Nova Scotia Offshore Wind: Wind and Ground Conditions

Desktop Study – Executive Summary

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Objectives & Background

Nova Scotia's offshore wind potential is significant, with consistently strong winds across the shallow waters immediately offshore. This makes it ideal for large-scale wind farm development, helping the province and Canada meet renewable energy targets.

The federal and provincial governments are committed to offshore wind development. On July 29, 2025, four Wind Energy Areas (WEAs) were finalized ahead of Canada's first offshore wind licence round, targeting up to 5 GW of wind power by 2030. This is the first of several planned offerings and sets Nova Scotia on a path to become a major exporter of clean energy.

This desktop study summarizes what we know about the wind speeds and ground conditions (both seafloor and sub-seafloor) offshore Nova Scotia. We use this information to highlight important considerations for potential developers, including geohazards, engineering constraints and geotechnical properties.

We generate suitability maps for various wind turbine foundation concepts to help guide lease screening and bidding decisions, and to set a solid basis for further investment and data acquisition decisions. Finally, we make recommendations for future site investigation and ground modeling campaigns that will be necessary to plan and develop the projects to meet Nova Scotia's offshore wind targets.

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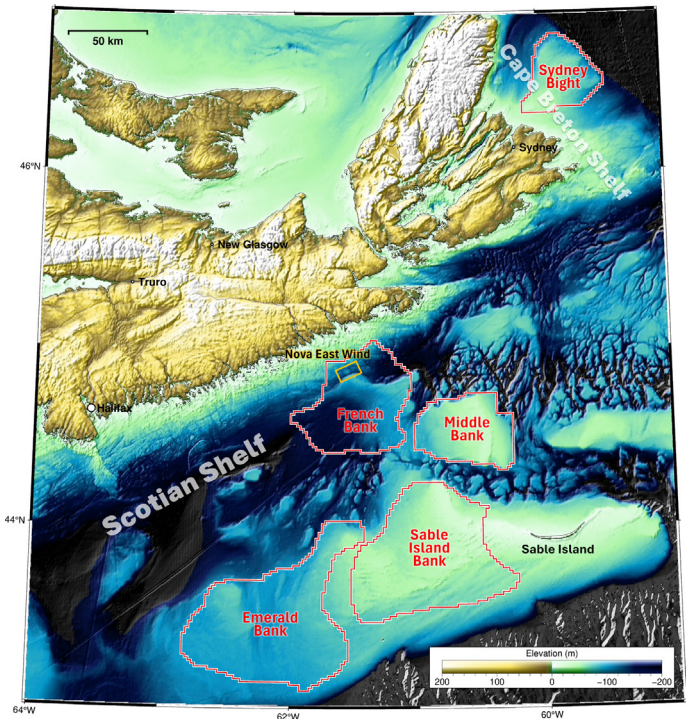


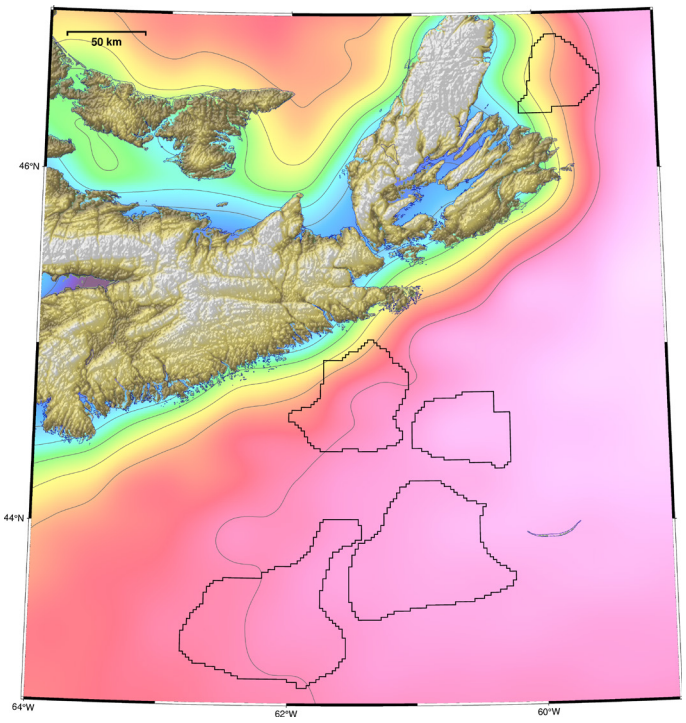
Wind Resources

All WEAs show strong offshore wind speeds and characteristics that are sufficient to support commercial scale development.

