

A Ground Model-Based Site-Wide Assessment of Offshore Wind Turbine Foundation Suitability and Constructability for the Designated Offshore Wind Energy Areas in Nova Scotia

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Canada has initiated regional assessments of offshore wind development with four designated wind energy areas (WEA) in Nova Scotia announced in 2025. These include Sydney Bight, French Bank, Middle Bank, and Sable Island Bank. The WEAs are located generally 20 km to 200 km offshore and lie on the Scotian Shelf except for Sydney Bight, which lies on the Cape Breton Shelf. The water depths for all the WEAs are between 20 m and 180 m. A preliminary assessment of site conditions across the proposed WEAs based on historical records indicates geo-engineering constraints including shallow bedrock, seafloor and shallow subsoil boulders, buried tunnel glacial valleys with potentially mixed soft sediments and boulders, hard grounds, and active sediment mobility associated with sand ridges. Suitable foundations for the offshore wind turbines based on the site conditions span from various fixed-bottom structures such as monopiles, suction buckets, and piled jackets to floating structures moored by anchors in deeper water depths.

This paper discusses the development of a preliminary ground model for the proposed WEAs and a framework for a ground model-based, automated assessment of wind turbine foundation suitability and constructability. The automated geotechnical design tool integrates 3D ground and foundation predictive capacity modelling application within a GIS-based platform enabling rapid, site-wide conceptual design of offshore wind turbine foundations based on spatially variable ground conditions.

This paper will provide regulators and developers a high-level overview of geo-considerations to start the planning phase of offshore wind development, such as develop an understanding of possible foundation conditions within the WEAs of interest. This will aid the planning of future desktop studies and reconnaissance surveys to derive site-specific information to start the preliminary assessment of foundation concepts as well as plan appropriate geophysical and geotechnical site investigations of the potential WEAs.