

Actual Deployment: Technical, Locational and Economic Potential of Atlantic Canada's Offshore Wind Resource





Agenda

1. Project Overview & Goals
2. Methods (Wind modeling + Constraints)
3. Key Findings (Technical, Locational, Economic)
4. Deployment Pathways & Scenarios
5. Next Steps & Discussion



Study Goals & Timeline

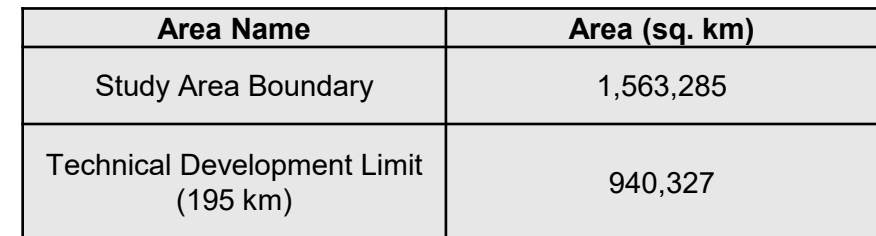
Study Goal and Key Outputs

- + **Overall:** Assess potential to integrate OSW into Atlantic Canada, including pathways, constraints, and investments needed
- + **Selected Key Outputs:**
 - Regional assessment of market opportunity
 - Detailed database of wind speeds for potential OSW sites
 - Operational challenges and opportunities
 - Grid infrastructure limitations and costs to integrate high levels of OSW

Phase	May-Aug2024	Sep-Dec 2024	Jan-May 2025	Jun-Aug 2025	Sep-Dec 2025	Jan-Mar 2026
Phase 1: Path to Market Domestic, export and hydrogen opportunities for OSW	<i>Phase 1 Completed Q1 2025</i>					
Phase 2: Offshore Wind Resource Potential Study Characterize OSW resource potential & create public database			Locational and economic potential in Spring 2025, with operational modeling August/September and database in Q4 2025			
Phase 3: Grid Integration Study Cost to integrate OSW & create public database & visualization					Phase 3 modeling to start fall 2025 and run through Q1 2026	



- Assess Technical, Locational, and Economic Potential of offshore wind, and explore Actual Deployment pathways for Atlantic Canada
- Completed wind resource modeling and constraint mapping to define feasible OSW areas for both fixed and floating foundations
- Delivered production data and economic estimates to support Phase 2 modeling (E3-led) and Phase 3 transmission studies
- Phase 3 will refine deployment locations based on cost, transmission, and system integration

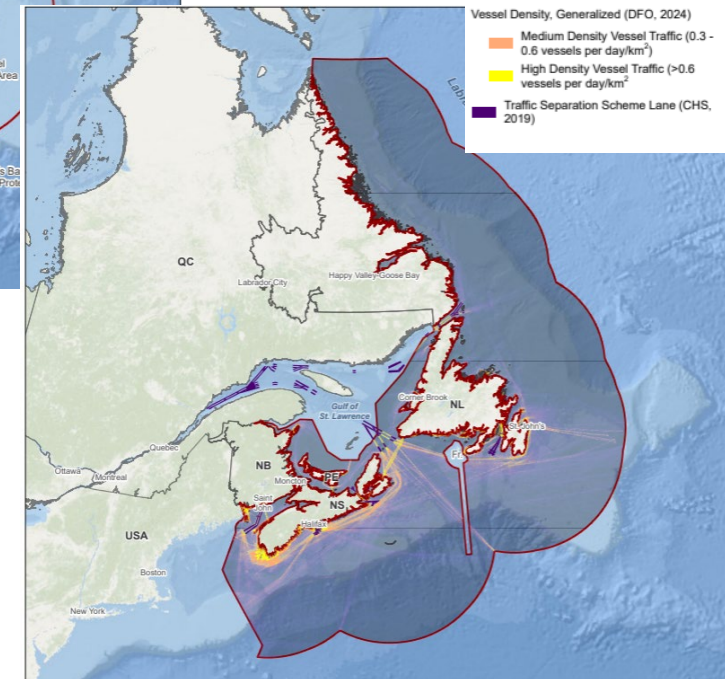
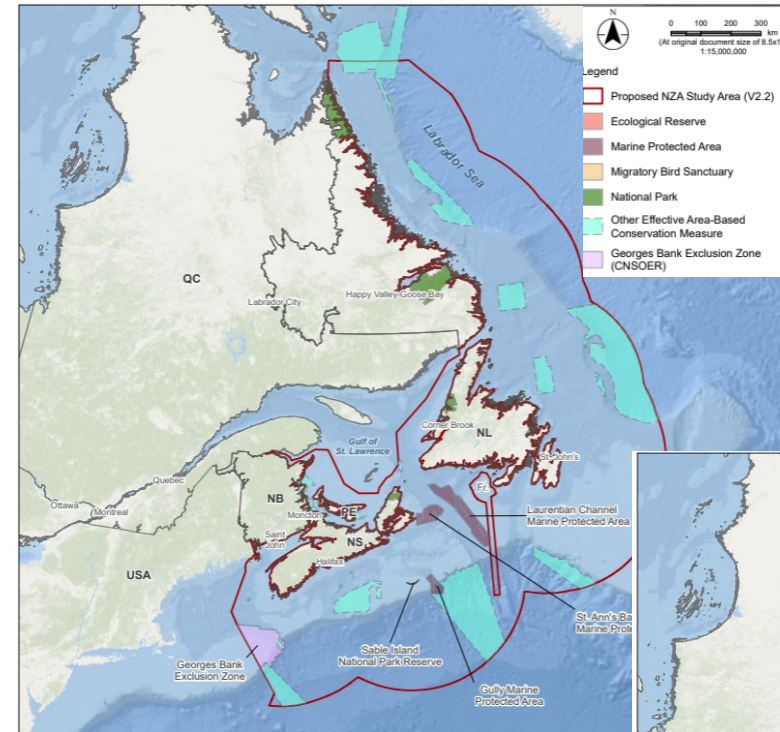
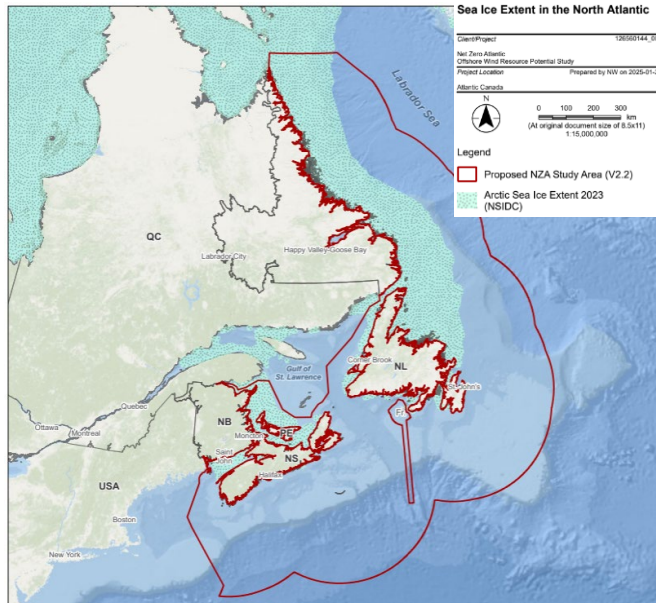




Mapping Constraints – Defining Feasible Offshore Wind Areas

Key Constraint Categories Considered:

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





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Reviewed: 2025-03-04 By: rwhite

