Technical and Locational Potential of Atlantic Canada's Offshore Wind Resource

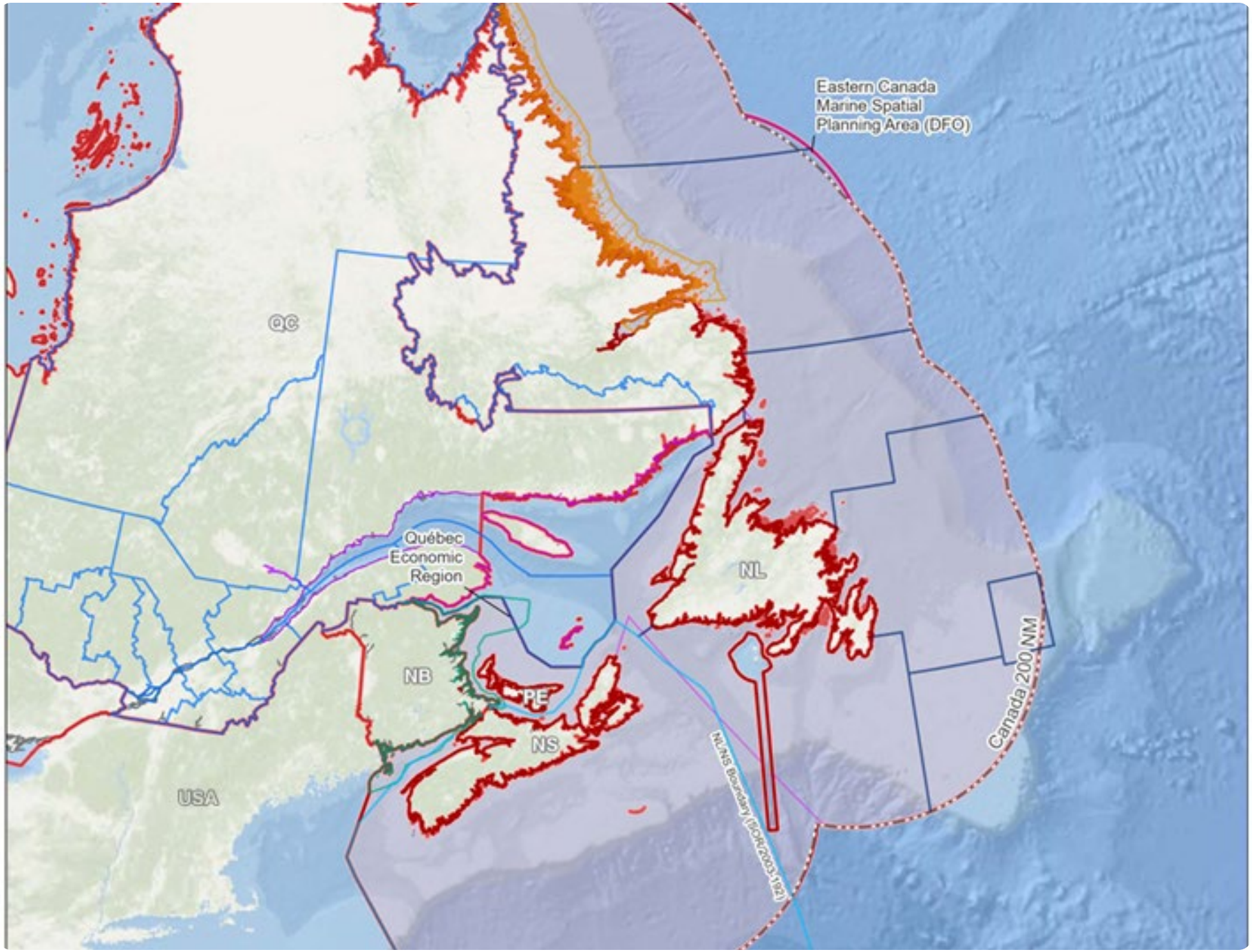
Stantec

Agenda

1. Why This Study Matters
2. The Challenge
3. Methodology
4. Wind Resource Modeling
5. Lessons in Collaboration
6. Preliminary Results
7. Integration with Grid Modeling
8. What’s Next

Why This Study Matters?

- First offshore wind potential study of this size in Canada
- 4 provinces, over 1.5 million sq km
- Multi-year, multi-partner project
- Essential first step for future OSW development
- Foundation for policy, investment, and project siting



This presentation covers phase 2 of three study phases

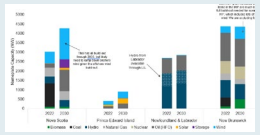
Offshore wind portfolios

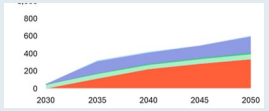
Hourly outputs & costs

Phase 1: Market Opportunity

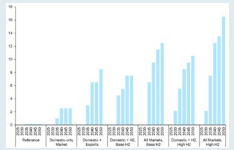
Define **policy** and **resource** assessment

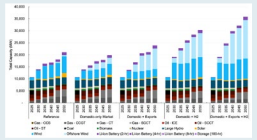
Identify potential **domestic**, **export** & **hydrogen** offshore wind export opportunity





Identify **offshore wind targets** aligned with assessments and develop resource portfolios

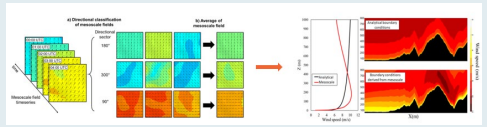




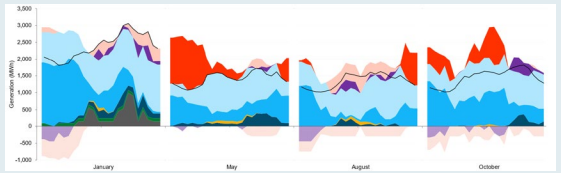
Iterative with subsequent phases

Phase 2: Resource Potential

Characterize the OSW **technical, locational, and economic potential** across provinces



Perform **hourly operational modeling** with unit commitment and dispatch

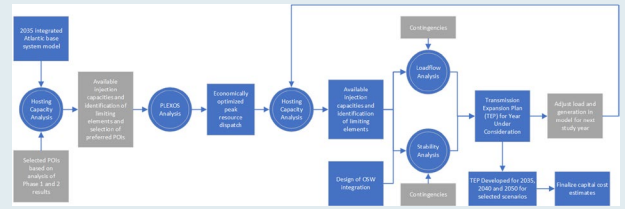


Create **public database & visual graphic interface** for developers

Phase 3: Grid Integration

Detailed **operational modeling** of transmission system needs and **points of interconnection**

Identify **transmission costs** to integrate offshore wind



Create **final coordinated transmission solutions to enable offshore wind**

Synthesize three phases into **final Roadmap and Action Plan** & final **Data Visualization**

Offshore wind potential & shapes

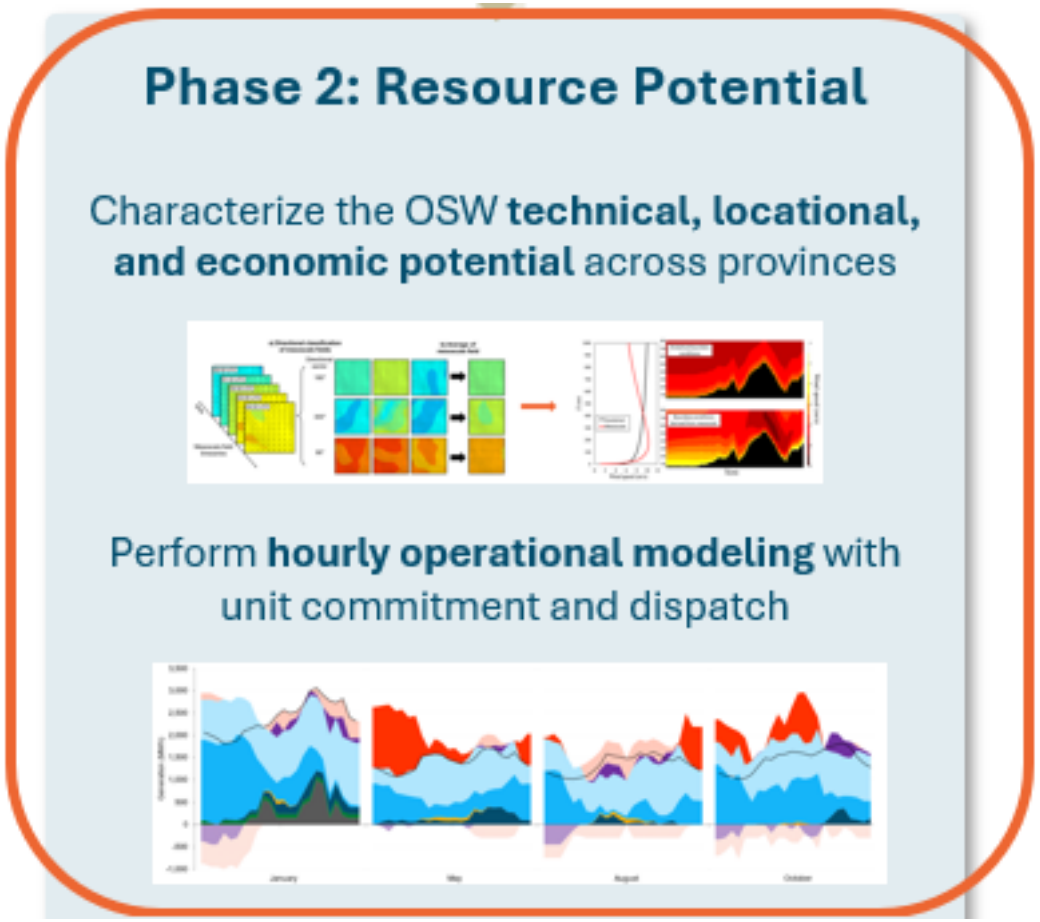
Updated costs & operational constraints from power flow modeling

Objective of Phase 2

Characterize the Offshore Wind (OSW) resource potential of Atlantic Canada with a focus on Technical and Locational Potential to support future energy development.

