Hazard 1 Study - Site Location and Layout Review

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2023-12-15	**A**	**Issue for Use**	**S. Moradi**	**E. Ng**	**K. Bavis**	**J. Murphy**
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				Discipline Lead	**Functional Manager**	**Client**

Revision History

Date	Rev No	Description
2023-12-07	A	Internal Review
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1. Project Background

North Atlantic Refining Corp. (NARL) is planning to build a green hydrogen in Newfoundland and Labrador for export. The location is ideal for leveraging the combination of high-quality renewable resources and existing deep-water port. To this end, NARL has engaged Hatch to undertake the Wind to Hydrogen pre-FEED (FEL-2) study.

The 'Project' will be located within proximity to the NARL refinery in Come by Chance, Newfoundland & Labrador. The project will consist of a 324 MW Wind Farm including 45 Wind Turbines, Batch Plant, Laydown Area and O & M Building, Collection System, Substation, Transmission Lines, and Access Roads.

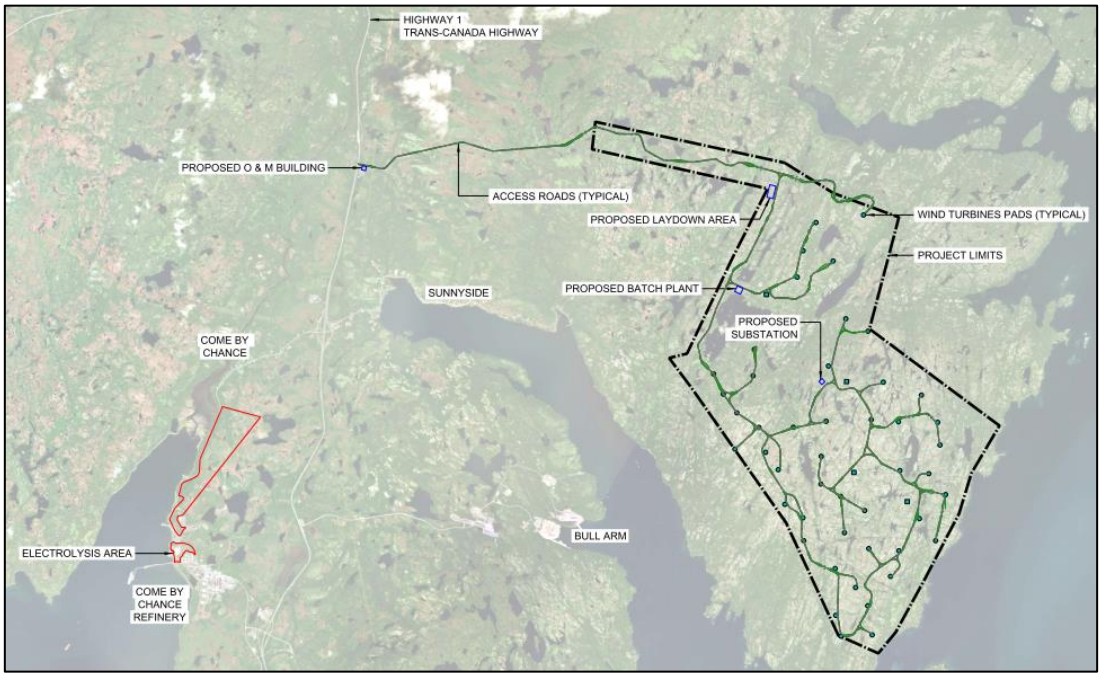

Figure 1-1: General Project Location

As part of the FEL-2 Study, a preliminary site layout and Hazard study has been completed based on existing information to assess the general conditions surrounding the site and to establish a reasonable understanding of the layout conditions and potential risks for conceptual design.

Figure 1-2 illustrates the overall layout and various facilities included in the scope.

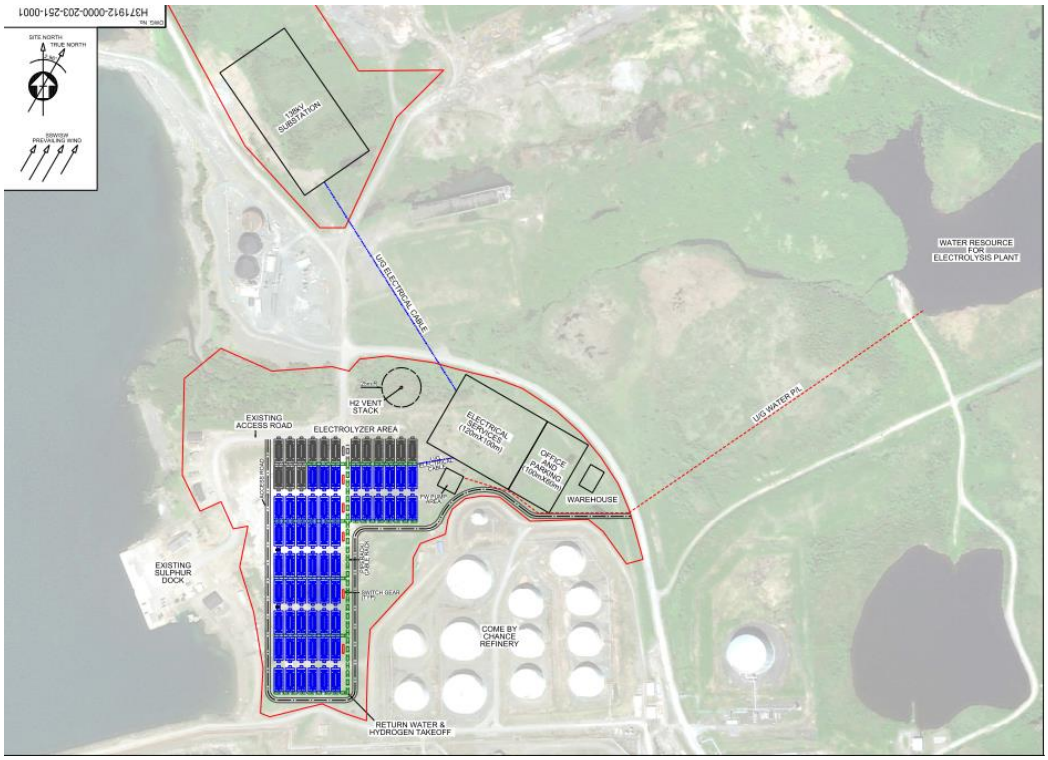

Figure 1-2: Layout NARL Green Energy Electrolysis Plant Facilities

2. Introduction

Hatch risk management process requires that projects undergo risk reviews to demonstrate that the identification of potential fatal flaws in siting and layout of various key surface facilities were assessed. The intent of the risk reviews is to document at a high-level any special control actions that may be required to manage residual risk to a tolerable level.

Hatch, Project Lifecycle Process (PLP) requires that a Hazard 1 study (site location and facility layout risk review) to be conducted for the NARL Wind to Hydrogen Project as part of North Atlantic Refining Corp. project deliverables. This risk review workshop was facilitated by Hatch on November 28th, 2023, and included members from the Hatch and NARL teams.

Further to the above, the risk workshop also includes the identification of potential fatal flaws in siting and layout of various key surface and underground facilities, as well as utilities supply and compliance to relevant legal requirements, where applicable, i.e., health and safety regulations; major hazard installation (MHI) regulations; environmental management act and the occupational health and safety regulations. The methodology followed was to evaluate the wind farm site and equipment locations, access roads, other infrastructure and process facility locations as contained on an aerial map view (Figure 1-2) and site layout drawing (Appendix D).

With the completion of this risk review workshop and the completion of proposed risk reduction or mitigation actions, the site selection and location of the process facilities may be finalized. This report summarises the hazard study participants, the risk review workshop methodology and outcomes of the risk review workshop.

