

Characterization of Site Conditions using Geophysical and Geotechnical Surveys G&G Survey Educational Session

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Objectives of G&G Surveys

- Support planning, design, installation and operation of wind farm developments
- Ground model development with geologic and anthropogenic hazards/constraints
- Archaeological and environmental studies



Starting Point



Geophysical Surveys



Engineering Ground Model

In Situ Testing (CPT)



Engineering Analysis and Design



Boreholes Sampling & Testing



Optimized Design



Lab Testing and Analysis





Multibeam depth sounder determines water depths and bottom topography

depth mines ns and praphy

> Side scan sonar creates an image of the seafloor

Sparker

Magnetometer

Sub-bottom profilers identify and characterize layers of sediment

Passive Acoustic

Monitoring Hydrophones

or rock under the seafloor

Protected species monitoring program with protected species observers, passive acoustic monitoring, and thermal imaging cameras



Geophysical Surveys – Seafloor Mapping

- A. Multibeam: seafloor elevation and features (sandwaves, rocks, etc.)
- B. Side Scan Sonar: identify shipwrecks, debris, boulders and seafloor conditions
- C. Magnetometer: identify ferromagnetic objects (pipelines, cables, debris, and UXO)







Geophysical Surveys – Sub-Seafloor Mapping

Shallow (10m): Sub-bottom Profiler

- Shallow stratigraphy and cables
 Deeper (40 to 100m): Sparker or
 boomer-seismic multichannel seismic
- Deeper stratigraphy and foundations



Sub-bottom Profiler



Sparker Multichannel Seismic



30m

Geotechnical Investigations

Wind turbine and substations

- Boreholes
- Cone penetration tests (CPT)
- Investigation depth dependent on foundation type (40 to 80m)



Inner-array and export cables

- Vibracores
- Cone penetration tests (CPT)
- Investigation depth 3 to 10m

Coiled 20-ton CPT



Vibracore





6 G&G Survey Educational Session – Sept 2, 2020

G&G Data Integration

- Ground models
- Inform wind turbine, cable and power sub-station layout

Seismic and Geotechnical Data



3D Model











Reconnaissance Geophysical Survey and Geotechnical Explorations

- Widely spaced survey lines
- Limited geotechnical explorations

Geophysical Survey Line

Geotechnical Borehole

Geotechnical CPT



Reconnaissance Geophysical Survey and Geotechnical Explorations

- Widely spaced survey lines
- Limited geotechnical explorations
- Site conditions/constraints inform how to phase site development

Geophysical Survey Line

- Geotechnical Borehole
- Geotechnical CPT

Constraint or Areas to Avoid



- More detailed survey to select wind turbine, sub-station, export cable and inner-array cable locations
- Survey covers conceptual number of turbines and sub-station locations
- Geotechnical investigations also conducted



UGRO

Potential Turbine Location

- Site constraints better defined
- Turbine cable locations refined based on site conditions
- Some turbine locations may be cancelled due to site conditions
- Some projects may elect to finalize inner-array cables or conduct a specialized survey (e.g. 3D seismic, UXO, etc.), if deemed necessary, later



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- BOEM requires Area of Potential Effect (APE) to have full surveys where seafloor disturbance will occur
- Full survey coverage of APE
- Two survey strategies
- 1. "Corridor" survey approach
 - 30m primary line spacing and full MBES/SSS coverage
 - Turbine corridor 200-400m wide
 - Cables 180-400m wide
- 2. Full survey of lease area



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Survey Corridor (green shaded zone)

Thank You

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