APPENDIX 8-1

GEOTECHNICAL & PEAT STABILITY ASSESSMENT REPORT

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

GEOTECHNICAL & PEAT STABILITY REPORT

GLENARD WIND FARM

Prepared for: **MKO Ltd**

Date: January 2022

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GEOTECHNICAL & PEAT STABILITY ASSESSMENT REPORT

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Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan to undertake a geotechnical assessment of the proposed Glenard wind farm site with respect to peat stability. As part of the geotechnical assessment of the proposed development, FT completed walkover surveys at the site and a ground investigation comprising trial pits with associated laboratory testing was also carried out. The findings of the geotechnical and peat stability assessment shows that the site has an acceptable margin of safety and is suitable for the proposed wind farm development.

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1. NON-TECHNCIAL SUMMARY

Fehily Timoney and Company (FT) was engaged by McCarthy Keville O'Sullivan on behalf of Futurenergy Glenard Designated Activity Company (DAC) to undertake a geotechnical and peat stability assessment of the proposed Glenard wind farm site. In accordance with planning guidelines compiled by the Department of the Housing, Planning and Local Government (Draft Revised Wind Energy Development Guidelines, DoHPLG, 2019), where peat >0.5m in thickness is present on a proposed wind farm development, a peat stability assessment is required.

A walkover including intrusive peat depth probing, trial pits, a desk study and a stability analysis and risk assessment was carried out to assess the susceptibility of the proposed development site to peat failure following the principles in the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017).

The findings of the peat assessment, which involved analysis of 220 locations, showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm project. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The proposed wind farm comprises 15 no. wind turbines and associated infrastructure.

The majority of the proposed development site is covered in blanket peat with undulating terrain. Up to 6.6km of existing tracks are present on the site and have been in operation for a number of years.

Peat thicknesses recorded during the site walkovers from over 450 probes ranged from 0 to >5.6m with an average of 2.0m. Over 60 percent of the probes recorded peat depths of less than 2.0m. Over 85 percent of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths of between 3.0 and >5.6m are present.

Slope inclinations at the main infrastructure locations range from 0 to 12 degrees. Ground conditions comprised mainly of peat overlying typically glacial till overlying bedrock.

The purpose of the stability analysis is to determine the stability i.e. Factor of Safety (FoS), of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS of greater than 1.0 indicates a stable slope. An acceptable FoS for slopes is generally taken as a minimum of 1.3 in order to minimise the risk of failure, as described in Section7.2. The stability analysis for this project, which analysed the turbine locations and associated infrastructure demonstrated an acceptable FoS and hence have a satisfactory margin of safety.

The risk assessment uses the results of the stability analysis in combination with qualitative factors which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to assess the risk of peat failure at the site. The results of the risk assessment are given in Appendix B. A construction buffer zone plan based on qualitative factors identified during the site walkover is included as Figure 4-2.

The findings of the peat assessment (which combines the FOS and the risk assessment), which involved analysis of 220 no. locations, showed that the proposed development areas have an acceptable margin of safety and that the site is suitable for the proposed wind farm development. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the wind farm to ensure peat failures do not occur on site.

Overall, the peat characteristics and ground conditions on the Glenard site are similar to that encountered on successfully developed wind farm sites in the area. In summary, the findings of the geotechnical and peat stability assessment showed that the proposed Glenard wind farm site has an acceptable margin of safety and is suitable for wind farm development. Based on the findings from the stability assessment, the proposed development footprint for the site would be considered to have a low risk of peat instability.

2. INTRODUCTION

2.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.70 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

FT have been involved in over 100 wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, design, construction and operational stage and have established themselves as one of the leading engineering consultancies in peat stability assessment, geohazard mapping in peat land areas, investigation of peat failures and site assessment of peat.

This Report was written by Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering). Ian is a Principal Geotechnical Engineer with Fehily Timoney and has over 20 years' experience in geotechnical engineering.

2.2 Project Description

Fehily Timoney and Company (FT) was engaged in August 2019 by McCarthy Keville O'Sullivan (MKO) on behalf of Futurenergy Glenard Designated Activity Company (DAC) to undertake a geotechnical and peat stability assessment of the proposed Glenard wind farm site.

The proposed development is at a site located approximately 5.9km east of Buncranna in Co. Donegal.

The site is heavily forested and consists predominantly of underlying blanket peat with a mainly man-made drainage network.

The development will comprise 15 no. wind turbines and associated hardstanding areas, 1 no. electricity substation, 1 no. borrow pit, 1 no. peat and spoil repository, 2 no. temporary construction compounds, upgrade of existing roads, construction of new site access roads, underground cabling connecting to the existing Trillick substation, proposed new link roads and accommodation works along the turbine delivery route, 1 no. permanent meteorological mast, amenity walkways, site drainage and all associated work as described in Chapter 1 of the EIAR.

2.3 Peat Stability Assessment Methodology

FT undertook the assessment following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (2nd Edition, PLHRAG, Scottish Government, 2017). The Peat Landslide Hazard and Risk Assessment Guide (PLHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

The aforementioned PLHRAG best practice guide was originally produced following peat failures in the Shetland Islands, Scotland in September 2003 but more pertinently following the peat failure in October 2003, during the construction of a wind farm at Derrybrien, County Galway, Ireland.

This peat stability assessment has been undertaken taking into account peat failures that have occurred on peatland sites (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal). The lessons learned from both peat slide events have been incorporated into the design of this project and the construction methodologies to be implemented. The Meenbog failure occurred during the construction of a section of floating road on sidelong ground in an area of weak peat. This construction technique is not proposed on sidelong ground on the Glenard site. It is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments for the turbines/access roads.

A constraints study was initially undertaken by the Environmental, Hydrogeological and Ecological members of the design team to determine the developable area on the site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT. The extent and depth of ground investigation and peat stability analysis by FT have been undertaken in accordance with guidance within Eurocode 7 and PLHRAG (2nd Edition, 2017) to investigate peat slopes that have the potential to impact on the proposed development, as applicable. Sufficient peat depth data has been recorded during the site walkovers to enable the characterisation of the peat depth across the proposed development site as shown in Figure 4.1 of the EIAR, with additional detail at infrastructure locations. The peat stability assessment is undertaken to identify peat slopes at risk from the proposed development, and to identify peat slopes that may pose a risk to the proposed development.

The geotechnical and peat stability assessment at the site included the following activities:

(1) Desk study, involving the review of publicly available soils and geology maps, records of historical peat failures, aerial photography.

(2) Site reconnaissance including shear strength and peat depth measurements undertaken following initial multidisciplinary constraints study (by the design team) to determine the proposed construction envelope within the site i.e. the area within the overall site where development is possible following multidisciplinary review and assessment of constraints.

(3) Peat stability assessment of the peat slopes on site within the proposed construction envelope using a deterministic and qualitative approach

(4) Peat contour depth plan – is compiled based on the peat depth probes carried out across the site by FT (2019, 2020 and 2021) and MKO (2019, 2020 and 2021)

(5) Factor of safety plan – is compiled for the short-term critical condition (undrained) for 220 no. FoS points analysed across the proposed development site

(6) Construction buffer zone plan – identifies areas with an elevated or higher construction risk where mitigation/control measures will need to be implemented during construction to minimise the potential risks and ensure they are kept within an acceptable range

(7) A peat stability risk register was compiled to assess the potential design/construction risks at the infrastructure locations and determine adequate mitigation/control measures for each location to minimise the potential risks and ensure they are kept within an acceptable range, where necessary

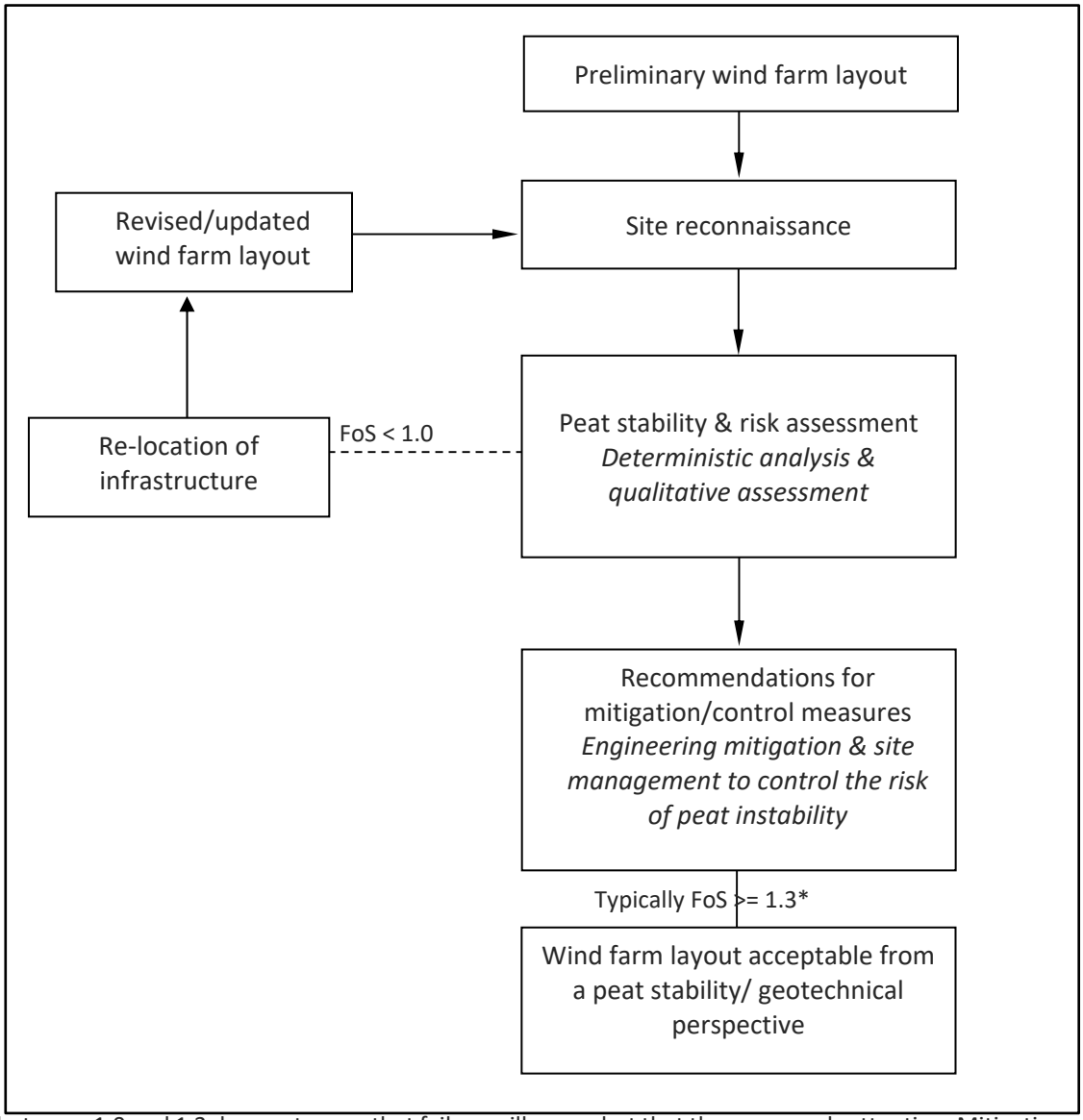
(8) Review of ground investigation carried out at the site by FT

(9) Initial assessment of foundation type for turbines (subject to confirmatory ground investigation)

(10) Commentary of founding details for other infrastructure elements such as access roads, crane hardstands, substation and construction compound platforms and met mast foundation.

A flow diagram showing the general methodology for peat stability assessment is shown in Figure 2-1. The methodology illustrates the optimisation of the wind farm layout based on the findings from a site reconnaissance and subsequent feedback.

Figure 2.1: Flow Diagram Showing General Methodology for Peat Stability Assessment



*A FoS of between 1.0 and 1.3 does not mean that failure will occur, but that the area needs attention. Mitigation measure can be provided for areas with an FoS of between 1.0-1.3 to reduce the risk of failure

As for all construction projects, a detailed engineering construction design must be carried out by the appointed construction stage designer prior to any construction work commencing on site. This must take account of the consented project details and any conditions imposed by that consent. This must include a confirmatory peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction.

2.4 Peat Failure Definition

Peat failure in this report refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that would occur (say) below an access road, creep movement or erosion type events.

The potential for peat failure at this site is examined with respect to wind farm construction and associated activity.

2.5 Main Approaches to Assessing Peat Stability

The main approaches for assessing peat stability for wind farm developments include the following:

(a) Geomorphological
(b) Qualitative (judgement)
(c) Index/Probabilistic (probability)
(d) Deterministic (factor of safety)

Approaches (a) to (c) listed above are subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach (as discussed in Section 2.6).

As part of FT's deterministic approach, a qualitative risk assessment (approach (b)) is also carried out taking into account qualitative factors, which cannot necessarily be quantified, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and several other factors. The qualitative factors used in the risk assessment are compiled based on FT's extensive experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK. FT have been involved with in excess of 100 wind farm developments across Ireland and the UK at various stages of development, from preliminary feasibility stage through planning and from scheme development at tender design and detailed design stage, through to the construction and operational stages. This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in the best practice for Peat Landslide Hazard and Risk Assessment Guide (PLHRAG, 2017), and takes into account the approach of MacCulloch (2005).

The risk assessment uses the results of the deterministic approach in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to assess the risk of instability on a peat land site.

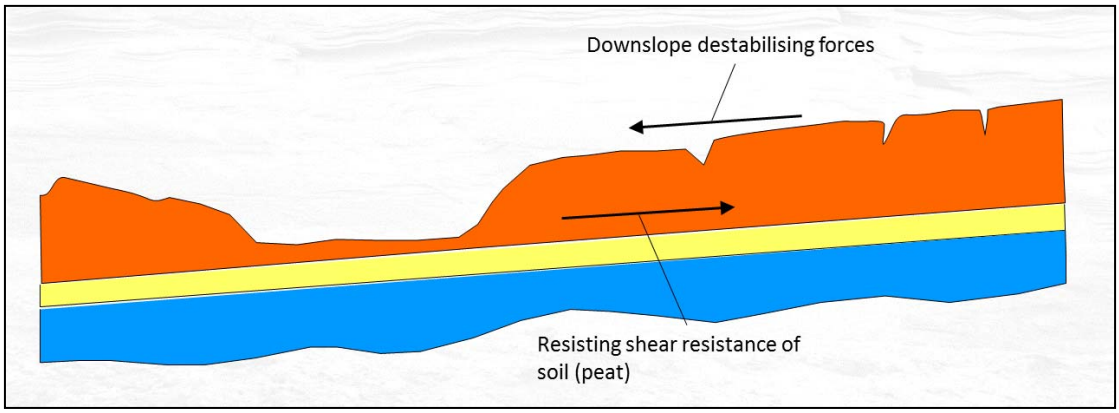
2.6 Peat Stability Assessment – Deterministic Approach

The peat stability assessment is carried out across a wide area of peatland to determine the stability of peat slopes and to identify areas of peatland that are suitable for development; this allows the layout of infrastructure on a particular wind farm site to be optimised. The assessment provides a numerical value (factor of safety) of the stability of individual parcels of peatland. The findings of the assessment discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply. This allows for the identification of the most suitable locations for turbines, access roads and infrastructure.

A deterministic assessment requires geotechnical information and site characteristics which are obtained from desk study and site walkover, e.g. properties of peat/soil/rock, slope geometry, depth of peat, underlying strata, groundwater, etc. An adverse combination of the factors listed above could potentially result in instability. Using the information above a factor of safety is calculated for the stability of individual parcels of peatland on a site (as discussed in Section 8).

The factor of safety is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance of forces between the weight of the soil/peat working downslope (destabilising force) and the inherent strength of the peat/soil (shear resistance) to resist the downslope weight, see Figure 2-2.

Figure 2.2: Peat Slope Showing Balance of Forces to Maintain Stability



The factor of safety provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force. Provided the available shear resistance is greater than the downslope destabilising force then the factor of safety will be greater than 1.0 and the slope will remain stable. If the factor of safety is less than 1.0 the slope is unstable and liable to fail. The acceptable range for factor of safety is typically from 1.3 to 1.4.

2.7 Applicability of the Factor of Safety (Deterministic) Approach for Peat Slopes

The factor of safety approach is a standard engineering approach in assessing slopes which is applied to many engineering materials, such as peat, soil, rock, etc.

The factor of safety approach is included in the Peat Landslide Hazard and Risk Assessments Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, 2017); see Section 5.3.1 of the guide. This guide provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

Furthermore, the best practice guide notes that the results from the factor of safety approach 'has provided the most informative results' with respect to analysing peat stability (Section 5.3.1 of the guide).

The factor of safety approach in this report includes undrained (short-term stability) and drained (long-term stability) analyses. The undrained condition is the critical condition for the development. The purpose of the drained analysis is to identify the relative susceptibility of rainfall-induced failures at the site.

Notwithstanding the above, the stability analysis used by FT in this report also includes qualitative factors to determine the potential for peat stability i.e. the analysis used does not solely rely on the factor of safety approach.

The deterministic analysis is considered an acceptable engineering design approach. This concurs with the best practice guide referenced above.

2.8 Assessment of Intense Rainfall and Extreme Dry Events on the Peat Slope

The deterministic approach carried out by FT examines intense rainfall and extreme dry events. The deterministic approach includes an undrained (short-term stability) and drained (long-term stability) analysis to assess the factor of safety for the peat slopes against a peat failure.

The drained loading condition applies in the long-term. This condition examines the effect of, in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes. For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the peat slope.

In order to represent varying water levels within the peat slopes, a sensitivity analysis is carried out which assesses varying water level in the peat slopes i.e. water levels ranging between 0 and 100% of the peat depth is conducted, where 0% equates to the peat been completely dry and 100% equates to the peat been fully saturated.

By carrying out such a sensitivity analysis with varying water level in the peat slopes, the effects of intense rainfall and extreme dry events are considered and analysed. The results of which are presented in Section 8 of this report.

3. DESK STUDY AND SITE RECONNAISSANCE

3.1 Desk Study

The main relevant sources of interest with respect to the site include:

- Geological plans
- Ordnance survey plans
- Literature review of peat failures

The Geological Survey of Ireland (GSI, 1997) geological plans for the site were used to verify the bedrock conditions.

The Ordnance Survey (OSI) plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical point of view) are present on the site.

The desk study also included a review of both published literature and GSI online dataset viewer (GSI, 2020/21) on peat failures/landslides in the vicinity of the site.

A review of the findings of a ground investigation carried out by FT was also included.

3.2 Soils, Subsoil & Bedrock

A review of the Geological Survey of Ireland online database and published documents from GSI namely Sheet 1 Geology of North Donegal was carried out.

A review of the GSI subsoils maps indicate that the proposed development site is mainly overlain by blanket peat.

In relation to bedrock, the site location and surrounding area is underlain by 2 different formations. Predominantly the site location is underlain by Fahan Grit Formation, which is described as generally pale grey, thickly bedded grits and flags with subsidiary pelitic horizons. The grit bands vary in thickness and composition, commonly exhibit graded beds and are sometimes markedly feldspathic. The southeastern portion of the site is underlain by the Fahan Slate Formation, which is described as pale-grey laminated pelites and thin bands of ripple-drift sandstone. There are also several discontinuous marble units within the formation.

There are no fault-lines within the bedrock of the site boundary.

No geological heritage sites are noted within the proposed development site. The closest features are approximately 7km east of the proposed site location at Quigley's Point. These features are described as alluvial gold and a possible double delta or relict drift deposit.

3.3 Previous Failures

There are no recorded peat failures within the Glenard wind farm site (GSI, 2021).

The nearest recorded peat failure is located 1km east of the study area. The failure occurred at Flughland (Glackmore Hill) in 2017 and comprised a series of shallow peat slides following extreme rainfall. GSI records indicate that 63mm of rainfall was recorded in 1 hour on the day of the failure.

Based on a broad, high-level assessment of landslide susceptibility the site was classified by the GSI (2019) as 'low' to 'high susceptibility', which is expected given the undulating terrain present.

The presence, or otherwise, of historical peat failures or clustering of historical failures within an area is an indicator that particular site conditions exist that pre-dispose a site to failure or not as the case may be. Based on the historical data reviewed and the terrain and ground conditions present on site it can be concluded that site conditions in the area of the proposed development site have low potential of peat failure.

3.4 Ground Conditions along Grid Connection Route

The proposed wind farm will connect to the grid via:

- An underground cable (8.1km in length) running from the on-site substation to the existing 110 kV Trillick substation, located to the west of the proposed development site. The proposed underground cable will be located on existing tracks and within the public road corridor.

Geological Survey of Ireland (GSI) online mapping indicate that the ground conditions along the grid connection route will comprise Blanket Peat and Till derived from Metamorphic rocks, With a localised section in Alluvium. No peat stability or geotechnical issues are envisaged as a result of the proposed grid connection works.

4. FINDINGS OF SITE RECONNAISSANCE

4.1 Site Reconnaissance

As part of the assessment of potential peat failure at the proposed site, FT carried out a site reconnaissance in conjunction with the desk study review described in Section 3. This comprised walkover inspections of the proposed development with recording of salient geomorphological features with respect to the proposed development which included peat depth and peat strength at specific locations. General photographs of the site are included in Appendix A of this document.

The following salient geomorphological features were considered:

- Active, incipient (developing) or relict instability (where present) within the peat deposits
- Presence of shallow valley or drainage line
- Wet areas
- Any change in vegetation
- Peat depth
- Slope inclination and break in slope

The survey covered the proposed locations for the turbine bases and all other associated infrastructure.

The method adopted for carrying out the site reconnaissance relied on practitioners carrying out a visual assessment of the site supplemented with measurement of slope inclinations.

4.2 Findings of Site Reconnaissance

The site reconnaissance comprised a walkover inspection of the proposed development site undertaken by FT from the 29th October to the 1st November 2019, on the 25th May 2020 and from the 1st to the 3rd June 2021. Conditions for the site visits were mainly dry. Additional probing was undertaken by MKO during July 2019, September 2020 and April 2021.

The findings from the site walkover have been used to optimise the layout of the infrastructure on site.

