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Appendix 11.1

Geotechnical & Peat Stability Assessment

FEHILY TIMONEY

DESIGNING AND DELIVERING
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GEOTECHNICAL & PEAT STABILITY REPORT

SHANCLOON WIND FARM

Prepared for:
RWE Renewables Ireland Limited

RWE

Date: **August 2025**

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1. NON TECHNCIAL SUMMARY

Fehily Timoney and Company (FT) was engaged by RWE Renewables Ireland Ltd. (RWE) to undertake a geotechnical and peat stability assessment of the proposed Shancloon 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 survey including intrusive peat depth probing and a ground investigation campaign including geophysical survey, boreholes and trial pits, desk study, stability analysis and risk assessment were carried out to assess the susceptibility of the site to peat failure following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, 2nd Edition, 2017).

The findings, which involved a stability analysis of over 80 locations, show that the site has an acceptable margin of safety and is suitable for the proposed wind farm project. Based on the findings, mitigation measures will be implemented for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety. It is noted that there have been numerous wind farms successfully constructed on blanket bog sites over the past 15 years without any issues relating to peat failure, such as Galway Wind Park, Arderroo (both Co. Galway), Slieve Callan (Co. Clare) and Slieve Bawn (Co. Roscommon), amongst others.

The Proposed Development at Shancloon Co. Galway comprises 11 no. wind turbines and associated infrastructure. A detailed description of the Proposed Development is included in Chapter 2 of the EIAR. The land use within the Proposed Development comprises predominately agricultural lands and vegetated peatlands, along with forestry and agricultural lands.

Slope inclinations at the infrastructure locations range from 1 to 2 degrees. The relatively flat topography/nature of the terrain on site reflects the low risk of peat failure. Ground conditions comprised mainly of blanket peat overlying silt and gravel, overlying bedrock.

In December 2021, 87 no. peat depth readings were taken within the Proposed Development. Peat depths recorded during the site walkovers and from the ground investigation ranged from 0.1 to 8.0m with an average peat depth of 2.0m. 52% of the probes recorded peat depths of less than 2.0m with 22% of peat depth probes recorded peat depths between 2.0m to 3.5m. The remaining 23% of probes recorded peat depths from 3.5 to 8.0m in localised areas. The deeper peat areas were generally avoided when optimising the wind farm layout of the site however Turbines T01 and T07 recorded deep peat up to 8.0m and 6.3m, respectively.

The purpose of the stability analysis was 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. The stability analysis for this project, which analysed the turbine locations, access roads and substation, resulted in FoS above the minimum acceptable value of 1.3 and hence the site has a satisfactory margin of safety.

From the stability analysis for both the undrained and drained conditions, which analysed the turbine locations and other proposed infrastructure locations, the calculated values were above the minimum acceptable FoS of 1.3.

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 A. A construction buffer zone plan based on qualitative factors identified during the site walkover is included as Planning Drawings P20-306-0600-0101 to P20-306-0600-0108.

The findings of the peat assessment (which combines the FOS and the risk assessment), which involved analysis of over 80 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.

In summary, the Shancloon wind farm site has an acceptable margin of safety and is considered to be at low risk of peat failure providing appropriate mitigation measures and construction controls are implemented, and is suitable for wind farm development.

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.100 members of staff, including engineers, scientists, planners and technical support staff. FT 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 Aaron Clarke (FT Principal Geologist, MSc in Geology) and Doireann Tarrant (FT Senior Project Engineer, BEng Civil and Environmental Engineering, MSc Structural and Geotechnical Engineering). Aaron is a Principal Geologist with Fehily Timoney and has over 15 years' experience in engineering geology. Doireann is a Senior Project Engineer with Fehily Timoney and has 2 years' experience in geotechnical engineering.

2.2 Project Description

FT was engaged in December 2020 by RWE Renewables Ireland Limited (RWE) to undertake a geotechnical & peat stability assessment of the proposed Shancloon wind farm site.

The proposed Shancloon wind farm is located approximately 3.5 km east of the village of Shrule and approximately 8 km west of Tuam, Co. Galway.

The Shancloon wind farm site comprises peat and agricultural land area. The surrounding landscape is predominately flat with land-use comprising forestry, agricultural land and cutaway peatland.

The description of the Proposed Development is included in Chapter 2 – Development Description and is summarised as:

- The wind farm site (referred to in this EIAR as the 'Site') which includes the turbine array and associated civil and electrical infrastructure and the on-site 110 kV substation and loop-in connection to the existing Cashla-Dalton overhead line;
- The turbine delivery route (referred to in this EIAR as the 'TDR').

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, 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 best practice guide was 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. The slope angle on the Proposed Development site are lower than those at Meenbog, and no significant areas of sidelong ground are present. 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.

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, 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 site, with additional detail at infrastructure locations. The peat stability assessment is undertaken within the proposed development to identify peat slope 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.
2. Site reconnaissance including shear strength and peat depth measurements undertaken following initial constraints study (by 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 (refer to Chapter 3 of the EIAR).
3. Peat stability assessment of the peat slopes on site using a deterministic and qualitative approach.
4. Peat contour depth plan – compiled based on the peat depth probes carried out across the site by FT
5. Factor of safety plan – compiled for the short-term critical condition (undrained) for over 80 no. FoS points analysed along the proposed infrastructure envelope on 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 Ground Investigations Ireland (GII).
9. Preliminary assessment of foundation type for turbines.
10. Commentary of founding details for other infrastructure elements such as access roads, crane hardstands, substation & construction compound platforms and met mast foundation.

A flow diagram showing the general methodology for the peat stability assessment is shown in Figure 2.1. The methodology illustrates the optimisation of the wind farm layout based on the findings from the site reconnaissance and stability analysis and subsequent feedback.

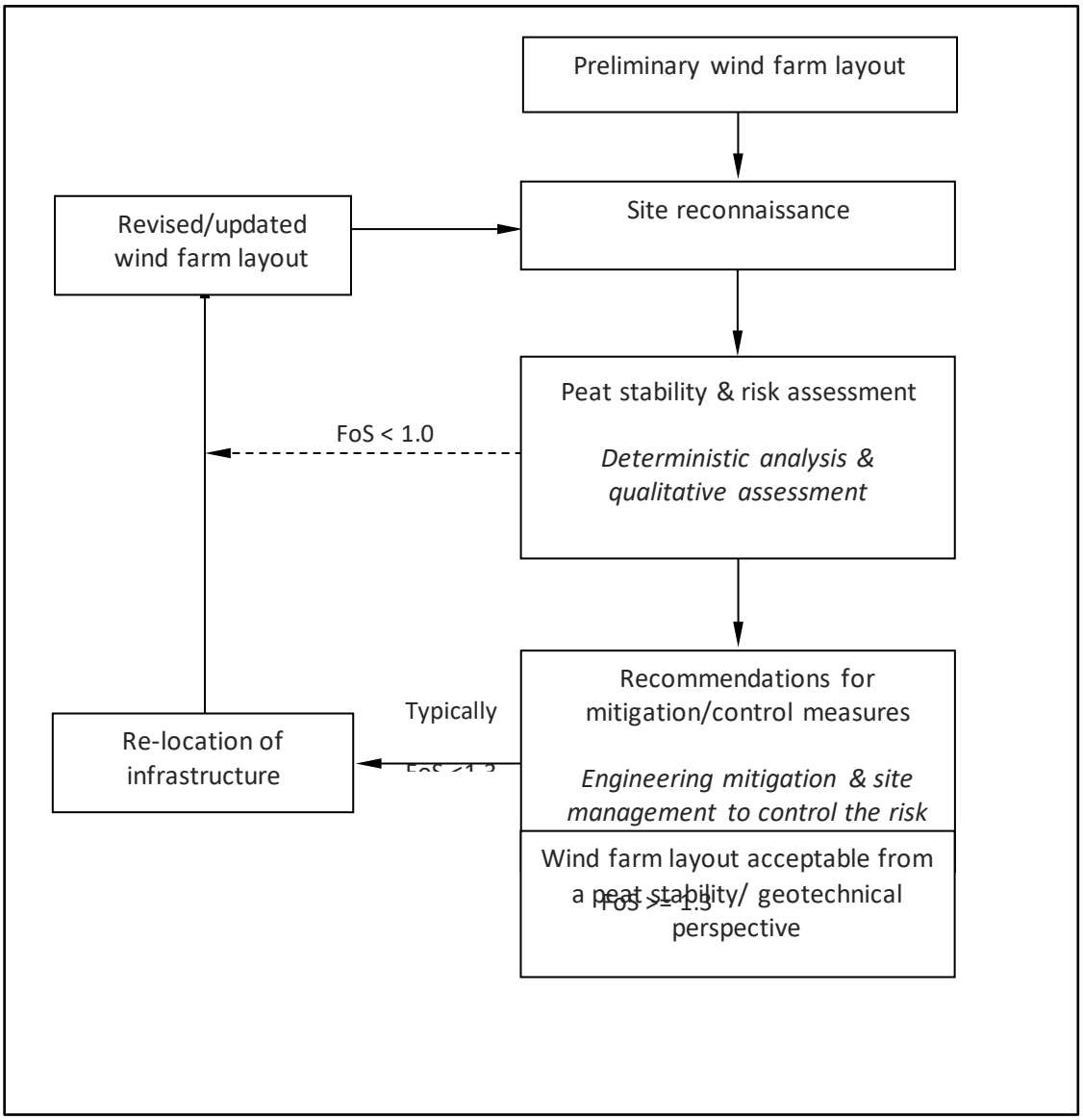

Figure 2-1: Methodology for Peat Stability Assessment

*An FoS of between 1.0 and 1.3 does not mean that a failure will occur, but that the area requires attention. Mitigation measures can be provided for areas with an FoS of between 1.0 and 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, and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

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 the proposed wind farm development or the surrounding environment. Peat failure excludes localised movement of peat that would occur 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:

1. Geomorphological
2. Qualitative (judgement)
3. Index/Probabilistic (probability)
4. Deterministic (factor of safety)

Approaches (1) to (3) listed above are 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 discussed in Section 2.6).

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, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and numerous other factors. The qualitative factors used in the risk assessment are compiled based on FT's 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 7).

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.

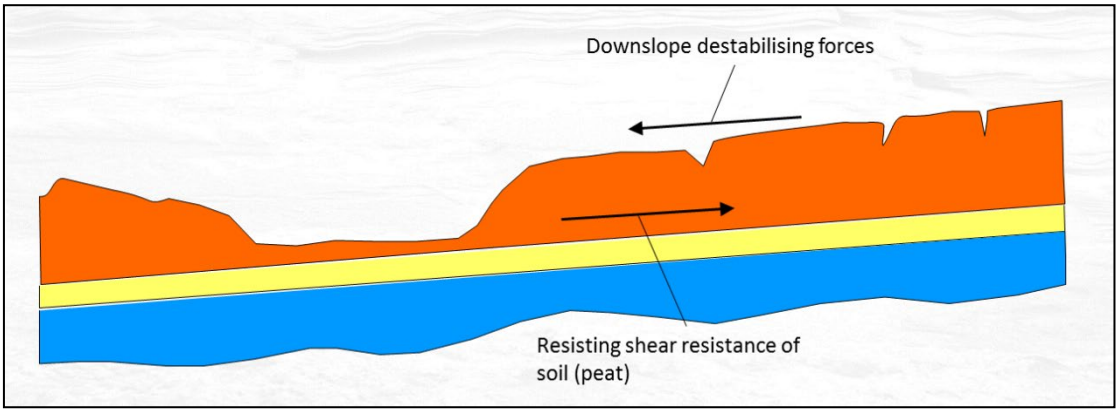

Figure 2-2: Peat Slope Showing Balance of Forces to Maintain Stability

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 and 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 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 from 0 to 100% of the peat depth is conducted, where 0% equates to the peat been completely dry and 100% equates to the peat being 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 7 of this report.

