standards, such as the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.



Source: WEGH2 2023

Figure 2.15 Hydrogen Storage Vessel

The total hydrogen storage quantities are subject to further engineering and safety studies, but are currently anticipated to be approximately 20 tons, which represents 60 tube-type ground mounted storage units . The storage racks will be located in a secure area in the utility area of the plant. Each unit is approximately 8 m x 2.3 m x 2.3 m. The storage would likely be configured stacked two units high for an area of 40 m deep x 26 m wide x 6 m high (depending on the storage pressure), requiring a footprint of approximtely1,040 m² plus access and safety buffers.

The ammonia will be stored next to the ammonia production facility in an industry-standard double-walled, insulated tank (full-containment) with refrigeration to maintain temperatures (Figure 2.16). The tank is equipped with safety systems to suppress vapours. The ammonia storage tank is located within the plant boundaries and is currently sized to a footprint of 15,000 m². The total storage amounts are to be further refined in engineering studies, but are likely to fall within the 50,000 to 100,000 m³ range at full capacity. There is space for multiple tanks for expandability.

Source: WEGH2 2023

Figure 2.16 Ammonia Storage Tank

Ammonia is classified as a liquefied compressed, flammable, and corrosive gas in accordance with the International Fire Code and National Fire Protection Association's (NFPA) definitions.

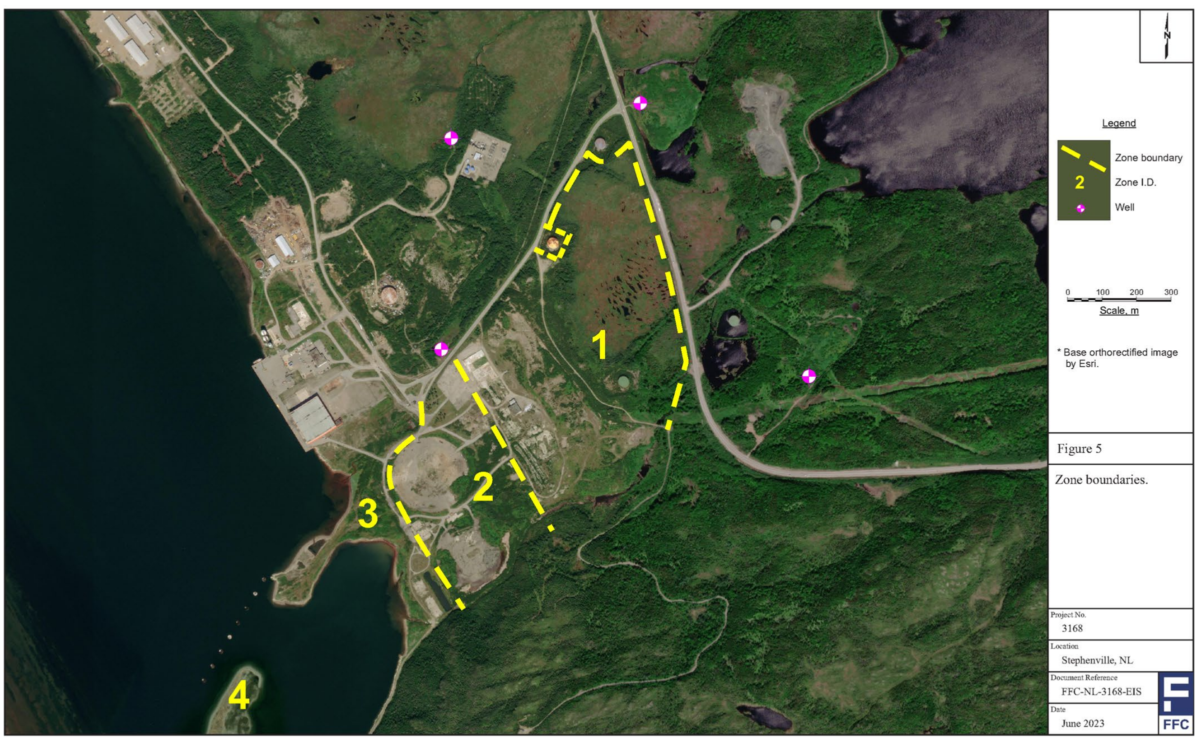
Plant Site Conditions

The overall property (referred to locally as the Abitibi Mill) was the site of a long period of military activity (1941 to 1966) when it was part of the Stephenville United States Air Force military base, followed by construction (1970 to 1973) and operation of the linerboard mill in the Port Harmon area and on the eastern side of the United States Air Force base. The linerboard mill was closed in 1977 and subsequently acquired by Abitibi-Price in 1979, and was operated by Abitibi-Price and then by Abitibi-Consolidated Company of Canada, during which time it was converted to a newsprint operation, which operated until 2005. Demolition and limited site rehabilitation was conducted during 2007 and 2008. Based on the Phase II and Phase III Environmental Site Assessment (ESA) intrusive investigations, it was concluded that many of the industrial activity areas did not contain environmental impacts above the Risk Based Screening Levels for a commercial property.

Additional site investigations such as ground-penetrating radar surveys followed by soil and groundwater sampling are planned where fluid and chemical storage tanks were known to exist prior to the completion of the demolition activities in 2008. The area to the west of the main Abitibi plant site that contained, and in some locations still contain, large bulk fuel storage tanks will be subject to additional Phase III and Phase IV ESA investigations in consultation with the Province.

Based on the known or the expected level of environmental impacts, the areas in which the additional ESA site remedial and site preparation activities for the former Abitibi property will be conducted has been divided into four zones (Figure 2.17):

- Zone 1 covers approximately 70% of the immediate former Abitibi plant area and has a number of areas that require test pit and borehole investigations, with the expectation for limited remedial activities that can be accomplished by excavation and stockpiling until the final laboratory data are obtained followed by completing risk assessments
- Zone 2 has the most extensive soil and groundwater impacts, along with buried fuel pipelines, that are expected to require remediation by excavation with backfilling, followed by bioremediation and bioventing
- Zone 3 (the smallest area) will require limited soil and groundwater sampling followed by completion of risk assessments to identify and obtain approval for solutions such as capping the old ash ponds. It is expected that the area around the old fuel distribution building will significant delineation work and selective excavation of hydrocarbon impacted soil followed by in-situ bioremediation and bioventing to deal with expected hydrocarbon impacts in soil and groundwater
- Zone 4 ESA will be limited to a small number of test pit samples and several monitoring wells plus sampling of old monitoring wells that can be rehabilitated. It is expected that the old landfills will be left in place based on a risk assessment and that a long term monitoring program will be prepared to manage the old landfills.



Source: FracFlow 2023

Figure 2.17 Zones of Anticipated Existing Contamination

2.3.5 Port Facilities (for Ammonia Transportation)

The Port is located in Stephenville and is suitable for ammonia production and export, as it has the advantage of a large lay down space and deep-water access for large ships.

The navigational channel (80 m x 2,100 m) and large, dredged turning basin (450 m radius) have a depth of 9.8 to 10 m that allows for vessels up to 385 m in length (this will be confirmed through a navigation study and possible vessel simulation). The quay has a berthing area of 293 m x 19 m. The dock is 293 m x 20 m, with 7,500 m^3 of asphalt paved dock area. Facilities and equipment on site include two boom cranes and a jib crane. The Port has prepared laydown space and numerous additional acreage of cleared land is available.

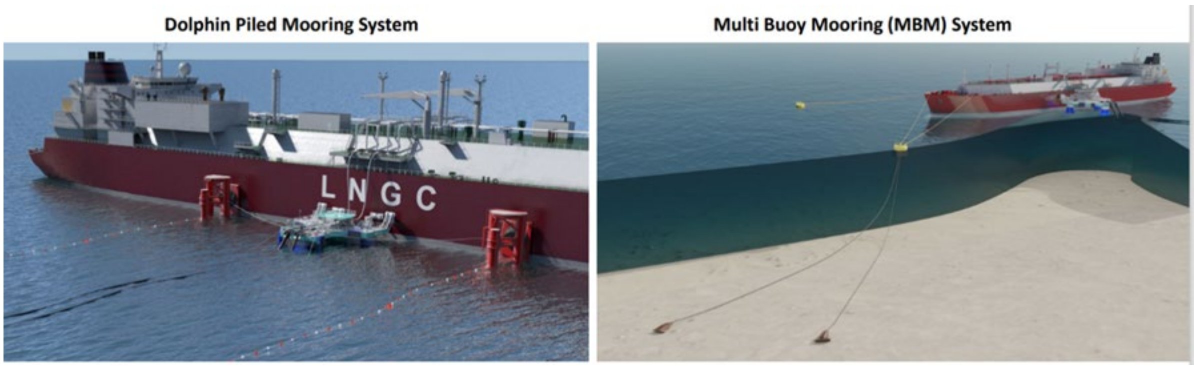
Ammonia carriers are typically in the range 15,000 to 85,000 m^3; the three common vessel sizes are 30,000 m^3, 52,000 m^3, and 80,000 m^3. Based on current understanding, the Port is able to accommodate vessels to transport ammonia without the construction of additional berthage. This will be confirmed prior to construction through the completion of a desktop navigation assessment and a vessel navigation simulation, if necessary. The existing quay will be inspected and load rated as part of detailed engineering for the Project to verify that it can accommodate the berthing and mooring loads from the maximum anticipated size ship.

The offloading system design remains under consideration. The two primary options are (1) placing a loading arm or loading hose structure on the existing quayside or (2) the construction of a floating "jettyless" loading system. The jettyless floating offloading system would be floated to the vessels side by tugs and secured to the vessels hull with a specialized mooring system. Figure 2.18 illustrates a jettyless system.

Source: WEGH2 2023

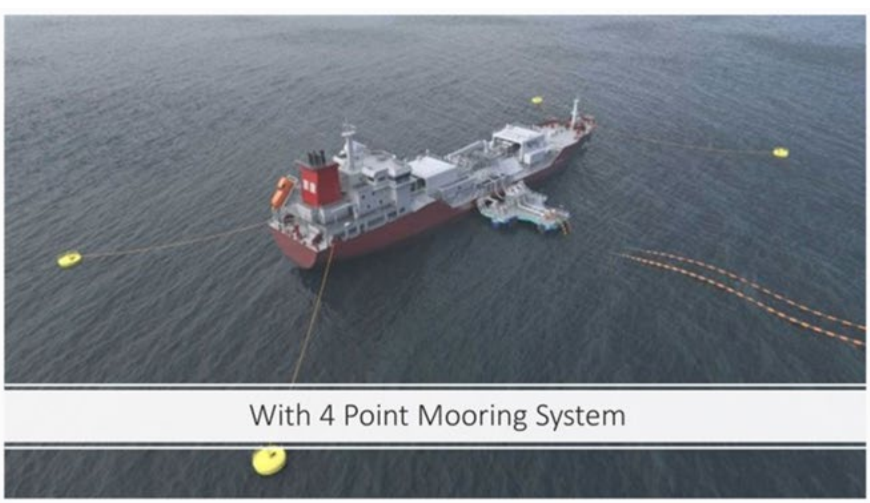
Figure 2.18 Jettyless System (foreground)

Specifically, the Jettyless Econnect system is one option that could provide greater versatility to the Port because it would allow the existing quayside to be used without obstruction from loading arms and transfer piping. Following a cargo transfer, the system would be purged with nitrogen and moored to the extreme end of a dock in such a way to allow access for other vessels or continued development of the Project. A small number of dolphins (Figure 2.19) or anchored mooring buoys fitted with quick release hooks (Figures 2.19 and 2.20) will be required.



Source: Econnect Website: https://www.econnectenergy.com/solutions/jettyless-transfer

Figure 2.19 Jettyless System Mooring Options



Source: WEGH2 2023

Figure 2.20 Jettyless Offloading Systems with 4-point Mooring Arrangement

The Port also includes a large central marshalling yard. In addition, there will be temporary marine landing sites on the Port au Port Peninsula constructed to receive low-draft barges for delivery of the wind turbine components and other bulk Project materials.

2.4 Project Schedule

The Project will be developed and constructed in stages with a staggered delivery schedule for the Port au Port and Codroy Wind Farms (and future expansion) (Figure 2.21). The final total installed capacity of the Project might vary depending on the final selected wind turbine type and capacity. In addition, micro-siting, after detailed engineering studies have progressed further, might lead to optimizing for the number of wind turbines and/or require adjustments.

The construction of the Port au Port Wind Farm and associated infrastructure is anticipated to start in Q4 2023, when the road preparation works will commence, pending EA approval and receipt of other required permits and approvals. The first wind turbine is planned for installation in July 2024 and the last wind turbine is projected to be installed in December 2025, with wind farm commissioning in February 2026. The hydrogen and ammonia plant will be constructed throughout 2024 and 2025, with the initial 600 MW of electrolyzer capacity expected to be commissioned in March 2026. Grid power sources are planned for hydrogen production in 2025 until March 2026, when the wind farm is commissioned.

The construction of the Codroy Wind Farm and associated infrastructure is expected to follow construction of the Port au Port Wind Farm. Road preparation works are planned to commence in 2025. The first wind turbine is planned for installation in October 2025 and the last wind turbine is projected to be installed in February 2027, with wind farm commissioning in May 2027. The additional 600 MW of electrolyzer capacity and a second ammonia production train will be added to the plant configuration and is expected to be commissioned in June 2027.

The hydrogen / ammonia plant will be constructed such that an additional 600 MW electrolyzer can be added to the plant configuration to accommodate potential future development; it would be commissioned in September 2028.

The Project will operate 24 hours a day, 7 days a week, except for scheduled maintenance events. The nominal design life of the Project is 30 years.

ID	Task Name
1	Hydrogen / Ammonia Plant Construction for Initial Start-up on Grid
2	First Hydrogen (from grid)
3	**Port au Port Wind Farm Construction**
4	Port au Port Construction Camp
5	Roads (permits needed before tarting roads)
6	Collector Systems Civil Works
7	Turbine Foundations – February 28, 204 – April 15 2025
8	Collector Systems Tower Installation and Cable Pulling
9	Turbine Towers Assembly
10	Commissioning and Start-up
11	Port au Port Hydrogen / Ammonia Plant Startup
12	Transmission Line Construction
13	Industrial Water Supply Construction
14	**Port of Stephenville**
15	Dredging
16	Dock Work
17	Testing and Commissioning of Dock System
18	**Codroy Wind Farm Construction**
19	Codroy Construction Camp
20	Roads (permits needed before starting roads)
21	Collector Systems Civil Works
22	Collector Systems Tower Installation and Cable Pulling
23	Turbine Foundations
24	Turbine Towers Assembly
25	Commissioning and Start-up
26	Codroy Hydrogen / Ammonia Plant Start-up

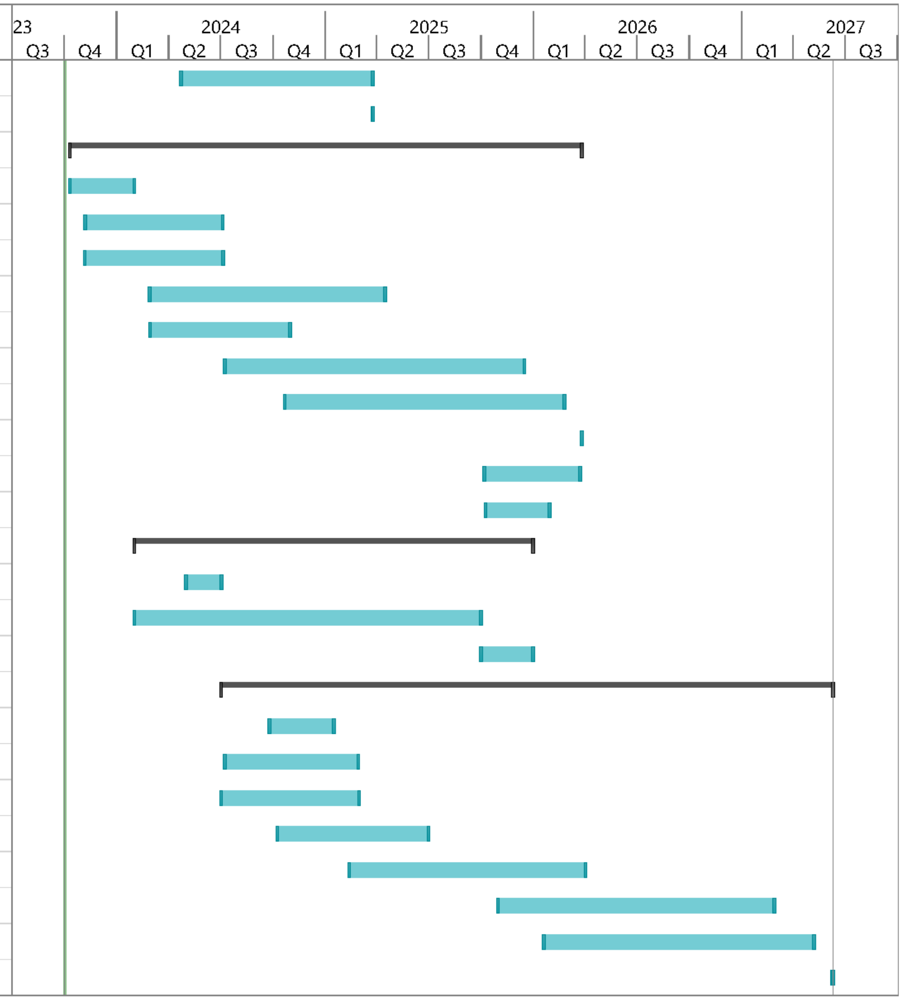


Figure 2.21 Integrated Project Schedule

2.5 Construction Activities

The construction phase of the Project will entail the buildout of the hydrogen production facility, wind farms, transmission infrastructure, and other supporting facilities. The construction phase will include site preparation and construction. Main activities include the following:

- Civil works, including temporary accommodation facilities, site preparation, site clearing and grading and access roads
- Wind farm construction, including wind turbine transportation and installation
- Electrical infrastructure, including connector systems, substations, transmissions lines, and hydrogen / ammonia plant terminal station
- Hydrogen / ammonia plant construction
- Port facility upgrades

The Project will have numerous Engineering, Procurement, and Construction (EPC) teams allocated to various scopes. An overview of the key metrics associated with construction of this Project are provided in Table 2.4.

Table 2.4 Key Metrics Associated with the Construction of the Project

Key Metrics	Estimated Quantity for Port au Port and Codroy Wind Farms
Total Road Length (km)	Approximately 350
Number of Wind Turbine Sites	maximum of 328
Wind Turbine Major Component Deliveries	14 loads per wind turbine
Wind Turbine Site Laydowns (ha)	1 per wind turbine
Cement (t)	75,000
Concrete (m^3)	200,000
Common Excavation (m^3)	3,500,000
Common Borrow (m^3)	400,000
Rock Excavation (m^3)	3,000,000
Rock Excavation (Quarried)	3,000,000
Crushed Aggregate (m^3)	1,500,000
Bulk Emulsion Explosives (kg)	7,000,000
Diesel Fuel (L)	40,000,000
Person Hours (hours)	4,000,000
Construction Duration (months)	30
Total Calendar Duration (months)	40

Note:

These are high-level metrics for the Port au Port and Codroy Wind Farms combined, inclusive of road and wind turbines works, excludes transmission line and hydrogen / ammonia plant. Approximately 55% of the total is associated with the Codroy Wind Farm, 45% with the Port au Port Wind Farm.

2.5.1 Site Preparation and Civil Works

Transportation and Storage of Project Materials and Equipment

Construction of the Port au Port Wind Farm will be supported by barging components across Port au Port Bay from the Port of Stephenville (or potentially unloading the turbine component vessel directly onto a barge), landing at Aguathuna and West Bay on the Port au Port Peninsula. The Transportation Impact Study conducted for the Project is provided as Appendix 2-C, which also contains a Traffic Management Plan. The proposed road network required to deliver the Project materials and equipment are described in Sections 2.5.1.4 and 2.5.1.5, including description of the potential barge sites on the Port au Port Peninsula (Section 2.5.1.4).

The Stephenville Port has several acres of prepared laydown space, and additional cleared land is available for any necessary expansion of the laydown yard.

A potential alternate site for laydown and staging areas for wind turbines and other components at the Stephenville Airport (previous US military offload dock location), and the airport lease has been signed by the Airport Authority and WEGH2. Nearby, existing infrastructure and littoral conditions would support a temporary marine terminal. Figure 2.22 shows the component laydown areas in red and indicates the location previously used as a US military offload dock location where the Project would potentially develop a landing ramp. The Aguathuna site also has good laydown potential.

Source: WEGH2 2023

Figure 2.22 Stephenville Airport Docking, Laydown and Staging Areas

Quarrying and Borrow Strategy

The Port au Port Wind Farm and hydrogen / ammonia plant are adjacent to existing operating and historical quarries and borrow sites. The Project will look to use existing quarry facilities and permitted sites to the extent possible, but it is anticipated that the bulk of project fill materials will come from road excavated materials, greatly limiting the need for new or existing borrow sources. WEGH2 anticipates applying for a permit along the proposed road network, authorizing rock and common material extraction for road building and concrete aggregates within 100 m of the centreline of roadways (a common practice used for overland transmission line construction). It is anticipated that the majority of needed Project aggregates and borrow materials can be sourced from inside the ROW. In limited instances, depending on the cut and fill balance for materials in a given zone, and the quality of rock in a given zone, quarry sites (and resulting permits) may be needed outside of the envisioned road ROW.

The concrete class will be specified in detailed design; however, initial review indicates that it would be Tercem 3000® cement powder and 45 Mpa concrete mix. It is estimated 200,000 m³ of concrete would be required for the Port au Port and Codroy Wind Farm sites. Granular materials will likely be Class A, Class B, 6" Minus, RipRap Slope Armoring, Coarse Concrete Aggregate, Fine Concrete Aggregate and Clear Stone, with a high-level estimate of 1,500,000 m³ of crushed / screened aggregate products required for the Port au Port and Codroy Wind Farm sites.

Wind Farm Road Network Construction

Tree clearing in advance of road works will be performed in compliance with obtained permits and WEGH2's environmental management practices, including avifauna management measures. Tree clearing is anticipated to include harvesting merchandisable timber and stacking. Cleared timber will be stockpiled locally adjacent to the road ROW for potential productive use within local communities. Trees of non-merchandisable size or brush will be mulched in place.

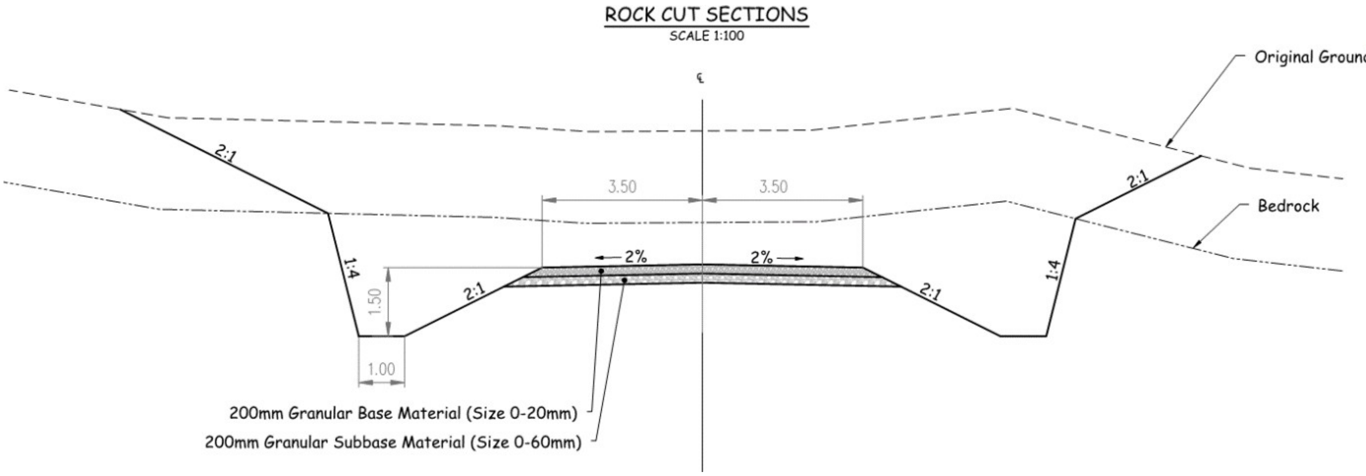
The road network has been developed to reduce footprint and land disturbance, with road widths reduced to 7 m top where possible; however, for the purposes of this environmental assessment, a buffer of up to 300 m has been assessed to accommodate in-field constraints. Mobile axel-mounted cranes or self-erecting tower-based cranes will be prioritized for the Project to use the narrower wind turbine road network. Reducing road width is a key consideration in reducing land disturbance associated with the roads themselves and the associated quarry / borrow areas required. Roads design features will include close alignment with turbine original equipment manufacturer to respect recommended grades and turning radius, key factors to be considered for delivery of large wind turbine components.

Roads will be designed to provide horizontal and vertical alignments that respect the road design criteria. The horizontal geometry and minimum horizontal curve radius will be dictated by equipment and vehicle details and dimensions. AutoTURN simulations will be conducted to confirm that the proposed road network can accommodate the wheel paths of the selected transportation vehicle(s), or to identify the potential need for curve widening to accommodate certain vehicles (if applicable). It is anticipated that the target maximum vertical road grade will be approximately 6% to 8%, based on experience with similar projects. In limited cases steeper grades may be considered with supplemental safety measures and secondary power units. Light detection and ranging data (LiDAR) has been acquired for the Project Area, and this will be used to design the road network.

The preliminary design of the access road network is based on a road cross-section with targeted surface width of 7 metres (m); this width may range based on logistics studies with Turbine transportation equipment requirements. Stable cut and fill slopes will be determined based on site-specific geotechnical information but are anticipated to be approximately four vertical (V) metres for each horizontal (H) metre (i.e., 4V:1H) in rock excavation and approximately one vertical (V) metre for each two horizontal (H) metres in other material (i.e., 1V:2H) in other material. The use of geogrids will be considered to reduce material requirements and provide additional stability to the road substructure. Detailed design of the road substructure will be completed to accommodate geotechnical conditions, as well as loading scenarios from the transportation vehicles. Table 2.5 summarizes key construction parameters for the wind farm access roads, based on preliminary design details. Figure 2.23 show preliminary cross-sections of the proposed access roads.

Table 2.5 Access Road Construction Parameters

Construction Parameter	Typical Values
Clearing Right-of-Way (m)	15 to 30
Grubbing Thickness (m)	0.3
Minimum Subgrade Thickness (m)	0.3
Minimum Road Width (m)	7.0
Maximum Grade (for Unassisted Deliveries) (%)	8%
Cross-slope (%)	1-2%
Side-slope (Rock)	4V:1H [four vertical metres for each horizontal metre in rock excavation]
Side-slope (Other Material)	1V:2H [one vertical metre for each two horizontal metres in other material]
Ditch Width (Unlined) (m)	1.0
Subbase Granular Thickness (m)	0.2 at 6.5 m width
Base Granular Thickness (m)	0.2 at 6.5 m width



Source: WEGH2 2023

Figure 2.23 Typical Access Road – Rock Cut Sections

Drainage for the access road network will include an engineered surface runoff management system consisting of ditches, culverts / arches, and appropriate erosion and sediment controls, including riprap, hydroseeding, and other stabilization measures. Standard ditching with a depth of approximately 1 m will direct stormwater along the roadway and cross culverts will maintain natural drainage patterns.

Pre-construction surveys of watercourse crossings will confirm which streams are fish bearing. Each fish-bearing crossing will be checked using the Fisheries and Oceans Canada (DFO) Swim Performance Online Tool (SPOT) to confirm the fish species present can navigate the culvert length and water velocity. If the water velocities and culvert lengths are too high, mitigation measures such as resting pools and baffles will be considered. As well, the culverts will be countersunk to provide a natural stream bed of granular material to meet environmental requirements. Alternatively, a bottomless culvert or bridge structure will be provided for larger crossings. Culvert crossings will be constructed to accommodate the selected design flow annual exceedance probability (minimum 1:10 year annual exceedance probability), which will incorporate climate change projections that are relevant to the design life of the Project.

The road network connections to the existing public road structure will be designed to achieve appropriate sight distance requirements at the intersections. The team will liaise with the NLDTI to obtain the required permits for the road connections. The road connections to public roads will be provided with an asphalt surface near the connection points to avoid granular migration onto the public road system.

In the absence of detailed geotechnical information, assumptions were made to provide a basis for estimating rock excavation volumes.

Port au Port Wind Farm Access Points

The Port au Port area wind farm, located west and north of Stephenville, will include up to 164 wind turbines (Figure 2.2). The Port au Port East wind farm is accessible from the Port of Stephenville via Hynes Road. The Port au Port West wind farm is located on the Port au Port Peninsula. The Peninsula is accessible from the Port of Stephenville via NL Routes 460 and 463, paved two-lane highways. Using Routes 460 and 463, there is an 80 km loop around the perimeter of the roughly triangular peninsula. Both highways are maintained year-round by the NLDTI.

Marine Access

The current concept for primary Project access involves two temporary marine landing sites on the Port au Port Peninsula. The marine landing sites will be constructed to receive low draft barges for delivery of the wind turbine components and other bulk Project materials. The landing sites at Aguathuna (Figure 2.24) and Western Bay (Figure 2.25) have been chosen to reduce interference with local traffic, with the exception of one public road crossing to get to the turbine access roads (which will have traffic control when trucks cross public roads, approximately 5 minutes per truck). Starting from the marine landing sites, major component deliveries transition to Project-specific roads in the peninsula interior.