3. Abbreviations

Table 3-1 below contains the list of abbreviations used in this report:

Table 3-1: Abbreviations

Abbreviation	Meaning
ALARP	As Low As Reasonably Practical
HAZID	Hazard Identification
EIA	Environmental Impact Assessment
LTI	Loss Time Injury
HAZMAT	Hazardous Material
MHI	Major Hazard Installation
PPE	Personal Protective Equipment
OHSA	Occupational Health and Safety Act
PHA	Process Hazard Analysis
UPS	Uninterruptible power supply
PLP	Project Lifecycle Process
IDZ	Industrial Development Zone
SOP	Standard Operating Procedure

4. Definitions

Table 4-1 below contains the list of definitions used in this report:

Table 4-1: Definitions

Term	Description
Hazard	A source of potential harm, which may be associated with the physical, chemical or biological aspects of a process plant, operational facility, pipeline system, system design, or may arise during construction, manufacturing, maintenance, transportation, storage, or other operations
Risk	A potential event that, should it occur, will have an impact on project objectives, plant operations, safety, health and/or environmental standards
Initial Risk	The risk level or classification posed by the hazard with existing controls in place
Residual Risk	The risk level or classification posed by the hazard with the existing, plus any additional controls and/or mitigation actions in place. In general, sufficient risk controls must be established such that the risk associated with a given hazard is moved into the ‘ALARP’ or ‘Tolerable’ zones of the agreed risk matrix
Risk Criteria	A quantified expression of the level of risk an entity is prepared to tolerate and illustrated on an agreed risk matrix. A tolerable risk level does not mean an acceptable risk level, it indicates a willingness to work/operate with an identified hazard/risk to secure certain benefits, with the provision that the hazard/risk scenario is kept under review and the risk level should be reduced as and when feasible and practical

Term	Description
ALARP	The ALARP principle states that the residual risk of a hazard, after controls and response plans have been implemented, shall be “As Low As Reasonably Practicable”. ALARP is generally achieved when a risk has been made low enough that further efforts to make it any lower would be grossly disproportionate to the incremental benefits gained

5. Workshop Participants

The Hazard 1 Study workshop was attended by multidisciplinary team from Hatch.

Refer to Table 4-1 for the risk workshop attendance register.

Table 5-1: Hazard 1 study attendance register

Attendance Register		
Project Name: NARL Wind to Hydrogen		Project No.: H371912
Date: 28 November 2023		Time: 8:30 – 17:00
Place: Hatch Office – St. John’s NL		Subject: Hazard 1 Study Site Location and Layout Review
Name	**Company**	**Designation**
Jeff Murphy	NARL	Project Manager
Rhonda Hiscock	NARL	
Jamie Beach	NARL	
Ben Elahipanah	Hatch	Process Plant Electrical Lead
Kenneth Bavis	Hatch	Project Manager
Karen Perry	Hatch	Project Engineer
Ethan Ng	Hatch	Process Plant Engineering Manager
Tom Wajda	Hatch	Hydrogen Subject Matter Expert
Martin Hamel	Hatch	Wind Farm Lead
Nevin Smyth	Hatch	Process Lead
Saeed Moradi	Hatch	Risk Manager (Facilitator)

6. Hazard 1 Study Methodology

The Hazard 1 study process (refer to Figure 6-1) is a structured and systematic technique for examining a defined site layout, process system and operational facility. This study

was conducted in accordance with the agreed risk criteria off NARL including the requirements of hatch technical risk guidelines RM-FG-3.

The result of applying this methodology leads to the identification of appropriate risk reduction, mitigation or remedial measures through the knowledge obtained during the risk review workshop. The response plans will either eliminate or reduce the hazard risk level to As Low as Reasonably Practical (ALARP).

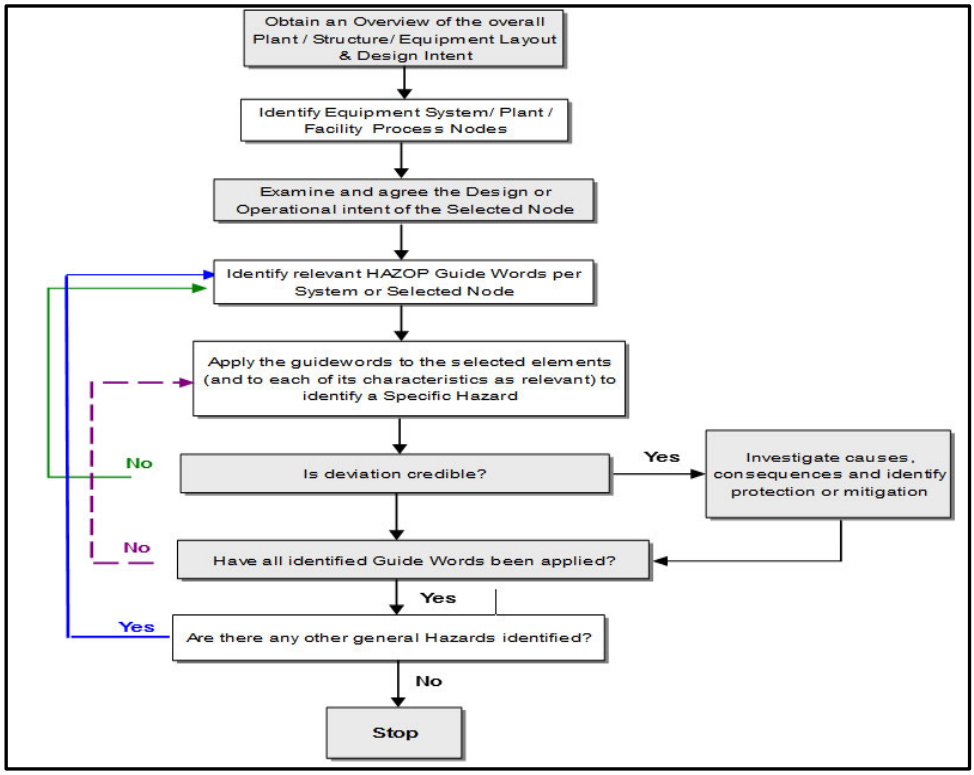

Figure 6-1: Flow Chart of the Risk Review Process

7. Risk Criteria

Risk criteria refers to standards, measures, or expectations used in assessing a given risk in context with strategic goals, the threshold or other decision rules by which the significance of risk is assessed, to determine whether risk treatment actions are required. Risk criteria also relate to a quantified expression of the level of “risk” a company, Individual or a Regulating Body is prepared to tolerate.

These are normally based on regulator or corporate risk appetite, legal or inherent safe design requirements, ethical and social considerations, financial prudence and/or broadly acceptable risk levels within society of what can and cannot be construed as a tolerable level of risk. A tolerable risk level does not mean an acceptable risk level, it indicates a willingness to work/operate with the identified hazards or risks, with the provision that the hazard/risk scenario is kept under review.

Risks are usually measured in terms of likelihood and consequences which, unless a risk is eliminated, will always be non-zero quantities. The ALARP principle dictates that if there are simple or low-cost risk reduction options available, then they should be implemented. It must be stressed that it is not sufficient to just reduce risks to “Tolerable” risk level. It should also be demonstrated that it is “reasonably impracticable” to reduce them any further. The risk level should be reduced as and when feasible and practical to ensure the risk is maintained within the As Low as Reasonably Practicable (ALARP) ranges.

Hazard identified during the risk review workshop were assessed on a qualitative basis using Anglo risk matrix and risk criteria (refer to Figure 7-1, Table 7-1 and Table 7-2) below.

The risk rankings results determined during the risk review workshop did consider the existing controls (standard practices) to be in place and that those included in the design basis of the project.