3. DESK STUDY

3.1 Desk Study

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

- Geological plans and Geological Survey of Ireland database
- Ordnance survey plans
- Literature review of peat failures

The Geological Survey of Ireland online dataset viewer (GSI, 2024) and geological plans (GSI, 1999) for the site were used to verify the soil and bedrock conditions.

The Ordnance Survey 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 includes a review of both published literature and GSI online dataset viewer (GSI, 2024) on peat failures/landslides in the vicinity of the site.

3.2 Soils, Subsoil & Bedrock

A review of the Geological Survey of Ireland online database and published documents from GSI was carried out. A site reconnaissance and intrusive (boreholes and trial pits) ground investigation were also carried out to identify potential surface karst features based on findings from a desk study.

The GSI quaternary mapping indicates the site is predominantly underlain by a mantle of cut over raised peat (peat). The remaining areas of the site are underlain by till derived from limestones. In general, the peat deposits are located in areas of slightly lower elevation when compared to the till. Subordinate linear deposits of Alluvium are mapped to the west of the site, underlying a portion of the proposed substation and approximately 800m of the proposed internal access track.

The GSI 1:100,000 scale bedrock mapping indicates that the site is entirely underlain by mid-Carboniferous Limestone, predominantly of the Ardnasillagh Formation comprising dark cherty calcarenites (limestone) and thin shales. However, peripheral areas of the Site are underlain to the north and northwest by the Cong Limestone Formation and Cong Canal Formation respectively. The Cong Canal Limestone comprises medium to thick bedded pure limestone.

Surface karst features (predominantly collapse dolines) are present throughout the Site. These features are believed to form along unmapped fault lines that create zones of weakened and fractured rock beneath the overlying Quaternary deposits (predominantly Glacial Till). The fault zones allow for piping of the fine grained portion of the Glacial Till, through fractured rock, resulting in voiding and eventual collapse of the soils overlying the limestone bedrock. The result is a broadly circular bowl shaped depression of varying widths and depths.

With the exception of borehole PBH-18 (thought to be within the Cong Canal Formation), no karst features were observed within the underlying shaley limestones of the Ardnasillagh Formation. No evidence of significant karst features such as caves were noted within the Site as part of the ground investigation assessment. Results from the combined desktop study, site reconnaissance and ground investigations suggest that voiding is confined to the Quaternary deposits overlying the limestone.

These surface karst features are not identified in the survey area on the GSI database however a turlough is identified approximately 2km to the southeast of the site.

There is 1 no. geological heritage site noted 5km south of the site in Knocknaa Co., Galway. The geological heritage site is noted as a large area of landscape with glacial deposits which have a modified a much older landscape.

3.3 Groundwater Monitoring

Groundwater monitoring has been carried out by FT once per month from November 2023 to Sept 2024. 17 no. water monitoring wells were installed in boreholes PBH-01 to PBH-21. The readings taken at each infrastructure location are summarised in Table 3-1. All groundwater monitoring readings are shown in Table 3-2.

Table 3-1: Summary of groundwater well readings at infrastructure locations

Turbine	Relevant Well ID	Range Water Level (mOD)	Average Water Level (mOD)
T01	PBH-01	26.2 - 27.2	26.8
T02	PBH-02	26.3 - 28.5	27.8
T03	PBH-03A	27.4 - 30.9	28.8
T04	PBH-04	27.9 - 29.8	29.1
T05	PBH-05	26.5	26.5
T06	PBH-06	26.1 - 27.8	27.2
T07	PBH-07	36.5 - 37.0	
T08	PBH-08, PBH-09, PBH-10, PBH-11, PBH-12	25.3 - 27.8 (west) 33.8 - 36.5 (east)	27.0 (west) 35.7 (east)
T09	PBH-13	33.7 - 36.2	35.7
T10	PBH-15	33.6 - 34.9	33.9
T11	PBH-16	35.1 - 35.1	35.3
Met Mast	PBH-03A	27.4 - 30.9	28.8
Substation	PBH-20	28.2	28.2
Construction Compound 1 (East)	-	-	-
Construction Compound 2 (West)	-	-	-

Table 3-2: Groundwater well readings depth below ground level (m)

	Depth below ground level (m)										
Well no.	8/11/2023	19/12/2023	30/01/2024	27/02/2024	20/03/2024	17/04/2024	29/05/2024	25/06/2024	30/07/2024	27/08/2024	24/09/2024
PBH01	1.02	0.86	1.07	1.04	0.94	1.02	1.46	1.73	1.84	0.96	1.67
PBH02	1.84	1.38	1.61	1.57	1.5	1.55	2.38	3.63	2.8	2.19	2.54
PBH03	9.02	8.21	6.21	8.56	8.42	8.59	9.77	n/a	n/a	n/a	n/a
PBH04	4.24	3.61	3.92	4.04	4.25	4.16	5.03	n/a	n/a	5.54	n/a
PBH06	2.975	2.74	3.03	2.99	2.91	2.97	3.53	4.02	4.45	n/a	3.82
PBH07	0.15	0.05	0.1	0.07	0.06	0.08	0.19	0.46	0.59	0.3	0.44
PBH09	3.12	2.88	3.14	3.1	3.01	3.05	4.08	4.85	5.35	3.66	4.38
PBH12	1.08	0.79	0.99	0.96	0.71	0.91	1.69	3.38	3.17	0.86	2.02
PBH13	2.1	1.82	1.82	2.04	1.94	1.96	n/a	n/a	4.26	2.56	n/a
PBH14	0.31	NA	0.31	0.25	0.13	0.25	0.31	0.66	0.89	0.07	0.55
PBH15	1.27	1.52	0.52	1.57	1.55	1.56	n/a	n/a	1.81	1.59	n/a
PBH16	0.25	0.14	0.32	0.25	0.15	0.18	0.46	0.49	0.52	0.02	n/a
PBH17	0.32	0.07	0.21	0.2	0.09	0.21	0.41	0.68	0.83	0.26	0.7
PBH18	NA	0.07	0.24	0.19	0.11	0.18	0.97	n/a	n/a	n/a	1.27
PBH19	0.81	0.74	0.89	0.83	0.78	0.83	1.22	1.5	1.66	0.75	1.31
PBH20	0.04	Artesian	Artesian	Artesian	Artesian	Artesian	n/a	n/a	n/a	n/a	n/a
PBH21	0.53	0.36	0.53	0.48	0.44	0.45	0.96	n/a	1.52	n/a	n/a

* Artesian refers to a groundwater level above the ground surface, where the groundwater is flowing over the top of the standpipe due to pressure in the bedrock which forces it to the surface.

3.4 Previous Failures

There are no recorded peat failures within the Shancloon wind farm site (GSI, 2022). The nearest recorded failure is located in Kilmore on cutover peat approximately 11km southeast of the study area. The landslide mechanism is noted as undefined. It occurred in 1909 and there have been no other recorded failures since.

The landslide susceptibility of the site was classified by the GSI (2022) as low susceptibility, which is expected given the flat terrain present.

The presence, or otherwise, of relict peat failures or clustering of relict 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. Hence 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 Shancloon site have a limited potential of peat failure.

4. FINDINGS OF SITE RECONNAISSANCE

4.1 Site Reconnaissance

As part of the assessment of potential peat failure at the Proposed Development site, FT carried out a site reconnaissance in conjunction with the desk study review described in Section 3. This comprised walkover inspections of the site with recording of salient geomorphological features with respect to the wind farm development which included peat depth and preliminary assessment of peat strength. The information gathered from these site visits provide sufficient information for a site-wide assessment of the extent, depth and strength of peat present at the Proposed Development.

The following salient geomorphological features were considered:

- Active, incipient 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 method adopted for carrying out the site reconnaissance relied on experienced 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 site undertaken on several different days during December 2021. Weather conditions for the site visits ranged from dry to wet.

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 of the wind farm site are as follows:

1. The site is typically covered in a layer of peat and is relatively flat. 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 few areas of higher ground. Bare cutover and cutaway peat, re-vegetation of bare peat and commercial Bord na Móna operated bog land are present across the site.
2. A total of 87 no. peat depth probes were carried out on site. Peat depths recorded from peat probing across the site ranged from 0 to 8.0m with an average depth of 2.0m (Drawings P20-306-0600-0001 to P20-306-0600-0006). Approximately 75 percent of peat depth probes recorded peat depths of less than 3.0m. A number of localised readings were recorded where peat depths were up to 8.0m.
3. The peat depths recorded at the turbine locations varied from 0 to 8.0m with an average depth of 3.5m. 3 no turbine locations, T01, T07 and T12, had peat depths greater than 3.5m.
4. With respect to the new proposed access roads, peat depths are typically less than 3.5m with localised depths of up to 8.0m recorded.

5. The access roads for the Proposed Development comprise of 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 either a floating or an excavate & replace construction technique which involves the removal and replacement of peat or soft ground where encountered.
6. Slope angles at the turbine locations ranged from 0 to 2 degrees. These slope angle readings 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 the site.
7. The slope angle quoted typically reflects the slope within the footprint of each infrastructure location. The flat topography/nature of the terrain on site highlights the low risk of peat failure.
8. Localised areas of ponded water were recorded. This is not unexpected given the ground conditions and the flat terrain present across the site.
9. No evidence of past failures or any significant signs of peat instability were noted on site.
10. 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 typically flat terrain and open peatland. Peat depths recorded across the site ranged from 0 to 8.0m with an average depth of 2.0m.
    b) A construction buffer zone plan has been produced for the site (Drawing P20-306-0600-0101 to P20-306-0600-0108). This shows areas on the site where no development is advised and areas with an elevated or higher construction risk. The above identified buffer 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 assessments, see Sections 6, 7 and 8 of this report for details.
    d) Based on the findings from the walkover survey, the Proposed Development is considered to have a low risk of peat failure.

5. GROUND INVESTIGATION

Ground investigations in the form of trial pits and rotary core boreholes were carried out at the Shancloon site by Ground Investigations Ireland (GII) between March and June 2023. The ground investigation by GII comprised a total of 22 no. trial pits, 22 no. rotary core boreholes and 18 no. groundwater monitoring wells with associated laboratory testing.

The laboratory testing included the following:

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

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

The purpose of the ground investigation was to assess the ground conditions at the main infrastructure locations and potential borrow pit locations across the site. A ground investigation location plan is included as Planning Drawing P20-306-0600-0201 to P20-306-0600-0204.

5.1 Summary of Ground Conditions

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

Topsoil– Typically described as topsoil of peaty topsoil was encountered at most exploratory holes and was present to a maximum depth of 0.4m.

Peat – Typically described as very soft brown clayey pseudo fibrous peat. Peat thicknesses ranged from 0.4m to 3.1m in the trial pits and 3.5m to 5.5m in the boreholes.

Made Ground – brown / dark brown slightly sandy slightly gravelly silty Clay / peaty Clay and contained rare fragments of string, ceramic, roots, and metal. The layer thickness ranged between 0.2m to 1.0m.

Cohesive Deposits– Typically described as soft to firm or stiff to very stiff light brown/grey slightly sandy gravelly silty CLAY or slightly sandy clayey SILT or sandy very gravelly clayey SILT. However, at peatland areas a slightly sandy silty CLAY was often recorded directly beneath the peat and was noted as a marl in the drilling records. The layer thickness ranged between 0.3m to 4.9m.

Granular Deposits– Typically described as grey silty sandy subangular to subrounded fine to coarse GRAVEL or slightly clayey gravelly fine to coarse SAND. The layer thickness ranged between 0.4m to 5.6m.