The main findings of the site walkover are as follows:

(1) The site is typically covered in a layer of peat and has undulating terrain. Peat depths vary across the site depending on mainly topography. Generally deeper peat was encountered in the flatter areas of the site with thinner peat on the surrounding slopes. Young and mature forestry is present across the site.

(2) Peat depths recorded across the site ranged from 0 to >5.6m with an average of 2m (Figure 4-1). A total of over 450 no. peat depth probes were carried out on site by FT and MKO. Over 85 percent of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths of between 3.0 and >5.6m are present.

(3) The peat depths recorded at the turbine locations varied from 0 to 3.0m with an average depth of 2m. The slope angle at the turbine locations range from 3 to 12 degrees.

(4) The access roads for the wind farm comprise the upgrade of existing access roads and the construction of new proposed access roads. The construction of new proposed access roads will be carried out using both floated and excavate & replace construction techniques.

(5) With respect to the new proposed access roads, peat depths are typically less than 2.0m with localised depths of up to 4m recorded. Approximately 60% of the access roads have peat depths of <2m.

(6) Slope angles at the turbine locations range from 3 to 12 degrees. These slope angle readings were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, (Silva Clino Master Slope Clinometer) which has an accuracy of +/- 0.25 degrees and from contour survey plans for the proposed development site.

(7) The slope angle quoted reflects the slope within the footprint of each infrastructure location, as recorded during the site walkover.

(8) Localised areas of ponding water were recorded. This is not unexpected given the ground conditions and the flat terrain present in localised areas across the site.

(9) An inspection of the ground conditions at 1 no. proposed borrow pit on site was carried out. The findings from this inspection are included in Section 10.

(10) No evidence of past failures or any significant signs of peat instability were noted on site, although there is evidence of peat failures on an adjacent site (Flughland).

(11) A watercourse is present along the proposed access route to turbine T5 and also between T6 and T7.

(12) A summary of the site walkover findings for the wind farm are as follows:

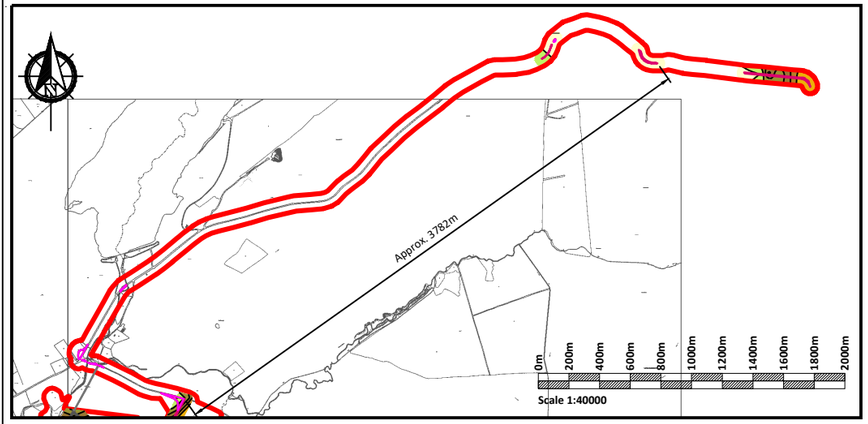
(a) The site is typically covered in a layer of peat with undulating terrain and widespread young to mature forestry coverage. Peat depths recorded across the site ranged from 0 to >5.6m with an average of 2m.

(b) A construction buffer zone plan has been produced for the site (Figure 4-2). This Figure shows areas on the site where no development is advised and areas with an elevated or higher construction risk. The above identified areas are based on qualitative factors identified during the walkover survey e.g. relatively deep peat, quaking peat, mechanically cut peat, recent peat landslide, etc.

(c) The results of the peat depth probing, shear strength testing of the peat and qualitative factors identified on site have been used in the stability and risk assessment, see Sections 7 and 8 of this report.

(d) Based on the findings from the walkover survey the proposed wind farm development would be considered to have a low risk of peat failure.

Based on the findings from the site reconnaissance, the proposed development footprint for the site would be considered to have a low risk of peat instability.



TDR AREAS OFFSITE TO THE NORTHEAST OF MAIN ENTRANCE

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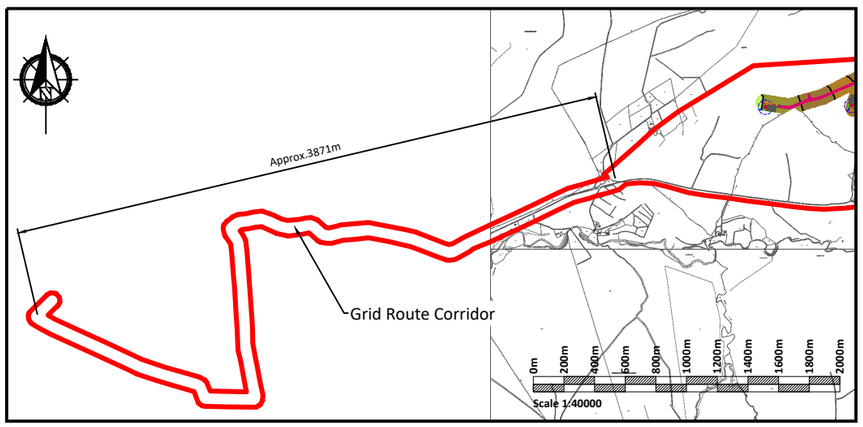

GRID ROUTE OFFSITE TO THE SOUTHWEST CORNER OF MAIN SITE

Scale 1:40000

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Peat Depth Legend:

- ≥ 0 < 0.5
- ≥ 0.5 < 1
- ≥ 1 < 1.5
- ≥ 1.5 < 2
- ≥ 2 < 2.5
- ≥ 2.5 < 3
- ≥ 3 < 3.5
- ≥ 3.5 < 4
- ≥ 4 < 4.5
- ≥ 4.5 < 5

0m 80m 160m 240m 320m 400m 480m 560m 640m 720m 800m

Scale 1:16000

Scale (@ A3)
1:16000

Date - 10.12.21

FIGURE 4.1 - PEAT DEPTH CONTOUR PLAN

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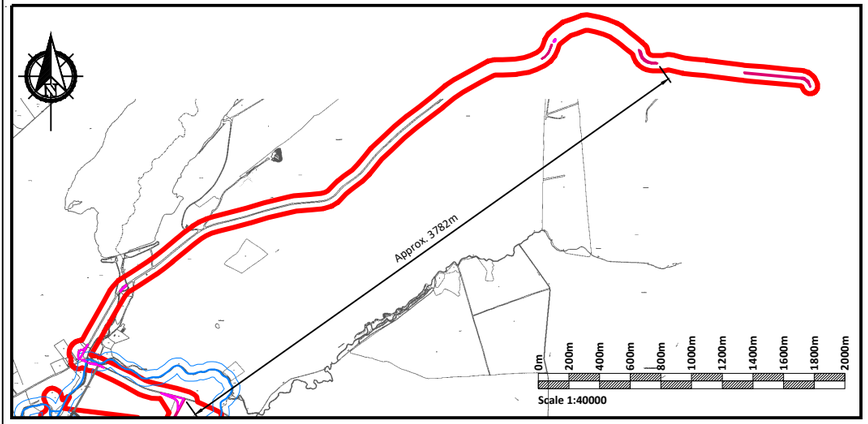
Friday 10 December 2021



TDR AREAS OFFSITE TO THE NORTHEAST OF MAIN ENTRANCE

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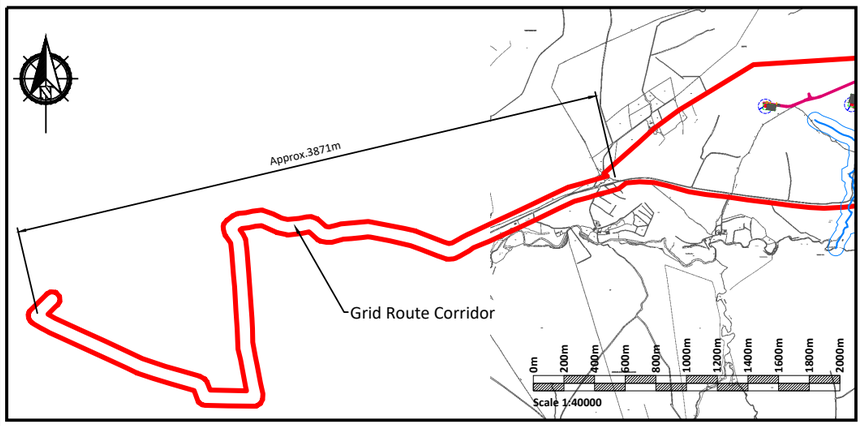

GRID ROUTE OFFSITE TO THE SOUTHWEST CORNER OF MAIN SITE

Scale 1:40000

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Construction Buffer Zone Legend:

Steep sided gully, construction to avoid area due to steep slopes.

Marginal buffer zones which may need supervision should construction works take place in these areas.

Watercourses with 50m buffer

EIAR Site Boundary
Construction Compound
Repository Area
Proposed Turbine
T4
T5
T3
Existing Access Track to be Upgraded
T6
T2
New Proposed Access Track
T7
T1
T10
T8
Proposed Borrow Pit
T9
Construction Compound
T14
T11
T12
T13
Proposed Substation
T15
Met Mast
Grid Route Corridor

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Scale 1:16000

0m 80m 160m 240m 320m 400m 480m 560m 640m 720m 800m

Scale 1:16000

Scale (@ A3)
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Date - 28.01.22

FIGURE 4.2 - CONSTRUCTION BUFFER ZONE PLAN

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Friday 28 January 2022

5. GROUND INVESTIGATION

A ground investigation was carried out at the proposed development site by FT in November 2019. The ground investigation by FT comprised 13 no. trial pits and laboratory testing, which was undertaken by Irish Drilling Ltd (IDL). The trial pits were carried to determine ground conditions across the proposed development site and to investigate a potential borrow pit location within the site. A ground investigation location plan is included as Figure 5-1 in this report.

The laboratory testing included the following:

- Classification testing for overburden material
- Minimum and maximum density values for over-burden material
- Determination of dry density/moisture content relationship

The trial pits logs, photographs and associated laboratory testing are included within Appendix E of this report.

5.1 Summary of Ground Conditions

The ground conditions at the site can be categorised into the following deposits:

Peat – Typically described as black & brown fibrous peat. Peat thicknesses from the trial pits ranged from 0.7 to 2.1m.

Glacial Till – Soft to firm brown sandy gravelly Clay and Silt with cobbles. The thickness of the layer is variable across the site.

Bedrock – Weak to moderately strong Psammitic Schist

Groundwater recordings in the trial pits varied from none to seepages and inflows between 0.5 and 3.1m bgl.

5.2 Summary of Laboratory Tests

Based on the results of the particle size distribution (PSD) tests, the descriptions on the final trial pit logs have been updated.

Atterberg limit tests carried out on the samples classify the material as Clay and Silt of low to very high plasticity.

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Ground Investigation Legend:

BP-TP... TP... Trial Pit Locations

EIAR Site Boundary

Construction Compound

Repository Area

Proposed Turbine

T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T1 T2 T3

TP01 TP02 TP03 TP04 TP05 TP06 TP07

BP-TP01 BP-TP02 BP-TP03 BP-TP04 BP-TP05 BP-TP06

Existing Access Track to be Upgraded

New Proposed Access Track

Proposed Borrow Pit

Construction Compound

Proposed Substation

Met Mast

Grid Route Corridor

0m 80m 160m 240m 320m 400m 480m 560m 640m 720m 800m

Scale 1:16000

Scale 1:16000

Scale (@ A3) 1:16000

Date - 10.12.21

FIGURE 5.1 - GROUND INVESTIGATION LOCATION PLAN

Drawn - POR

Checked - IH

Rev - C

Friday 10 December 2021

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6. PEAT DEPTHS, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS

As part of the site walkover, peat depth, in-situ peat strength and slope angles were recorded at various locations across the site.

6.1 Peat Depth

Peat depth probes were carried out at/near to proposed turbine locations, access roads and across the proposed development site. At turbine locations up to 5 probes were carried out around the turbine location and an average peat depth was calculated.

6.2 Peat Strength

The strength testing was carried out in-situ using a Geonor H-60 Hand-Field Vane Tester. From FT's experience hand vanes give indicative results for in-situ strength of peat and would be considered best practice for the field assessment of peat strength. Shear strengths have been recorded at 0.5m vertical intervals to a maximum depth of 2.5m.

Vane testing in peat is recognised as being an index tool (Boylan, Jennings & Long, 2008) and remains the most practical means of assessing peat strength during a site walkover.

6.3 Slope Angle

The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, (Silva Clino Master Slope Clinometer) which has an accuracy of +/- 0.25 degrees, and from contour survey plans for site.

The slope angle quoted reflects the slope within the footprint of each infrastructure location as recorded during the site walkover. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography. Slope angles recorded during the site reconnaissance by FT using handheld equipment and would generally be deemed more accurate and representative of local topography.

6.4 Summary of Findings

Based on the peat depths recorded across the site by FT, the peat varied in depth from 0 to >5.6m with an average of 2m. All peat depth probes carried out on site have been utilised to produce a peat depth contour plan for the site (Figure 4-1).

A summary of the peat depths and slopes at the proposed infrastructure locations is given in Table 6.1 and 6.2. The data presented in Table 6.1 is used in the peat stability assessment of the site; see Section 8 of this report.

Table 6.1: Peat Depth & Slope Angle at Proposed Turbine/Infrastructure Locations

Turbine	Easting	Northing	Peat Depth Range (m) (1)	Average Peat Depth (m)	Slope Angle (°) (2)
T1	644782	931991	0.5-2.0	1.5	8
T2	644839	932466	1.5-1.8	1.6	8
T3	644684	932840	0.5-0.8	0.7	10
T4	644383	933164	0.8-2.3	2.0	5
T5	643824	932948	1.7-2.5	2.1	4
T6	643953	932577	1.8-2.8	2.3	6
T7	644075	932161	0.5	0.5	12
T8	643927	931653	1.4-3.2	2.0	8
T9	644356	931516	1.8-2.2	2.0	7
T10	643370	931654	1.7-2.7	2.1	6
T11	643505	931222	1.7-2.1	1.9	6
T12	641736	930910	0.5-0.8	0.65	3
T13	642298	930921	2.2-2.8	2.5	4
T14	642958	931192	1.9-2.4	2.2	4
T15	642589	930617	1.2 -1.6	1.4	8
Substation	643021	930754	1.5-2.0	1.8	4
Construction Compound 1	644431	933435	2.7	2.7	2
Construction Compound 2	643760	931327	0.5	0.5	6
Borrow Pit 1	644215	931710	0.5	0.5	-
Peat Repository	644646	933227	3.5-5.5	5	2
Met Mast	643538	930890	1.2	1.2	12

Note (1) Based on probe results from the site walkovers. The range of peat depths for the turbine locations are typically based on a 10m grid carried out around the infrastructure element, where accessible.

Note (2) The slope angles across the proposed development site were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master (which has an accuracy of +/- 0.25 degrees) and from contour survey plans for site. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location.

Note (3) The data presented in the Table above is used in the peat stability assessment of the site; see Section 8 of this report.

Table 6.2: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Road	Easting	Northing	Peat Depth Range (m) (1)	Average Peat Depth (m)	Slope Angle (o) (2)
Entrance Road	Varies		0.8-2.9	2.1	0 - 4
Main Spine Road	Varies		0.5-4.1	1.1	0 - 15
Spur to T1	Varies		1.5-2.4	2.0	6 - 8
Spur to T2	Varies		1.2-1.9	1.4	6 - 10
Spur to T3	Varies		0.8-2.5	1.0	4 - 9
Spur to T4	Varies		1.7-2.3	2.1	2 - 6
Spur to T5	Varies		0.0-3.4	2.0	2 - 4
Spur to T6	Varies		0.9-3.7	1.9	4 - 8
Spur to T7	Varies		0.5-2.0	1.2	6 - 12
Spur to T8	Varies		1.8-2.3	2.0	3 - 5
Spur to T9	Varies		1.4-3.8	2.1	4 - 8
Spur to T10	Varies		1.3-4.1	2.6	4 - 6
Spur to T11	Varies		1.5-2.9	2.6	4 - 6
Spur to T12	Varies		1.1-2.6	1.8	3 - 4
Spur to T13	Varies		2.4-2.6	2.5	2 - 3
Spur to T14	Varies		1.0-3.2	2.5	2
Spur to T15	Varies		1.6-2.2	2.0	2 - 3

Note (1) Based on probe results from the site walkovers.

Note (2) The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master (which has an accuracy of +/- 0.25 degrees) and from contour survey plans for site. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location.

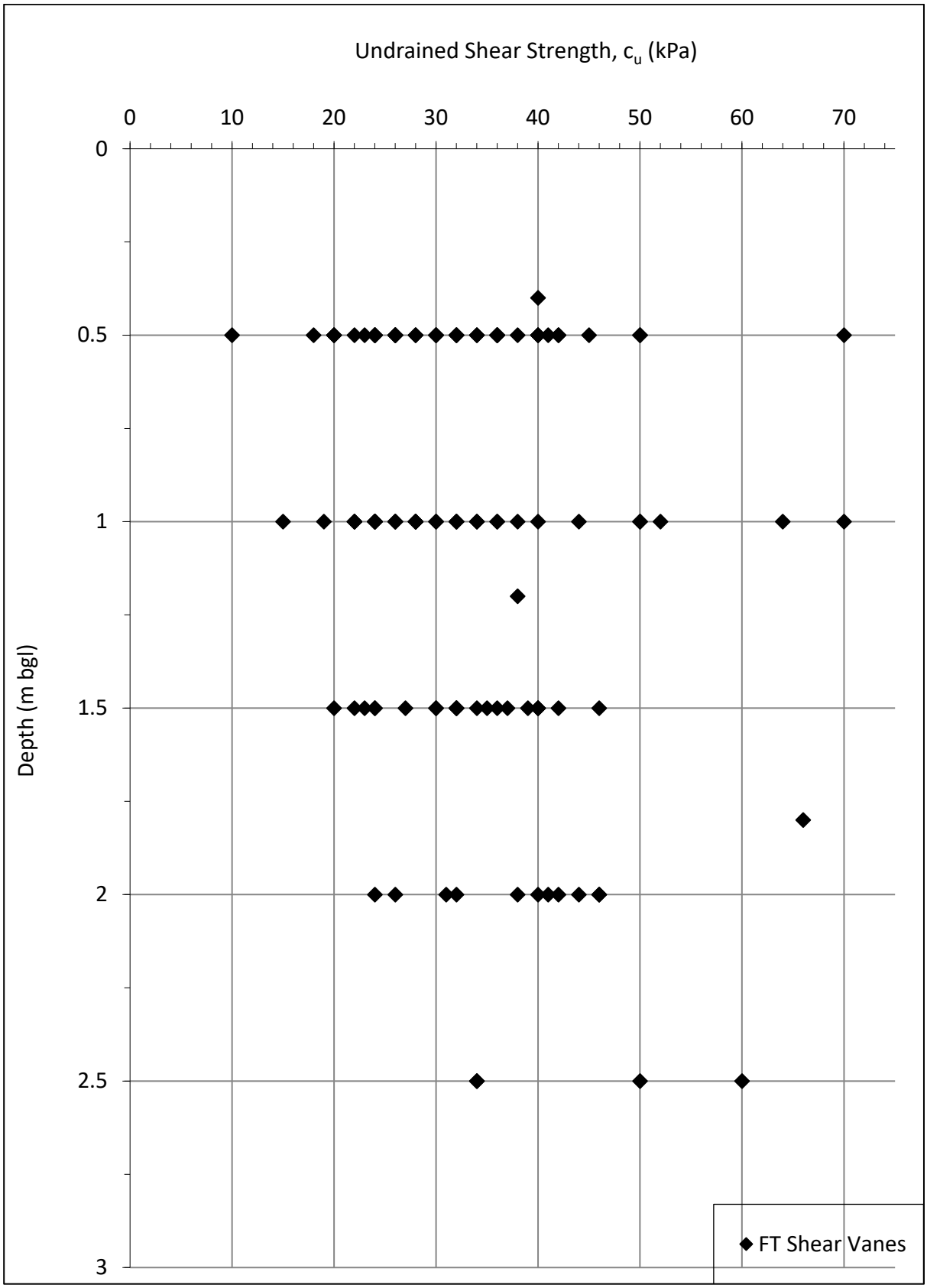
Note (3) The data presented in the Table above is used in the peat stability assessment of the site; see Section 8 of this report.

In addition to probing, in-situ shear vane testing was carried out as part of the ground investigation. Strength testing was carried out at selected locations across the site to provide representative coverage of indicative peat strengths. The results of the vane testing are presented in Figure 6-1.

The hand vane results indicate undrained shear strengths in the range 10 to 78kPa, with an average value of about 35kPa. The strengths recorded would be typical of well drained peat as is present on the Glenard site.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-analysis, though some testing was carried out, was estimated at 2.5kPa. The recorded undrained strength is significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Glenard site.

Figure 6.1: Undrained Shear Strength (c_u) Profile for Peat with Depth



7. PEAT STABILITY ASSESSMENTS

The peat stability assessment analyses the stability of the natural peat slopes for individual parcels across the site including at the turbine/hardstand locations, substation and temporary construction compound platforms, settlement ponds and along the proposed access roads. The assessment also analyses the stability of the natural peat slopes with a surcharge loading of 10kPa, equivalent to placing 1m of stockpiled peat on the surface of the peat slope.

7.1 Methodology for Peat Stability Assessment

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To assess the factor of safety for a peat slide, an undrained (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

1. The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

2. The drained loading condition applies in the long-term. The condition examines the effect of, in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the 2003 Derrybrien failure and other failures in peat, undrained loading during construction was found to be the critical failure mechanism. A more recent failure at Garvagh Glebe, Co. Leitrim followed a similar pattern.

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values a review of published information on peat was carried out. Table 7.1 shows a summary of the published information on peat together with drained strength values.