Source: WEGH2 2023

Figure 2.24 Possible Barge Landing: Aguathuna Site

Source: WEGH2 2023

Figure 2.25 Possible Barge Landing: Western Bay Site

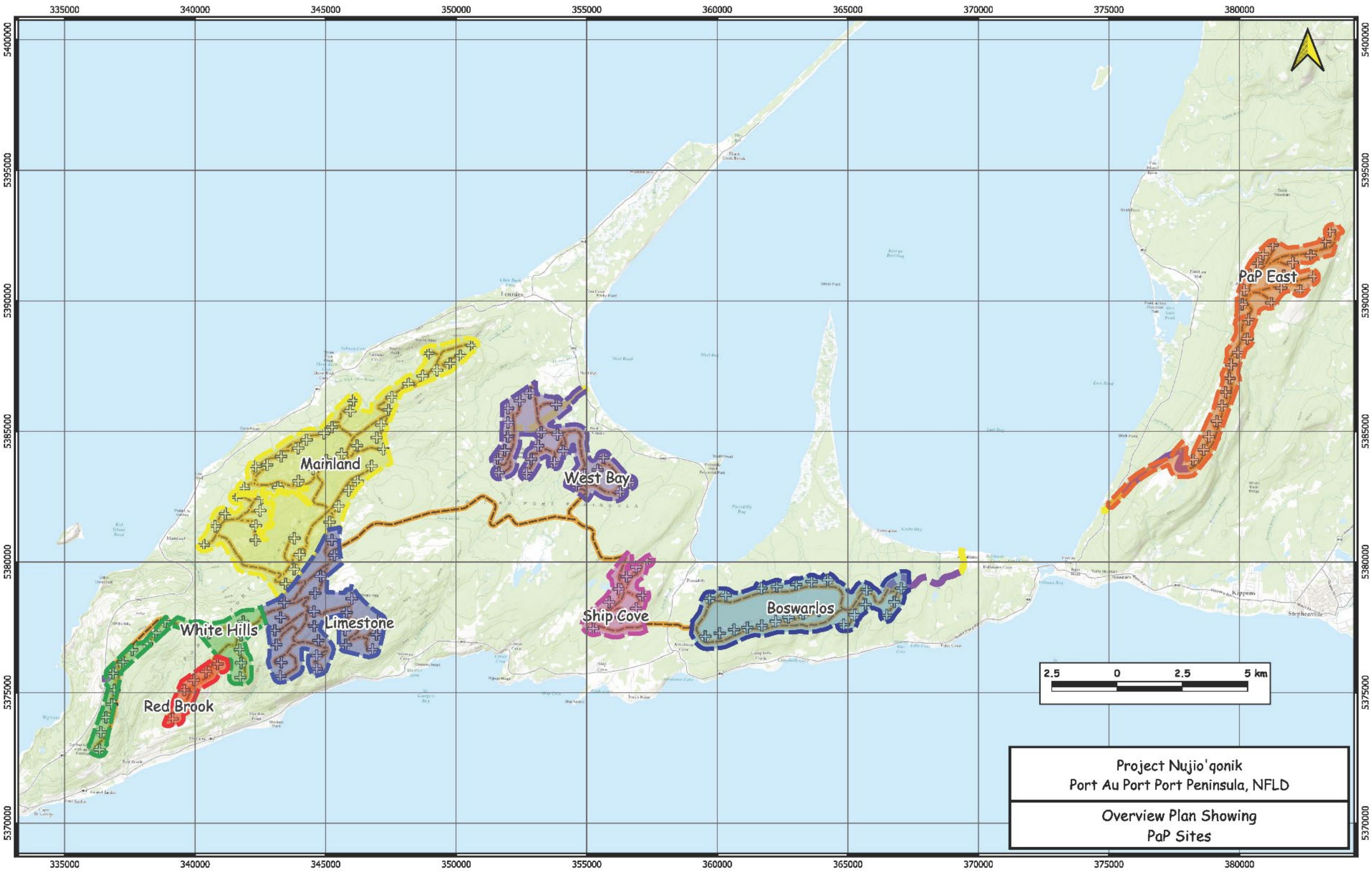
The barge sites will require clean rock-fill to build a jetty for barge landing. The jetty sizes have not yet been determined, but are estimated as 50 m x 200 m. The Aguathuna landing site is a brownfield historic mining / quarry site that remains heavily disturbed. This site has numerous benefits:

- Existing disturbed area and coastline
- Ideal landing location for delivery of Project materials
- Minimal to no residential properties
- Large, existing laydown area

While Aguathuna is preferred due to the laydown area, both landing sites may be used (i.e., West Bay will be used for the turbines located on the western part of the Port au Port Peninsula). The size of the barges and frequency of trips is still being evaluated.

Port au Port Road Access Sections

The following sections provide a preliminary assessment of the conditions, design considerations and alternatives considered for accessing turbine locations on Port au Port Peninsula (Figure 2.26).



Source: WEGH2 2023

Figure 2.26 Port au Port Road Access Sections

The Lower Cove - Boswarlos Wind Turbine Area

Entering the Port au Port Peninsula from the east, the first continuous designated wind turbine development area spans from Lower Cove in the west to Boswarlos in the east. The area is dissected by a north-south section of Highway 463. There are 33 wind turbine sites planned for this area, 10 west of Highway 463 and 23 east of the highway. The area would be the first one accessed when heading west from the Aguathuna marine landing site. There is an existing NL Power substation and a transmission line ROW that runs parallel and just south of this area. Grades are favourable and borrow sources are available throughout this area (Figure 2.27).

Source: WEGH2 2023

Figure 2.27 Boswarlos Road Existing Conditions, Looking East from Abraham's Cove

Several accesses were considered for this area. An access could be developed from the community of Boswarlos, from Goose Pond Road, and from the Lower Cove area. These accesses were de-prioritized in favour of the Aguathuna access point (with one perpendicular crossing of Highway 463 near an existing NL Power substation) due to potential challenges with the local road design (tight turns and steep grades), interferences with residences, and the general objective of reducing construction-related traffic on public roads.

An alternative access from the community of Boswarlos was considered but rejected due to potential challenges with the local road, including tight turns and steep grades, as well as residences. An additional alternative access could be created from Goose Pond Road; however, like with the community of Boswarlos, this is a residential road and farther away from the proposed wind turbine locations.

The Cape Wind Turbine Area

The largest grouping of wind turbines on the Port au Port Peninsula spans from Cape St. George in the south (Figure 2.28) to Three Rock Cove in the north. While several short access roads along Highway 463 on the westernmost part of the peninsula could provide access to many of these wind turbine sites, the Project currently plans to access these sites via a marine landing site either in West Bay or Aguathuna. This reduces interaction with local residents associated with the use of public roadways during Project construction. Grades in this area present some of the most challenging for the Project. There are many areas of exposed bedrock in this area, especially in the southwest; however, borrow sources are available throughout this area.

Source: WEGH2 2023

Note: The highway on the left side of the image is Route 463. The area to the right of this highway is largely a provisional ecological reserve. Wind turbines will be located on the east side of Route 463.

Figure 2.28 Cape Saint George, Looking Southwest Towards Boutte du Cap

West Bay Wind Turbine Area

A second potential marine landing site is located near the town of West Bay (Figure 2.29). It could serve to substantially reduce the travel required to wind turbine sites on the western section of the peninsula, as this site is directly opposite (crossing Highway 463) an existing access road leading inland. It is an existing road to an inactive dumpsite from the community of West Bay, along Highway 463, referred to as West Bay Resource Road on local signage (Figure 2.29). Beyond the dumpsite, there are 22 planned wind turbine sites. Much of the road is straight and has low grades. There are a few residences in the area, but few are immediately adjacent to the road.

Source: WEGH2 2023

Note: The West Bay Resource Road is visible on the right side of the image. The resource road intersects the line of turbines.

Figure 2.29 West Bay Road, Looking North Towards the Community of West Bay

Codroy Wind Farm Access Points

The Codroy Wind Farm (Figure 2.3) is 75 km south of Stephenville via NL Route 490 and Route 1 TCH and includes up to 164 wind turbine locations on the Anguille Mountains. Highways are maintained year-round by the NLDTI.

The following sections provide an overview of the various access roads to be constructed for the Codroy Wind Farm, including a preliminary assessment of the conditions, design considerations and alternatives considered or being considered.

Bald Mountain Access Road Access Point

Bald Mountain Access Road (Figure 2.30) is an existing forest access road that extends to the south of the TCH to the 20 wind turbine locations that are clustered south of the highway. It runs parallel to Rainy River. While several washouts were observed near the highway during the site visits, this access route follows the topography to provide relatively low-grade access to the group. Several good-quality borrow sources were observed, which could be used for the upgrades and fills required to create access.

Source: WEGH2 2023

Figure 2.30 Bald Mountain Access Road

Once at elevation, there is an option for a steep descent to rejoin the TCH at the eastern end of Codroy Pond. While this road cannot be developed for the delivery of wind turbine components, it may be useful as egress for construction equipment, or other non-wind turbine deliveries, as it would create a clockwise loop with Rainy Brook Road.

Codroy Pond Roads Access Point

On the north side of the TCH, along Codroy Pond, there are several forest access roads that extend into the Anguille Mountains, including Morris Brook Resource Road (Figure 2.31). Some have been maintained for local cabins or hunting, while others have been abandoned and are overgrown.

Source: WEGH2 2023

Note: Morris Brook Resource Road on the right. Note the grades and recent landslide in the bottom right quadrant of the image.

Figure 2.31 Morris Brook, Looking Northwest

The northernmost wind turbine sites may be accessed from two of the roads at each end of Codroy Pond. These roads have the most potential for development as the existing grades are moderate and no major water crossings or steep grades were observed. However, in some areas, the road traverses steep embankments where washouts have occurred. These areas would require substantial cuts into the uphill embankment to stabilize the road and make it suitable for turbine equipment transportation.

While it is possible to access the remaining Codroy Wind Farm turbines from the southernmost Codroy Pond access road, the access route for the southernmost Codroy wind turbine sites may come from further south in the Codroy Valley.

North Branch Resource Road Access Point

Further south from Codroy Pond, towards Port aux Basques, the remaining wind turbine sites can be accessed from North Branch Access Road (Figure 2.32), which begins parallel to North Branch (Grand Codroy River). There is currently a washed-out bridge along North Branch Access Road; however, the road conditions that were observed during the site visits were generally good, with grades under 10% and with borrow sources available.

Source: WEGH2 2023

Note: The Anguille Mountains are mostly hidden by cloud.

Figure 2.32 North Branch Resource Road, Looking West at Approximately KM 9

Water Crossings

Access road construction will require water crossings. In-water or near-water works could include culvert installation (such as arch installation) and/or bridge foundation installation. Some minor fording may be required. The duration of in-water works will be reduced to the extent practically feasible and conform to timelines established by regulators. Changes to natural flow regimes will be reduced through careful detailed design. Removal of stream side vegetation will be limited to the footprint of crossing abutments, and re-vegetated to the extent possible.

Water crossings associated with potentially fish-bearing waters were identified through a desktop analysis of existing satellite imagery, the 1:50,000 topographic mapping, and the location of the proposed access road, transmission line RoWs, collector line RoWs, and substations. Stream characterizations are described in Section 4.4.2 of the Aquatic Baseline Study. Locations were approximated based on land topography in the area. Culvert sizing will be determined during detailed design, along with inclusions of embedded or bottomless arch culverts for fish-bearing watercourses. Detailed design assessments will be performed to specify appropriate use of materials, aggregates, slope armouring and vegetative cover, along with spatial requirements for exact location, length, diameter, and slope.

It is anticipated that bridges will be replaced with single span, standard, new steel panel-style bridges sized to accommodate the anticipated delivery of heavy equipment and wind turbine components. Abutments will be cast-in-place or precast concrete.

Two to three short, new bridges are anticipated within the footprint of the Port au Port Wind Farm. It is also noted that the Romaine's River Bridge, connecting the Town of Stephenville with the Port au Port Peninsula, is undergoing replacement. This structure sits on the primary road access to and from the Port au Port Peninsula. The existing structure is to remain in service until the new water crossing at this location is completed. It is not anticipated that the timeline of this work will affect construction activities in the area, but given the criticality of access to the peninsula, two marine access areas are being considered. Work on the Port au Port Wind Farm is planned to include two temporary marine landing sites for delivery of Project materials by barge (Section 2.5.1.6). This strategy will reduce the traffic on public road systems during delivery of major Project components requiring specialized delivery approaches.

Four forestry road bridges along the primary forestry access road into the Codroy Wind Farm were identified as requiring replacement.

Drilling and Blasting

Overview

The combination of access road systems, wind turbine footprints, and the hydrogen / ammonia plant will necessitate an extensive drill and blast program. The Project's drill and blast team will employ appropriate control techniques to manage risks, with attentiveness to local concerns, regulatory compliance, and best practices.

Materials and Suppliers

WEGH2 plans to use a local, licensed supplier for explosives. The Project's blasting team currently plans to use a bulk emulsion product for the majority of its work. Bulk emulsion is a stable, non-soluble explosive product that involves no direct contact for workers. Mechanized trucks deliver the product directly into blast holes. No packaging is required with bulk emulsion explosives, thereby reducing waste. The type of emulsion could be a pre-sensitized emulsion, which would reduce noticeable gassing and provide better control of rock movement during blasting.

Bulk emulsion explosives will be stored in emulsion tankers (not tanks) on site (one per wind farm). These tankers typically hold 20,000 kg. These will be left in a secured, fenced compound with one set of wheels removed and the king pin locked. These tankers would become the permanent transfer site into which other tankers offload. Pumper trucks would then remove product from these tankers daily for delivery to the blasting site(s). The pumper trucks would carry no more than 12,000 kg per load (depending on terrain) and could possibly be limited to as low as 7,000 kg. There would be separate storage facilities at each wind farm, which should ideally be placed no more than a one-hour drive to the usage location.

Given Project requirements (possibly consuming up to 25,000 kg/day), it is likely that at least two tankers would be required in the compound. This would mean that at least 1,000 m would need to be maintained between the compound and sensitive infrastructure, such as public roads and buildings. The quantity maintained on site will be within regulations.

Equipment

The Project's blasting team is fully equipped for activities required in the execution of Project blasting requirements, including excavators, emulsion delivery trucks (pumper trucks), specialized blaster trucks equipped with transportation boxes (federally and provincially approved), down-the-hole drills, top hammer drills, and remotely controlled drills.

Top-hammer drills will perform the majority of the drilling for the Project, as most blast holes will be in the range of 7.6 to 10.2 cm (3 to 4 inches). These drills use a mechanical dust suppression system to control dust. These drills have the ability to be anchored in rock and winch down to locations that are hard to reach.

The explosive accessories will be transported in qualified vehicles with necessary placards and stored in licensed magazines respecting regulatory requirements.

Access Roads

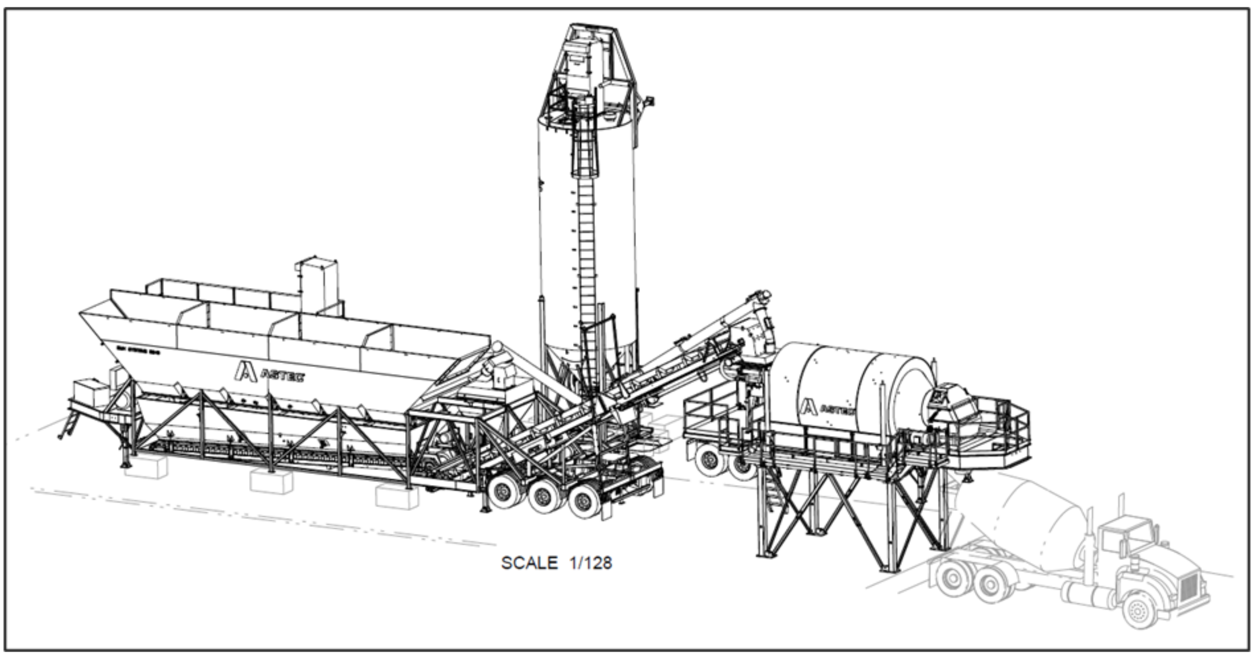
In the construction of the access road systems, numerous small and large cuts will be required to meet the specific road building parameters dictated by the wind turbine component transportation equipment, while large quantities of rockfill and gravels will be required for roadbuilding fills and construction footprints. Preliminary estimates suggest between 4,000,000 to 8,000,000 m^3 of rock excavation will require blasting for this Project, requiring approximately 4,000,000 to 10,000,000 kg of explosives. This is based on a visual estimation of road excavation volumes and average haul distances to visually observed potential borrow / quarry sites:

- Drilling and blasting assumes a powder factor of 1.2 kg/m³
- Road rock cuts assume an average cut depth of 3.5 m
- Quarry rock cuts assume an average cut depth of 8.0 m

Cement Supply and Concrete Production

The wind turbine bases and hydrogen / ammonia plant will require substantial volumes of cement and aggregate for onsite production of concrete. The Town of Corner Brook has existing facilities for cement storage that may be used, but production schedule may require dedicated dry storage at the Port of Stephenville.

Concrete aggregate is anticipated to be a mix of locally sourced stone for the coarse fraction, and naturally occurring fine fraction sourced either from Project borrow sources or existing pits. Concrete production will take place on the wind turbine farm sites and the hydrogen / ammonia plant site. The Project will also leverage known existing capacity from concrete supplies within the Town of Stephenville; however, due to transportation distances and required throughputs, additional production capacity will be required. This supplemental capacity will be provided through modern mobile batch plants equipped with specialized carbon capture systems. An example of a mobile batch plant is illustrated in Figure 2.33.



Source: WEGH2 2023

Figure 2.33 ASTEC Sample Mobile Concrete Batch Plant

Cement transport from the dry storage to batch plant silos will be performed with standard highway trailers. Wet concrete will be batched at strategic locations prepared for the purpose. Wet concrete will be delivered to the various work areas with standard rotating drum concrete trucks. Onsite batching of concrete will reduce traffic on the public road system.

Site infrastructure will include the batch plant with cement silos, water tanks, material transfer conveyors or augers, truck loading system, and fine and coarse aggregate stockpile area. Anticipated production is 100 m^3/hr per plant, which provides a factor of safety within the production target of pouring a full wind turbine foundation in a one-day shift.

Two potential locations for a batch plant have been identified for the Port au Port Wind Farm: along Local Access Road (1 km from Mainland; off Highway 463); and adjacent to Atlantic Minerals Ltd (3 km from Highway 460, off existing haul road). Acquisition (leasehold or freehold interest) of the latter property will require consultation and negotiation with Atlantic Materials Ltd., the current property owner; consultation and negotiation has been initiated. Potential locations for batch plants in the Codroy Wind Farm location include the Codroy Pond area and another site along North Branch Road. The locations of the batch plants are preliminary. Precise locations will be determined based on the final schedule, as well as batch plant specifications and laydown constraints.

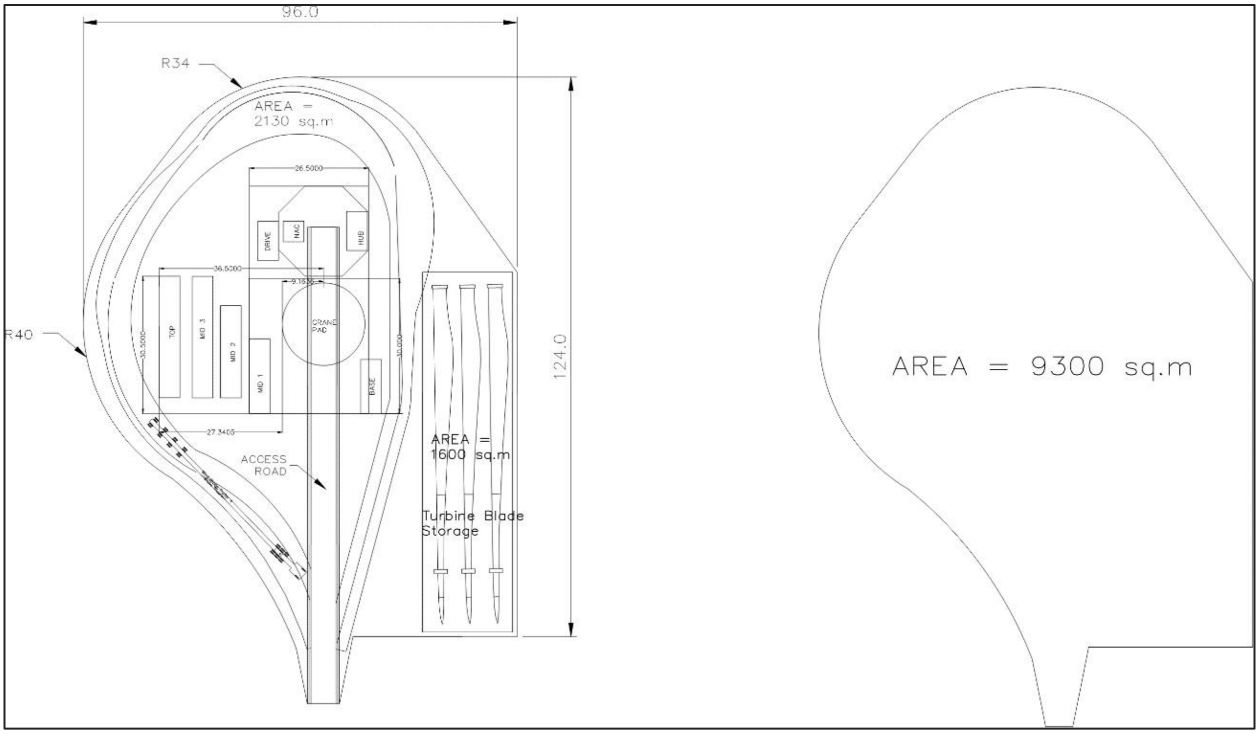
2.5.2 Installation and Commissioning of Temporary Workforce Accommodations and Associated Infrastructure

At the Port of Stephenville, the temporary workforce accommodations will make use of the available lands and require an area of approximately 400 m x 150 m, assuming multi-story construction. For the Codroy Wind Farm location, a greenfield site of relatively flat land, approximately 300 m x 100 m, would be required to construct a camp complex, which would include accommodations (modular construction), support buildings, parking, and laydown areas.

2.5.3 Installation and Commissioning of Wind Turbines

Wind Turbine Laydown Areas

Each wind turbine location will require a cleared area of 1 to 2.5 ha. Each site will have an approximate prepared footprint of approximately 100 m x 100 m (10,000 m^2, or 1 ha) for temporary laydown to store wind turbine components during construction (Figure 2.34). The orientation and shape of the laydown area will vary slightly between sites depending on topography.



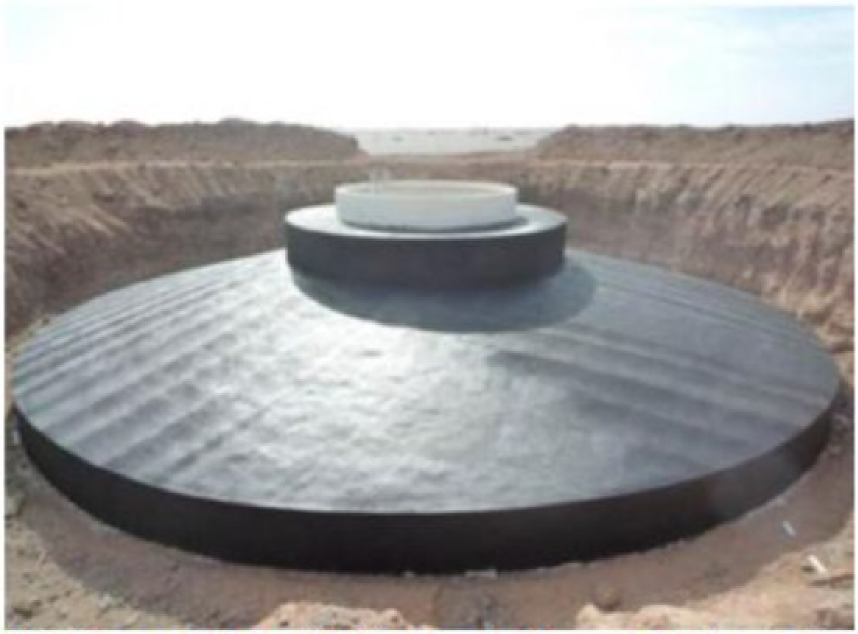
Source: WEGH2 2023

Figure 2.34 Proposed Turbine Site Laydown Area

Gravity Wind Turbine Base Installation

A detailed geotechnical assessment will be undertaken to characterize each wind turbine site. By way of a preliminary estimate, it is anticipated that on average a wind turbine site will include 1,800 m³ of overburden excavation and 600 m³ of rock excavation (note that these are indicative volumes only, individual sites will vary considerably). A concrete mud slab is anticipated to extend 1.5 m beyond the diameter of the foundation. The mudslab is assumed to be 150 mm-thick 15 MPa concrete, with a total volume of 68 m³ per gravity foundation.

It is anticipated that the wind turbines will use the shallow matt foundation (an example of a gravity foundation), pending field confirmation of site-specific geotechnical conditions. Shallow matt foundations are typically reinforced concrete, with a diameter of 10 to 15 m (potentially up to 20 m depending on soil conditions if gravity base foundations are required for the size of the turbine). Figure 2.35 shows 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.



Source: WEGH2 2023

Figure 2.35 Example of a Shallow Matt Foundation with Concrete Poured Prior to Backfilling

A forming system can be used to finish the formwork required for the wind turbine bases. The forms will be set to the design grades, lines, and radii as required for each wind turbine site. Forms will be anchored and firmly set above the bearing areas to prevent displacement during pouring concrete. Correction of grade or alignment prior to or during concrete placement will be documented on the pour release checklist. Formwork will be detailed on form / lift drawings, which will detail the form system, construction details, materials, tie system, spacing, rigging, finish requirements, brace locations.

A dedicated rebar tying crew will be used for the supply and installation of reinforcing steel. During rebar placement, grades will be set by the survey crew to provide proper concrete coverage. It is estimated that the reinforcement for each gravity foundation is 66.6 t.

A specialized supplier will be used for the supply of the anchor ring templates, bottom ring, and anchor bolts. The anchor cage will be prefabricated and then installed within the form. During placement, grades will be set by the survey crew to provide proper concrete coverage. Miscellaneous items including conduits will be installed with correct grades / locations. To protect anchor bolts during concrete placement, grease and/or caps will be used. After the concrete is poured and adequately cured, the corrosion protection will be applied to the anchor bolts.

A formal inspection will be completed for each pour prior to concrete placement. Concrete for this Project is 45 MPa mass concrete to provide a consistent foundation for each turbine. Thermal curing of concrete and temperature differential will be carefully controlled. The estimated concrete per foundation is 610 m^3 for the base and 56 m^3 for the pedestal, for a combined single pour of 666 m^3.

Concrete field-testing methods and requirements will be in accordance with CSA A23.1 Methods of Testing for Concrete (and the contract drawings and specifications). The frequency and number of tests will be in accordance with the requirements of CSA A23.1. Embedded thermal sensors can be used for real time internal concrete monitoring.

Based on the construction schedule, it is anticipated that a portion of the concrete activities may be completed in winter conditions. Thermometers will be installed in each heat insulation enclosure so that temperatures remain within the accepted range. Given the large diameter of the spread footing, a custom fabricated steel heat insulation structure may be used to accelerate the deployment and relocation of the insulating structure.

Once the concrete is adequately cured, backfilling will proceed in a series of lifts to achieve the specified compaction and grades. The backfill volume is estimated to be 1,690 m³. Backfill of new foundations will be completed using a combination of in-situ or excavated materials and crushed rock materials, as required. Once the foundation is partially backfilled, a grounding grid will be installed. Surplus material will be spread in the immediate vicinity of the foundation to promote positive drainage.

Rock Anchor Wind Turbine Base Installation

For rock anchor foundations, the foundation preparation activities are largely the same prior to the drilling and grouting for the anchors. The components include the following:

- Excavation: 423 m³ overburden and 300 m³ rock
- Mudslab: 32 m³ 150-mm thick 15 MPa concrete
- Formwork: reduced quantity due to smaller foundation size
- Rebar and embedments
  - Reinforcement: 37.7 t
  - Installation of conduits and embedments
  - Blockouts for drilling templates
- Concrete: 377 m³

Once the foundations have been prepared, post-tension anchor positions will be drilled using a template. Bars will be covered with grouting tubes and prepared with specialized fabrics as needed to suit the borehole conditions. Once the anchor rods have been installed in the hole, the holes will be filled with grout. The post-tension anchors will be installed into the pre-drilled holes and once set, post-tensioning will take place using an engineered beam, blocking, and tensioning jack. Loads will be held for pre-determined durations to measure against acceptance criteria.

Wind Turbine Assembly

While the wind turbine assembly method will be based on the specific requirements for the wind turbine equipment selected (Figure 2.36), a typical work sequence includes preparing for the lifts prior to the arrival of the main erection crane to reduce delays. Components for each turbine will be delivered as per the final construction sequence directly to pads. Lifting of the blades, hub and nacelle, and each section of the tower will be performed in accordance with the engineered lifting plans. For the lifts, the special tooling and equipment necessary to lift, rig, and install the turbines will be supplied by the turbine manufacturer.

Source: WEGH2 2023

Figure 2.36 Wind Tower Construction

It is assumed that the hub and nacelle will require separate lifts for the Project (Figure 2.37). With the nacelle and hub in position above the top flange of the tower, the assembly will be lowered onto the tower.

Source: WEGH2 2023

Figure 2.37 Mounted Hub and Nacelle

Prior to blade installation, the turning gear will be installed onto the gearbox. The hub is prepared for blade installation once the locks and brakes have been applied, mechanically preventing rotation of the parts. Each of the three blades is then installed (Figure 2.38) and electrical and hydraulic connections are made. Once the turbine has been erected, the hardware installation, wiring, and terminations can be completed.

Source: WEGH2 2023

Figure 2.38 Blade Lift

Once all sections have been installed and the tower is fully erected, a temporary navigation light will be installed on each turbine until the turbine is energized and permanent navigation lights are installed and operational.

Equipment and Temporary Infrastructure Requirements

A sample equipment fleet for one wind farm is provided in Table 2.6; this fleet would be approximately doubled in order to construct two wind farms concurrently. The units listed represent the core fleet, omitting smaller and miscellaneous equipment. Construction companies within the province have been identified with existing fleets of heavy equipment that will make up the initial mobilization and construction fleet. The existing fleet will be supplemented and expanded upon with acquisitions as needed from local original equipment manufacturer vendors.

