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SOILS AND WATERS ASSESSMENTS
FOR
WINDFARM DEVELOPMENT

David McLorinan, Associate
Michael Boyd, Director

Presentation Content

- Brief Overview of 'Soils and Water' Assessment for EIA
- Geological and Hydrogeological Issues for Wind Farm Development
- Wind Farm Development on Uplands – Bog Burst Assessments
- Case Study
- Summary

'Soils and Waters' Assessment for EIA

- Topsoil Profiles
  - Soil Type / Thickness
  - Agricultural Usefulness
  - Drainage Characteristics
  - Presence of Fill Materials
- Drift Geology
  - Nature and Thickness / Variability
  - Permeability / Aquifer Protection
  - Aquifer Potential

'Soils and Waters' Assessment for EIA

- Solid Geology
  - Depth to Rockhead
  - Aquifer Potential / Permeability
  - Geological Features of Note / Designations
- Surface Water Assessment
  - Meteorology – Usually High Rainfall
  - Catchment Mapping
  - Water Course Mapping
  - Drainage Characteristics – Usually Poor Drainage

'Soils and Waters' Assessment for EIA

- Qualitative / Quantitative Risk Assessment
- Identify Potential Impacts to Soils and Waters Environments
  - Loss of Agricultural land
  - Changes to Drainage Regime
  - Aquifer Vulnerability
  - Identify Nearby Water Receptors
  - Assess Risks
- Develop Mitigating Measures to Minimise Impact from Development
  - Usually Concentrating on Waters Issues
  - Aquifer Pollution
  - SuDS

'Soils and Waters' Assessment for Wind Farms

- Historically Assumed to be Relatively Straight Forward
- Usually in Upland Areas
  - Thin, Peaty Soils, Little Drift
  - Fairly Simple Upland Drainage Patterns, Runoff Dominated
  - Geology Easy to Identify – near surface / exposed
  - Hydrogeology – Commonly Dismissed
- No Major Ground Disturbance, only Turbine Bases
- Mitigating Measures
  - Development Phase – Surface Water / Runoff Management / Groundwater Protection
  - Operational Phase – Maybe some SuDS Recommendations

Soils and Waters' Assessment for Wind Farms

Bog Burst, Derrybrien Windfarm, Loughrea, Co Galway

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Wind Farms on Upland / Blanket Bog Areas

- Blanket Bogs cover c. One Million Hectares in Ireland
- Cover Many Upland Areas
- Therefore Present at Many Existing / Potential Wind Farm Sites
- Wind Farm Developments Blamed for Several 'Bog Burst' Incidents
- Bog Burst Risks Should Therefore be Addressed for Proposed Upland / Wind Farm Developments

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Causes of Bog Bursts

- Not Common – Only 40 Recorded Significant Incidents in Last 100 Years
- Majority Have Occurred on Blanket Bogs of West Ireland and Uplands
- Tend to be More Frequent in Autumn – Winter
- May be Naturally Occurring as Well as Induced
- Instability is Usually Caused by Accumulation of Shallow Groundwater in Base of Peat Deposits
- Number of Other Major Contributing Factors

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Contributing Factors – Risk of Bog Bursts

- Presence of a Break in Slope at Edge of Upland Plateau
- Presence of Areas of High Water Content
- Presence of Man-Made Drainage Channels Especially Parallel to break in Slope / Bog Edge
- Peat Extraction Activities – Creation of Excavations / Banks
- Removal of Vegetative Cover by Burning / Peat Extraction
- Exceptionally Dry Conditions prior to Heavy Rain – Leads to Creation of Macropores Allowing Much Quicker Infiltration Rates to Bog Base
- Evidence of Historical Bog Bursts at Site
- IDENTIFY REQUIREMENT FOR PEAT STABILITY ASSESSMENT

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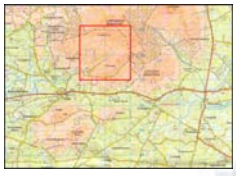
Tappaghan Mountain Case Study

- Proposed Wind Farm Site, Co. Fermanagh, 6km Northeast of Lack
- Upland Area at 180mOD – 325mOD, 2.5km^2
- Blanket Bog Covers Majority of Site, up to 4.5m thick
- Underlain by Discontinuous Glacial Till over Dalradian Schist
- Proposed Thirteen 1.5MW Turbines at 280mOD 325mOD



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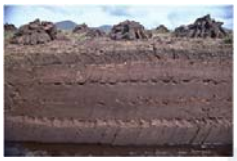
Peat Stability Risk Assessment – Current Condition

- Review of Historical Aerial Photographs / OS Maps to Assess Presence of On-site / Near by Bog Burst Events
- Topographical Survey to Identify Ground Slope, Slope Breaks, Drainage Channels
- Delineation of all Drainage Features and Excavations
- Identification of Areas of Peat Extraction
- Assessment of Peat Depth and Water Content Variability