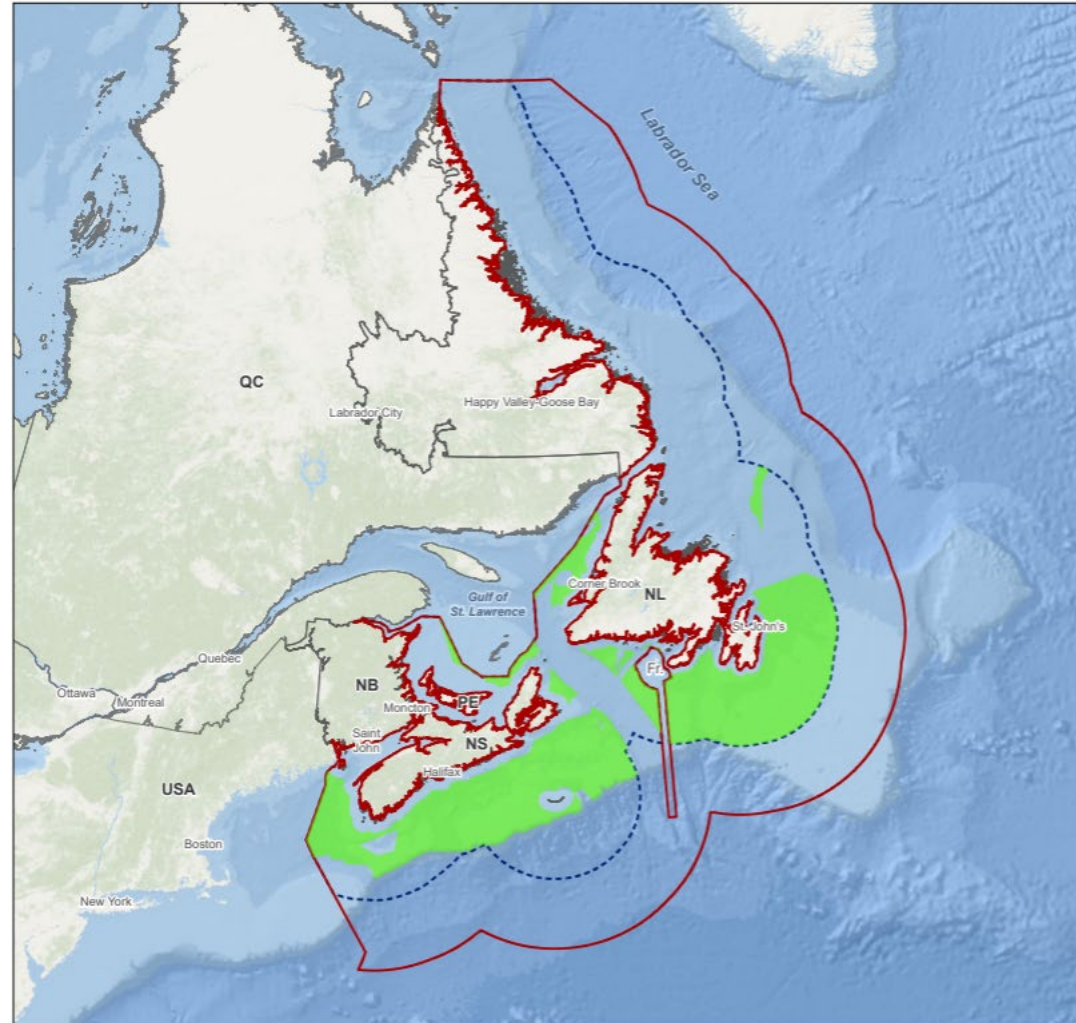


Figure No. 17
176
Buildable Area - Floating Platform

Client/Project: 126560144_017
Net Zero Atlantic Offshore Wind Resource Potential Study
Project Location: Prepared by NW on 2025-03-31
Atlantic Canada

N
0 100 200 300 km
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1:15,000,000

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

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Reviewed: 2025-03-04 By: rwhite

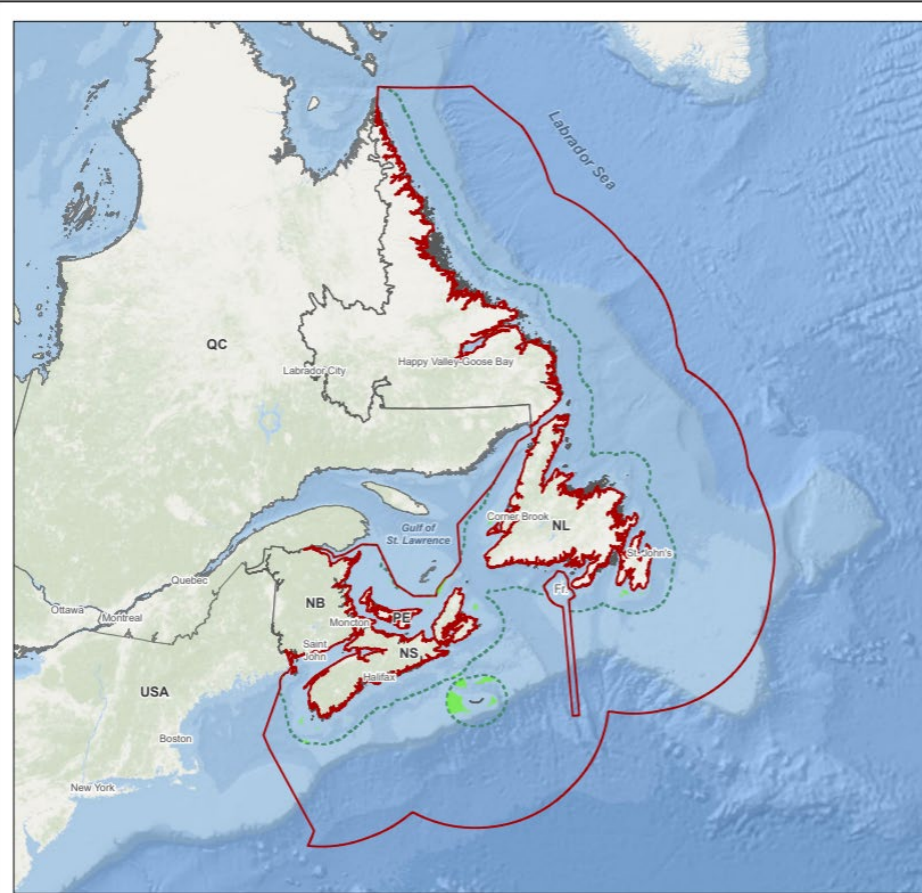


Figure No. 16
166
Buildable Area - Fixed Platform

Client/Project: 126560144_016
Net Zero Atlantic Offshore Wind Resource Potential Study
Project Location: Prepared by NW on 2025-03-31
Atlantic Canada

N
0 100 200 300 km
(At original document size of 8.5x11)
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Legend