From Table 7-1 the values for c' ranged from 1.1 to 8.74kPa and ø' ranged from 21.6 to 43°. The average c' and ø' values are 4.5kPa and 30° respectively. Based on the above, it was considered to adopt a conservative approach and to use design values below the averages.

For design the following general drained strength values have been used for the site:

c' = 4kPa
ø' = 25 degrees

Table 7.1: List of Effective Cohesion and Friction Angle Values

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-
Farrell and Hebib (1998)	0	38	From ring shear and shear box apparatus. Results are not considered representative.
	0.61	31	From direct simple shear (DSS) apparatus. Result considered too low therefore DSS not considered appropriate
Rowe, Maclean and Soderman (1984)	1.1	26	From simple shear apparatus
	3	27	From DSS apparatus
McGreever and Farrell (1988)	6	38	From triaxial apparatus using soil with 20% organic content
	6	31	From shear box apparatus using soil with 20% organic content
Hungr and Evans (1985)	3.3	-	Back-analysed from failure
Dykes and Kirk (2006)	3.2	30.4	Test within acrotelm
Dykes and Kirk (2006)	4	28.8	Test within catotelm
Warburton et al (2003)	5	23.9	Test in basal peat
Warburton et al (2003)	8.74	21.6	Test using fibrous peat
Hendry et al (2012)	0	31	Remoulded test specimen
Komatsu et al (2011)	8	34	Remoulded test specimen
Zwanenburg et al (2012)	2.3	32.3	From DSS apparatus
Den Haan & Grognet (2014)	-	37.4	From large DSS apparatus
O'Kelly & Zhang (2013)	0	28.9 to 30.3	Tests carried out on reconstituted, undisturbed and blended peat samples

7.2 Analysis to Determine Factor of Safety (Deterministic Approach)

The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes using infinite slope analysis. The analysis was carried out at the turbine locations, along the proposed access roads and at various locations across the site.

The FoS provides a direct measure of the degree of stability of the slope. A FoS of less than unity indicates that a slope is unstable, a FoS of greater than unity indicates a stable slope.

The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3.

As a general guide the FoS limits for peat slopes in this report are summarised in Table 7.2.

Table 7.2: Factor of Safety Limits for Slopes

Factor of Safety (FoS)	Degree of Stability
Less than 1.0	Unstable (red)
Between 1.0 and 1.3	Marginally stable (yellow)
1.3 or greater	Acceptable (green)

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and the basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional approach, EC7 does not provide a direct measure of stability, since global Factors of Safety are not used.

As such, and in order to provide a direct measure of the level of safety on a site, EC7 partial factors have not been used in this stability assessment. The results are given in terms of FoS.

A lower bound undrained shear strength, c_u for the peat of 8kPa was selected for the assessment. The lowest recorded value on the Glenard wind farm site was 10kPa. It should be noted that a c_u of 8kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength as a result of the extensive drainage existing on site.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Where:

F = Factor of Safety
cu = Undrained strength
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
α = Slope angle

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2 \alpha \tan \phi'}{\gamma z \sin \alpha \cos \alpha}$$

Where:

F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the slope. Since the water level in blanket peat can be variable and can be recharged by rainfall, it is not feasible to establish its precise location throughout the site. Therefore, a sensitivity analysis using water level ranging between 0 and 100% of the peat depth was conducted, where 0% equates to the peat been completely dry and 100% equates to the peat been fully saturated, which would be considered the worst case.

The following general assumptions were used in the analysis of peat slopes at each location:

(1) Peat depths are based on the maximum peat depth recorded at each location from the walkover surveys.

(2) The slope angles used in the peat stability assessment were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment and from contour survey plans for site where site readings were not available. It should be noted that slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography.

(3) Slope angle on base of sliding assumed to be parallel to ground surface.

(4) A lower bound undrained shear strength, c_u for the peat of 8kPa was selected for the assessment. The lowest recorded value on the Glenard wind farm site was 10kPa. It should be noted that a c_u of 8kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength as a result of the extensive drainage on site.

For the stability analysis two load conditions were examined for both the undrained analysis and the drained analysis, namely

Condition (1): no surcharge loading

Condition (2): surcharge of 10kPa, equivalent to 1m of stockpiled peat assumed as a worst case. This assumes that the water level stays at the original ground surface level.

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

The results of the undrained analysis for the naturally occurring peat slopes are presented in Appendix C and the results of the undrained analysis for the most critical load case (load condition 2) are shown on Figure 7-1. The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface. The results from the main infrastructure locations are summarised in Tables 7-3 to 7-5.

The calculated FoS for load condition (1) is in excess of 1.30 for each of the locations (220 no. locations) analysed with a range of FoS of 1.83 to in excess of 10, indicating a low risk of peat instability.

The calculated FoS for load condition (2) is in excess of 1.30 for 219 of the 220 locations analysed, except for 1 no. location where an FoS of 1.24 was recorded along a section of access track. No sidecasting of peat is proposed for this location, and as such this load condition will not occur. Areas with marginally low FoS's coincide with steeper slopes angles or localised deeper areas of peat. This area is considered to have a slightly elevated construction risk and is highlighted on the construction buffer zone plan (Figure 4-3). No evidence of instability was recorded at this location.

Table 7.3: Factor of Safety Results (Undrained Condition)(Infrastructure)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	644782	931991	**3.22**	**2.07**
T2	644839	932466	**3.22**	**2.07**
T3	644684	932840	**5.85**	**2.60**
T4	644384	933164	**4.01**	**2.79**
T5	643824	932948	**4.60**	**3.28**
T6	643953	932577	**2.75**	**2.03**
T7	644075	932161	**7.87**	**2.62**
T8	643927	931653	**2.90**	**1.93**
T9	644356	931516	**3.31**	**2.20**
T10	643370	931654	**2.85**	**2.08**

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T11	643505	931222	3.66	2.48
T12	641736	930910	19.13	8.50
T13	642298	930921	4.11	3.03
T14	642958	931192	1.95	1.38
T15	642589	930617	3.63	2.23
Substation	643021	930754	5.75	3.83
Construction Compound 1	644431	933435	8.50	6.20
Construction Compound 2	643760	931327	15.39	5.13
Met Mast	643536	930895	9.83	2.81
Peat Repository	644646	933227	4.17	3.53

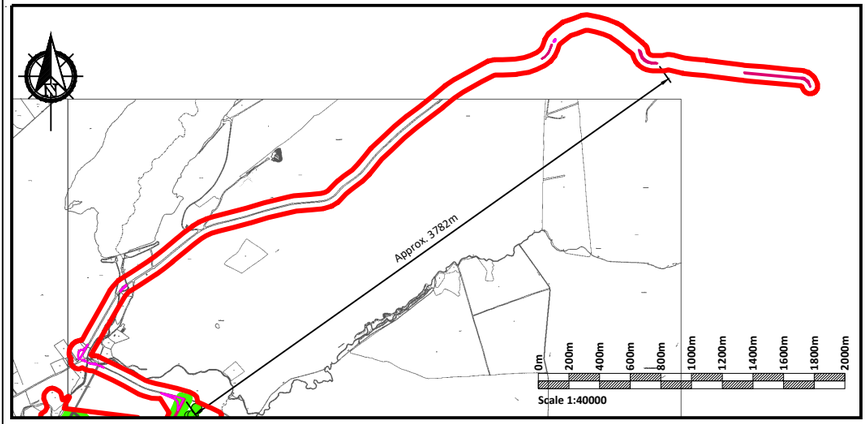
Table 7.4: Factor of Safety Results along Access Roads (Undrained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Site Entrance Road	Varies		7.91	5.88
Main Spine Road	Varies		2.91	1.52
Spur to T1	Varies		2.90	1.93
Spur to T2	Varies		2.07	1.36
Spur to T3	Varies		5.18	2.59
Spur to T4	Varies		2.52	1.76
Road to T5	Varies		22.99	7.66
Road to T6	Varies		3.06	2.00
Spur to T7	Varies		3.28	1.79
Spur to T8	Varies		4.01	2.79
Spur to T9	Varies		2.76	1.87
Road to T10	Varies		2.96	2.14
Spur to T11	Varies		2.96	2.14
Road to T12	Varies		6.39	4.11
Spur to T13	Varies		5.89	4.25
Spur to T14	Varies		7.17	5.46

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Spur to T15	Varies		4.39	2.97

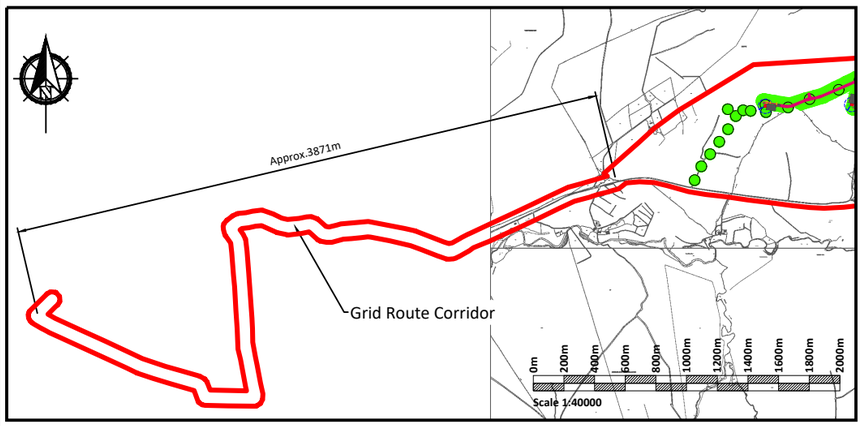
Table 7.5: Factor of Safety Results Settlement Ponds (Undrained Condition)

Location	Settlement Pond Number	Factor of Safety for Load Condition	
		Condition (1)	Condition (2)
T1	SP-O3	2.60	1.67
T2	SP-L4	2.88	1.85
T3	SP-K1	5.85	2.60
T4	SP-I3	4.01	2.79
T5	SP-F2	6.12	4.37
T6	SP-G2	2.75	2.03
T7	SP-H2	13.23	4.41
T8	SP-M5	7.65	5.10
T9	SP-N6	3.31	2.20
T10	SP-V5	5.67	4.14
T11	SP-Q2	5.47	3.71
T12	SP-Z5	19.13	8.50
T13	SP-Y1	4.11	3.03
T14	SP-W5	3.84	2.71
T15	SP-T2	7.19	4.42
Substation	SP-S4-1	6.56	4.38
Construction Compound 1	SP-I1	4.61	3.07
Construction Compound 2	SP-P1	13.23	4.41
Peat Repository	SP-J2-1	4.17	3.53



TDR AREAS OFFSITE TO THE NORTHEAST OF MAIN ENTRANCE

Scale 1:40000



GRID ROUTE OFFSITE TO THE SOUTHWEST CORNER OF MAIN SITE

Scale 1:40000

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Factor of Safety Legend:

- 0 < 1.0
- ≥ 1.0 < 1.3
- ≥ 1.3

Increasing Stability

No Peat Recorded At This Location

Scale (@ A3) 1:16000

Date - 16.12.21

FIGURE 7.1 - FACTOR OF SAFETY PLAN - SHORT TERM CRITICAL CONDITION (UNDRAINED)

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Thursday 16 December 2021

7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix C. The results from the main infrastructure locations are summarised in Table 7.6 to 7.8. As stated previously, the drained loading condition examines the effect of in particular, rainfall on the existing stability of the natural peat slopes and represents the post construction phase of the development.

The calculated FoS for load condition (1) (no surcharge loading) is in excess of 1.30 for each of the locations (220 no. locations) analysed with a range of 1.30 to in excess of 10, except for 6 no. locations where an FoS ranging from 1.02 to 1.27 was calculated. Areas with marginally low FoS's coincide with steeper slopes angles or localised deeper areas of peat along sections of access tracks. These areas will have a slightly elevated construction risk and will require control and mitigation measures to maintain the drainage paths around these locations to prevent the buildup of water in the slope. No evidence of instability was recorded at these locations, or across the proposed development site.

The slope angles at each of the main infrastructure locations were obtained using a combination of readings taken during the site reconnaissance by FT using handheld equipment, such as the Silva Clino Master which has an accuracy of +/- 0.25 degrees and from contour survey plans for site.

The calculated FoS for load condition (2) (surcharge of 10kPa, equivalent to 1m of stockpiled peat assumed as a worst case) is in excess of 1.30 for each of the locations (220 no. locations) analysed with a range of FoS of 1.30 to in excess of 10. Areas with marginally low FoS's coincide with steeper slopes angles or localised deeper areas of peat. These areas will have a slightly elevated construction risk and will require control and mitigation measures to maintain the drainage paths around these locations to prevent saturation of the peat. The results of Condition (2) are slightly higher than for Condition (1) in the drained case because the water level is assumed to be at original ground level, rather than at the top of the additional 1m of peat. This results in a slightly higher FoS because the effective height of the water in the peat is no longer 100% of the height of the peat.

Table 7.6: Factor of Safety Results (Drained Conditions)(Infrastructure)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	644782	931991	**1.61**	**2.22**
T2	644839	932466	**1.61**	**2.22**
T3	644684	932840	**2.92**	**2.77**
T4	644384	933164	**2.00**	**3.01**
T5	643824	932948	**2.30**	**3.55**
T6	643953	932577	**1.37**	**2.18**
T7	644075	932161	**3.93**	**2.77**
T8	643927	931653	**1.45**	**2.07**
T9	644356	931516	**1.65**	**2.37**
T10	643370	931654	**1.43**	**2.24**
T11	643505	931222	**1.83**	**2.67**

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T12	641736	930910	9.57	9.20
T13	642298	930921	9.03	8.49
T14	642958	931192	3.86	3.58
T15	642589	930617	5.60	4.90
Substation	643021	930754	2.87	4.14
Construction Compound 1	644431	933435	4.25	6.71
Construction Compound 2	643760	931327	7.70	5.52
Met Mast	643536	930895	1.64	1.89
Peat Repository	644646	933227	2.09	3.82

Table 7.7: Factor of Safety Results along access roads (Drained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Site Entrance Road	Varies		3.95	6.36
Main Spine Road	Varies		1.45	1.59
Spur to T1	Varies		1.02	1.46
Spur to T2	Varies		1.07	1.42
Spur to T3	Varies		2.59	2.77
Spur to T4	Varies		1.67	1.88
Road to T5	Varies		11.50	8.28
Road to T6	Varies		1.53	2.14
Spur to T7	Varies		1.64	1.89
Spur to T8	Varies		1.44	2.37
Spur to T9	Varies		1.27	1.97
Road to T10	Varies		1.48	2.30
Spur to T11	Varies		1.48	2.36
Road to T12	Varies		3.19	4.66
Spur to T13	Varies		2.94	4.94
Spur to T14	Varies		3.58	6.36

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Spur to T15	Varies		2.19	3.45

Table 7.8: Factor of Safety Results Settlement Ponds (Drained Condition)

Location	Settlement Pond Number	Factor of Safety for Load Condition	
		Condition (1)	Condition (2)
T1	SP-O3	1.30	1.78
T2	SP-L4	1.44	1.98
T3	SP-K1	2.92	2.77
T4	SP-I3	2.00	3.01
T5	SP-F2	3.06	4.73
T6	SP-G2	1.37	2.18
T7	SP-H2	6.61	4.74
T8	SP-M5	3.83	5.52
T9	SP-N6	1.65	2.37
T10	SP-V5	2.83	4.47
T11	SP-Q2	2.74	4.01
T12	SP-Z5	9.57	9.20
T13	SP-Y1	2.05	3.27
T14	SP-W5	1.92	2.92
T15	SP-T2	3.59	4.78
Substation	SP-S4-1	3.28	4.73
Construction Compound 1	SP-I1	2.30	3.31
Construction Compound 2	SP-P1	6.61	4.74
Peat Repository	SP-J2-1	2.09	3.82

7.4 Stability of Borrow Pit Buttress

A stability check has been undertaken to demonstrate the stability of the proposed perimeter berms around the borrow pit. The perimeter berm is considered to be more critical than any internal buttresses, as peat is only present on one side of the buttress. Slope stability has been checked using Slope/W slope stability software. The analysis was carried out without using partial factors, and as such a minimum Factor of Safety (FoS) of 1.3 is required to demonstrate the stability of the proposed berms, as explained in Section 2 of this report.

The following material properties have been used in the stability assessment. A low strength for the peat retained within the borrow pit/repositories has been used to model the effect of disturbance on the saturated peat mass.

Table 7.9: Material Properties

Material	Unit Weight (kN/m^3)	Undrained Shear Strength, c_u (kPa)	Angle of Shearing Resistance, ϕ (degrees)	Effective Cohesive, c' (kPa)
Intact Peat	10.5	8	25	4
Granular fill (berm)	21	-	46	0
Retained Peat within Borrow Pit (disturbed)	10.5	2	5	2
Glacial Till	20	75	34	0.5
Bedrock	21	-	34	250

The berm along the northern side of the borrow pit will be up to 8m in height. Bedrock has been assessed at 2m below ground level based on the available ground investigation information, overlain by 0.75m of peat and 1.25m of Glacial Till. All peat will be excavated from below the perimeter berm. The base of the rock berm will be benched into the glacial till to create a level platform (not shown in stability output). The inside slope of the perimeter berm has been modelled as a 60 degree slope, and the outside slope as 45 degrees. Groundwater has been assumed at ground level on the downslope side of the berm.

The stability analysis has been undertaken using both undrained (short term) and drained (long term) strength parameters.

Table 7.10: Borrow Pit Stability Analysis

Borrow Pit	Factor of Safety
Undrained Analysis	1.54
Drained Analysis	1.46

8. PEAT STABILITY RISK ASSESSMENT

A peat stability risk assessment was carried out for the main infrastructure elements at the wind farm. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2017) and MacCulloch (2005).

The risk assessment uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability, to assess the risk for each infrastructure element.

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated and rated as shown in Table 8.1. Where a location is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

Table 8.1: Risk Rating Legend

17 to 25	High: avoid works in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

A full methodology for the peat stability risk assessment is given in Appendix E.

8.1 Summary of Risk Assessment Results

The results of the peat stability risk assessment for potential peat failure at the main infrastructure elements and along access roads is presented as a Geotechnical Risk Register in Appendix B and summarised in Table 8.2 and 8.3.

The post-control measure risk rating, for each infrastructure element at the proposed development site is designated negligible or low following some routine mitigation/control measures being implemented (Refer to Appendix B).

Details of the required mitigation/control measures can be found in the Geotechnical Risk Register for each infrastructure element (Appendix B) and are summarised below:

- Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
- Use of experienced geotechnical staff for site investigation.
- Maintain hydrology of area as far as possible by maintaining existing drains to prevent the build-up of water pressures in the peat, leading to the peat becoming "buoyant".
- Use of experienced contractors and trained operators to carry out the work.

Table 8.2: Summary of Peat Stability Risk Register (Infrastructure)

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Turbine T1	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T2	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T3	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T4	Low	5 to 10	No	Negligible	1 to 4
Turbine T5	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T6	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T7	Low	5 to 10	No	Low	5 to 10
Turbine T8	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T9	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T10	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T11	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T12	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T13	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T14	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T15	Negligible	1 to 4	No	Negligible	1 to 4
Substation	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 1	Negligible	1 to 4	No	Negligible	1 to 4
Construction Compound 2	Negligible	1 to 4	No	Negligible	1 to 4
Met Mast	Negligible	1 to 4	No	Negligible	1 to 4
Borrow Pit	Negligible	1 to 4	No	Negligible	1 to 4

Table 8.3: Summary of Peat Stability Risk Register (Access Roads)

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Site Entrance Road	Low	5 to 10	No	Low	5 to 10
Main Spine Road	Low	5 to 10	No	Low	5 to 10
Spur to T1	Medium	11 to 16	Yes	Low	5 to 10
Spur to T2	Low	5 to 10	Yes	Low	5 to 10
Spur to T3	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T4	Negligible	1 to 4	No	Negligible	1 to 4
Road to T5	Medium	11 to 16	No	Low	5 to 10
Road to T6	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T7	Low	5 to 10	No	Low	5 to 10
Spur to T8	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T9	Negligible	1 to 4	No	Negligible	1 to 4
Road to T10	Low	5 to 10	No	Low	5 to 10
Spur to T11	Negligible	1 to 4	No	Negligible	1 to 4
Road to T12	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T13	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T14	Negligible	1 to 4	No	Negligible	1 to 4
Spur to T15	Negligible	1 to 4	No	Negligible	1 to 4

9. INDICATIVE FOUNDATION TYPE & FOUNDING DEPTH FOR TURBINES

Based on a review of the ground investigation information for the site, an assessment of the likely foundation type and founding depths for each turbine location was carried out. A summary of this assessment is provided in Table 9.1.

Table 9.1: Summary of Indicative Turbine Foundation Type & Founding Depth

Turbine No.	Turbine Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T1	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T2	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T3	Gravity foundation	TP07	3.0	Peat to 2.0m.
T4	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T5	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T6	Gravity foundation	TP01	3.0	Peat to 1.6m overlying soft sandy gravelly Clay. Possible weathered bedrock at 2.6m bgl.
T7	Gravity foundation	Peat probing	3.0	Estimate based on location and ground conditions
T8	Gravity foundation	TP05	3.5	Peat to 1.1m overlying sandy gravelly Silt. Possible weathered bedrock at 3.2m bgl.
T9	Gravity foundation	TP06	3.0	Peat to 2.0m overlying sandy gravelly Clay. Possible bedrock at 2.5m bgl.
T10	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T11	Gravity foundation	TP04	c3.5	Peat to 2.1m overlying sandy gravelly silty Clay to 3.1m.
T12	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T13	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T14	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above
T15	Gravity foundation	Peat probing	3.0	Peat Depth range included in Table 6.1 above

Note: Peat probes were also carried out at each turbine location to confirm peat depths.

It should be noted that further confirmatory ground investigation will be carried out at each turbine location in the form of a borehole with in-situ SPT's (Standard Penetration Test) carried out at 1.0m intervals in the overburden and follow-on rotary core through bedrock to confirm the foundation types and founding stratums in Table 10.1.