Limestone Bedrock – medium strong to very strong thinly bedded to thickly bedded dark grey fine grained fossiliferous argillaceous LIMESTONE. The upper 2.5m is described as dense grey subrounded cobbles and boulders of limestone (possible weathered rock). Bedrock is encountered between 14.6mbgl.

Groundwater was recorded in 18 no. of the trial pits on site and varied between 0.5 and 4.5m bgl.

5.2 Summary of Laboratory Tests

Following completion of intrusive site investigations by FT and GII laboratory testing was scheduled by FT and undertaken by Ground Investigations Ireland (GII). Soil testing was carried out in accordance with BS1377 (1990) - Methods of Test for Soils for Civil Engineering Purposes in GII's Materials Laboratory, accredited in accordance with the Irish National Accreditation Board (INAB).

The samples of the overburden material were analysed for a range of parameters which included Particle Size Distribution (PSD), Moisture Content and Atterberg Limits.

The results are summarised in Table 5.1. Atterberg limit tests carried out on the samples classify the material as Clay of low to high plasticity, and silt of extremely high plasticity (ME). No elevated sulphate levels were detected in the samples tested.

Figure 5-1: Laboratory Testing

Type	N	Min	Max	Remarks
Natural Moisture Content (%)	14	5.4	86.0	Typical % lower from gravel dominated soil and higher for silt dominated soil.
Atterberg Limits	35	-	-	Low (CL) to high (CH) plasticity Clay and one Extremely High Plasticity (ME)
Particle Size Distribution	20	-	-	% passing 63 µm ranged from 0 to 37%
Unconfined Compressive Strength (MPa)	8	58.1	76.5	
Point Load	72	0.12	6.44	IS50 (MPa) – Axial and Diametrical
Soil Organic Content (%)	0	-	-	
Sulphate Total (mg/kg)	20	144	1392	
Water Soluble Sulphate as SO4 (g/L)	39	0.0038	0.2593	
pH	39	7.95	9.34	

5.3 Summary of Geotechnical Parameters

Table 5-2 contains characteristic geotechnical parameters for the main material types likely to be encountered on the Proposed Development site. Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values. Characteristic values are defined as a cautious estimate of the value affecting the occurrence of limit state based on clause 2.4.5.2 from Eurocode 7.

Figure 5-2: Summary of Geotechnical Parameters

Material Type/Strata	Unit Weight	Geotechnical Parameters		
		Undrained Parameters	Drained Parameters	
	γ (kN/m3)	cu (kPa)	ϕ' (°)	c' (kPa)
Peat	11	6 (3)	25	4
Made Ground	18	20	30	0
Alluvium/Marl	16	8	28	0
Glacial Deposits	20			
Fluvioglacial – Sand & Gravel	20	-	32	0

Notes
Note (1) The above parameters are indicative only and have been derived based on experience and from a review of the ground investigation carried out at the site.
Note (2) Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values.
Note (3) A lower bound undrained shear strength, cu for the peat of 6kPa was selected. The lowest recorded value on the Shancloon wind farm site was 2kPa based on NSPT values hence a value of 6kPa is a conservative value.

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 and access roads and other main infrastructure elements. 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. 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 with depth are presented in Figure 6.1.

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, such as the Silva Clino Master and from contour survey plans for site.

The slope angle quoted typically reflects the slope within the footprint of each infrastructure location. 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 would generally be deemed more accurate and representative of local topography.

6.4 Summary of Finding

Based on the peat depths recorded across the site by FT and the exploratory holes by GII, the peat varied in depth from 0.1 to 8.0m with an average depth of 2.0m. All peat depth probes carried out on site have been utilised to produce a peat depth contour plan for the site (Drawing P20-306-0600-0001 to P20-306-0600-0006).

A summary of the peat depths at the proposed infrastructure locations is given in Table 6.1. The data presented in Table 6.1 is used in the peat stability assessment of the site.

Table 6-1: Peat Depth & Slope Angle at Proposed Infrastructure Locations

Turbine	Easting	Northing	Peat Depth Range (m) (1)	Average Peat Depth (m)	Slope Angle (°) (2)
T01	532133	754079	8	8	2
T02	531396	754501	0 – 0.4	0	2
T03	531596	753976	No peat	No peat	2
T04	531886	753395	No peat	No peat	2
T05	533286	754179	0.7 – 2.5	1.7	2
T06	533953	754649	No peat	No peat	2
T07	534433	754560	1.5 – 6.3	6.3	2
T08	533733	755199	No peat	No peat	2
T09	533408	755568	2.1 – 3.1	0	2
T10	533136	755861	2.0 – 3.1	2.8	2
T11	534947	755115	2.2 - 5.5	4.9	2
Met Mast	531555	753596	No peat	No peat	2
Substation	529932	752825	1.3 - 2.3	1.7	2
Construction Compound 1 (West)	531869	753881	No peat	No peat	2
Construction Compound 2 (East)	538249	755792	No Peat	No peat	2

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

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 with depth are presented in Figure 6.1.

The hand vane results indicate undrained shear strengths in the range 15 to >65kPa, with an average value of about 48kPa. The strengths recorded would be typical of well drained peat as is present on the Proposed Development 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, was estimated at 2.5kPa. The recorded undrained strength at Shancloon 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 Proposed Development site.

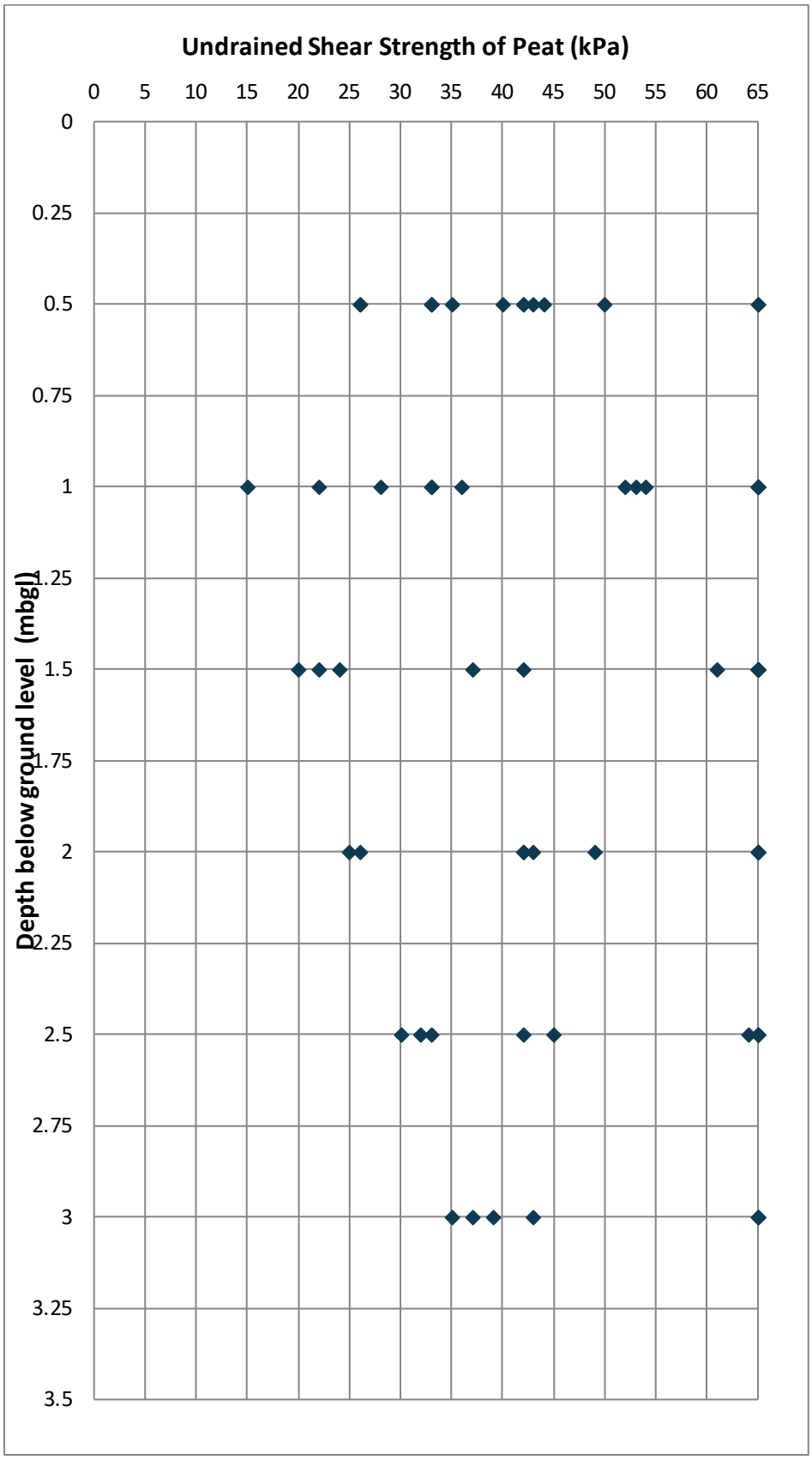

Figure 6-1: Undrained Shear Strength (c_u) Profile for Peat with Depth

7. PEAT STABILITY ASSESSMENTS

The peat stability assessment includes an assessment of the stability of the natural peat slopes for individual parcels across the site including at the turbine locations 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 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 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°

Table 7-1: List of Effective Cohesion and Friction Angle Values for Peat

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 based on the c_u values recorded at the site. 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 generally has a higher undrained strength.

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

c_u = 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 being completely dry and 100% equates to the peat been fully saturated.

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 and ground investigation.

(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. 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 at 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 Shancloon wind farm site during the site walkover was 15kPa. 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 & extraction works which have been carried out on site.

For the stability analysis two load conditions were examined, namely

Condition (1): no surcharge loading

Condition (2): surcharge of 10 kPa, equivalent to 1m of stockpiled peat assumed as a worst case.

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

The results of the undrained analysis for the natural peat slopes are presented in Appendix B and the results of the undrained analysis for the most critical load case (load condition 2) are shown on Drawing P20-306-0600-0301 to P20-306-0600-0308. 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 Table 7.3.

The calculated FoS for load condition 1 is in excess of 1.30 for each of the infrastructure locations (over 80 no. locations) analysed with a range of FoS of 2.87 to 76.46, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the infrastructure locations (over 80 no. locations) analysed with a range of FoS of 2.55 to 17.64, indicating a low risk of peat instability.

Table 7-3: Factor of Safety Results (Undrained Condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	532133	754079	**2.87**	**2.55**
T02	531396	754501	**57.34**	**16.38**
T03	531596	753976	**No Peat**	
T04	531886	753395	**No Peat**	
T05	533286	754179	**13.49**	**8.5**
T06	533953	754649	**No Peat**	
T07	534433	754560	**3.64**	**3.14**
T08	533733	755199	**No Peat**	
T09	533408	755568	**No Peat**	
T10	533136	755861	**8.19**	**6.04**
T11	534947	755115	**4.68**	**3.89**
Met Mast	531555	753596	**No Peat**	
Substation	529932	752825	**No Peat**	
Construction Compound 1 (West)	531869	753881	**No Peat**	
Construction Compound 2 (East)	538249	755792	**No Peat**	

7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix B. The results from the main infrastructure locations are summarised in Table 7.4. As stated previously, the drained loading condition examines the effect of rainfall and water on the existing stability of the natural peat slopes.

The calculated FoS for load condition 1 is in excess of 1.30 for each of the locations (over 80 no. locations) analysed with a range of FoS of 10.53 to 51.58, indicating a low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.30 for each of the locations (over 80 no. locations) analysed with a range of FoS of 10.24 to 22.18, indicating a low risk of peat instability.