Key Goals:

- Assess the *Technical* Potential → Wind Resource & Energy Production
- Assess the *Locational* Potential → Feasibility considering environmental, technical, and regulatory constraints
- Identify areas suitable for *Fixed* and *Floating* technologies
- Develop high-resolution wind resource mapping
- Provide technical inputs for grid integration and economic modeling



The Challenge

Limited offshore met data

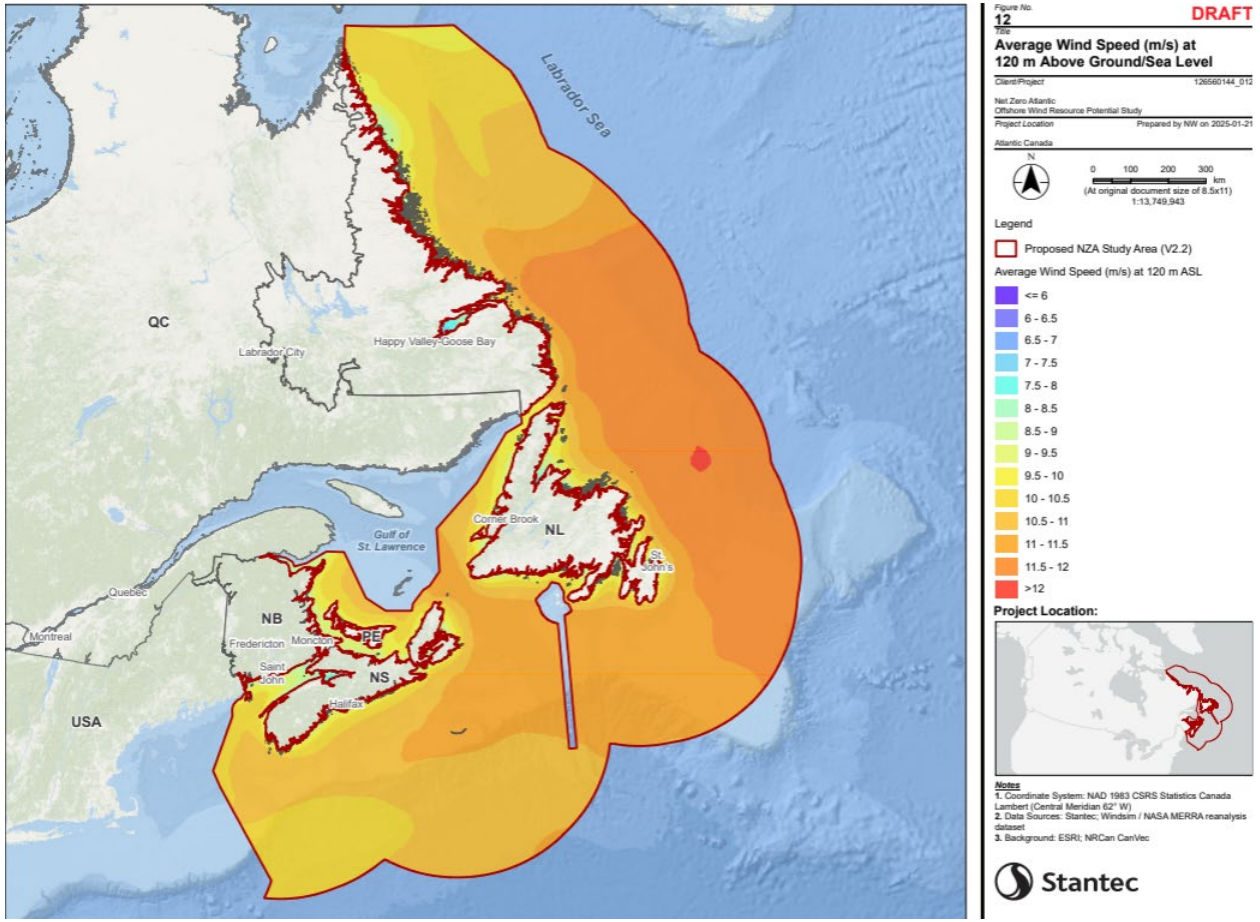
No previous roadmap for a study of this scale

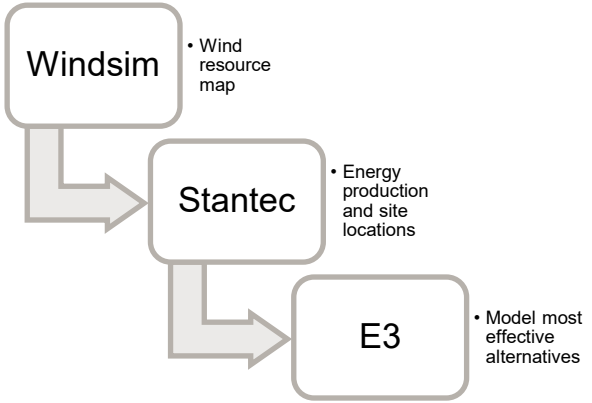
Identifying constrains and POI's

Wind Turbine Power Specifications

Harsh Environmental Conditions

Methodology Overview





- Define and refine study area
- Identify primary and secondary constraints
- Determine fixed vs floating potential
- Model wind resource using WRF and CFD - WindSim
- Create grid of potential development areas
- Group results in clusters for future modeling

Strategy:

- Iterative mapping
- Refine feasible areas step-by-step
- Iterative modeling

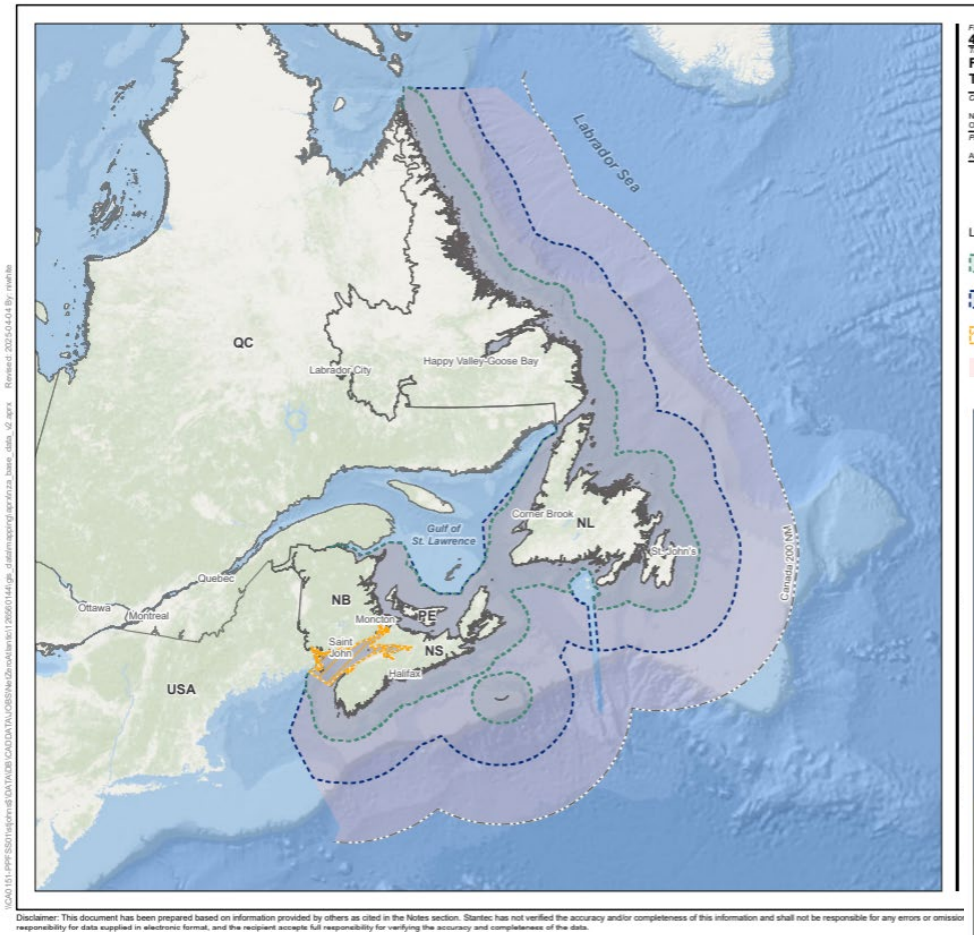


Figure No. 4 **DRAFT**

Title
Fixed/Floating Platform Technical Development Limits

Client/Project 126560144_004

Net Zero Atlantic Offshore Wind Resource Potential Study

Project Location — Prepared by NW on 2025-01-21

Atlantic Canada

N

0 100 200 300 km
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Legend

- Fixed Platform Technical Development Limit (70 km)
- Floating Platform Technical Development Limit (195 km)
- Bay of Fundy Tidal Area (Approximate)
- Proposed NZA Study Area (V2.2)