For gravity type turbine foundations, where the depth of excavation exceeds the required founding depth for the proposed turbine base, all unsuitable material will be excavated and up-fill material consisting of granular fill (6N) shall be used to backfill the excavation to the required founding depth.

For piled turbine foundations, a typical piling type and configuration would be 16 no. 900mm rotary bored piles or similar.

10. GROUND CONDITIONS AT PROPOSED BORROW PIT

10.1 Overview

A single borrow pit location was investigated and is included in this report namely:

(1) **Proposed Borrow Pit No. 1** – located in the central part of the site with a plan area of 350 x 110m.

10.2 Summary of Ground Conditions

10.2.1 Proposed Borrow Pit

6 no. trial pits were carried out within an area of worked ground adjacent to the proposed borrow pit. The general ground conditions comprised a thin layer of peat overlying glacial deposits. Bedrock was recorded at <2m bgl. These ground conditions are considered representative of those within the proposed borrow pit.

The glacial soils were typically described as a sandy gravelly Clay with cobbles. Weathered bedrock, comprising weak to medium strong psammitic Schist, was recorded below the overburden. Intact bedrock is likely to be suitable for reuse as general granular fill (Class 1A and 1C).

11. FOUNDING DETAILS FOR OTHER INFRASTRUCTURE ELEMENTS

This section provides a summary of the founding details for various elements of the proposed infrastructure across the proposed development site. The detailed methodologies for the construction these elements of the proposed development are included in Chapter 4 of the EIAR.

11.1 Access Roads

The access roads on site will be constructed as a combination of floating and excavate and replace (founded) type construction, which, given the ground conditions and type of terrain present, is deemed an appropriate construction approach. Floating road construction will be limited to areas of flat ground (<2 degrees) as shown on Figure 2-1 in the Peat & Spoil Management Plan.

The total length of new proposed access road to be constructed on site is 9.7km (see Figure 1.1 of the Peat and Spoil Management Plan – Appendix 4-2 of the EIAR).

The proposed make-up of the founded access roads is a minimum stone thickness of 500mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed at pre-construction stage. Floating roads will have a minimum stone thickness of 1000mm with a layer of geogrid at the base of the road.

See the Peat & Spoil Management Plan for Glenard wind farm for further details on the proposed access roads on site.

11.2 Crane Hardstands

The crane hardstands will be constructed using the founded technique (i.e. not floated technique

Crane hardstands are constructed using compacted Class 1/6F material on a suitable sub-formation to achieve the required bearing resistance. The hardstands will be designed for the most critical loading combinations from the crane.

The hardstands will require to be founded on competent material underlying the peat deposits. The founding levels for the hardstands will be variable across the site and will be confirmed at pre-construction stage.

The typical make-up of the hardstands may include up to 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid.

11.3 Substation Foundations & Platforms

The substation platform will be constructed using the founded technique (i.e. not floated technique). The substation foundations will comprise strip/raft foundations under the main footprint of the building with possibly a basement/pit for cable connections.

Substation platforms are constructed using compacted Class 1/6F material on a suitable sub-formation to achieve the required bearing resistance.

The substation platform will require to be founded on competent material underlying the peat deposits.

Given the ground conditions present at the proposed substation, it is envisaged that the foundations will require to be founded on glacial till. The peat will not be a be a suitable founding stratum for the substation foundations.

The typical founding depth for substation platforms is to be 1.5-2.0m.

The typical make-up of the substation platform may include up to 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid. At the underside of the substation foundations, a layer of structural up-fill (class 6N) will be required.

11.4 Construction Compound Platforms

The construction compound platforms will be constructed using the founded technique (i.e. not floated technique).

The construction compound platforms are generally constructed using compacted Class 1/6F material on a suitable sub-formation to achieve the required bearing resistance.

The construction compound platforms will require to be founded on material underlying the peat deposits.

Typical founding depth for construction compound platforms will require excavations from 1.0m to 3.0m bgl.

The typical make-up of the construction compound platform may include up to 750mm of granular stone fill with possibly a layer of geotextile and/or geogrid.

11.5 Met Mast Foundations

The met mast foundation will comprise a gravity type foundation.

Given the ground conditions present at the proposed met mast, it is envisaged that the foundation will require to be founded on glacial till, glacial granular till or bedrock.

Typical founding depth for the met mast foundation is envisaged to be 2.0 to 3.0m bgl. At the underside of the met mast foundation, a layer of structural up-fill (class 6N) will be required.

11.6 Peat Repository

A number of potential peat repository locations were reviewed as part of the assessment of the site. One location was selected and is shown on the site plans.

Discussion of the peat repository is provided in the Peat and Spoil Management Plan (FT, 2021) for the proposed development site.

12. SUMMARY AND RECOMMENDATIONS

12.1 Summary

The following summary is given.

FT was engaged by MKO on behalf of Futurenergy Glenard Designated Activity Company (DAC) to undertake a geotechnical and peat stability assessment of the proposed Glenard wind farm site.

The findings of the peat assessment showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development. The report includes recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

The site which comprises undulating to hilly terrain consists predominantly of mature and young forestry. The ground conditions across the site consist predominantly of blanket peat.

Peat thicknesses recorded during the site walkovers from over 450 probes ranged from 0 to >5.6m with an average of 2.0m. Over 85 percent of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths of between 3.0 and >5.6m are present. The deeper peat areas were generally avoided when optimising the wind farm layout for site.

Slope inclinations at the main infrastructure locations range from 3 to 12 degrees.

An analysis of peat sliding was carried out at the main infrastructure locations across site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes.

An undrained analysis was carried out, which applies in the short-term during construction, which is considered to be the worst case based on the 2003 Derrybrien failure and other failures in peat, undrained loading during construction was found to be the critical failure mechanism. For the undrained condition, the calculated FoS for load conditions (1) & (2) for the locations analysed, show that all locations have an acceptable FoS of greater than 1.3 except for 1 no. location where an FoS of 1.24 was calculated (for Condition 2). As a control measure, no sidecasting of peat is proposed for this location, and as such this load condition will not occur. The undrained analysis would be considered the most critical condition for the peat slopes.

A drained analysis was carried out, which examines the effect of in particular, rainfall on the existing stability of the natural peat slopes on site. For the drained condition, the calculated FoS for load conditions (1) & (2) for the locations analysed, show that all locations have an acceptable FoS of greater than 1.3 except for 6 no. locations along access roads where FoS's ranging from 1.02 to 1.26 were calculated. Areas with marginally low FoS's coincide with steeper slopes angles or localised deeper areas of peat along sections of access tracks. These areas will have a slightly elevated construction risk and will require control and mitigation measures to maintain the drainage paths around these locations to prevent the buildup of water in the slope. No evidence of instability was recorded at these locations, or across the proposed development site.

Areas with marginally low FoS's in the drained condition coincide with steeper slopes angles or localised deeper areas of peat. No signs of peat instability were noted at these locations during the site walkovers. These areas will have a slightly elevated construction risk and will require localised control and mitigation measures, specifically to control surface water flow and to prevent the buildup of water in drains.

The peat stability risk assessment report provides a number of mitigation/control measures to reduce the potential risk of peat failure at each infrastructure location. Sections of access roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element. See Appendix B for details of the required mitigation/control measures for each infrastructure element.

In summary the findings of the peat assessment showed that the proposed Glenard wind farm site has an acceptable margin of safety, is suitable for the proposed wind farm development and is considered to be at **low** risk of peat failure. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

12.2 Recommendations

The following general recommendations are given.

Notwithstanding that the site has an acceptable margin of safety a number of mitigation/control measures are given to ensure that all works adhere to an acceptable standard of safety for work in peatlands. Mitigation/control measures identified for each of the infrastructure elements in the risk assessment will be taken into account and implemented throughout design and construction works (Appendix B).

Figure 4.2 shows areas with elevated or higher construction risk based on qualitative factors identified during the site walkover e.g. relatively deep peat, quaking peat, etc. Figure 7.1 shows the results of the factor of safety (FoS) analysis for the peat slopes on site for the most critical load condition.

Recommendations and guidelines given in FT's report 'Peat & Spoil Management Plan - Glenard Wind Farm, County Donegal' (FT 2021), included as Appendix 4-2 of the EIAR, should be implemented during the design and construction stage of the wind farm development.

To minimise the risk of construction activity causing potential peat instability it is recommended that the Construction Method Statements (CMSs) for the project follow, but not be limited to, the recommendations above. This will ensure that best practice guidance regarding the management of peat stability will be inherent in the construction phase.

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APPENDIX A

Photos from Site Walkover

Photo 1: Example of peat exposed in ditch alongside existing track

Photo 2: Felled area east of T10

Photo 3: View south towards T6

Photo 4: Steep sided gully south of T7

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APPENDIX B

Peat Stability Risk Registers

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T1

Grid Reference (Eastings, Northings):	**644782**	**931991**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.5-2.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.07 (u), 1.61(d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T1**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T2

Grid Reference (Eastings, Northings):	**644839**	**932466**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.5-1.8**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.07 (u), 1.61 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T2**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T3

Grid Reference (Eastings, Northings):	**644684**	**932840**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.5-0.8**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.60 (u), 2.77 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T3**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T4

Grid Reference (Eastings, Northings):	644383	933164
Distance to Watercourse (m)	100 - 150	
Min & Max Measured Peat Depth (m):	0.8-2.3	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.79 (u), 2.00 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	2	6	Low	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T4**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T5

Grid Reference (Eastings, Northings):	**643823**	**932948**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.7-2.5**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 3.28 (u), 2.30 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T5**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T6

Grid Reference (Eastings, Northings):	643653	932577
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.8-2.8	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.03 (u), 1.37 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T6**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T7

Grid Reference (Eastings, Northings):	643075	932161
Distance to Watercourse (m)	50 - 100	
Min & Max Measured Peat Depth (m):	0.5	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.62 (u), 2.77 (d)	1	3	3	Negligible	No	See Below	1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	2	3	6	Low	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	3	3	9	Low	No		3	3	9	Low
7	Evidence of very soft/soft clay at base of peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Other	0	3	0	Not Applicable	No		0	3	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T7**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T8

Grid Reference (Eastings, Northings):	**643927**	**931653**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.4-3.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.93 (u), 1.45 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		2	1	2	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T8**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T9

Grid Reference (Eastings, Northings):	**644356**	**931516**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8-2.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.20 (u), 1.65 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T9**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T10

Grid Reference (Eastings, Northings):	643370	931654
Distance to Watercourse (m)	< 50	
Min & Max Measured Peat Depth (m):	1.7-2.7	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.08 (u), 1.43 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Negligible	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		1	4	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T10**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T11

Grid Reference (Eastings, Northings):	**643505**	**931222**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.7-2.1**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.48 (u), 1.83(d)	3	1	3	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T11**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T12

Grid Reference (Eastings, Northings):	642736	931910
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	0.5-0.8	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 8.5 (u), 9.2 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T12**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T13

Grid Reference (Eastings, Northings):	642298	930921
Distance to Watercourse (m)	100 - 150	
Min & Max Measured Peat Depth (m):	2.2-2.8	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 3.03 (u), 8.49 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		1	2	2	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	1	2	2	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	2	4	Negligible	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T13**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T14

Grid Reference (Eastings, Northings):	642958	931192
Distance to Watercourse (m)	100 - 150	
Min & Max Measured Peat Depth (m):	1.9-2.4	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 3.38 (u), 2.40 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		1	2	2	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	3	2	6	Low	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	2	4	Negligible	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T14**
i	Due to poor drainage and relatively deeper peat this location would require additional construction measures such as: - detailed ground investigation to determine peat, mineral soil and bedrock condition and properties. - excavation side slopes to be supports or excavation face battered to shallow angle - potential for greater water inflow into excavation requiring remvoal of water using pumps - daily detailed inspection of excavation faces - increased exclusion zone around excavation to aviod accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Turbine T15

Grid Reference (Eastings, Northings):	642589	930617
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.2-1.6	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.23 (u), 1.81 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T15**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Substation

Grid Reference (Eastings, Northings):	**643021**	**930754**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.00**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.79 (u), 3.01 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Substation**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. 1

Grid Reference (Eastings, Northings):	**644431**	**933435**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.7**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 6.20 (u), 6.71 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound 1**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Const. Comp. 2

Grid Reference (Eastings, Northings):	643760	931327
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	0.5	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.91 (u), 7.53 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound 2**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Met. Mast

Grid Reference (Eastings, Northings):	643538	930890
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	1.2	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.97 (u), 1.64 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Met. Mast**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Borrow Pit

Grid Reference (Eastings, Northings):	644215	931710
Distance to Watercourse (m)	50 - 100	
Min & Max Measured Peat Depth (m):	0.5	
Control Required:	No	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 10 (u), 10.8 (d)	1	3	3	Negligible	No	See Below	1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	2	3	6	Low	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	1	3	3	Negligible	No		1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Other	0	3	0	Not Applicable	No		0	3	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Borrow Pit 1**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix D.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Site Entrance Road**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**0.8-2.9**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.88 (u), 6.36(d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	2	4	8	Low	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		2	4	8	Low
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Site Entrance Road**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Main Spine Road**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**0.5-4.1**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.52 (u), 1.59 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	2	4	8	Low	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		2	4	8	Low
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Main Spine road**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T1**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**1.5-2.4**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.32 (u), 1.02 (d)	4	4	16	Medium	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Negligible	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		2	4	8	Low
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T1**
i	Maintain hydrology/drainage of area to prevent buildup of water in drains;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
v	Potential requirement for small buttress on upslope side of access road to retain peat should any instability be noted.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T2

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**100 - 150**
Min & Max Measured Peat Depth (m):	**1.2-1.9**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.64 (u), 1.07 (d)	4	2	8	Low	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	2	6	Low	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T2**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T3**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.8-2.5**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.59 (u), 2.77 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T3**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T4

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**100 - 150**
Min & Max Measured Peat Depth (m):	**1.7-2.3**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.76 (u), 1.26 (d)	2	2	4	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	2	4	Negligible	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T4**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T5

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**0.0-3.4**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 7.66 (u), 8.22 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		1	4	4	Negligible
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	2	4	8	Low	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	3	4	12	Medium	No		3	4	12	Medium
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T5**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Sput to T6**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.9-3.7**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.0 (u), 2.4 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	2	1	2	Negligible	No		2	1	2	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T6**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Sput to T7**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**0.5-2.0**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.79 (u), 1.89 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	2	4	8	Low	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		2	4	8	Low
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T7**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T8

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**100 - 150**
Min & Max Measured Peat Depth (m):	**1.8-2.3**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.19 (u), 2.37 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	1	2	2	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	2	4	Negligible	No		1	2	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T8**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T9

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**1.4-3.8**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.87 (u), 1.27(d)	2	1	2	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T9**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note

(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T10**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**1.3-4.1**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.14 (u), 2.3 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	1	4	4	Negligible	No		1	4	4	Negligible
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	2	4	8	Low	No		2	4	8	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	4	8	Low	No		2	4	8	Low
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T10**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T11**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**1.5-2.9**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.32 (u), 2.49 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T1**1
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	Spur to T12

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**100 - 150**
Min & Max Measured Peat Depth (m):	**1.1-2.6**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 4.11 (u), 9.34 (d)	1	2	2	Negligible	No		1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	2	6	Low	No	See Below	2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T12**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T13**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.8-2.6**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.59 (u), 2.77 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No		2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T13**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T14**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**100 - 150**
Min & Max Measured Peat Depth (m):	**1.0-3.2**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.46 (u), 17.96 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	2	4	Negligible	No		2	2	4	Negligible
7	Evidence of very soft/soft clay at base of peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T14**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Glenard Wind Farm - Peat Stability Risk Register (Rev 0)

Location:	**Spur to T15**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**1.6-2.2**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.97 (u), 7.56 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	1	3	Negligible	No	See Below	3	1	3	Negligible
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Spur to T15**
i	Maintain hydrology of area as far as possible;
ii	Use of experienced geotechnical staff for confirmatory site investigation;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.
(2) Probability assessed as per Table A and B of Appendix E.
(3) Impact based on distance of infrastructure element to nearest watercourse.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
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APPENDIX C

Calculated FOS for Peat Slopes on Site

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
T1	644782	931991	8	8	10	1.80	2.8	**3.22**	**2.07**
T2	644839	932466	8	8	10	1.80	2.8	**3.22**	**2.07**
T3	644684	932840	10	8	10	0.80	1.8	**5.85**	**2.60**
T4	644384	933164	5	8	10	2.30	3.3	**4.01**	**2.79**
T5	643824	932948	4	8	10	2.50	3.5	**4.60**	**3.28**
T6	643953	932577	6	8	10	2.80	3.8	**2.75**	**2.03**
T7	644075	932161	12	8	10	0.50	1.5	**7.87**	**2.62**
T8	643927	931653	8	8	10	2.00	3.0	**2.90**	**1.93**
T9	644356	931516	7	8	10	2.00	3.0	**3.31**	**2.20**
T10	643370	931654	6	8	10	2.70	3.7	**2.85**	**2.08**
T11	643505	931222	6	8	10	2.10	3.1	**3.66**	**2.48**
T12	641736	930910	3	8	10	0.80	1.8	**19.13**	**8.50**
T13	642298	930921	4	8	10	2.80	3.8	**4.11**	**3.03**
T14	642958	931192	4	8	10	2.40	3.4	**4.79**	**3.38**
T15	642589	930617	8	8	10	1.60	2.6	**3.63**	**2.23**
Con Comp 1	644431	933435	2	8	10	2.70	3.7	**8.50**	**6.20**
Con Comp 2	643760	931327	6	8	10	0.50	1.5	**15.39**	**5.13**
Substation	643021	930754	4	8	10	2.00	3.0	**5.75**	**3.83**
Met Mast	643536	930895	12	8	10	0.40	1.4	**9.83**	**2.81**
Repository	644646	933227	2	8	10	5.50	6.5	**4.17**	**3.53**
CC1	644345	930169	2	8	10	3.20	4.2	**7.17**	**5.46**
CC5	644016	931652	3	8	10	2.00	3.0	**7.65**	**5.10**
WP46	642747	930574	4	8	10	2.00	3.0	**5.75**	**3.83**
WP64	642906	930622	6	8	10	1.80	2.8	**4.28**	**2.75**
WP66	643086	930707	2	8	10	0.90	1.9	**25.49**	**12.07**
WP69	643319	930891	8	8	10	1.50	2.5	**3.87**	**2.32**
WP72	643554	931076	8	8	10	1.60	2.6	**3.63**	**2.23**
WP80	644070	931683	8	8	10	1.90	2.9	**3.06**	**2.00**
WP83	644295	931876	5	8	10	1.50	2.5	**6.14**	**3.69**
WP86	644406	932154	10	8	10	0.30	1.3	**15.59**	**3.60**
WP88	644479	932340	15	8	10	1.10	2.1	**2.91**	**1.52**
WP90	644552	932526	3	8	10	1.50	2.5	**10.20**	**6.12**
WP92	644602	932717	10	8	10	1.30	2.3	**3.60**	**2.03**
WP96	644591	933095	2	8	10	4.10	5.1	**5.59**	**4.50**
WP98	644516	933281	2	8	10	2.40	3.4	**9.56**	**6.75**
WP116	644009	931606	5	8	10	1.50	2.5	**6.14**	**3.69**
WP119	643784	931413	5	8	10	1.70	2.7	**5.42**	**3.41**
WP129	643606	932246	8	8	10	1.30	2.3	**4.47**	**2.52**
WP131	643568	932442	6	8	10	1.80	2.8	**4.28**	**2.75**
WP135	643897	932525	8	8	10	1.80	2.8	**3.22**	**2.07**
WP137	644084	932581	5	8	10	0.80	1.8	**11.52**	**5.12**
WP140	644251	932821	2	No peat encountered					
WP145	644165	933275	2	No peat encountered					
WP148	643937	933468	1	No peat encountered					
WP150	643915	933656	3	No peat encountered					
WP152	643925	933845	3	8	10	3.80	4.8	**4.03**	**3.19**
WP158	643646	931485	4	8	10	1.80	2.8	**6.39**	**4.11**
WP163	643554	931916	5	8	10	1.60	2.6	**5.76**	**3.54**
WP165	644081	931665	7	8	10	1.70	2.7	**3.89**	**2.45**
WP167	644048	931471	8	8	10	1.90	2.9	**3.06**	**2.00**
WP169	644227	931454	7	8	10	2.60	3.6	**2.54**	**1.84**
WP173	644573	931644	10	8	10	0.70	1.7	**6.68**	**2.75**
WP176	644718	931901	8	8	10	1.50	2.5	**3.87**	**2.32**
WP184	644358	932028	8	8	10	0.60	1.6	**9.67**	**3.63**
WP190	644287	932533	6	8	10	0.50	1.5	**15.39**	**5.13**
WP195	644456	932045	15	8	10	0.80	1.8	**4.00**	**1.78**
WP197	644558	932215	12	8	10	1.15	2.2	**3.42**	**1.83**
WP199	644686	932367	13	8	10	1.40	2.4	**2.61**	**1.52**
WP207	644405	933573	1	8	10	1.80	2.8	**25.47**	**16.37**
WP208	644490	933625	1	8	10	1.20	2.2	**38.20**	**20.84**
WP210	644647	933747	3	8	10	1.00	2.0	**15.31**	**7.65**
WP212	644740	933916	2	8	10	3.70	4.7	**6.20**	**4.88**
WP215	644325	933374	2	8	10	1.00	2.0	**22.94**	**11.47**
WP219	643978	933193	2	8	10	1.30	2.3	**17.64**	**9.97**
WP224	643914	933282	4	8	10	0.50	1.5	**22.99**	**7.66**
WP229	643755	933101	6	8	10	1.60	2.6	**4.81**	**2.96**
WP233	643827	933204	3	8	10	1.70	2.7	**9.00**	**5.67**
WP237	643878	932840	7	8	10	0.90	1.9	**7.35**	**3.48**
WP242	643835	933031	2	8	10	2.00	3.0	**11.47**	**7.65**
WP244	644018	933081	7	8	10	1.40	2.4	**4.72**	**2.76**
WP248	644047	932862	5	8	10	2.90	3.9	**3.18**	**2.36**
WP252	643961	932857	5	8	10	1.90	2.9	**4.85**	**3.18**
WP283	645188	930202	12	8	10	1.00	2.0	**3.93**	**1.97**
2	641274	930428	6	8	10	0.20	1.2	**38.48**	**6.41**
4	641317	930518	5	8	10	0.40	1.4	**23.04**	**6.58**
6	641375	930598	3	8	10	1.00	2.0	**15.31**	**7.65**
8	641434	930678	4	8	10	0.70	1.7	**16.42**	**6.76**
10	641492	930760	4	8	10	1.00	2.0	**11.50**	**5.75**
12	641542	930847	4	8	10	1.00	2.0	**11.50**	**5.75**
15	641490	930891	5	8	10	0.70	1.7	**13.16**	**5.42**
17	641590	930884	3	8	10	0.80	1.8	**19.13**	**8.50**
18	641640	930880	4	8	10	0.70	1.7	**16.42**	**6.76**
20	641739	930872	4	8	10	1.20	2.2	**9.58**	**5.23**
23	641884	930903	3	8	10	1.10	2.1	**13.92**	**7.29**
26	642023	930957	4	8	10	1.80	2.8	**6.39**	**4.11**
30	642214	931018	3	8	10	2.60	3.6	**5.89**	**4.25**