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

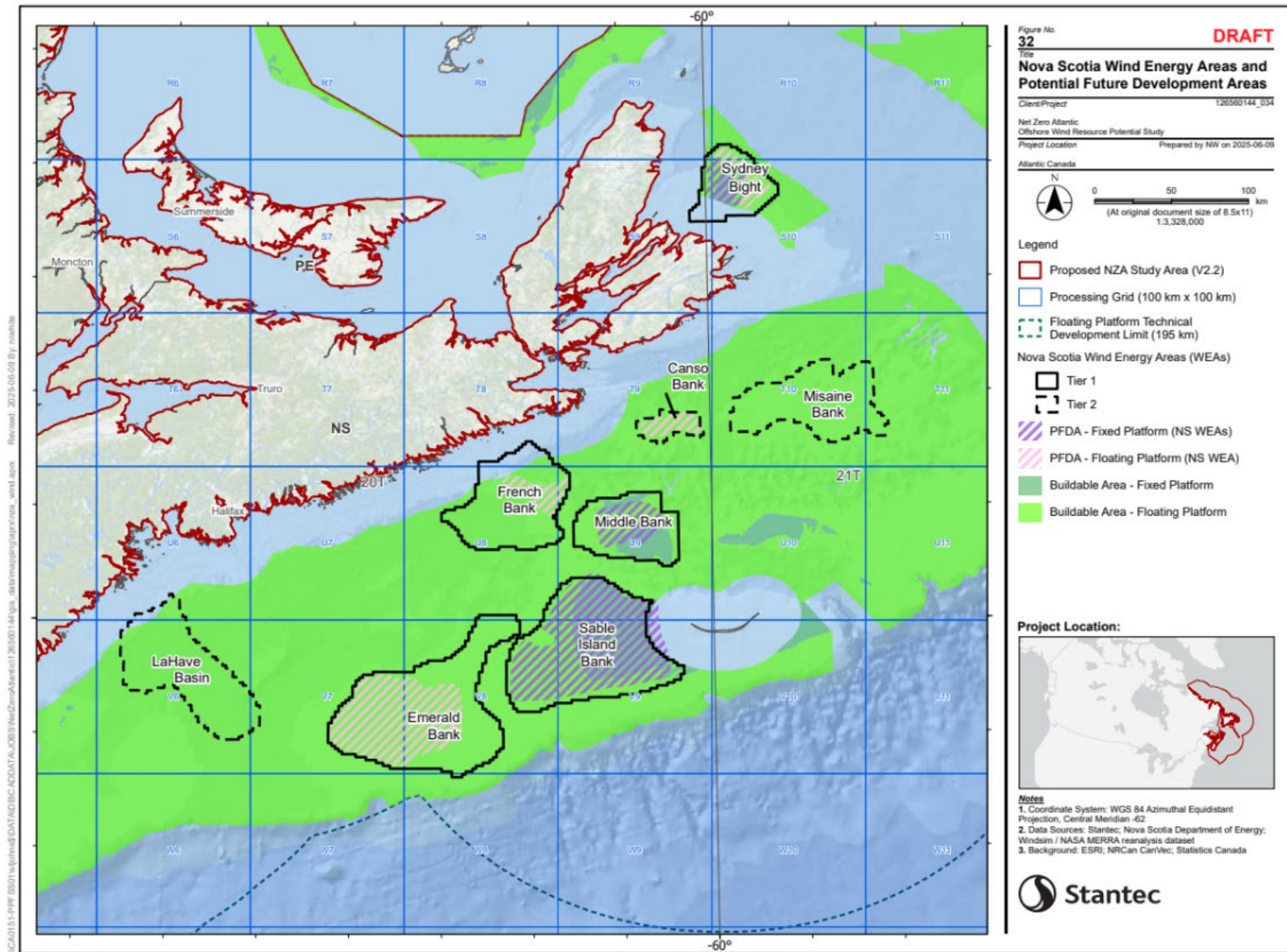
Project Location:

Notes

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

Stantec

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Revised: 2025-06-09 By: mshille

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Modeling the Wind Resource

Hybrid 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

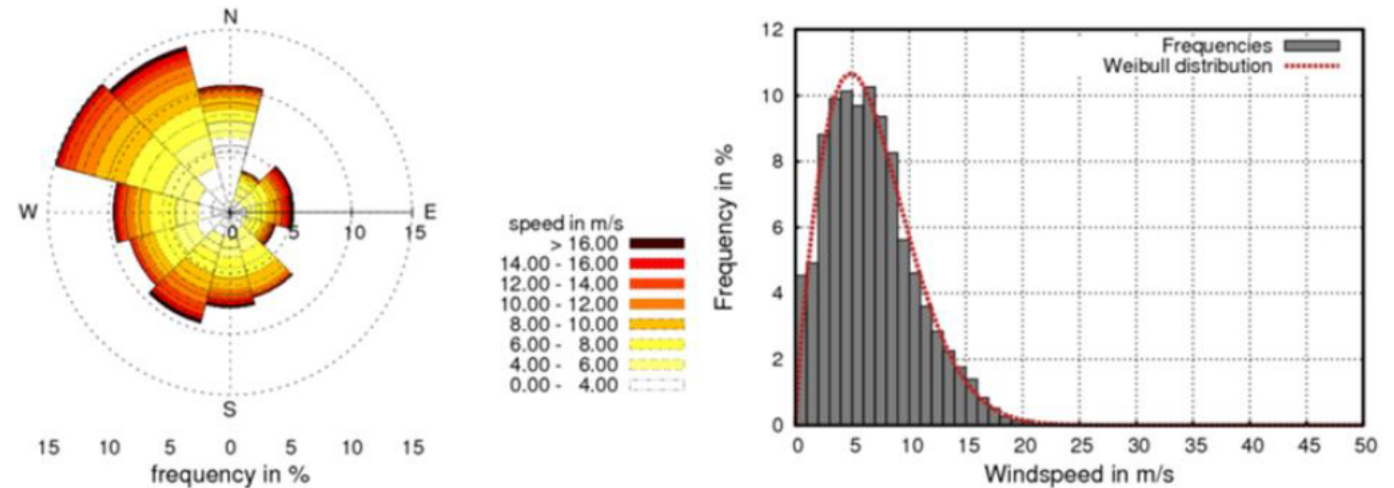
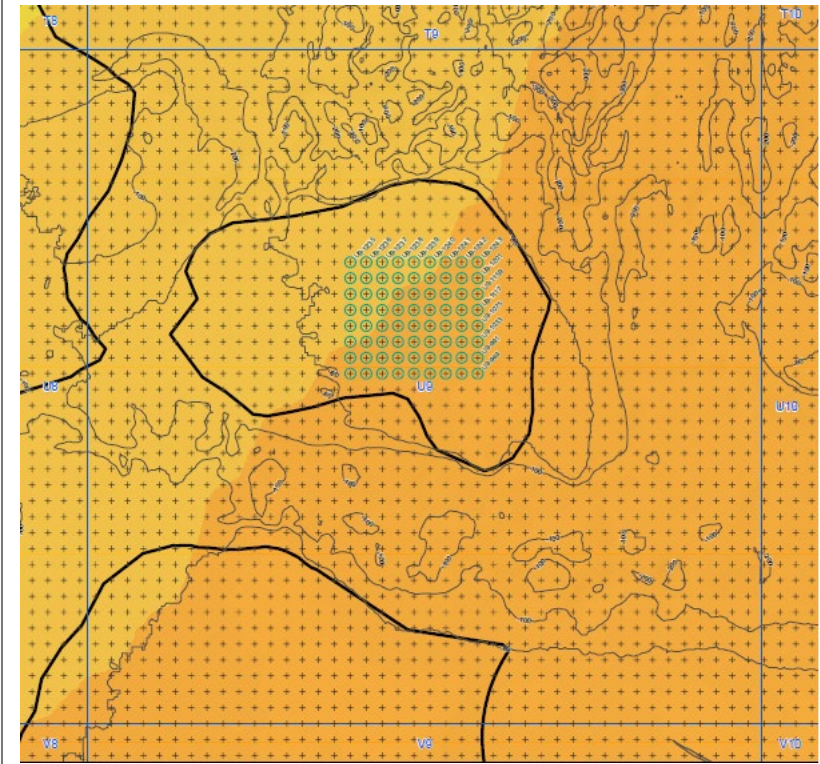
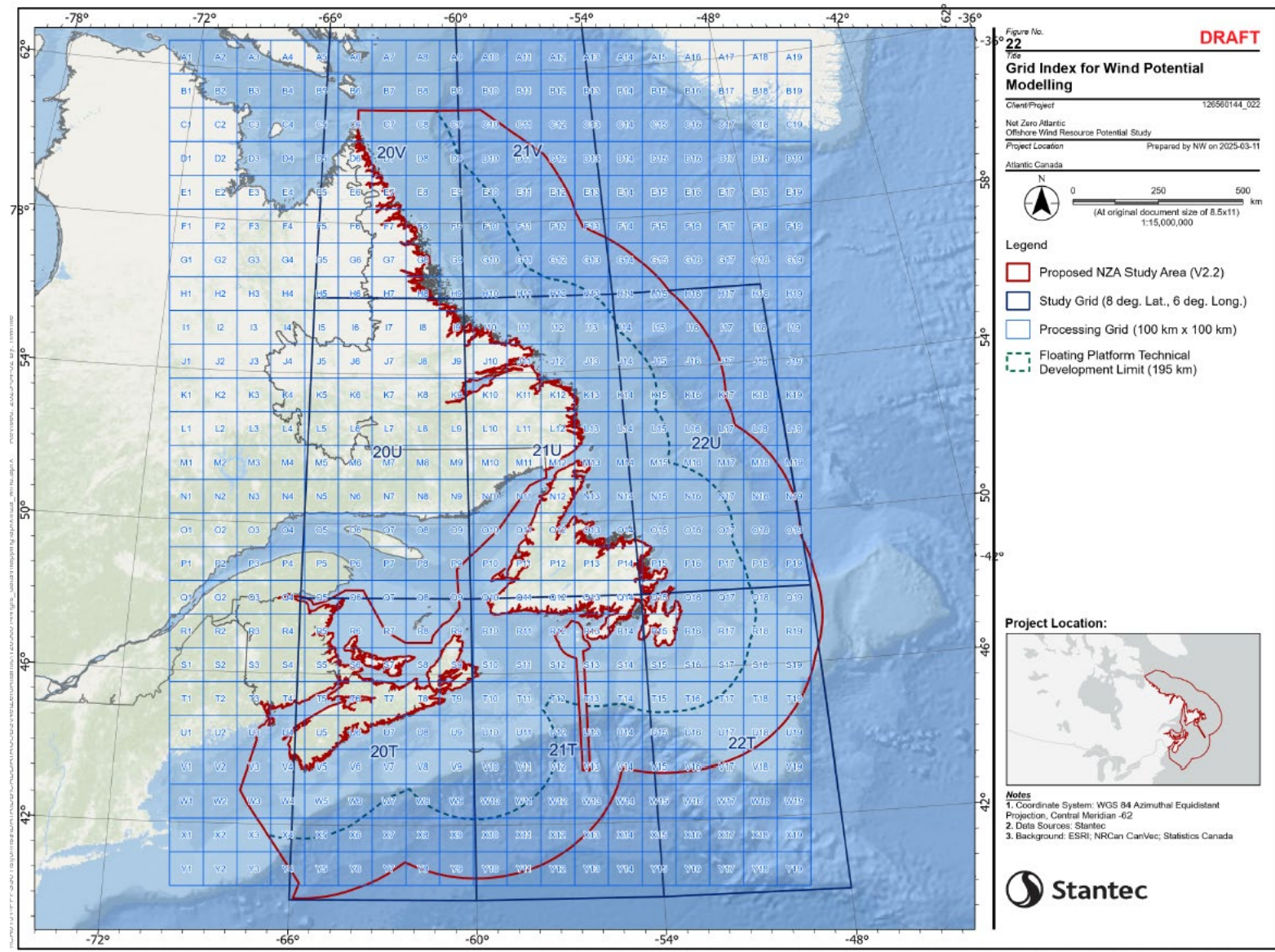