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Peat Stability Risk Rating Table

Factor	Existing Risk	Reason
Historical incidences of bog burst in North West	**LOW to MEDIUM**	Bog bursts are not a common occurrence, however, a number have been recorded in the north west of the Island.
Historical incidences of bog burst on site.	**LOW**	There are no recorded incidences of bog bursts on the site. Aerial photographs and site investigations revealed no evidence of historical bog bursts.
Rainfall	**MEDIUM**	Annual rainfall is high in the western part of the province and is particularly high in upland areas. Bog bursts have been associated with extreme precipitation events or snowmelt.
Hydrology	**LOW to MEDIUM**	Bog bursts are sometimes associated with over saturated of peat, especially where this peat crosses a break in slope. There are a number of areas on the site where water content in the peat is high.
Man made drainage	**LOW**	Current man-made drainage lies perpendicular to the bog margin and is unlikely to significantly affect slope stability.
Peat depth	**LOW to MEDIUM**	Bog burst can occur on various depths of upland peat. The variation in peat depth is typical of blanket bogs where bursts have occurred in the past.
Slope	**MEDIUM**	Bog bursts can occur on relatively minor slopes (as low as 2°). Some bog bursts have been associated with break in slope, which can act as a pathway for the release of built up water at the base of peat. The topography on Tappaghan Mt. is highly variable.
Land use	**MEDIUM**	The current land uses have been associated with bog bursts that have occurred in the past.

Tappaghan Wind Farm - Site Zoning

High risk area
Medium risk area
Low risk area
Existing track
New track
No peat

Peat Stability Risk Assessment – Proposed Development

- Construction of Turbine / Met Mast Foundations
- Burial Trenches for Underground Services
- Construction of Sub-Station
- Excavations for Installation of Poles for Overhead Cables
- Construction of 3.5km Long Access Road
  - Disruption of Hydrology
  - Increase in Runoff
  - Weakening of Peat Structure
  - Changing Peat Depth / Vegetative Cover by Excavations and Site Works
  - Storing of Excavated Material

Risk Assessment and Mitigations

Impact	Risk Assessment	Mitigation Measure
Disruption of flow regime	Disruption of flow regime may cause excessive water build up or drying of peat leading to instability. Associated risk: **HIGH**	Installation of transverse drainage across the access tracks to allow through flow of surface and subsurface water. Any streams, pipes or drains to be culverted.
Increased runoff	Increased runoff from road and hardstanding may cause erosion and hence weakening of peat. Associated risk: **MEDIUM**	Tracks constructed to allow water to flow off the road into the drainage ditches rather than along the length of the track. Hardstanding areas to be surfaced with gravel and allowed to revegetate to allow infiltration and prevent rapid surface runoff.
Changing peat depth by excavation	Cutting into peat may provide an outlet for water that has accumulated at the base of the peat, which could trigger a bog burst. Associated risk: **HIGH**	Minimisation of depth of excavation. Drainage ditches to be dug with sufficient angle to prevent collapse of drain wall. Drainage ditches to be filled with gravel to provide additional support of drain wall. All plant should follow prescribed travel routes across the site in order to prevent excessive disturbance of exposed soils.
Changing peat depth by storing of excavated material	Excavated material stored on marginally stable peat may trigger a bog burst. Associated risk: **HIGH**	No concentrated loads of excavated material should be stored on marginally stable ground. The suitability of the ground on which excavated material is to be placed should be assessed prior to storage.

Monitoring Programme

- Baseline Monitoring, Targeting High Risk Areas
- Works Supervision – Geotechnical Engineer
- On-Site Soils Testing
- Visual Inspection
  - Water logging, drying, channelling, excavations etc
- Electronic Water Level Monitoring in Peat
- Ground Movement Monitoring – Inclinometers / Topographical Surveying
- Monthly Monitoring Report Produced by Site Supervisor
- Post Construction Monitoring / Long-Term Monitoring May be Required

Summary

- Before Bog Burst Issues Became Recognised as a Concern:-
  - Straight forward 'Soils and Waters Assessment' Usually Sufficient – Cost c £3,000 - £5,000
  - Planning Usually Relatively Straight Forward for Soils / Waters Issues
  - Geotechnical Investigations and Detailed Designs for Foundations set as Condition of Planning, not part of EIA
- Now Bog Bursts are recognised as a Concern:-
  - Carry out Initial Soils and Waters Assessment, and identify Potential for Bog Burst
  - If Significant Risk, then
  - Geotechnical Investigation
  - Peat Stability Assessment, Mitigation Measures, Design Monitoring Programme
  - Included in EIA
  - Monitoring Programme for Peat Stability set as Condition of Planning
  - Costs Could be in Order of £30,000 - £50,000