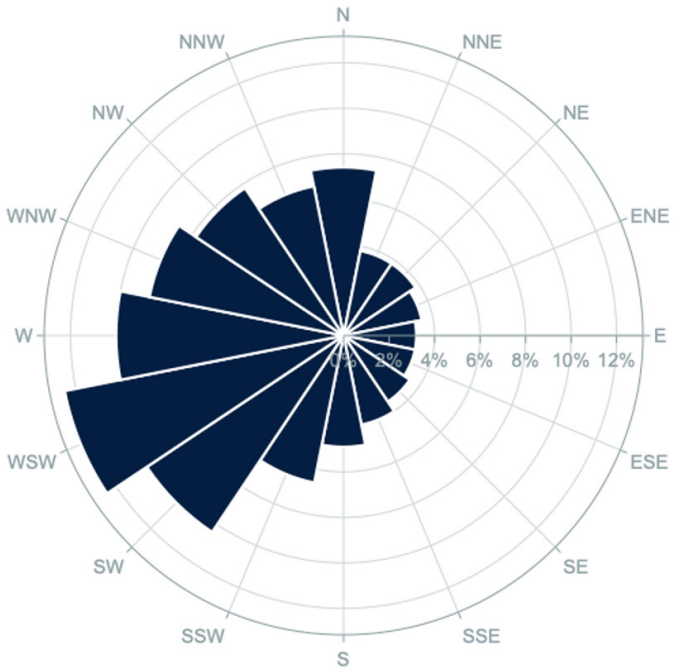
We analyze the wind resource using the ERA5 data set, which combines meteorological observations with forecasting models to estimate long-term wind speeds.

Seasonality is crucial as wind speeds are highest during late fall and winter, driven by low-pressure systems, and lowest during summer. Wind roses diagrams are presented to show dominant wind directions, and vertical wind shear profiles show how wind speeds vary with height.

Understanding this level of variability will help developers optimize turbine design and project layout to maximize energy yields and minimize wake effects.



Mean annual wind speeds at 137m elevation.



Example wind rose for Scotian Shelf location

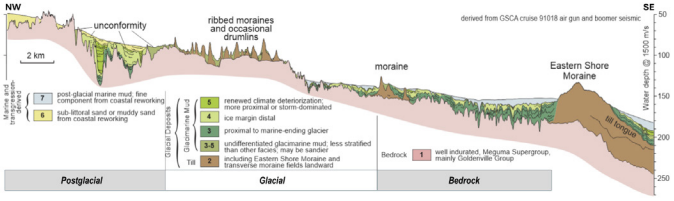
Ground Conditions

The area of interest for the desktop study includes the entire Scotian Shelf and Cape Breton Shelf. Across this region, five WEAs were originally earmarked for Canada's first offshore wind development, although Emerald Bank was subsequently set aside for later licence rounds.

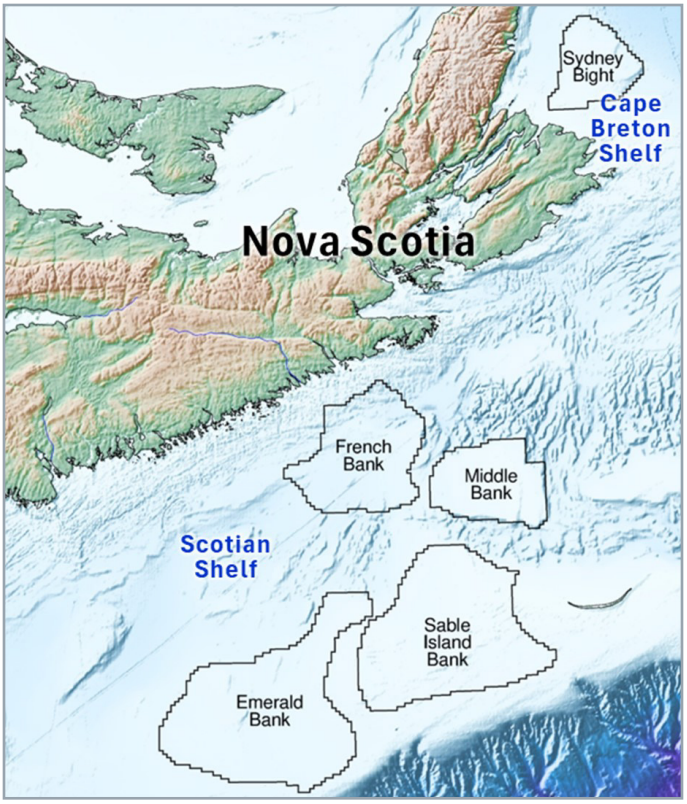
The study includes a thorough review of the available bathymetric and geoscience data and research, including the glacial history and the resulting geologic features and variability in the ground conditions.