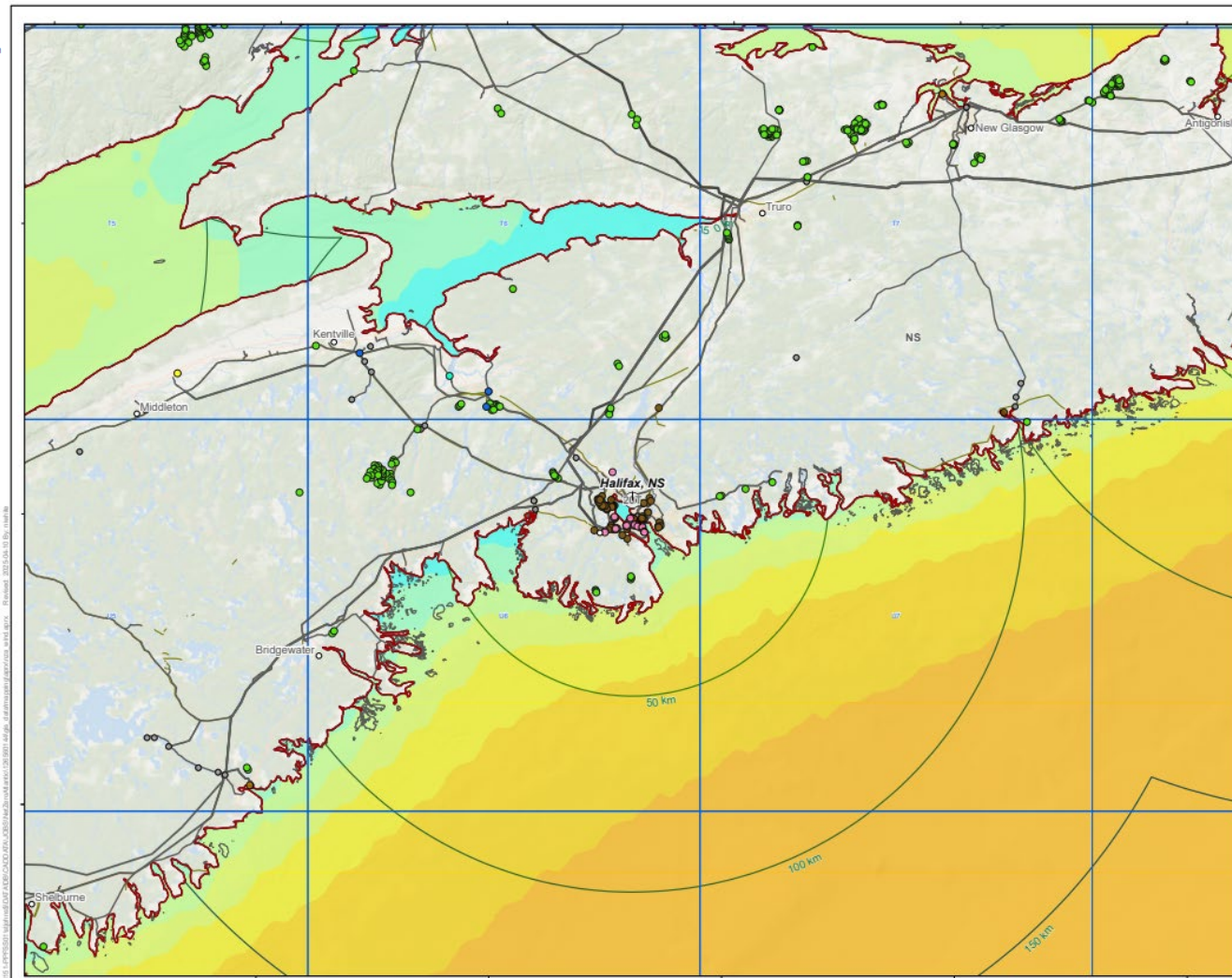
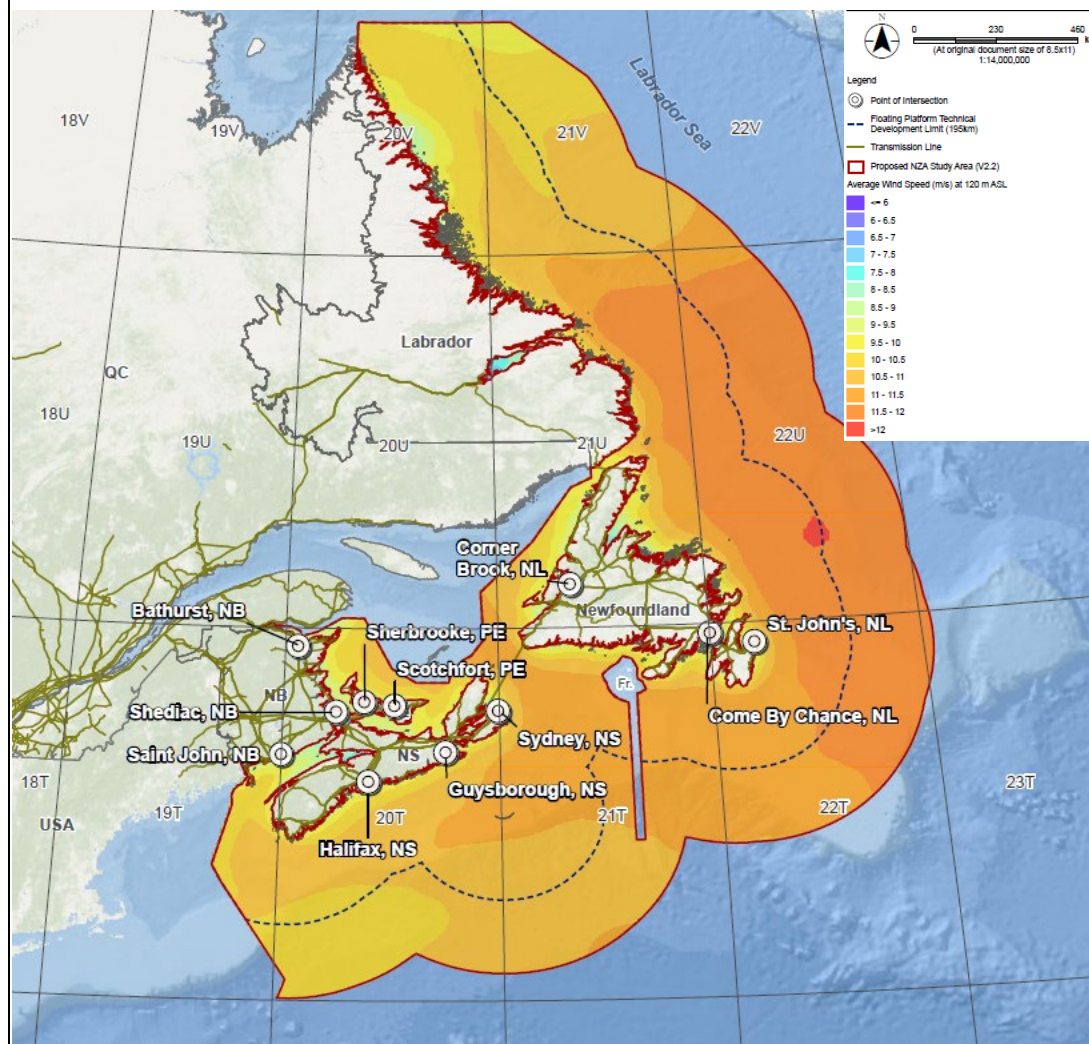
Figure 2-6 Wind rose (left) and frequency distribution with Weibull fitting (right) for all sectors