Table 2.6 Sample Equipment Fleet Required to Construct One Wind Farm

Type	Model / Description	Units	Type	Model / Description	Units
Excavators	C390	1	Concrete	Concrete Plant	2
	C349	8		Cement Transport	4
	C336	2		Concrete Truck	14
	C324	3		Concrete Pump Truck	2
	C305	2		Crushing Spread	2
Haul Trucks	HM400	14	D&B	Copco L8	2
	Live Bottom	5		Copco D9	3
	Tandem	5		Explosives Truck	2
Dozers	D8	2	Grader	G140	2
	D6	3	Support	Flat Deck	4
	D4	1		Water Truck	2
Roller	CS56	5		Fuel Truck	3
Loader	988	2		Telehandler	2
	980	2		Support Cranes	10
	IT38	2		Boom Truck	4
Cranes	LG 1750	2-4		Pickups	30
	JLG Lift	8		Lighting/Pumps/Gens	100+

The following temporary site installations are anticipated at each wind turbine site:

- Eight office trailers
- Eight lunchroom trailers
- Six washcars
- Ten port-a-potties
- Six satellite lunchrooms
- One service workshop
- One rebar workshop
- Fuel storage / refueling (Section 2.6.6)

2.5.4 Installation and Commissioning of Electrical Infrastructure

The collector substations (Port au Port West, Port au Port East, and Codroy) will be installed in greenfield sites. Construction materials and equipment will be received at the Port. Items will be modularized where possible and assembled onsite with local resources. The hydrogen / ammonia plant terminal station will be installed in a brownfield site at the Port of Stephenville in a combined facility with utility services and support infrastructure following a similar methodology as the wind farm collector substations.

The high-level philosophy for installation of transmission lines and substations will be fully developed during the detailed engineering phase and will use onsite labour for the majority of work. The overall EPC process will be managed by a regional or international engineering and construction company experienced in the construction of similar systems.

In advance of the start of the main construction, a number of critical surveys and studies will be completed as required to support detailed design and permitting to prepare the construction sites for mobilization. The surveys and studies include:

- Geotechnical surveys
- Topographical survey
- Soil survey
- Vegetation survey (i.e., baseline studies conducted for the EIS)
- Wildlife impact survey (i.e., baseline studies conducted for the EIS)
- Seabed survey along the proposed submarine cable route
- Marine environment impact study for submarine cable route (i.e., baseline studies conducted for EIS)

Rough grading will clear vegetation along the transmission and collector system corridor ROWs to improve drainage and to shape the sites for the start of construction activities, such as construction of access roads and electrical infrastructure.

Modular construction techniques will be the preferred installation approach as this approach offers opportunities for local labour while reducing the size of the travelling workforce to be accommodated in the camp.

- Offsite prefabrication of items will occur in specialized facilities close to the site. Prefabricated components can be shipped to site by truck or ship depending on the prefabrication yard location and then are installed by the site labour force.

Activities performed by site-based labour will include.

- Civil works (e.g., site preparation, foundations, vegetation clearing, access roads, drainage, fencing, underground services)
- Survey locating of foundations and poles
- Installation of foundations, poles, pole hardware, and guying

- Installation of isolation switches
- Stringing of conductors
- Installation / erection of prefabricated steel structures
- Installation of prefabricated buildings
- Installation of major equipment (e.g., main power transformers, dead tank breakers)
- Installation of grounding system.
- Pulling and termination of cabling (high voltage, medium voltage, and low voltage)
- Construction services (e.g., batch plant, temporary power, and water)
- System testing, commissioning and start-up

The installation of submarine cables is a specialized task that takes place with substantial involvement of the cable manufacturer and uses specialized marine vessels. Other specialized services required to support or supervise the installation could include:

- Licensed personnel to verify proper installation
- Heavy haul / heavy lift
- Laboratory services
- Original equipment manufacturer specialists to oversee installation and start-up
- Specialty welding
- Licensed / certified personnel to perform submarine cable spiling and verify proper installation.
- Submarine cable laying vessel

Two single circuit 230 kV transmission lines will be constructed from each wind farm to the hydrogen / ammonia plant. Typical construction will likely be monopole steel towers, with bundled conductors (two per phase), with overhead shield wires for lightning protection. It is assumed that new overhead transmission lines will follow existing transmission line ROWs for a common utility corridor, where feasible. A typical ROW width for two parallel transmission lines is 70 to 75 m; however, for the purposes of this environmental assessment a 350 m wide buffer centred on this ROW has been assessed to accommodate in-field constraints. This conservative assessment approach will allow ROW alignment modifications at least 100 m on either side if required during the detailed spotting. Once the ROW survey, design, and clearing are completed, structure locations will be staked in the field.

Once poles have been erected and the necessary framing (i.e., insulators, cross arms, and bracing) has been installed, conductors will be strung by pulling conductor off a stationary wire spool located at the start of each line segment and connecting the connector to insulators. Appropriate tension is applied to adjust the line sag and to bring the conductor to the design specifications once conductors are in place.

Confirmation of the transmission line operating voltages (230 kV), line configuration, and routing will be improved during detailed design and power system analysis, with consideration for reducing visual impacts to nearby communities where required. In general, it is assumed that new overhead transmission lines will follow existing transmission line ROWs for a common utility corridor where feasible, with final routing determined during detailed design.

2.5.5 Installation and Commissioning of Hydrogen / Ammonia Production, and Storage Facilities

The hydrogen / ammonia plant will be installed in a brownfield site at the Port of Stephenville in a combined facility with utility services and support infrastructure (Section 2.3.4; Figure 2.12). The ammonia plant will be constructed close to the Port facilities to reduce transport of product to the ships. The hydrogen plant will be constructed at the inland side of the site, closer to the industrial water supply. Construction materials and equipment will be primarily received at the Port. Items will be modularized where possible and assembled onsite with local resources. The Project's international EPC team will oversee the installation.

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

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

In advance of the start of the main construction, a number of critical activities will be completed to support detailed design of the facility and prepare the site for the mobilization of the construction contractors and to be able to receive materials at the Port of Stephenville. These activities include:

- Data gathering (geotechnical, topographical, soil and contamination, and port facilities surveys)
- Dismantling / removal of existing facilities / obstructions that are not included in the permanent facility (to be removed by mechanical means without blasting)
- Environmental studies to verify the soil properties at the specific plant location and any remediation required as defined by the Regulator(s)
- Rough grading to improve drainage and to shape the site for the start of construction activities

Installation will involve a mix of onsite labour, offsite prefabrication, and offsite fabrication of modules. The overall EPC process will be managed by a regional or international engineering and construction company experienced in the construction of similar facilities.

Activities performed by site-based labour will include.

- Civil works (site preparation, roads, foundations, drainage, fencing, underground services)
- Module hook-up (piping, electrical and instrumentation)
- Erection of ammonia plant
- Non-modular steel
- Ammonia tank
- Compressor and electrolyzer shelters
- Scaffolding
- Heavy haul / heavy lift
- Construction support services (e.g., batch plant, temporary power, and water)
- System testing, commissioning and start-up

Items to be prefabricated offsite include:

- Piping spools
- Structural steel
- Steel shelters
- Precast concrete

Modular construction techniques offers opportunities for local labour while reducing the size of the travelling workforce to be accommodated in the camp. There are several different types of modules that will be used including:

- Hydrogen electrolyzer units
- Pre-assembled racks
- Pre-assembled units
- Vendor assembled units
- Vendor packaged units
- Modular buildings
- Pre-dressed vessel or column
- Preassemblies

The modules will be delivered to the Port of Stephenville and transported to the site along heavy haul roads designed for the load capacity. Transportation will be achieved using trucks or self-propelled modular transporters, depending on the weight and size. Modules will either be set in place directly from the self-propelled modular transporter or by lifting with cranes. At site, the modules will be installed on prepared foundations and interconnected with pipe and cables installed by the site labour force.

Specialized services required to support or supervise the installation include:

- Original equipment manufacturer specialists to oversee installation and start-up
- Licensor personnel to verify proper installation
- Specialty welding
- Heavy haul / heavy lift
- Laboratory services
- Medical services

2.5.6 Restoration of Existing Port Facilities

The Port will be used to support wind farm construction and will include a large central marshalling yard. The electrolyzer and ammonia facilities will be located at the Port of Stephenville, which offers deep-water shipping access to the world.

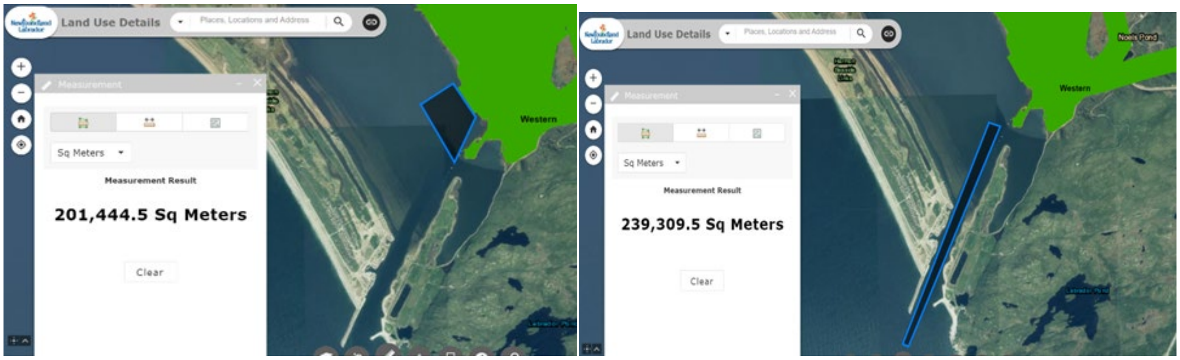
The number of vessel trips to deliver hydrogen / ammonia plant components and wind turbine components to the wind farms is to be determined through an ongoing transportation study. At the height of construction, one to three vessels per week would be expected at the Port.

To support Project construction and operations, existing port facilities will require restoration. The Port facilities will likely require upgrades to reinstate the dock to its original load rating and condition. Based on a pending engineering analysis, some substantial work may be required to the underside and topside of the dock. This may require the strengthening or replacement of existing pile supports due to normal tidal erosion. Additionally, permanent or temporary support to the topside of the dock may be required to support cranage required to lift wind turbine and plant components.

Some pile work will likely be required based on the final design of the offloading system and the dock restoration work. Should pile driving be required, a detailed list of locations will be provided with the process details and durations.

The Port was last dredged in 2004 and in 12-year intervals before that (1992 and 1980). A storm in 2017 resulted in bottom material migrating into the channel, with depths of 8.6 m within the mouth of the channel reported following the storm. The Project will require maintenance dredging to reinstate depths to 11 m above chart datum of Mean Low Spring Tide. Specific environmental surveys, bottom profiling, and sub-bottom surveys are planned to determine if additional dredging is required due to increased vessel size.

The Port currently consists of a dock and two breakwaters, one on both the north and south sides of the harbour entrance. The area of the Port to be dredged includes the turning basin adjacent to the dock and the length of the approach channel (Figure 2.39).



Source: WEGH2 2023

Figure 2.39 Areas to be Dredged in Port of Stephenville

The method of dredging has not been determined; however, it may be a combination Trailing Hopper Suction Dredger (THSD) (Figure 2.40) and clams shell bucket from a barge. A THSD trails a suction pipe off the side of the hull. At the entrance of a suction pipe is a draghead, which collects the soil like the mouth of a vacuum cleaner. The slurry may be pumped via discharge hose or to the hopper and stored for transport. When full, the THSD sets sail to the discharge location. Depending on Project specifications, the discharge takes place by opening the hopper doors, pumping the material to shore or by ejecting it using a rainbow installation.

Source: WEGH2 2023

Figure 2.40 Trailing Hopper Suction Dredger Royal IHC Dredging

The dredging program could be four to eight weeks within a May to November window based on the composition of the seabed, required depth to dredge, capacity of dredger, and the means of disposal. The approximate area to dredge is 442,000 m². Assuming an average depth of 10 m at low low-water, dredging to 12 m will result in approximately 900,000 m³ of dredging material for disposal.

Approvals will be obtained from the relevant authorities prior to disposal of dredged material at sea or on land.

A detailed bottom survey will be conducted in 2023 to determine the composition of the seabed down to 5 m below the sea floor. The survey will provide accurate volumes of dredged debris and a detailed report on the geology below the sea floor. The survey will also determine the existence of anthropogenic obstructions that could introduce additional risk to the dredging program, such as pipelines, anchors, nets, unexploded ordnance, and ammunition. The bottom survey work will be conducted with a sub-bottom profiler, bottom sonar, magnetometer, and some small barge work, including geotechnical drilling and sampling based on results from the profiling findings.

2.6 Operation and Maintenance Activities

The operation phase of the Project will cover managing the continuous wind energy generation and subsequent use in the production of green hydrogen and green ammonia. The Project's operation and maintenance strategy will be formulated to maximize the wind farms' and hydrogen and ammonia facility's production over the lifetime of the assets, in a safe, qualitative and environmentally friendly manner. A detailed operation and maintenance strategy and guidelines will be defined as per manufacturers' specifications and maintenance requirements. Factors that will determine the operation and maintenance strategy will include the length and requirements of the performance warranties of the equipment / components, lender requirements, sponsor preferences, and location specifics.

In the hydrogen and ammonia production processes, the wind energy will be used for the following purposes (based on current calculations):

- Most of the wind energy produced (approximately 92%) will be used in electrolyzers to produce hydrogen
- A small portion of the wind energy (less than 4%) will be used by the air separation unit, which is part of the ammonia plant, to produce the nitrogen required for the ammonia production
- A small portion of the wind energy (approximately 4.5%) will be used in the Haber-Bosch process in the ammonia plant for ammonia production

Excess electricity produced by the wind farm will either be stored in the power storage unit or curtailed (Section 2.6.4.4).

2.6.1 Presence, Operation and Maintenance of the Wind Farms

The wind turbines will be operating at relatively the same time. The wind farm will be remotely monitored and controlled 24 hours per day using plant control software including alarm call-outs, which will be monitored by trained personnel.

Regular maintenance activities will include:

- A maintenance building (Figure 2.41) which will be used as a base for operation and maintenance personnel
- Maintenance of roads and access (e.g., snow clearing, road maintenance and repair) as required to enable access to each turbine site by maintenance personnel for daily inspections as required
- Servicing of wind turbines (e.g., replacement of worn components, lubricants, and drone inspection of turbine blades) will be conducted at manufacturer recommended intervals and as determined by monitoring equipment
- Servicing of electrical equipment (e.g., inspection of components, transformer oil, periodic replacement of minor components, and testing)

Source: WEGH2 2023

Figure 2.41 Example of Operation and Maintenance Building

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

Periodic road maintenance and repair will be undertaken to maintain a safely traversable road network. Road maintenance activities primarily consist of grading granular road surface and ditch cleaning. During the winter season road maintenance could include snow removal as needed. Regular inspection of turbines during winter months may be conducted on snowmobiles. Small volumes of maintenance gravel could be sourced from existing aggregate providers. There is potential for small quarry blasts during operation and maintenance to generate gravel material for the Codroy Wind Farm; this will be infrequent over the lifetime of the Project.

2.6.2 Presence, Operation and Maintenance of Electrical Infrastructure

Collector Systems / 34.5 kV Cabling / Substations

The collector system will primarily be comprised of 34.5 kV overhead collector pole lines and isolation switches that will require scheduled and emergency maintenance and inspections from the ground using offroad-capable bucket trucks or from the air using drones or helicopters. Maintenance activities will be carried out by qualified specialists.

Typical preventative maintenance would include items such as:

- ROW clearing of encroaching vegetation
- Thermographic surveys / infrared scans
- Earth wire integrity
- Guying integrity
- Checking for missing or broken hardware
- Proper operation of isolation switches

Vegetation management activities (through application of herbicides and manual cutting of brush) will be conducted in accordance with the *Pesticide Control Regulations* under the NL EPA and are subject to approval from the NLDECC Pesticide Control Section. In the event of equipment failure, emergency repairs may be required (Section 24.5.5). Emergency and preventative maintenance will follow detailed protocols.

The substations will be remotely monitored and controlled 24 hours per day using dedicated Supervisory Control and Data Acquisition and video surveillance systems. Operators are notified and dispatched when required to address issues such as protection trips, equipment operating parameters exceeded, and unauthorized substation entry that the Supervisory Control and Data Acquisition system has identified. The control room will be monitored by trained personnel.

Scheduled maintenance activities will be carried out by qualified specialists, based on a detailed plan that considers equipment manufacturer recommendations and International Electrical Testing Association standards and includes items such as:

- Transformer oil sampling
- DC battery bank and charger system performance
- Thermographic surveys/IR Scans
- Grounding system integrity
- Station service automatic transfer system operation

The above maintenance examples along with overall system function tests will provide substation systems performance in the event of a system fault or normal operation of equipment.

Generator Tie Line / Transmission Lines

The 230 kV system will primarily be comprised of overhead transmission lines that will require scheduled preventative maintenance (and emergency repairs as required) and inspection from the ground using offroad capable bucket trucks or from the air using drones or helicopters. Maintenance activities will be carried out by qualified specialists.

Typical preventative maintenance would include items such as:

- ROW clearing of encroaching vegetation
- Thermographic surveys / infrared scans
- Earth wire integrity
- Checking for missing or broken hardware

Emergency and preventative maintenance will follow detailed safety protocols.

Vegetation management activities (through application of herbicides and manual cutting of brush) will be conducted in accordance with the P*esticide Control Regulations* under the NL EPA and are subject to approval from the NLDECC Pesticide Control Section.

Facilities Supporting Reliable Grid Operation

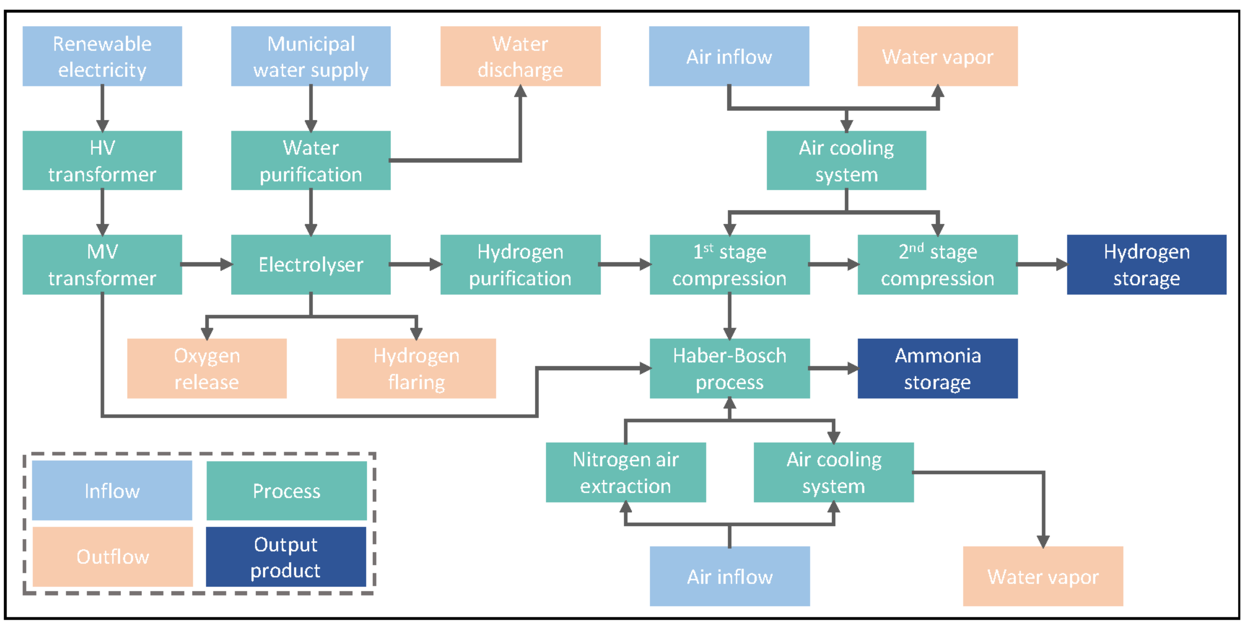
The hydrogen / ammonia plant terminal station and the collector substations will be designed with various levels of redundancy and protection and control systems to improve grid stability and reliability. Further details on this topic will be provided once the system impact study is completed by NL Hydro. WEGH2 has submitted an application for 10 MW firm and 145 MW non-firm. This will involve an overall system model that allows accurate simulations of the effect of the Project on the NL Hydro grid and optimization of the Project's major electrical equipment ratings.

In addition, the Project will use power storage to manage seasonal and intra-day wind energy generation variations, acting as a buffer between the wind farms and the hydrogen / ammonia plant. Power storage could also be used as an additional facility for grid balancing. Various options of the electrical power storage design are being pursued in parallel to determine the optimal solution for the Project. Advanced discussions with power storage providers have taken place and potential solutions will continue to be further assessed in the coming months, based on a refining of the wind farm design parameters, anticipated operating characteristics, and energy generation profile. Key evaluation criteria for the final selection of the power storage technology will include the capacity, duration, ramp-up rates, lifetime, price, logistical set-up, local supply chain capabilities, and benefits. The four primary options the Project is considering consist of the following technologies: thermal battery storage; battery energy storage; renewable diesel or bio-diesel. More details on battery storage and on the three other power storage technologies are provided in Appendix 2-D.

The Project will not deploy gas turbines for auxiliary power during operations to reduce carbon dioxide emissions.

2.6.3 Presence, Operation and Maintenance of Hydrogen / Ammonia Production, and Storage Facilities

Figure 2.42 displays the flows of the hydrogen / ammonia plant, including the relevant inflows and outflows from the system. Planned inputs and outputs from the plant are summarized in Table 2.6; emissions and discharges are described in more detail in Section 2.8.



Source: WEGH2 2023

Figure 2.42 Block Diagram of Hydrogen / Ammonia Plant

Table 2.7 Hydrogen / Ammonia Plant Inputs and Outputs

Inputs	Outputs
• Renewable electricity: The hydrogen / ammonia plant will be powered with green electricity (from the Project's wind farm) and will not have substantial carbon emissions. • Industrial water supply: The hydrogen / ammonia plant will use water from an industrial water source and will purify water for the electrolysis process using reverse osmosis. • Air: Nitrogen, which makes up approximately 80% of the air, is extracted from the air to be fed into the Haber-Bosch process.	• Water discharge: The hydrogen / ammonia plant will discharge water from the purification process. The effluent will contain minerals that are already present in the water source, concentrated to approximately three times the initial concentration. • Oxygen: The hydrogen / ammonia plant will emit oxygen to the atmosphere as a byproduct of the electrolysis process as well as from the air separation unit. The oxygen can be safely vented to the atmosphere or captured and used in industrial processes or wastewater treatment. • Hydrogen: Not routinely discharged. 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. • Water vapour: The hydrogen / ammonia plant will require a cooling system that may emit water vapour to the air.

The hydrogen / ammonia plant will operate using electricity generated by the Project wind farms and water sourced from the industrial water system. An overview of the water requirements for hydrogen production and an assessment of the potential industrial water supply for the Project is provided in Section 2.6.3.5 and concludes that, based on the average precipitation data, the Gull (Mine) Pond drainage basin, with a functioning water outflow control structure, can supply the water required for the Project.

The hydrogen and ammonia production processes are described above in Section 2.3.4 and Figure 2.12.

Emissions and discharges (including wastewater) from the hydrogen / ammonia plant will be sampled and analyzed on a regularly scheduled basis. 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.

Hydrogen and ammonia transportation will take place within the plant's premises until the ammonia is shipped for export purposes.

The hydrogen will be transported to the ammonia production loop by industry standard piping (Figure 2.43).

Source: WEGH2 2023

Figure 2.43 Hydrogen Plant Piping

Hydrogen storage will be designed to provide sufficient hydrogen feedstock to operate the ammonia plant at 10% turndown while the hydrogen / ammonia plant is shut down for 13 hours of low grid power availability. The ammonia unit will be operated from the same control room and distributed control system as the hydrogen unit. It will use the site-wide utility systems and flare system.

The ammonia unit will be in continuous operation outside of planned maintenance periods. During times of low power availability from the wind farm or the power grid, the ammonia unit will operate at a 10% turndown ratio. The ammonia unit will be specifically designed with features such as recycle and control systems to support this turndown ratio.

It is assumed that approximately 50,000 to 100,000 m^3 of ammonia will be stored. The ammonia will likely be refrigerated to approximately -33 degrees Celsius (°C) to -34°C and stored at atmospheric pressure as a liquid in double-walled, insulated tank(s) with refrigeration. There will be export pumps to move the ammonia to the loading point.

At this time, no underground hydrogen / ammonia storage is proposed for the Project; therefore, this is not assessed as part of this EIS.

The ammonia can be exported from the plant in two methods: 1) by truck for local distribution; and/or 2) by marine vessel for export. Ammonia can be delivered locally by industry standard tank trucks, but the Project does not currently include local use of the produced hydrogen / ammonia. It is anticipated that ammonia produced will be delivered by piping to the existing marine facility in the Port of Stephenville, where it will be transported overseas. The piping will not cross (public) roads or private properties to limit effects on the public. The loading point will either use the existing dock fitted with loading arms with mooring hooks and electrostatic discharge system, or a jettyless floating offloading system (Section 2.3.5).

Inspection and Maintenance Activities

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 / ammonia plant 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.

Inspection and maintenance of the hydrogen / ammonia plant 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
- 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 ten years). Other components, such as electrolyzer stacks and catalysts, will also require replacement during the operational lifetime of the Project.

Response to Varying Wind Energy Output for Hydrogen and Ammonia Production

The Project's current plant design intends to use three strategies to accommodate varying / intermittent wind power generation: 1) variable load facility; 2) NL Hydro grid connection; and 3) power storage facilities.

Variable Load Facility

A core design feature of the hydrogen / ammonia plant is the use of equipment with variable load operating capabilities. The hydrogen / ammonia plant will make use of independent modular electrolyzer arrays. Each array can operate at varying loads, between approximately 20% to100% of its capacity, giving the plant the capability to ramp up and ramp down the arrays as needed due to varying energy availability. Additionally, due to the independency of the electrolyzer arrays, modules can be shut down during periods of low energy availability.

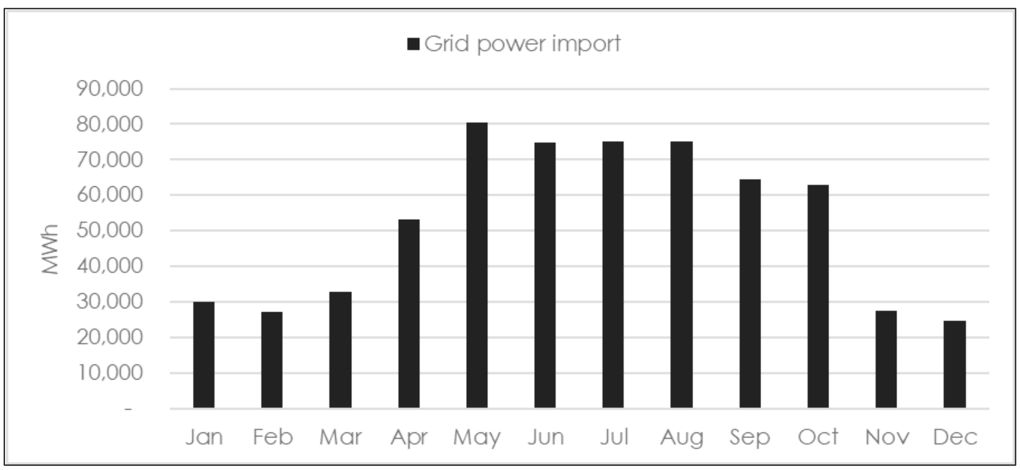
The anticipated total facility load can curtail from 100% to approximately 20% of load within 10 minutes. The primary load for the plant, approximately 90%, is for the water electrolyzers, which produce hydrogen. The electricity consumption of the electrolyzers can be safely and rapidly reduced by at least

90% in 10 minutes. The water would be shut down if the electrolyzers go down, as there will only be limited storage at the plant. However, the air separation unit and the ammonia unit would need to remain running and would take longer to shut down (except in an emergency shut down situation). As a conservative approach, it is assumed that the "other electrical consumption" cannot be reduced within 10 minutes.

The hydrogen / ammonia plant has been designed to allow shut-down such that it does not consume power. However, to maintain the operational integrity of the ammonia loop, the estimated uninterruptible facility load values (during normal operations) will be less than 20 MW per individual phase.

NL Hydro Grid Connection

The Project has filed an application with NL Hydro for a 155 MW grid connection. The 155 MW grid connection will comprise a 10 MW "firm load" capacity that will always be made available to the Project, and an additional capacity of 145 MW ("non-firm load") that will be made available 24/7 during summer, and partially available during the four months in winter (lower capacity available overall and zero capacity available for some 13-hour periods). Figure 2.44 shows that higher power imports are expected during summer, when grid power demand in the region is relatively low, as well as wind power production.



Source: WEGH2 2023

Figure 2.44 Expected Monthly Grid Import Profile (MWh)

Further details on this topic will be provided once the system impact study is completed by NL Hydro. This will involve an overall system model that allows accurate simulations of the effect of the Project on the NL Hydro grid and optimization of the Project's major electrical equipment ratings.

Power Storage Facilities

The Project will use power storage to manage seasonal and intra-day wind energy generation variations acting as a buffer between power generation and the hydrogen production unit. The Project will not deploy gas turbines for auxiliary power during operations to reduce carbon dioxide emissions. Various options of the electrical power storage design are being pursued in parallel to provide the optimal solution for the Project and stakeholders. Advanced discussions with the power storage providers have taken place and the potential solutions will continue to be further assessed in the coming months based on a refining of the wind farm design parameters, anticipated operating characteristics, and energy generation profile. Key evaluation criteria for the final selection of the power storage technology will include the capacity, duration, ramp-up rates, lifetime, price, logistical set-up, local supply chain capabilities, and benefits. The four primary options the Project is considering are : (i) thermal battery storage; (ii) battery energy storage; (iii) renewable diesel or bio-diesel. Refer to Appendix 2-D for a description of these power storage alternatives.