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
33	642350	931081	2	8	10	1.70	2.7	**13.49**	**8.50**
36	642451	931186	4	8	10	1.80	2.8	**6.39**	**4.11**
38	642545	931171	4	8	10	2.00	3.0	**5.75**	**3.83**
41	642686	931162	3	8	10	1.00	2.0	**15.31**	**7.65**
44	642817	931229	2	8	10	1.50	2.5	**15.29**	**9.17**
45	642867	931226	2	8	10	2.80	3.8	**8.19**	**6.04**
46	642902	931255	2	8	10	3.20	4.2	**7.17**	**5.46**
48	642920	931353	2	8	10	3.20	4.2	**7.17**	**5.46**
50	642936	931452	2	8	10	2.90	3.9	**7.91**	**5.88**
53	642957	931600	2	8	10	1.60	2.6	**14.34**	**8.82**
56	642971	931749	1	8	10	2.00	3.0	**22.92**	**15.28**
59	642871	931854	3	8	10	2.40	3.4	**6.38**	**4.50**
64	643088	931629	4	8	10	1.50	2.5	**7.66**	**4.60**
66	643183	931655	4	8	10	1.60	2.6	**7.19**	**4.42**
67	643233	931658	5	8	10	1.00	2.0	**9.21**	**4.61**
69	643333	931655	3	8	10	1.70	2.7	**9.00**	**5.67**
71	643431	931639	3	8	10	1.80	2.8	**8.50**	**5.47**
73	643510	931583	3	8	10	2.10	3.1	**7.29**	**4.94**
75	643596	931533	4	8	10	2.20	3.2	**5.23**	**3.59**
ditional FT locations									
1	644419	933386	4	8	10	2.40	3.4	**4.79**	**3.38**
2	644395	933303	10	8	10	2.30	3.3	**2.03**	**1.42**
PR1	644724	933282	2	8	10	2.70	3.7	**8.50**	**6.20**
PR2	644637	933217	2	8	10	3.30	4.3	**6.95**	**5.33**
Met	643536	930895	12	8	10	0.40	1.4	**9.83**	**2.81**
5	643516	930982	6	8	10	1.70	2.7	**4.53**	**2.85**
6	643968	931865	10	8	10	0.80	1.8	**5.85**	**2.60**
7	643923	931954	12	8	10	1.20	2.2	**3.28**	**1.79**
8	643885	932046	12	8	10	0.40	1.4	**9.83**	**2.81**
9	643847	932139	10	8	10	0.70	1.7	**6.68**	**2.75**
10	643854	932235	10	8	10	1.80	2.8	**2.60**	**1.67**
11	643882	932331	8	8	10	2.00	3.0	**2.90**	**1.93**
12	643909	932428	10	8	10	1.90	2.9	**2.46**	**1.61**
13	643936	932524	8	8	10	0.50	1.5	**11.61**	**3.87**
MKO Probes									
13	643557	931538	1	8	10	1.30	2.3	**35.27**	**19.93**
17	643603	932137	10	8	10	0.60	1.6	**8.11**	**3.04**
18	643267	930878	7	8	10	0.90	1.9	**7.35**	**3.48**
19	643804	931319	8	8	10	1.00	2.0	**5.95**	**2.97**
21	643772	931215	11	8	10	1.20	2.2	**3.69**	**2.01**
26	643674	931117	9	8	10	2.10	3.1	**2.52**	**1.71**
27	643603	932053	3	8	10	2.40	3.4	**5.63**	**3.97**
41	643644	932054	4	8	10	1.20	2.2	**8.60**	**4.69**
42	643601	931996	4	8	10	1.20	2.2	**10.94**	**5.97**
47	643549	932051	7	8	10	1.80	2.8	**3.57**	**2.30**
67	644838	932435	6	8	10	1.80	2.8	**4.28**	**2.75**
68	644888	932462	11	8	10	1.05	2.1	**4.03**	**2.07**
75	644673	932959	6	8	10	2.50	3.5	**3.29**	**2.35**
82	644624	933112	1	8	10	5.60	6.6	**6.50**	**5.51**
84	643604	932149	6	8	10	1.00	2.0	**7.85**	**3.93**
93	644360	933560	7	8	10	1.80	2.8	**3.50**	**2.25**
95	644446	933600	1	8	10	1.00	2.0	**38.21**	**19.10**
97	644531	933655	5	8	10	1.30	2.3	**6.75**	**3.82**
99	644599	933720	7	8	10	0.90	1.9	**7.40**	**3.51**
101	644659	933772	4	8	10	0.45	1.5	**28.37**	**8.80**
103	644719	933838	7	8	10	1.70	2.7	**3.78**	**2.38**
105	644760	933920	1	8	10	4.05	5.1	**11.32**	**9.08**
106	644783	933965	1	8	10	4.30	5.3	**10.66**	**8.65**
109	644800	931953	9	8	10	1.70	2.7	**3.05**	**1.92**
114	644476	932030	12	8	10	0.90	1.9	**4.30**	**2.04**
117	644335	931439	6	8	10	2.25	3.3	**3.57**	**2.47**
121	644376	931486	2	8	10	2.80	3.8	**6.83**	**5.03**
122	644350	931540	7	8	10	1.95	3.0	**3.21**	**2.12**
531	643782	933142	4	8	10	3.80	4.8	**3.03**	**2.40**
533	643721	933085	4	8	10	2.40	3.4	**4.56**	**3.22**
535	643796	933020	4	8	10	1.90	2.9	**6.61**	**4.33**
537	643842	933131	2	8	10	3.60	4.6	**7.67**	**6.01**
541	643956	933186	3	8	10	4.70	5.7	**2.96**	**2.44**
543	644032	933247	2	8	10	5.00	6.0	**5.73**	**4.78**
545	644107	933265	6	8	10	2.40	3.4	**3.21**	**2.26**
562	643862	932887	5	8	10	1.30	2.3	**7.38**	**4.17**
564	643804	932953	5	8	10	1.90	2.9	**4.85**	**3.18**
573	643879	932838	6	8	10	1.60	2.6	**5.10**	**3.14**
575	643867	932759	4	8	10	2.10	3.1	**5.10**	**3.45**
577	643871	932663	1	8	10	2.40	3.4	**19.10**	**13.48**
579	643829	932591	5	8	10	2.80	3.8	**3.36**	**2.47**
580	644034	931655	3	8	10	2.10	3.1	**6.71**	**4.55**
581	644007	931641	3	8	10	2.30	3.3	**5.88**	**4.09**
582	643976	931587	4	8	10	1.80	2.8	**6.23**	**4.01**
583	643927	931554	1	8	10	2.00	3.0	**22.92**	**15.28**
584	643888	931515	6	8	10	2.40	3.4	**3.34**	**2.36**
585	643855	931481	8	8	10	2.10	3.1	**2.76**	**1.87**
590	643621	931600	2	8	10	2.10	3.1	**9.11**	**6.17**
591	643589	931671	4	8	10	2.00	3.0	**5.75**	**3.83**
592	643566	931739	2	8	10	2.50	3.5	**7.84**	**5.60**
593	643570	931836	6	8	10	2.40	3.4	**3.21**	**2.26**
594	643552	931891	4	8	10	3.50	4.5	**3.28**	**2.55**

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Undrained Analysis

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
600	644084	931680	6	8	10	2.10	3.1	**3.92**	**2.66**
602	644049	931577	6	8	10	2.20	3.2	**3.74**	**2.57**
604	644036	931501	6	8	10	1.70	2.7	**4.45**	**2.80**
606	644085	931444	7	8	10	2.30	3.3	**2.84**	**1.98**
610	644233	931449	6	8	10	2.10	3.1	**3.66**	**2.48**
612	644348	931503	3	8	10	1.90	2.9	**8.14**	**5.33**
614	644465	931543	7	8	10	2.40	3.4	**2.76**	**1.95**
616	644581	931723	9	8	10	2.40	3.4	**2.11**	**1.49**
618	644659	931867	12	8	10	2.10	3.1	**1.83**	**1.24**
620	644732	931950	9	8	10	1.80	2.8	**2.88**	**1.85**
621	644784	931959	8	8	10	2.00	3.0	**2.90**	**1.93**
622	644376	932066	10	8	10	1.60	2.6	**2.98**	**1.83**
624	644439	932029	13	8	10	1.70	2.7	**2.08**	**1.31**
626	644509	932123	13	8	10	1.30	2.3	**2.81**	**1.59**
628	644619	932299	11	8	10	1.70	2.7	**2.51**	**1.58**
630	644714	932384	9	8	10	1.90	2.9	**2.79**	**1.82**
632	644774	932443	12	8	10	1.40	2.4	**2.81**	**1.64**
633	644824	932469	8	8	10	2.20	3.2	**2.64**	**1.81**
634	643925	931470	1	8	10	2.30	3.3	**31.64**	**22.05**
636	643960	931510	1	8	10	2.70	3.7	**12.13**	**8.85**
637	642816	930601	7	8	10	1.90	2.9	**3.63**	**2.38**
639	642739	930577	1	8	10	2.00	3.0	**19.10**	**12.74**
641	642663	930561	8	8	10	1.90	2.9	**3.17**	**2.08**
643	642764	930536	5	8	10	1.70	2.7	**5.42**	**3.41**
645	642796	930564	2	8	10	2.00	3.0	**10.43**	**6.95**
700	643297	932555	5	8	10	2.00	3.0	**4.61**	**3.07**
701	643223	932519	7	8	10	1.70	2.7	**3.89**	**2.45**
702	643164	932508	6	8	10	2.00	3.0	**3.85**	**2.57**
703	643080	932467	6	8	10	2.30	3.3	**3.35**	**2.33**
704	643001	932420	7	8	10	2.00	3.0	**3.31**	**2.20**
MKO3	644394	933218	5.0	8	10	2.30	3.3	**4.01**	**2.79**
MKO5	644375	933170	5.0	8	10	2.00	3.0	**4.61**	**3.07**
MKO6	644388	933124	5.0	8	10	2.20	3.2	**4.19**	**2.88**
MKO11	644665	932841	9.0	8	10	1.00	2.0	**5.18**	**2.59**
MKO15	644696	932881	9.0	8	10	0.40	1.4	**12.94**	**3.70**
MKO16	644512	932444	9.0	8	10	0.30	1.3	**17.26**	**3.98**
MKO20	643701	931229	6.0	8	10	1.30	2.3	**5.92**	**3.35**
MKO21	643619	931263	6.0	8	10	2.60	3.6	**2.96**	**2.14**
MKO22	643517	931311	6.0	8	10	1.60	2.6	**4.81**	**2.96**
MKO23	643510	931245	6.0	8	10	2.10	3.1	**3.66**	**2.48**
MKO27	643631	931151	6.0	8	10	2.00	3.0	**3.85**	**2.57**
MKO28	643128	930742	4.0	8	10	1.80	2.8	**6.39**	**4.11**
MKO30	643057	930826	4.0	8	10	1.70	2.7	**6.76**	**4.26**
MKO32	642983	930792	4.0	8	10	2.00	3.0	**5.75**	**3.83**
MKO33	642965	930772	4.0	8	10	2.00	3.0	**5.75**	**3.83**
MKO34	644327	933535	2.0	8	10	1.50	2.5	**15.29**	**9.17**
MKO38	644414	933648	2.0	8	10	1.80	2.8	**12.74**	**8.19**
MKO42	644514	933712	2.0	8	10	0.90	1.9	**25.49**	**12.07**
MKO46	644592	933815	2.0	8	10	1.30	2.3	**17.64**	**9.97**
MKO50	644610	933935	2.0	8	10	0.80	1.8	**28.67**	**12.74**
MKO52	644639	933989	2.0	8	10	0.50	1.5	**45.87**	**15.29**
MKO53	644650	934032	2.0	8	10	0.30	1.3	**76.46**	**17.64**
MKO54	644685	934032	2.0	8	10	0.80	1.8	**28.67**	**12.74**
MKO55	644664	934033	2.0	8	10	0.50	1.5	**45.87**	**15.29**
MKO56	644647	934043	2.0	8	10	0.70	1.7	**32.77**	**13.49**
MKO57	644803	933948	2.0	8	10	2.40	3.4	**9.56**	**6.75**
MKO59	644857	933939	2.0	8	10	5.10	6.1	**4.50**	**3.76**
MKO60	644722	934018	2.0	8	10	1.00	2.0	**22.94**	**11.47**
MKO96	642590	930554	5.0	8	10	1.20	2.2	**7.68**	**4.19**
MKO98	642583	930663	5.0	8	10	2.10	3.1	**4.39**	**2.97**
MKO100	642553	930618	5.0	8	10	1.70	2.7	**5.42**	**3.41**
MKO102	642840	931570	5.0	8	10	3.00	4.0	**3.07**	**2.30**
MKO104	642856	931698	3.0	8	10	2.50	3.5	**6.12**	**4.37**
MKO106	642887	931517	3.0	8	10	3.80	4.8	**4.03**	**3.19**
							Minimum =	**1.83**	**1.24**
							Maximum =	**76.46**	**22.05**
							Average =	**8.93**	**4.78**

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa

(3) Slope inclination (β) based on site readings and site contour plans

(4) A lower bound undrained shear strength, cu for the peat of 8kPa was selected for the assessment. It should be noted that a cu of 8kPa for the pea is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.

(5) Peat depths based on probes carried out by FT and MKO.

(6) For load conditions see report text.

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Undrained Analysis

Track Location	Relevant WP	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
		β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
Entrance road	MKO34,38, 42, ETC	2	8	10	2.90	3.9	**7.91**	**5.88**
Main spine road	WP72, 83, 86, 88, 92	15	8	10	1.10	2.1	**2.91**	**1.52**
Spur to T1	WP173, 176	8	8	10	2.00	3.0	**2.90**	**1.93**
Spur to T2	197, 199	10	8	10	1.80	2.8	**2.60**	**1.67**
Spur to T3	MKO11, 13	9	8	10	1.00	2.0	**5.18**	**2.59**
Spur to T4	FT(2021) 1, 2	6	8	10	2.30	3.3	**3.35**	**2.33**
Spur to T5	WP145, 224	4	8	10	0.50	1.5	**22.99**	**7.66**
Spur to T6	FT(2021) 10, 12	8	8	10	1.90	2.9	**3.06**	**2.00**
Spur to T7	FT(2021) 6, 7	12	8	10	1.20	2.2	**3.28**	**1.79**
Spur to T8	T8	5	8	10	2.30	3.3	**4.01**	**2.79**
Spur to T9	WP167, 169	8	8	10	2.10	3.1	**2.76**	**1.87**
Spur to T10	WP167, 169	6	8	10	2.60	3.6	**2.96**	**2.14**
Spur to T11	MKO21, 23	6	8	10	2.60	3.6	**2.96**	**2.14**
Spur to T12	FT18, 20, 23, 26	4	8	10	1.80	2.8	**6.39**	**4.11**
Spur to T13	FT30, 33	3	8	10	2.60	3.6	**5.89**	**4.25**
Spur to T14	FT46	2	8	10	3.20	4.2	**7.17**	**5.46**
Spur to T15	WP46, MKO98	5	8	10	2.10	3.1	**4.39**	**2.97**
						Minimum =	**2.60**	**1.67**
						Maximum =	**22.99**	**7.66**
						Average =	**5.32**	**3.05**

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa

(3) Slope inclination (β) based on site readings and site contour plans

(4) A lower bound undrained shear strength, cu for the peat of 8kPa was selected for the assessment. It should be noted that a cu of 8kPa for the pea is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly highe undrained strength.

(5) Peat depths based on probes carried out by FT and MKO.

(6) For load conditions see report text.

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Undrained Analysis

Pond Location	Settlement Pond Number	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
		β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
T1	SP-O3	10	8	10	1.80	2.8	**2.60**	**1.67**
T2	SP-L4	9	8	10	1.80	2.8	**2.88**	**1.85**
T3	SP-K1	10	8	10	0.80	1.8	**5.85**	**2.60**
T4	SP-I3	5	8	10	2.30	3.3	**4.01**	**2.79**
T5	SP-F2	3	8	10	2.50	3.5	**6.12**	**4.37**
T6	SP-G2	6	8	10	2.80	3.8	**2.75**	**2.03**
T7	SP-H2	7	8	10	0.50	1.5	**13.23**	**4.41**
T8	SP-M5	3	8	10	2.00	3.0	**7.65**	**5.10**
T9	SP-N6	7	8	10	2.00	3.0	**3.31**	**2.20**
T10	SP-V5	3	8	10	2.70	3.7	**5.67**	**4.14**
T11	SP-Q2	4	8	10	2.10	3.1	**5.47**	**3.71**
T12	SP-Z5	3	8	10	0.80	1.8	**19.13**	**8.50**
T13	SP-Y1	4	8	10	2.80	3.8	**4.11**	**3.03**
T14	SP-W5	5	8	10	2.40	3.4	**3.84**	**2.71**
T15	SP-T2	4	8	10	1.60	2.6	**7.19**	**4.42**
Peat Repository	SP-J2-1	2	8	10	5.50	6.5	**4.17**	**3.53**
Substation	SP-S4-1	4	8	10	2.00	3.0	**6.56**	**4.38**
Construction Compound 1	SP-I1	5	8	10	2.00	3.0	**4.61**	**3.07**
Construction Compound 2	SP-P1	7	8	10	0.50	1.5	**13.23**	**4.41**
						Minimum =	**2.75**	**2.03**
						Maximum =	**19.13**	**8.50**
						Average =	**6.88**	**3.85**

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa

(3) Slope inclination (β) based on site readings and site contour plans

(4) A lower bound undrained shear strength, cu for the peat of 8kPa was selected for the assessment. It should be noted that a cu of 8kPa for the pea is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly highe undrained strength.

(5) Peat depths based on probes carried out by FT and MKO.

(6) For load conditions see report text.