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



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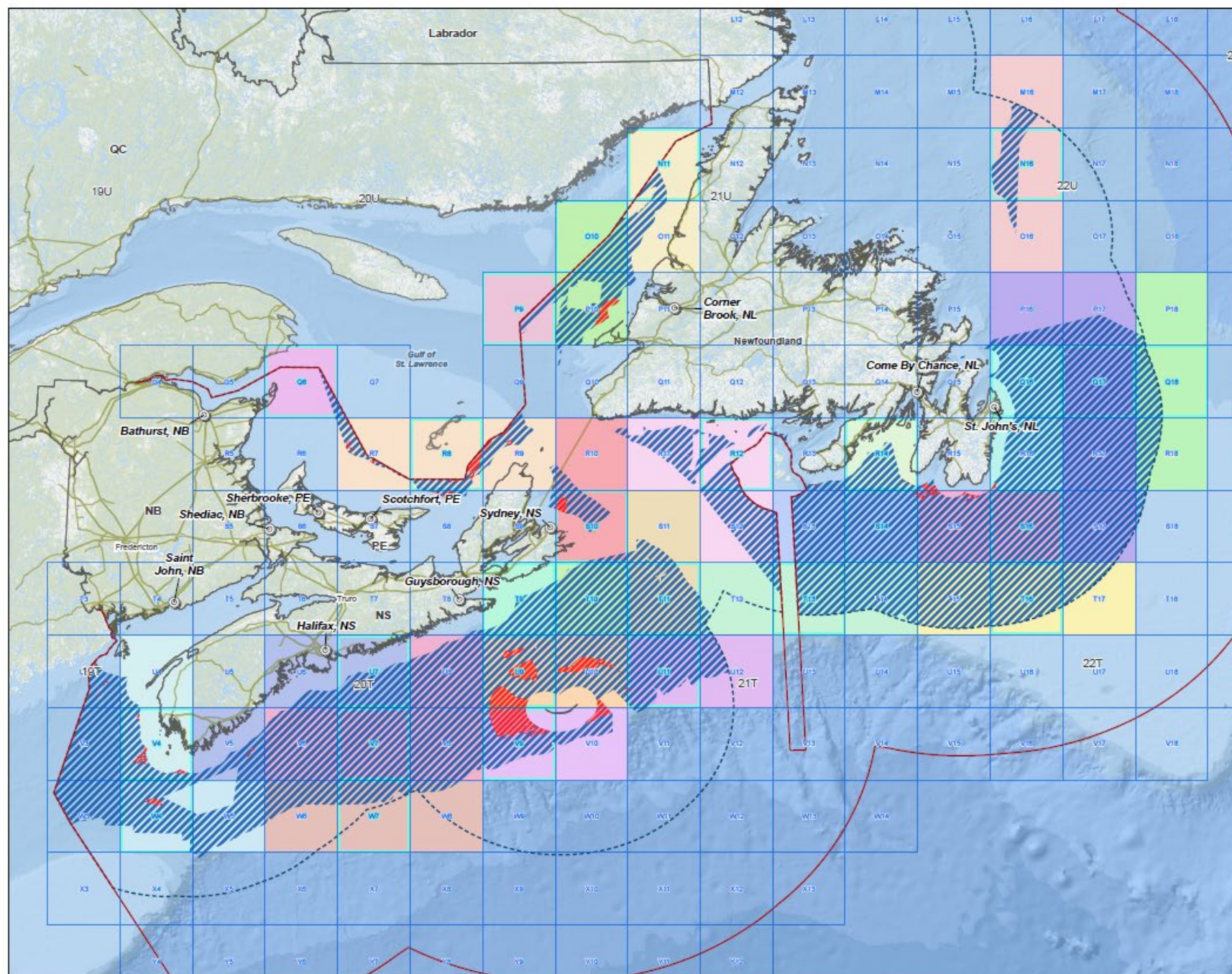


Figure No.

