APPENDIX 6-2

Fehily Timoney Peat Stability Assessment of Meenbog Wind Farm Site (2021)

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Meenbog Wind Farm

Peat Stability Assessment of Meenbog Wind Farm Site

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Meenbog Wind Farm

Peat Stability Assessment of Meenbog Wind Farm Site

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Abstract: This assessment addresses the stability of the site of the Meenbog Wind Farm, County Donegal following a peat failure at the site on 12 November 2020.

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1. INTRODUCTION

1.1 General

Fehily Timoney and Company (FT) were engaged by Planree Ltd. (Planree) to carry out an assessment of the stability of peat at the site of the Meenbog Wind Farm, County Donegal following a peat failure that occurred during wind farm construction on 12 November 2020. This assessment is prepared for the purpose of complying with the EPA's (Environmental Protection Agency) Direction under Regulation 8(1)(b) of the European Communities (Environmental Liability) Regulations 2008. This Direction is dated 3 December 2020 and requested Planree to submit information in relation to peat stability assessments carried out in relation to the development at Meenbog Wind Farm.

Further EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021 and EPA letter dated 29 July 2021 are also addressed within this assessment.

At the time of the peat failure most of the construction footprint of the wind farm was completed. The peat failure of 12 November 2020 occurred at the location and during the construction of a floating road to turbine T7.

1.2 Statement of Authority

This assessment was carried out by Dr Paul Jennings (PhD, BEng, DipArb, CEng, MIEI), Chartered Engineer, UK Registered Ground Engineering Professional (Advisor) with over 30 years' geotechnical consultancy experience in Ireland, and internationally. Paul has completed numerous stability and geotechnical assessments for wind farm developments in Ireland and Scotland. In addition, he has attended and provided oral evidence at numerous oral hearings for energy developments. Dr Paul Jennings was a former technical director with AGEC, who were involved in the original peat stability assessment of the site in 2017.

1.3 Scope

The scope of this peat stability assessment at the site includes the following:

(1) Review of construction works at the site, namely but not limited to turbine bases, access roads, hard stands, peat repositories and borrow areas.

(2) Review of ground conditions at the wind farm site with particular reference to ground conditions at the location of peat failures.

(3) Site inspection and selected investigation of the ground conditions at the site.

(4) Detailed site inspection and reporting of the 12 November 2020 peat failure.

(5) Identification of previous peat failures and instability at the site.

(6) Qualitative assessment of peat stability at the site.

(7) Findings and mitigation measures.

In undertaking this assessment, FT carried out a number of key activities which included site visits to the wind farm site in November and December 2020, and January and April 2021 along with a review of construction records and existing reports and published data.

In addition to the above, the developer has engaged with the EPA and their consultants (Arup) and this report addresses comments received from the EPA, see below.

1.4 Schedule of Revisions to Report

Following submission of an earlier version of this report (FT, 2021b) to the EPA in January 2021, a number of documents have been received and meetings held with the EPA which included comments on the earlier version of this report. These comments have been addressed in this revised report which also includes the results of further investigations at the site which have been carried out since the release of the earlier report.

A schedule of the documents and meetings containing the comments and responses are summarised in Table 1, which also includes the relevant sections of this report that have been revised to address the comments. For ease of reference these documents have been included in Appendix C of this report.