Probability / Likelihood						
	P - 5	10 Tolerable (Medium)	16 Intolerable (Significant)	20 Intolerable (Significant)	23 Intolerable (High)	25 Intolerable (High)
	P - 4	7 Tolerable (Medium)	12 Tolerable (Medium)	17 Intolerable (Significant)	21 Intolerable (High)	24 Intolerable (High)
	P - 3	4 Broadly Acceptable (Low)	8 Tolerable (Medium)	13 Intolerable (Significant)	18 Intolerable (Significant)	22 Intolerable (High)
	P - 2	2 Broadly Acceptable (Low)	5 Broadly Acceptable (Low)	9 Tolerable (Medium)	14 Intolerable (Significant)	19y Intolerable (Significant)
	P - 1	1 Broadly Acceptable (Low)	3 Broadly Acceptable (Low)	6 Tolerable (Medium)	11 Tolerable (Medium)	15 Intolerable (Significant)
		C - 1	**C - 2**	**C - 3**	**C - 4**	**C - 5**
		Consequences				

Figure 7-1: Risk Matrix used during Hazard Study

Table 7-1: Likelihood/Frequency Table

Rating	Description and Indicative Frequency
5 (Almost Certain)	The unwanted event is almost certain to happen within the Life of Plant. In the case of repetitive/frequent tasks the unwanted event has or will occur in order of one or more times per year. In terms of major events, as also in the case of long term health, environmental or social impacts, it may happen only once in the Life of Plant.
4 (Likely)	There is a high probability that the unwanted event will occur within the Life of Plant. In the case of repetitive/frequent tasks the unwanted event has occurred or is likely to occur in order of less than once per year. In terms of major events, as also in the case of long-term health, environmental or social impacts, it might happen once in the Life of Plant.
3 (Possible)	It is possible that the unwanted event can occur within the Life of Plant. In the case of repetitive/frequent tasks, the unwanted event has occurred or is likely to occur in order of once every 5-10 years. In terms of major events, as also in the case of long-term health, environmental or social impacts, there is a low probability for the event to happen in the Life of Plant.
2 (Unlikely)	There is a low probability for the unwanted event to occur within the Life of Plant. In the case of repetitive/frequent tasks, the unwanted event has occurred sometime or is likely to occur not more than once every 10-20 years. In terms of major events, as also in the case of long-term health, environmental or social impacts, there is a low probability for the event to happen in the Life of Plant.
1 (Rare)	There is a very low probability for the unwanted event to occur within the Life of Plant. In the case of repetitive/frequent tasks there are no records of the event occurring or it is highly unlikely that it will occur within the next 20 years. In terms of major events, as also the case of long-term health, environmental or social impacts, there is a very low probability for the event to ever happen.

Table 7-2: Consequence/Severity Table

Consequence Type	1 - Insignificant	2 - Minor	3 - Moderate	4 - High	5 - Major
Schedule	Less than 1% impact on overall project timeline	May result in overall project timeline overrun equal to or more than 1% and less than 3%	May result in overall project timeline overrun of equal to or more than 3% and less than 10%	May result in overall project timeline overrun of equal to or more than 10% and less than 30%	May result in overall project Timeline overrun of 30% or more
Cost	Less than 1% impact on the overall budget of the project	May result in overall project budget overrun equal to or more than 1% and less than 3%	May result in overall project budget overrun of equal to or more than 3% and less than 10%	May result in overall project budget overrun of equal to or more than 10% and less than 30%	May result in overall project budget overrun of 30% or more
Technical Performance	Minor Difficulties, More than 99.4% of design capacity	97.5 to 99.4% of design capacity	92.5 to 97.5% of design capacity	85 to 92.5% of design capacity	less than 85% of design capacity
Safety	First aid case	Medical treatment case	Lost time injury	Permanent disability or single fatality	Numerous permanent disabilities or multiple fatalities
Image and reputation	Reference to community consultation group, public awareness may exist, but there is no public concern	Adverse news in local media; concerns on performance raised by shareholders, government or the community	Adverse news in state or regional media; decrease in political, shareholder or community support	Damage to corporate reputation at national level; raised in national media; significant decrease in political, shareholder or community support	Damage to corporate reputation at international level; raised in international media; major loss of political; shareholder or community support
Environment	Lasting days or less; affecting small area(meters); receiving environment highly altered with no sensitive habitats and no biodiversity value (e.g., urban / industrial areas).	Lasting weeks; affecting limited area (hundreds of meters); receiving environment altered with little natural habitat and low biodiversity value	Lasting months; affected extended area(kilometers); receiving environment comprising largely natural habitat and moderate biodiversity value	Lasting years; affecting area on sub-basin scale; receiving environment classified as having sensitive natural habitat with high biodiversity value	Permanent impact; affecting area on a whole basin or regional scale; receiving environment classified as highly sensitive natural habitat with very high biodiversity value
Legal & Regulatory	Technical non-compliance. No warning received; no regulatory reporting required	Breach of regulatory requirements; report/involvement of authority. Attracts administrative fine	Minor breach of law; report/investigation by authority. Attracts compensation/ penalties/enforcement action	Breach of the law; may attract criminal prosecution, penalties/ enforcement action. Individual license temporarily revoked	Significant breach of the law. Individual or company lawsuits; permit to operate substantially modified or withdrawn

8. Hazard 1 Study Workshop

The Hazard 1 study workshop is considered an enhancement to evaluate a predefined system, process, infrastructure or facility by using deviations and guide words to identify possible safety, health, environmental, design or operating hazards particularly through a systematic and careful consideration of deviations that may occur.

The steps followed during the risk review workshop are as follows:

1. Copies of facility site layout (aerial map) and process plant layout was distributed amongst all stakeholders.
2. The wind farm location and NARL site selection was then reviewed via the hazard study process as separate “Hazard Nodes”.
3. The “Nodes” were then evaluated applying the hazard study process (refer to Figure 6-1) by discussing the hazards and risks related to the site/equipment location and operational interface hazards that could lead to fatal flaws.
4. Each identified potential deviation was then analysed further in order to determine what control and/or preventative measures were currently in place in order to either mitigate the consequence or probability/likelihood of the potential deviation.
5. The potential deviation was then ranked based on a series of the pre-defined PROBABILITY and CONSEQUENCE tables, of the existing controls in order to determine whether any additional mitigation actions were required for the potential deviation.
6. All potential deviations and hazard scenarios with an initial risk classification of extreme or high, refer to the risk matrix and criteria Figure 7-1 were assigned additional mitigation actions, which were then assigned to a relevant stakeholder.

The hazards were identified in ten different categories including:

1. Material Related Hazards.
2. Environmental (Air pollution, water pollution, solid waste disposal, Noise, Aesthetics, Major spills).
3. Health & Toxicology (Working Environment of Employees).
4. Legal Aspects & External Authorities.
5. Site Selection & Layout (Transport Stages, Existing Plant or Operations, Rare Events).
6. Safety, Health, and Environmental Criteria.
7. Design Guidelines & Codes.
8. Organizational & Human Requirements.
9. Emergency Facilities.

10. Security Aspects.

The following hazard study guidewords were considered relevant and typical for the workshop. The guidewords are aligned with international guidewords for hazard studies and risk reviews. However, any additional guidewords were added during the risk workshop by a team member for a relevant scenario not covered by the generic guidewords listed below.

- Process Materials/Flow Sheets (Are there any hazards during storage/transportation of materials?).
- Process Materials/Flow Sheets (Is there a hazard due to loss of containment?).
- Process Materials/Flow Sheets (What potential fire can occur?).
- Process Materials/Flow Sheets (Is there a potential for violent release of energy/containment?).
- Unit site layout (Is the unit location properly done to minimize exposure to public and workers?).
- Unit site location (What hazardous adjacent facilities are in close range?).
- Unit site location (What external forces or facility could impact the site or equipment location?).
- Unit site location (Are there any civil construction excavation hazards, related to the site location?).
- Unit site layout (Are equipment/buildings located at safe distance regarding fire/explosion impact?).
- Unit site layout (Is there adequate access provided for emergency vehicles?).
- Unit site layout (Are there any transportation road/conveyor/rail, shipping air freight hazards?).
- Unit site location (Any hazards due to high winds, noise, vibration, etc.?).
- Unit site location (Electrical power supply availability for proposed site location?).
- Unit site layout (Any hazards regarding emergency response?).
- Unit site location (Are sufficient utilities e.g., water, raw material available based on site location?).
- Unit site location (Any waste management hazards based on site location?)
- Unit site layout (Any hazards related to falling objects from conveyors, structures in rivers or on public roads, community facilities, etc.?).
- Miscellaneous (Are there any lightening, thunder, heavy rain, hazards based on site location?).
- Miscellaneous (Are there any security hazards due to site or equipment location?).