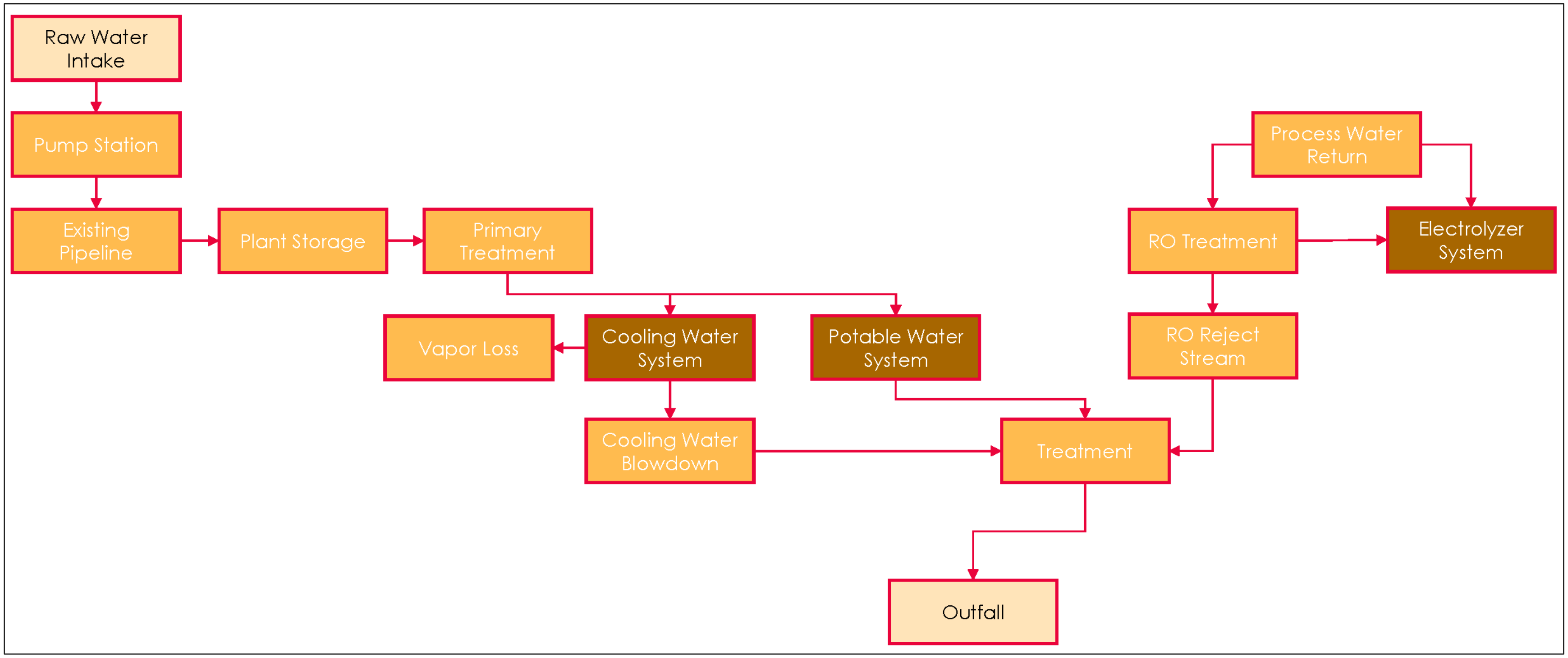
Energy Rates

WEGH2 is not currently seeking a non-firm energy rate other than the PUB scheduled rates. However, the anticipated benefits of potentially supplying electricity to the grid are detailed in Section 2.3.4.5.

Industrial Water Requirements

Water is one of the key inputs for the green hydrogen / ammonia plant. A holistic approach to selection of water technologies can make a substantial difference in the overall water balance and viability of the Project. Finding sustainable water sources and reducing the water consumption for hydrogen production will assist to lead to a suitable way to produce green hydrogen. The information in this section is provided by FracFlow (2023). Figure 2.45 is a simplified diagram providing an overview of water use in the hydrogen / ammonia plant.

The electrolyzer system needs to be supplied with demineralized water. The pre-designed demineralization system assumes a potable water stream but is fully customizable for a source of raw water. As a general rule, the average demineralized water consumption of the electrolyzer system is approximately 10 m^3 demineralized water per produced metric ton of hydrogen. It is assumed that approximately 36% of the water supplied is eventually lost to purification effluent, cooling, and flushing water and is considered wastewater. With potable water as the raw water source, consumption is approximately 15 m^3 potable water to produce the 10 m^3 of demineralized water. Water requirements to produce 15 m^3 of potable water depend on starting water quality.



Source: WEGH2 2023

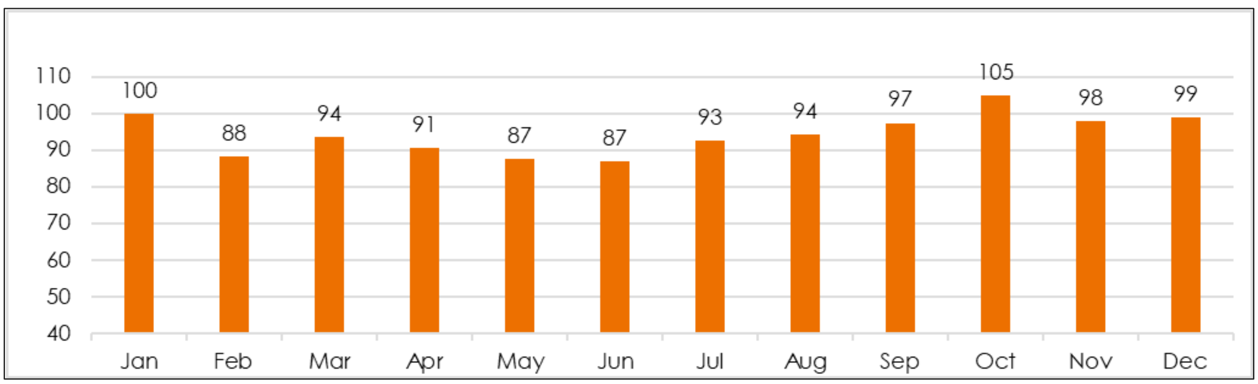
Figure 2.45 Overview of Hydrogen / Ammonia Plant Water Use

Based on the current hydrogen technical design, the estimated water requirements for green hydrogen production are summarized in Table 2.8.

Table 2.8 Hydrogen Electrolyzer Feedwater Quantity Requirements

	Unit	Port au Port Wind Farm Operating (~2026)	Codroy Wind Farm Operating (~2027)	Future Expansion
Avg. hourly water use	m^3 per hr	123	246	368
Avg. daily water use	m^3 per day	2,947	5,895	8,843
Max. day demand	m^3 per day	8,842	17,684	26,528
Avg. Monthly water use	m^3 per month	88,420	176,840	265,280
Note: Assumes a 30-day month.				

The water consumption amount will, to some extent, correlate with the amount of wind energy generation. For example, more water is expected to be consumed in winter periods when there is high wind energy generation (and consequently higher hydrogen production) than in summer periods. The water consumption might therefore vary on a monthly and weekly basis and is estimated to be approximately 5% higher during winters than summers (or approximately 20% higher in October compared to May / June), as indicated in Figure 2.46.

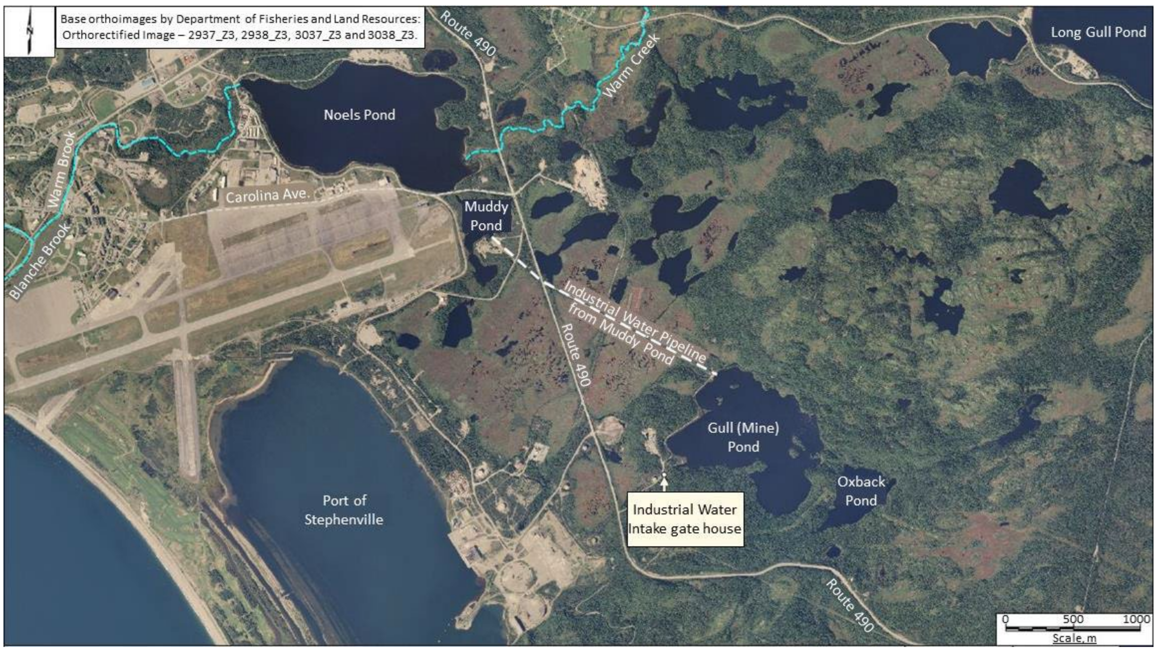


Source: WEGH2 2023

Figure 2.46 Seasonal Variation in Expected Water Consumption (base 100)

Water Sources

Gull (Mine) Pond is planned to be the primary source of industrial water for the hydrogen / ammonia plant (Figure 2.47). Muddy Pond and Noels Pond are considered as secondary sources. In order to access these water sources, WEGH2 plans to refurbish and update the existing industrial water supply infrastructure that was originally constructed in the 1970s to supply a liner board mill and subsequently the Abitibi mill. It is estimated that more than 37.9 m³/min (10,000 USgpm) of water were being withdrawn from Noels Pond when both the Town of Stephenville and the industrial users were withdrawing water from Noels Pond. The Project is projected to draw less than three-quarters of that amount, at maximum capacity.



Source: FracFlow 2023

Figure 2.47 Sources of Water Supply for Hydrogen / Ammonia Plant

An average of 1,688 m³/hr (28 m³/min) of raw industrial water will be pumped from Gull (Mine) Pond to feed the hydrogen / ammonia plant, with a maximum short-term demand of 2,403 m³/hr. Since the drainage basin for Gull (Mine) Pond can only supply approximately 3 m³/min of water, the additional 25 m³/min of average water demand will be pumped to Gull (Mine) Pond via the existing pipeline (Figure 2.53). The active storage in Gull (Mine) Pond will supply the short-term peak water demand. The existing pumping station on Muddy Pond along with the existing secondary industrial water pumping station that is owned by the Town of Stephenville will be refurbished to move water from the Muddy Pond-Noels Pond system to Gull (Mine) Pond and to supply the existing industrial water users. The existing gravity feed intake structure (Figure 2.53) on Gull (Mine) Pond that was used to feed water to the former industrial mill operations will be refurbished and upgraded to pump industrial water to the hydrogen / ammonia plant. The hydrogen / ammonia plant site is not connected to the municipal water supply and municipal wastewater system onsite (FracFlow 2023).

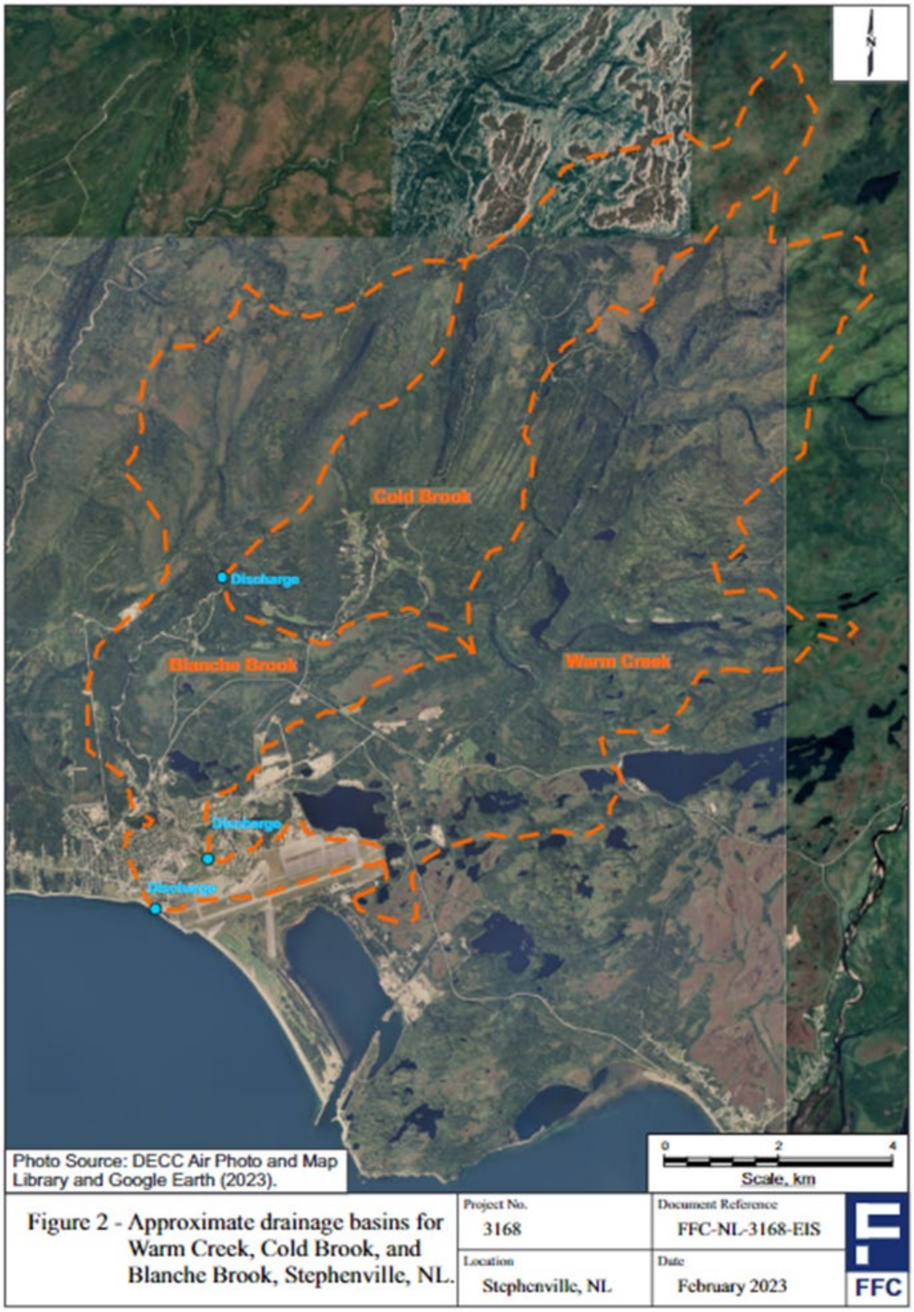
The Gull (Mine) Pond drainage basin or the area that contributes flow to Gull (Mine) Pond is approximately 3,556,000 m² and is located to the east of but not connected to the Warm Creek drainage basin (Figure 2.48). Gull (Mine) Pond itself has a surface area of approximately 673,900 m².

Muddy Pond and Noels Pond are fed by the Warm Creek drainage basin, which has an area of approximately 60,100,000 m² (60.1 km²). This is similar to the Blanche Brook drainage basin, from which the Town of Stephenville draws its potable water supply (Figure 2.54). Noels Pond has an area of 1,078,321 m² and Muddy Pond has an area of 133,552 m² for a combined interlinked area of 1,211,873 m².

Given their similar underlying geology, the flow data (Acres 1994) from the three adjacent drainage basins / streams (Blanche Brook, Harry's River, and Barachois Brook) were used to calculate the precipitation runoff relationships and baseflow in Warm Creek once corrections for the differences in area were completed.

Based on the total yearly precipitation values, the average, minimum, and maximum flows for Harry's River and the calculated flows in Warm Creek where it discharges into Noels Pond, the calculated minimum discharge from Warm Creek ranged from 0.09 to 0.33 m³/hr for the low precipitation years and from 0.27 to 0.43 m³/s for the high precipitation years. The calculated average discharge into Noels Pond ranged from 1.75 to 2.17 m³/s for the low precipitation years to 2.39 to 3.03 m³/s for the high precipitation years. For comparison with the water demand units, the minimum discharge ranges from a low of 324 m³/hr to a high 1,548 m³/hr, with the average discharge ranging from a low of 6,300 m³/hr to a high of 10,908 m³/hr).An average of 1,688 m³/hr (28 m³/min) of raw industrial water is required to feed the hydrogen / ammonia plant, with a maximum short term demand of 2,403 m³/hr (FracFlow 2023.

Muddy Pond is connected to Noels Pond via two large culverts that are currently submerged under Carolina Avenue. A large diameter pipeline was constructed between Muddy Pond and Noels Pond and Gull (Mine) Pond (Figure 2.48). This pipeline was used to provide additional industrial water to the original liner board mill and subsequently to the Abitibi mill operations. The overall components of the original industrial water supply, and the recent modifications, are described in detail in Fracflow (2023). The records (the Water Resources Atlas of Newfoundland) indicate the previous Abitibi mill site operators used an average of more than 15.9 m³/min (4,200 USgpm) of industrial water that was drawn from the Muddy Pond and Noels Pond system through the large diameter pipeline between Muddy Pond and Noels Pond and Gull (Mine) Pond. Noels Pond was also part of the original source of the potable water for the Town of Stephenville, but was decommissioned in the early 2000s in favor of a groundwater source in the Blanche Brook drainage basin.



Source: FracFlow 2023

Figure 2.48 Adjacent Drainage Basins / Streams

Active Storage

Because of the normal variation in stream flow throughout the year, active storage is a critical part of the proposed industrial water supply system. The active storage in the industrial water supply system when the three ponds (Gull [Mine] Pond, Noels Pond, and Muddy Pond) are combined is conservatively estimated at 47 days (Fracflow 2022) at the projected average demand of 28 m³ per minute. [A lower peak demand will produce a longer period of active storage or safe yield. It is expected that completion of the planned Hydrologic Engineering Center Hydrologic Modeling System analysis of the Warm Creek drainage basin will take into account the additional storage and buffering that is provided by the ponds in the upper part of the drainage basin. This will produce a longer period of active storage so that the required flows needed to support fish passage into and through Noels Pond will be maintained.

Industrial Water Supply Infrastructure

The details of the individual components of the existing industrial water transfer infrastructure and the refurbishing and upgrading work required to restore the overall system are presented in Fracflow (2023). The main components of the overall industrial water infrastructure are summarized below.

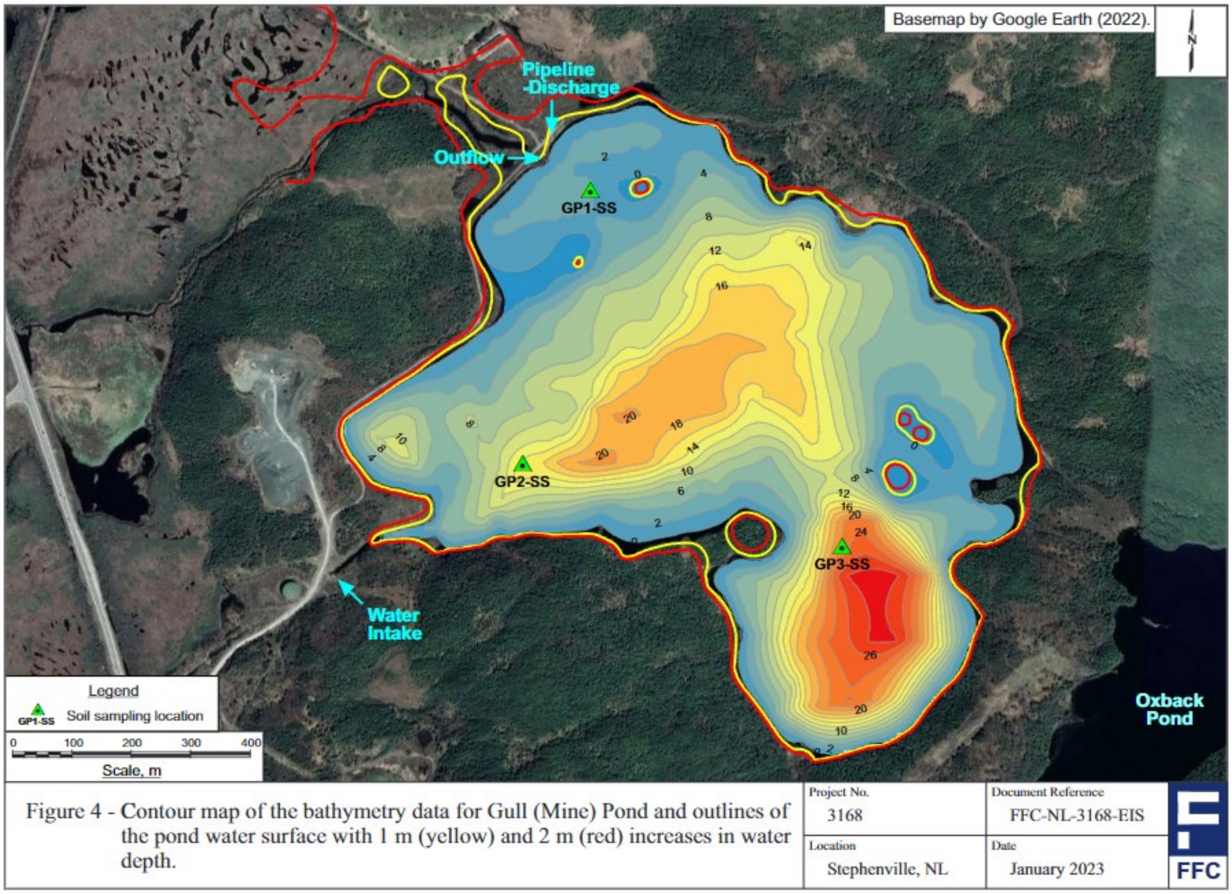
The infrastructure on Gull (Mine) Pond is relatively old, but the earthen berm is still retaining water in the pond, with limited evidence of seepage through the berm. The cleaning of the canal, road repairs, minor ditching and culvert installation, and extensions on the cribwork are a few of the changes needed to develop full active water storage.

The infrastructure on Noels Pond is in good shape, and the refurbishing and upgrading work is limited to installation of water control gates and a fish ladder or bypass and removal of driftwood debris.

The infrastructure on Muddy Pond is relatively old but was well maintained during the Abitibi mill's operation. However, the key infrastructure for controlling the storage in Muddy Pond is located on Noels Pond, and water is conveyed through the culverts beneath Carolina Avenue.

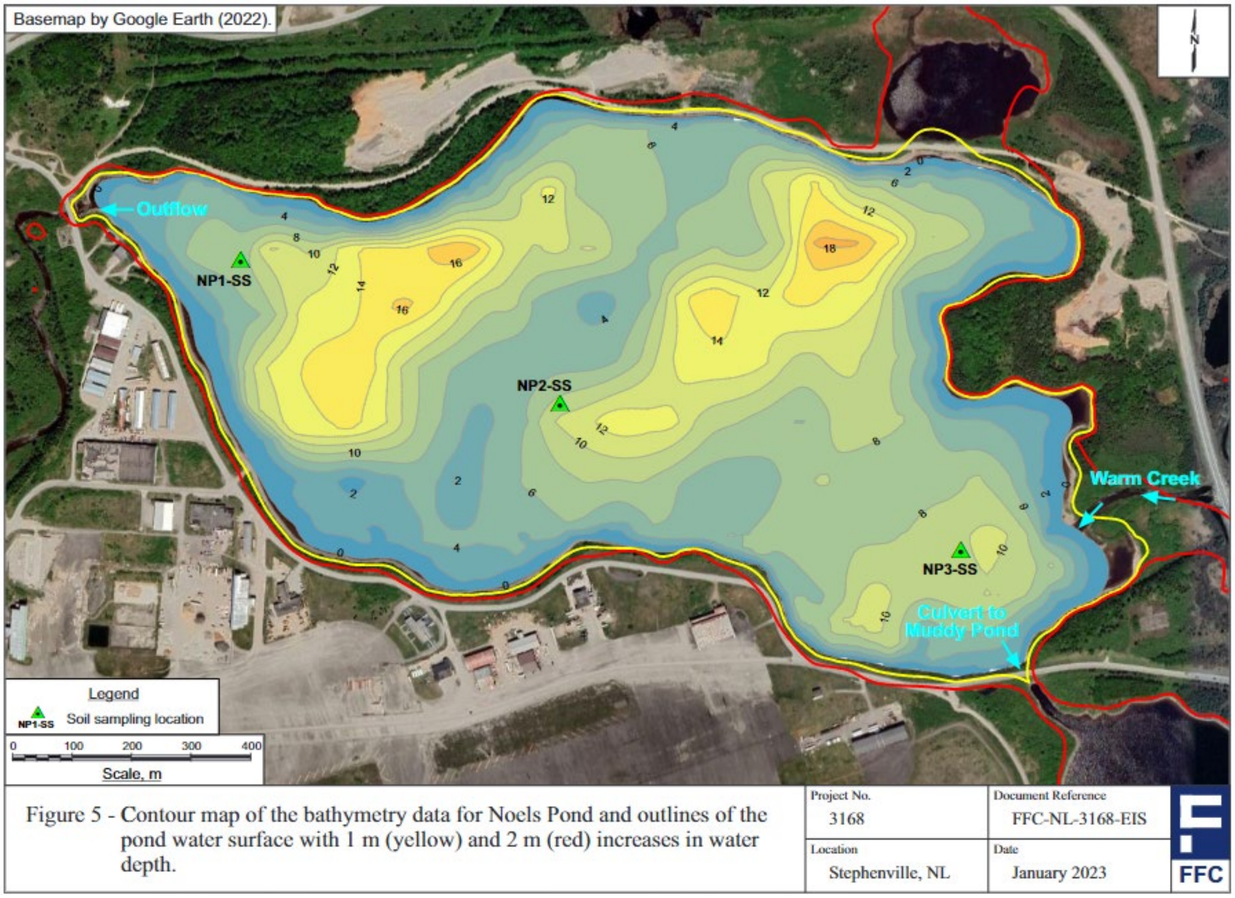
Water Quality

A sonar survey was conducted in September 2022 on each of the three industrial water supply ponds and bathymetry maps (Figures 2.49 to 2.51) were constructed from that data.



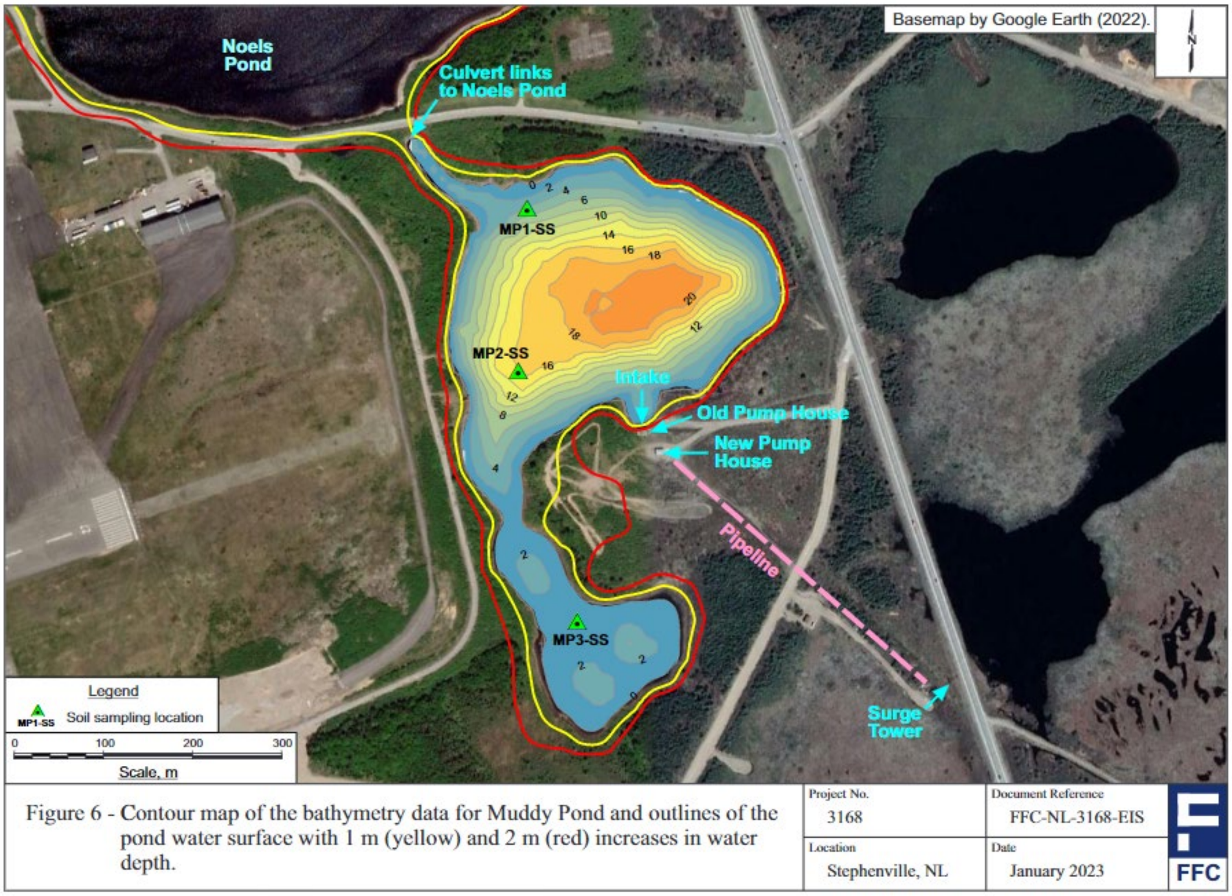
Source: FracFlow 2023

Figure 2.49 Bathymetry of Gull (Mine) Pond



Source: FracFlow 2023

Figure 2.50 Bathymetry of Noels Pond



Source: FracFlow 2023

Figure 2.51 Bathymetry of Muddy Pond

These maps also show the areas that would be flooded by raising the water level in each pond by 1 m and then by an additional 1 m. Water and pond sediment samples were collected from three locations in each pond during the sonar surveys. The water and sediment samples were analyzed for a range of components that were considered to be relevant to the intake water for the proposed hydrogen / ammonia plant.

The general water chemistry for the water samples from the three ponds met the Canadian Council of Ministers of the Environment Guidelines for Freshwater Aquatic Life, except for three noted exceedances [total aluminum, total iron, and dissolved selenium]. There was no detectable low-level benzene, toluene, ethylbenzene and xylenes / total petroleum hydrocarbons (TPH). The pond sediments do show some detectable levels of petroleum hydrocarbons in the form of TPHs and polycyclic aromatic hydrocarbons. The measured TPH values in the pond sediments are considered to reflect organic signatures but confirmation would require successive silica gel clean-ups to remove most residual organic material. The visible sheen observed with sample MP02SS1 [in Muddy Pond] suggests that the measured TPH values reflect hydrocarbon signatures, rather than organics. Also selected metals such as selenium are most likely related to the discharge of deep bedrock ground water as observed in other parts of this ground water flow system. The total suspended solids (TSS) levels are expected to vary on a seasonal basis. Monitoring requirements for the water supply will be determined by the local ministry authorities as appropriate.