Table 1: Schedule of revisions to report

Document	Description of Document/Meeting	Addressed in this Report in the following Sections
Arup (2021)	Provided with EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021. Referred to as the EPA Report, which was issued on 26 March 2021. Arup were appointed by the EPA to undertake a review of peat stability assessments which were undertaken for the Meenbog Wind Farm. The scope of the review considered the following: • Whether the assessment was undertaken in accordance with good practice and in line with appropriate guidelines and standards, in particular in terms of the approach adopted and the scope of the assessments (i.e. site-wide versus infrastructure footprint). • Whether the recommendations and mitigation measures presented for the remaining construction works at the site are adequate, and sufficiently address the risks.	Document responding to these comments included in Appendix C. Revisions included in a number of sections but notably within 5. ,7. ,8. and 9.
Fehily Timoney (2021a)	Intended approach to addressing the conclusions and recommendations of the EPA Report by way of response to the EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021 (the Direction).	As above.
EPA (2021)	Site visit meeting on 16 April 2021. Site Visit Report (Environmental Liability Regulations) by the EPA issued following a joint visit to Meenbog Wind Farm site on 16 April 2021. Contains further issues that the operator shall consider in preparing the updated peat stability assessment.	Document included in Appendix C. Revisions included in a number of sections but notably within 5. ,7. ,8. and 9.
Not applicable	On-line meeting with EPA, Arup and FT on 28 April 2021. In addressing conclusions and recommendations from the EPA report the following items discussed, namely: • A number of mitigation measures are recommended by FT which could be beneficial in mitigating the risk of instability. However, the rationale for adopting a number of these is not clear, and further consideration should be given to how the measures will be adopted in practice. • Further consideration should be given to the proposed mitigation measures prior to construction resuming. The rationale for these measures, and consideration of their practical implementation on site should be considered.	Revisions included in a number of sections but notably within 5. ,7. ,8. and 9.

Document	Description of Document/Meeting	Addressed in this Report in the following Sections
EPA (2021a)	Further works carried out based on items included in letter from EPA Reference Number ELD200005/Corr(1) /Planree dated 29 July 2021. Further items addressed are essentially included within Ionic report (Appendix D), and include the following: • Additional analysis in accordance with Eurocode 7 • Sensitivity analysis including further site investigation at critical locations • Basis of crane loading • Temporary excavations in peat • Meaning of observational approach	Document included in Appendix C. Minor revisions within this report. Revisions to Ionic report (Appendix D) and Appendix E.

1.5 Roles and Responsibilities

This stability assessment has been carried out by a number of parties in order to provide a comprehensive response to EPA requests. The following parties and their roles in this stability assessment are given below:

(1) FT were independently engaged by Planree to investigate the failure of 12 November and to assess the peat stability at the site.

(2) Ionic Consulting (Ionic) were engaged by Mid-Cork Electrical Limited as designers for the civil works at the wind farm. As part of this design work, Ionic have carried out a stability assessment with respect to the proposed infrastructure works, see Appendix D.

(3) Mid Cork Electrical Limited (MCE) are the contractor for the wind farm civil works. MCE have provided construction control procedures for the proposed infrastructure works (Appendix E) taking into account the findings of the above.

The structure of this stability assessment report is provided below and explains the contributions and relationship between the parties.

1.6 Structure of this Report

This report contains an assessment of the stability assessment of peat at the site of the Meenbog Wind Farm which includes the following main items:

(1) Main text comprises a site-wide stability assessment of peat by FT who were engaged by Planree to investigate the failure of 12 November and to assess the peat stability at the site. The main text includes an overview of the ground conditions at the site, further ground investigation, assessment of the constructed works, review of the 12 November and other peat failures at the site, a qualitative assessment of peat stability site-wide and findings and mitigation measures.

The mitigation measures provided in the FT report have been incorporated in to the Ionic Consulting (Ionic) report (Appendix D) and construction control procedures (Appendix E).

(2) The Ionic report (Appendix D) provides a detailed quantitative peat stability assessment along the proposed infrastructure at the site which has been produced using data that has been obtained from ground investigation compiled up to end of April 2021 together with more recent data obtained up to August 2021. The ground investigation comprises a significant amount of data (including over 1750 peat probes and shear vane results).

(3) MCE have provided the construction control procedures that shall be used on site to manage the proposed construction with particular reference to works within peat (Appendix E), which includes recent revisions to the design documents in August 2021. The construction control procedures have been developed based on best practice and include the mitigation measures and findings of the FT and Ionic reports.

2. PEAT STABILITY ASSESSMENT METHODOLOGY

2.1 General

The peat stability assessment of the site follows the guidance in the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017) (the Guide).

It is recognised that the site has been previously subject to a peat stability assessment as part of the planning application (AGEC, 2017) which also includes a hydrological assessment (MKO, 2017). Construction works have also been designed in accordance with the recognised standard for geotechnical works, I.S. EN 1997-1:2007 Eurocode 7 Geotechnical Design - Part 1: General Rules. The details included in these documents have been taken into consideration in the assessment included in this report.