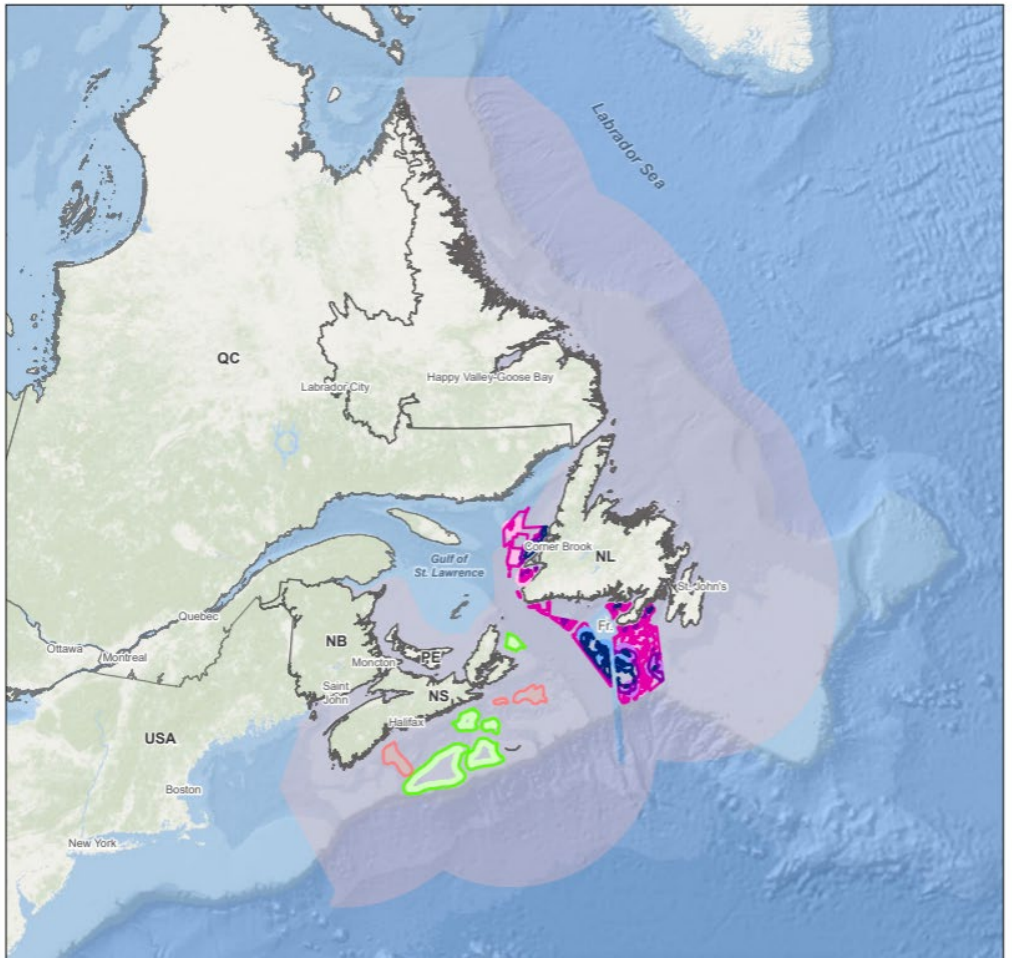

Figure No. 15 **DRAFT**

Title
Proposed Offshore Wind Development and Licensing Areas

Client/Project 126560144_015

Net Zero Atlantic Offshore Wind Resource Potential Study

Project Location — Prepared by NW on 2025-01-21

Atlantic Canada

N

0 100 200 300 km
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Legend

- Proposed NZA Study Area (V2.2)

Potential Development Areas (Nova Scotia OSW RA)

- Tier 1
- Tier 2

Preliminary Offshore Wind Licensing (NL OSW RA)

- Depth up to 60m / profondeur jusqu'à 60 m
- Depth between 60-80m / profondeur entre 60 et 80 m
- Depth between 80-300m / profondeur entre 80 et 300 m

Project Location:

Notes
1. Coordinate System: NAD 1983 CSRS Statistics Canada Lambert (Central Meridian 62° W)
2. Data Sources: Stantec; IAAC; Committee for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador; Commit
3. Background: ESRI; NRCan CanVec

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Area Name	Area (sq. km)
Study Area Boundary	1,563,285
Technical Development Limit Fixed (70 km)	453,045
Technical Development Limit Floating (195 km)	940,327

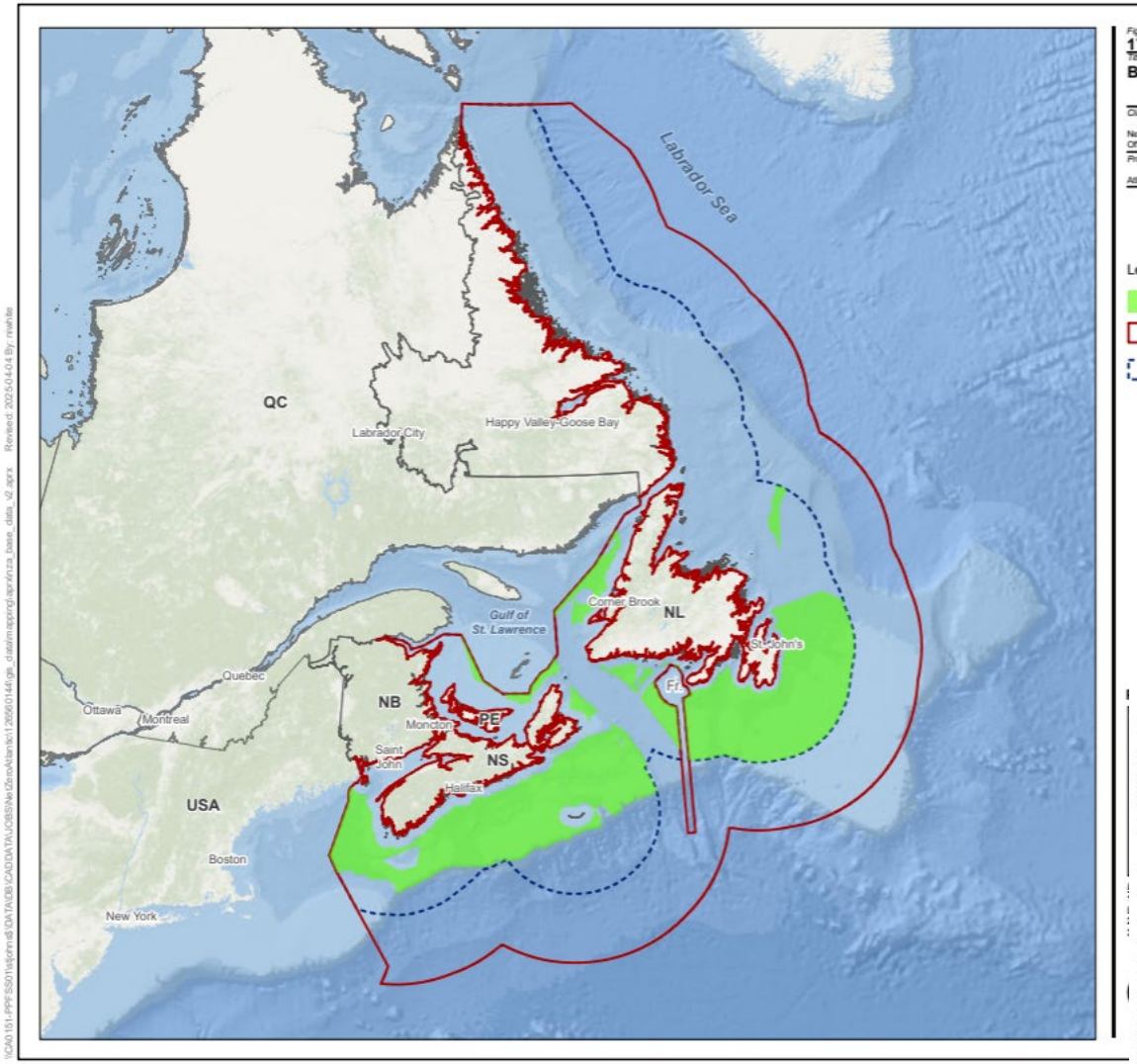

Figure No. 17 — DRAFT

Title: Buildable Area - Floating Platform

Client/Project: 126560144_017

Net Zero Atlantic Offshore Wind Resource Potential Study

Project Location: Atlantic Canada

Prepared by NW on 2025-03-31

N

0 100 200 300 km

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Legend

- Buildable Area - Floating Platform (V4)
- Proposed NZA Study Area (V2.2)
- Floating Platform Technical Development Limit (195 km)

Area Name	Area (sq. km)
Buildable Area Fixed	6,377
Buildable Area Floating	280,959