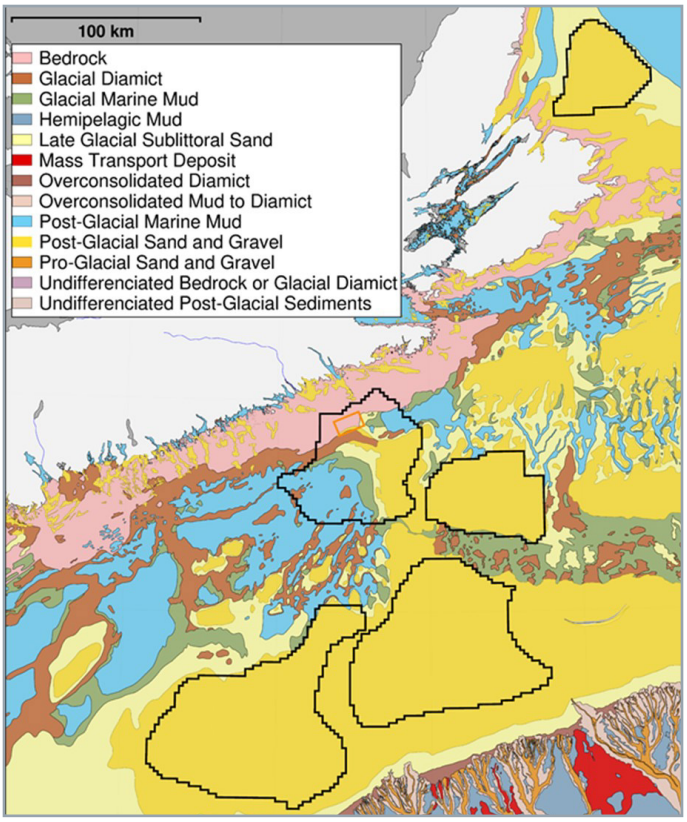
This understanding is converted into a description of the geohazards and engineering constraints, highlighting potential areas of elevated risk. This includes factors such as sediment mobility, fluid expulsion, mine collapse, boulders, bedrock, shipwrecks, existing infrastructure, and geotechnical properties.

The analyses, results and recommendations will be critical to evaluate the opportunities available in the upcoming license round, and for future offerings as Nova Scotia builds its offshore wind capacity.



Geologic cross section (from Geological Survey of Canada)





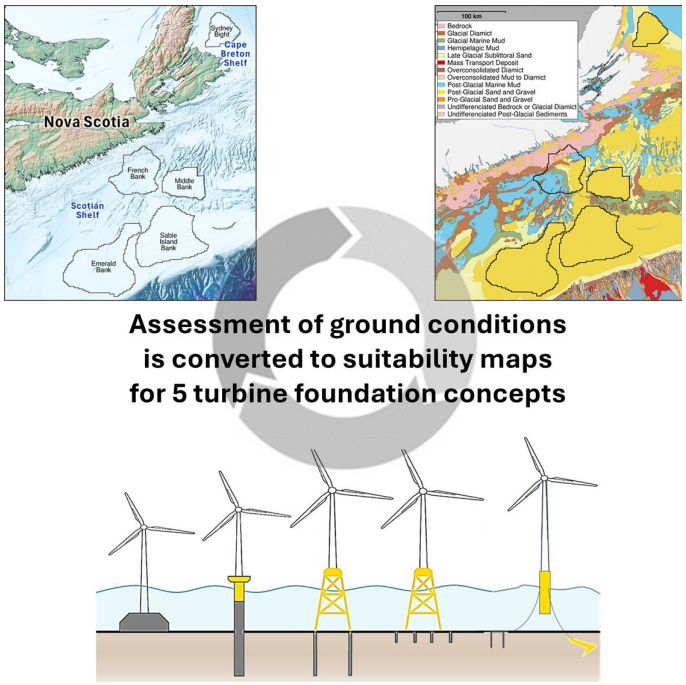
Seafloor geology (from Geological Survey of Canada)