The peat stability assessment includes the following key elements:

(1) Assessment of desk study data, ground conditions and character of the peat land at the site, which includes relevant hydrology and geomorphological factors. See Sections 4. to 6.

(2) An assessment of peat failures pre-construction and during construction together with evidence based on visual inspection and investigation of pre-failure indicators, such as tension cracks. See Sections 7. to 8.

(3) A site-wide qualitative assessment of the potential peat stability using a geomorphological approach taking into account the findings from previous failures, and relevant reports and records (AGEC, 2017 and construction records). See Section 9.

(4) Identification of key receptors (such as water courses, human life) exposed to any peat stability. See Section 9.

(5) A site-wide qualitative risk assessment using the potential peat stability determined above that considers the potential adverse consequences of peat landslides for the identified key receptors. See Section 9.

It is noted that whilst the Guide refers to a site-wide approach to particular ground investigation this is in relation to scoping of the site to identify the optimum location of the proposed infrastructure (SEPA, 2017). As the infrastructure footprint at the site has already been determined and is fixed by way of the granted planning permission then the site-wide approach is no longer relevant and as such there has been a focus in this report, but particularly within the Ionic report (Appendix D), on assessing the stability within a zone of influence of the permitted proposed infrastructure, that is an expanded infrastructure corridor. There is little benefit in carrying out investigations on parts of the site which are remote from the proposed infrastructure and which cannot be affected by the proposed infrastructure works. This is discussed in more detail in Section 6.4.1.

Notwithstanding the above, the qualitative stability assessment included in this report is site-wide, as this provides an improved understanding of the geomorphological features at the site and allows for better identification of areas where there is potential for an elevated risk from peat instability. The accompanying Ionic report (Appendix D) takes the findings of this report and assesses in more detail the peat stability within the zone of influence of the proposed infrastructure.

2.2 Sources of Information

The following sources were used to assess the peat stability at the site:

(1) Published records (for example GSI and GSNI landslide databases)

(2) Historical aerial photography

(3) Observations from site inspection in November and December 2020, and January 2021

(4) Ground investigation data (peat strength and depth) at selected locations

(5) Detailed site inspection of the 12 November peat failure

(6) Planning and design reports

(7) Rainfall and hydromet data

(8) Construction records

(9) Drone survey

3. WIND FARM SITE

3.1 General

The Meenbog Wind Farm comprises 19 turbines and associated works located on Meenbog in Co. Donegal. The site is located approximately 8km to the southwest Ballybofey and Stranorlar, Co. Donegal.

The developer for the wind farm is Planree Ltd, a subsidiary company of Enerco Energy Ltd. The wind farm was granted planning permission in June 2018.

The contractor for the wind farm civil works is Mid Cork Electrical Limited (MCE). The designer for the civil works is Ionic Consulting, who are also acting as the Project Supervisor for the Design Process (PSDP). For the wind farm project and project management, MCE is the Project Supervisor Construction Stage (PSCS). McCarthy Keville O'Sullivan (MKO) is the planning consultant.

Construction works at the wind farm site commenced in November 2019 and was ongoing at the time of the peat failure in November 2020.

3.2 Wind Farm Layout

The extent of the wind farm and associated works is detailed in the planning documents for the development (MKO, 2017) as referenced in An Bord Pleanála Board Order ABP-300460-17. The wind farm and associated works comprises the following main elements:

(1) Up to 19 no. wind turbines with a generating capacity in excess of 50MW with maximum overall ground to blade tip height of up to 156.5m.

(2) 1 no. permanent Meteorological Mast up to a maximum height of 110m.

(3) 1 no. 110kV Electrical substation with 2 no. control buildings.

(4) Internal wind farm underground cabling.

(5) 110kV underground grid connection cabling.

(6) Upgrade of access junctions to public road.

(7) Upgrade of existing tracks, roads and provision of new site access roads and hard stand areas.

(8) 3 no. borrow pits.

(9) 2 no. temporary construction compounds.

(10) Recreation and amenity works, including marked trails (upgrade of existing tracks and provision of new tracks), picnic, amenity and play areas, car parking and vehicular access.

(11) Site drainage.

(12) Forestry felling.

(13) Permanent signage.

(14) All associated site development and ancillary works.