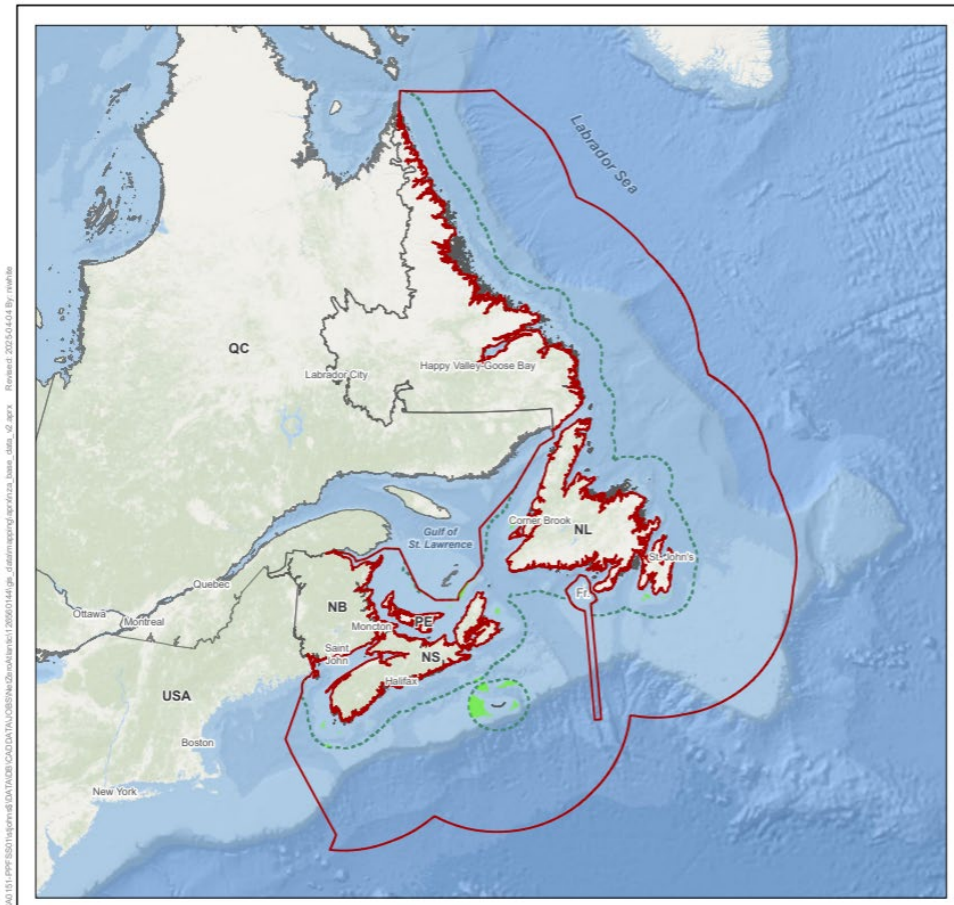

Figure No. 16 — DRAFT

Title: Buildable Area - Fixed Platform

Client/Project: 126560144_016

Net Zero Atlantic Offshore Wind Resource Potential Study

Project Location: Atlantic Canada

Prepared by NW on 2025-03-31

N

0 100 200 300 km

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Legend

- Buildable Area - Fixed Platform (V4)
- Proposed NZA Study Area (V2.2)
- Fixed Platform Technical Development Limit (70 km)

Project Location:

Notes
1. Coordinate System: NAD 1983 CSRS Statistics Canada Lambert (Central Meridian 62° W)
2. Data Sources: Stantec; Fisheries and Oceans Canada
3. Background: ESRI; NRCan CanVec

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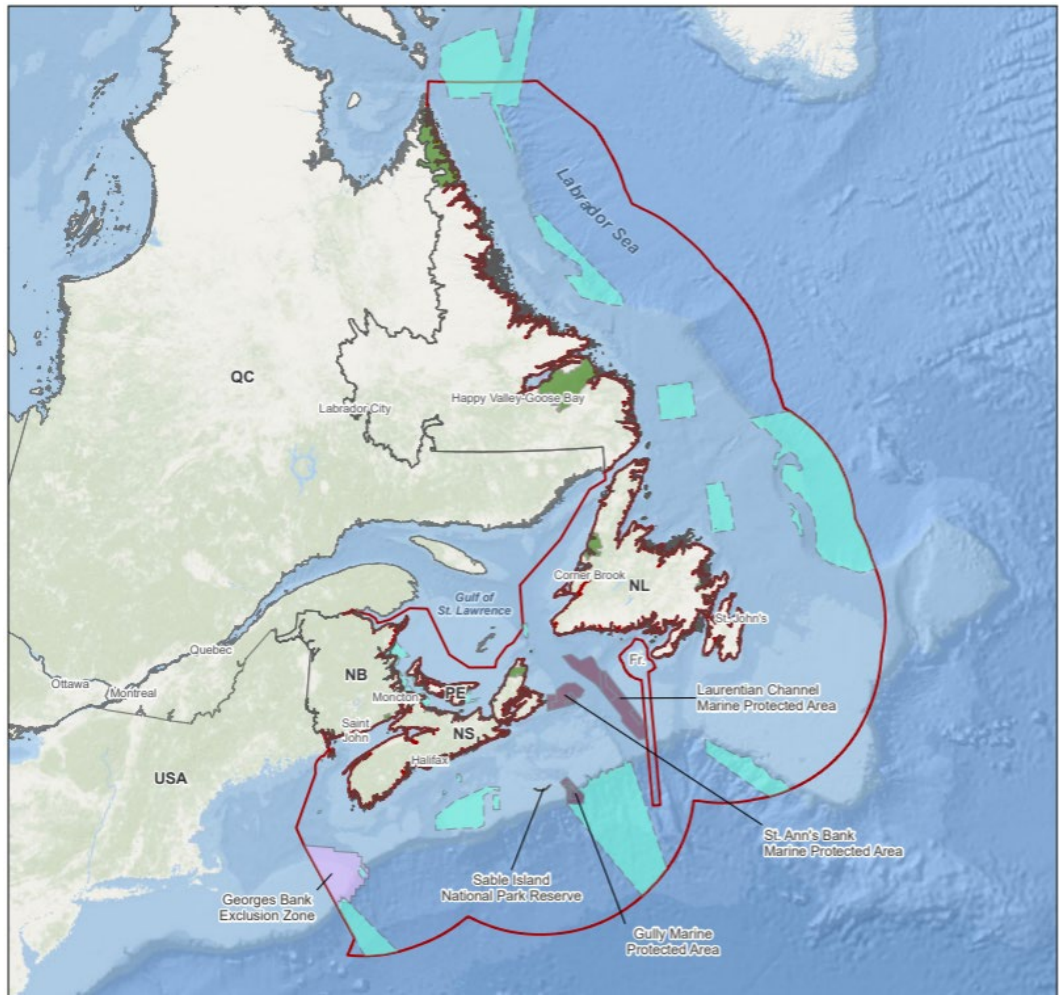
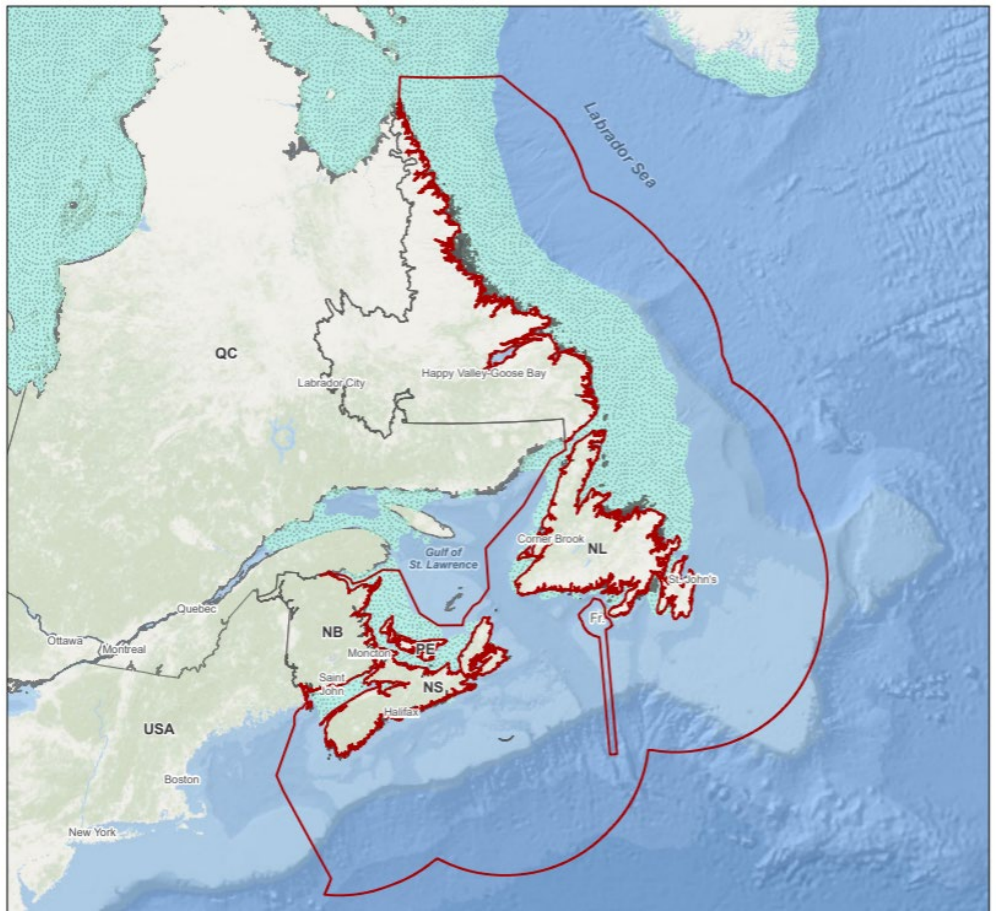
Mapping Constraints – Defining Feasible Offshore Wind Areas