35

DRAFT

Title

Grid Optimization Clusters and Time Series Data Reference

Client/Project

128560144_035

Net Zero Atlantic Offshore Wind Resource Potential Study

Project Location

Prepared by NW on 2025-07-17

Atlantic Canada



0 100 200
Kilometres
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Legend

- Point of Intersection
- Transmission Line
- NZA Study Area (V2.2)
- Floating Platform Technical Development Limit (100 km)
- Buildable Area - Floating Platform
- Buildable Area - Fixed Platform
- Processing Grid (100 km x 100 km)
- Time Series Data Reference Cell

Optimization Cluster

- C1
- C2
- C3
- C4
- C5
- C6
- C7
- C8
- C9
- C10
- C11
- C12
- C13
- C14
- C15
- C16
- C17
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- C20
- C21
- C22
- C23
- C24
- C25
- C26
- C27



Notes

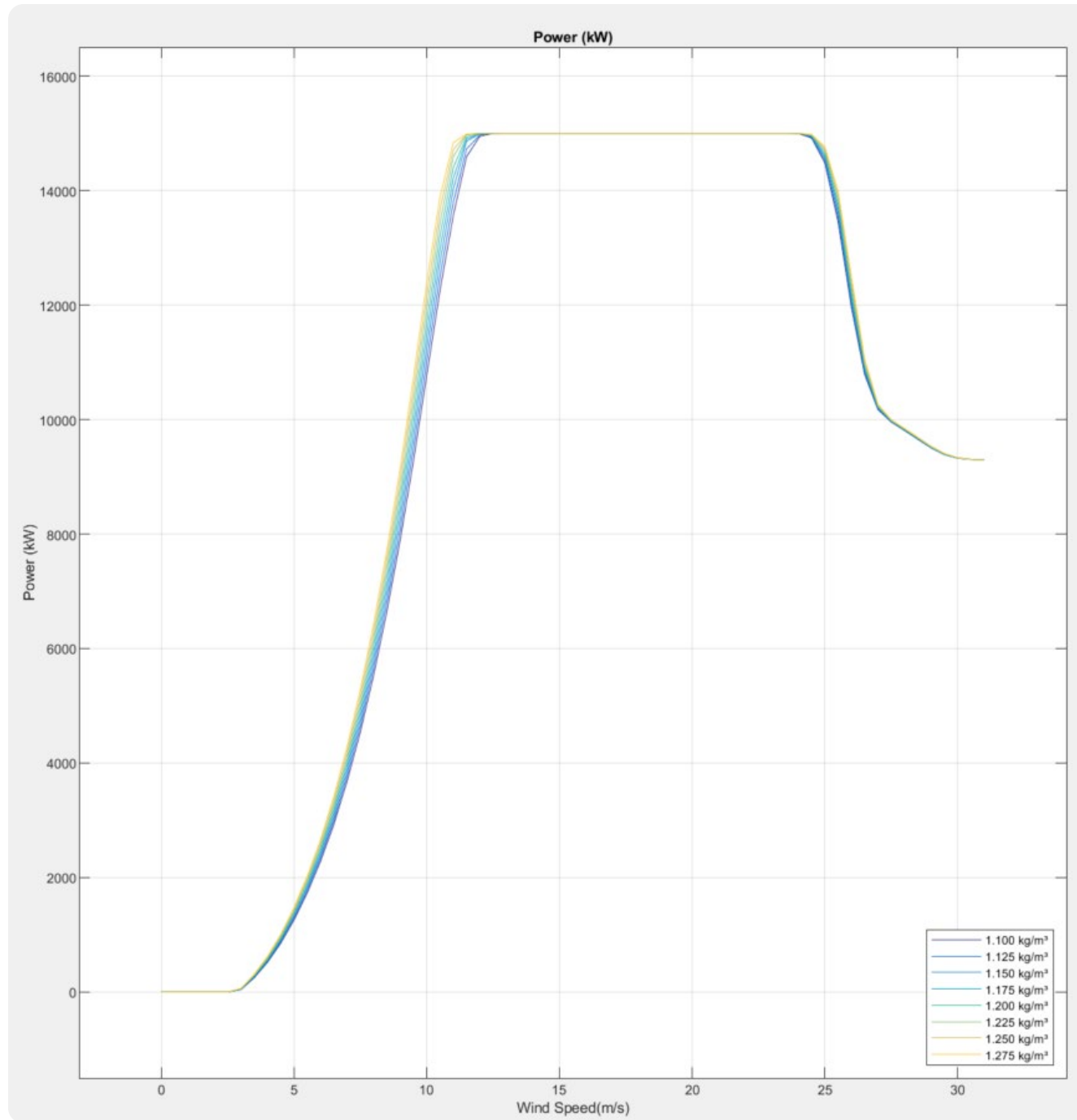
- Coordinate System: WGS
- Data Sources: Stantec
- Background: NWCA, CanVec, Statistics Canada, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community, CHS, Esri, GEBCO, Garmin, NaturalVue





Reference Wind Farm

- Standardized 1 GW (1080 MW) per cell
- Turbine: 15 MW model
- Layout: 72 turbines per site
- Spacing: 10D × 10D (rotor diameter-based), equivalent to capacity density ~ 3.5 MW/km²
- Rotor diameter: 236 m
- Cut-in / Rated / Cut-out: 3 m/s / 13 m/s / 30 m/s
- Suitable for both fixed-bottom and floating configurations





Hourly profile generation

Hourly profile generation and potential generation

- Average area of wind farm 1 GW= 311 km^2
- Extrapolated to available buildable area for the different clusters.

Cluster	C27		C11	
Grid cell	U9- Middle Bank fixed		S10 - Sydney Bright floating	
Date/Time	Net Power Production	Wind speed	Net Power Production	Wind speed
	(KWh)	(m/s)	(KWh)	(m/s)
1/1/2018 0:00	1,080,000	14.01	1,031,665	13.58
1/1/2018 1:00	1,080,000	13.78	1,026,388	13.29
1/1/2018 2:00	1,080,000	13.69	1,030,440	13.45
1/1/2018 3:00	1,080,000	13.55	1,043,843	15.36
1/1/2018 4:00	1,080,000	13.43	1,043,843	17.13
1/1/2018 5:00	1,079,993	13.14	1,043,843	15.98
1/1/2018 6:00	1,079,958	12.71	1,043,840	14.84
1/1/2018 7:00	1,077,379	12.15	1,043,843	15.18
1/1/2018 8:00	1,062,927	11.62	1,043,843	14.93
1/1/2018 9:00	1,011,709	11.05	1,043,843	14.56
1/1/2018 10:00	912,477	10.48	1,043,843	13.99
1/1/2018 11:00	740,339	9.63	1,043,843	13.36
1/1/2018 12:00	566,899	8.79	1,043,801	12.58
1/1/2018 13:00	434,031	8.08	1,033,859	11.61
1/1/2018 14:00	397,253	7.93	1,005,534	11.12
1/1/2018 15:00	404,938	8.08	1,032,028	11.51
1/1/2018 16:00	410,606	8.2	1,040,606	12.06
1/1/2018 17:00	400,451	8.16	1,040,123	12.5
1/1/2018 18:00	371,780	7.95	1,032,442	12.44
1/1/2018 19:00	343,675	7.74	1,025,279	12.01
1/1/2018 20:00	317,875	7.54	997,246	11.37
1/1/2018 21:00	278,982	7.24	905,912	10.84
1/1/2018 22:00	253,101	6.9	838,800	10.51
1/1/2018 23:00	212,208	6.4	735,974	10.09



Shape Profile Results

Specific Outputs:

- Annual Energy Production (AEP)
- Capacity Factor (CF)