Table 7-4: Factor of Safety Results (Drained Conditions)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T01	532133	754079	**14.79**	**14.63**
T02	531396	754501	**42.02**	**21.55**
T03	531596	753976	**No Peat**	
T04	531886	753395	**No Peat**	
T05	533286	754179	**17.94**	**16.63**
T06	533953	754649	**No Peat**	
T07	534433	754560	**15.17**	**14.92**
T08	533733	755199	**No Peat**	
T09	533408	755568	**No Peat**	
T10	533136	755861	**17.76**	**16.54**
T11	534947	755115	**10.53**	**10.24**
Met Mast	531555	753596	**No Peat**	
Substation	529932	752825	**No Peat**	
Construction Compound 1 (West)	531869	753881	**No Peat**	
Construction Compound 2 (East)	538249	755792	**No Peat**	

8. PEAT STABILITY RISK ASSESSMENT

A peat stability risk assessment was carried out for the main infrastructure elements at the Proposed Development site. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (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 subsection 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 C.

8.1 Summary of Risk Assessment Results

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

The risk rating for each infrastructure element at the Proposed Development is designated Negligible to Low following some mitigation/control measures being implemented. Sections of access roads to the nearest infrastructure element will be subject to the same mitigation/control measures that apply to the nearest infrastructure element.

Details of the required mitigation/control measures can be found in the Geotechnical Risk Register for each infrastructure element (Appendix A).

Table 8-2: Summary of Peat Stability Risk Register

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
T01	Negligible	1 to 4	No	Negligible	1 to 4
T02	Negligible	1 to 4	No	Negligible	1 to 4
T03	N/A – No Peat recorded at location				
T04	N/A – No Peat recorded at location				
T05	Medium	11 to 16	Yes	Low	5 to 10
T06	N/A – No Peat recorded at location				
T07	Negligible	1 to 4	No	Negligible	1 to 4
T08	N/A – No Peat recorded at location				
T09	N/A – No Peat recorded at location				
T10	Negligible	1 to 4	No	Negligible	1 to 4
T11	Negligible	1 to 4	No	Negligible	1 to 4
Met Mast	N/A – No Peat recorded at location				
Substation	N/A – No Peat recorded at location				
Construction Compound 1 (West)	N/A – No Peat recorded at location				
Construction Compound 2 (East)	N/A – No Peat recorded at location				

9. INDICTATIVE FOUNDATION TYPE AND FOUNDATION DEPTH FOR TURBINES

9.1 Summary

Based on a review of the ground investigation information for site, a preliminary assessment of the likely foundation type and founding depths for each turbine location was carried out, where possible. A summary of this assessment is provided in Table 9-1.

Table 9-1: Summary of Indicative Turbine Foundation Type and Founding Depths

Turbine No.	Turbine Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T1	Piled foundation	PBH-01	9.5 (Dense Gravel)	The site investigation works carried out indicate that a piled foundation may be required.
T2	Gravity/Piled foundation	PBH-02, BH-6, PTP-01, PTP-02, TP-3	4.5 (Dense Gravel)	The site investigation works carried out indicate that a gravity or piled foundation may be required.
T3	Gravity/Piled foundation	PBH-03A	4.5 (Very Stiff Clay)	The site investigation works carried out indicate that a gravity or piled foundation may be required.
T4	Piled foundation	PBH-04, BH-1, PTP-03, PTP-04, TP-1, TP-2	6.0 (Bedrock)	The site investigation works carried out indicate that a piled foundation may be required.
T5	Piled foundation	PBH-05	9.0 (Bedrock)	The site investigation works carried out indicate that a piled foundation will be required.
T6	Gravity/Piled foundation	PBH-06, PTP-06	4.5 (Very Stiff Clay)	The site investigation works carried out indicate that a gravity or piled foundation may be required.
T7	Piled foundation	PBH-07	8.0 (Bedrock)	The site investigation works carried out indicate that a piled foundation may be required.
T8	Gravity/Piled foundation	PBH-08, PBH-09, PBH-10, PBH-11, PBH-12, PBH-13, BH-2, BH-3 PTP-07,	4.5 (Very Stiff Clay)	The site investigation works carried out indicate that a gravity or piled foundation may be required.

Turbine No.	Turbine Foundation Type	Relevant GI	Indicative founding depth (m bgl)	Comment
T9	Gravity/Piled foundation	PBH-13, PTP-08, PTP-09,	4.5 (Very Stiff Clay)	The site investigation works carried out indicate that a gravity or piled foundation may be required.
T10	Piled foundation	PBH-15, PTP-10	8.5 (Very Stiff Clay)	The site investigation works carried out indicate that a piled foundation may be required.
T11	Piled foundation	PBH-16	8.5 (Very Stiff Clay)	The site investigation works carried out indicate that a piled foundation may be required.

It should be noted that confirmatory ground investigation will be carried out prior to construction at each turbine location in the form of a borehole with in-situ SPT testing at 1m intervals in the overburden and follow-on rotary core through bedrock to confirm the foundation types and founding stratums assumed in Table 9-1. It is likely that following the completion of further ground investigation prior to construction that a number of the turbine bases will be deemed suitable for gravity type foundations.

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

For the piled turbine foundations, a typical piling type and configuration could be up to 16 no. 1200-1600mm diameter rotary bored piles.

10. 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 of these elements of the proposed development are included in Chapter 4 of the EIAR.

10.1 Access Roads

Floating access roads are the predominant road construction type proposed for the site which given the ground conditions and type of terrain present is deemed an appropriate construction approach.

The total length of proposed access road to be constructed on site is 13.7km, this is comprised of 3.56km of upgrades to the existing tracks/roads, 8.4km of new access roads and 1.77km of floating road. (see Planning Drawings P20-306-0100-0011 to P20-306-0100-0072).

The typical make-up of the founded access roads is a minimum stone thickness of 800mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed at detailed design stage.

Refer to the Peat & Spoil Management Plan for the Proposed Development for further details on the proposed access roads on site.

10.2 Crane Hardstands

The crane hardstands will be constructed using the founded 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 determined at pre-construction stage.

The typical make-up of the hardstands will include a minimum of 1000mm of granular stone fill with possibly a layer of geotextile and/or geogrid, if deemed necessary by the Designer.

10.3 Substation Foundations & Platforms

The onsite substation platform will be constructed using the founded technique (i.e. not floated technique). The substation foundations may 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 in accordance with Eirgrid/ESB network requirements on a suitable sub-formation to achieve the required bearing resistance.

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

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

Typical founding depth for substation platforms is likely to be 1.5-2.5m.

The typical make-up of the substation platform will require approximately 2.5-3.5m 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/6P) in accordance with Eirgrid requirements will likely be required.

10.4 Construction Compound Platforms

The construction compound platforms will be constructed using the founded or floated technique as appropriate.

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 1.0mbgl.

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

10.5 Met Mast and Loop -in Towers Foundations

The met mast and Loop-in towers foundations will comprise gravity type foundations.

Given the ground conditions present at the proposed met mast and loop-in, it is envisaged that the foundation will require to be founded on a competent stratum.

Typical founding depth is envisaged to be 1.0mbgl. At the underside, a layer of structural up-fill (class 6N) will be required.

11. SUMMARY AND RECOMMENDATIONS

11.1 Summary

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 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 site which is typically flat consists agricultural land, cut-away peat and intact shallow peat. Deep peat of up to 8.0m was identified during peat probing in a localised area to the east of the site near T11.

Peat thicknesses recorded during the site walkover and from the ground investigation ranged from 0 to 8.0m with an average peat depth of 2.0m. 39% of the probes recorded peat depths of less than 1.0m, 13% of the peat probes recorded peat depths between 1.0m to 2.0m and 22% of peat probes recorded 2.0m to 3.0m of peat. A number of localised readings recorded peat depths from 3.5 to 8.0m.

Slope inclinations at the main infrastructure locations range from 0 to 2 degrees.

An analysis of peat sliding was carried out at the main infrastructure locations across the Proposed Development 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. For the undrained condition, the calculated FoS for load conditions (1) and (2) for the locations analysed, showed that all locations have an acceptable FoS of greater than 1.3, indicating a low risk of peat failure. The undrained analysis would be considered the most critical condition for the peat slopes.

A drained analysis was also carried out, which examined 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, showed that all infrastructure locations have an acceptable FoS of greater than 1.3.

The peat stability risk assessment at each infrastructure location identified a number of mitigation/control measures to reduce the potential risk of peat failure. 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 A for details of the required mitigation/control measures for each infrastructure element.

In summary, the findings of the peat assessment showed that the proposed Shancloon 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.

11.2 Recommendations

The following 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 A).

Recommendations and guidelines given in the 'Peat & Spoil Management Plan' for Shancloon Wind Farm, included as Appendix 11.4 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 the Construction Method Statements (CMSs) for the project will take into account, 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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FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX A

Peat Stability Risk Registers

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

Location:	Turbine T1

Grid Reference (Eastings, Northings):	**532133**	**754079**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**6.5 - 8.0**	
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 = 2.55 (u), 14.63 (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	4	1	4	Negligible	No		4	1	4	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively Deep Peat	5	1	5	Low	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T1**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.
vii	Movement monitoring posts to be installed upslope of the turbine/harsdtand excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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.

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

Location:	Turbine T2

Grid Reference (Eastings, Northings):	**531396**	**754501**
Distance to Watercourse (m)	**100 - 150**	
Min & Max Measured Peat Depth (m):	**0 - 0.4**	Potentially no peat - peat only recoded at 1 probe
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 = 3.89 (u), 21.55 (d)	1	2	2	Negligible	No	See Below	1	2	2	Negligible
2	Evidence of sub peat water flow	2	2	4	Negligible	No		2	2	4	Negligible
3	Evidence of surface water flow	2	2	4	Negligible	No		2	2	4	Negligible
4	Evidence of previous failures/slips	1	2	2	Negligible	No		1	2	2	Negligible
5	Type of vegetation	1	2	2	Negligible	No		1	2	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	2	2	Negligible	No		1	2	2	Negligible
7	Evidence of very soft/soft clay at base of peat	1	2	2	Negligible	No		1	2	2	Negligible
8	Evidence of mechanically cut peat	1	2	2	Negligible	No		1	2	2	Negligible
9	Evidence of quaking or buoyant peat	1	2	2	Negligible	No		1	2	2	Negligible
10	Evidence of bog pools	1	2	2	Negligible	No		1	2	2	Negligible
11	Other	1	2	2	Negligible	No		1	2	2	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T2**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T3

Grid Reference (Eastings, Northings):	**531596**	**753976**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**NO PEAT**	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T3**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T4

Grid Reference (Eastings, Northings):	531886	753395
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	NO PEAT	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T4**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T5

Grid Reference (Eastings, Northings):	**533286**	**754179**
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**0.70 - 5.5**	
Control Required:	**Yes**	

		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 = 6.55 (u), 16.63 (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	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	1	3	3	Negligible	No		1	3	3	Negligible
5	Type of vegetation	1	3	3	Negligible	No		1	3	3	Negligible
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	4	3	12	Medium	No		2	3	6	Low
8	Evidence of mechanically cut peat	1	3	3	Negligible	No		1	3	3	Negligible
9	Evidence of quaking or buoyant peat	1	3	3	Negligible	No		1	3	3	Negligible
10	Evidence of bog pools	1	3	3	Negligible	No		1	3	3	Negligible
11	Relatively Deep Peat	4	3	12	Medium	No		2	3	6	Low

	Control Measures to be Implemented Prior to/and During Construction for **T5**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.
vii	Movement monitoring posts to be installed upslope of the turbine/harsdtand excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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.