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Drained Analysis

Pond Location	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
T1	8	4	10.0	10.0	1.80	25	1.0	2.8	**1.61**	**2.22**
T2	8	4	10.0	10.0	1.80	25	1.0	2.8	**1.61**	**2.22**
T3	10	4	10.0	10.0	0.80	25	1.0	1.8	**2.92**	**2.77**
T4	5	4	10.0	10.0	2.30	25	1.0	3.3	**2.00**	**3.01**
T5	4	4	10.0	10.0	2.50	25	1.0	3.5	**2.30**	**3.55**
T6	6	4	10.0	10.0	2.80	25	1.0	3.8	**1.37**	**2.18**
T7	12	4	10.0	10.0	0.50	25	1.0	1.5	**3.93**	**2.77**
T8	8	4	10.0	10.0	2.00	25	1.0	3.0	**1.45**	**2.07**
T9	7	4	10.0	10.0	2.00	25	1.0	3.0	**1.65**	**2.37**
T10	6	4	10.0	10.0	2.70	25	1.0	3.7	**1.43**	**2.24**
T11	6	4	10.0	10.0	2.10	25	1.0	3.1	**1.83**	**2.67**
T12	3	4	10.0	10.0	0.80	25	1.0	1.8	**9.57**	**9.20**
T13	4	4	10.0	10.0	2.80	25	1.0	3.8	**2.05**	**3.27**
T14	4	4	10.0	10.0	2.40	25	1.0	3.4	**2.40**	**3.65**
T15	8	4	10.0	10.0	1.60	25	1.0	2.6	**1.81**	**2.39**
Con Comp 1	2	4	10.0	10.0	2.70	25	1.0	3.7	**4.25**	**6.71**
Con Comp 2	6	4	10.0	10.0	0.50	25	1.0	1.5	**7.70**	**5.52**
Substation	4	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
Met Mast	12	4	10.0	10.0	1.20	25	1.0	2.2	**1.64**	**1.89**
Repository	2	4	10.0	10.0	5.50	25	1.0	6.5	**2.09**	**3.82**
CC1	2	4	10.0	10.0	3.20	25	1.0	4.2	**3.58**	**5.91**
CC5	3	4	10.0	10.0	2.00	25	1.0	3.0	**3.83**	**5.52**
WP46	4	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
WP64	6	4	10.0	10.0	1.80	25	1.0	2.8	**2.14**	**2.96**
WP66	2	4	10.0	10.0	0.90	25	1.0	1.9	**12.74**	**13.06**
WP69	8	4	10.0	10.0	1.50	25	1.0	2.5	**1.93**	**2.49**
WP72	8	4	10.0	10.0	1.60	25	1.0	2.6	**1.81**	**2.39**
WP80	8	4	10.0	10.0	1.90	25	1.0	2.9	**1.53**	**2.14**
WP83	5	4	10.0	10.0	1.50	25	1.0	2.5	**3.07**	**3.97**
WP86	10	4	10.0	10.0	0.30	25	1.0	1.3	**7.80**	**3.83**
WP88	15	4	10.0	10.0	1.10	25	1.0	2.1	**1.45**	**1.59**
WP90	3	4	10.0	10.0	1.50	25	1.0	2.5	**5.10**	**6.62**
WP92	10	4	10.0	10.0	1.30	25	1.0	2.3	**1.80**	**2.17**
WP96	2	4	10.0	10.0	4.10	25	1.0	5.1	**2.80**	**4.87**
WP98	2	4	10.0	10.0	2.40	25	1.0	3.4	**4.78**	**7.30**
WP116	5	4	10.0	10.0	1.50	25	1.0	2.5	**3.07**	**3.97**
WP119	5	4	10.0	10.0	1.70	25	1.0	2.7	**2.71**	**3.68**
WP129	8	4	10.0	10.0	1.30	25	1.0	2.3	**2.23**	**2.70**
WP131	6	4	10.0	10.0	1.80	25	1.0	2.8	**2.14**	**2.96**
WP135	8	4	10.0	10.0	1.80	25	1.0	2.8	**1.61**	**2.22**
WP137	5	4	10.0	10.0	0.80	25	1.0	1.8	**5.76**	**5.52**
WP140	2	4	10.0	10.0	No Peat Encountered					
WP145	2	4	10.0	10.0	No Peat Encountered					
WP148	1	4	10.0	10.0	No Peat Encountered					
WP150	3	4	10.0	10.0	No Peat Encountered					
WP152	3	4	10.0	10.0	3.80	25	1.0	4.8	**2.01**	**3.45**
WP158	4	4	10.0	10.0	1.80	25	1.0	2.8	**3.19**	**4.43**
WP163	5	4	10.0	10.0	1.60	25	1.0	2.6	**2.88**	**3.82**
WP165	7	4	10.0	10.0	1.70	25	1.0	2.7	**1.95**	**2.63**
WP167	8	4	10.0	10.0	1.90	25	1.0	2.9	**1.53**	**2.14**
WP169	7	4	10.0	10.0	2.60	25	1.0	3.6	**1.27**	**1.97**
WP173	10	4	10.0	10.0	0.70	25	1.0	1.7	**3.34**	**2.93**
WP176	8	4	10.0	10.0	1.50	25	1.0	2.5	**1.93**	**2.49**
WP184	8	4	10.0	10.0	0.60	25	1.0	1.6	**4.84**	**3.89**
WP190	6	4	10.0	10.0	0.50	25	1.0	1.5	**7.70**	**5.52**
WP195	15	4	10.0	10.0	0.80	25	1.0	1.8	**2.00**	**1.86**
WP197	12	4	10.0	10.0	1.15	25	1.0	2.2	**1.71**	**1.94**
WP199	13	4	10.0	10.0	1.40	25	1.0	2.4	**1.30**	**1.60**
WP207	1	4	10.0	10.0	1.80	25	1.0	2.8	**12.73**	**17.73**
WP208	1	4	10.0	10.0	1.20	25	1.0	2.2	**19.10**	**22.56**
WP210	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**
WP212	2	4	10.0	10.0	3.70	25	1.0	4.7	**3.10**	**5.28**
WP215	2	4	10.0	10.0	1.00	25	1.0	2.0	**11.47**	**12.41**
WP219	2	4	10.0	10.0	1.30	25	1.0	2.3	**8.82**	**10.79**
WP224	4	4	10.0	10.0	0.50	25	1.0	1.5	**11.50**	**8.28**
WP229	6	4	10.0	10.0	1.60	25	1.0	2.6	**2.40**	**3.19**
WP233	3	4	10.0	10.0	1.70	25	1.0	2.7	**4.50**	**6.13**
WP237	7	4	10.0	10.0	0.90	25	1.0	1.9	**3.67**	**3.74**
WP242	2	4	10.0	10.0	2.00	25	1.0	3.0	**5.73**	**8.27**
WP244	7	4	10.0	10.0	1.40	25	1.0	2.4	**2.36**	**2.96**
WP248	5	4	10.0	10.0	2.90	25	1.0	3.9	**1.59**	**2.55**
WP252	5	4	10.0	10.0	1.90	25	1.0	2.9	**2.42**	**3.43**
WP283	12	4	10.0	10.0	1.00	25	1.0	2.0	**1.97**	**2.08**
2	6	4	10.0	10.0	0.20	25	1.0	1.2	**19.24**	**6.90**
4	5	4	10.0	10.0	0.40	25	1.0	1.4	**11.52**	**7.10**
6	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**
8	4	4	10.0	10.0	0.70	25	1.0	1.7	**8.21**	**7.30**
10	4	4	10.0	10.0	1.00	25	1.0	2.0	**5.75**	**6.21**
12	4	4	10.0	10.0	1.00	25	1.0	2.0	**5.75**	**6.21**
15	5	4	10.0	10.0	0.70	25	1.0	1.7	**6.58**	**5.85**
17	3	4	10.0	10.0	0.80	25	1.0	1.8	**9.57**	**9.20**
18	4	4	10.0	10.0	0.70	25	1.0	1.7	**8.21**	**7.30**
20	4	4	10.0	10.0	1.20	25	1.0	2.2	**4.79**	**5.64**
23	3	4	10.0	10.0	1.10	25	1.0	2.1	**6.96**	**7.88**
26	4	4	10.0	10.0	1.80	25	1.0	2.8	**3.19**	**4.43**
30	3	4	10.0	10.0	2.60	25	1.0	3.6	**2.94**	**4.60**
33	2	4	10.0	10.0	1.70	25	1.0	2.7	**6.75**	**9.19**
36	4	4	10.0	10.0	1.80	25	1.0	2.8	**3.19**	**4.43**
38	4	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
41	3	4	10.0	10.0	1.00	25	1.0	2.0	**7.65**	**8.28**

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Drained Analysis

Pond Location	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
44	2	4	10.0	10.0	1.50	25	1.0	2.5	**7.65**	**9.93**
45	2	4	10.0	10.0	2.80	25	1.0	3.8	**4.10**	**6.53**
46	2	4	10.0	10.0	3.20	25	1.0	4.2	**3.58**	**5.91**
48	2	4	10.0	10.0	3.20	25	1.0	4.2	**3.58**	**5.91**
50	2	4	10.0	10.0	2.90	25	1.0	3.9	**3.95**	**6.36**
53	2	4	10.0	10.0	1.60	25	1.0	2.6	**7.17**	**9.55**
56	1	4	10.0	10.0	2.00	25	1.0	3.0	**11.46**	**16.55**
59	3	4	10.0	10.0	2.40	25	1.0	3.4	**3.19**	**4.87**
64	4	4	10.0	10.0	1.50	25	1.0	2.5	**3.83**	**4.97**
66	4	4	10.0	10.0	1.60	25	1.0	2.6	**3.59**	**4.78**
67	5	4	10.0	10.0	1.00	25	1.0	2.0	**4.61**	**4.97**
69	3	4	10.0	10.0	1.70	25	1.0	2.7	**4.50**	**6.13**
71	3	4	10.0	10.0	1.80	25	1.0	2.8	**4.25**	**5.91**
73	3	4	10.0	10.0	2.10	25	1.0	3.1	**3.64**	**5.34**
75	4	4	10.0	10.0	2.20	25	1.0	3.2	**2.61**	**3.88**
MKO Probes										
13	1	4	10.0	10.0	1.30	25	1.0	2.3	**17.63**	**21.58**
17	10	4	10.0	10.0	0.60	25	1.0	1.6	**4.05**	**3.24**
18	7	4	10.0	10.0	0.90	25	1.0	1.9	**3.67**	**3.74**
19	8	4	10.0	10.0	1.00	25	1.0	2.0	**2.97**	**3.19**
21	11	4	10.0	10.0	1.20	25	1.0	2.2	**1.84**	**2.14**
26	9	4	10.0	10.0	2.10	25	1.0	3.1	**1.26**	**1.83**
27	3	4	10.0	10.0	2.40	25	1.0	3.4	**2.82**	**4.30**
41	4	4	10.0	10.0	1.20	25	1.0	2.2	**4.30**	**5.06**
42	4	4	10.0	10.0	1.20	25	1.0	2.2	**5.47**	**6.45**
47	7	4	10.0	10.0	1.80	25	1.0	2.8	**1.79**	**2.47**
67	6	4	10.0	10.0	1.80	25	1.0	2.8	**2.14**	**2.96**
68	11	4	10.0	10.0	1.05	25	1.0	2.1	**2.02**	**2.19**
75	6	4	10.0	10.0	2.50	25	1.0	3.5	**1.65**	**2.54**
82	1	4	10.0	10.0	5.60	25	1.0	6.6	**3.25**	**5.97**
84	6	4	10.0	10.0	1.00	25	1.0	2.0	**3.93**	**4.23**
93	7	4	10.0	10.0	1.80	25	1.0	2.8	**1.75**	**2.42**
95	1	4	10.0	10.0	1.00	25	1.0	2.0	**19.10**	**20.68**
97	5	4	10.0	10.0	1.30	25	1.0	2.3	**3.38**	**4.12**
99	7	4	10.0	10.0	0.90	25	1.0	1.9	**3.70**	**3.77**
101	4	4	10.0	10.0	0.45	25	1.0	1.5	**14.18**	**9.51**
103	7	4	10.0	10.0	1.70	25	1.0	2.7	**1.89**	**2.56**
105	1	4	10.0	10.0	4.05	25	1.0	5.1	**5.66**	**9.83**
106	1	4	10.0	10.0	4.30	25	1.0	5.3	**5.33**	**9.37**
109	9	4	10.0	10.0	1.70	25	1.0	2.7	**1.52**	**2.05**
114	12	4	10.0	10.0	0.90	25	1.0	1.9	**2.15**	**2.15**
117	6	4	10.0	10.0	2.25	25	1.0	3.3	**1.78**	**2.66**
121	2	4	10.0	10.0	2.80	25	1.0	3.8	**3.41**	**5.44**
122	7	4	10.0	10.0	1.95	25	1.0	3.0	**1.61**	**2.28**
531	4	4	10.0	10.0	3.80	25	1.0	4.8	**1.51**	**2.59**
533	4	4	10.0	10.0	2.40	25	1.0	3.4	**2.28**	**3.48**
535	4	4	10.0	10.0	1.90	25	1.0	2.9	**3.30**	**4.68**
537	2	4	10.0	10.0	3.60	25	1.0	4.6	**3.84**	**6.50**
541	3	4	10.0	10.0	4.70	25	1.0	5.7	**1.48**	**2.64**
543	2	4	10.0	10.0	5.00	25	1.0	6.0	**2.87**	**5.17**
545	6	4	10.0	10.0	2.40	25	1.0	3.4	**1.60**	**2.44**
562	5	4	10.0	10.0	1.30	25	1.0	2.3	**3.69**	**4.50**
564	5	4	10.0	10.0	1.90	25	1.0	2.9	**2.42**	**3.43**
573	6	4	10.0	10.0	1.60	25	1.0	2.6	**2.55**	**3.38**
575	4	4	10.0	10.0	2.10	25	1.0	3.1	**2.55**	**3.73**
577	1	4	10.0	10.0	2.40	25	1.0	3.4	**9.55**	**14.60**
579	5	4	10.0	10.0	2.80	25	1.0	3.8	**1.68**	**2.67**
580	3	4	10.0	10.0	2.10	25	1.0	3.1	**3.35**	**4.91**
581	3	4	10.0	10.0	2.30	25	1.0	3.3	**2.94**	**4.43**
582	4	4	10.0	10.0	1.80	25	1.0	2.8	**3.12**	**4.33**
583	1	4	10.0	10.0	2.00	25	1.0	3.0	**11.46**	**16.55**
584	6	4	10.0	10.0	2.40	25	1.0	3.4	**1.67**	**2.54**
585	8	4	10.0	10.0	2.10	25	1.0	3.1	**1.38**	**2.01**
590	2	4	10.0	10.0	2.10	25	1.0	3.1	**4.55**	**6.67**
591	4	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
592	2	4	10.0	10.0	2.50	25	1.0	3.5	**3.92**	**6.06**
593	6	4	10.0	10.0	2.40	25	1.0	3.4	**1.60**	**2.44**
594	4	4	10.0	10.0	3.50	25	1.0	4.5	**1.64**	**2.76**
600	6	4	10.0	10.0	2.10	25	1.0	3.1	**1.96**	**2.86**
602	6	4	10.0	10.0	2.20	25	1.0	3.2	**1.87**	**2.77**
604	6	4	10.0	10.0	1.70	25	1.0	2.7	**2.23**	**3.02**
606	7	4	10.0	10.0	2.30	25	1.0	3.3	**1.42**	**2.12**
610	6	4	10.0	10.0	2.10	25	1.0	3.1	**1.83**	**2.67**
612	3	4	10.0	10.0	1.90	25	1.0	2.9	**4.07**	**5.76**
614	7	4	10.0	10.0	2.40	25	1.0	3.4	**1.38**	**2.09**
616	9	4	10.0	10.0	2.40	25	1.0	3.4	**1.06**	**1.59**
618	11	4	10.0	10.0	2.10	25	1.0	3.1	**1.02**	**1.46**
620	9	4	10.0	10.0	1.80	25	1.0	2.8	**1.44**	**1.98**
621	8	4	10.0	10.0	2.00	25	1.0	3.0	**1.45**	**2.07**
622	10	4	10.0	10.0	1.60	25	1.0	2.6	**1.49**	**1.96**
624	13	4	10.0	10.0	1.70	25	1.0	2.7	**1.04**	**1.38**
626	13	4	10.0	10.0	1.30	25	1.0	2.3	**1.40**	**1.67**
628	11	4	10.0	10.0	1.70	25	1.0	2.7	**1.26**	**1.68**
630	9	4	10.0	10.0	1.90	25	1.0	2.9	**1.39**	**1.95**
632	12	4	10.0	10.0	1.40	25	1.0	2.4	**1.40**	**1.73**
633	8	4	10.0	10.0	2.20	25	1.0	3.2	**1.32**	**1.94**
634	1	4	10.0	10.0	2.30	25	1.0	3.3	**15.82**	**23.88**
636	1	4	10.0	10.0	2.70	25	1.0	3.7	**6.07**	**9.58**
637	7	4	10.0	10.0	1.90	25	1.0	2.9	**1.82**	**2.56**
639	1	4	10.0	10.0	2.00	25	1.0	3.0	**9.55**	**13.79**
641	8	4	10.0	10.0	1.90	25	1.0	2.9	**1.59**	**2.23**
643	5	4	10.0	10.0	1.70	25	1.0	2.7	**2.71**	**3.68**

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Drained Analysis

Pond Location	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
645	2	4	10.0	10.0	2.00	25	1.0	3.0	**5.21**	**7.52**
700	5	4	10.0	10.0	2.00	25	1.0	3.0	**2.30**	**3.31**
701	7	4	10.0	10.0	1.70	25	1.0	2.7	**1.95**	**2.63**
72	6	4	10.0	10.0	2.00	25	1.0	3.0	**1.92**	**2.76**
703	6	4	10.0	10.0	2.30	25	1.0	3.3	**1.67**	**2.51**
704	7	4	10.0	10.0	2.00	25	1.0	3.0	**1.65**	**2.37**
MKO3	5.0	4	10.0	10.0	2.30	25	1.0	3.3	**2.00**	**3.01**
MKO5	5.0	4	10.0	10.0	2.00	25	1.0	3.0	**2.30**	**3.31**
MKO6	5.0	4	10.0	10.0	2.20	25	1.0	3.2	**2.09**	**3.11**
MKO11	9.0	4	10.0	10.0	1.00	25	1.0	2.0	**2.59**	**2.77**
MKO15	9.0	4	10.0	10.0	0.40	25	1.0	1.4	**6.47**	**3.95**
MKO16	9.0	4	10.0	10.0	0.30	25	1.0	1.3	**8.63**	**4.26**
MKO20	6.0	4	10.0	10.0	1.30	25	1.0	2.3	**2.96**	**3.60**
MKO21	6.0	4	10.0	10.0	2.60	25	1.0	3.6	**1.48**	**2.30**
MKO22	6.0	4	10.0	10.0	1.60	25	1.0	2.6	**2.40**	**3.19**
MKO23	6.0	4	10.0	10.0	2.10	25	1.0	3.1	**1.83**	**2.67**
MKO27	6.0	4	10.0	10.0	2.00	25	1.0	3.0	**1.92**	**2.76**
MKO28	4.0	4	10.0	10.0	1.80	25	1.0	2.8	**3.19**	**4.43**
MKO30	4.0	4	10.0	10.0	1.70	25	1.0	2.7	**3.38**	**4.60**
MKO32	4.0	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
MKO33	4.0	4	10.0	10.0	2.00	25	1.0	3.0	**2.87**	**4.14**
MKO34	2.0	4	10.0	10.0	1.50	25	1.0	2.5	**7.65**	**9.93**
MKO38	2.0	4	10.0	10.0	1.80	25	1.0	2.8	**6.37**	**8.86**
MKO42	2.0	4	10.0	10.0	0.90	25	1.0	1.9	**12.74**	**13.06**
MKO46	2.0	4	10.0	10.0	1.30	25	1.0	2.3	**8.82**	**10.79**
MKO50	2.0	4	10.0	10.0	0.80	25	1.0	1.8	**14.34**	**13.79**
MKO52	2.0	4	10.0	10.0	0.50	25	1.0	1.5	**22.94**	**16.55**
MKO53	2.0	4	10.0	10.0	0.30	25	1.0	1.3	**38.23**	**19.09**
MKO54	2.0	4	10.0	10.0	0.80	25	1.0	1.8	**14.34**	**13.79**
MKO55	2.0	4	10.0	10.0	0.50	25	1.0	1.5	**22.94**	**16.55**
MKO56	2.0	4	10.0	10.0	0.70	25	1.0	1.7	**16.38**	**14.60**
MKO57	2.0	4	10.0	10.0	2.40	25	1.0	3.4	**4.78**	**7.30**
MKO59	2.0	4	10.0	10.0	5.10	25	1.0	6.1	**2.25**	**4.07**
MKO60	2.0	4	10.0	10.0	1.00	25	1.0	2.0	**11.47**	**12.41**
MKO96	5.0	4	10.0	10.0	1.20	25	1.0	2.2	**3.84**	**4.52**
MKO98	5.0	4	10.0	10.0	2.10	25	1.0	3.1	**2.19**	**3.21**
MKO100	5.0	4	10.0	10.0	1.70	25	1.0	2.7	**2.71**	**3.68**
MKO102	5.0	4	10.0	10.0	3.00	25	1.0	4.0	**1.54**	**2.48**
MKO104	3.0	4	10.0	10.0	2.50	25	1.0	3.5	**3.06**	**4.73**
MKO106	3.0	4	10.0	10.0	3.80	25	1.0	4.8	**2.01**	**3.45**
								Minimum =	**1.02**	**1.38**
								Maximum =	**38.23**	**23.88**
								Average =	**4.56**	**5.30**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)

(2) Assuming a surcharge equivalent to fill depth of 1.0m.

(3) Slope inclination (β) based on site readings and contour survey plans of site.

(4) FoS is based on slope inclination and shear test results obtained from published data.

(5) Peat depths based on probes carried out by FT and MKO.

(6) For load conditions see Report text.

(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Drained Analysis

Track Location	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
Entrance road	2	4	10.0	10.0	2.90	25	1.0	3.9	**3.95**	**6.36**
Main spine road	15	4	10.0	10.0	1.10	25	1.0	2.1	**1.45**	**1.59**
Spur to T1	11	4	10.0	10.0	2.10	25	1.0	3.1	**1.02**	**1.46**
Spur to T2	13	4	10.0	10.0	1.70	25	1.0	2.7	**1.07**	**1.42**
Spur to T3	9	4	10.0	10.0	1.00	25	1.0	2.0	**2.59**	**2.77**
Spur to T4	6	4	10.0	10.0	2.30	25	1.0	3.3	**1.67**	**2.51**
Spur to T5	4	4	10.0	10.0	0.50	25	1.0	1.5	**11.50**	**8.28**
Spur to T6	8	4	10.0	10.0	1.90	25	1.0	2.9	**1.53**	**2.14**
Spur to T7	12	4	10.0	10.0	1.20	25	1.0	2.2	**1.64**	**1.89**
Spur to T8	5	4	10.0	10.0	2.30	25	1.0	3.3	**2.00**	**3.01**
Spur to T9	7	4	10.0	10.0	2.60	25	1.0	3.6	**1.27**	**1.97**
Spur to T10	6	4	10.0	10.0	2.60	25	1.0	3.6	**1.48**	**2.30**
Spur to T11	6	4	10.0	10.0	2.60	26	1.0	3.6	**1.48**	**2.36**
Spur to T12	4	4	10.0	10.0	1.80	27	1.0	2.8	**3.19**	**4.66**
Spur to T13	3	4	10.0	10.0	2.60	28	1.0	3.6	**2.94**	**4.94**
Spur to T14	2	4	10.0	10.0	3.20	28	1.0	4.2	**3.58**	**6.36**
Spur to T15	5	4	10.0	10.0	2.10	28	1.0	3.1	**2.19**	**3.45**
								Minimum =	**1.02**	**1.42**
								Maximum =	**11.50**	**8.28**
								Average =	**2.62**	**3.38**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)
(2) Assuming a surcharge equivalent to fill depth of 1.0m.
(3) Slope inclination (β) based on site readings and contour survey plans of site.
(4) FoS is based on slope inclination and shear test results obtained from published data.
(5) Peat depths based on probes carried out by FT and MKO.
(6) For load conditions see Report text.
(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

Calculated FoS of Natural Peat Slopes for Glenard Wind Farm - Drained Analysis

Pond Location	Settlement Pond Number	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
		α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)
										100% Water	100% Water
T1	SP-O3	10	4	10.0	10.0	1.80	25	1.0	2.8	**1.30**	**1.78**
T2	SP-L4	9	4	10.0	10.0	1.80	25	1.0	2.8	**1.44**	**1.98**
T3	SP-K1	10	4	10.0	10.0	0.80	25	1.0	1.8	**2.92**	**2.77**
T4	SP-I3	5	4	10.0	10.0	2.30	25	1.0	3.3	**2.00**	**3.01**
T5	SP-F2	3	4	10.0	10.0	2.50	25	1.0	3.5	**3.06**	**4.73**
T6	SP-G2	6	4	10.0	10.0	2.80	25	1.0	3.8	**1.37**	**2.18**
T7	SP-H2	7	4	10.0	10.0	0.50	25	1.0	1.5	**6.61**	**4.74**
T8	SP-M5	3	4	10.0	10.0	2.00	25	1.0	3.0	**3.83**	**5.52**
T9	SP-N6	7	4	10.0	10.0	2.00	25	1.0	3.0	**1.65**	**2.37**
T10	SP-V5	3	4	10.0	10.0	2.70	25	1.0	3.7	**2.83**	**4.47**
T11	SP-Q2	4	4	10.0	10.0	2.10	25	1.0	3.1	**2.74**	**4.01**
T12	SP-Z5	3	4	10.0	10.0	0.80	25	1.0	1.8	**9.57**	**9.20**
T13	SP-Y1	4	4	10.0	10.0	2.80	25	1.0	3.8	**2.05**	**3.27**
T14	SP-W5	5	4	10.0	10.0	2.40	25	1.0	3.4	**1.92**	**2.92**
T15	SP-T2	4	4	10.0	10.0	1.60	25	1.0	2.6	**3.59**	**4.78**
Peat Repository	SP-J2-1	2	4	10.0	10.0	5.50	25	1.0	6.5	**2.09**	**3.82**
Substation	SP-S4-1	4	4	10.0	10.0	2.00	25	1.0	3.0	**3.28**	**4.73**
Construction Compound 1	SP-I1	5	4	10.0	10.0	2.00	25	1.0	3.0	**2.30**	**3.31**
Construction Compound 2	SP-P1	7	4	10.0	10.0	0.50	25	1.0	1.5	**6.61**	**4.74**
									Minimum =	**1.30**	**1.78**
									Maximum =	**9.57**	**9.20**
									Average =	**3.07**	**3.90**

Notes:

(1) Assuming a bulk unit weight of peat of 10 (kN/m^3)
(2) Assuming a surcharge equivalent to fill depth of 1.0m.
(3) Slope inclination (β) based on site readings and contour survey plans of site.
(4) FoS is based on slope inclination and shear test results obtained from published data.
(5) Peat depths based on probes carried out by FT and MKO.
(6) For load conditions see Report text.
(7) Minimum acceptable factor of safety required of 1.3 for first-time failures based on BS: 6031:1981 Code of practice for Earthworks.