Foundation Suitability

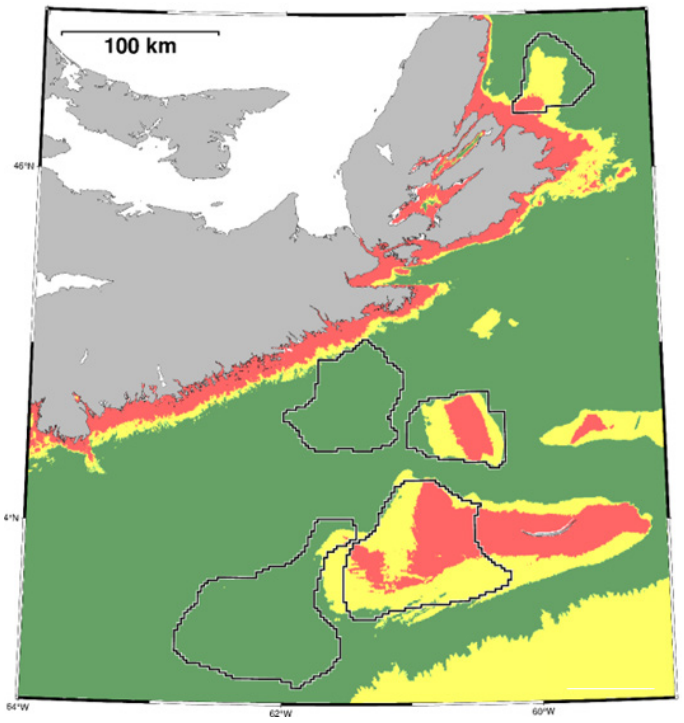
The study looks at various foundation types, including gravity-based structures, monopiles, jackets with pin piles, suction bucket jackets, and anchors for floating structures. The suitability of each depends on local water depth and seabed conditions.

Our analyses highlight areas where specific foundation types are most suited. Suitability maps for each concepts are created and then combined into a single map to help identify the most suitable foundation types.

Across each WEA, when combined with maps of seafloor and geologic features, our "integrated site characterizations" provide insights that will be critical to understand the long-term performance of wind farm infrastructure.



Suitability mapping workflow



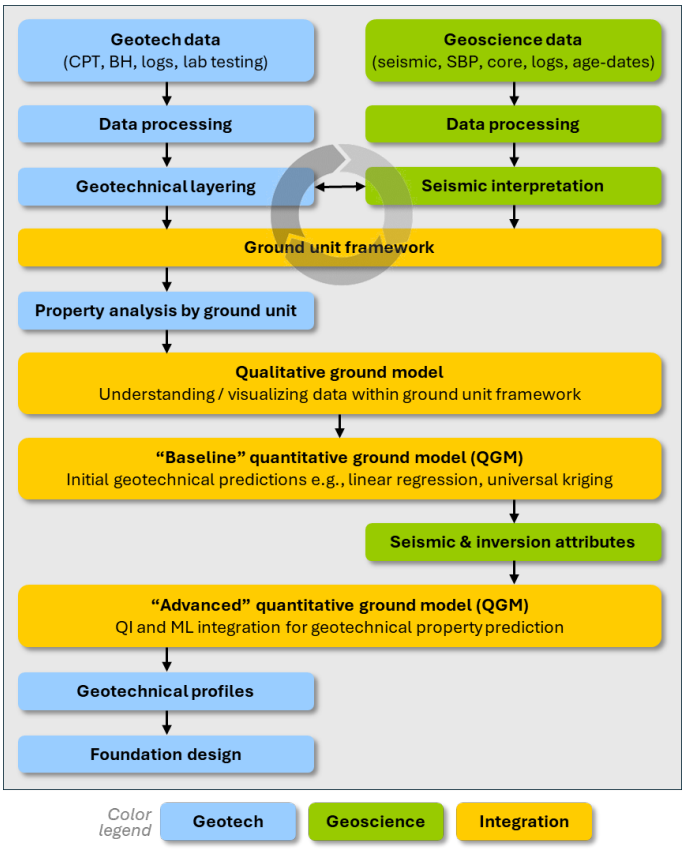
Sample water depth suitability map for one foundation type