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

Location:	Turbine T6

Grid Reference (Eastings, Northings):	533953	754649
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	NO PEAT	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T6**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T7

Grid Reference (Eastings, Northings):	534433	754560
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	3.50 - 6.30	
Control Required:	Yes	

		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 = 3.14 (u), 14.92(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	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	4	1	4	Negligible	No		1	1	1	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	4	1	4	Negligible	No		3	1	3	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively deep peat	5	1	5	Low	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T7**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.
vii	Movement monitoring posts to be installed upslope of the turbine/harsdtand excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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.

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

Location:	Turbine T8

Grid Reference (Eastings, Northings):	533733	755199
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	NO PEAT	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T8**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T9

Grid Reference (Eastings, Northings):	533408	755568
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	NO PEAT	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T9**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of turbine base subformation by a competent person where a gravity type foundation base is constructed

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.

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

Location:	Turbine T10

Grid Reference (Eastings, Northings):	533136	755861
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	2.0 - 3.1	
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 = 6.04 (u), 16.54 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	Negligible	No		2	1	2	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	3	1	3	Negligible	No		3	1	3	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively Deep Peat	4	1	4	Negligible	No		4	1	4	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T10**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	Turbine T11

Grid Reference (Eastings, Northings):	534947	755115
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	2.2 - 5.5	
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 = 3.89 (u), 10.24 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	Negligible	No		2	1	2	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		2	1	2	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	3	1	3	Negligible	No		3	1	3	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively Deep Peat	5	1	5	Low	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T11**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	Met Mast

Grid Reference (Eastings, Northings):	**531555**	**753596**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**No peat**	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Other	1	1	1	Negligible	No		1	1	1	Negligible

	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 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	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	Const. Comp. (West)

Grid Reference (Eastings, Northings):	531869	753881
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	No peat	
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 = - (u), - (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	3	1	3	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	2	1	2	Negligible	No		2	1	2	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively Deep Peat	1	1	1	Negligible	No		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (West)**
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.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	Const. Comp. (East)

Grid Reference (Eastings, Northings):	538249	755792
Distance to Watercourse (m)	> 150	
Min & Max Measured Peat Depth (m):	0-2.7	
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 = - (u), -(d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	2	1	2	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	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	3	1	3	Negligible	No		3	1	3	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	2	1	2	Negligible	No		2	1	2	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively deep peat	3	1	3	Negligible	No		3	1	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (East)**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (e.g. boulders, sheet piles) or excavation face battered to a shallow angle - temporary works designer may be required to provide excavation support design -daily detailed inspection of excavation faces -potential for greater water inflow into excavation requiring removal of water using pumping -increased exclusion zone around excavation to avoid 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;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
vi	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	Substation

Grid Reference (Eastings, Northings):	**529932**	**752825**
Distance to Watercourse (m)	**< 50**	
Min & Max Measured Peat Depth (m):	**1.3 to 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 = - (u), - (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	1	4	4	Negligible	No		1	4	4	Negligible
4	Evidence of previous failures/slips	1	4	4	Negligible	No		1	4	4	Negligible
5	Type of vegetation	1	4	4	Negligible	No		1	4	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Negligible	No		1	4	4	Negligible
7	Evidence of very soft/soft clay at base of peat	4	4	16	Medium	No		4	4	16	Medium
8	Evidence of mechanically cut peat	1	4	4	Negligible	No		1	4	4	Negligible
9	Evidence of quaking or buoyant peat	1	4	4	Negligible	No		1	4	4	Negligible
10	Evidence of bog pools	1	4	4	Negligible	No		1	4	4	Negligible
11	Relatively deep peat	1	4	4	Negligible	No		1	4	4	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Construction Compound (3)**
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.
v	Inspection & approval of turbine base sub-formation by a competent person where a gravity type foundation base is constructed.

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.

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

Location:	T1 to T2

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.0 - 3.5**
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 = 5.1 (u), 15.90 (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	1	1	1	Negligible	No		1	1	1	Negligible
5	Type of vegetation	3	1	3	Negligible	No		3	1	3	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	1	1	1	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		1	1	1	Negligible
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	1	1	1	Negligible	No		1	1	1	Negligible
11	Relatively Deep Peat	4	1	4	Negligible	No		4	1	4	Negligible

	Control Measures to be Implemented Prior to/and During Construction for T1 to T2
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of subformation by a competent person where a gravity type foundation base is constructed
vii	Movement monitoring posts to be installed upslope of the road excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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 in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	T1 to T4

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**50 - 100**
Min & Max Measured Peat Depth (m):	**NO PEAT**
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 = - (u), - (d)	1	3	3	Negligible	No		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	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	1	3	3	Negligible	No		1	3	3	Negligible
5	Type of vegetation	1	3	3	Negligible	No		1	3	3	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	3	3	Negligible	No	See Below	1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	1	3	3	Negligible	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	1	3	3	Negligible	No		1	3	3	Negligible
9	Evidence of quaking or buoyant peat	1	3	3	Negligible	No		1	3	3	Negligible
10	Evidence of bog pools	1	3	3	Negligible	No		1	3	3	Negligible
11	Other	1	3	3	Negligible	No		1	3	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T1 to T4**
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 D in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	T1/T4 Junction to Togher River Crossing

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**No Peat**
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 = (u), (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	1	4	4	Negligible	No		1	4	4	Negligible
4	Evidence of previous failures/slips	1	4	4	Negligible	No		1	4	4	Negligible
5	Type of vegetation	1	4	4	Negligible	No		1	4	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Negligible	No		1	4	4	Negligible
7	Evidence of very soft/soft clay at base of peat	1	4	4	Negligible	No		1	4	4	Negligible
8	Evidence of mechanically cut peat	1	4	4	Negligible	No		1	4	4	Negligible
9	Evidence of quaking or buoyant peat	1	4	4	Negligible	No		1	4	4	Negligible
10	Evidence of bog pools	1	4	4	Negligible	No		1	4	4	Negligible
11	Other	1	4	4	Negligible	No		1	4	4	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T1/T4 Junction to Togher River Crossing**
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 D in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	**Peat area around T5**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**50 - 100**
Min & Max Measured Peat Depth (m):	**1.0 - 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 = 8.82 (u), 17.76 (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	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	1	3	3	Negligible	No		1	3	3	Negligible
5	Type of vegetation	3	3	9	Low	No		3	3	9	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	1	3	3	Negligible	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	1	3	3	Negligible	No		1	3	3	Negligible
9	Evidence of quaking or buoyant peat	1	3	3	Negligible	No		1	3	3	Negligible
10	Evidence of bog pools	1	3	3	Negligible	No		1	3	3	Negligible
11	Other	1	3	3	Negligible	No		1	3	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Access roads near T5**
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 D in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	**Togher River to T8 & T9**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.3 - 0.9**
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 = 12.07 (u), 19.39 (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		0	1	0	Not Applicable
5	Type of vegetation	1	1	1	Negligible	No		1	1	1	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	1	1	1	Negligible	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		0	1	0	Not Applicable
10	Evidence of bog pools	1	1	1	Negligible	No		0	1	0	Not Applicable
11	Other		1	0	Not Applicable	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **Togher River to T8 & T9**
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 D in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	**T9 to T10**

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**50 - 100**
Min & Max Measured Peat Depth (m):	**0.3 - 2.6**
Control Required:	**Yes**

		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 = 6.37 (u), 16.52 (d)	1	3	3	Negligible	No	See Below	1	3	3	Negligible
2	Evidence of sub peat water flow	2	3	6	Low	No		2	3	6	Low
3	Evidence of surface water flow	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	1	3	3	Negligible	No		1	3	3	Negligible
5	Type of vegetation	3	3	9	Low	No		3	3	9	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	4	3	12	Medium	No		4	3	12	Medium
8	Evidence of mechanically cut peat	1	3	3	Negligible	No		1	3	3	Negligible
9	Evidence of quaking or buoyant peat	1	3	3	Negligible	No		1	3	3	Negligible
10	Evidence of bog pools	1	3	3	Negligible	No		1	3	3	Negligible
11	Relatively Deep Peat	1	3	3	Negligible	No		1	3	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **T9 to T10**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of subformation by a competent person where a gravity type foundation base is constructed
vii	Movement monitoring posts to be installed upslope of the road excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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 in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	T7 to T6 to T8

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.0 - 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 = 15.29 (u), 21.0 (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		1	1	1	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	1	1	1	Negligible	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		0	1	0	Not Applicable
10	Evidence of bog pools	1	1	1	Negligible	No		0	1	0	Not Applicable
11	Other	1	1	1	Negligible	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **T7 to T6 to T8**
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 D in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	T6/T8 Junction Raised Bog

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**> 150**
Min & Max Measured Peat Depth (m):	**0.5 - 8.0**
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 = 2.55 (u), 14.63 (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	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	1	1	1	Negligible	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		1	1	1	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	1	1	1	Negligible	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	1	1	1	Negligible	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	1	1	1	Negligible	No		0	1	0	Not Applicable
10	Evidence of bog pools	1	1	1	Negligible	No		0	1	0	Not Applicable
11	Relatively Deep Peat	1	1	1	Negligible	No		0	1	0	Not Applicable

	Control Measures to be Implemented Prior to/and During Construction for **T6/T8 Junction Raised Bog**
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of subformation by a competent person where a gravity type foundation base is constructed
vii	Movement monitoring posts to be installed upslope of the road excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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 in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

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

Location:	East Entrance to T12

Grid Reference (Eastings, Northings):	**Varies**
Distance to Watercourse (m)	**< 50**
Min & Max Measured Peat Depth (m):	**1.0 - 3.0**
Control Required:	**Yes**

		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 = 4.88 (u), 15.79 (d)	1	4	4	Negligible	No	See Below	1	4	4	Negligible
2	Evidence of sub peat water flow	2	4	8	Low	No		2	4	8	Low
3	Evidence of surface water flow	2	4	8	Low	No		2	4	8	Low
4	Evidence of previous failures/slips	1	4	4	Negligible	No		1	4	4	Negligible
5	Type of vegetation	3	4	12	Medium	No		3	4	12	Medium
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Negligible	No		1	4	4	Negligible
7	Evidence of very soft/soft clay at base of peat	1	4	4	Negligible	No		1	4	4	Negligible
8	Evidence of mechanically cut peat	1	4	4	Negligible	No		1	4	4	Negligible
9	Evidence of quaking or buoyant peat	1	4	4	Negligible	No		1	4	4	Negligible
10	Evidence of bog pools	1	4	4	Negligible	No		1	4	4	Negligible
11	Relatively Deep Peat	1	4	4	Negligible	No		1	4	4	Negligible

	Control Measures to be Implemented Prior to/and During Construction for East Entrance to T2
i	Maintain hydrology of area as far as possible;
ii	Installation of appropriate drainage measures to alleviate ingress of surface water into excavations
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties
vi	Inspection and approval of subformation by a competent person where a gravity type foundation base is constructed
vii	Movement monitoring posts to be installed upslope of the road excavation and monitored on a regular basis
viii	No sidecasting of excavated peat or spoil on in-situ peat
ix	No machinery to track directly on the peat surface

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 in PSA.
(3) Impact based on distance of infrastructure element to nearest watercourse.