- Miscellaneous (Environmental and Health hazards).
- Miscellaneous (Legal impact and considerations, etc.?).
- Miscellaneous (Electrical power supply availability for proposed equipment/site location).
- Process and operational interface hazards due to location of facilities/equipment.

9. Hazard 1 Study Nodes

Wind farm and Electrolysis plant Site selection were considered as two separate hazard "Nodes" for the NARL Wind to Hydrogen Project and it was reviewed during the risk workshop. These nodes were agreed by the hazard workshop participants during a multidisciplinary group session.

10. Risk Review Results

The risk review workshop specifically addressed the proposed location of the infrastructures and facilities as contained to the aerial map view and plant layout (Appendix D).

A total of 16 hazards were identified and recorded in hazard register. By applying qualitative risk evaluation techniques, risk mitigation actions were recommended for risk scenarios with a risk classified of significant or high, which resulted in a total of 9 recorded risk mitigation actions. Refer to Appendix D for detail Hazard register.

Risk mitigation based on international guidelines was recommended with the following order of preference, which may be subject to cost - benefit analysis where appropriate:

- Elimination of hazard.
- Substitution of the hazard with a less hazardous equipment, material and/or processes.
- Reduction of risk through engineering/design controls (e.g., guarding, active/ passive fire protection, isolation systems, etc.).
- Reduction of risk true personal protective equipment.
- Reduction of risk through administrative controls (e.g., safe works procedures, pictograms, signs, emergency procedures, training, etc.).
- Reduction of risk through behavioral controls (e.g., reliance on awareness of hazards and personal judgment regarding actions to reduce the associated risks).

10.1 Parking Lot

Four parking lot items were identified during the study for further discussion out of the workshop, as following:

- [redacted] electrolyzer cabinets are rated for harsh coastal environment, and therefore, the requirement for a weather enclosure was not

investigated during Pre-FEED. It is recommended that this be further reviewed during FEED.

- The consequences of Leak of H_2 to the glycol cooling cabinet needs to be studied.
- Seismic and flood need to be studied in the design basis.
- Material selection is ongoing as a part of the design based on the existing standards.

11. Conclusion

There was a total of 16 hazards identified and recorded in the Hazard study register.

By applying qualitative risk evaluation techniques, wherever it was possible based on the team's judgment, 10 mitigation actions were recommended for risk scenarios, refer to summary list in Appendix B and for detail Hazard study register refer to Appendix C.

Considering the following Hazard study 2 (HAZID) and Hazard study 3 (HAZOP) which will be right after this study, the risks with significant and high rankings need to be addressed thoroughly and further reviewed to determine whether they require further risk mitigation and to evaluate and validate the effectiveness of the proposed mitigation.

Appendix A
Attendance Sheet

Client: NARL
Project: NARL Green Energy Hub
11/28/2023

HAZID Workshop Participants

Name	Initials	Organization	14.28.2023
Karen Perry	KP	HATCH	11.28.2023
MARTIN HAMEL	MH	HATCH	"
Nevin Smyth	NES	HATCH	"
Ethan Ng	EN	HATCH	" "
Tom Wajcle.	TW.	HATCH	"
Ken Bavis	KB	Hatch.	— " —
JEFF MURPHY		NARL	— " —
RHONDA HISCOCK	PP	NARL	— " —
JAMIE BEACH	PP	NARL	— " —
Ben Elahipanah (PM)	KP PP	HATCH	— " —
Maria Blake (AM)	KP PP	" "	" "
Jason Yetman (AM)	KP PP	" "	" "

Appendix B
Proposed Mitigation Actions

Proposed Mitigation Actions and Responsibilities

Hazard Number	Hazard	Proposed Mitigation Action	Action Responsibility
Wind Farm			
1.01	Spills of oil on the ground	Absorbent pads and industry standard spill kits	Hatch
2.03	Visual impacts of the turbines	Engage with public	NARL
5.01	Hazards in transporting wind turbines parts regarding the traffic	Road & traffic management plan Safer design for the access roads	Hatch
5.02	Icing and freeze on the blades and towers	De-icing system for the blades	Hatch
5.05	Heavy liftings in a congested area	Ealy engagement of specialized contractor for crane work	NARL
6.02	Falling objects from height	Engage with local educational institutions to have special training programs	NARL
6.03	Working at heights	Engage with local educational institutions to have special training programs	NARL
Electrolysis Plant			
1.04	Glycol spills	Spill kit	Hatch
6.01	Liquid transformers explosion	Firewalls between the transformers and the equipment Preventive instrumentation on the transformers Using proper design standards in transformer construction	Hatch
6.02	Lift truck collision	Jersey barriers between the transformers and the passage	Hatch
End of the List			

Appendix C
Hazard 1 Study Register

Project: **NARL Wind to Hydrogen Project**

Preliminary Hazard Analysis
Electrolysis Plant

Hazard No.	Deviation		Hazard	Possible & Credible Cause	Likely & Credible Consequences	Existing Safeguards	C1	L1	Initial Risk Rating With Safeguards		Consequence Rating Based On	Preventative or Corrective Action	Responsible Person For Action	Target Date
1	Material Related Hazards													
1.01	**Process Materials & Flow Sheets {Are there any hazards during storage/ transportation of materials?}**		N2 is needed for purging and maintenance. No issues of concern.						#N/A	#N/A				
1.02	**Process Materials & Flow Sheets {Are process materials compatible?}**		Material selection is ongoing as a part of the design based on the existing standards.	Embrittlement and corrosion considerations.					#N/A	#N/A				
1.03	**Process Materials & Flow Sheets {Is there a hazard due to loss of containment?}**		Explosion/fire due to H2 leak	Leak of H2 in the electrolysers	Concentrate of H2 in the electrolyser cabinet and explosion	1.The cabinets have fans that exchange the air and ventilate to dilute the H2 2. RPM sensors on the fans Interlock between RPM on the fans and electrolyser operation 3. The electrolysers are not enclosed	**4**	**1**	**11**	**Short Term**	H&S	ALARP		
1.04	**Process Materials & Flow Sheets {Is there a hazard due to loss of containment?}**		Glycol spills	Leak of Glycol from cooling cabinet	Glycol is irritant however it does not have high temperature. Environmental impacts	Interlocks between systems to shutdown in case of overheat.	**2**	**2**	**5**	**No Action**	Env	Spill kit	Hatch	
1.05	**Process Materials & Flow Sheets {What provisions are made to prevent runaway reaction?}**		No issues of concern.						#N/A	#N/A				
1.06	**Process Materials & Flow Sheets {What potential fire can occur, is there a fire philosophy in place?}**		In case of fire the entire system will be dispersed. No issues of concern.						#N/A	#N/A				
2	Environmental	Air pollution, water pollution, solid waste disposal, Noise, Aesthetics, Major spills												
2.01	**Miscellaneous {Are there any waste management or environmental hazards?}**		No issues of concern						#N/A	#N/A				
3	Health & Toxicology (Working Environment of Employees)													
3.01	**Site or Equipment layout {Is the unit location properly done to minimize exposure to public and workers?}**		No issues of concern						#N/A	#N/A				
4	Legal Aspects & External Authorities													
4.01	Miscellaneous {Legal impact and considerations based on process flow data and site location?}		No issues of concern						#N/A	#N/A				
5	Site Selection & Layout													
Transport Stages														
5.01	Process Materials & Flow Sheets {Are there any hazards during storage/ transportation of materials?}		Fire water wet pipes are located underground and the above ground is a dry system with heat tracing.						#N/A	#N/A				
5.02	Process Materials & Flow Sheets {Are there any hazards during storage/ transportation of materials?}		Fire water pump fuel tanks contain diesel. Double walled tanks. No reactions. No issues of concern.						#N/A	#N/A				
Existing Plant or Operations														
5.03	Site or Equipment layout {Is the unit location properly done to minimize exposure to public and workers?}		Design the setbacks based on standard and guidelines						#N/A	#N/A				
5.04	Site or Equipment layout {What hazardous adjacent facilities are in close range?}		Reirrigated butane in Braya facilities	Braya is storing large amount of butane and it imposes explosion and fire hazards to the plant	Refer to the Consequence analysis study.				#N/A	#N/A				
5.05	Unit site location {What external forces or facility could impact the site location?}		Sulphur pile will be removed. For other concerns refer to consequence analysis.						#N/A	#N/A				
Rare Events														
5.06	Miscellaneous {Are there any static, lightening, thunder, heavy rain, hazards?}		Seismic activities, Flood, hurricanes will be studied in design basis. Refer to parking lot item 3.						#N/A	#N/A				
5.07	Miscellaneous {Are there any static, lightening, thunder, heavy rain, hazards?}		Based on Munich RE report Lightning hazards is low in the area. No issues of concern.						#N/A	#N/A				