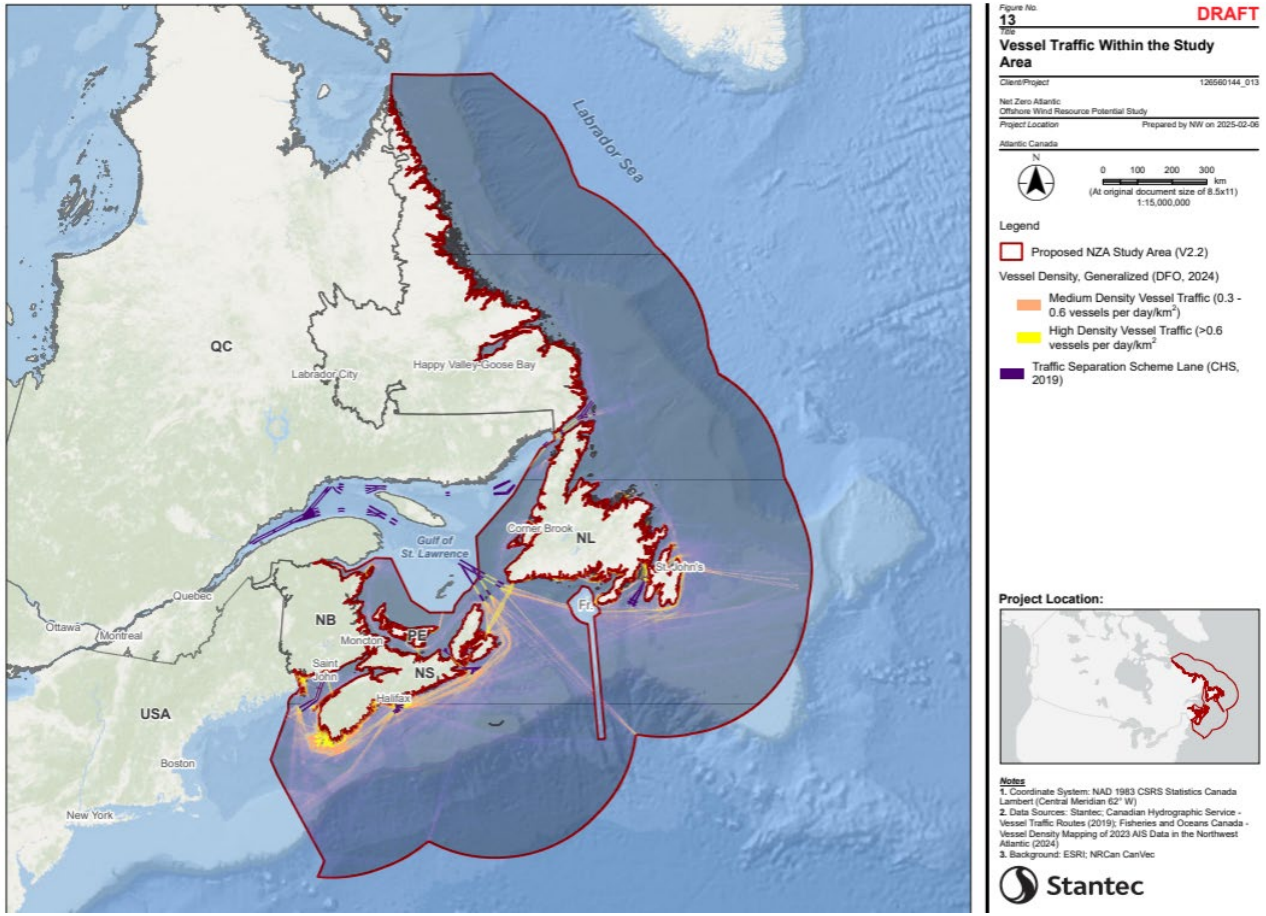
Key Constraint Categories Considered:

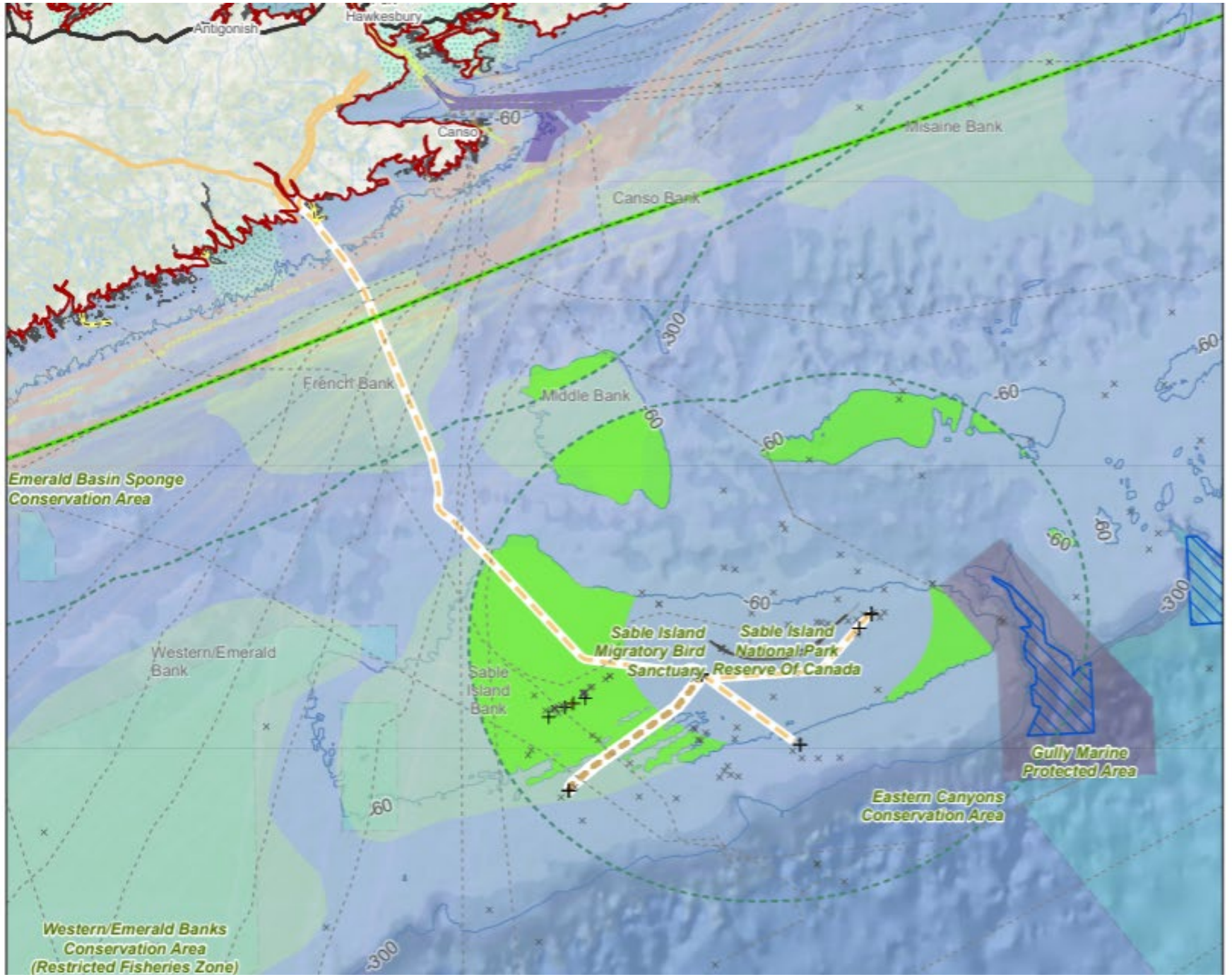
- *Environmental & Ecological Areas*
- *Critical Habitats for Species at Risk*
- *Bathymetry & Ice Conditions*
- *Marine Use & Navigation*
- *Infrastructure & Development Zones*



Mapping Constraints – Defining Feasible Offshore Wind Areas







Net Zero Atlantic
Offshore Wind Resource Potential Study

Project Location — Prepared by NW on 2025-03-31

Atlantic Canada

N

0 10 20 30 km
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Legend

- Buildable Area - Fixed Platform (Stantec)
- Potential Development Areas (Nova Scotia OSW RA)
- Proposed NZA Study Area (V2.2)
- Fixed Platform Technical Development Limit (70 km)

Critical Habitat for Aquatic Species at Risk
- Northern Bottlenose Whale

Protected and Conserved Areas
- Marine Protected Area
- Migratory Bird Sanctuary
- National Park
- Other Effective Area-Based Conservation Measure

Offshore Wells
- Gas well
- Injection well
- Abandoned/Suspended Wellhead

Offshore Infrastructure
- Subsea Cables (Active)
- Subsea Cables (Inactive)
- EXA Express (formerly Hibernia Express) Subsea Cable
- Abandoned Subsea Pipelines (SOEP, Deep Panuke)

Onshore Infrastructure
- Highway
- Onshore Pipeline

Vessel Traffic
- Traffic Separation Scheme Lane (CHS, 2019)
- Medium Density Vessel Traffic (0.3 - 0.6 vessels per day/km²)
- High Density Vessel Traffic (>0.6 vessels per day/km²)

Other Features
- Bathymetry Contour
- Sea Ice Extent 2023 (NSIDC)