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APPENDIX D

Methodology for Peat Stability Risk Assessment

Methodology for Peat Stability Risk Assessment

A peat stability risk assessment was carried out for each of the infrastructure elements at the proposed wind farm development. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2nd Edition, 2017) and MacCulloch (2005). The degree of risk is determined as a Risk Rating (R), which is the product of probability (P) and impact (I). How these factors are determined and applied in the analysis is described below.

The main approaches for assessing peat stability include the following:

(a) Geomorphological

(b) Qualitative (judgement)

(c) Index/Probabilistic (probability)

(d) Deterministic (factor of safety)

Approaches (a) to (c) listed above would be considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement/experience is required which makes it difficult to relate the findings to real conditions. FT apply a more objective approach, the deterministic approach. As part of FT's deterministic approach, a qualitative risk assessment is also carried out taking into account qualitative factors, which cannot necessarily be quantified.

Probability

The likelihood of a peat failure occurring was assessed based on the results of both the quantitative results of stability calculations (deterministic approach using factors of safety) and the assessment of the severity of several qualitative factors which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability.

The qualitative factors used in the risk assessment are outlined in Table A and have been compiled based on FT's experience of assessments and construction in peat land sites and peat failures throughout Ireland and the UK.

Table A: Qualitative Factors used to Assess Potential for Peat Failure

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor (1)	Explanation/Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations. Sub peat water flow generally occurs in the form of natural piping at the base of peat. Where there is a constriction or blockage in natural pipes a build-up of water can occur at the base of the peat causing a reduction in effective stress at the base of the peat resulting in failure; this is particularly critical during periods of intense rainfall.
	Possibly	
	Probably	
	Yes	

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of surface water flow	Dry	Based on site walkover observations. The presence of surface water flow indicates if peat in an area is well drained or saturated and if any additional loading from the ponding of surface water onto the peat is likely.
	Localised/Flowing in drains	
	Ponded in drains	
	Springs/surface water	
Evidence of previous failures/slips	No	Based on site walkover observations. The presence of clustering of relict failures may indicate that particular pre-existing site conditions predispose a site to failure.
	In general area	
	On site	
	Within 500m of location	
Type of vegetation	Grass/Crops	Based on site walkover observations. The type of vegetation present indicates if peat in an area is well drained, saturated, etc. Vegetation that indicates wetter ground may also indicate softer underlying peat deposits.
	Improved Grass/Dry Heather	
	Wet Grassland/Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope/downslope from infrastructure location	Concave	Based on site walkover observations. Slope morphology in the area of the infrastructure location is an important factor. A number of recorded peat failures have occurred in close proximity to a convex break in slope.
	Planar to concave	
	Planar to convex	
	Convex	
Evidence of very soft/soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover. Several reported peat failures identify the presence of a weak layer at the base of the peat along which shear failure has occurred.
	Yes	
Evidence of mechanically cut peat	No	Based on site walkover observations. Mechanically cut peat typically cut using a ‘sausage’ machine to extract

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor (1)	Explanation/Description of Qualitative Factor
	Yes	peat for harvesting. Areas which have been cut in this manner have been linked to peat instability. The mechanical cuts can notably reduce the intrinsic strength of the peat and also allow ingress of rainfall/surface water.
Evidence of quaking or buoyant peat	No	Based on site walkover observations. Quaking/buoyant peat is indicative of highly saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability.
	Yes	
Evidence of bog pools	No	Based on site walkover observations. Bog pools are generally an indicator of areas of weak, saturated peat. Commonly where there are open areas of water within peat these can be interconnected, with the result that there may be sub-surface bodies of water. The presence of bog pools have been previously linked with peat instability.
	Yes	
Other	Varies	In addition to the above features/ indicators and based on site recordings the following are some of the features which may be identified: Excessively deep peat, weak peat, overly steep slope angles, etc.

Note (1) The list of features/indicators for each qualitative factor are given in increasing order of probability of leading to peat instability/failure.

It should be noted that the presence of one of the qualitative factors alone from Table A is unlikely to lead to peat instability/failure. Peat instability/failure at a site is generally the combination of a number of these factors occurring at the same time at a particular location. The probability rating assigned to the quantitative (FOS) and qualitative factors is judged on a 5-point scale from 1 (indicating negligible or no probability of failure) to 5 (indicating a very likely failure), as outlined in Table B.

Table B: Probability Scale

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.10	Probable
5	≤1.0	Very Likely

Scale	Likelihood of Qualitative Factor leading to Peat Failure	Probability of Failure
1	Negligible/None	Least
2	Unlikely	
3	Probable	
4	Likely	
5	Very Likely	Greatest

Impact

The severity of the risk is also assessed qualitatively in terms of impact. The impact of a peat failure on the environment within and beyond the immediate wind farm site is assessed based on the potential travel distance of a peat failure. Where a peat failure enters a watercourse, it can travel a considerable distance downstream. Therefore, the proximity of a potential peat failure to a drainage course is a significant indicator of the likely potential impact.

The risk is determined based on the combination of hazard and impact. A qualitative scale has been derived for the impact of the hazard based on distance of infrastructure element to a watercourse (Table C).

The location of watercourses is based on topographic maps and supplemented by site observations from walkover survey..

Table C: Impact Scale

Scale	Criteria	Impact
1	Proposed infrastructure element greater than 150m of watercourse	Negligible/None
2	Proposed infrastructure element within 150 to 101m of watercourse	Low
3	Proposed infrastructure element within 100 to 51m of watercourse	Medium

4	Proposed infrastructure element within 50 m of watercourse	High
5	Proposed infrastructure element within 50 m of watercourse, in an environmentally sensitive area	Extremely High

Risk Rating

The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk Rating (R) as follows:

The Risk Rating is calculated from: R = P x I

Due to the 5-point scales used to assess Probability and Impact, the Risk Rating can range from 1 to 25 as shown in Table D.

Table D: Qualitative Risk Rating

Impact \ Probability	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Rating & Control Measures	
17 to 25	High: avoid working in area or significant control measures required
11 to 16	Medium: notable control measures required
5 to 10	Low: only routine control measures required
1 to 4	Negligible: none or only routine control measures required

The risk rating is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Low' risk rating. The control measures in response to the qualitative risk ratings are included in the peat stability risk registers for each main infrastructure element in Appendix C.

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APPENDIX E

Ground Investigation (November 2019):
Trial Pit Logs
Photographs
Laboratory test Results

Trial Pit Log

Trialpit No
T03 - TP07
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644790.79 - 933004.01 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 2.00	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼							Fibrous, very wet peat.
				2.00			End of pit at 2.00 m

1
2
3
4
5

Remarks: Terminated due to instability of sides caused by water ingress.

Stability:

Trial Pit Log

Trialpit No
T06 - TP01
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 643612.30 - 932562.79 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 2.60	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Brown fibrous PEAT.
				1.60			Soft, grey, sandy, gravelly CLAY with low cobble content.
				2.60			End of pit at 2.60 m

1
2
3
4
5

Remarks: Terminated due to obstruction - possibly weathered bedrock.

Stability:

Trial Pit Log

Trialpit No
T08 - TP05
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644131.06 - 931887.54 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 3.20	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				1.10			Fibrous, intact peat with rootlets. Medium water content.
				3.20			Brown sandy, gravelly SILT with medium cobble content. Cobbles are sub-angular. End of pit at 3.20 m

1
2
3
4
5

Remarks: Terminated due to very firm ground - possibly bedrock.

Stability:

Trial Pit Log

Trialpit No
T09 - TP06
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644403.95 - 931540.98 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 2.50	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown, fibrous peat with a high water content
				2.00			Grey sandy, gravelly CLAY with low cobble content. Cobbles are sub-angular.
				2.50			End of pit at 2.50 m

Remarks: Terminated as bedrock was met.

Stability:

Trial Pit Log

Trialpit No
T11 - TP04
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 643708.91 - 931152.78 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 3.10	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Intact, slightly damp, fibrous peat.
				2.10			Grey sandy, gravelly, silty clay with medium cobble content. Cobbles are sub-angular.
▼				3.10			End of pit at 3.10 m

1
2
3
4
5

Remarks: Terminated due to instability of trial pit caused by inflow of water.

Stability:

Trial Pit Log

Trialpit No
T12 - TP02
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 642595.39 - 930509.11 Level:	Date 04/11/2019
Location: Donegal		Dimensions (m): Depth 2.50	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼				0.70			Damp fibrous peat.
				2.50			Sandy gravelly silty clay with medium cobble content. Cobbles are sub-angular. Clay is damp directly beneath peat but becomes dry at 1m BGL. End of pit at 2.50 m

1
2
3
4
5

Remarks: Terminated due to instability of trial pit caused by inflow of water.

Stability:

Trial Pit Log

Trialpit No
BP - TP01
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644310.74 - 931853.87 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 2.00	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼				0.20			Fibrous Peat
							Gravelly, cobbly SILT. Cobbles are angular
				2.00			End of pit at 2.00 m

1
2
3
4
5

Remarks: Terminated due to weathered bedrock at base.

Stability:

Trial Pit Log

Trialpit No
BP - TP02
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644325.28 - 931852.16 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 2.50	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼				2.50			Brown sandy, gravelly silt with high cobble content. Cobbles are sub-angular. Higher cobble content at 2m BGL. End of pit at 2.50 m

1
2
3
4
5

Remarks: Terminated due to weathered bedrock at base.

Stability:

Trial Pit Log

Trialpit No
BP - TP03
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644320.82 - 931837.28 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 1.50	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼				0.10			Peaty topsoil
							Sandy gravelly silt with medium cobble content. Rootlets also present.
				1.50			End of pit at 1.50 m

Remarks: Terminated as bedrock was met.

Stability:

Trial Pit Log

Trialpit No
BP - TP04
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644296.89 - 931821.27 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 0.40	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40			Sandy cobbly silt. End of pit at 0.40 m

1
2
3
4
5

Remarks: Terminated as bedrock was met.

Stability:

Trial Pit Log

Trialpit No
BP - TP05
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644278.27 - 931822.94 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 1.50	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Brownish-orange sandy gravelly silt with high cobble content
				1.50			End of pit at 1.50 m

1
2
3
4
5

Remarks: Terminated as bedrock was met.

Stability:

Trial Pit Log

Trialpit No
BP - TP06
Sheet 1 of 1

Project Name: Glenard Wind Farm	Project No. P2192	Co-ords: 644326.55 - 931778.27 Level:	Date 05/11/2019
Location: Donegal		Dimensions (m): Depth 2.70	Scale 1:25
Client: Coillte			Logged

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Fibrous peat (damp)
							Grey sandy gravelly clay with medium cobble content. Cobbles are sub-angular.
				2.70			End of pit at 2.70 m

1
2
3
4
5

Remarks: Terminated as bedrock was met.

Stability:

Photo 1 Trial pit T13 -TP02

Photo 2 Trial pit T12 - TP03

Photo 3 Excavated arisings from trial pit T12 – TP03

Photo 4 Trial pit T11 – TP04

Photo 5 Trial pit T8 – TP05

Photo 6 Excavated arisings from trial pit T8 – TP05

Photo 7 Trial pit T9 – TP06

Photo 8 Trial pit BP – TP01

Photo 9 Trial pit BP – TP02

Photo 10 Trial pit BP – TP03

Photo 11 Trial pit BP – TP04

Photo 12 Trial pit BP – TP05

Photo 13 Trial pit BP – TP06

Project ID	2019Lab106	Client		Remarks	Turnaround
Project Name	Glenard WF	Due Date	06/12/2019 15:25		
Schedule ID	2019Lab106_1	Scheduled Date	06/11/2019 15:25		

Sample Details							Classification						Chemical / Concrete									Compaction					Compressibility			Strength (Total)							Shear Stregth (Effective Stress)			Rock		Other							
Location	Depth (m)	Base Depth	Sample Type	Sample Ref	Date Sampled	Storage	Moisture Content	Atterberg 4 Point	Particle Density by Gas Jar	Particle Density by Small Pyknometer	Particle Size Distribution	Hydrometer	Organic Content	Loss On Ignition	Sulphate Total	Sulphate Water Gravimetric	Carbonate Titration	ph	Chloride Content	Chloride Content Acid	Compaction Light	Compaction Heavy	Compaction Vibrating Hammer	Moisture Condition Value	Moisture Condition Relationship	CBR	Consolidation	Pressures	Swelling Pressure Test	Laboratory Vane test	Small Direct Shearbox	Ring shear Test	Triaxial Quick Undrained	(Specify Cell Pressure)	Triaxial UU Multi Stage	Triaxial UU Multi Specimen	Consolidated Drained Triaxial Test	Consolidated Undrained Triaxial Test	Consolidated Undrained Triaxial Multis	Rock Uniaxial compression	Point Load	Los Angeles Coefficient						
BP01	0.30		B	1	05/11/19																																				0*	* not enough material provided					
BP04	0.30		B	1	05/11/19																																										
BP05	0.80		B	1	05/11/19																																										
TP06	2.30		B	1	05/11/19		1	1			1																																			
TP08	1.20		B	1	05/11/19		1	1			1																																			
TP09	2.20		B	1	05/11/19		1	1			1																																			
TP11	2.10		B	1	05/11/19		1	1			1																																			
TP12	2.20		B	1	05/11/19		1	1			1																																			
TP13	0.00		B	1	05/11/19		1	1			1																																			
	Tets completed and reported						6	6			6																																0						

Summary of Classification Test Results

Project No.	Project Name
2019Lab106	Glenard WF

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
TP06	1	2.30		B		Grey slightly sandy slightly gravelly SILT.			15.0	58	31	19	12		CL
TP08	1	1.20		B		Light orange silty very sandy medium GRAVEL.			13.0	18	50	35	15		MH
TP09	1	2.20		B		Dark grey silty very sandy GRAVEL.			65.0	27	109	59	50		MEO
TP11	1	2.10		B		Light brown very silty very sandy medium and coarse GRAVEL.			19.0	32	87	47	40		MV
TP12	1	2.20		B		Dark grey very silty very sandy GRAVEL.			55.0	31					NP
TP13	1	0.00		B		Light grey slightly gravelly sandy SILT.			12.0	57	27	23	4		ML

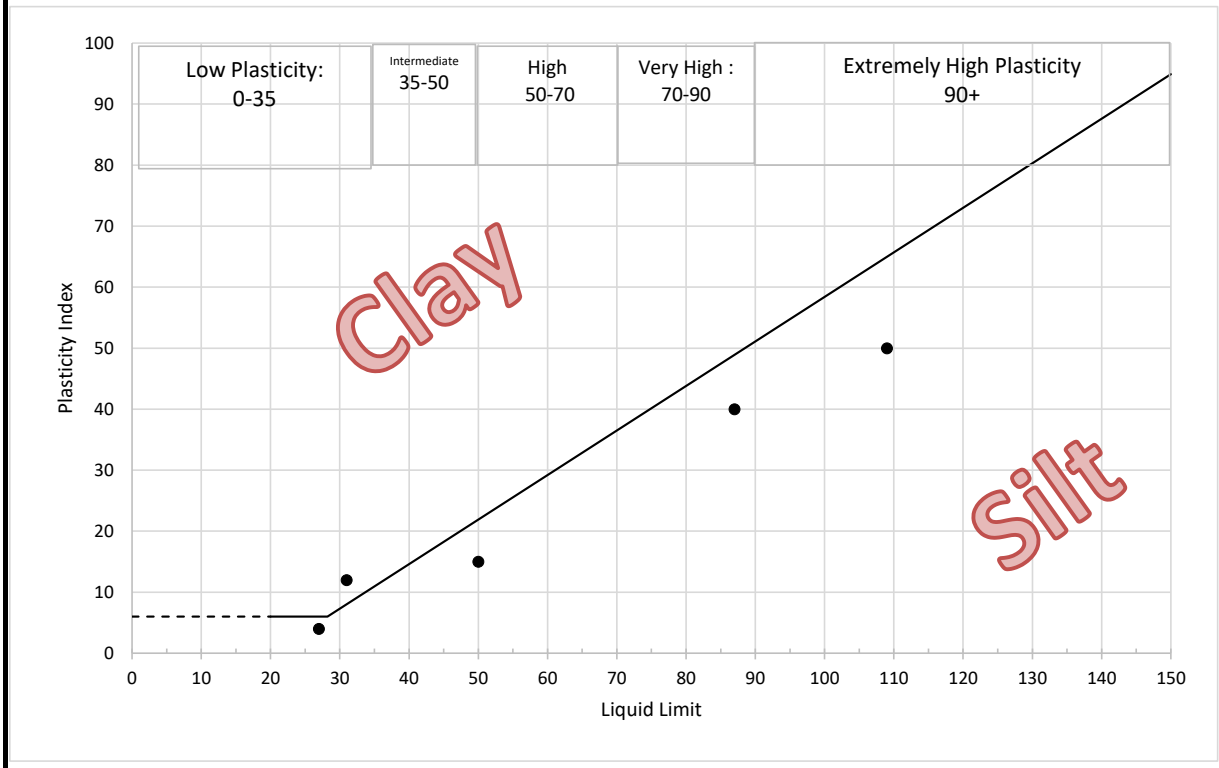
All tests performed in accordance with BS1377:1990 unless specified otherwise

Key			Date Printed	Approved By	Table
Density test	Liquid Limit	Particle density			1
Linear measurement unless :	4pt cone unless :	sp - small pyknometer	12/09/2019 00:00		
wd - water displacement	1pt - single point test	gj - gas jar			sheet
wi - immersion in water	NP - Non Plastic		QC From No: R1		1

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

	Plasticity (A-Line) Chart	Project Number
Project Name:	**Glenard WF**	
Location:		2019Lab106



Abreviations in the remarks column of the Classification Summary Sheet: C = Clay, M = Silt

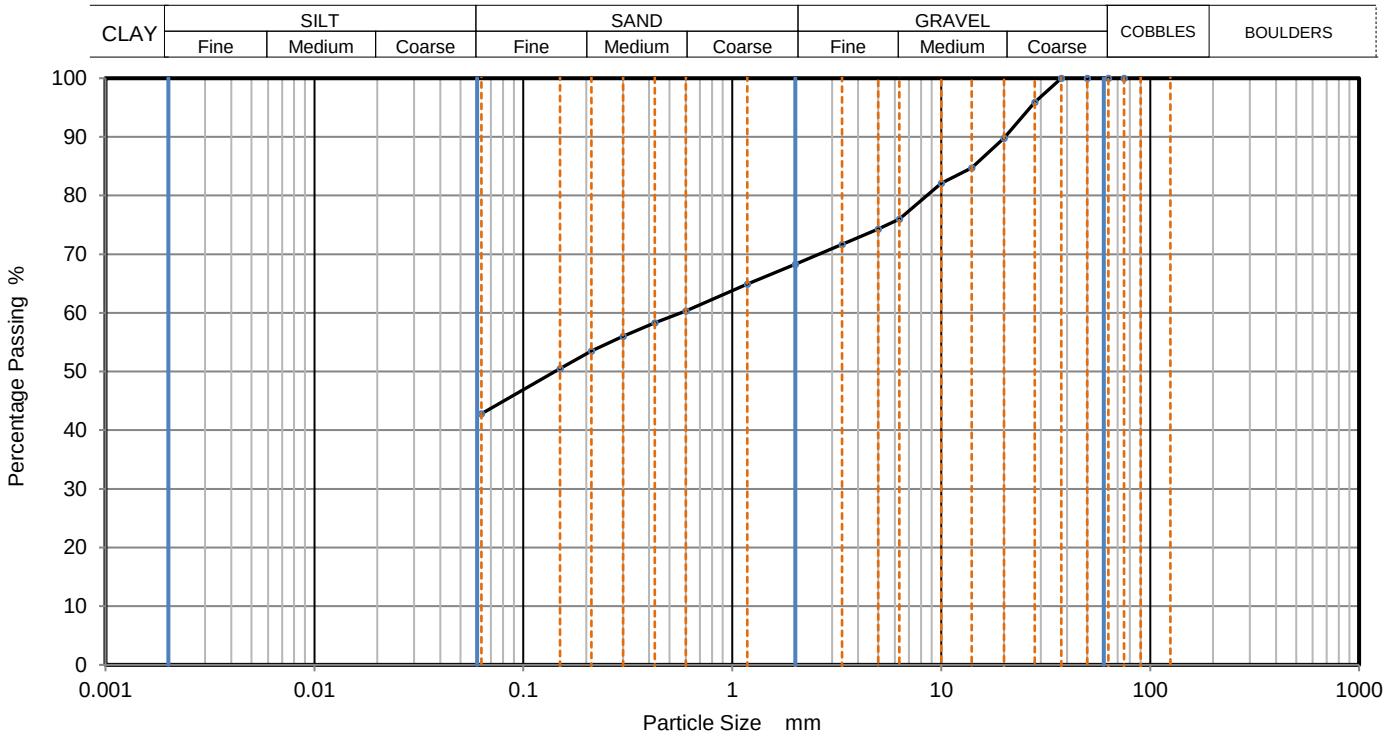
Plasticity abeviations: L = Low, I = Intermediate = H = High, V = Very High, E = Extremely High.