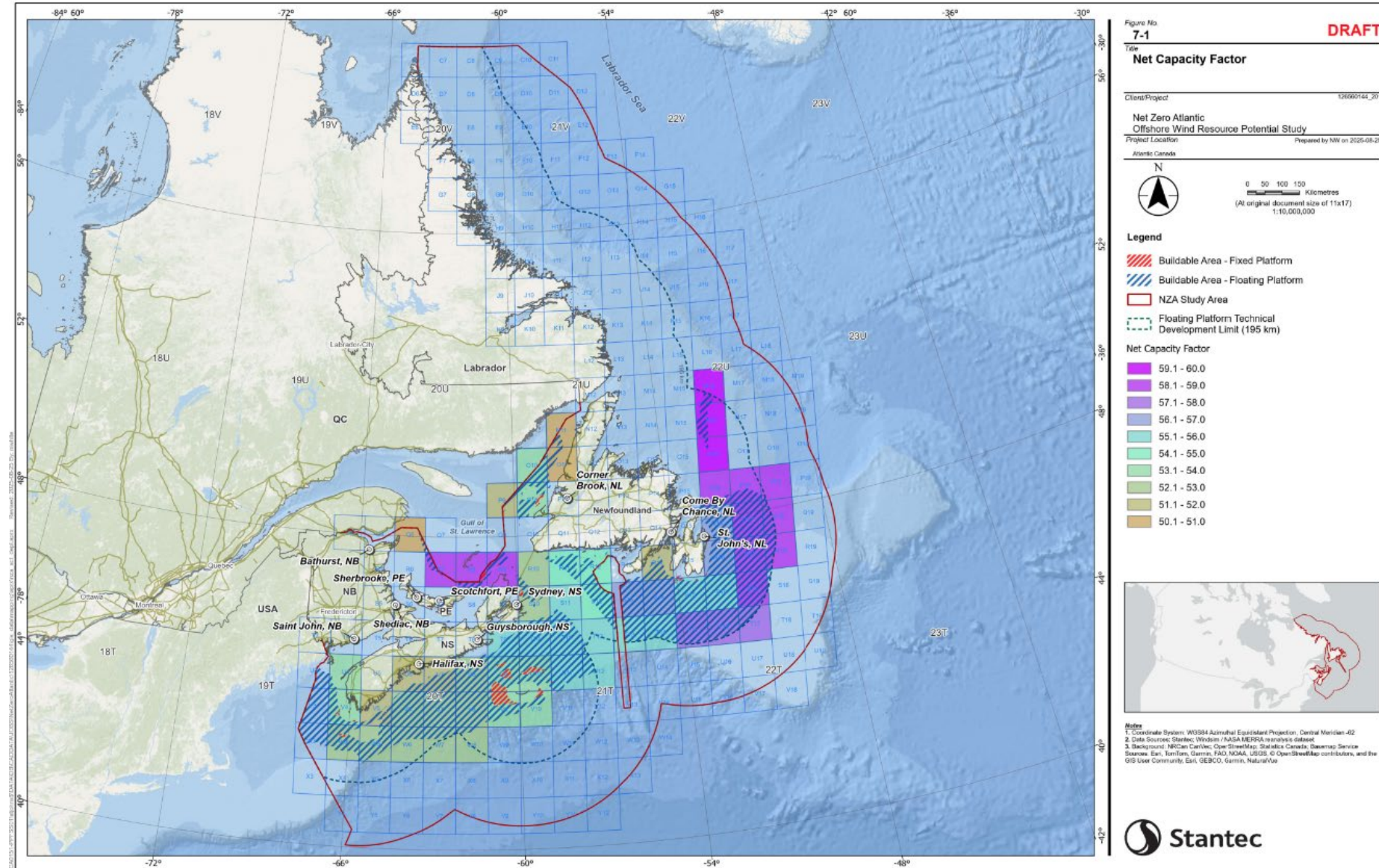
Losses included for simulation:

- Unavailability losses: 4.98%
- Electrical losses: 2.87%
- Turbine performance: 1.68%
- Environmental losses: 1.49%

Entire Project Area		
	Maximum	Minimum
Gross AEP (MWh/year)	6,709,402	5,614,365
Net AEP (MWh/year)	5,657,016	4,739,458
Gross CF (%)	70.92	59.34
Net CF (%)	59.79	50.09



Net Capacity Factors





Economic Potential Methodology & Assumptions

+ Area Selection and Spacing

- Buildable area refined based on GIS exclusion constraints: Shipping, fisheries, depth, ecological protection, marine traffic, national defense public areas

+ Selected Key Outputs:

- Based on pre-feasibility standards (AACE Class 5: -50% to +100% accuracy)
- Values in 2025 USD (\$/kW), with focus on CAPEX
- Reflects early-stage market and Atlantic Canada site complexity

+ Cost Categories Included

- Buildable Turbine supply & installation
- Foundations (Monopile or Floating)
- Electrical (export, inter-array, substations)
- Soft costs: permitting, engineering, development
- Contingency (15%) & Risk range: Class 5

+ Exclusions

- Port Upgrades, insurance, taxes, financing, leasing, integration costs

Configuration	Min (\$/kW)	Mid (\$/kW)	Max (\$/kW)
Fixed-Bottom	\$4,315	\$5,735	\$7,650
Floating	\$6,360	\$8,770	\$11,295



Actual Deployment – Key Considerations

+ The economic viability of offshore wind resources is shaped by 3 core economic drivers

- Cost of development and grid interconnection
- Availability and competitiveness of alternative resources
- Scale of demand that offshore wind can serve

+ Demand-driven Potential

- **Domestic Only Market:** Assumes OSW serves only Atlantic Canada, with limited transmission growth
- **All Markets with High Hydrogen Sensitivity:** Includes expanded ties to New England, enhanced regional transmission, and hydrogen load growth — enabling significantly higher OSW deployment



Actual Deployment – 2035-2050 Different Scenarios

C1				
		Resource Name	2035	2050
NL	Fixed	OSW_NL_C4	-	92
NS	Fixed	OSW_NS_C11	1,000	1,778
PE	Fixed	OSW_PE_C22	-	483
NS	Fixed	OSW_NS_C27	-	147