For operational purposes there will be some in-field instrumentation measuring source water and wastewater flows and concentrations included in the design for this Project. Some measured parameters will be bench tested daily or several times per week on site, while less frequent monitoring will likely be done through third-party accredited laboratories, based on the need of the operation and/or environmental monitoring plans in the eventual permitting process. For wastewater, monitoring may include grab sampling or composite sampling. Some examples of continue instrument monitoring may include, but are yet to be determined, are salinity and/or conductivity, pH, temperature and flow.

Potable Water Supply

The potable water supply for the hydrogen / ammonia plant will use the same approach as is being used for the existing port facilities. There are no acceptable potable water sources in the immediate area of the proposed plant site that could produce good quality water or would not have an effect on existing freshwater users such as the MOWI-East fish hatchery.

At Muddy Pond, raw water will be drawn through a tee-type, end-of-pipe intake screen, conveyed through a 900 mm high density polyethylene (HDPE) pipe extending 100 m into the pond to provide water flows to the refurbished raw water pump station. The intake screen is sized with an approach velocity of 0.03 m/s (0.11 feet/s), providing the most conservative approach velocity for fishery protection as per DFO guidelines. The intake system will be designed to facilitate cleaning of the intake screen with compressed air at 175 psi through a 200-mm HDPE pipe extending from the pump house to the intake screen. From the Muddy Pond pump house, approximately 25 m^3/min of raw water will be pumped to Gull (Mine) Pond through the existing 700-mm polyethylene pipe.

At Gull (Mine) Pond, approximately 28 m^3/min [volumes to be confirmed] will be sourced through a channel-mounted, fixed travelling screen system into the new raw water pump station. From the pump station, the raw water will then be pumped to the hydrogen / ammonia plant site area through the existing 700-mm HDPE influent pipeline (i.e., existing Abitibi influent pipeline). The travelling screen will be provided at the end of the channel to facilitate cleaning. The screen is sized with an approach velocity of 0.03 m/s (0.11 feet/s) to provide the most conservative protection for fishery protection. The fixed screen will be housed inside the pump house to facilitate operation and maintenance. Outside application of the travelling screen will require additional enclosures and winterization, such as a heat trace system to prevent the screen freezing in winter.

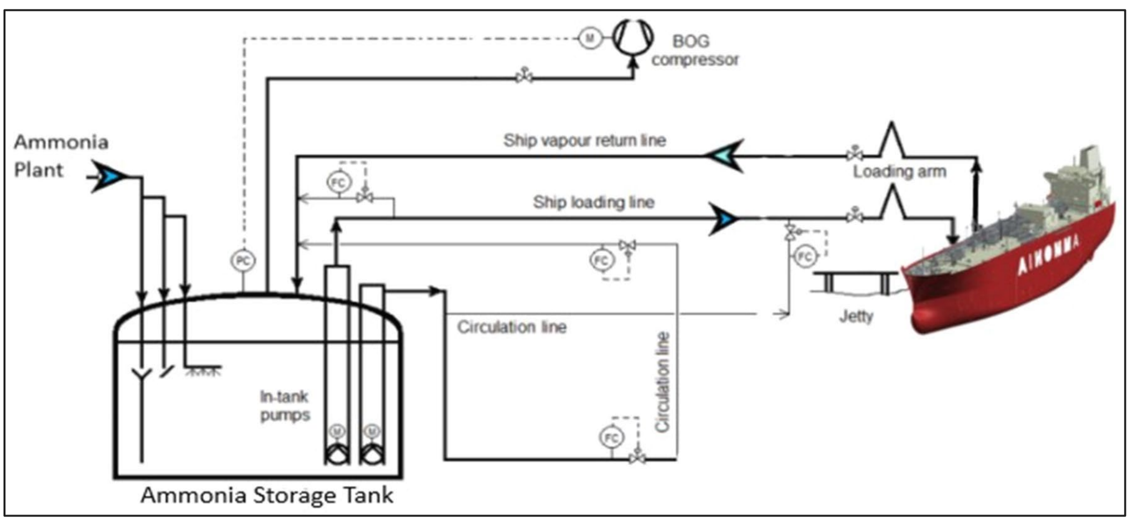
A new, approximately 250 m^2 pollution control building is proposed to be built adjacent to the East Ash Pond. It will rest on top of the existing Abitibi effluent pipeline. The existing effluent pipe is approximately 2.5 km long, connecting from the new pollution control building to the north ASB Pond. The pollution control building will serve as a central hub for blending streams and directing the treated effluent from the East Ash Pond and the high total dissolved solids (TDS) wastewater from the water purification building. The existing Abitibi effluent pipeline may be suitable to be reused to convey a total of 2.7 m^3/min of industrial wastewater (which is 30% of total 9.0 m^3/min of raw industrial water supply needed for electrolysis and cooling) from the pollution control building to the north ASB Pond by gravity. Therefore, a pumping station has not been included in the Project design at this time. The building will include an office / lab room, a chemical room with chemical dosing equipment and holding tanks, an electrical room, a mechanical room, a washroom with showers, and a deep-flow sump for mixing and sampling.

2.6.4 Presence, Operation and Maintenance of Port Facilities

Berthing infrastructure at the Port of Stephenville will require maintenance over the operation life of the Project. WEGH2 will work with the Port to identify maintenance requirements and facilitate work. Horizon Maritime will operate the Port on behalf of WEGH2. Supplies will be delivered by cargo ship based on the operational needs, likely not on a regular basis.

Shipping of Anhydrous Ammonia

A typical terminal set-up is presented in Figure 2.52. The anhydrous ammonia is transferred using pumps submerged in the storage tanks. During the loading process, a large quantity of vapour is generated. This vapour is returned ashore via the ship's vapour return line for reliquification within the plant. The safe transfer of ammonia from the terminal storage tanks to the vessel occurs when the dockside loading arms are connected to the ships manifold (as indicatively shown in Figure 2.53). Loading commences with a small quantity of cargo to allow a controlled cooldown of the ships tanks and loading lines. Loading arms suited for the ammonia are fitted with a vapour return line, several safety sensors, purge points, and connections for electrostatic discharge. Transportation to / from the Port will use existing charted shipping routes and are described in Section 2.6.5.2. Pilotage at the Port is mandatory, with the pilot boarding station located 0.7 miles west-southwest of Indian Head.



Source: WEGH2 2023

Note: This is a simplified drawing. The actual system will include several more isolations, sensors and safety systems.

Figure 2.52 Transfer of Ammonia from the Terminal Storage Tank to the Vessel

Source: WEGH2 2023

Figure 2.53 Marine Loading Arms Connected to Vessel's Manifold

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, ammonia could be transported by marine vessels in special built, multi-modal containers.

Ammonia is transported globally by dedicated ammonia carriers and by standard liquefied petroleum gas capable vessels. The vessels are typically in the range 15,000 to 85,000 m³. The base case vessel has a 35K m³ capacity (Figure 2.54), with a maximum load draft of 10.2 m in salt water.

Source: https://www.balticshipping.com/vessel/imo/9471018

Figure 2.54 *MT Gaschem Hamburg*, Example of 35,000 m³ Base Case Vessel

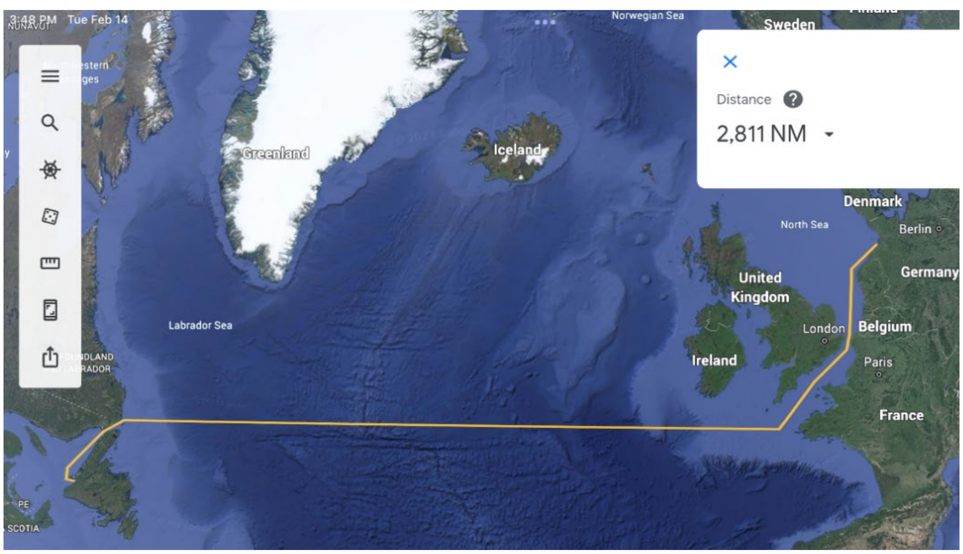
Ammonia carriers require a number of operational certificates to operate in Canadian waters, based on the standards that apply under the international maritime conventions to which Canada has acceded. Vessels would also be subject to Canadian laws and regulations in relation to emissions and discharges.

The current schedule indicates the first commercial shipments would commence in 2026. Based on a projected annual production of 585,000 tonnes, it is estimated that one to two vessels per month would be required. This would increase to four to six vessels per month for future potential development in 2028, with expected production of 1,756,000 tonnes annually. These estimates are based on vessels with a cargo capacity of 35,000 m³. It typically takes 24 hours to load ammonia.

Based on current understanding, the Port is able to accommodate vessels to transport ammonia without the construction of additional berthage. This will be confirmed prior to construction through a desktop navigation assessment and 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.

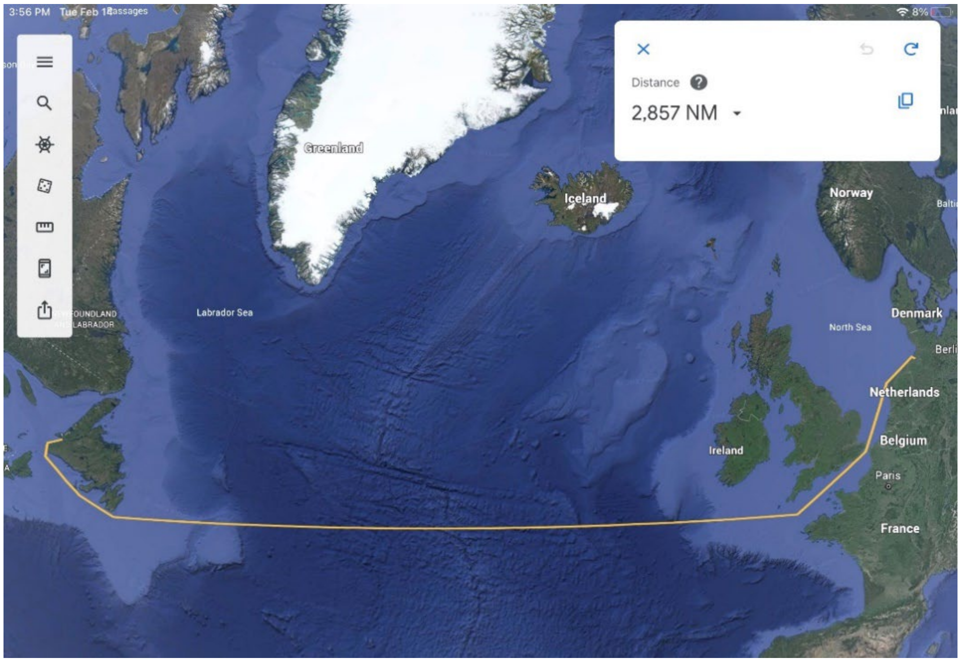
Marine Transportation Routes

Shipping for the Project will use existing charted shipping routes. Vessels coming to and from the Port will be operated by a third party and will follow standard shipping routes and operate under guidance of the Pilotage Authority. Route 1 (Figure 2.55) will be the regular routing for vessels, but in the case of pack ice blocking the Strait of Belle Isle, the route illustrated in Figure 2.56 will be the alternate route. Weather and time of year may also dictate the route.



Source: WEGH2 2023

Figure 2.55 Route 1: Strait of Belle Isle



Source: WEGH2 2023

Figure 2.56 Route 2: South Coast Island of Newfoundland

Biosecurity in Relation to Aquatic Invasive Species and the Movement of International Vessels

Vessels entering the Port of Stephenville will be in compliance with the Canadian *Ballast Water Regulations*. This will be confirmed by a pre-vetting process and incorporated into the Port arrival checklist. Port State Control under Transport Canada will also do checks on foreign vessel. Ships of 400 gross tonnes and above trading internationally must have:

- An International Ballast Water Management Certificate
- An approved ballast water management plan that provides details on how compliance will be achieved with the necessary procedures
- Technical documentation and approval certificate for the ballast water treatment system fitted to the vessel
- A ballast water record book. This remains on board the ship at least two years after the last entry has been made and following that held by the shipowner for at least three years

Routine entries in the ballast water record book provide details on location, volume and water depth:

- When ballast water is taken on board
- When ballast water is circulated or treated for management purposes
- When ballast water is discharged into the sea
- When ballast water is discharged to a reception facility

There are two performance standards:

- D-1, which is based on ballast water exchange (in at least 370.4 km [200 nautical miles] from shore in water not less than 200 m)
- D-2, which addresses ballast water treatment systems and specifies the levels of viable organisms that are allowed to remain in the water after treatment

2.6.5 Materials Storage and Handling

Hazardous products will be stored according to industrial requirements and standards and safely secured so that access is limited to authorized personnel. Both hydrogen and liquid ammonia are hazardous products and their storage and handling is addressed in Section 2.3.4.5.

Lubricants will be stored in the operation and maintenance buildings for the turbines. If bulk fuel storage for maintenance vehicle is required during operations, it will be stored in an approved dual-wall fuel storage tank. 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.

Explosives and accessories will be stored in licensed magazines respecting regulatory requirements (refer to Section 2.5.1.7). Bulk emulsion explosives for blasting during construction will be stored in emulsion tankers (one at each wind farm site). These tankers typically hold 20,000 kg. These will be left in a secured, fenced compound with one set of wheels removed and the king pin locked.

2.6.6 Site Security and Management of Public Access to Project Components

There will be no restrictions to public access within the wind farms except fencing around the substations. There will be signage for a barrier around the base of the turbines to mitigate ice throw risk. For nine months of the year, there is no risk to ice throw. If there is risk of ice throw, signage will direct the public to remain 412.5 m from the turbines, otherwise the public will have access. A staffed guard house will be located at the entrance to the hydrogen / ammonia plant.

2.7 Decommissioning and Rehabilitation Activities

It is recognized that the Project is in its early stage, and that it will take at least 30 years for it to reach the end of the Project's nominal design life. WEGH2 will continue to seek solutions and improve the decommissioning strategy considering available technologies. Decommissioning activities would comply with environmental regulations and requirements in place at the time of decommissioning.

The Project's decommissioning and rehabilitation activities aim to restore the site and typically include:

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

Preliminary details on Project decommissioning and rehabilitation are provided below (including for demobilization of temporary construction facilities).

2.7.1 Construction Demobilization and Remediation

Personnel and equipment will be demobilized as they become no longer required for the Project. Project sequencing and work force allocation will look to reduce temporary layoffs during winter seasons for workforce continuity. Equipment will be carefully removed, and offices will be taken down in reverse order of setup and transported off site.

Existing materials, equipment, and spare parts at the laydown or storage facilities will be removed from the site or turned over to WEGH2. Once the overall scope has been completed, the contractor will fully demobilize from the site. Temporary construction trailers will be removed, as well as equipment that is no longer required.

Final grading will be completed at the site laydown and site office areas once infrastructure has been removed. These areas will have organic materials re-spread and seeded.

At the wind farms, surplus excavated material will be spread in the immediate vicinity of the new tower foundation to provide positive drainage. The area immediately surrounding the turbine foundation will be re-graded, and soil that was removed will be replaced. Excavated organics will be stored and reapplied during decommissioning and revegetation will be allowed to occur naturally.

2.7.2 Decommissioning and Rehabilitation of Wind Farms

A high-level decommissioning strategy has been developed for the wind turbines and key activities include removing the structure, including the turbine. Components such as nacelle and tower components have an established practice of recycling, and appropriate plans will be implemented. Some wind turbine manufacturers have recently introduced recyclable wind blades; these new products will be factored into the overall strategy. For components that do not currently have a mature recycling method, it will be determined whether they can be resold at the time of decommissioning. Typically, the foundation pedestal concrete will be removed to 1 m below ground, rebar cut off and the site covered with soil. Laydown areas and turbine access roads will be reclaimed, while public roads will remain and gates will be removed. The underground electrical cable collectors will be cut off and removed to 1 m depth and the overhead collector poles and conductors will be removed.

2.7.3 Decommissioning and Rehabilitation of Electrical Infrastructure

Decommissioning of the electrical infrastructure includes removal of the conductors, dropping poles to ground level and disassembling the framing / hardware for removal from the ROW for reuse, recycling or sent to an appropriate facility for disposal.

The equipment within the substations and primary terminal station in Stephenville (e.g., circuit breaker, disconnect switches, conductors, oil-filled equipment), will be removed and either reused or disposed of via licensed contractors. The substation structures will also be decommissioned and removed.

A high-level decommissioning strategy for electrical infrastructure has been developed and key activities include:

- Transmission line decommissioning: steel towers, wood poles, and conductors will be removed as efficiently as possible, and the trenches for 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 transformers. 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.

2.7.4 Decommissioning and Rehabilitation of Hydrogen / Ammonia Production and Storage Facilities

The components of the hydrogen unit, including electrolyzers, water purification systems, and hydrogen handling systems will be disassembled and removed from site. The components will be recycled or refurbished for continued use. The buildings housing the electrolyzers can be demolished or left in place to facilitate redevelopment of the site by other industries. It is assumed that the pond water level control systems will remain in place, however the pipes and intake structures will be removed, or if value to municipality of Stephenville, sold or relinquished to their authority.

The ammonia unit will be purged and cleared of ammonia and hydrogen. Following purge, the system will be systematically dismantled and removed from site. It is not unusual for Haber-Bosch-based ammonia plants to be re-assembled in a new location and returned to service. The foundations will be removed, and the site will be cleaned and graded. The ammonia tank and water tanks will be purged, cleaned, disassembled, and removed from site for recycling.

2.7.5 Decommissioning of Port Facilities

The Port facilities will be decommissioned by removing the ammonia loading infrastructure such as loading lines and loading arms. The quay and associated mooring infrastructure can be either demolished or left in place for use in future site development. The jettyless mooring infrastructure will be removed.

2.8 Emissions, Discharges, and Wastes

Various emissions, discharges and wastes will be generated by the Project during construction, operation and maintenance, and decommissioning and rehabilitation. These emissions, discharges and waste are summarized below, with reference to applicable Project phases where relevant. The operation of wind turbines will be visible on the landscape. A visual study (Appendix 19-A) has been conducted to determine the visibility of the turbines from various viewpoints and will be used to support engagement with local residents.

2.8.1 Air Emissions

During construction, the main sources of air emissions will include mobile equipment, generators, blasting, and fugitive dust (e.g., unpaved roads, material handling, laydown areas). These activities will generate air contaminants and GHGs, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and particulate matter (total suspended particulate, TSP; particulate matter with an aerodynamic diameter less than 10 µm, PM_{10}; fine particulate matter with an aerodynamic diameter less than 2.5 µm, $PM_{2.5}$; and diesel particulate matter, DPM).

The main sources of air emissions during Project operation and maintenance relate primarily to the operation of the hydrogen / ammonia plant (flare pilot, flaring event, and cooling tower) and the use of a bio-diesel generator for back-up power. Oxygen will be generated during electrolysis and the nitrogen separation process and will be safely vented to the atmosphere. Approximately 2,260 tonnes of oxygen will be generated daily from electrolysis when both wind farms are operational; this volume could increase to 3,400 tonnes per day during future expansion. Hydrogen, nitrogen, and ammonia releases are not planned. However, in upset conditions where safety requires rapid depressurization of the facility, ammonia and hydrogen will be safely combusted in the flare stack. The flare stack will be sized for controlled safety release of hydrogen, ammonia, and nitrogen exhaust in non-routine situations. It is assumed there will be up to three stacks on the main flare, each approximately 91.4 to 121.9 m (300 to 400 feet). Each pilot will require 6,500 standard cubic feet per hour (SCFH) of butane, for a maximum of 19,500 SCFH for all three flare stacks. These activities will generate air contaminants including SO_2, NO_X, CO, VOCs, PAHs, ammonia (NH_3), and particulate matter (TSP, PM_{10}, $PM_{2.5}$, and DPM), along with a

GHGs including CO_2, CH_4, and N_2O. for the purposes of the model, it was assumed there would be one flaring event per year.

The assessment of Project-related effects on the atmospheric environment, including details on sources of air emissions, estimates of emission quantities (including direct and indirect GHGs), air dispersion modelling results, and proposed mitigation measures and residual effects, is provided in Chapter 6, Atmospheric Environment.

2.8.2 Noise and Vibration

The Project will generate noise and vibration emissions. During construction, key sources of noise emissions will include the operation of heavy equipment / vehicles and marine vessels (e.g., barges and vessels delivering wind turbine components).

During the operation and maintenance phase, the operation of the wind turbines at the wind farms will be the primary noise emission source, although equipment associated with the operation of the hydrogen / ammonia plant (e.g., hydrogen electrolyzers, typically enclosed and therefore low-noise emitters) and electrical infrastructure (e.g., substation transformers, designed to meet the sound level criteria at receptors) will also generate audible noise emissions. A Project-related increase in marine vessel traffic at the Port of Stephenville will also contribute to elevated noise levels.

A noise impact study has been conducted as part of the EIS. It reviews baseline noise conditions, models noise emissions from the Project, and determines noise levels at sensitive receptors. This will support planning and design mitigation for noise and will support engagement with local residents. Details on noise emissions and vibration including air contaminants, GHGs and dust are provided in Chapter 6, Atmospheric Environment.

2.8.3 Lighting

Lighting will be required at Project facilities for the safety of staff and contractors during night operations, as well as to comply with Transport Canada requirements related to aviation and marine navigation. Lighting at the hydrogen / ammonia plant will provide safety during night operations and will comply with the standards set by the American National Standards Institute - Illuminating Engineering Society, or other standards acceptable to the minister, as required by the NL *Occupational Health and Safety Regulations*. Transport Canada will be consulted to determine the specifications and design for the lighting required at the flare structure(s). Transport Canada will also be consulted regarding lighting requirements for the turbines. The high-voltage substation site will also require lighting.

Several design measures will reduce light emissions from the Project:

- Electrolyzers and other mechanical equipment will be enclosed, which would block the lighting from night skies and the surrounding environment
- The use of LED lighting will provide more targeted and less invasive lighting and could include the use of warm bulbs, shielded light fixtures, and motion sensors where appropriate

2.8.4 Electromagnetic Fields

The operation of higher voltage transmission lines and substations can result in the production of electromagnetic fields (EMF). The highest voltage for the proposed transmission lines is 230 kV. EMFs produced by the transmission and use of electricity are considered to be of extremely low frequency. An electromagnetic interference study, including analysis of potential interference with communications on the Port au Port Peninsula, will be completed prior to construction and will provide guidance to Project planning and design. Additional information EMF and potential interactions with human health is provided in Chapter 19, Human Health.

2.8.5 Industrial Wastewater

A total of 2.7 m^3/min (713 USgpm) of industrial wastewater is used as the basis of design for the wastewater treatment system. It is assumed that 30% of the total 9 m^3/min (2,378 USgpm) of industrial water supply will become wastewater streams from the purification treatment system, the remaining will be used for electrolysis and cooling.

The following industrial wastewater streams are included in the concept design for industrial wastewater system:

- High TSS/low TDS stream: 0.76 m^3/min (28% of total 2.7 m^3/min industrial wastewater flow), 258 mg/L of TSS, 4 mg/L of TDS.
- High TDS stream: 1.94 m^3/min (72% of total industrial wastewater flow), 2,160 mg/L of TDS.

Although the facility process streams are not yet finalized, it is assumed that high TSS wastewater generated could be from pre-treatment stages such as filter backwash or the cooling water blowdown. It is also assumed the high TDS wastewater could be generated from a double-pass reverse osmosis concentrate streams and polishing treatment as per other similar high purity water projects. These technologies will be confirmed during subsequent stages of design and may modify assumptions. It should be noted that quantity and quality of the generated wastewater streams can vary depending on the eventual selected water purification system.

Water will be discharged through a water purification plant prior to discharge. If sampling / data analysis indicate that the outflow is not acceptable for discharge treatment will be explored prior to discharge. Water reuse will be explored within the Project production facility to reduce wastewater volumes discharge; this is typically undertaken as part of best practices in design regardless of wastewater discharge compliance. The source water and water treatment facility will be further defined to identify which treatment options will be suited for the 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

As high purity water is required for the hydrogen / ammonia plant regardless, it is assumed that the water purification process will include (i) pretreatment using various types of filters such as multi-media and carbon filters, (ii) double-pass reverse osmosis, and (iii) ion exchange as polishing step. These technologies were used to develop wastewater design assumptions regarding the composition of wastewater at the Project design volumes. WEGH2 is currently evaluating wastewater treatment options.

The treated effluent will be designed to be discharged to the ocean and needs to meet the discharge limit under the Schedule A of NLR65/03: *Environmental Control Water and Sewage Regulations* under the *Water Resource Act*. The treated effluent target of TSS <30 mg/L and TDS <1,000 mg/L is adopted as the design basis for concept design. It is important to note that there are other parameters in the NLR65/03 such as the biological oxygen demand, bacteria, and heavy metals, which must be met before discharging the effluent to the harbour. These water quality parameters are not known at this time and are highly dependent on the process. Discharges to the natural receiving environment must also meet federal requirements of Environment and Climate Change Canada and DFO. The design will be subject to various levels of regulatory influence as the Project moves through the environmental approvals process and subsequent permitting for construction and operation.

2.8.6 Sanitary Waste

In addition to the industrial wastewater stream (Section 2.8.4), sanitary wastewater will be generated by employees working at Project facilities (there will be no sanitary wastewater generated during operation and maintenance of the wind farms).

During construction, the proposed accommodation facility associated with the Port au Port Wind Farm will connect to an engineered septic system or to the Town of Stephenville wastewater system, depending on the final location of the camp. The Codroy accommodations camp will be connected to a designed septic system.

A sanitary sewage treatment system is proposed to serve up to 100 employees at the hydrogen / ammonia plant. The domestic sewage treatment system will include a combination of septic tanks, pump station, and leaching beds to allow for subsurface disposal of domestic sewage onsite.

Where portable toilets are required, waste will be removed from the site by the supplier in a timely manner for appropriate disposal.

2.8.7 Solid Waste

Solid waste generated by the Project will include: scrap metal; insulation waste; packing and crating materials; domestic waste; and solids from the water purification plant. Material not deemed acceptable for re-use or recycling will be disposed of via a local certified contractor for the safe transportation of solid waste to an approved facility (e.g., Wild Cove waste disposal site). Materials that can be recycled will be sorted and taken to an approved facility. Burning of rubbish and waste materials on-site will not be permitted. Rubbish and waste materials will not be buried on-site.

2.8.8 Dangerous Goods / Hazardous Waste

Hazardous waste generated by the Project may include: paints, oils and lubricants, batteries. Generated hazardous wastes will be stored on site in a separate and temporary hazardous waste storage area until removal by a licensed contractor for disposal off-site in accordance with regulatory requirements.

The disposal of waste oil and garbage from vessels within the Port will be in compliance with the *Vessel Pollution and Dangerous Chemicals Regulations* under the *Canada Shipping Act*, 2001. Vessels within the Port will be required to produce records of compliance with MARPOL. These will include report keeping within the vessel's Oil Record Book and the Garbage Record Book following the onshore disposal to a local certified waste disposal contractor.

2.9 Health, Safety, and Environmental Management

The Project regards health, safety and environment (HSE) management to be of the upmost importance and applies the highest safety standards, for Project employees, contractors and anyone in contact with the works. HSE will be managed by (i) focusing on design aspects, (ii) influencing human behaviour and safety awareness, and (iii) setting HSE criteria for staff and contractors. WEGH2 considers the protection of HSE as a core value of the Project and is convinced that accidents and incidents are preventable. WEGH2's goals are:

- To protect the health and safety of individuals involved or affected by the Project (zero accidents)
- To prevent damage to the environment
- Use material and energy efficiently (sustainability)
- Act in accordance to permits and regulatory requirements

2.9.1 Health and Safety

WEGH2 maintains the health and safety of the public, Project stakeholders and employees as the prime consideration within its Project activities. Project execution will include working within established and tailored procedures and programs, conducting training, routine self-evaluation, and continuous improvement. Contractors involved in the execution of work will be required to hold a Certificate of Recognition™ from the NL Construction Safety Association, a relevant standard set by industry and implemented by the Canadian Federation of Construction Safety Associations.

A Project-specific Health and Safety Plan that addresses the safety concerns related to this Project will be developed and implemented prior to construction. The Health and Safety Plan will be administered and supported by a team of trained safety professionals. Contractors and employees engaged in the Project will participate and conform to the Project-specific Health and Safety Plan, with support from dedicated safety professionals.

Standard operational requirements for construction works will include, but not be limited to, the following:

- Plan of the Day meetings
- Daily Toolbox Talks
- Pre-construction meetings
- Schedule meetings
- Progress meetings
- HSE and quality meetings
- Interface meetings

Staffing

The Project will directly employ safety professionals whose primary responsibility will be to provide Project contractor partners with the tools and coaching needed to implement the Project Health and Safety Plan. These professionals will provide guidance and will audit the effectiveness of the Health and Safety Plan implementation in areas of Project activity.

Contractor partners will be required to have in-house safety professionals who will be directly responsible for coordinating, coaching, and auditing the implementation of the Project Health and Safety Plan in their respective organizations. Project leadership will directly review the suitability of these safety professionals before they are assigned by their respective contractor partners and approval will be required from the Project safety leadership. If warranted, the Project safety leadership may arrange interviews with prospective contractor partner safety advisors prior to approval.

Hazard Identification and Management

Thorough hazard identification and management systems are crucial to the successful implementation of a safety management system. Project safety leadership will implement and oversee a multi-tiered hazard identification function to correctly recognize, document, and manage hazards associated with the Project.

Each contractor partner will be responsible for the development of a hazard registry that provides a list of identified hazards in their respective areas and work scopes. Project safety leadership will provide a template for the development of this register so it is consistently applied across contractor partners. The registry will outline each hazard and the corresponding mitigation measures that can be used to manage these hazards to keep risk as low as reasonably achievable. The registry will be reviewed once per quarter with Project safety leadership for new hazards and revisions as work scopes and areas change.