3.3 Site Description

The wind farm site is located in an upland rural area with a landscape character that is largely open moorland, with extensive commercial coniferous forestry plantations. The permanent footprint of the wind farm covers about 28.5 hectares (ha), which represents approximately 2.9% of the primary study area of about 4,400ha which was included in the Environmental Impact Assessment Report (EIAR) (MKO, 2017). The site is generally also bordered by commercial forestry plantations with the eastern and southern boundaries defined by the Northern Ireland border (**Figure 1**).

The elevation of the site ranges from about 180 to 313mOD (metres above Ordnance Datum). Most of the site is located on a upland ridge line that is aligned southwest to northeast.

The site is dominantly within commercial forestry plantations that have been planted on blanket peat, except for 2 turbines (T16 and T19) which are both located on open peatland.

There is a network of existing forestry roads within the wind farm site. The internal road layout for the wind farm makes use of the forestry roads where possible, with approximately 14.5km of existing forestry roads requiring upgrading. The EIAR reports that about 7.7km of new access road is required to be constructed for the wind farm.

The site is covered by blanket peat with relatively few exposures of mineral subsoil or bedrock. There are a small number of existing borrow pits previously used for forestry activities on the site where subsoil and bedrock is exposed.

3.4 Wind Farm Construction

Construction works at the wind farm site commenced in November 2019 by MCE. Most of the civil works, such as access roads, hard stands, turbine bases, peat repositories and borrow areas at the wind farm site were substantially complete at the time of the peat failure. **Table 2** provides a summary of the state of completion of the main civil works construction at the site prior to the peat failure.

With respect to access roads, these have all been substantially completed except the access road to T7 (which was involved in the November peat failure) and T18. The access road to T7 was being constructed as a floating road. The access road to T18 is to be an upgrade to the existing access road. The upgraded section of floating road is proposed to be founded on competent stratum. Substantially completed refers to the road having been constructed, that is the main body of road material has been placed and the road has been used for construction traffic. Typically to complete the road only minor elements of work are required such as for example grading, final road surfacing and testing. As there is limited further excavation and loading of the peat required for the access roads there is limited risk of peat instability. Where further works are required these will be subject to the mitigation measures included in this report.

Hardstands are similarly substantially complete except at T7 and T18. T7 is still to be completed. T18 is estimated at 50% complete. Hardstands comprise a suitable mass of crushed stone founded on a competent bearing stratum, such as competent mineral soil or bedrock below the peat. As there is limited further excavation required for hard stands there is limited risk of peat instability. Again, where any further works are required these will be subject to the mitigation measures included in this report.

Of the 19 turbines bases on the site, all have been started except at T7. Of the 18 turbines bases that have been started all except T2, T16, T18 and T19 have been substantially completed, that is concrete has been poured. Turbine bases comprise gravity bases formed of reinforced concrete founded on a competent bearing stratum, such as typically bedrock. T2, T16, T18 and T19 are at various stages of completion ranging from exposure of formation, blinding, steel fixing and shuttering. Again, where any further works are required these will be subject to the mitigation measures included in this report.

The meteorological mast has yet to be completed. Foundations for the mast would comprise a block of concrete founded on a competent bearing stratum, such as competent mineral soil or bedrock below the peat. Such works are considered to have minimal impact on peat stability and will be subject to the mitigation measures included in this report.

A summary of the remaining civil works to be completed is provided in **Table 3**. The remaining works are generally minor in nature and do not require extensive groundworks, except for the works at T7 and the access to T18, as mentioned above. These works will be subject to the mitigation measures included in this report. The construction control procedures which will govern the works are included in Appendix E.

Table 2: Summary of civil works state of completion (from MCE)

Location	Access Road	Hard Stand	Turbine Foundation
T1	Substantially complete	Substantially complete	Poured
T2	Substantially complete	Substantially complete	Steel fixed
T3	Substantially complete	Substantially complete	Poured
T4	Substantially complete	Substantially complete	Poured
T5	Substantially complete	Substantially complete	Poured
T6	Substantially complete	Substantially complete	Poured
T7*	About 75% complete	Not started	Not started
T8	Substantially complete	Substantially complete	Poured
T9	Substantially complete	Substantially complete	Poured
T10	Substantially complete	Substantially complete	Poured
T11	Substantially complete	Substantially complete	Poured
T12	Substantially complete	Substantially complete	Poured
T13	Substantially complete	Substantially complete	Poured
T14	Substantially complete	Substantially complete	Poured
T15	Substantially complete	Substantially complete	Poured
T16	Substantially complete	Substantially complete	At formation level; rock
T17	Substantially complete	Substantially complete	Poured
T18	Road upgrade 15% complete	50% complete	Blinded
T19	Substantially complete	Substantially complete	Steel fixed and shuttered
Met mast	Not started	Not started	Not started