Project: **NARL Wind to Hydrogen Project**

Preliminary Hazard Analysis
Electrolysis Plant

Hazard No.	Deviation		Hazard	Possible & Credible Cause	Likely & Credible Consequences	Existing Safeguards	C1	L1	Initial Risk Rating With Safeguards		Consequence Rating Based On	Preventative or Corrective Action	Responsible Person For Action	Target Date
5.08	Process Materials & Flow Sheets {What potential fire can occur, is there a fire philosophy in place?}		Fire detection system and preliminary fire philosophy are in place.						#N/A	#N/A				
6	Safety, Health and Environmental Criteria													
6.01	**Site or Equipment layout {Is the unit location properly done to minimize exposure to public and workers?}**		Liquid transformers explosion	Overheating, design flaws, internal failure	Damage to the nearby equipment Operators may get hurt up to have fatality	Permitted access to the transformer areas	4	1	11	Short Term	H&S	Provisions to consider Firewalls between the transformers and the equipment Preventive instrumentation on the transformers Using proper design standards in transformer construction	Hatch	
6.02	**Equipment layout {Is sufficient equipment accessibility provided for installation and maintenance?}**		Lift truck collision	Tight pass ways between electrolyser limits the vision and movement of the lift truck	Collision with the equipment or people on the plant if it is a live operation the driver may be electrocuted	Permit work system to restrict vehicle access to the electrolyser area	4	2	14	Short Term	H&S Perf.	Jersey barriers between the transformers and the passage	Hatch	
7	Design Guidelines & Codes													
7.01	**Process Materials & Flow Sheets {Is the size of drains, sumps. vents, relief valves, flares, etc. adequate?}**		Hazardous area classification is not done yet.						#N/A	#N/A				
8	Organizational & Human Requirements													
8.01	Miscellaneous {Are there any hazards regarding operation, training / competency of personnel?}		No issues of concern.						#N/A	#N/A				
9	Emergency Facilities													
9.01	Equipment layout {Is there adequate access provided for emergency vehicles?}		No issues of concern.						#N/A	#N/A				
10	Security Aspects													
10.01	Miscellaneous {Confined space entry, congestion, equipment movement, heavy vehicles, etc.}		The facility is required to be compliant with transport Canada Marine Security regulations. No issues of concern.						#N/A	#N/A				

Project: **NARL Wind to Hydrogen Project**

Preliminary Hazard Analysis
Wind Farm

Hazard No.	Deviation		Hazard	Possible & Credible Cause	Likely & Credible Consequences	Existing Safeguards	C1	L1	Initial Risk Rating With Safeguards		Consequence Rating Based On	Preventative or Corrective Action	Responsible Person For Action	Target Date
1	Material Related Hazards													
1.01	**Process Materials & Flow Sheets {Are there any hazards during storage/ transportation of materials?}**		N2 is needed for maintenance. No issues of concern.	Drops of oil from the turbines	The oil can be washed by rain and penetrates to the soil	None at the moment	2	2	5	No Action	Environment	Absorbent pads and industry standard spill kits	Hatch	
1.02	**Process Materials & Flow Sheets {Is there a hazard due to loss of containment?}**		Oil leaks inside the turbine	Parts malfunction and mechanical failure	The platform and ladders will be slippery and may leads to trip and fall of the operator	Operators are equipped with the proper PPE	2	2	5	No Action	H&S	ALARP		
1.03	**Process Materials & Flow Sheets {What potential fire can occur, is there a fire philosophy in place?}**		Fire in the turbines	1Overheating in the turbine 2.Electrical sparks 3. Lightning	Loss of equipment Fire may cause injuries to the operators	Specific training for the operators Fire extinguisher The operator gets signal in the control room	1	2	2	No Action	Per	ALARP		
2	Environmental													
2.01	**Equipment layout {Any hazards due to high winds, noise, vibration, etc.?}**		Noise from the wind turbines	Blades may produce annoying noise for the surrounding residential areas	Poor Public perception	Design to keep the safe set backs (2 km)	1	5	10	Medium Term	Env.	ALARP		
2.02	**Site or Equipment layout {Is the unit location properly done to minimize exposure to public and workers?}**		Blades may hit the flying birds in the area	Kills the flying birds	Poor Public perception	Environmental assessment and environmental monitoring	1	5	10	Medium Term	Env.	ALARP		
2.03	**Equipment layout {Any hazards due to high winds, noise, vibration, etc.?}**		Visual impacts of the turbines	Blades may cause visual disruption for the people living in the area	Visual annoyance	None at the moment	2	3	8	Medium Term	Reputation	Engage with public	NARL	
3	Health & Toxicology (Working Environment of Employees)													
3.01	**Site or Equipment layout {Is the unit location properly done to minimize exposure to public and workers?}**		No Issues of concern.						#N/A	#N/A				
4	Legal Aspects & External Authorities													
4.01	Miscellaneous {Legal impact and considerations based on process flow data and site location?}		No Issues of concern.						#N/A	#N/A				
5	Site Selection & Layout													
Transport Stages														
5.01	Process Materials & Flow Sheets {Are there any hazards during storage/ transportation of materials?}		Hazards in transporting wind turbines parts regarding the traffic	Road network logistic limitation No detours for the access roads Climate conditions in the area (wind, fog,...) Large components need to be transported at night due to lighter traffic	1.Heavy equipment may break the road 2.Traffic disruption 3. Parts can drop off and cause damages or hurt people 4. Lower vision of the transportation team may leads to incidents	None at the moment	5	4	24	Immediate	H&S	Road & traffic management plan Safer design for the access roads	Hatch	
5.02	Equipment layout {Are there any transportation road/conveyor/rail, shipping air freight hazards?}		Icing and freeze on the blades and towers	Weather conditions including fog, freezing rains and wind	Equipment damage Ice fall may leads to injuries for the operators	Large setbacks for the turbine	2	4	12	Short Term	Perf.	De-icing system for the blades	Hatch	
5.03	Equipment layout {Is there adequate access provided for emergency vehicles?}								#N/A	#N/A				
5.04	Miscellaneous {Confined space entry, congestion, equipment movement, heavy vehicles, etc.}		Some tasks need to be done inside the turbines and blades eighter during the construction and maintenance		No consequences of concern.				#N/A	#N/A				
5.05	Miscellaneous {Confined space entry, congestion, equipment movement, heavy vehicles, etc.}		Heavy liftings in a congested area	Huge cranes are required to installing and moving the parts Job site congestion High winds in the jobsite	Collisions Injuries to workers/operators Equipment damage	Work plans	4	2	14	Short Term	H&S	Ealy engagement of specialized contractor for crane work	NARL	
Existing Plant or Operations														
5.06	Site or Equipment layout {What hazardous adjacent facilities are in close range?}		Crossing with other power lines addressed in the Project Risk Register						#N/A	#N/A				
5.07	Unit site location {Are there any civil construction excavation hazards, related to the site location?}		Blasting of rock surface	To install the turbines in the rocks need to be blasted using the explosives	Blasting operations study will be done the next phase. No major consequences of concern at this point.				#N/A	#N/A				