Turbine	Distance to stream (m)	
T1	250	closest part of hardstand to Togher River
T2	130	closest part of hardstand to Black River
T3	595	closest part of hardstand to Black River
T4	244	closest part of hardstand to Togher River
T5	75	closest part of hardstand to Togher River
T6	614	closest part of hardstand to Togher River
T7	850	closest part of hardstand to Togher River
T8	890	closest part of hardstand to Togher River
T9	1125	closest part of hardstand to Togher River
T10	1200	closest part of hardstand to Black River
T11	1515	closest part of hardstand to Togher River
MM	600	Closest corner to Togher River
TC1 (W)	375	Closest corner to Togher River
TC2 E	2335	Closest corner to Togher River
SS1	<50	Closest corner to Togher River

FEHILY TIMONEY

DESIGNING AND DELIVERING A SUSTAINABLE FUTURE

APPENDIX B

Calculated FOS for Peat Slopes on Site

Infinite Slope Analysis

Assumptions as follows:

(1) Undrained analysis assumed to give worst case, using infinite slope:

Infinite slope analysis (undrained)

$FoS = Cu/[\gamma.z.\sin \beta \cos \beta]$

where,
β = slope angle
Cu = undrained strength
z = depth of sliding layer
γ = bulk unit weight

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

Turbine No./Waypoint	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
PP001	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP002	2	4	10.0	10.0	3.5	25	1.0	4.5	16.63	15.90
PP003	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP004	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP005	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP006	2	4	10.0	10.0	1.6	25	1.0	2.6	20.52	17.76
PP007	2	4	10.0	10.0	0.7	25	1.0	1.7	29.74	20.10
PP008	2	4	10.0	10.0	2.5	25	1.0	3.5	17.94	16.63
PP009	2	4	10.0	10.0	0.9	25	1.0	1.9	26.10	19.39
PP011	2	4	10.0	10.0	0.9	25	1.0	1.9	26.10	19.39
PP012	2	4	10.0	10.0	0.3	25	1.0	1.3	51.58	22.18
PP013	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP014	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP015	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP016	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP017	2	4	10.0	10.0	0.5	25	1.0	1.5	36.29	21.00
PP018	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP019	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP020	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP021	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP022	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP023	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP024	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP025	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
PP026	2	4	10.0	10.0	6	25	1.0	7.0	15.26	14.99
PP027	2	4	10.0	10.0	4	25	1.0	5.0	16.22	15.65
PP028	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP029	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP030	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP031	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP032	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP033	2	4	10.0	10.0	3.6	25	1.0	4.6	16.54	15.85
PP034	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
PP035	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP036	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP037	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP038	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP039	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP040	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP041	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP042	2	4	10.0	10.0	0.3	25	1.0	1.3	51.58	22.18
PP043	2	4	10.0	10.0	0.9	25	1.0	1.9	26.10	19.39
PP044	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP045	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP046	2	4	10.0	10.0	1.3	25	1.0	2.3	22.18	18.34
PP047	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP048	2	4	10.0	10.0	3.5	25	1.0	4.5	16.63	15.90
PP055	2	4	10.0	10.0	2.7	25	1.0	3.7	17.60	16.45
PP056	2	4	10.0	10.0	2.9	25	1.0	3.9	17.31	16.29
PP057	2	4	10.0	10.0	3	25	1.0	4.0	17.18	16.22
PP058	2	4	10.0	10.0	2.2	25	1.0	3.2	18.57	16.94
PP059	2	4	10.0	10.0	2.5	25	1.0	3.5	17.94	16.63
PP060	2	4	10.0	10.0	3	25	1.0	4.0	17.18	16.22
PP061	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP062	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP063	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP064	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP065	2	4	10.0	10.0	2.6	25	1.0	3.6	17.76	16.54
PP066	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP067	2	4	10.0	10.0	3	25	1.0	4.0	17.18	16.22
PP068	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP069	2	4	10.0	10.0	2.6	25	1.0	3.6	17.76	16.54
PP070	2	4	10.0	10.0	2	25	1.0	3.0	19.09	17.18
PP071	2	4	10.0	10.0	3.7	25	1.0	4.7	16.45	15.79
PP072	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP073	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP074	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP075	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP077	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP082	2	4	10.0	10.0	2.7	25	1.0	3.7	17.60	16.45
PP083	2	4	10.0	10.0	2.5	25	1.0	3.5	17.94	16.63
PP084	2	4	10.0	10.0	2.7	25	1.0	3.7	17.60	16.45
PP085	2	4	10.0	10.0	2.6	25	1.0	3.6	17.76	16.54
PP086	2	4	10.0	10.0	2.7	25	1.0	3.7	17.60	16.45
PP087	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
PP088	2	4	10.0	10.0	1	25	1.0	2.0	24.82	19.09
PP089	2	4	10.0	10.0	3	25	1.0	4.0	17.18	16.22
PP090	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP091	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
PP092	2	4	10.0	10.0	3.5	25	1.0	4.5	16.63	15.90
T01-W	2	4	10.0	10.0	6.5	25	1.0	7.5	15.12	14.88
T01-C	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
T01-N	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
T01-S	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
T01-E	2	4	10.0	10.0	8	25	1.0	9.0	14.79	14.63
T02-N	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T02-S	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T02-E	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T02-W	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T02-C	2	4	10.0	10.0	0.4	25	1.0	1.4	42.02	21.55
T05-C	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
T05-S	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
T05-E	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
T05-W	2	4	10.0	10.0	1.5	25	1.0	2.5	21.00	17.94
T05-N	2	4	10.0	10.0	1.7	25	1.0	2.7	20.10	17.60
T07-S	2	4	10.0	10.0	6	25	1.0	7.0	15.26	14.99
T07-W	2	4	10.0	10.0	6	25	1.0	7.0	15.26	14.99
T07-E	2	4	10.0	10.0	6.1	25	1.0	7.1	15.23	14.97

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

Turbine No./Waypoint	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
T07-C	2	4	10.0	10.0	6.3	25	1.0	7.3	**15.17**	**14.92**
T07-N	2	4	10.0	10.0	6.3	25	1.0	7.3	**15.17**	**14.92**
T09-C	3	NO PEAT ENCOUNTERED AT THIS LOCATION								
T09-N	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T09-S	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T09-E	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T09-W	2	NO PEAT ENCOUNTERED AT THIS LOCATION								
T10-E	2	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**
T10-C	2	4	10.0	10.0	2.6	25	1.0	3.6	**17.76**	**16.54**
T10-W	2	4	10.0	10.0	2.6	25	1.0	3.6	**17.76**	**16.54**
T10-N	2	4	10.0	10.0	2.7	25	1.0	3.7	**17.60**	**16.45**
T10-S	2	4	10.0	10.0	2.8	25	1.0	3.8	**17.45**	**16.37**
T11-N	2	4	10.0	10.0	4.5	25	1.0	5.5	**15.90**	**15.44**
T11-C	3	4	10.0	10.0	4.7	25	1.0	5.7	**10.53**	**10.24**
T11-S	2	4	10.0	10.0	4.9	25	1.0	5.9	**15.69**	**15.30**
T11-E	2	4	10.0	10.0	4.9	25	1.0	5.9	**15.69**	**15.30**
T11-W	2	4	10.0	10.0	4.9	25	1.0	5.9	**15.69**	**15.30**

Minimum =	**10.53**	**10.24**
Maximum =	**51.58**	**22.18**
Average =	**19.80**	**16.79**

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.

(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 Shancloon 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)
PP001	531552	754326	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP002	532028	753989	2	8	10	3.5	4.5	6.55	5.10
PP003	532128	753816	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP004	532210	753652	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP005	532390	753643	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP006	533004	754045	2	8	10	1.6	2.6	14.34	8.82
PP007	533081	754114	2	8	10	0.7	1.7	32.77	13.49
PP008	533188	754094	2	8	10	2.5	3.5	9.17	6.55
PP009	533389	754237	2	8	10	0.9	1.9	25.49	12.07
PP011	533622	754888	2	8	10	0.9	1.9	25.49	12.07
PP012	533591	754988	2	8	10	0.3	1.3	76.46	17.64
PP013	533820	755212	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP014	533870	755126	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP015	533903	755031	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP016	533948	754938	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP017	534010	754858	2	8	10	0.5	1.5	45.87	15.29
PP018	533657	754789	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP019	532910	753881	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP020	531948	753951	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP021	534099	754801	2	8	10	2	3.0	11.47	7.65
PP022	534162	754718	2	8	10	2	3.0	11.47	7.65
PP023	534186	754671	2	8	10	1	2.0	22.94	11.47
PP024	534228	754574	2	8	10	1	2.0	22.94	11.47
PP025	534297	754537	2	8	10	1.5	2.5	15.29	9.17
PP026	534368	754548	2	8	10	6	7.0	3.82	3.28
PP027	534475	754530	2	8	10	4	5.0	5.73	4.59
PP028	534492	754434	2	8	10	2	3.0	11.47	7.65
PP029	534565	754494	2	8	10	8	9.0	2.87	2.55
PP030	534655	754510	2	8	10	8	9.0	2.87	2.55
PP031	534758	754519	2	8	10	8	9.0	2.87	2.55
PP032	534849	754554	2	8	10	8	9.0	2.87	2.55
PP033	534949	754580	2	8	10	3.6	4.6	6.37	4.99
PP034	532951	753975	2	8	10	1.5	2.5	15.29	9.17
PP035	532149	753725	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP036	532303	753638	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP037	532066	753899	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP038	533793	755315	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP039	533739	755406	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP040	533645	755469	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP041	533556	755515	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP042	533336	755682	2	8	10	0.3	1.3	76.46	17.64
PP043	533318	755769	2	8	10	0.9	1.9	25.49	12.07
PP044	533240	755774	2	8	10	2	3.0	11.47	7.65
PP045	533113	755978	2	8	10	2	3.0	11.47	7.65
PP046	533133	756070	2	8	10	1.3	2.3	17.64	9.97
PP047	533235	756081	2	8	10	1	2.0	22.94	11.47
PP048	533335	756061	2	8	10	3.5	4.5	6.55	5.10
PP055	535359	755236	2	8	10	2.7	3.7	8.50	6.20
PP056	535282	755167	2	8	10	2.9	3.9	7.91	5.88
PP057	535214	755100	2	8	10	3	4.0	7.65	5.73
PP058	534813	755093	2	8	10	2.2	3.2	10.43	7.17
PP059	535037	755084	2	8	10	2.5	3.5	9.17	6.55
PP060	535138	755070	2	8	10	3	4.0	7.65	5.73
PP061	535185	754995	2	8	10	1	2.0	22.94	11.47
PP062	535142	754901	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP063	535097	754809	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP064	535050	754717	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP065	535011	754623	2	8	10	2.6	3.6	8.82	6.37
PP066	532209	753597	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP067	534886	755103	2	8	10	3	4.0	7.65	5.73
PP068	533374	755615	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP069	533185	755816	2	8	10	2.6	3.6	8.82	6.37
PP070	533249	754125	2	8	10	2	3.0	11.47	7.65
PP071	532085	754034	2	8	10	3.7	4.7	6.20	4.88
PP072	531491	754404	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP073	531440	754459	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP074	531582	754230	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP075	533012.82	754142.884	2	8	10	1	2.0	22.94	11.47
PP077	533051.11	754237.528	2	8	10	1	2.0	22.94	11.47
PP082	534721.33	755084.946	2	8	10	2.7	3.7	8.50	6.20
PP083	534698.35	755159.348	2	8	10	2.5	3.5	9.17	6.55
PP084	534674.28	755238.673	2	8	10	2.7	3.7	8.50	6.20
PP085	534611.37	755290.098	2	8	10	2.6	3.6	8.82	6.37
PP086	534521.65	755251.256	2	8	10	2.7	3.7	8.50	6.20
PP087	534441.23	755215.696	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
PP088	534405.67	755135.823	2	8	10	1	2.0	22.94	11.47
PP089	534364.64	755053.215	2	8	10	3	4.0	7.65	5.73
PP090	534272.18	755003.979	2	8	10	8	9.0	2.87	2.55
PP091	534180.27	754955.836	2	8	10	8	9.0	2.87	2.55
PP092	534097.12	754913.711	2	8	10	3.5	4.5	6.55	5.10
T01-W	532133	754079	2	8	10	6.5	7.5	3.53	3.06
T01-C	532133	754079	2	8	10	8	9.0	2.87	2.55
T01-N	532133	754079	2	8	10	8	9.0	2.87	2.55
T01-S	532133	754079	2	8	10	8	9.0	2.87	2.55
T01-E	532133	754079	2	8	10	8	9.0	2.87	2.55
T02-N	531396	754500	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T02-S	531396	754500	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T02-E	531396	754500	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T02-W	531396	754500	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T02-C	531396	754500	2	8	10	0.4	1.4	57.34	16.38
T05-C	533307	754159	2	8	10	1.5	2.5	15.29	9.17
T05-S	533307	754159	2	8	10	1.5	2.5	15.29	9.17
T05-E	533307	754159	2	8	10	1.5	2.5	15.29	9.17
T05-W	533307	754159	2	8	10	1.5	2.5	15.29	9.17
T05-N	533307	754159	2	8	10	1.7	2.7	13.49	8.50
T07-S	534433	754560	2	8	10	6	7.0	3.82	3.28
T07-W	534433	754560	2	8	10	6	7.0	3.82	3.28
T07-E	534433	754560	2	8	10	6.1	7.1	3.76	3.23
T07-C	534433	754560	2	8	10	6.3	7.3	3.64	3.14
T07-N	534433	754560	2	8	10	6.3	7.3	3.64	3.14
T09-C	533408	755568	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T09-N	533408	755568	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T09-S	533408	755568	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T09-E	533408	755568	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T09-W	533408	755568	2	NO PEAT ENCOUNTERED AT THIS LOCATION					
T10-E	533136	755861	2	8	10	2.5	3.5	9.17	6.55
T10-C	533136	755861	2	8	10	2.6	3.6	8.82	6.37
T10-W	533136	755861	2	8	10	2.6	3.6	8.82	6.37
T10-N	533136	755861	2	8	10	2.7	3.7	8.50	6.20
T10-S	533136	755861	2	8	10	2.8	3.8	8.19	6.04
T11-N	534947	755115	2	8	10	4.5	5.5	5.10	4.17
T11-C	534947	755115	2	8	10	4.7	5.7	4.88	4.02
T11-S	534947	755115	2	8	10	4.9	5.9	4.68	3.89
T11-E	534947	755115	2	8	10	4.9	5.9	4.68	3.89
T11-W	534947	755115	2	8	10	4.9	5.9	4.68	3.89
							Minimum =	**2.87**	**2.55**
							Maximum =	**76.46**	**17.64**
							Average =	**13.03**	**7.01**