A job hazard analysis will be completed whenever a new task is undertaken in the execution of the Project. The field level risk analysis is a tool that will be placed directly in the hands of each employee throughout the Project. Employees will be expected to scan their work environment for hazards and formally document identified hazards. Along with the informal and formal safety inspections that each contractor partner will be executing in the course of satisfying their own safety management systems, Project safety leadership will implement a rotating formal inspection program. Project safety leadership will join with contractor partner safety advisors and construction staff to perform joint inspections aimed to share and coach for best practices in hazard identification and control.

Tracking Progress

Safety performance metrics will be established, and contractor partners will be required to report safety results on a monthly basis. Project-wide statics will be tracked by the Project's safety team, and results will be communicated back to employees and contractors. Safety data and incident reporting will be constantly reviewed by the Project's safety team to identify trends and gaps in safety performance. Discussions with contractor partner management will be arranged as required to address concerns. Results and achievements will be visually displayed in common areas such as camps and meeting rooms and important safety milestones will be recognized and celebrated to reinforce the Project's safety culture.

Coordination and Communication

It is critically important that there be clear and readily available channels of communication and coordination between Project leadership, contractor partners, and employees in the field. An integral component of the Health and Safety Plan will be the systems established to enable information pertaining to safety to be quickly and accurately relayed.

Each day, before commencement of work, employees will be required to attend a Toolbox Meeting, where they will be briefed on safety issues relevant to their responsibilities, along with members of their crew. In these meetings they will be encouraged to voice safety concerns or ask questions related to safety. While these meetings will be chaired by contractor construction staff, Project safety and construction leadership will also attend to monitor the Toolbox Meetings and to show the Project's commitment to safety. Each day in the morning construction meeting (one per contractor partner), construction management personnel from both the Project and the contractor will have opportunity to raise safety concerns and ideas for discussion with the wider Project team. Safety advisors and Project safety leadership will meet daily for a safety coordination meeting where emerging safety and environmental issues are discussed. Safety-related achievements, challenges and opportunities will be highlighted each week in the weekly Project Progress Meeting (one per each contractor partner).

Training and Education

A key component of the Project's Health and Safety Plan is enabling employees with the skills and training required to safely perform their jobs. Contractor partners will be required to maintain a database of training records to support the credentials of employees engaged in high-risk work activities such as working at heights, working in confined spaces, and operating heavy equipment. These data will be reviewed on a regular basis to maintain current credentials.

As the risks associated with this Project and the sites that it will occupy will be unique, the Project will develop a Project-specific orientation and training package. New employees and visitors accessing the Project work areas will be required to finish the orientation.

2.9.2 Environmental Management

WEGH2's environmental management team will provide direction and guidance throughout the Project so that work is planned, designed, and constructed in a manner consistent with environmental legislation, regulation, and policies and WEGH2's goal of environmental excellence.

Project execution will involve regular engagement with communities where WEGH2 operates and will include trained environmental monitors. These monitors will assist the operations team through up-front, early planning to reduce construction footprints and support the execution of works in strict adherence to baseline environmental guidelines.

Several environmental management plans will be developed to provide guidance on environmental protection procedures and best management practices to reduce adverse environmental effects of the Project. Key environmental management plans are outlined below.

Environmental Protection Plan

WEGH2 will prepare an Environmental Protection Plan (EPP) for each Project Component (e.g., wind farms, electrical infrastructure, hydrogen / ammonia plant) before starting construction of these components. These EPPs will be prepared and submitted to NLDECC for review subsequent to the completion of the EIS. A proposed Table of Contents and an annotated outline for the EPPs is provided in Appendix 2-E.

Emergency Response / Contingency Plan

WEGH2 has prepared a preliminary Emergency Response / Contingency Plan (ERCP) (Appendix 2-F) for the Project which outlines response procedures for potential accidents, malfunctions and emergency scenarios including the following:

- Accidental spills and/or releases of hydrogen, ammonia, chemicals, pesticides or any potentially hazardous substance on land or in air or water
- Fire and explosion
- Traffic accidents

- Dislodging of a wind tower or turbine blade
- Hurricanes and other natural disasters
- Occupational hazards and human injuries
- Failure of industrial water supply
- Energy generation/transmission failure including the buried portion of the transmission line
- Flaring and/or venting of hydrogen, ammonia or other gases in the event of a malfunction
- Wildlife emergencies / incidents.

The ERCP includes an emergency communication strategy with those potentially affected, and also describes the capacity of the proponent / nearby communities to respond to each type of accident, malfunction or emergency, including the availability of required response equipment and training. WEGH2 will assume costs of any upgrades of equipment or training required by local first responders that will be assumed as a resource in case of emergency

As design progresses and specific equipment selection is finalized, a Quantitative Risk Analysis (QRA), including a hazard identification study, will be conducted to determine high-level risks and suitable mitigation measures. In later phases of Project design, a structured hazard and operability study will be conducted to further identify and evaluate risks and potential hazards in the system. These studies will be used to update the ERCP as appropriate.

Additional information on accidents and malfunctions, including preventative and response measures as well as potential environmental effects is provided in Chapter 24, Accidents and Malfunctions.

Waste Management Plan

WEGH2 has prepared a Waste Management Plan (WMP) (Appendix 2-G) that describes the liquid and solid waste expected to be generated during construction, operation and maintenance, decommissioning, and rehabilitation for all components of the Project. The WMP also includes methods to reduce, reuse, recycle, recover, and/ or manage residual wastes through disposal.

Hazardous Materials Response and Training Plan

WEGH2 has prepared a Hazardous Materials Response and Training Plan (Appendix 2-H) that describes training requirements for fire fighters and first responders as well as vehicles and equipment required to execute a Hazardous Materials Response in the event of an unplanned event involving hazardous materials.

Traffic Management Plan

WEGH2 has prepared a Traffic Management Plan (Appendix 2-C) for project-related vehicular traffic during transportation of oversized and overweight loads. Informed by the Transportation Impact Study (Appendix C), this Plan addresses municipal requirements and traffic management plans for the transport of oversized and overweight loads through municipal roadway and identifies provincial access and right of way permit requirements as expected over the life of the Project.

Public Participation Plan

WEGH2 has prepared a Public Participation Plan (Appendix 4-A) that describes how the public can meaningfully participate in all phases of the Project and how they will continue to be consulted throughout the life of the Project, including in the monitoring of environmental effects.

Workforce and Employment Plan

WEGH2 has prepared a Workforce and Employment Plan (Appendix 2-I), for the construction, operation and maintenance, decommissioning and rehabilitation phases of the Project. Using the information currently available, this Plan outlines: positions required (including National Occupation Classification codes); timelines for employment; estimates of apprentices and journeypersons required; qualifications, certifications and other requirements (including training); anticipated source of the workforce; a commitment to provide quarterly summary reports; and a commitment to develop a Benefits Agreement.

Domestic Wood Cutting Consultation Plan

WEGH2 has prepared a Domestic Wood Cutting Consultation Plan (Appendix 4-B) with domestic users on the Port au Port Peninsula to identify and address concerns regarding the Project and have developed appropriate mitigations.

Environmental Effects Monitoring Programs

As required by the Project's EIS Guidelines, Environmental Effects Monitoring Programs (EEMPs) will be developed prior to construction and in consultation with appropriate regulatory agencies. Follow-up and monitoring programs are intended to verify accuracy of effects assessment predictions, as well as the effectiveness of mitigation measures.

The following EEMPs will be developed:

- Species at Risk Effects Mitigation and Monitoring Program
- Groundwater and Surface Water Monitoring Program
- Avifauna Effects Mitigation and Monitoring Program
- Outfitter Effects Monitoring Program

Preliminary information on planned monitoring is provided in Chapters 6 to 22 for each of the Valued Environmental Component assessments.

2.10 Quality

A Project-specific Quality Management Plan will be implemented. A dedicated, full-time team of quality professionals will ensure that construction and operation activities align with Project specifications and requirements. Suitable field laboratories will be established onsite to provide real-time monitoring and testing.

2.11 Summary of Project Design Codes and Standards

The codes and standards that are applicable to the Project are listed in Table 2.9. Regulations applicable to the Project are listed in Table 1.4.

Table 2.9 List of Potential Codes / Standards Applicable to the Project

Code / Standard	Legislation / Regulation	Authority / Department
Provincial		
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
Newfoundland and Labrador Occupational Health and Safety Act	*Occupational Health and Safety Act*	Government of NL
Newfoundland and Labrador Environmental Protection Act	*Environmental Protection Act*	Government of NL
Newfoundland and Labrador Dangerous Goods Transportation Act	*Dangerous Goods Transportation Act*	Government of NL
Federal		
Canadian Hydrogen Installation Code	CAN/BNQ 1784-000 Canadian Hydrogen Installation Code (CHIC)	CAN/BNQ
Methods of Testing for Concrete	CSA A23.1	CSA
Hydrogen Technologies Code	NFPA 2	NFPA
Compressed Gases and Cryogenic Fluids Code (which covers both hydrogen and ammonia).	NFPA 55	NFPA
Metering grid connection to NL Hydro (for revenue purposes)	Measurement Canada standards	Measurement Canada
Anhydrous Ammonia Bulk Storage Regulations	C.R.C., c. 1146	CAN
National Fire Code of Canada	NFC	CAN
Canadian Electrical Code	CAN/CSA C22.1	CAN/CSA
National Plumbing Code of Canada	NPC	CAN
Facility Fire Brigades	NFPA 600	NFPA

Table 2.9 List of Potential Codes / Standards Applicable to the Project

Code / Standard	Legislation / Regulation	Authority / Department
Competencies for EMS Personnel Responding to Hazardous Materials/Weapons of Mass Destruction Incidents	NFPA 472 NFPA 473	NFPA
Disaster Emergency Management	NFPA 1600	NFPA
Emergency and Continuity Management Program	CSA Z-1600	CSA
Pre-Incident Planning	NFPA 1620	NFPA
Boiler, Pressure Vessel, and Pressure Piping Code	CAN/CSA B51-97	CAN
Test methods for evaluating material compatibility in compressed hydrogen applications – Metals	CSA/ANSI CHMC 1- 2014	CSA/ANSI
Test methods for evaluating material compatibility in compressed hydrogen applications – Polymers	CSA/ANSI CHMC 2- 2019	CSA/ANSI
International		
Pressure Welder and Brazier Testing	ASME Code, Section IX	ASME
Process Piping	AS E B31.3	ASME
Hydrogen Piping and Pipelines	ASME B31.12	ASME
Design Guidelines for Hydrogen Piping and Pipelines	ASME STP-PT-006	ASME
Design Guidelines for Hydrogen Piping and Pipelines	ASME STP-PT-006	ASME
Boiler and Pressure Vessel Code	ASME	ASME
International Fire Code (IFC)	IFC	International Code Council
Storage of Ammonia	API 650	American Petroleum Institute
International Gas Carrier	IMO 1986 code	International Maritime Organization
Basic considerations for safety of hydrogen systems	ISO/TR 15916: 2015	International Organization for Standardization
Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications	ISO 22734:2019	International Organization for Standardization
Boilers and pressure vessels	ISO 16528-1	International Organization for Standardization
Safety devices for protection against excessive pressure — Part 1: Safety valves	ISO 4126-1:2013	International Organization for Standardization
Gaseous hydrogen – Cylinders and tubes for stationary storage	ISO 19884	International Organization for Standardization

2.12 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

Standard environmental protection procedures, best management practices, and mitigation measures are listed in Table 2.10; VEC-specific mitigation measures are not included.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
1	Mitigation	Existing riparian vegetation will be maintained according to buffer specifications in permits and regulations.
2	Mitigation	Work will be performed so that materials such as sediment, fuel or other hazardous materials do not enter watercourses and waterbodies through implementation of erosion and sediment control measures and hazardous materials management practices.
3	Mitigation	Work will be conducted in a manner to protect watercourses and wetlands from siltation and disturbance in accordance with Best Management Practices or as otherwise agreed upon with the regulator.
4	Mitigation	Sensitive areas (e.g., wetlands, rare plant occurrences, hibernacula, mineral licks, roosts) identified prior to Project activities will be flagged and appropriate buffers maintained around these areas, where feasible.
5	Mitigation	Clearing for temporary 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, where possible.
6	Mitigation	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.
7	Mitigation	Grading will be directed away from wetlands, where possible, and will be reduced within wetland boundaries unless required for site specific purposes.
8	Mitigation	Project staff and contractors will adhere to the waste management procedures to be included in the EPP and the Waste Management Plan.
9	Mitigation	Construction areas will be kept clear of rubbish and debris. Rubbish and debris will be appropriately stored and managed.
10	Mitigation	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.
11	Mitigation	Volatile wastes and materials, such as fuel, mineral spirits, oil, or paint thinner will be stored appropriately and will not be permitted to enter into waterways or storm drains. They will be disposed of at an approved site.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
12	Mitigation	Where portable toilets are required, waste will be removed from the site by the supplier in a timely manner for appropriate disposal. These toilets will be located more than 30 m from the boundaries of wetlands or watercourses.
13	Mitigation	Burning of rubbish and waste materials on-site will not be permitted. Rubbish and waste materials will not be buried on-site.
14	Mitigation	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.
15	Mitigation	Hazardous products will be stored according to industrial requirements and standards, and safely secured so that access is limited to authorized personnel.
16	Mitigation	Fuelling and servicing will be conducted using appropriate containment equipment, including spill kits.
17	Mitigation	Fuelling and servicing areas will be sited more than 100 m away from watercourses, coastlines, waterbodies, and wetlands.
18	Mitigation	The potential for spills will be reduced through the use of standard good practices, such as the use of appropriate containers, and avoiding overfilling.
19	Mitigation	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.
20	Mitigation	Project footprint and disturbed areas will be limited to the extent practicable.
21	Mitigation	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.
22	Mitigation	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.
23	Mitigation	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.
24	Mitigation	Dust from Project activities will be controlled where required by using applications of water or other approved agents. Waste oil will not be used for dust controls.
25	Mitigation	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

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
26	Mitigation	Re-seeding of areas will follow standard methods in compliance with permit conditions. These methods will be included the Project EPP.
27	Mitigation	Specific stockpiles of topsoil, overburden, and other potentially dust-generating materials will be kept covered, where practical, and used as soon as practical, or will be appropriately temporarily vegetated.
28	Mitigation	Nearby residents will be notified prior to blasting.
29	Mitigation	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.
30	Mitigation	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/or approved / designed explosive storage methods.
31	Mitigation	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.
32	Mitigation	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.
33	Mitigation	Areas to be cleared will have sediment and erosion control measures implemented per the site-specific Erosion and 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.
34	Mitigation	Construction areas will be routinely monitored to identify areas of potential erosion and to apply appropriate mitigation. Best practice erosion and sediment control measures will be implemented, as required.
35	Design	The drainage system for the site will be designed to appropriately manage stormflows considering impacts to on-site downstream watercourses, and coastlines, and infrastructure. Additionally, the site drainage system will consider the variable and seasonal up-stream drainage needs to provide adequate access to downstream watercourses without adverse impact on the plant site or other nearby infrastructure.
36	Mitigation	In the event that project activities occur in any designated water supply areas, the work will be completed in conjunction with the jurisdiction having authority.
37	Mitigation	For work during the nesting season, pre-clearing surveys will be conducted for active migratory bird nests and buffer / set-back distances from active nests will be established.
38	Mitigation	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 the Project EPP.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
39	Mitigation	Environmental personnel responsible for site monitoring during construction will receive training to recognize SAR / SOCC that may be present in Project Area.
40	Mitigation	WEGH2 will work with Wildlife Division to manage interactions with identified sensitive areas.
41	Mitigation	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.
42	Mitigation	Native plants will be used for landscaping, where practical.
43	Mitigation	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.
44	Mitigation	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.
45	Mitigation	Known occurrences of plant SAR / SOCC will be avoided through micro-siting of Project infrastructure, when practicable. 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.
46	Mitigation	If complaints are received from land users regarding perceived Project-related impacts, WEGH2 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.
47	Mitigation	Workforce training will be provided to address topics such as WEGH2's Equity, Diversion and Inclusion Policy and health and safety policies.
48	Mitigation	Management of employees and the temporary accommodations camp will consider measures to reduce impacts on the local community and local infrastructure through provision of services on site, and bussing.
49	Engagement	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 WEGH2 will engage with Indigenous groups during the development of the Plan. A business access strategy for members of underrepresented populations will be included in the plan.
50	Mitigation	WEGH2 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.
51	Mitigation	WEGH2 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.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
52	Engagement	WEGH2 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, a discussion of issues and concerns, and a potential means of addressing them.
53	Mitigation	Project activities, locations, and timing will continue to be communicated to Indigenous groups, members of the public and government throughout the life of the Project. In particular, and as part of a Traffic Management Plan, WEGH2 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, as applicable.
54	Mitigation	Project personnel will conduct daily occupational health and safety meetings.
55	Mitigation	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.
56	Mitigation	The Project will be compliant with the legal, statutory, and regulatory occupation health and safety and labour requirements, to safeguard community and worker safety and health.
57	Mitigation	Personnel will be required to use protective gear to guard against on-the-job injuries.
58	Mitigation	Only trained and/or certified persons will use specialized equipment and handle dangerous chemicals.
59	Mitigation	Hazardous products will be stored according to industrial requirements and standards, and safely secured so that access is limited to authorized personnel.
60	Mitigation	WEGH2's Emergency Response Plan will describe emergency response measures, training requirements, roles and responsibilities, and contact and reporting procedures in the event of a fire at, or near, the Project Area.
61	Mitigation	Traffic management measures will be put in place and consistently implemented to control on-site traffic, as well as the practices of drivers to and from construction sites. Emergency vehicle access will be maintained.
62	Mitigation	There will be adequate safety and security measures to prevent unauthorized entry into restricted Project areas.
63	Mitigation	Adequate safety signage, fencing, guardrails, and/or warning tape will be installed to indicate restricted Project areas to deter members of the public, and sufficient security will be in place to monitor and enforce these restrictions.
64	Mitigation	Safety warning signs will be strategically placed near construction works to inform the public of prohibited activities.
65	Mitigation	Project drivers will be cautioned to obey the speed limit and other traffic laws.
70	Mitigation	Waste generated on-site will be removed on a regular basis and disposed of appropriately at an approved facility.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
71	Mitigation	A hazardous waste inventory will be developed to support the management of general and hazardous operational waste streams.
72	Mitigation	Turbine lighting levels will be at, or above, 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.
73	Mitigation	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.
74	Mitigation	An adaptive management framework will be used to introduce new mitigation measures if high fatality rates are observed. Mitigation measures such as an increase in cut-in speeds, or other effective mitigation measures from operational wind power projects, will be considered.
76	Mitigation	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 potential effects 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.
77	Mitigation	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.
78	Mitigation	WEGH2 will liaise with local emergency providers so that roles and responsibilities are understood, and that the necessary resources required to respond to accidents and emergencies are in place.
79	Mitigation	Mandatory safety orientations will be provided for employees.
80	Mitigation	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.
81	Mitigation	Appropriate Project personnel will be trained in fuel handling, equipment maintenance, and fire prevention and response measures.
82	Design	Fire prevention and suppression systems will be maintained on site and will consider proper suppression systems for the various potential ignition sources.
83	Mitigation	Spill response kits will be available on-site. Project vehicles will be equipped with appropriately sized spill kits.
84	Mitigation	In the event of a spill, dry clean up and mopping techniques will be used, as appropriate. The area will not be "washed down" as this could cause the spills to spread to the surrounding environment and potentially enter drainage works or environmentally sensitive areas.
85	Mitigation	Soil that may have become contaminated will be remediated. This may be done on-site or removed from site for disposal at an approved location.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
86	Design	The potential effects of extreme weather, including storms, precipitation, and drought will be considered in Project planning, design, and operation and maintenance strategies, including the selection of materials and equipment, and design of components. These designs will consider projected climate change conditions over the life of the Project.
87	Mitigation	WEGH2 will regularly inspect and monitor Project infrastructure and equipment that may be impacted by the environment (in addition to its normal function) and take required action to maintain, repair, and upgrade infrastructure / equipment as needed.
88	Design	Work activities will include allowance / procedures for delays due to poor weather.
89	Mitigation	Contingency plans, including emergency back-up power for necessary operations, will be in place to manage delays, such as temporary power outages.
90	Mitigation	Weather forecasts (including marine forecasts) will be considered when planning construction and operation activities that may be affected by adverse conditions, such as receipt of materials and supplies, and product deliveries, particularly deliveries of products and diesel fuel. Where required, these activities will be scheduled for periods of favourable weather conditions.
91	Mitigation	Barge anchors will be moved only when necessary to reduce the resuspension of sediments.
92	Mitigation	Construction vessels and barges will use designated routes to and from the construction site.
93	Mitigation	WEGH2 will maintain up-to-date communication with fishers on Project activities and Project vessel operators, facilitated through a community liaison representative.
94	Mitigation	Navigational Warnings and Notices to Mariners will be issued.
95	Mitigation	Movement of vessels will be subject to the Practices and Procedures for Public Harbours under the *Marine Act.*
96	Mitigation	Vessels will use Pilots within compulsory pilotage area
97	Mitigation	All marine-based work undertaken by registered vessels will comply with the requirements of the *Canada Shipping Act*.
98	Mitigation	All marine-based work undertaken by foreign vessels must be undertaken pursuant to a Coasting Trade Permit issued under the *Coasting Trade Act*, and will comply with applicable regulations under the International Maritime Organization Conventions including the International Convention for the Prevention of Pollution from Ships (MARPOL).
99	Mitigation	All marine Project activities will be conducted in accordance with the requirements of the Canadian Coast Guard Marine Communication and Traffic Services (CCG-MCTS).
100	Mitigation	Consultation with local fish harvesters and other stakeholders will be undertaken regarding marine-related activities that may interact with fisheries.
101	Mitigation	Vessel maintenance, inspection and certifications will be required prior to mobilization. WEGH2 will require supportive evidence by a third-party vetting process.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
102	Mitigation	Marine vessels operated by the Project or Contractors will be required to have trained and qualified personnel in accordance with *Canadian Marine Personnel Regulations*, the *Marine Occupational Health and Safety Act*, or an equivalent IMO-approved program.
103	Design	Project components will be designed to reduce the area of disturbance to the extent feasible.
104	Design	Subsea cables will be buried to reduce risk of species mortality and disturbance in the nearshore marine environment at both landfall sites.
105	Design	Fill material for the rock berms will be reasonably free of fines, debris and substances that would be deleterious to the marine environment.
106	Mitigation	All marine activities will comply with the conditions of Letter of Advice and authorization issued by DFO.
107	Mitigation	The use of ship's whistles will be reduced to the extent possible, and only used in compliance with the *International Collision Regulations* and standard operating procedures.
108	Mitigation	Project vessels will comply with applicable legislation, codes and standards of practice for shipping, including the Ballast Water Regulations under the *Canada Shipping Act* and the Guide to Canada's Ballast Water Regulations, to reduce risk of introduction of marine-invasive species.
109	Mitigation	Water quality monitoring will be conducted for total suspended solids (TSS) prior to, and during, dredging, as required by applicable permits and authorizations.
110	Mitigation	Vessels and equipment to be used during construction will be operated and maintained according to manufacturer's specifications with supervision and inspections being undertaken throughout the construction phase.
111	Mitigation	Routine effluents and operational discharges produced by marine vessels (e.g., grey and black water, bilge water, deck drainage, discharges from machinery, and non-hazardous waste material) will be managed in accordance with MARPOL and IMO guidelines, of which Canada has incorporated provisions under various sections of the *Canada Shipping Act.*
112	Mitigation	Ammonium nitrate-fuel oil mixtures for blasting will not be used in, or near, water due to the potential for production of toxic by-products.
113	Mitigation	Prior to dredging, the Contractor will test the sediments in the dredge area for contaminants, and compare the results against relevant guidelines for the intended fate of the material (e.g., reuse for fill and/or land reclamation, and/or disposal at sea of surplus material) to determine if it is safe for industrial land use, commercial land use, parkland/residential land use, and/or for disposal at sea of surplus material (if required).
114	Mitigation	For disposal at sea of surplus dredge material that is coarse sediment (e.g., rubble and coral rock), the location for the creation of artificial reefs will be determined by regulators and in consultation with fishers.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
115	Mitigation	Awareness training will be provided to Project-dedicated marine personnel to identify signs of marine mammals and sea turtles at the sea surface. Project-dedicated vessel masters will be instructed to avoid marine mammals and sea turtles while in transit, and reduce speed or deviate from course if safe to do so, in order to reduce probability of collisions / vessel strikes. For example, to comply with measures within the Cabot Strait voluntary slowdown zone.
116	Mitigation	Lighting on Project vessels will be directed to the operational areas rather than sea surface where safe to do so, so as not to attract avifauna.
117	Mitigation	Lights will be directed away from observed turtle nesting areas.
118	Mitigation	Lighting on vessels will adhere to maritime safety regulations / standards.
119	Mitigation	Stranded/injured/deceased birds found on board the Project vessels will be documented by the vessel and reported to CWS.
120	Mitigation	Project vessels will be equipped with communication mechanisms to communicate with third-party mariners.
121	Mitigation	If construction activities must be scheduled during commercial fishing seasons and be conducted in the fishing grounds, WEGH2 will continue to manage and reduce adverse conflicts with affected fishers.
122	Mitigation	The cable installation contractor will issue regular "Security Messages" stating the vessel is restricted in ability to maneuver, course, speed and intentions. This will also be issued prior to the vessel arriving through the Notice to Mariners.
123	Design	ACSR conductors will be sized and spaced accordingly in a way that reduces corona effect to the extent possible.
124	Design	Proposed design will be submitted to Navigation Canada for evaluation and approval, where warning lights on the 230kV structures along the transmission path may be required.
125	Design	Transmission line configurations, designed to limit overall height, will be used where practicable.
126	Mitigation	Routine effluents and operational discharges produced by cable-laying and support vessels (e.g., grey and black water, bilge water, deck drainage, discharges from machinery, and non-hazardous waste material) will be managed in accordance with MARPOL and IMO guidelines, of which Canada has incorporated provisions under various sections of the *Canada Shipping Act*.
128	Mitigation	Ploughing or jetting will be employed as the primary method of cable burial during Project construction.
129	Mitigation	Following completion of cable deployment, the cable will only be extracted if necessary for cable repairs, thereby reducing potential effects on the marine environment related to cable removal and reburial.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
130	Mitigation	Proper cable placement will mitigate potential underwater vibration caused by strumming. Cable pay-out tension will be regulated during construction to reduce suspensions between rocks. Post-lay inspection will be carried out to confirm that cable has been correctly deployed either on or into the seabed. In addition, modern cables have been designed to improve their protection against fish biting (Carter et al. 2009).
131	Mitigation	The cable will be de-activated and left in place indefinitely when no longer in use. This end-of-life option will avoid additional seabed disturbance and has, therefore, been selected rather than removal, which would require pulling up the cable along the entire route (including buried and unburied portions), and cause unwarranted disruption to the seabed, sediments, and benthic communities.
132	Design	The Project will be designed and constructed to meet applicable engineering codes, standards and best management practices (e.g., such as the National Building Code of Canada, the Canadian Standards Association Guide to Canadian Wind Turbine Codes and Standards, National Fire Code of Canada). The codes and standards account for safety features that address hazards from power outages, sudden system upset/disruption and weather variables, including extreme conditions, that could affect the structural integrity of buildings and infrastructure. Designs will also consider projected climate change over the life of the Project. For example, the National Building Code of Canada contains design requirements to account for extreme weather on infrastructure such as: (1) Critical structures and steel selection to prevent brittle fracture at low ambient temperatures; (2) Electrical grounding structures for lightning protection; (3) Maximum motor ambient temperature; and (4) Ice and freeze protection
133	Mitigation	To mitigate risk to public as a result of ice shedding, warning signs will be installed to indicate the potential risk of ice shedding around the wind turbines. Operational staff will be made aware of the risks of ice shedding and associated safety protocols and procedures, and should be directed to take appropriate action when the weather conditions are likely to lead to ice accumulation on the wind turbine blades. Staff will require personal protection equipment to be worn near the wind turbines.
134	Mitigation	Weather forecasts (including marine forecasts) will be regularly monitored and, prior to extreme weather events, appropriate preventative measures will be taken to reduce the risk of damage to the Project. This will include site inspection by staff to secure loose items and identify other risks (for wind events), and inspection / maintenance of sediment and erosion control measures prior to, and following, precipitation events.
135	Mitigation	The Project will be designed and constructed to meet applicable engineering codes, standards, and best management practices, including the National Building Code of Canada, which provides standards of safety to account for geological hazards, including seismic activity in accordance with the applicable requirements.
136	Mitigation	Site-specific erosion and sedimentation control plans will be developed during detailed design phase of the Project and will be implemented.
137	Mitigation	To address the risk of slope instability, a detailed terrain mapping assessment, including ground-truthing, for the final Project Area will be completed to identify both construction constraints and geohazards that may impact the Project. Slope stability assessments will be completed as part of the design, particularly at locations where there is proposed re-grading and glacio-fluvial deposits that are susceptible to erosion and undermining as seen in Stephenville.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
138	Mitigation	To address the risk of subsidence a detailed terrain mapping assessment using LiDAR from the Project Area to assess for karst formation that may be present will be completed.
139	Mitigation	To address the risk of landslide/rock fall a detailed terrain mapping assessment will be used to identify historical landslides and rock fall activity within the Project Area. Identification of naturally occurring past events may necessitate further investigation or avoidance. For human-made rock cuts, or largescale re-grading of rock slopes, geotechnical investigation and design will be conducted so that the final cuts / grading are stable and will not cause potential instability during construction or long term.
140	Mitigation	WEGH2 will actively monitor wildfires that could affect the wind turbines, substations, supporting transmission infrastructure, and/or access roads and coordinate with provincial authorities with respect to response, including the need for potential shutdown and evacuation of employees.
141	Mitigation	On-site fire prevention and response equipment will be provided and maintained, and WEGH2 will have employees / teams that will be trained in safe fire response. While the purpose of this response training and equipment is to respond to Project-related fire scenarios, NLDFFA would be responsible for response to a forest fire in the area not related to the Project.
142	Mitigation	Proper fire breaks will be considered and cleared, where necessary, during clearing and site layout.
143	Mitigation	Project-related activities will be adjusted in case of a severe fire and as needed to protect the health and safety of employees.
144	Mitigation	Approval from NLDECC will be obtained to establish the required concrete batch plants at each Site. Plant operations will comply with the conditions outlined in the approvals and requirements under air pollution control regulations.
145	Mitigation	The Environmental Code of Practice for Concrete Batch Plant and Rock Washing Operations, 1992 will be adhered to during concrete production activities.
146	Mitigation	Washwater from the cleaning of mixers, mixer trucks and concrete delivery systems will be handled using the procedures outlined in Section 3.0 of the Environmental Code of Practice for Concrete Batch Plant and Rock Washing Operations.
147	Mitigation	Rinsing activities will be carried out at the site of the concrete batch plant, except rinsing of the chute and applicable concrete placement equipment.
148	Mitigation	Wildlife surveillance will be conducted prior to, and post, noise elevated activities. Activities may be delayed until wildlife have been allowed to leave the area as directed by the OSEM.
149	Mitigation	Blasting patterns and procedures will be used to reduce shock or instantaneous peak noise levels, in accordance with a Blast Management Plan that will be developed for the Project.