Project: **NARL Wind to Hydrogen Project**

Preliminary Hazard Analysis
Wind Farm

Hazard No.	Deviation		Hazard	Possible & Credible Cause	Likely & Credible Consequences	Existing Safeguards	C1	L1	Initial Risk Rating With Safeguards		Consequence Rating Based On	Preventative or Corrective Action	Responsible Person For Action	Target Date
Rare Events														
5.08	Miscellaneous {Are there any static, lightening, thunder, heavy rain, hazards?}		Lightning damage to the wind turbine	Lightning	Equipment damage	Design precautions for lightning protection system Grounding	1	2	2	No Action		ALARP		
6	Safety, Health and Environmental Criteria													
6.01	**Site or Equipment layout {What hazardous adjacent facilities are in close range?}**		The electrical equipment are designed as per design standards and guidelines. No issue of concerns.						#N/A	#N/A				
6.02	**Miscellaneous {Any hazards due to falling objects from conveyors, hoppers, bins, etc.?}**		Falling objects from height	Falling tools of the operators during the construction and operation	Falling objects may case serious injuries	Proper PPE Specific trainings	3	2	9	Medium Term	H&S	Engage with local educational institutions to have special training programs	NARL	
6.03	**Equipment layout {Any hazards due to high winds, noise, vibration, etc.?}**		Working at heights	Workers need to work at heights inside and outside the turbines	Trip and fall from height may case fatalities	Proper PPEs Specific Trainings and certifications (e.g. GWO)	4	1	11	Short Term	H&S	Engage with local educational institutions to have special training programs	NARL	
7	Design Guidelines & Codes													
7.01	**Process Materials & Flow Sheets {Is the size of drains, sumps. vents, relief valves, flares, etc. adequate?}**		No issues of concern at this point.						#N/A	#N/A				
8	Organizational & Human Requirements													
8.01	Miscellaneous {Are there any hazards regarding operation, training / competency of personnel?}		No issues of concern at this point.						#N/A	#N/A				
9	Emergency Facilities													
9.01	Equipment layout {Is there adequate access provided for emergency vehicles?}		Emergency plan is in place. All turbines have access. Emergency vehicles can be escorted by the site supervisors. No issues of concern.						#N/A	#N/A				
10	Security Aspects													
10.01	Miscellaneous {Confined space entry, congestion, equipment movement, heavy vehicles, etc.}		No issues of concern.						#N/A	#N/A				

Appendix D
Aerial Map View and Equipment Layout Drawing Nodes

DWG. No. H371912-0000-203-251-0001

SITE NORTH
TRUE NORTH
2.96°

SSW/SW
PREVAILING WIND

138kV SUBSTATION

U/G ELECTRICAL CABLE

WATER RESOURCE FOR ELECTROLYSIS PLANT

U/G WATER P/L

25m R

H2 VENT STACK

EXISTING ACCESS ROAD

ELECTROLYZER AREA

ELECTRICAL SERVICES (120mX100m)

OFFICE AND PARKING (100mX60m)

U/G ELECTRICAL CABLE

FW PUMP AREA

WAREHOUSE

ACCESS ROAD

PIPERACK/ CABLE RACK

SWITCH GEAR (TYP)

EXISTING SULPHUR DOCK

COME BY CHANCE REFINERY

RETURN WATER & HYDROGEN TAKEOFF

Notes:

1. PRELIMINARY LAYOUT, TO BE CONFIRMED UPON RECEIPT OF FINAL VENDOR EQUIPMENT SIZING.
2. ELECTRICAL SERVICES AND OFFICE LOCATION, TO BE FURTHER CONFIRMED AFTER CIVIL GRADING CHECK IS COMPLETED.
3. U/G WATER P/L ROUTING INDICATINVE AT THIS STAGE. TO BE CONFIRMED WITH CLIENT, BASED ON ACTUAL TIE-IN TO EXISTING WATER SUPPLY LINE.
4. H2 VENT STACK LOCATION TO BE CONFIRMED IN NEXT PHASE BASED ON DISPERSION MODELING.
5. THE 138/34.5 kV SUBSTATION WILL BE LOCATED IN NORTHERN PARCEL OF LAND.
6. OVERHEAD vs UNDERGROUND TRANSMISSION LINE ROUTING TO BE CONFIRMED.
7. WIND FARM TRANSMISSION LINE ROUTING TO BE CONFIRMED.
8. PRELIMINARY LAYOUT FOR PURPOSE OF COST ESTIMATE. LOCATION MAY CHANGE BASED ON DETAILED EQUIPMENT INFORMATION, FINAL GRADE AND EQUIPMENT SPACING STUDIES.
9. GRAVEL ACCESS TO TRANSFORMERS AND STAMPS OFF FROM ACCESS ROAD.

LEGEND:

CURRENT SCOPE

EXPANSION ALLOWANCE

PRELIMINARY

NOT FOR CONSTRUCTION

0 20 40 60 80 100
1:2000 SCALE IN METRES

DRAWING No.	DRAWING TITLE				
REFERENCE DRAWINGS					

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REG. PROFESSIONAL

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REVISIONS

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ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	BIR KHANGURA	NR	2023/11/01
DESIGNER	BIR KHANGURA	NR	2023/11/01
CHECKER	TOMASZ ZAPALSKI		2023/11/15
DESIGN COORD.	N/A		
RESP. ENG.	SMYTH NEVIN	Smyth, Nevin	2023/11/15
LEAD DISC. ENG.	SMYTH NEVIN	Smyth, Nevin	2023/11/15
ENG. MANAGER	NG ETHAN		2023/11/15
PROJ. MANAGER	KENNETH BAVIS	Bavis, Kenneth	2023/11/15