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 6kPa was selected for the assessment. It should be noted that a cu of 6kPa 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.

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

(6) For load conditions see report text.

ID	Easting	Northing	Peat Depth	Slope	FoS - Undrained	FoS - Drained
PP001	531552	754326	0	2	0.00	0.00
PP002	532028	753989	3.5	2	5.10	15.90
PP003	532128	753816	0	2	0.00	0.00
PP004	532210	753652	0	2	0.00	0.00
PP005	532390	753643	0	2	0.00	0.00
PP006	533004	754045	1.6	2	8.82	17.76
PP007	533081	754114	0.7	2	13.49	20.10
PP008	533188	754094	2.5	2	6.55	16.63
PP009	533389	754237	0.9	2	12.07	19.39
PP011	533622	754888	0.9	2	12.07	19.39
PP012	533591	754988	0.3	2	17.64	22.18
PP013	533820	755212	0	2	0.00	0.00
PP014	533870	755126	0	2	0.00	0.00
PP015	533903	755031	0	2	0.00	0.00
PP016	533948	754938	0	2	0.00	0.00
PP017	534010	754858	0.5	2	15.29	21.00
PP018	533657	754789	0	2	0.00	0.00
PP019	532910	753881	0	2	0.00	0.00
PP020	531948	753951	0	2	0.00	0.00
PP021	534099	754801	2	2	7.65	17.18
PP022	534162	754718	2	2	7.65	17.18
PP023	534186	754671	1	2	11.47	19.09
PP024	534228	754574	1	2	11.47	19.09
PP025	534297	754537	1.5	2	9.17	17.94
PP026	534368	754548	6	2	3.28	14.99
PP027	534475	754530	4	2	4.59	15.65
PP028	534492	754434	2	2	7.65	17.18
PP029	534565	754494	8	2	2.55	14.63
PP030	534655	754510	8	2	2.55	14.63
PP031	534758	754519	8	2	2.55	14.63
PP032	534849	754554	8	2	2.55	14.63
PP033	534949	754580	3.6	2	4.99	15.85
PP034	532951	753975	1.5	2	9.17	17.94
PP035	532149	753725	0	2	0.00	0.00
PP036	532303	753638	0	2	0.00	0.00
PP037	532066	753899	0	2	0.00	0.00
PP038	533793	755315	0	2	0.00	0.00
PP039	533739	755406	0	2	0.00	0.00
PP040	533645	755469	0	2	0.00	0.00
PP041	533556	755515	0	2	0.00	0.00
PP042	533336	755682	0.3	2	17.64	22.18
PP043	533318	755769	0.9	2	12.07	19.39
PP044	533240	755774	2	2	7.65	17.18
PP045	533113	755978	2	2	7.65	17.18
PP046	533133	756070	1.3	2	9.97	18.34
PP047	533235	756081	1	2	11.47	19.09
PP048	533335	756061	3.5	2	5.10	15.90
PP055	535359	755236	2.7	2	6.20	16.45
PP056	535282	755167	2.9	2	5.88	16.29
PP057	535214	755100	3	2	5.73	16.22
PP058	534813	755093	2.2	2	7.17	16.94
PP059	535037	755084	2.5	2	6.55	16.63
PP060	535138	755070	3	2	5.73	16.22
PP061	535185	754995	1	2	11.47	19.09
PP062	535142	754901	0	2	0.00	0.00
PP063	535097	754809	0	2	0.00	0.00
PP064	535050	754717	0	2	0.00	0.00
PP065	535011	754623	2.6	2	6.37	16.54
PP066	532209	753597	0	2	0.00	0.00
PP067	534886	755103	3	2	5.73	16.22
PP068	533374	755615	0	2	0.00	0.00
PP069	533185	755816	2.6	2	6.37	16.54
PP070	533249	754125	2	2	7.65	17.18
PP071	532085	754034	3.7	2	4.88	15.79
PP072	531491	754404	0	2	0.00	0.00
PP073	531440	754459	0	2	0.00	0.00
PP074	531582	754230	0	2	0.00	0.00
PP075	533012.8	754142.9	1	2	11.47	19.09
PP077	533051.1	754237.5	1	2	11.47	19.09
PP082	534721.3	755084.9	2.7	2	6.20	16.45
PP083	534698.4	755159.3	2.5	2	6.55	16.63
PP084	534674.3	755238.7	2.7	2	6.20	16.45
PP085	534611.4	755290.1	2.6	2	6.37	16.54
PP086	534521.6	755251.3	2.7	2	6.20	16.45
PP087	534441.2	755215.7	0	2	0.00	0.00
PP088	534405.7	755135.8	1	2	11.47	19.09
PP089	534364.6	755053.2	3	2	5.73	16.22
PP089	534364.6	755053.2	8	2	2.55	14.63
PP090	534272.2	755004	8	2	2.55	14.63
PP091	534180.3	754955.8	8	2	5.10	15.90
PP092	534097.1	754913.7	3.5	2	3.06	14.88
T01-W	532133	754079	6.5	2	2.55	14.63
T01-C	532133	754079	8	2	2.55	14.63
T01-N	532133	754079	8	2	2.55	14.63
T01-S	532133	754079	8	2	2.55	14.63
T01-E	532133	754079	8	2	0.00	0.00
T02-N	531396	754500	0	2	0.00	0.00
T02-S	531396	754500	0	2	0.00	0.00
T02-E	531396	754500	0	2	0.00	0.00
T02-W	531396	754500	0	2	16.38	21.55
T02-C	531396	754500	0.4	2	9.17	17.94
T05-C	533307	754159	1.5	2	9.17	17.94
T05-S	533307	754159	1.5	2	9.17	17.94
T05-E	533307	754159	1.5	2	9.17	17.94
T05-W	533307	754159	1.5	2	8.50	17.60
T05-N	533307	754159	1.7	2	3.28	14.99
T07-S	534433	754560	6	2	3.28	14.99
T07-W	534433	754560	6	2	3.23	14.97
T07-E	534433	754560	6.1	2	3.14	14.92
T07-C	534433	754560	6.3	2	3.14	14.92
T07-N	534433	754560	6.3	2	0.00	0.00
T09-C	533408	755568	0	2	0.00	0.00
T09-N	533408	755568	0	2	0.00	0.00
T09-S	533408	755568	0	2	0.00	0.00
T09-E	533408	755568	0	2	0.00	0.00
T09-W	533408	755568	0	2	6.55	16.63
T10-E	533136	755861	2.5	2	6.37	16.54
T10-C	533136	755861	2.6	2	6.37	16.54
T10-W	533136	755861	2.6	2	6.20	16.45
T10-N	533136	755861	2.7	2	6.04	16.37
T10-S	533136	755861	2.8	2	4.17	15.44
T11-N	534947	755115	4.5	2	4.02	10.24
T11-C	534947	755115	4.7	2	3.89	15.30
T11-S	534947	755115	4.9	2	3.89	15.30
T11-E	534947	755115	4.9	2	3.89	15.30
T11-W	534947	755115	4.9	2	0.00	0.00

Minimum factor of safety is >1.3

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APPENDIX C

Methodology for Peat Stability Risk Assessment

Methodology for Peat Stability Risk Assessment

A peat stability risk assessment was carried out for each of the main 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	
	Dry	

Qualitative Factor	Type of Feature/Indicator for each Qualitative Factor [1]	Explanation/Description of Qualitative Factor
Evidence of surface water flow	Localised/Flowing in drains	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.
	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 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. Note that not all watercourses are shown on maps.

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

		Probability				
		1	**2**	**3**	**4**	**5**
Impact	**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 A.

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

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APPENDIX D

Ground Investigation Reports

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)	Comment
T1	452	3.00	1,356		0.00	0		Assumes min. excavation depth of 3m. Piled foundation
T2	452	0.40	181		2.60	1,176		Assumes min. excavation depth of 3m. Piled foundation
T3	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T4	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T5	452	1.70	769		1.30	588		Assumes min. excavation depth of 3m.Piled foundation
T6	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m. Piled foundation
T7	452	3.00	1,356		0.00	0		Assumes min. excavation depth of 3m. Piled foundation
T8	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m. Piled foundation
T9	452	0.00	0		3.00	1,356		Assumes min. excavation depth of 3m.Piled foundation
T10	452	2.80	1,266		0.50	226		Assumes min. excavation depth of 3m.Piled foundation
T11	452	3.00	1,356		0.50	226		Assumes min. excavation depth of 3m. Piled foundation
Hardstand at T1	4,480	5.07	27,238		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T2	4,480	0.10	448		0.90	4,032		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T3	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T4	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T5	4,480	1.70	7,616		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T6	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T7	4,480	4.60	24,730		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T8	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T9	4,480	0.00	0		1.00	4,480		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T10	4,480	2.80	12,544		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T11	4,480	3.30	14,784		0.00	0		Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Turbine Sub-total			**93,645**	107,692		**35,430**	38,973	
Temp Construction Compound 2 (West)	3,600	0.00	0		0.00	0	0	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater. Assume Floated construction
Temp Construction Compound 1 (East)	12,400	0.00	0		0.00	0	0	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater Assume Floated construction
Met mast 1	900	0.00	0		1.00	900	990	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Substation (Cut)	6832	0	0		0.00	4,321	4,753	Assumed no overdig required. Cut volume of 4321m^3 provided by Client.
Substation (Fill)	7893	0	0		0.50	3,947	4,341	min. 500mm topsoil to be removed before fill is placed
Dolines	1,257	0	0		3.00	3,770	4,147	20m diameter average and 3m to be excavated. Assumes 4 no. dolines
All access roads	-	-	2,124	2,443		17,933	19,726	See seperate tab for breakdown of volumes.
Total Excavated Peat Volume =			**95,769**	**110,134**		**66,300**	**72,930**	