Table 2.10 Standard Environmental Protection Procedures, Best Management Practices, and Mitigation Measures

ID #	Mitigation Type	Commitment Description
150	Mitigation	Explosives will be used in a manner that will reduce damage or defacement of landscape features, trees, ecologically sensitive areas such as wetlands, and other surrounding objects, by controlling through standard best practice (including precisely calculated explosive loads and adequate stemming), the scatter of blasted material beyond the limits of activity. Outside of cleared areas, inadvertently damaged trees will be cut, removed, and salvaged, if merchantable (refer to Section, "Clearing of Vegetation"). Fly rock, which inadvertently enters a waterbody, watercourse, or ecologically sensitive area and that can be recovered without further damage to the environment, will be removed. Instances where larger fly rocks (boulders) enter these areas or deep waterbodies, recovery of this will be discussed with the OSEM.
151	Mitigation	Time delay blasting cycles or blasting mats will be used, if necessary, to control the scatter of blasted material.
152	Mitigation	Blasting will not occur in the vicinity of fuel storage facilities.
153	Mitigation	Blasters will have a Blasters' Safety Certificate from the NL Department of Labour. This certificate and a Temporary Magazine License will be obtained prior to drilling and blasting.
154	Mitigation	Use of explosives will be restricted to authorized Personnel who have been trained in their use.
155	Mitigation	There will be separate magazines on-site for explosives and for dynamite blasting caps. All temporary magazines for explosive storage will have appropriate approvals.
156	Mitigation	Blasting associated debris, such as explosive boxes and used blasting wire, must be collected for proper disposal as soon as possible following blasting activity.

2.13 Labour Requirements

The Project will have a substantial positive effect on local economic activity. Table 2.11 provides an initial but conservative estimate of the potential number of jobs created as a result of the Project. Further analysis including the construction execution strategy, the contracting strategy for operations and maintenance, and the results of the supply chain studies will refine these estimates. The Workforce and Employment Plan (Appendix 2-I) will provide details on the specific workforce requirements.

Table 2.11 Assumptions of Direct Labour Required for Project (full-time equivalents)

Project Component	Construction	Operations and Maintenance (annual)	Decommissioning	Total
Wind (including balance of plant)	599	146	100	845
Plant	2,258	132	250	2,640
Other (overhead, management, port)	242	113	25	380
Total	**3,099**	**391**	**375**	**3,865**

Construction activities, by nature, will not continue in perpetuity. Nonetheless, the large scale of the Project will create a substantial number of construction jobs over the five-year period. The construction activities will extend through the build-out of the Project. This will include the construction of the Port au Port and Codroy Wind Farms and future potential developments, as well as the hydrogen / ammonia plant. The Project will require construction workers related to other areas of the Project, including the Port and overhead. In total, it is anticipated using 1,800 workers for the construction process.

The construction of the wind farms, inclusive of the balance of plant, will require an anticipated 600 staff. Construction of the wind farms will occur sequentially over a planned five-year period. Since not every construction worker will be actively working across the construction phase, it is estimated the total number of person hours would be 800,000 person-hours per year for the wind farm and balance of plant construction. Across a five-year construction period, this amounts to 4 million person-hours.

Similar to the construction of the wind farms, the buildout of the hydrogen / ammonia plant will be a phased approach. As the wind farms come online, further capacity will be added to the hydrogen / ammonia plant. As such, the hydrogen / ammonia plant construction positions with likewise be long-term. At a projected 1,000 plant construction workers, it is estimated that a total of 1.3 million person-hours per year, or 6.7 million person-hours across the life of the Project. For other associated activities, this would total 268,000 person-hours per annum.

Table 2.12 provides a breakdown of direct employment and labour income by estimated geographic residency of workers. In consideration of existing levels of educational attainment and baseline labour force conditions within the LAA and RAA (province), approximately 16% of direct employment effects are anticipated to occur in the LAA, with the rest of the direct employment effects occurring in the remainder of NL. The operation and maintenance of Project facilities will be a constant undertaking, with workers employed full time through the life of the Project.

Table 2.12 Estimate of Direct Employment by Estimated Geographic Residency of Workers Over the Life of Project

Project Phase	Employment (Person-Years)			
	LAA	Rest of RAA (NL)	RAA (NL) Total	Rest of Canada
Construction	1,521	7,776	9,297	0
Operations[1]	5,940	2,220	8,160	3,570

Notes:
The nature of the decommissioning workforce is unavailable.
[1] Based on information provided by Jupia Consultants (2023); capacity of labour in the LAA / RAA and trends from similar industrial projects in NL.

WEGH2 will also employ additional workers throughout the operation of the Project related to the plant, port, overhead, and as management personnel. It is anticipated that an additional 460,000 person-hours per year for the hydrogen / ammonia plant and other parts of the Project will be required. In total, it is estimated that the operation and maintenance phase of the Project will entail 300 workers, totaling 600,000 person-hours annually.

Looking toward the future, the Project will require a sizable workforce to decommission wind turbines, transmission lines, substations, balance of plant, and the hydrogen / ammonia facility. It is estimated that these duties will require an estimated 100 people for the wind farm and an additional 250 people to remove, load and ship out for decommissioning of the hydrogen / ammonia plant (Table 2.13).

Table 2.13 Decommissioning Direct Jobs Projections (in personnel)

Project Component	Decommissioning
Wind (incl balance of plant)	100
Hydrogen / Ammonia Plant	250
Other (overhead, management, port)	25

The workforce is divided into four classifications in relation to employment occupational category (Table 2.14).

Table 2.14 Employment Occupational Category Breakdown

Project Function	Percent of Workforce
Company (Project management, legal, health and safety, administration, stakeholder management, and planning)	30%
Development, procurement and contracting (engineering and interfaces, commissioning, general site management, electrical, civil, wind, hydrogen, and ammonia, operation and maintenance, and procurement)	64%
Offtake and logistics	3%
Risk management and financing	3%

WEGH2 will make every reasonable effort to hire locally to the maximum extent possible and is currently undertaking studies on employment availability to analyze local labour capacity for the Project. WEGH2 will be able to better determine how many of these jobs can be filled using local labour from these analyses and studies. Working closely with industry partners, trade groups, and local universities will allow the Project to source qualified candidates locally.

WEGH2 is also focused on maximizing hiring from members of the Qalipu First Nation. WEGH2 intends for jobs created for the Project to be held by Qalipu members, and local residents, except in cases that capacity and available skillsets present limitations.

WEGH2 is developing a comprehensive "Gender Equity and Diversity Plan". The Project will adopt a hiring criterion targeting strong Indigenous representation, with a stated preference for diverse local employment, expanding geographically as needed. A Workforce and Employment Plan, including a commitment to develop a Benefits Agreement, is provided as Appendix 2-I.

2.14 Project Expenditures

The Project expenditures are broken out by construction, operation and maintenance, and decommissioning. The Project's total construction costs are currently estimated to be $5.4 Billion[1] (Bn), with an additional $106 Million (M) of planned development expenditures (DEVEX) budgeted and $246 M of contingency budgeted. In total, DEVEX, capital expenditures (CAPEX), and contingencies are estimated at a combined $5.6 Bn. The exact amount of construction costs will ultimately be determined at financial close and are likely to require modifications. Operation and maintenance costs are currently projected at $190 M per year and decommissioning costs are expected to amount to $99 M. These expenditures will be divided across NL, other Canadian, and foreign expenditures. WEGH2 plans to work towards the highest local content and use the most local labour reasonably possible during equipment procurement and contract agreements.

While it will not be possible to procure complex technologies, such as wind turbines and electrolyzers, locally, WEGH2 is currently assessing the local supply chain and is committed to sourcing components and raw materials locally to the greatest extent possible. For those products and services that it is determined cannot be procured locally, other Canadian suppliers will be provided the opportunity to respond to procurement requests. Only after evaluating the possibility of procuring both locally and domestically will the Project explore international alternatives.

Although t WEGH2 and its Project team have held numerous discussions around procuring goods and services, the expenditure breakdown by location will not be determined until final close. Nonetheless, a current estimation of the expenditure breakdown is Table 2.15, which represents the Project's estimates at present. These expenditures and associated percentage breakouts are subject to change as the Project progresses and vendors are identified.

Table 2.15 Expenditure Breakdown by Phase

Expenditures	Construction (including contingency)	Operation / Maintenance	Decommissioning
Project	$5,747 M[1]	$190 M[2]	$99 M[3]
NL	30%	70%	90%
Other Canadian	10%	15%	10%
Foreign	60%[4]	15%	0%

Notes:
[1] Total construction costs including CAPEX, DEVEX and contingency (nominal); presented in Canadian dollars
[2] Lifetime average, per year (nominal)
[3] Total decommissioning costs (real 2021)
[4] Equipment sourcing such as turbines and electrolyzers.

[1] All estimates are presented in Canadian dollars.

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3.0 Project Alternatives

3.1 Alternatives to the Project

As described in Chapter 2.2 (Rationale for the Undertaking), the Project's need and purpose is to produce cost-effective green electrolytic hydrogen and ammonia for export to meet growing market demand, supporting the reduction in greenhouse gases (GHG) emissions and the global energy transition. Green hydrogen produced from electrolysis using renewable energy is widely recognized as having the potential to play a pivotal role in meeting international energy and future climate goals (International Energy Agency 2022). Green hydrogen and ammonia provide a solution for decarbonizing sectors of industry where direct electrification is not feasible. Further, several hydrogen use cases have no low-carbon alternative, meaning that green hydrogen is the best option for decarbonization. Examples include but are not limited to production of fertilizer, methanol, and shipping fuel; steel production; long-term energy storage; long-haul / short-haul aviation fuel; long-distance trucking and busing; and high-temperature industrial processes.

Currently, 70 Megatonnes (Mt) of the 118 Mt of total hydrogen produced worldwide today is produced in dedicated fossil fuel-based hydrogen plants responsible for 2% of global emissions. Less than 0.03% of produced hydrogen can be considered green (Kearney Energy Transition Institute 2020). Given the need to reduce GHG emissions globally, the lack of viable decarbonization alternatives in several industries, and the market demand for green hydrogen and ammonia, no functionally different alternative methods of meeting the Project need and purpose were identified.

As described in Section 2.2, there is a substantial supply-demand imbalance for renewable hydrogen and ammonia. The demand for green hydrogen is expected to peak at 250 Mt by 2030 and 700 Mt by 2050 (International Renewable Energy Agency and Ammonia Energy Association 2022). Demand from Europe is expected to increase rapidly over the next decade as momentum to move to renewable alternatives and increase energy security continues. The substantial demand for renewable hydrogen and ammonia is a major market influence for the Project. Developing the Project at the current size will ensure that appropriate economies of scale are met to enable the Project to produce cost-effective hydrogen and ammonia.

In addition to market circumstances and international energy policies, the development of the Project has been influenced by the following domestic policies:

- Canadian government's execution of the *Hydrogen Strategy for Canada* (Natural Resources Canada [NRCan] 2020) that sets the country on the path to meet climate change goals in meeting net-zero by 2050 and positions Canada as a world-leading producer, user and exporter of clean hydrogen, and associated technologies

- The Newfoundland and Labrador (NL) Provincial Renewable Energy Plan (Government of NL 2021), which recognizes the potential for wind resources and the opportunities to export energy surplus
- Canada's climate action plans, including *Pan-Canadian Framework on Clean Growth and Climate Change* (Government of Canada 2016) and *Federal Actions for a Clean Growth Economy* (Environment and Climate Change Canada 2016)

If the Project is not developed, the market demand for hydrogen will be supplied from other sources elsewhere, as several other countries are competing to establish green hydrogen industries. Local communities in NL will not experience the opportunity to develop one of the first Canadian, commercial-scale green hydrogen and ammonia production facilities powered by renewable energy. Not developing the Project will mean that the economic advantages of the Project and opportunities for construction and operation related to tax revenue, employment (both direct and indirect), training, and servicing and supply in western NL will not be realized. Further, not developing the Project could move the region and Canada further from the Government of Canada's goals outlined in the Hydrogen Strategy for Canada (NRCan 2020) and other policy documents, which seek to develop the hydrogen market, diversify the economy, and position Canada as word-leading exporter of clean hydrogen.

3.2 Alternative Methods of Carrying Out the Project

This section provides an evaluation of design alternatives and technologies that have been considered by World Energy GH2 (WEGH2) as alternative means for undertaking the Project. The specific alternative methods evaluated and discussed in the sections below have been informed by the Environmental Impact Statement Guidelines and include:

- Sources of energy supply
- Wind turbine sizes and types
- Locations, land area requirements, and access routes for key project components, including:
  - Wind generation sites
  - Transmission line alignments
  - Hydrogen and ammonia production facility
  - Access points
- Sources of industrial water supply for hydrogen / ammonia production
- Options for aboveground and underground storage of hydrogen

The evaluation of alternatives considered the following criteria:

- Technical feasibility (e.g., criteria that could influence the safety, reliability, and efficiency of operations)
- Economic feasibility (e.g., capital, and operational project expenditures, opportunity cost)
- Schedule risk / availability (e.g., schedule and supply availability of the technology)
- Environmental risk (i.e., potential effect of the Project on environmental resources)
- Social costs / benefits (i.e., potential to affect nearby communities)

Sub-criteria have been established, where appropriate, to refine the analysis, making it more applicable to the alternative under consideration. Only alternatives that are considered technically feasible have been carried further in the analysis.

The Environmental Impact Statement Guidelines requested an evaluation of alternative timelines for construction and operational phases; however, no feasible alternative was identified that met the need for and purpose of the Project described in Section 2.2.1. Considerable planning has led to the development of an optimized schedule and timeline for both the construction and operational phases of the Project. Many inputs were factored into the schedule, including the timeline for the detailed design of the Project, the availability and delivery schedule of major components, and delivery lead items. Alternative schedules and phases would result in higher costs and may jeopardize the economic feasibility of the Project and Canada's goal of delivering hydrogen derivatives to Germany in 2025 (NRCan 2022).

3.2.1 Alternative Sources of Energy Supply

As part of Project planning, different sources of energy for the Project were considered. The total facility loads for the Project, including the hydrogen / ammonia plant and ancillary infrastructure is 2+ gigawatts (GW) at full build out. Given the intent of the Project is to produce cost-effective hydrogen and ammonia from renewable sources to reduce GHG emissions, only on-grid and off-grid renewable energy options have been investigated. The Project base case comprises onshore wind farms at Port au Port and Codroy described in Section 2.3. Alternative energy supply options for the Project discussed below include purchasing 100% of the electrical power from the provincial NL Hydro power grid and the self-generation of power from offshore wind farms.

The Project currently anticipates drawing electricity from the grid in times of low winds and no capacity from energy storage. Given the high-energy magnitude of the Project (approximately 2 GW peak), using the existing grid for all energy is not possible. Supplying the Project 100% from the existing grid would have the lowest capital expenditure, however this level of energy is not available hence was not considered further. Developing onshore wind farms also provides the opportunity for NL to grow the wind sector, potentially providing excess electricity produced to the grid, and provide considerable economic opportunities, including construction employment, training and service / local supplier opportunities.

The development of offshore wind farms instead of onshore wind farms to provide power would involve the installation of wind turbines at sea, comprising either gravity-based foundations or floating platforms, installation of submarine transmission cables to an at-sea substation, and submarine transmission cables to an onshore substation connecting to land-based transmission infrastructure. Globally, offshore wind is often recognized as being stronger and more consistent than onshore alternatives. In addition, development of an offshore wind farm would also have a smaller terrestrial footprint than an onshore alternative. However, a location for 2 GW offshore wind (approximate footprint of 350 to 450 square kilometres [km^2]) would need to be identified in proximity to the Project site that does not interfere with fisheries, regular shipping routes, existing strategic installations, and areas of ecological interest. Developing offshore wind farms would require overcoming considerable technical challenges, including placing foundations on the sea floor, installation of submarine cables, and complex logistics that could be delayed during adverse weather conditions. As such, this alternative would have considerably higher capital expenditure and maintenance costs when compared to development of onshore wind sites. Given the higher costs of offshore wind when compared to onshore wind (widely considered as having double the capital expenditure), additional logistics, potential interference with fisheries and shipping, and an expanded schedule that would delay the commissioning and the first shipments of ammonia to export partners, this option was not considered further.

Early in project planning, WEGH2 identified excellent wind resources at the Port au Port and Codroy wind farm sites and availability of suitable Crown land through the Crown land bid process as key factors in pursuing the development. Wind speeds were identified as equivalent to those observed at some offshore sites globally. Development of onshore wind farms to provide energy to the Project was identified as having much lower capital expenditure, and lower maintenance and servicing costs than offshore wind development. The purpose of the Project is to produce cost-effective renewable electrolytic hydrogen, using off-grid wind energy for electricity and treated fresh-water as process inputs while supporting carbon emission reduction and generation of long-term benefits for the province of NL. Onshore wind energy was identified as the most cost-effective renewable energy source, given suitable crown land availability, shorter installation and project commissioning timeframe, lower capital expenditure, and overall maintenance costs.

A comparison of the identified options energy supply is provided in Table 3.1, including technical feasibility, economic feasibility, environmental risk and social costs / benefits. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.1 Comparison of Technical Feasibility, Cost, and Environmental and Social Risk of Alternative Sources of Energy

Evaluation Factor	NL Hydro Grid	Offshore Wind Farm	Onshore Wind Farm
Technical Feasibility Sub-criteria: • Feasibility of alterative to meet Project energy demands	Not technically feasible, given the 2 GW energy demands of the Project, is far greater than available power	Technically feasible, but challenges finding a site that does not interfere with fisheries and shipping routes in water less than 60 m. Technology and installation methods proven, but relatively new in Canada where there are no offshore wind farms yet approved or developed, due to absence of regulatory framework and crown land leasing process for offshore sites.	Technically feasible, selected onshore sites wind speeds equivalent to those observed at some offshore sites globally. Technology and installation methods firmly established and proven.
Economic Feasibility Sub-criteria: • Relative capital expenditure • Operating costs	n/a - due to absence of available grid power.	Offshore wind farms have a higher capital expenditure and increased maintenance and operating costs which would jeopardize Project feasibility.	Onshore wind farms have lower capital expenditure and maintenance costs compared to offshore wind farms.
Schedule Risk / Availability Sub-criteria: • Potential for project delay	n/a - due to absence of available grid power.	Development of an offshore wind farm would lead to an expanded schedule given the logistical complexity in developing offshore sites and absence of regulatory framework and crown land leasing process for offshore sites.	Constructed and ready for commercial operation much more quickly than offshore wind farms.
Environmental Risk Sub-criteria: • Terrestrial footprint • Risk to marine/terrestrial resources	n/a -due to absence of available grid power.	Environmental effects on marine resources including but not limited to marine mammals, benthic habitat, fish and seabirds. Limited terrestrial footprint associated with ancillary infrastructure.	Greater footprint of interaction on the terrestrial landscape. Environmental effects on terrestrial resources including vegetation, wetlands, avifauna and bats.
Social Costs / Benefits Sub-criteria: • Economic benefits • Potential for disruption to nearby communities	n/a - due to absence of available grid power.	Economic benefits from construction and operation Potential interference with fisheries, navigation and other marine uses. Less disruption to nearby communities (e.g., traffic congestions and noise effects).	Economic benefits from construction and operation. Disruption to local receptors anticipated during construction, including traffic congestion and noise that will need to be carefully managed.
Preferred Option (carried forward for assessment)	X	X	**Preferred Option**

3.2.2 Alternative Wind Turbine Sizes and Types

During the preliminary analysis of the onshore wind farm resource, turbine options were considered from several manufacturers based on the characteristics of the sites selected and energy demand. The current base case assumption for the Project is to use a turbine with a rated capacity of 6.6 megawatts (MW) or above. Turbines of this size would stand at an approximate height of 102 m from base to hub (pending final design configuration based on wind conditions and suitability analysis to determine the best fit for site) and use 76-m blades, with a rotor diameter of 155 metres (m). Note that conservative assumptions have been made for the turbine model for the purposes of the assessment (e.g., noise modelling, visual impact assessment, shadow flicker study), assuming a 6.6 MW model with a 122.5 m hub height and a 76 m blade length, for a total height of 198.52 m. There are a range of turbine options that could be considered for the Project, including wind turbines by several manufacturers (e.g., Siemens Gamesa, Vestas, GE, Goldwind, Envision) in different sizes and configurations. WEGH2 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. Specific 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 is still to be selected. For the purposes of the impact assessment, we have made a conservative assumption in turbine height to assess a potential "worst case" scenario. The final selection of the wind turbine vendor will be subject of a detailed design and yield assessment based on measured wind data as well as commercial negotiations with possible vendors.

For comparison purposes, various turbine options have been reviewed below, representing smaller, less powerful turbine models compared to a larger 6.6 MW or above model which forms the current Project base case. Smaller options could range in size from 5.0 MW with a rotor diameter of 145 m and tower heights ranging from 90 to 127 m; to 3.4 MW units with rotor diameters of 132 m. These options would have smaller nominal power output. To meet the 2 GW capacity demand of the Project, a much larger number of 5 MW or 3.4 MW wind turbines would be required when compared with a 6.6 MW energy output. An increase to the number of turbines at the wind farm sites would require a larger terrestrial footprint. The larger generating capacity of 6.6 MW turbine equates to greater annual energy production per turbine and optimized capital expenditure and reduced operating expenditure for the Project.

Bladeless wind turbines are an innovative pole-shaped wind turbine, currently in development by Spanish startup Vortex Bladeless Limited. The vortex bladeless vibrates using the power contained in vortices that is generated when wind bypasses the structure and transforms mechanical energy into electricity. As it operates on low to medium wind speeds, it is energy efficient, generating the same amount of energy at a cost 45% lower than that of a conventional three-blade wind turbine (Vortex Bladeless 2023). However, this technology is only in the development phase and is not optimized for commercialization. Given the magnitude of the Project, the need for proven technology reducing risk and providing reliability, and overall Project schedule constraints, this wind turbine option was not considered further by WEGH2 as a viable alternative.

A comparison of the identified options for wind turbines is provided in Table 3.2, considering technical feasibility, economic feasibility, environmental risk and social costs/benefits. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.2 Comparison of Technical Feasibility, Cost, and Environmental and Social Risk of Alternative Sources of Energy

Evaluation Factor	Smaller turbine models (e.g., 5.0 MW to; 3.4 MW)[1]	Vortex Bladeless Wind Turbines	Wind Turbine Unit of 6.6 MW or above
Technical Feasibility Sub-criteria: • Feasibility of alternative to meet Project energy demands	Technically feasible to meet the energy demands of the Project. Smaller nominal power output than the large models.	Not technically feasible as technology is still under development and this alternative would not meet the scale of the Project.	Technically feasible to meet the meet the energy demands of the Project. Represents latest technology with largest energy output per turbine.
Economic Feasibility Sub-criteria: • Relative capital expenditure • Operating costs	Higher installation cost as more turbines will be required to meet the energy demands. Costs will be higher to service a larger number of turbines.	n/a – technology in development	Lower installation cost when compared to alternatives as less turbines will be required to meet the Project's energy demands. Optimized capital expenditure and reduced operating expenditure for the Project.
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Potential for timing constraints from supply.	n/a – technology in development	Potential for timing constraints from supply.
Environmental Risk Sub-criteria: • Terrestrial footprint • Risk to avifauna and bats	Larger terrestrial footprint required to accommodate a greater number of turbine sites. Potential for a greater impact to avifauna, bats and habitat from a larger number of turbines.	n/a – technology in development	Terrestrial footprint required would be less than alternatives given the larger generating capacity of each turbine.
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities	Greater potential for disruption from an increased number of traffic movements and construction activities.	n/a – technology in development	Potential for disruption to nearby communities during construction would be less given the larger generating capacity of each turbine (e.g., less road deliveries would be required).
Preferred Option (carried forward for assessment)	X	X	**Preferred Option**

3.2.3 Alternative Locations, Land Area Requirements, and Access Routes for Key Project Components

3.2.3.1 Onshore Wind Farm Locations

Alternative locations for onshore wind farms in western Newfoundland have been considered by WEGH2 during planning for the Project. These have included the preferred Port au Port and Codroy sites, as well as an alternative at Lewis Hills.

Criteria considered for wind farm locations included:

- Proximity to the selected brownfield hydrogen / ammonia plant location in Stephenville limiting the distance of transmission line infrastructure required
- Availability and extent of Crown land to accommodate the required number of turbines to provide the 2 GW electricity demands of the Project
- Ability to support access requirements for the transportation of turbine components and equipment
- Reliable onshore wind speed distribution equivalent to offshore sites globally

The Port au Port and Codroy wind farm sites selected as the preferred alternatives are described in Section 2.1.2. The Lewis Hills site located approximately 30 km north of hydrogen / ammonia plant in Stephenville was contemplated as meeting criteria for a 1 GW wind farm.

During further evaluation the Lewis Hill site was identified as being partially within a Protected Public Water Supply Area for Humber Arm South, prohibitive in terms of access and was not considered economically viable for development. In addition, pending further land bid consultation the Government of NL removed the Lewis Hill site from the Crown Land Bid process.

A comparison of the identified options for onshore wind farm locations is provided in Table 3.3, in consideration of technical feasibility, economic feasibility, environmental risk and social costs/benefits. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.3 Comparison of Technical Feasibility, Cost, and Environmental and Social Risk of Alternative Wind Farm Sites

Evaluation Factor	Lewis Hills Wind Farm Site	Codroy Wind Farm Site	Port au Port Wind Farm Site
Technical Feasibility Sub-criteria: • Sufficient average wind speeds to support the Project • Land availability • Crown Land Bid Area	Sufficient average wind speeds to support the Project. Technically feasible to install a 1 GW windfarm; however, area removed from the Crown Land Bid Process.	Sufficient average wind speeds to support the Project. Technically feasible to install a 1 GW windfarm, parcel available as part of the Land Bid Process.	Sufficient average wind speeds to support the Project. Technically feasible to install a 1 GW windfarm, parcel available as part of the Land Bid Process.
Economic Feasibility Sub-criteria: • Relative capital expenditure	n/a – based on removal from the Crown Land Bid process.	Relative capital expenditure higher than Port au Port.	Lowest relative capital expenditure, given the proximity to Stephenville.
Schedule Risk / Availability Sub-criteria: • Potential for project delay	n/a – based on removal from the Crown Land Bid process.	Potential risk for Project delay comparable to other site options.	Potential risk for Project delay comparable to other site options.
Environmental Risk Sub-criteria: • Terrestrial footprint • Relative risk to environmental resources	n/a – based on removal from the Crown Land Bid process.	Potential risk for terrestrial footprint and relative risk to environmental resources comparable to other site options. Primary environmental risks at Codroy are related to diversity of avifauna present in the adjacent estuary.	Potential risk for terrestrial footprint and relative risk to environmental resources, comparable to other site options. The primary environmental concerns at Port au Port are related to presence of rare plants in the vicinity of turbine sites.
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities	n/a – based on removal from the Crown Land Bid process.	Potential disruption to nearby communities lower than Port au Port Wind Farm site and comparable to Lewis Hill Wind Farm site	Potential disruption to nearby communities higher than Codroy and Lewis Hills Wind Farm sites
Preferred Option (carried forward for assessment)	X	**Preferred Option**	**Preferred Option**

3.2.3.2 Transmission Line Alternative Alignments

Two alternative transmission routing options have been evaluated for the Port au Port Wind Farm from the transition compound station along the south shore of Port au Port Bay, approximately 1.3 km west of Bellmans Cove and the Port au Port East Collector Station (Figures 3.1), these include a submarine transmission system and an on-land route either overhead or buried across the isthmus of the Port au Port Peninsula (Figure 3.1).

Although the specific routing has not been finalized,, the submarine transmission system comprises two circuits of 230 kilovolt submarine transmission lines and fibre optic cabling approximately 7 km in length from the East Collector Substation on the Port au Port Peninsula to a transition compound on the mainland. From there, the transmission lines would continue overhead to the Port au Port West Collector Substation.

An alternative to the submarine transmission system under consideration would be to continue the overland transmission alignment routing along the narrow isthmus, either adjacent to NL Route 460, or along the rocky shoreline south of Gravels Pond following existing transmission line routes. However, this alternative was considered technically challenging, given that existing transmission lines already occupy this route and minimal space exists on the narrow isthmus for the construction of a new overhead transmission line. Another alternative considered was to install the transmission lines in a buried duct bank along the Port au Port isthmus and route the transmission lines overhead from there.

The submarine transmission line was identified as the preferred alternative based on the need to reduce potential impacts to the local community during the construction and operational phases of the Project. Several communities in the area expressed concern regarding impacts of an additional right-of-way (RoW) or expanded RoW on land use in Port au Port East. The buried duct bank alternative along the narrow isthmus would still require overhead routing once the transmission lines reached the mainland. Installation of an overhead line or buried duct bank along the narrow isthmus would also have greater potential for disruption to residential receptors during the construction phase of the Project (e.g., traffic congestion, construction noise). Installing submarine cables within a trench along the identified route is currently being evaluated further, including a geotechnical investigation. The transmission routing will be confirmed during the detailed engineering phase of the Project. The cable installation methodology will be developed to reduce the impact to the marine environment.