Notes:
(1) *Access road to T7 was under construction at time of failure in November 2020.
(2) Turbine foundation construction comprises several stages, namely excavate to formation, blinding, steel fixing and shuttering, and pouring of concrete.
(3) Access road substantial completion refers to road having been constructed, that is main body of road material has been placed and road having been used for construction traffic but for example grading, final road surfacing and testing still to be carried out.
(4) Hard stand substantial completion refers to hard stand having been constructed, that is main body of hard stand material has been placed and hard stand has been used for construction traffic but for example grading, final surfacing and testing still to be carried out.

Table 3: Summary of civil works to be completed (from MCE)

Location	Details of Works
Main Access Road	Bend at CH 950, CH 1350, CH 2650, CH 2970
All roads to be capped	Cl.804 capping on all roads
Road to be re-graded at spur to T12	Dropped by 1m
T7 hard stand and base to be excavated and access completed	
Entrance to T6 to be widened and graded	
Turning head to North East of T5	
T2 hard stand to be completed	
Turning head at T3	
Turning head at T1	
Turning head at T4	
Turning head at T2	
Re-alignment of access to T15	
Bend to be widened at T17/T19 Junction	
Turning head at T19	
T16 Turning head	
T16 hard stand and base to be completed	
Bend at T13/T9 spur to be re-aligned	
Stripping of borrow pit B	
Fencing at peat storage 1 & 2	Peat to be stripped, area to be prepared
Access road to T18	1500m approx.
Hard stand at T18	
Water management at T2	Ponds etc.
Peat storage area at T15	
Peat storage area at T17	
Fencing of peat storage beside the substation	
T1	1nr. Blade finger
T2	Finish hard stand, backfill base & blade fingers
T3	Raise hard stand & 2 blade fingers
T4	1nr. Blade finger & backfill base
T5	Raise hard stand, backfill base & 1nr. Blade finger
T6	2nr. Blade fingers, grade around base
T7	Excavate whole hard stand & blade fingers
T8	Finish hard stand & blade fingers
T9	Blade Fingers
T10	2nr. Blade fingers, raise hard stand
T11	2nr. Blade fingers
T12	2nr. Blade fingers, raise hard stand
T13	2nr. Blade fingers
T14	2nr. Blade fingers
T15	Raise hard stand & Blade Fingers
T16	Finish hard stand & blade fingers
T17	1nr. Blade finger
T18	Finish hard stand & blade fingers
T19	Fill hard stand, pour base & blade fingers
Ducting (excavating peat)	T12-T5, Peat storage area-1 - T15, T-Junction - T18
Ducting (floating road)	T3/T1 junction - T1 & T2

4. DESK STUDY

4.1 General

The desk study assessment is based on published records and historical aerial photography.

4.2 Published Landslide Data

A review of GSI (2020) and GSNI (2020) landslide databases shows no failures within the site.

The nearest failures are given in Table 4. There are a number of failures recorded by the GSI (2020) within about 10 to 15km to the west of the site within the neighbouring Bluestack Mountains which are generally described as comprising undifferentiated material.

Table 4: GSI & GSNI landslide records

Location	Comments
Immediately west of site entrance by N15. GSI reference: GSI_LS03-0022	Occurred in 1963. Failed material involved blanket peat. Described as a peat flow. The flow began at a marked break in slope where morainic sands and gravels beneath the peat had recently been removed for road work.
2.9km southwest of site entrance on N15. GSI reference: GSI_LS14-0036	No date given. Failed material described as undifferentiated. Occurred on steep slope within the Barnesmore Gap. Likely shallow failure or erosion event.
16km southeast in Carrickaholten Forest GSNI reference: NK	No date given. Failed material described as landslide deposit. Failure covers a small plan area.