Next Step

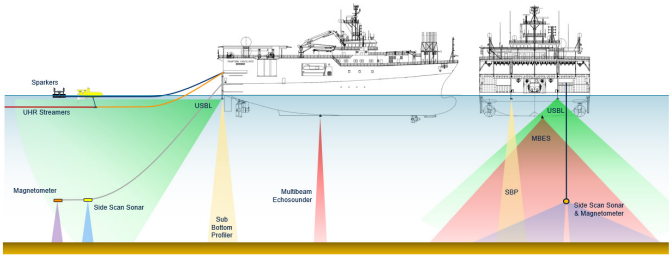
This desktop study facilitates early screening and project feasibility decisions and sets a solid basis for future investment and data acquisition decisions. In addition to detailed wind measurements, a significant volume of geophysical, geological and geotechnical data needs to be acquired across future project sites. Their integrated analysis and the development of three-dimensional ground model that will inform project design and installation decisions.

We make recommendations for future site investigations and provide guidance on ground model development as project plans mature towards installation and operations.

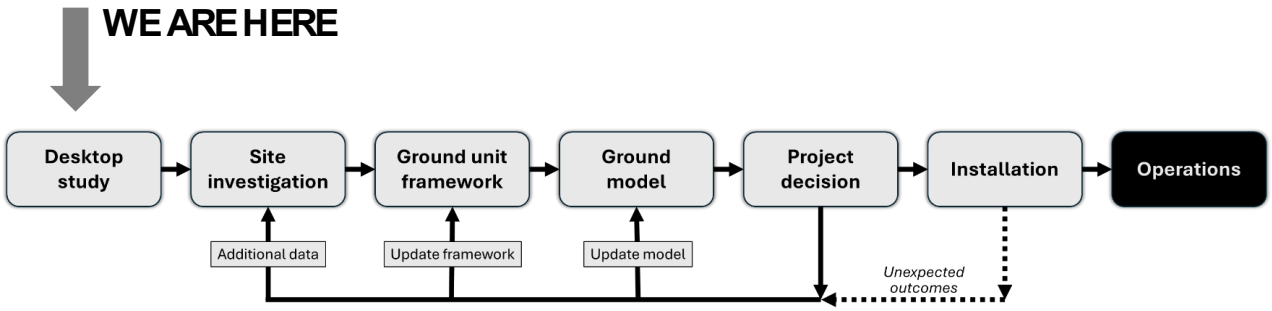
Coordination across the value chain is critical to the success development of Nova Scotia's offshore wind resource. This will require close collaborations between regulatory agencies, manufacturers, developers, data acquisition companies, and experts in geoscience and engineering.



General ground modeling workflow



Integrated geophysical site investigation



General site characterization workflow

About TGS

TGS is headquartered in Oslo, Norway, and publicly traded on the Oslo Stock Exchange. Our other main offices are in Calgary, Houston, London and Perth, and we have employees in cities around the globe. Our primary business is to provide geoscience data to energy companies worldwide. We offer extensive global libraries that include seismic data, magnetic and gravity data, multibeam and coring data, digital well logs, production data and directional surveys. Additionally, we offer advanced processing and imaging services, interpretation products and data integration solutions.

About NGI

The Norwegian Geotechnical Institute (NGI) is a research center and consulting firm with deep expertise in the fields of geotechnical engineering and geoscience across covering offshore energy, geotechnics, natural hazards and technology. Established in 1953 and headquartered in Oslo, NGI has offices in Norway (Oslo, Trondheim, Tromsø), the USA (Houston, Boston) and Australia (Perth). We also operate internationally renowned geotechnical laboratories in Oslo, Houston and Perth.

More information about NGI's projects, consulting and research can be found at the following link: About NGI.

Access the Full Desktop Study

This sample paper provides a high-level overview of wind and ground conditions offshore Nova Scotia. The complete 100-page desktop study offers in-depth data, detailed suitability maps, and comprehensive recommendations to support project planning and investment decisions.

To access the full study, contact Katie Applebaum at katie.applebaum@tgs.com.