DRAWING APPROVAL STATUS: ISSUED FOR CLIENT REVIEW

North Atlantic

NORTH ATLANTIC REFINING CORP.
NARL GREEN ENERGY HUB

ELECTROLYSIS PLANT
SITE LOCATION PLAN

SCALE 1:2000 OR AS NOTED

DWG. No. H371912-0000-203-251-0001

REV A

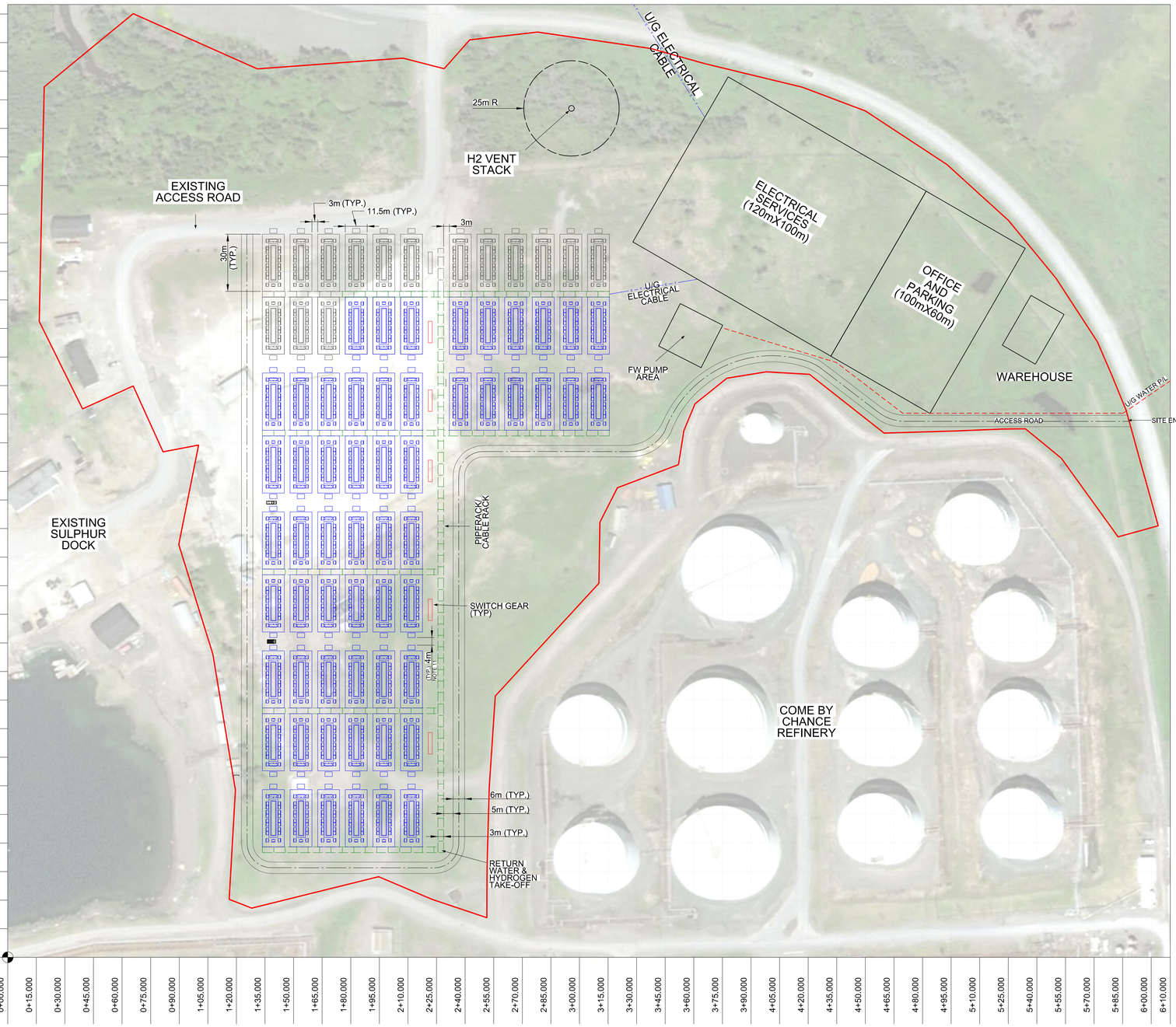
SHEET SIZE: A1

$USERNAME$
$DATE$
$FILE$
$TIME$

DWG. No. H371912-0000-203-251-0002

SITE NORTH
TRUE NORTH
2.96°

SSW/SW
PREVAILING WIND



SITE LOCATION PLAN
SCALE NTS

Notes:

1. DIMENSIONS AND CO-ORDINATES ARE IN METERS.
2. GRAYED OUT EQUIPMENT AND PIPERACK SPACE IS FUTURE SCOPE.
3. PRELIMINARY LAYOUT, TO BE CONFIRMED UPON RECEIPT OF FINAL VENDOR EQUIPMENT SIZING.
4. ELECTRICAL SERVICES AND OFFICE LOCATION, TO BE FURTHER CONFIRMED AFTER CIVIL GRADING CHECK IS COMPLETED.
5. U/G WATER P/L ROUTING INDICATINVE AT THIS STAGE, TO BE CONFIRMED WITH CLIENT, BASED ON ACTUAL TIE-IN TO EXISTING WATER SUPPLY LINE.
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8. OVERHEAD vs UNDERGROUND TRANSMISSION LINE ROUTING TO BE CONFIRMED.
9. WIND FARM TRANSMISSION LINE ROUTING TO BE CONFIRMED.
10. PRELIMINARY LAYOUT FOR PURPOSE OF COST ESTIMATE. LOCATION MAY CHANGE BASED ON DETAILED EQUIPMENT INFORMATION, FINAL GRADE AND EQUIPMENT SPACING STUDIES.
11. GRAVEL ACCESS TO TRANSFORMERS AND STAMPS OFF FROM ACCESS ROAD.

LEGEND:

CURRENT SCOPE

EXPANSION ALLOWANCE

PRELIMINARY

NOT FOR CONSTRUCTION

0 25 50 100 200
1:1250 SCALE IN METRES

NAME			
SIGNATURE			
ENG REG NUMBER			
REVISION DATE			
ORIGINAL DATE			
DRAWING No.	DRAWING TITLE		
REFERENCE DRAWINGS		REG. PROFESSIONAL	

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A	ISSUED FOR CLIENT REVIEW	BSK	TAZ	2023/11/15

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HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	BIR KHANGURA	NR	2023/11/01
DESIGNER	BIR KHANGURA	NR	2023/11/01
CHECKER	TOMASZ ZAPALSKI		2023/11/15
DESIGN COORD.	N/A		
RESP. ENG.	SMYTH NEVIN	Smyth, Nevin	2023/11/15
LEAD DISC. ENG.	SMYTH NEVIN	Smyth, Nevin	2023/11/15
ENG. MANAGER	ETHAN NG	EN	2023/11/15
PROJ. MANAGER	KENNETH BAVIS		2023/11/15

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NORTH ATLANTIC REFINING CORP.
NARL GREEN ENERGY HUB

ELECTROLYSIS PLANT
PLOT PLAN

SCALE	DWG. No.	REV
1:1250 OR AS NOTED	H371912-0000-203-251-0002	A

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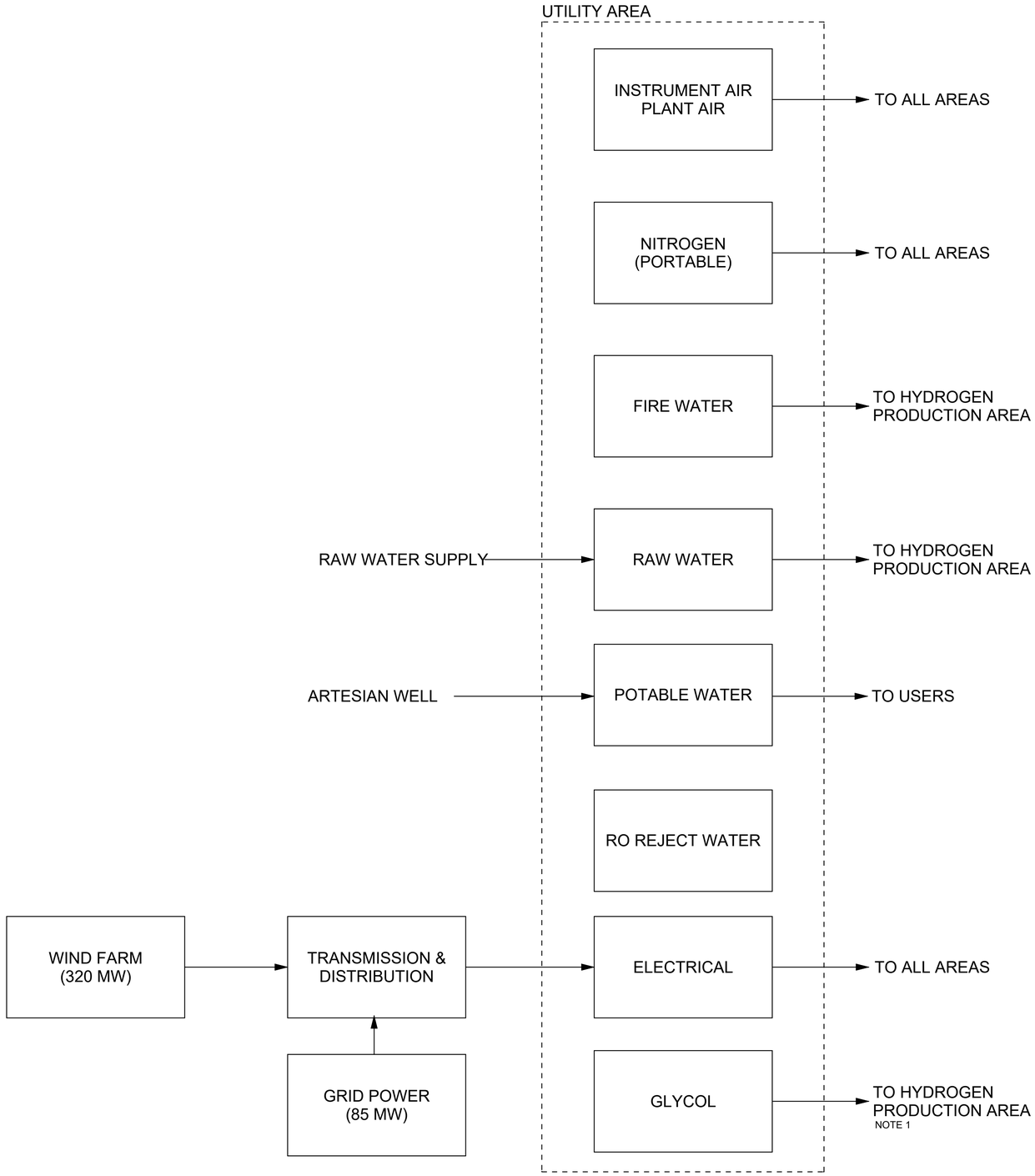
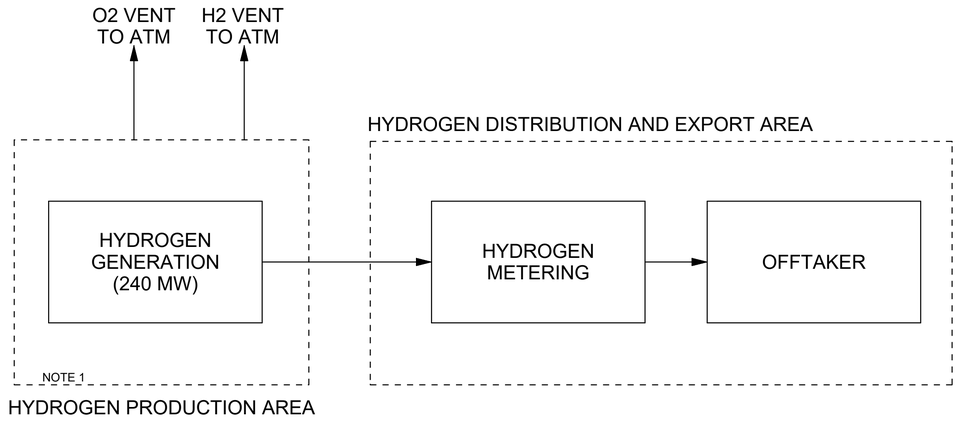
$DATES
$FILES