The Landslide Susceptibility Classification (GSI, 2020) provides an indication of the susceptibility of an area of land to landsliding. Based on the Landslide Susceptibility Classification the site is classified by the GSI (2020) as 'low' to 'moderately low' and locally 'moderately high' susceptibility.

For the wind farm site, the 'moderately high' susceptibility areas are generally located where there are steeper slope gradients. This would tend to be areas where rock is closer to the surface and peat depth is less, which would not necessarily be for all cases where peat failures would be anticipated. It is recognised that the Landslide Susceptibility Classification is indicative and is used for guidance only.

It is noted that the initiation site of the peat failure of 12 November 2020 is classified as 'Low' on the Landslide Susceptibility Classification. The initiation site comprises very gently sloping ground and as such would not generally be identified as having an elevated landslide susceptibility.

4.3 Aerial Photography

Historical aerial photography was examined for the site covering the years 1995 to 2020. The photographs are included in Appendix A3 and the findings included in Table 5.

Based on the above, prior to construction of the wind farm there were no apparent peat failures on the site based on published information and a review of historical aerial photographs. The presence of relict peat failures or clustering of relict failures would indicate that site conditions existed that pre-dispose a site to failure. The site has been forested for a number of years with tree felling having been carried out with no signs of pe at failure. Based on the historical data reviewed, and prior to construction, the site would be considered to have an acceptably low potential for peat failure.

Considering the historical data combined with for example the results of strength results for p eat, except for the vane shear strength test results for the upper scar of the 12 November 2020 peat failure, then qualitatively the combined results would indicate that the site was suitable for development with the appropriate construction measures in place and would be considered to have an acceptably low potential for peat failure.

Whilst the desk study indicates that the site would be suitable for development with the appropriate construction measures in place nevertheless there has been a number of peat failures during the construction works. A review of these failures is included below to identify the causes of the failures.

Table 5: Historical aerial photographic review

Year	Comments
1995	The site is essentially covered in forestry plantation. The southern part of the site has a cover of trees. In the northern part of the site, trees have been removed/recently planted. The site of the 12 November failure is an open peat land that covers an area of about 340m by 280m (9.5ha). Drainage furrows are present in essentially the southern part of the open peat land. There are no apparent signs of peat failure within the site. The 1963 failure is shown on the aerial photograph. It is noted that the peat land to the east of the site entrance shows concentric mounds; this is a flat lying area and this possibly represents either peat growth or creep movement. AGEC (2017) recorded an area of notably deeper peat on the site, this is shown on the photogr aph.
2005	The site is essentially covered in forestry plantation. The southern part of the site has a cover of trees. In the northern part of the site, trees have been recently planted. Removal of some stands of trees in the west of the site. The site of the 12 November failure remains as open peat land and remains unchanged from earlier photograph. There are no apparent signs of peat failure within the site.
2013 to 2018	The site is essentially covered in forestry plantation. The southern part of the site has a cover of trees. In the northern part of the site, trees have been recently planted. Further removal of some stands of trees in the west and south of the site. The site of the 12 November failure remains as open peat land and remains unchanged from earlier photograph. There are no apparent signs of peat failure within the site.
September 2020	The site remains essentially covered in forestry plantation. Areas of forestry have been removed for the wind farm works together with some stands of trees, including trees below 12 November peat failure. The outline of the wind farm is clearly visible (hence overlay is not included). The site of the 12 November failure remains as open peat land and remains unchanged from earlier photograph. The failure scar has been added to show its extent. There are a number of peat failures apparent, these failures referenced 1 to 4 and 8 in this report text.

5. FURTHER GROUND INVESTIGATION AND ASSESSMENT

5.1 General

Following comments in the EPA Report and the site meeting of 16 April 2021 (**Table 1**) further ground investigation and assessment has been carried out. The further investigation has been carried out principally due to the difficulties in testing peat to determine the operational peat strength. The Guide recognises the difficulties in determining peat strength and as such is intentionally non-prescriptive with respect to the testing carried out. Whilst the peat assessment uses vane testing in peat this is recognised as being an index tool (Boylan, Jennings & Long, 2008) though remains the most practical means of assessing peat strength and has been used extensively for testing peat on many wind farm sites.