A comparison of the identified options for power transmission is provided in Table 3.4, in consideration of technical feasibility, economic feasibility, environmental risk and social costs / benefits. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Stantec

Proposed Project Features

- Transmission Line 230 kV

Port au Port Interconnection

- Proposed Route
- Alternate Route
- Collector Line
- Access Road
- Substation
- Project Area

Other Features

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

N

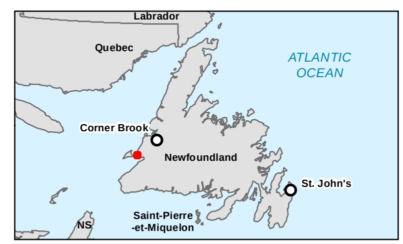
0 0.5 1 Kilometres

(At original document size of 8.5x11)

1:50,000

Notes

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



Project Location
Stephenville
NL

Prepared by MB on 2023-07-20
QR by AW on 2023-07-20

Client/Project
World Energy GH2
Project Nujio'qonik

121417233_060a

Figure No.
3.1

Proposed Project Features: Port au Port Interconnection

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Table 3.4 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of the Transmission System Between Port au Port Peninsula and the Mainland

Evaluation Factor	On-Land Transmission – Overhead Transmission Lines	On-Land Transmission – Buried Duct Bank	Submarine Cable Installation
Technical Feasibility Sub-criteria: • Land availability and engineering requirements	Proven construction and installation methods. Technically feasible to install an overhead transmission system; however, this option is considered challenging given that existing transmission lines already occupy the narrow isthmus, and a route would need to be developed that would avoid existing transmission lines and infrastructure.	Technically feasible to install an on-land buried duct bank transmission system; however, there may be RoW easement and access constraints along the narrow isthmus.	Technically feasible to install a submarine transmission system.
Economic Feasibility Sub-criteria: • Relative capital expenditure	Lowest relative capital expenditure	Relative capital expenditure lower than submarine transmission, but higher than an overhead transmission system	Relative capital expenditure higher than an overhead transmission system/buried duct bank
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Least potential for delays given proven installation methods	Some potential for delays related to logistics and land access for cable burial	Some potential for delays, related to adverse marine weather during installation of the cable.
Environmental Risk Sub-criteria: • Terrestrial footprint • Relative risk to environmental resources	Terrestrial land disturbance along the RoW	Increased area of land disturbance along the RoW than overhead system during construction Clearing of vegetation and excavation for cable burial Relative risks to archeological and historical resources.	Potential for interaction with commercial fisheries (including fixed gear for lobster, groundfish, and pelagic species) conducted in the bay. Placement of submarine transmission system on the ocean floor could temporarily increase turbidity, and cause noise, disturbance, and habitat loss, although impacts are expected to be generally localized and temporary Cable installation methods will be developed to reduce the impact to the marine environment

Table 3.4 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of the Transmission System Between Port au Port Peninsula and the Mainland

Evaluation Factor	On-Land Transmission – Overhead Transmission Lines	On-Land Transmission – Buried Duct Bank	Submarine Cable Installation
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities	Potential for disruption to local communities during construction (e.g., traffic congestion, construction noise etc.) Highest impacts on land use of a new or expanded RoW in Port au Port East	Potential for disruption to local communities during construction (e.g., traffic congestion, construction noise etc.) Impact to land use as the overhead routing would still require overhead routing once the transmission lines reach the mainland Lower visual effects than overhead lines	Avoids interaction with existing infrastructure and the potential for construction impacts to local residents in the immediate area from construction noise and traffic. Lower visual effects than overhead lines
Preferred Option (carried forward for assessment)	X	X	**Preferred Option**

3.2.3.3 Hydrogen and Ammonia Production Facility

During Project planning WEGH2 considered alternative locations for the hydrogen / ammonia plant, including the brownfield Port of Stephenville site and greenfield sites at Rothesay Bay (a highway site and a waterfront site). Given the intent of the Project to export hydrogen / ammonia internationally only sites located with marine access near the Port of Stephenville were considered feasible.

The Rothesay Bay highway site is located adjacent to the Highway 490 to the north and Seal Cove to the east, approximately 1.5 km east of the Port of Stephenville site. The Rothesay Bay waterfront site is situated further south along the coastline near the Emera, Maritime Link grounding site, approximately 2.77 km south of the Port of Stephenville site. While both sites are greenfield undeveloped and occupy Crown land (Figure 3.2), they are not part of the Crown land bid process.

Figure 3.2 Rothesay Bay Sites (Highway and Waterfront Site)

Early in the project planning the Port of Stephenville site was identified as the preferred alternative for the hydrogen / ammonia plant, given the availability of existing cleared brownfield land (50 hectares) with enough space to accommodate the Project, including cleared land available for laydown areas. In addition, other reasons for selecting this site included:

- Accessibility to existing port facilities for deep-water shipping to and from destinations in Atlantic Canada, North America, and Europe
- Suitable zoning for industrial use (e.g., *Town of Stephenville Development Regulations*)
- Located outside of Wellhead Protected Water Supply Areas and ecologically sensitive areas
- Existing land disturbance with reduced relative risk to terrestrial and freshwater habitats, as well as archaeological and heritage resources
- Distance from residential and other sensitive receptors
- Accessibility to power grid connection infrastructure
- Existing quay suitable to accommodate the berthing and mooring loads from the maximum anticipated ship size and without the requirement for additional berthage

Both of the Rothesay Bay sites are greenfield sites, are not part of the Crown land bid process and fall outside of the Stephenville industrial land use zoning. Furthermore, both sites would require additional pipeline infrastructure to transfer hydrogen / ammonia to existing port facilities in the Port of Stephenville.

A high-level summary of the alternatives considered rated against the evaluation factors is provided in Table 3.5. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.5 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Hydrogen / Ammonia Plant Sites

Evaluation Factor	Rothesay Bay Site - Highway	Rothesay Bay Site – Waterfront	Port of Stephenville Site
Technical Feasibility Sub-criteria: • Land availability • Development zoning requirements	Technically feasible given the land parcel available to construct the hydrogen/ammonia plant; Additional geotechnical investigations would be required to confirm suitability. Located on Crown land, not part of the Land bid process.	Technically feasible given the land parcel available to construct the hydrogen / ammonia plant. Additional geotechnical investigations would be required to confirm suitability. Located on Crown land, not part of the Crown land bid process.	Technically feasible given the land parcel available Land already zoned industrial use and leveled for redevelopment.
Economic Feasibility Sub-criteria: • Relative capital expenditure	Relative capital expenditure higher than the Port of Stephenville site, given the requirements for geotechnical investigations, land clearing, and earthworks	Relative capital expenditure higher than the Port of Stephenville site, given the requirements for geotechnical investigations, land clearing, and earthworks	Lowest relative capital expenditure, given the land parcel is already cleared and leveled for development
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Some potential for project delays from additional geotechnical investigations, land clearing, and earth works to prepare the site	Some potential for project delays from additional geotechnical investigations, land clearing, and earth works to prepare the site	Least potential for delays, given the current site is cleared, additional earthworks to level the site for development would also not be required
Environmental Risk Sub-criteria: • Terrestrial footprint • Relative risk to environmental resources	Largest terrestrial footprint and relative risk to terrestrial and freshwater habitats. Extensive clearing of vegetation required. Potential risks to archaeological and heritage resources from earthworks	Larger terrestrial footprint and relative risk to terrestrial and freshwater habitats. Extensive clearing of vegetation required. Potential risks to archaeological and heritage resources from earthworks	Existing land disturbance with reduced relative risk to terrestrial and freshwater habitats, as well as archaeological and heritage resources Located outside of Wellhead Protected Water Supply Areas and ecologically sensitive areas
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities	Higher potential for disruption to local communities during construction given the additional land clearing and earthworks required (e.g., traffic congestion, construction noise)	Higher potential for disruption to local communities during construction given the additional land clearing and earthworks required (e.g., traffic congestion, construction noise)	The potential for construction impacts to residents in the immediate area from construction noise and traffic will be reduced given that the site is already cleared
Preferred Option (carried forward for assessment)	X	X	**Preferred Option**

3.2.3.4 Alternative Port au Port Access Points

During Project planning, several access point options were considered for transporting turbine components from the Port of Stephenville, where components will arrive by marine vessel to the specific Port au Port wind farm turbine sites. Intermodal transportation of wind turbine components using barging and final transfer via road was compared with the transportation of wind turbine components fully by road from Stephenville.

The Port au Port Peninsula is accessible via NL Routes 460 and 463, paved two-lane highways. Using Routes 460 and 463, there is an 80-km loop around the perimeter of the roughly triangular peninsula. A narrow isthmus connects the Port au Port Peninsula to the mainland, with the peninsula bound by the Gulf of St. Lawrence to the west, Bay St. George to the south and Port au Port Bay to the north-west.

Two temporary marine landing sites on the Port au Port Peninsula were identified that could receive low draft barges for delivery of turbine components and other bulk Project materials. For this option, turbine components could be shipped to the Port of Stephenville and then transferred to the barge landing sites, where components would be transferred to specific installation locations via road. The landing sites, include Aguathuna and West Bay. The Aguathuna landing site (Figure 3.3) is a brownfield historic mining / quarry site that remains heavily disturbed. Benefits to using this landing site include:

- Existing disturbed area and coastline
- Few to no residential properties
- Large existing laydown area

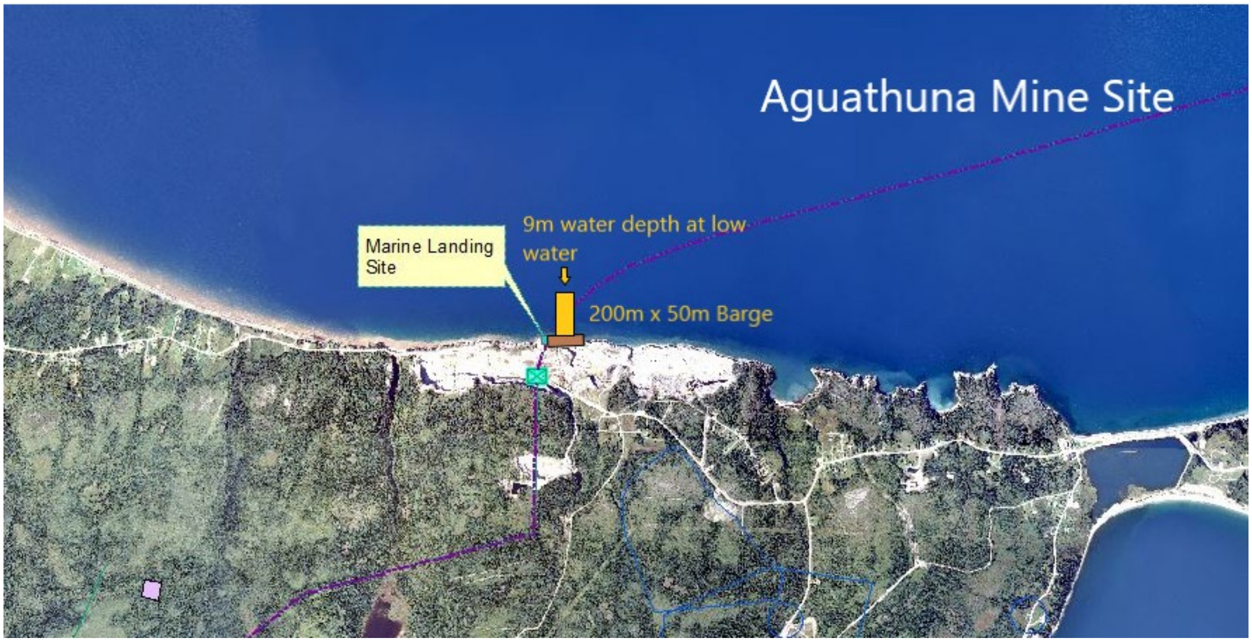


Figure 3.3 Possible Barge Landing: Aguathuna Site

Using the Aguathuna landing site, turbine components could then be transported more easily, over a shorter overland distance, to designated wind turbine development areas. In evaluating the use of the Aguathuna landing site, WEGH2 considered alternative road access to Lower Cove, including developing access from the community of Boswarlos, from Goose Pond Road, and from the Lower Cove area. Both of these access points were not preferred when compared to marine landing access from Aguathuna due to potential challenges with the local road design (tight turns and steep grades), interferences with residences, and the general objective of reducing construction-related traffic on public roads. An additional alternative access could be created from Goose Pond Road; however, as with the community of Boswarlos, this is a residential road and farther away from the proposed wind turbine locations.

A second potential marine landing site is located near the town of West Bay (Figure 3.4). This site is directly opposite (crossing Highway 463) an existing access road leading inland. It could serve to substantially reduce the travel required to the wind turbine sites on the western section of the peninsula. Marine landing sites at either Aguthuna or West Bay can also enable easy access to the largest grouping of wind turbines as part of the Port au Port wind farm, spanning from Cape Saint George in the south to Three Rock Cove in the north, when compared to access roads along Highway 463 on the westernmost part of the peninsula. From the community of Mainland, there is an existing service road stretching 12 km inland; however, the road would require upgrades for Project use, including some substantial fills to maintain grades within the acceptable range. Although interior portions of this roadway will be upgraded and used by the Project, the entry point near Mainland has been deprioritized in an effort to reduce disruptions on the public highways and inconvenience to the local population.

Figure 3.4 Possible Barge Landing: Western Site

Use of the marine landing sites would enable the transportation of components to Project-specific roads in the peninsula interior. When compared with transportation of turbine components via road from Stephenville, barging of turbine components would reduce interference with local traffic and reduce inconvenience to residents along public roadways during construction. Road transportation of components from Stephenville is also more challenging due to physical infrastructure limitations caused by the size and weight of wind turbine components. Specifically, longer turning radiuses are required for blades and vertical and horizontal clearance for tower sections requiring upgrades to roads which may lead to increased land clearing.

An evaluation of the marine landing sites compared to transporting components along the road network is provided in Table 3.6. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.6 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Port au Port Access Points

Evaluation Factor	Road Transportation of Components Along the Road Network	Marine Based Landing Sites Aguathuna and West Bay
Technical Feasibility Sub-criteria: • Identification of suitable barge landing sites / suitable road routes	Technically feasible, but logistically more challenging due to route limitations, physical infrastructure limitations, including turning radiuses and vertical and horizontal clearance from tower sections	Technically feasible, suitable barge landing sites identified at Aguathuna and West Bay and connecting road options available
Economic Feasibility Sub-criteria: • Relative construction cost expenditure	Relative expenditure of road transportation of components is still being evaluated. Upgrades to some public road sections required.	Relative expenditure of barging components when compared to full road transportation is still being evaluated
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Road transfer may only be authorized at certain times/days Road congestion may cause delays to transport equipment	Adverse weather could affect the barging of components and equipment
Environmental Risk Sub-criteria: • Terrestrial footprint • Relative risk to environmental resources	Larger terrestrial footprint when compared to the alterative, road upgrades (e.g., road widening) required on certain routes to facilitate access	The Aguathuna landing site is a brownfield historic mining / quarry site that remains heavily disturbed with very little land clearing required to facilitate use. The West Bay site landing site may require some clearing to facilitate use subject to design. In addition, some road upgrades may be required to transport equipment to the landing sites

Table 3.6 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Port au Port Access Points

Evaluation Factor	Road Transportation of Components Along the Road Network	Marine Based Landing Sites Aguathuna and West Bay
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities • Safety risks	Higher number of trips and interference with traffic along routes, may cause some traffic delays to other road users and noise and other nuisance to nearby communities Truck transport of heavy equipment could present public safety risks which will require careful management	Reduced interference with local traffic usage Less public safety risk as the number and distance of trips will be reduced
Preferred Option (carried forward for assessment)	X	**Preferred Option**

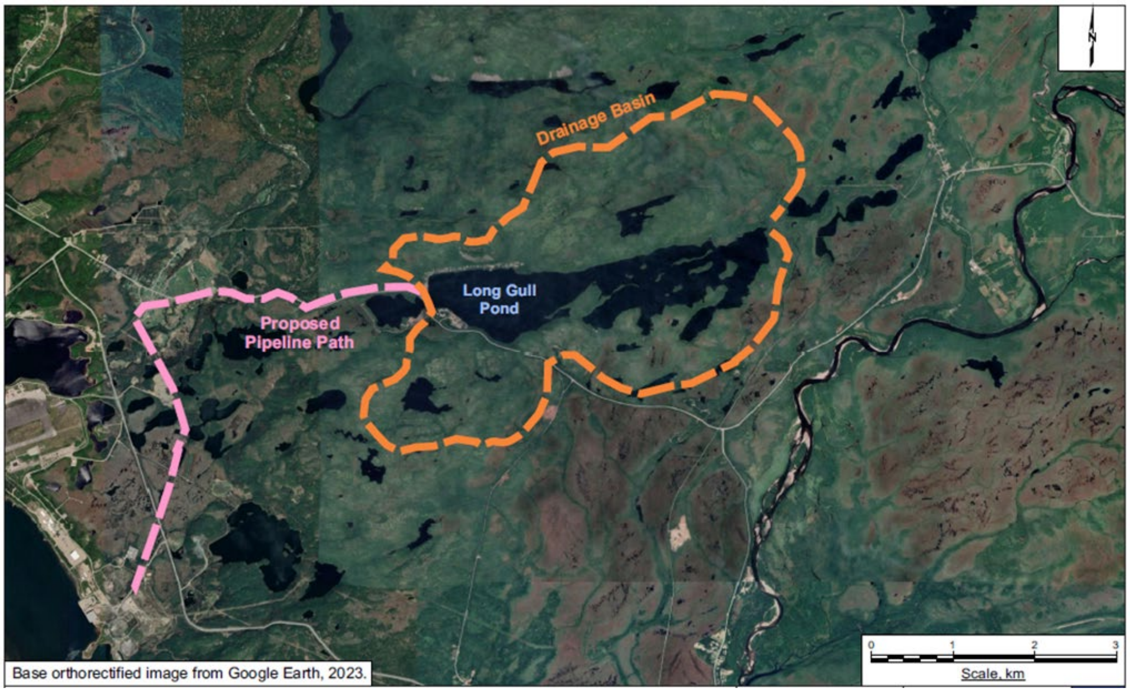
3.2.4 Alternative Sources of Industrial Water Supply

During planning, WEGH2 considered industrial water supply options within a reasonable distance of the Project. Given the previous use as a water supply by a pulp and paper plant, Gull (Mine) Pond was evaluated initially as the primary source, with Muddy-Noels Pond serving as the secondary source.

Gull (Mine) Pond and Muddy-Noels Pond are described in Section 2.6.3.3. There are two alternate freshwater sources for the industrial water supply for the proposed hydrogen / ammonia plant within reasonable distances. Two potential alternative sources of freshwater are Long Gull Pond (Figure 3.5) and Harry's River (Figure 3.6).

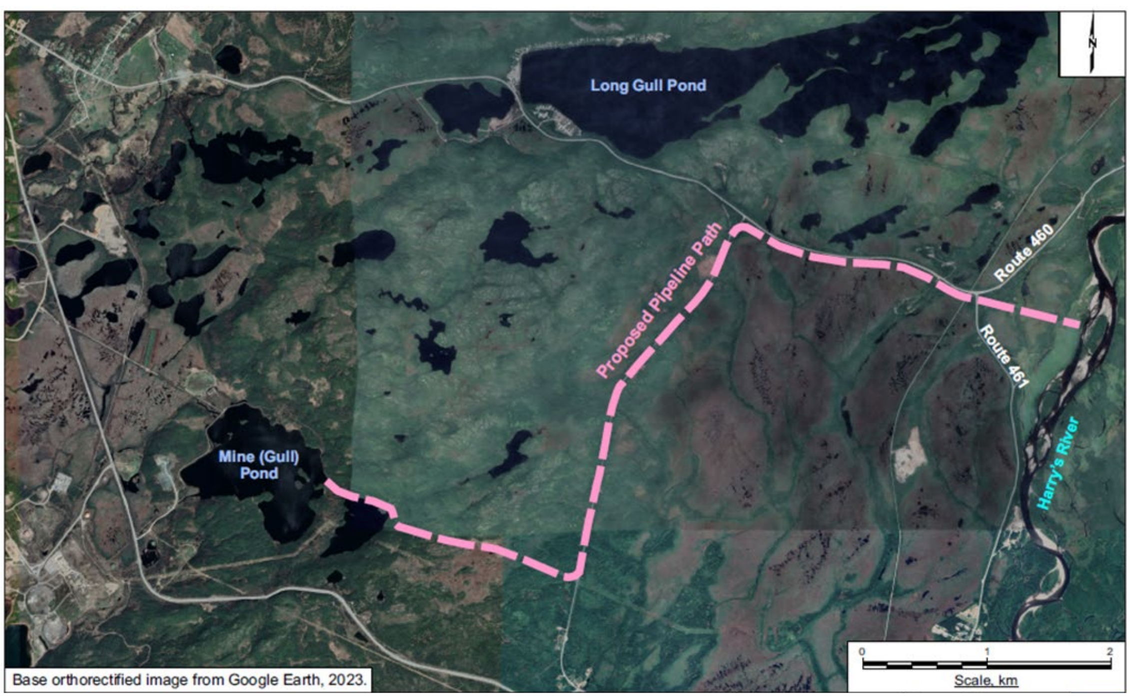
Harry's River is fed by a large drainage basin, approximately 618,200,000 square metres (m^2) (NL Department of Environment and Climate Change 2023). Harry's River could supply well in excess of the stated hydrogen / ammonia plant industrial water supply requirements. This would require the construction of an intake structure on the edge of Harry's River immediately east of the intersection of Highway 460 and Highway 461 (White's Road). A pipeline (Figure 3.6) could then be constructed along the edge of the highway and along an abandoned road that is located on the west side of the Indian Head range, and then up over the drainage divide and down into Gull (Mine) Pond.

Long Gull Pond has a surface area that is approximately twice as large as Noels Pond and can be expected to provide approximately 45 days of active storage. However, the drainage basin (Figure 3.6) for Long Gull Pond is relatively small and cannot supply the full freshwater needs of the Project. Water from Long Gull Pond can be delivered by a pipeline to the proposed plant site that can be constructed along an old and abandoned railway line or rail bed that leads from Long Gull Pond to the plant site.



Source: FracFlow 2023

Figure 3.5 Proposed Alternate Industrial Water Supply and Pipeline Route from Long Gull Pond



Source: FracFlow 2023

Figure 3.6 Proposed Alternate Industrial Water Supply and Pipeline Route from Harry's River

Based on the industrial water requirements described in Section 2.6.3.3, and technical and environmental constraints, WEGH2 selected Gull (Mine) Pond with secondary sources from Muddy-Noels Pond as the preferred alternative. Long Gull Pond is relatively small and cannot supply the full industrial water needs of the Project. Harry's River is a large river fed by a large drainage basin of approximately 618,200,000 m² and could supply more than the Project's industrial water supply requirement; however, active storage would still be required because of the normal variation in stream flow throughout the year. Gull (Mine) Pond and secondary sources Muddy Pond-Noels Pond, with a functioning water outflow control structure can supply the water required for the Project exclusively based on feasibility data, including average precipitation data (Fracflow 2023).

Selecting Gull (Mine) Pond with secondary sources from Muddy Pond-Noels Pond as the preferred alternative would require the least amount of construction related terrestrial and aquatic disturbance as existing water supply infrastructure can be refurbished and reused. In addition, this option requires the least construction expenditure, presents the least risk to schedule and would likely lead to less disruption or interference on local receptors from construction activities. In comparison, the Harry's River alternative would require the construction of an intake structure on the edge of Harry's River immediately east of the intersection pipeline. Further, water supply from Long Gull Pond would also require construction of an additional pipeline along either an abandoned railway line or rail bed.

A high-level summary of the alternatives considered rated against the evaluation factors is provided in Table 3.7. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.7 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Sources of Industrial Water Supply

Evaluation Factor	Harry's River with Connection to Mine Pond	Long Gull Pond	Gull (Mine) Pond and Muddy-Noels Pond
Technical Feasibility Sub-criteria: • Feasibility of alternative to meet Project water demands based on average precipitation data	Technically feasible, Harry's River fed by a large drainage basin of approximately 618,200,000 m²˒ could supply more than the stated hydrogen plant industrial water supply requirement; however, active storage would still be required to compensate for periods of low river flow	Technically feasible, but Long Gull Pond has a relatively small catchment basin and cannot supply the full industrial water needs of the hydrogen / ammonia plant Water supply from Gull (Mine) and Muddy-Noels Pond would still be required	Technically feasible, this option can supply enough water to production plant based on average precipitation data
Economic Feasibility Sub-criteria: • Relative capital expenditure to develop infrastructure required for each alternative	Higher capital expenditure to construct an additional pipeline and water abstraction infrastructure	Higher capital expenditure to construct an additional pipeline and water abstraction infrastructure	Lower capital expenditure when compared to other alternatives, as existing infrastructure already in place can be refurbished and reused

Table 3.7 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Sources of Industrial Water Supply

Evaluation Factor	Harry's River with Connection to Mine Pond	Long Gull Pond	Gull (Mine) Pond and Muddy-Noels Pond
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Permitting and construction of additional infrastructure would add to the Project schedule; however, activities could occur concurrently with the construction of other components	Permitting and construction of additional infrastructure would add to the Project schedule; however, these activities could occur concurrently with the construction of other components	Updating and refurbishing equipment would take less time than the other options, given previous use as an industrial water supply.
Environmental Risk Sub-criteria: • Terrestrial footprint • Relative risk freshwater habitat and fish	Larger terrestrial footprint from construction of a new pipeline in comparison to using existing infrastructure Temporary disturbance to aquatic habitat and fish (e.g., habitat loss, turbidity, noise disturbance) and potential impacts to water quantity. Depending on installation method new pipeline could lead to physical disturbance to the substrate either permanent or temporary alteration to fish habitat. Harry River is a scheduled salmon river.	Larger terrestrial footprint disturbance from construction of a new pipeline in comparison to using existing infrastructure Temporary disturbance to aquatic habit and fish (e.g., habitat loss, turbidity, noise disturbance) and potential impacts to water quantity Depending on installation method new pipeline could lead to physical disturbance to the substrate either permanent or temporary alteration to fish habitat	Terrestrial footprint and aquatic disturbance would be limited to activities associated with refurbishing existing infrastructure Temporary disturbance to aquatic habit and fish (e.g., habitat loss, turbidity, noise disturbance) and potential impacts to water quantity
Social Costs / Benefits Sub-criteria: • Potential for interference to local residential receptors	Potential interference to local receptors from construction of additional water supply infrastructure (e.g., traffic congestion, noise from construction equipment)	Potential interference to local receptors from construction of additional water supply infrastructure (e.g., traffic congestion, noise from construction equipment)	Potential interference to receptors likely less than the other alternatives as activities are limited to refurbishing equipment
Preferred Option (carried forward for assessment)	X	X	**Preferred Option**

3.2.5 Alternative Methods of Storing Hydrogen

Aboveground hydrogen storage, which comprises storing high pressure hydrogen in a gaseous state in above-ground storage vessels, is described in Section 2.3.4.5. Hydrogen storage will be designed to provide sufficient hydrogen feedstock to operate the ammonia plant at 10% turndown for approximately 13 hours during low grid power availability. During Project planning, onsite above ground storage for gaseous hydrogen was considered necessary to support efficient operation of the ammonia plant. It was recognized the site had enough land available to support the development of high-pressure above-ground storage vessels. These vessels will be constructed to industry standards, such as the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

Onsite storage tanks can be installed concurrently with other components of the hydrogen / ammonia plant. Further, this option would lead to less terrestrial clearing and potential for disruption to nearby communities as infrastructure can be contained to the site and a transfer pipeline would not be required.

To support the alternatives analysis, storage of hydrogen in salt caverns in the vicinity of the hydrogen / ammonia plant's location is compared with onsite storage. The salt caverns under consideration are approximately 26 km south of Stephenville. TriplePoint Resources Ltd owns Fischell's Brook Salt Dome mineral rights , which comprises a total of 226 km² of mineral licenses prospective for salt on the west coast of the Island of Newfoundland. TriplePoint Resources Ltd. intends to build, own, and operate a multi-cavern storage facility which could accommodate hydrogen storage for the Project (TriplePoint 2023).

The Fischell Brook salt dome is a subterranean high density, zero permeability salt deposit large enough to allow for the creation of more than 10 large caverns, with an opportunity to wash additional smaller volume caverns. The larger caverns can individually store up to 1 million cubic metres (m³) or more of green hydrogen safely. TriplePoint is planning to develop caverns that will vary in size from 500,000 m³ to 1 million m³. The company's initial cavern developed will likely be approximately 500,000 m³, with future caverns developed to suit Project requirements for hydrogen storage. Although caverns are initially expensive to wash, they have lower ongoing costs of maintenance for hydrogen storage, and substantially longer lifecycles with less operational risk compared to pressure spheres. Also, hydrogen can be produced and injected into the caverns quickly and removed quickly. However, salt cavern storage was not considered further as part of the current Project design, given the lag in timelines between the projects. The Fischell Brook Salt dome could be developed for use in the future to support the Project but is not considered part of the current scope of the Project.

A high-level summary of the two alternatives considered rated against the evaluation factors is provided in Table 3.8. Where applicable, the risks and uncertainties for each alternative are included within the applicable factor.

Table 3.8 Comparison of Technical Feasibility, Cost, Environmental and Social Risk of Alternative Methods of Storing Hydrogen

Evaluation Factor	Salt Cavern Storage	Aboveground Storage
Technical Feasibility Sub-criteria: • Feasibility of the alternative to meet the Project hydrogen storage capacity requirements (approximately 20 tons)	Higher risks of leakage along pipeline, but technically feasible. Identified salt dome is high density, has zero permeability and is large enough to store 1 million m³ of hydrogen. However, supplementary onsite storage may also be required to support ammonia production requirements	Technically feasible, hydrogen can be stored efficiently in a gaseous state in high-pressure above-ground, commercially available storage vessels
Economic Feasibility Sub-criteria • Relative construction cost expenditure	Higher capital expenditure to install the necessary pipeline infrastructure to transfer hydrogen 26 km, as well as the cost of other supporting infrastructure Lower ongoing costs of maintenance, especially for hydrogen storage, and substantially longer lifecycles with less operational risk compared to pressure spheres Improved economies of scale for storage of large quantities of hydrogen $/m³	Lower capital expenditure to the develop storage for approximately 20 tons of hydrogen; however, cost per cubic meter higher for storage of large quantities of hydrogen
Schedule Risk / Availability Sub-criteria: • Potential for project delay	Salt cavern storage option would not be available in time to meet the Project's targeted commissioning date which would lead to Project delays	Above-ground storage vessels can be installed and commissioned concurrently with other components associated with the hydrogen and ammonia plant
Environmental Risk Sub-criteria: • Terrestrial footprint	Salt cavern storage would require clearing of new RoW (approximately 26 km) to transfer hydrogen to/from the hydrogen / ammonia plant; this option would lead to larger terrestrial footprint than the aboveground storage option.	Above-ground storage vessels can be fully accommodated within the 50 hectare brownfield site for the hydrogen / ammonia plant
Social Costs / Benefits Sub-criteria: • Potential for disruption to nearby communities	Installation of hydrogen transfer pipeline from the hydrogen and ammonia plant to the salt cavern site could cause construction disruption to nearby communities (e.g., traffic congestion, noise).	Above-ground storage vessels can be installed and commissioned concurrently with the hydrogen / ammonia plant. This option would lead to limited additional disruption to local communities
Preferred Option (carried forward for assessment)	X	**Preferred Option**

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