PRELIMINARY

NOT FOR CONSTRUCTION

NOTES:

1. GLYCOL COOLING IS INCLUDED WITHIN THE HYDROGEN PRODUCTION PACKAGE.

DRAWING No.	DRAWING TITLE
REFERENCE DRAWINGS	

NAME
SIGNATURE
ENG REG NUMBER
REVISION DATE
ORIGINAL DATE
REGISTERED PROFESSIONAL

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A	CLIENT REVIEW	C.P.	T.J.	11-15-2023

REVISIONS

HATCH

ROLE	NAME	SIGNATURE	DATE
DESIGNER	L. YEPES	NR	
CHECKER	C. PEREZ		
DESIGN COORD.	B. ZAMBON		
RESP.ENG	T. WAJDA		
ENG.CHECKER			
LEAD DISC. ENG.	N. SMYTH		
ENG. MANAGER	E. NG		
PROJ. MANAGER			

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North Atlantic

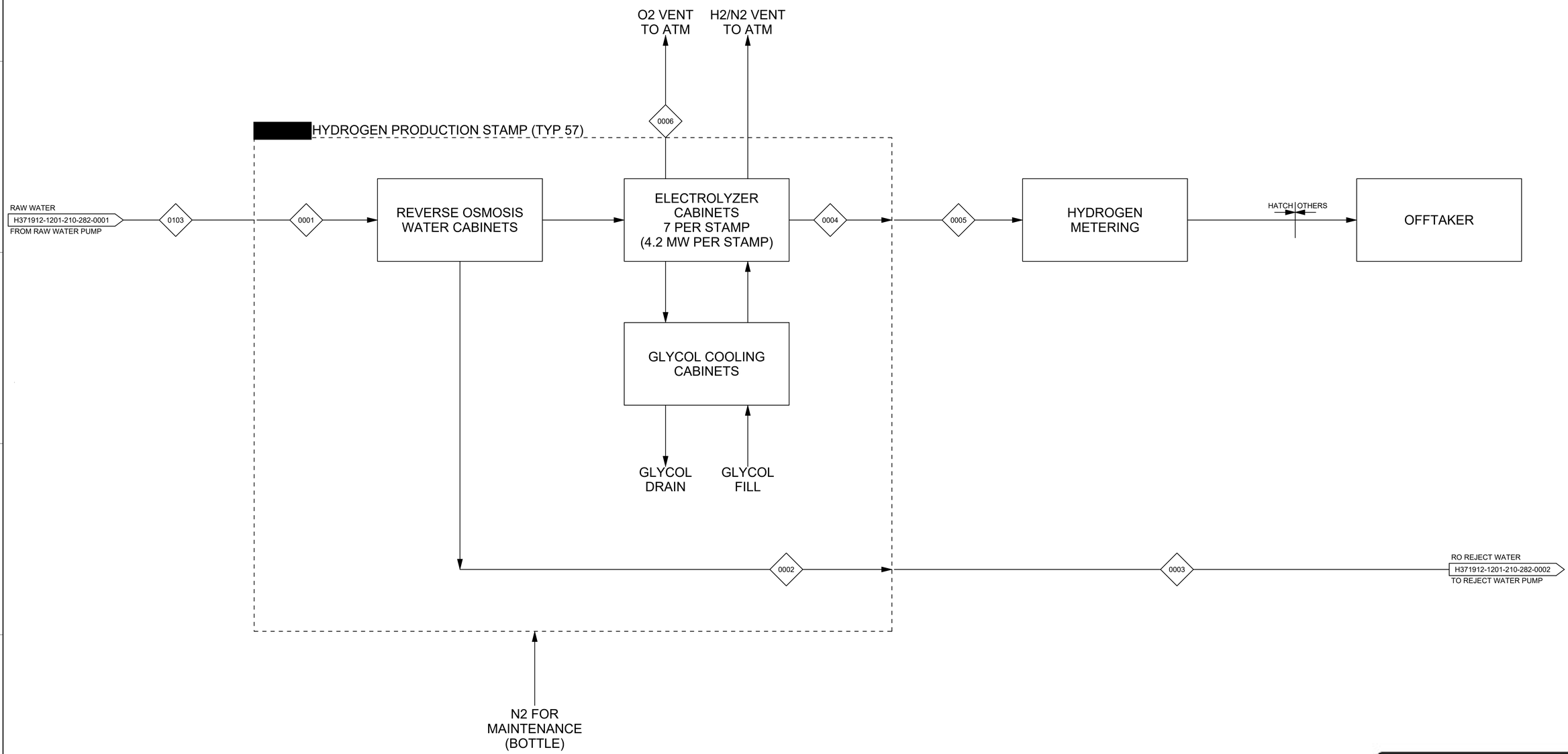
NARL GREEN ENERGY HUB
NORTH ATLANTIC REFINING CORP

GENERAL
OVERALL FACILITY
BLOCK FLOW DIAGRAM

SCALE NTS OR AS NOTED

DWG No. H371912-1000-210-252-0001

REV A



PRELIMINARY

NOT FOR CONSTRUCTION

		NAME							DESIGNER	L. YEPES	NR		HATCH	North Atlantic	
		SIGNATURE							CHECKER	C. PEREZ			NARL GREEN ENERGY HUB		
		ENG REG NUMBER							DESIGN COORD.	B. ZAMBON			NORTH ATLANTIC REFINING CORP		
		REVISION DATE							RESP.ENG	T. WAJDA			HYDROGEN GENERAL		
		ORIGINAL DATE							ENG.CHECKER				HYDROGEN PLANT		
									LEAD DISC. ENG.	N. SMYTH			PROCESS FLOW DIAGRAM		
									ENG. MANAGER	E. NG					
									PROJ. MANAGER						
			A	CLIENT REVIEW	C.P.	N.S.	11-15-2023								
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