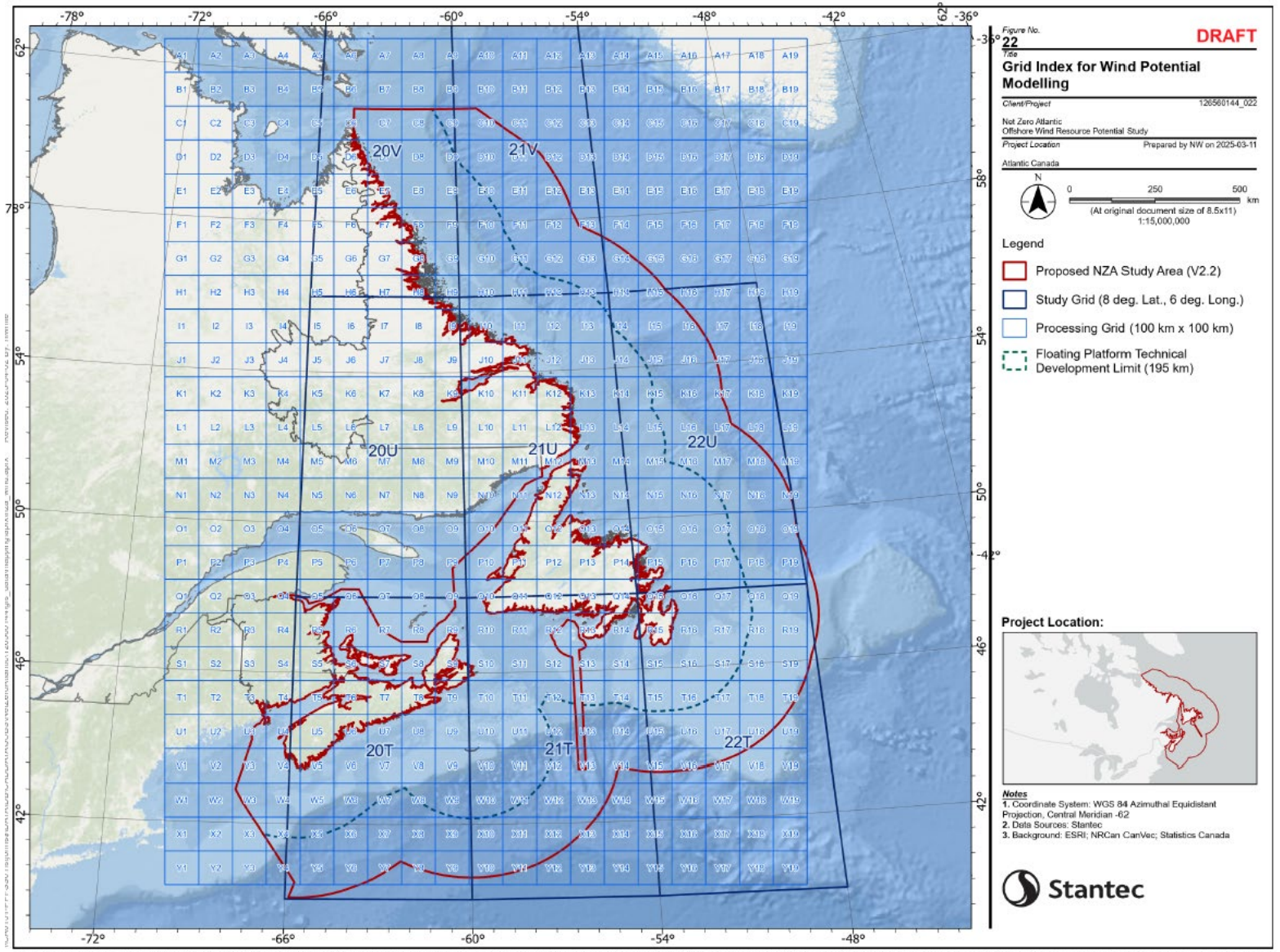
Project Location:

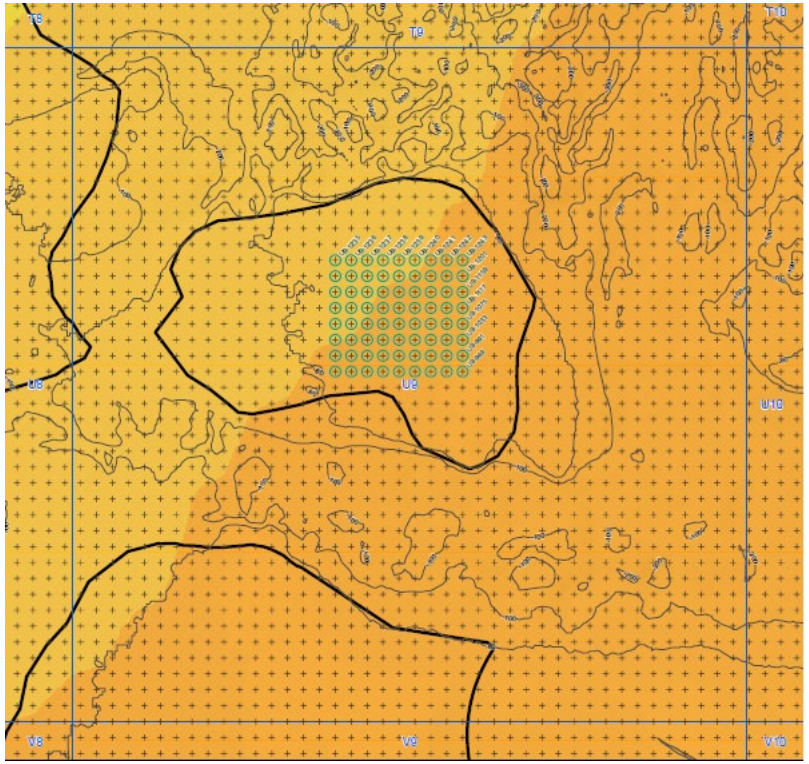
Notes

1. Coordinate System: NAD 1983 CSRS Statistics Canada Lambert (Central Meridian 62° W)

2. Data Sources: Stantec; Fisheries and Oceans Canada - Critical Habitat for Aquatic Species at Risk (2016), Vessel Density Mapping of 2023 AIS Data in the Northwest Atlantic (2024); Environment and Climate Change Canada, Canadian Wildlife Service; Canada - Nova Scotia Offshore Energy Regulator; TeleGeography Submarinecablemap.com; NSIDC (National Snow and Ice Data Center); Statistics Canada

3. Background: ESRI; NRCan CanVec; GEBCO 2024



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P.E.I.
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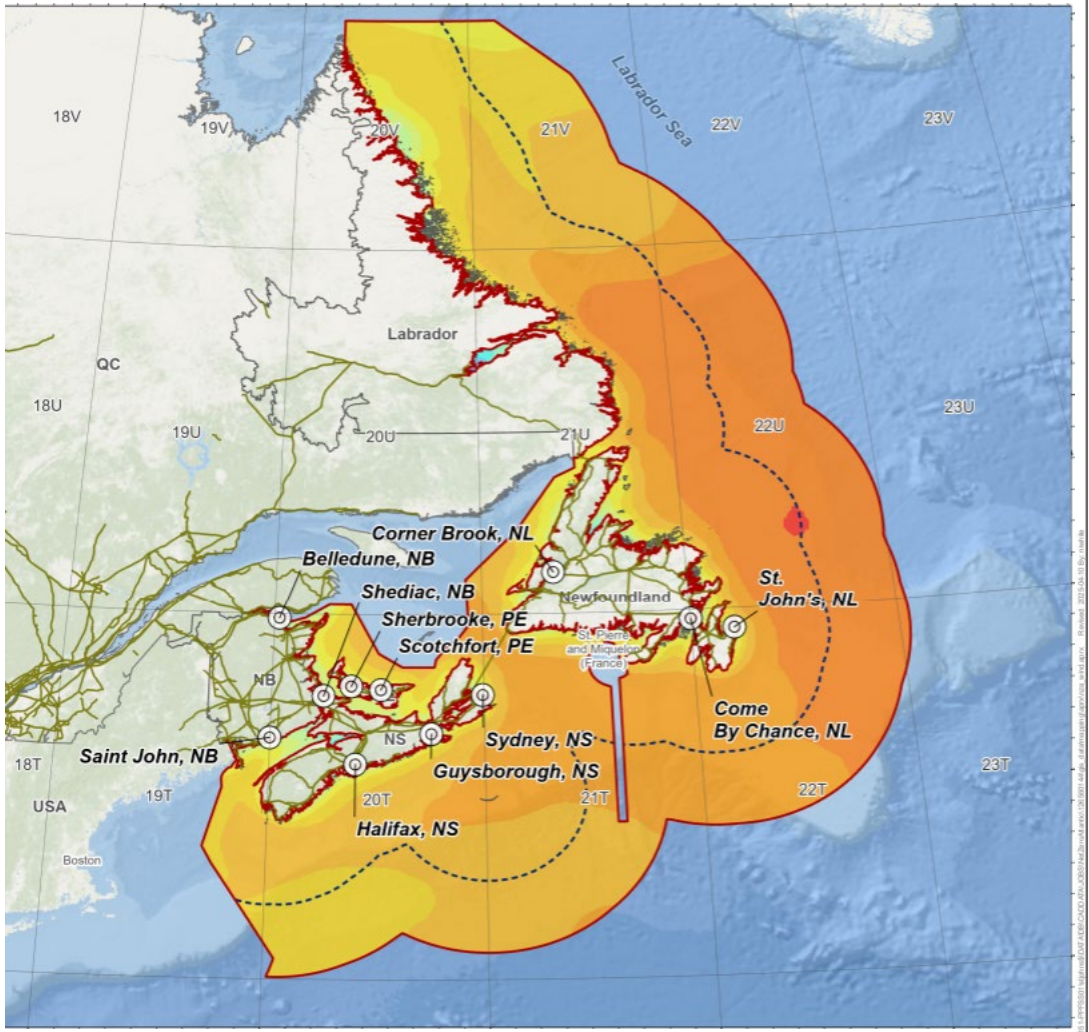
Labrador Sea
18V
19V
20V
21V
22V
23V
Labrador
QC
18U
19U
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21U
22U
23U
Corner Brook, NL
Belledune, NB
Shediac, NB
Sherbrooke, PE
Scotchfort, PE
Newfoundland
St. John's, NL
Come By Chance, NL
NB
NS
Saint John, NB
Sydney, NS
Guysborough, NS
Halifax, NS
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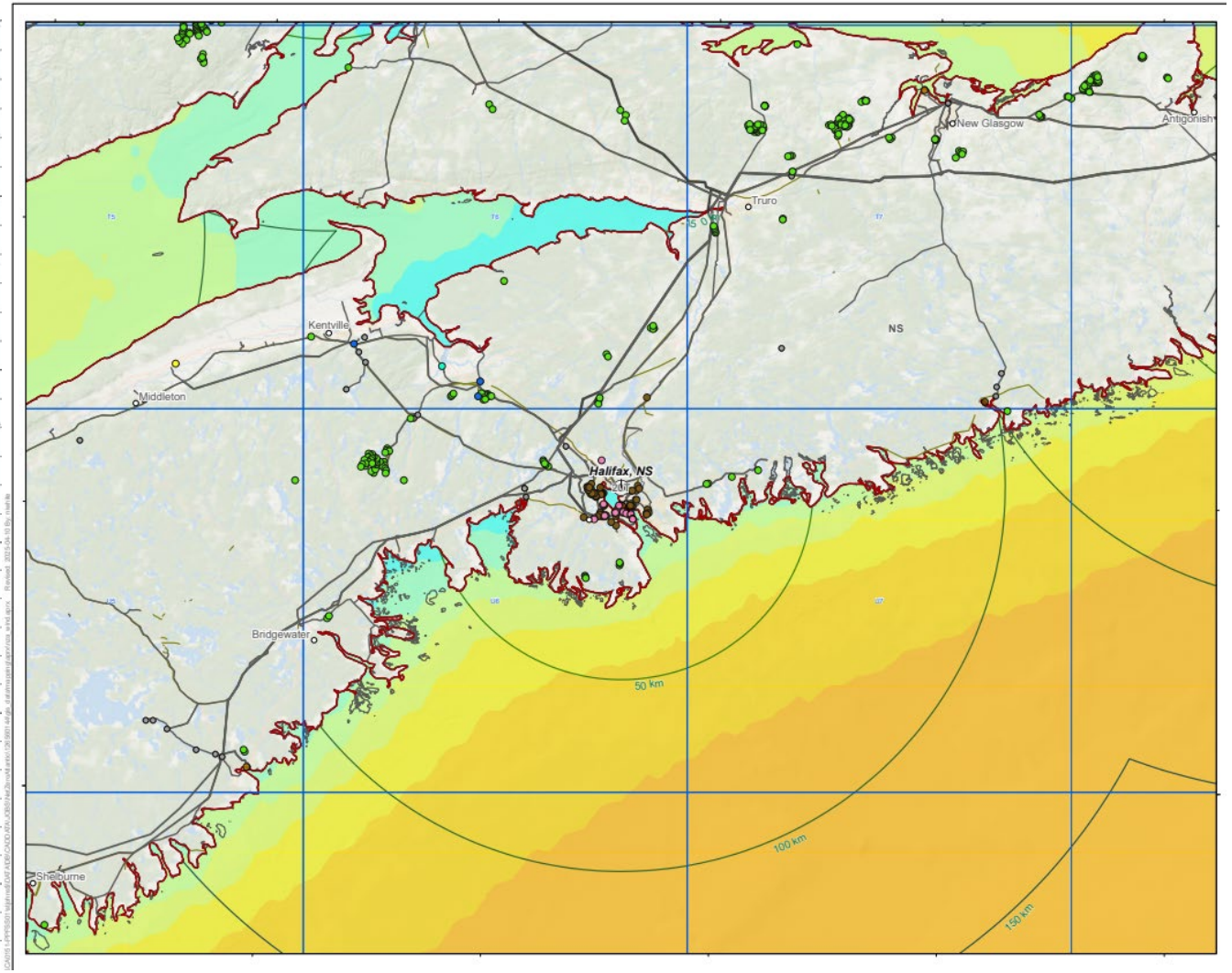
USA
Boston