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
West Storage Area (A)	4,650	2.50	11,625	11,625	0
West Storage Area (B)	11,150	2.50	27,875	27,875	
West Storage Area (C)	15,050	2.50	37,625	37,625	
West Storage Area (D)	6,700	2.50	16,750	16,750	
West Storage Area (E)	7,400	1.00	7,400	0	7,400
West Storage Area (F)	2,750	2.50	6,875	4,125	2,750
West Storage Area (G)	3,700	2.50	9,250	0	9,250
East Storage Area	20,000	2.50	50,000	0	50,000
T11 Storage Area	3,150	1.00	3,150	3,150	
Landscaping	-	-	22,000	11,275	10,725
Available Peat & Spoil Storage on Site (m^3)			192,550		
Required Peat & Spoil Storage on Site (m^3)			183,064		
Total Off-Site Peat & Spoil Volume (m^3)			0	0	0
Total On-Site Peat & Spoil Storage Volume (m^3)			**183,064**	112,425	80,125

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Comment
T1	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 7.9m. Piled foundation
T2	452	0.40	181		Min 24m excavation footprint. Max peat depth used.Average peat depth 0.1m
T3	452	0.00	0		Min 24m excavation footprint. No peat
T4	452	0.00	0		Min 24m excavation footprint. No peat
T5	452	1.70	769		Min 24m excavation footprint. Max peat depth used.
T6	452	0.00	0		Min 24m excavation footprint. No peat
T7	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 5.9m. Piled foundation
T8	452	0.00	0		Min 24m excavation footprint. No peat
T9	452	0.00	0		Min 24m excavation footprint. No peat
T10	452	2.80	1,266		Min 24m excavation footprint. Max peat depth used.
T11	452	3.00	1,356		Min 24m excavation footprint. Average peat depth 4.9m. Piled foundation
Hardstand at T1	4,480	5.1	27,238		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T2	4,480	0.10	448		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T3	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T4	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T5	4,480	1.70	7,616		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T6	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T7	4,480	4.60	24,730		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T8	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T9	4,480	0.00	0		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T10	4,480	2.80	12,544		Area advised by Project Team. Average peat depth over footprint used.
Hardstand at T11	4,480	3.30	14,784		Area advised by Project Team. Average peat depth over footprint used.
Turbine Sub-total			**93,645**	107,692	
Temp Construction Compound 2 (West)	3,600	0.00	0		No mapped peat. Assume floated construction
Temp Construction Compound 1 (East)	12,400	0.00	0		Peat depth assumed based on aerial photos. No peat probe data. Assume floated construction
Met mast 1	900	0.00	0		No mapped peat.
Substation (Cut)	6,832	0.00	0		No mapped peat.
Substation (Fill)	7,893	0.00	0		
Dolines	1,257	0.00	0		20m diameter average and 3m to be excavated
All access roads	-	-	2,124		See seperate tab for breakdown of volumes
Total Excavated Peat Volume =			**95,769**	**110,134**	
Infrastructure Element	**Typical Plan Area**	**Height of Placed Peat**	**Total Storage Volume (m^3)**	**Peat Storage Volume (m^3)**	
West Storage Area (A)	4650	2.5	11625	11625	**2.5 high storage area with 3.5m high bund**
West Storage Area (B)	11150	2.5	27875	27875	**3m high storage area with 3.5m high bund**
West Storage Area (C)	15050	2.5	37625	37625	**3m high storage area with 3.5m high bund**
West Storage Area (D)	6700	2.5	16750	16750	**3m high storage area with 3.5m high bund**
West Storage Area (E)	7400	1	7400	0	**Approximately 3.0m of insitu peat**
West Storage Area (F)	2750	2.5	6875	4125	
West Storage Area (G)	3700	2.5	9250	0	
T11 Storage Area	3150	1	3150	3150	
Landscaping	-	-	22,000	11,275	**2,000m^3** required at each of the 11 no. turbine locations
Total Peat Storage Volume =				**112,425**	

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (25% - total)	Average Stone Depth (m)	Stone Volume (m^3) - Unfactored	Stone Volume (m^3) - Factored for 25% Contingency	Comment
T1	452	3.00	1,356		0.50	226		500mm stone thickness assumed at all turbine bases
T2	452	0.40	181		0.50	226		
T3	452	0.00	0		0.50	226		
T4	452	0.00	0		0.50	226		
T5	452	1.70	769		0.50	226		
T6	452	0.00	0		0.50	226		
T7	452	3.00	1,356		0.50	226		
T8	452	0.00	0		0.50	226		
T9	452	0.00	0		0.50	226		
T10	452	2.80	1,266		0.50	226		
T11	452	3.00	1,356		0.50	226		
Hardstand at T1	4480	5.1	27238		5.07	22,699	28,373	Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Hardstand at T2	4480	0.1	448		1.00	4,480	5,600	
Hardstand at T3	4480	0	0		1.00	4,480	5,600	
Hardstand at T4	4480	0	0		1.00	4,480	5,600	
Hardstand at T5	4480	1.7	7616		1.70	7,616	9,520	
Hardstand at T6	4480	0	0		1.00	4,480	5,600	
Hardstand at T7	4480	4.6	24729.6		4.60	20,608	25,760	
Hardstand at T8	4480	0	0		1.00	4,480	5,600	
Hardstand at T9	4480	0	0		1.00	4,480	5,600	
Hardstand at T10	4480	2.8	12544		2.80	12,544	15,680	
Hardstand at T11	4480	3.3	14784		3.30	14,784	18,480	
Turbine Sub-total			**93,645**			**107,618**		
Temp Construction Compound 2 (West)	3600	0	0		1.00	3,600	4,500	
Temp Construction Compound 1 (East)	12400	0	0		1.00	12,400	15,500	
Met mast 1	900	0	0		1.00	900	1,125	Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Substation (Cut)	6832	0	0		0.00	0	0	
Substation (Fill)	7893	0	0		1.00	7,893	9,866	
Dolines	1257	0	0		3.00	3,770	4,712	
All access roads	-	-	2,124		1.00	37,853	47,316	See seperate tab for breakdown of volumes
Total Excavated Peat & Stone Volume =			**95,769**	**119,711**		**174,033**	**217,541**	

Road Element	Length	Area (m2)	Average Stone depth (m)	FTC - Volume of Stone (m3)	Stone Volume (m^3) -Factored for 25% Contingency
New Roads					
existing (widening)	3565	17,825	0.5	8,913	
new track	8390	41950	0.5	20,975	
floating roads	1770	7080	0.75	7,965	
Total Access Roads				**37,853**	**47316**

Road Element	Length	Area (m2)	Average Peat depth (m)	Average Spoil depth (m)	FTC - Volume of Peat (m3)
Roads					
existing (widening)	3565	17,825	0	0.30	0
new track	8390	41,950	0	0.30	0
floating roads	1770	7,080	0.3	-	2,124
Total Access Roads					**2,124**

FTC - Volume of Spoil (m3)
5,348
12,585
-
17,933

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)
T1	452	3.00	1356		0.00	0	
T2	452	0.40	181		2.60	1176	
T3	452	0.00	0		3.00	1356	
T4	452	0.00	0		3.00	1356	
					0.50		
Hardstand at T1	4,480	5.07	27238		0.00	0	
Hardstand at T2	4,480	0.10	448		0.90	4,032	
Hardstand at T3	4,480	0.00	0		1.00	4,480	
Hardstand at T4	4,480	0.00	0		1.00	4,480	
Turbine Sub-total			**29,224**			**16,881**	
Temp Construction Compound 2 (West)	3,600	0.00	0.00		0.00	0	
Met mast 1	900	0.00	0.00		1.00	900	
Substation (Cut)	6832	0	0		-	4321	
Substation (Fill)	7893	0	0		0.50	3947	
All access roads	-	-	850			7173	
Total Excavated Peat Volume =			**30,073**	**34,584**		**33,221**	**36,543**

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
West Storage Area (A)	4650	2.5	11625	11625	0
West Storage Area (B)	11150	2.5	27875	27875	0
West Storage Area (C)	15050	2.5	37625	37625	0
West Storage Area (D)	6700	2.5	16750	16750	0
West Storage Area (E)	7400	1	7400	0	7400
West Storage Area (F)	2750	2.5	6875	4125	2750
West Storage Area (G)	3700	2.5	9250	0	9250
Landscaping	-	-	8,000	6,000	2,000
Total Storage Volume (m^3)			**125,400**	**71,128**	
Surplus Peat and Spoil Storage Volume (m^3)			-54,272		

Comment
Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
Assumes min. excavation depth of 3m.
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Assumes min. excavation depth of 3m.
Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
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Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
Assumed no overdig required. Cut volume of 4321m3 provided by Client.
min. 500mm topsoil to be removed before fill is placed
See seperate tab for breakdown of volumes.

Infrastructure Element	Typical Plan Area of Foundation (m^2)	Average Peat Depth (m)	Peat Volume (m^3) - Unfactored	Peat Volume (m^3) - Factored for Bulking & Contingency (15% - total)	Average Spoil Depth (m)	Spoil Volume (m^3) - Unfactored	Spoil Volume (m^3) - Factored for Bulking & Contingency (10% - total)
T5	452	1.70	769		1.30	588	
T6	452	0.00	0		3.00	1356	
T7	452	3.00	1356		0.00	0	
T8	452	0.00	0		3.00	1356	
T9	452	0.00	1		3.00	1356	
T10	452	2.80	1266		0.50	226	
T11	452	3.00	1356		0.50	226	
Hardstand at T5	4,480	1.70	7616		0.00	0	
Hardstand at T6	4,480	0.00	0		1.00	4480	
Hardstand at T7	4,480	4.60	24730		0.00	0	
Hardstand at T8	4,480	0.00	0		1.00	4480	
Hardstand at T9	4,480	0.00	0		1.00	4480	
Hardstand at T10	4,480	2.80	12544		0.00	0	
Hardstand at T11	4,480	3.30	14784		0.00	0	
Turbine Sub-total			**64,422**			**18,549**	
Temp Construction Compound 1 (East)	12,400	0.00	0		1.00	12,400	
Dolines	1,257	0.00	0		3.00	3,770	
All access roads	-	-	1,274			10,760	
Total Excavated Peat Volume =			**65,697**	**75,551**		**45,479**	**50,027**

Infrastructure Element	Typical Plan Area	Height of Placed Peat	Total Storage Volume (m^3)	Peat Storage Volume (m^3)	Spoil Storage Volume (m^3)
T11 Storage Area	3150	1	3150	3150	#REF!
East Storage Area	20000	2.5	50000	0	50000
Landscaping	-	-	14,000	7,175	6,825
Total Storage Volume (m^3)			**67,150**	**125,578**	
Surplus Peat and Spoil Storage Volume (m^3)			58,428		

Comment
Assumes min. excavation depth of 3m.
Assumes min. excavation depth of 3m.
Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
Assumes min. excavation depth of 3m.
Assumes min. excavation depth of 3m.
Assumes min. excavation depth of 3m.
Assumes 0.5m D&R beneath peat and 6N upfill beneath pile mat and a min. excavation depth of 3m.
Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
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Min. 1000mm stone thickness assumed at all hardstands or max peat depth whichever is greater
Min. 1000mm stone thickness assumed at construction compound or max peat depth whichever is greater
20m diameter average and 3m to be excavated
See seperate tab for breakdown of volumes.

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