The letter O is added to the symbol of any material containing a significant proportion of organic material.

Chart taken from BS5930: 2010

QC Form: R1

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019Lab106**
				Borehole/Pit No.	TP06
Site Name	Glenard WF			Sample No.	1
Soil Description	Grey slightly sandy slightly gravelly SILT.			Depth, m	2.30
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110646



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	90		
14	85		
10	82		
6.3	76		
5	74		
3.35	72		
2	68		
1.18	65		
0.6	60		
0.425	58		
0.3	56		
0.212	54		
0.15	51		
0.063	43		

Dry Mass of sample, g	979

Sample Proportions	% dry mass
Very coarse	0
Gravel	32
Sand	26
Fines <0.063mm	43

Grading Analysis		
D100	mm	
D60	mm	0.574
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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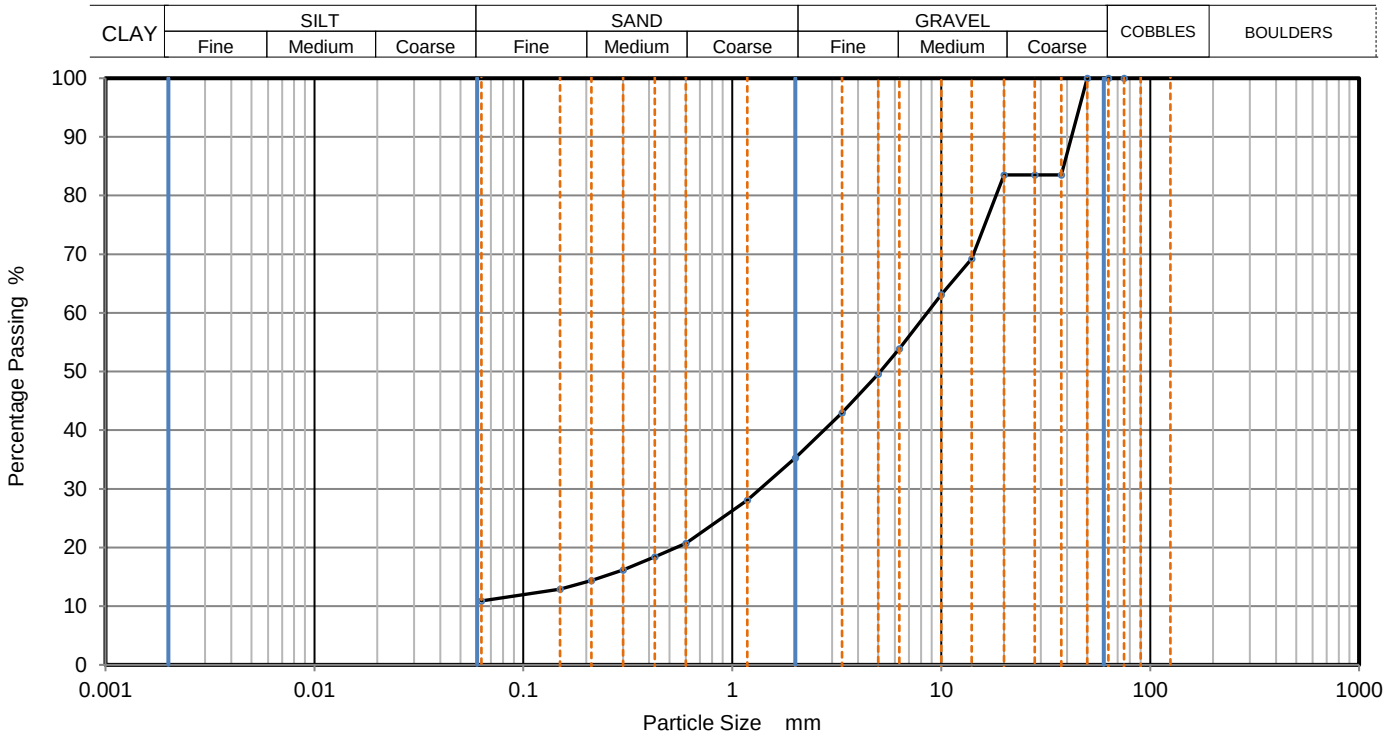
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019Lab106**
				Borehole/Pit No.	TP08
Site Name	Glenard WF			Sample No.	1
Soil Description	Light orange silty very sandy medium GRAVEL.			Depth, m	1.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110647



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	84		
28	84		
20	84		
14	69		
10	63		
6.3	54		
5	50		
3.35	43		
2	35		
1.18	28		
0.6	21		
0.425	18		
0.3	16		
0.212	14		
0.15	13		
0.063	11		

Dry Mass of sample, g	756

Sample Proportions	% dry mass
Very coarse	0
Gravel	65
Sand	24
Fines <0.063mm	11

Grading Analysis		
D100	mm	
D60	mm	8.56
D30	mm	1.35
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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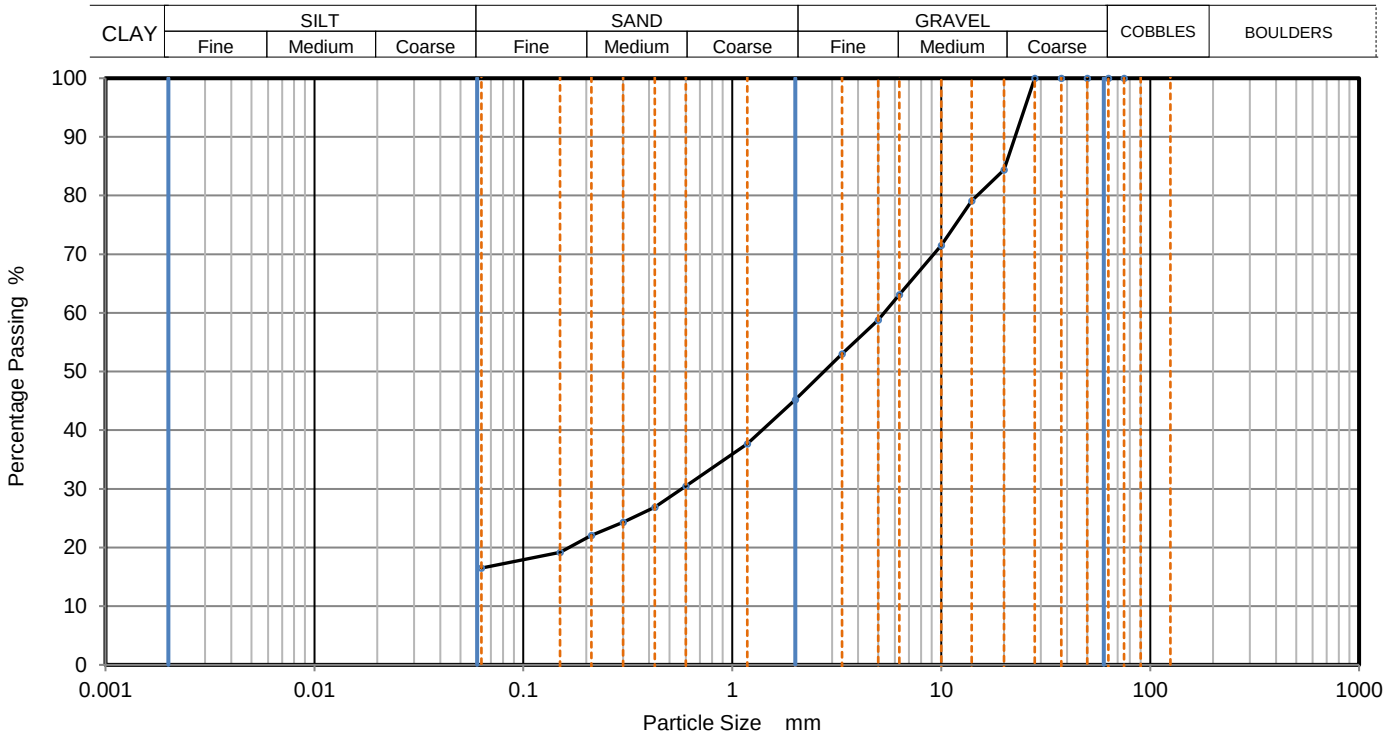
PARTICLE SIZE DISTRIBUTION

				Job Ref	**2019Lab106**
				Borehole/Pit No.	TP09
Site Name	Glenard WF			Sample No.	1
Soil Description	Dark grey silty very sandy GRAVEL.			Depth, m	2.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110648



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	84		
14	79		
10	72		
6.3	63		
5	59		
3.35	53		
2	45		
1.18	38		
0.6	31		
0.425	27		
0.3	24		
0.212	22		
0.15	19		
0.063	17		

Dry Mass of sample, g	608

Sample Proportions	% dry mass
Very coarse	0
Gravel	55
Sand	29
Fines <0.063mm	17

Grading Analysis		
D100	mm	
D60	mm	5.34
D30	mm	0.57
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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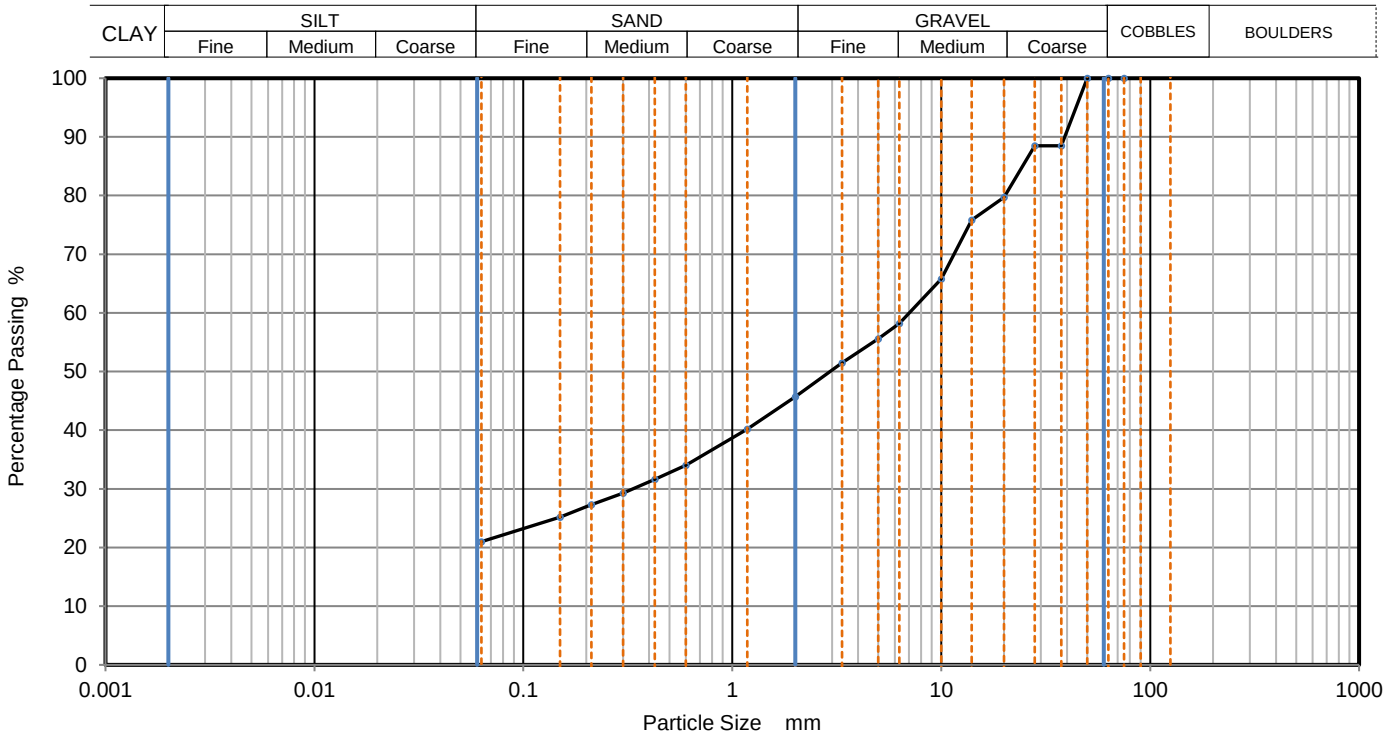
IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019Lab106**
				Borehole/Pit No.	TP11
Site Name	Glenard WF			Sample No.	1
Soil Description	Light brown very silty very sandy medium and coarse GRAVEL.			Depth, m	2.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110649



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	89		
28	89		
20	80		
14	76		
10	66		
6.3	58		
5	56		
3.35	52		
2	46		
1.18	40		
0.6	34		
0.425	32		
0.3	29		
0.212	27		
0.15	25		
0.063	21		

Dry Mass of sample, g	1082

Sample Proportions	% dry mass
Very coarse	0
Gravel	54
Sand	25
Fines <0.063mm	21

Grading Analysis		
D100	mm	
D60	mm	7.03
D30	mm	0.333
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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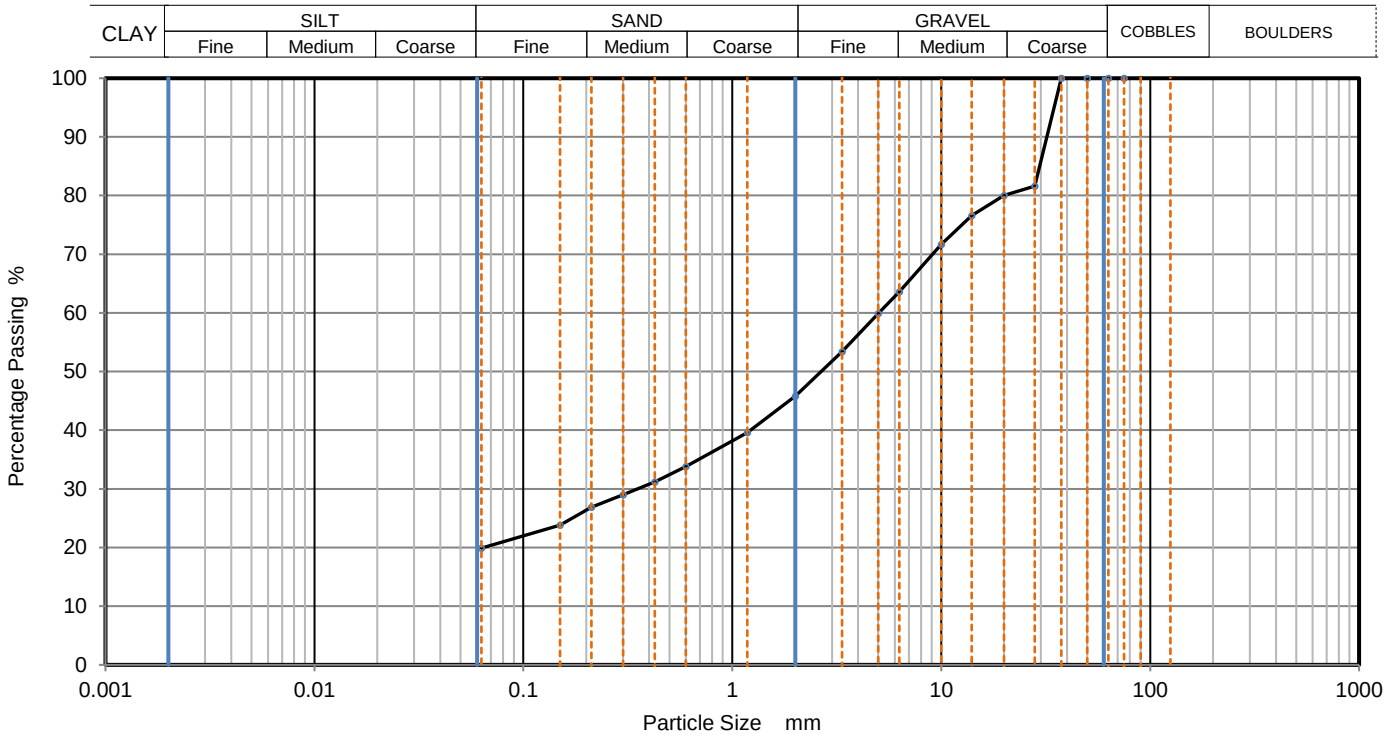
IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019Lab106**
				Borehole/Pit No.	TP12
Site Name	Glenard WF			Sample No.	1
Soil Description	Dark grey very silty very sandy GRAVEL.			Depth, m	2.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110650



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	82		
20	80		
14	77		
10	72		
6.3	64		
5	60		
3.35	53		
2	46		
1.18	40		
0.6	34		
0.425	31		
0.3	29		
0.212	27		
0.15	24		
0.063	20		

Dry Mass of sample, g	789

Sample Proportions	% dry mass
Very coarse	0
Gravel	54
Sand	26
Fines <0.063mm	20

Grading Analysis		
D100	mm	
D60	mm	5.03
D30	mm	0.35
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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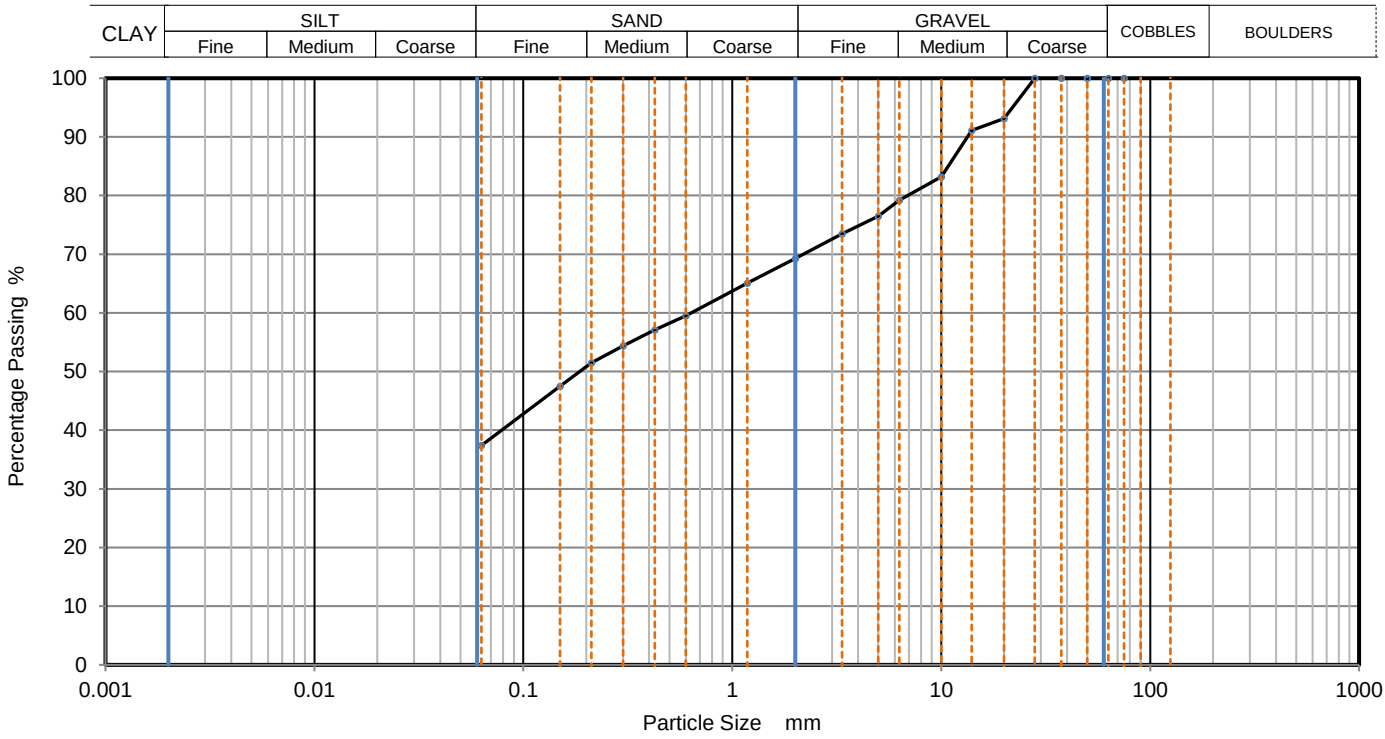
PARTICLE SIZE DISTRIBUTION

				Job Ref	**2019Lab106**
				Borehole/Pit No.	TP13
Site Name	Glenard WF			Sample No.	1
Soil Description	Light grey slightly gravelly sandy SILT.			Depth, m	0.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clause 9.2			KeyLAB ID	IDL12019110651



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	91		
10	83		
6.3	79		
5	77		
3.35	74		
2	69		
1.18	65		
0.6	60		
0.425	57		
0.3	54		
0.212	52		
0.15	48		
0.063	37		

Dry Mass of sample, g	968

Sample Proportions	% dry mass
Very coarse	0
Gravel	31
Sand	32
Fines <0.063mm	37

Grading Analysis		
D100	mm	
D60	mm	0.634
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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