New Glasgow
Antigonish
Truro
Kentville
Middleton
NS
Halifax, NS
Bridgewater
Shelburne
50 km
100 km
150 km

Modeling the Wind Resource

Dual Approach:

- WRF mesoscale modeling at 9x9 km resolution
- WindSim CFD microscale modeling at 1x1 km resolution
- Focused on hub heights 80m and 120m
- Time resolution of 5 minutes over 3 years
- Lifted available met mast data
- Validated against global datasets

Table 2-10 Climatology characteristics including average wind speed (m/s) for all sectors, Weibull shape (k) and scale (A) parameters for all sectors

File name	transfer_ref001_W8205092_80m		
Period, # records	01/01/2019 00:00 - 01/01/2020 00:00	8747	
Position: easting, northing, z (agl)	459281.7	4941946.5	80.0
Average wind speed, Weibull k, A	6.65	1.81	7.57

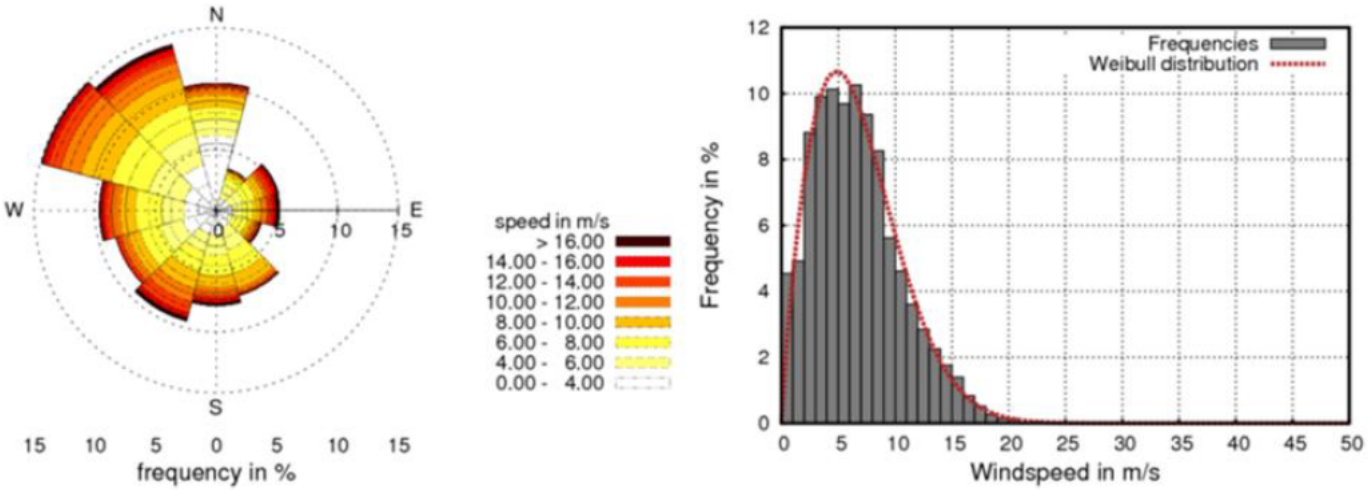


Figure 2-6 Wind rose (left) and frequency distribution with Weibull fitting (right) for all sectors

Table 2-11 Average wind speed, frequency and Weibull shape (k) and scale (A) parameters versus sectors

	1	2	3	4	5	6	7	8	9	10	11	12
Average wind speed (m/s)	3.93	5.61	7.71	7.91	6.65	6.40	6.90	7.83	5.95	6.72	7.33	6.94
Frequency (%)	10.44	3.52	5.34	5.25	3.88	7.24	7.83	9.41	8.54	9.60	14.87	14.08
Weibull shape, k	1.17	2.28	1.62	1.72	1.97	2.33	1.67	1.99	1.87	1.94	2.23	1.84
Weibull scale, A	4.41	6.26	8.26	8.82	7.59	7.25	7.62	8.92	6.69	7.58	8.25	7.80

Lessons in Collaboration & Problem Solving

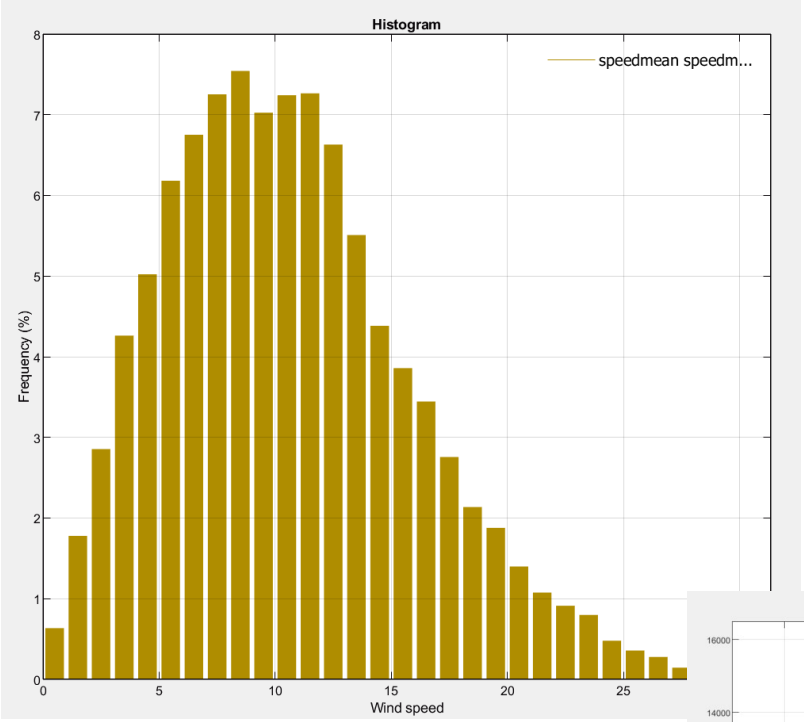
A detail no one thought would be a problem:
Getting the data from WindSim to Stantec to Public Availability