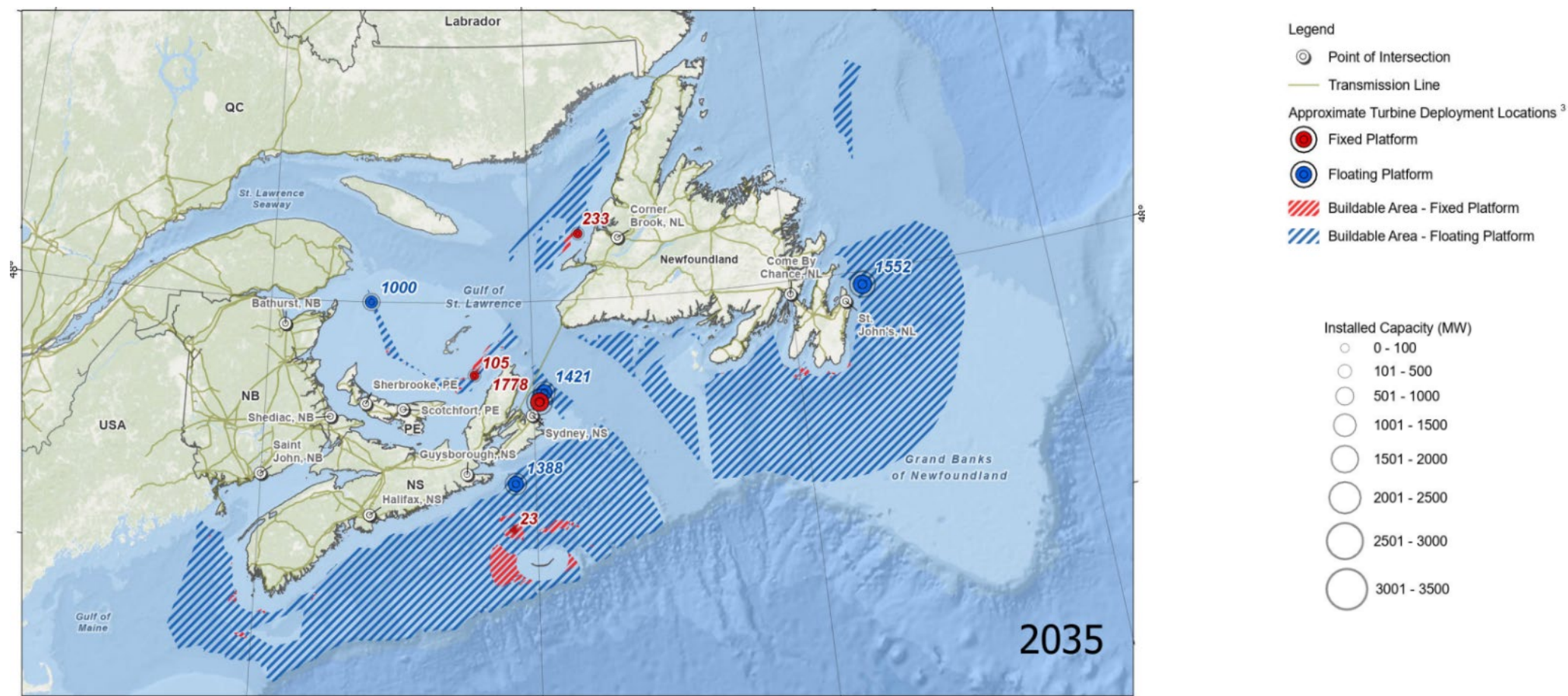
C3 high				
		Resource Name	2035	2050
NL	Fixed	OSW_NL_C4	0	92
NS	Fixed	OSW_NS_C11	1778	1778
NB	Fixed	OSW_NB_C21	0	
PE	Fixed	OSW_PE_C22	0	415
NL	Fixed	OSW_NL_C25	275	1319
NS	Fixed	OSW_NS_C27	86	2072
NL	Floating	OSW_NL_C4	1338	1802
NS	Floating	OSW_NS_C11	1022	1022
NB	Floating	OSW_NB_C21	0	63
NB	Floating	OSW_NB_C24	1000	1318

C2				
		Resource Name	2035	2050
NL	Fixed	OSW_NL_C4	37	92
NS	Fixed	OSW_NS_C11	1540	1778
NB	Fixed	OSW_NB_C21	0	87
PE	Fixed	OSW_PE_C22	2	866
NL	Fixed	OSW_NL_C25	0	968
NS	Fixed	OSW_NS_C27	0	3288
NS	Floating	OSW_NS_C11	1421	1421

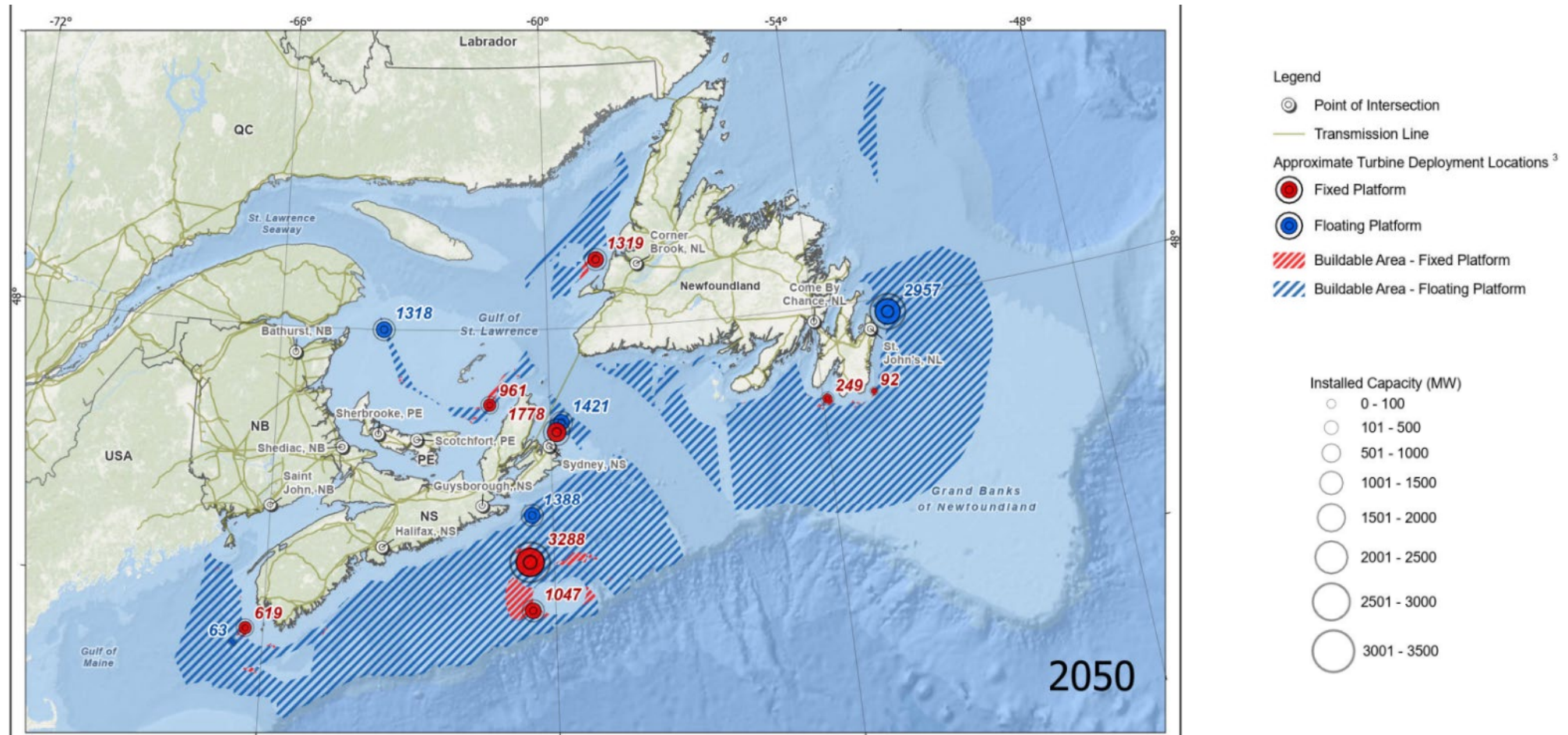
C4 high				
		Resource Name	2035	2050
NL	Fixed	OSW_NL_C4	-	92
NL	Fixed	OSW_NL_C5	-	249
NS	Fixed	OSW_NS_C11	1,778	1,778
NS	Fixed	OSW_NS_C13	-	1,047
NB	Fixed	OSW_NB_C21	-	619
PE	Fixed	OSW_PE_C22	105	961
NL	Fixed	OSW_NL_C25	233	1,319
NS	Fixed	OSW_NS_C27	23	3,288
NL	Floating	OSW_NL_C4	1,552	2,957
NS	Floating	OSW_NS_C11	1,421	1,421
NS	Floating	OSW_NS_C14	1,388	1,388
NB	Floating	OSW_NB_C21	-	63
NB	Floating	OSW_NB_C24	1,000	1,318



2035 – All Markets with High Hydrogen Sensitivity



2050 – All Markets with High Hydrogen Sensitivity





Thank you



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SCAN ME



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