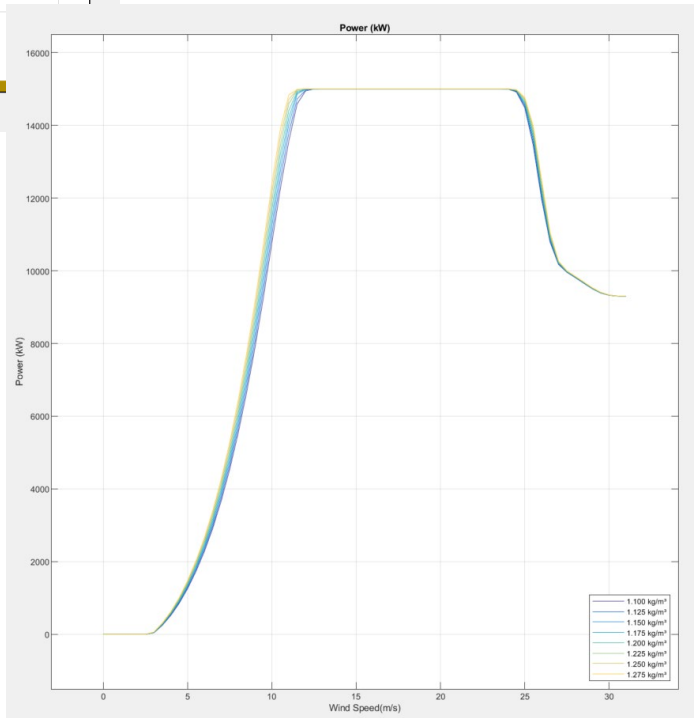
- Original WindSim dataset size: 56 TB
- Needed to transfer to Stantec for analysis
- Became a major project bottleneck
- Required coordination from both teams
- Creative solutions to compress, package, and transfer
- Final size: ~20 TB
- Still ongoing — real teamwork in action

Preliminary Results

Wind Farm in Zone 20T:

- Installed Capacity: 1080 MW ~ 1 GW
- Gross Capacity Factor: 63.88%
- Net Capacity Factor: **49.42%**
- Net Annual Energy Production: ~4,675 GWh

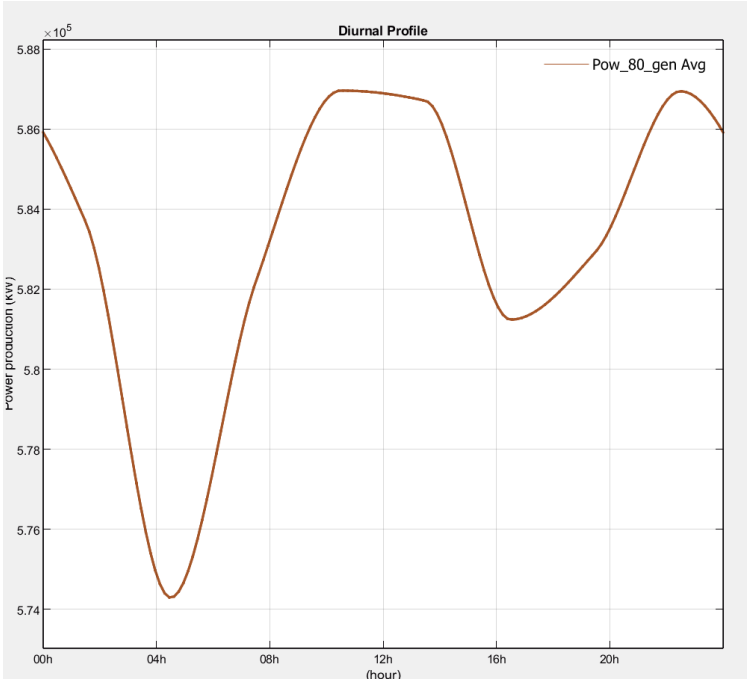


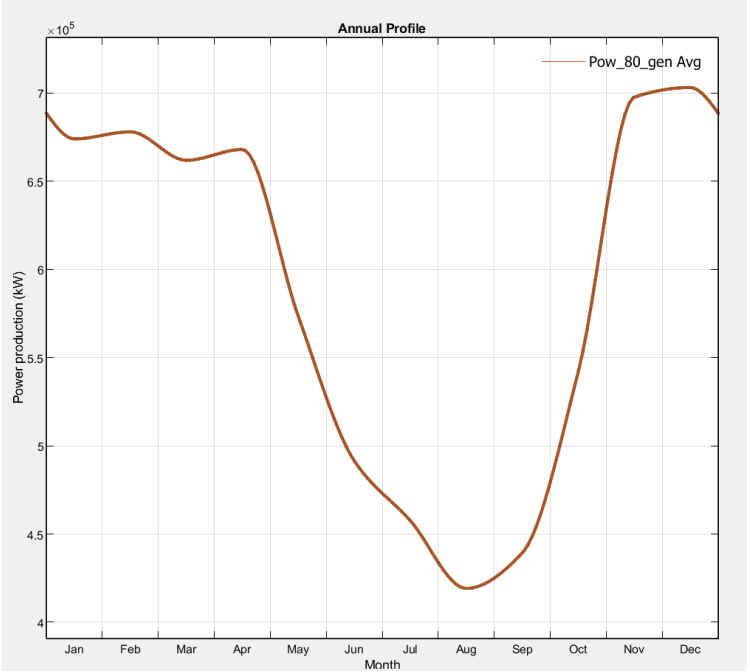


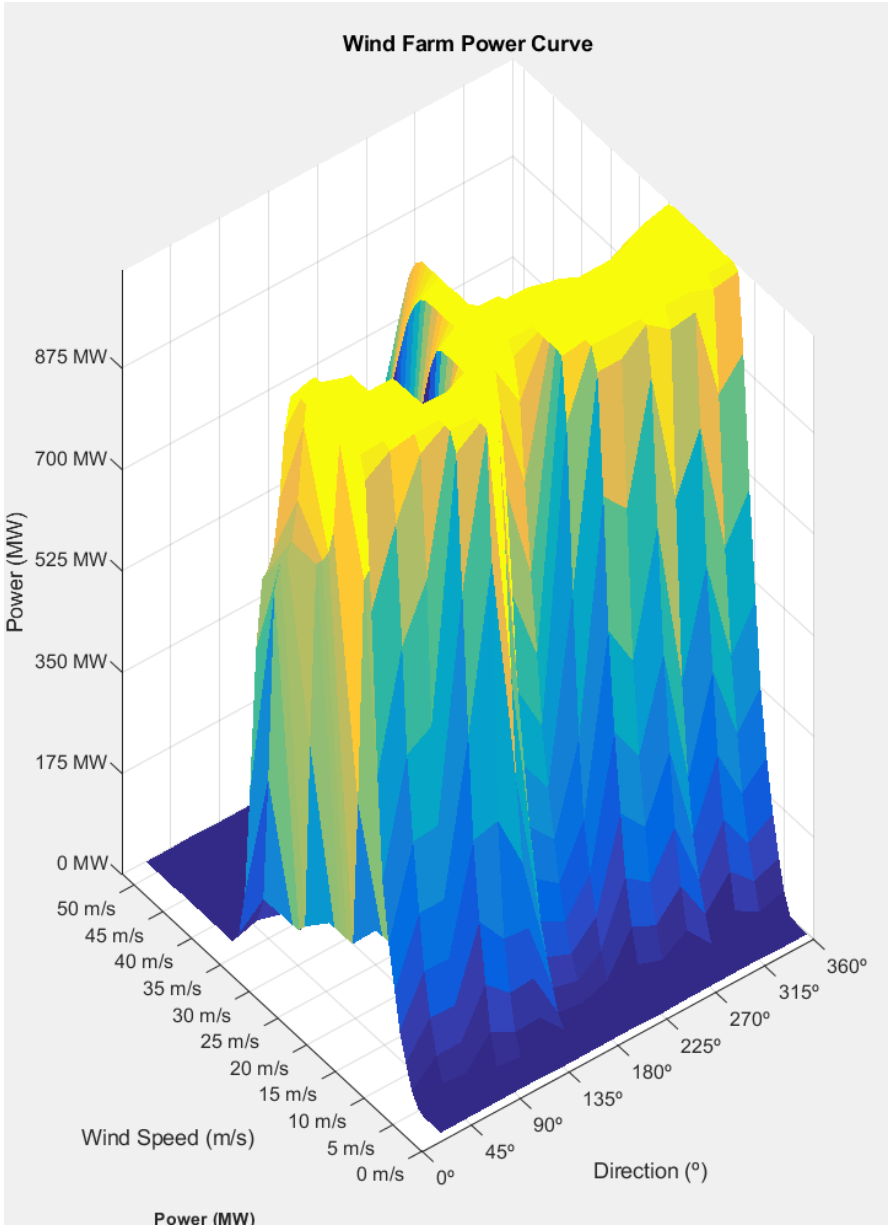
Preliminary Results

Highlights:

- Good offshore resource
- Results includes wake losses and energy losses
- High full load hours
- Confirms the technical viability of OSW in Atlantic Canada







Integration with Grid & Economic Modeling

Partnering with E3 to use results in PLEXOS:

- Clustered technical outputs feed operational modeling
- Understanding energy production patterns
- Evaluating grid needs for integration
- Informing future infrastructure planning
- Supporting economic dispatch, exports, and hydrogen scenarios

What's Next?

- Finalize technical potential maps
- Hourly results from different clusters
- Integration with E3 economic modeling
- Refining clusters for site-specific development
- Informing policy, investment, and future projects
- Continuing cross-disciplinary collaboration

Turning uncharted waters into Canada’s clean energy opportunity.

Conclusions

- First offshore wind resource study of this scale in Canada
- Innovative technical approach to overcome data limitations
- Detailed assessment of Technical & Locational Potential
- Integration of environmental, technical constraints
- Collaboration across teams and disciplines was critical
- Preliminary results show world-class offshore wind resources in Atlantic Canada
- This is a foundational step towards future offshore wind development

Thank you

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SCAN ME

Learn More About
Stantec Atlantic Offshore Wind Study™