A number of alternative peat strength testing methods have been carried out as part of the further ground investigation to provide a comparison between the alternative approaches, and the applicability of using an insitu shear vane.

The further ground investigation has comprised the following:

(1) Trial pits

(2) Peat cores and peat humification

(3) Comparison of peat strength measurements

(4) Comparison of peat strength measurements and degree of humification

(5) Walk-over survey along proposed route to T18

The location of the further ground investigation is included on the site plan in Appendix A1. The data obtained from the further ground investigation is included in Appendix A6.

5.2 Trial Pits

A number of trail pits (4 nos.) were carried out at selected locations across the site. The purpose of the trial pitting was to investigate in more detail the variation in peat classification and strength with depth and to retrieve peat samples for laboratory testing. For each trail pit the following was carried out:

(1) Detailed logging of peat with depth both before and during trial pitting

(2) Extraction of undisturbed block samples for laboratory (triaxial), shear vane testing and index testing

(3) Localised controlled failure of pit side wall, where safe to do so

(4) Back-analysis of localised failure of pit side wall

A number of trial pit locations were inspected prior to carrying out trial pitting, with many locations not being suitable due to presence of disturbed peat mainly due to tree roots left insitu from cleared forestry and a unsuitable depth and strength of peat for testing. Trial pits (4 nos.) were located close to T4, T5, T7 and T18.

Insitu shear vane testing of peat, including sampling of peat using a Russian Peat Sampler (RPS), was carried out at each of the trial pit locations prior to excavation of the pit. Insitu shear vane testing was carried out at each corner and at the centre of the proposed pit. Peat sampling using the RPS was also carried out at the centre of the pit and logged to provide a detailed trial pit stratigraphy (this allowed for a more accurate log than could be obtained using excavated material from the trial pit).

Undisturbed (U100) samples were obtained of the insitu peat. To limit sample disturbance the sampling tube was pushed at a slow rate into the insitu peat within the pit excavations. In total 8 nos. undisturbed samples and 11 nos. disturbed samples were obtained from the trial pits.

Trial pit logs (T4-TP1, T7-TP1, T18-TP2 and T5-TP1) and the associated RPS logs are included in Appendix A6.

The results of the insitu shear vane testing of peat at the location of the trial pits are included in **Figure 11 (a) to (d)**.

The results of the insitu shear vane testing and a summary of the results of trial pits is included in **Table 6**.

Prior to excavating the trial pits the upper fibrous peat layer (acrotelm) was severed using a saw. Several saw-cuts were placed along the length of the pits at various distances from the trial pit edge. The purpose of the saw-cuts was to ensure that side wall failure was controlled by the underlying more humified layer (catotelm). Side wall failure occurred in 3 nos. of the trial pits (T4-TP1, T7-TP1 and T5- TP1), with failure typically occurring as slumping of the side wall with notable deformation of the surrounding ground surface and inward deformation of peat from the base and sides of the pit.

The theoretical limit for a vertical height for an undrained face to remain stable is determined from the following formula:

$$Hc = 4 \times c_u / \Upsilon - Zt \text{ (Potts, 2004)}$$

Where:

Hc height of vertical sidewall at failure (m)

c_u undrained strength (kPa)

Υ bulk unit weight of peat, taken as $10kN/m^3$

Zt depth of tension crack (m), this is equivalent to the depth of the saw-cuts which is taken as 0.5m

Using the above formula and the average insitu shear vane test results the theoretical failure height of the side wall (in m) was determined to assess the adequacy of using insitu vane strength to measure the operational strength of the peat. The results (**Table 6**) from the trial pits are as follows:

(1) In general there is a reasonably good correlation between the actual failure height of the side wall and the theoretical failure height of the side wall, particularly for the average insitu shear vane strength of the full peat depth.

(2) Where the average insitu shear vane strength within the depth of the failure height is used (that is within 2m below ground level), then the shear vane tends to underestimate the actual failure height. The insitu shear vane strength underestimates the strength of the peat in this instance.

(3) The above results indicate that the insitu shear vane strength provides a reasonable indication of the operational shear strength of peat, particularly at the lower shear strength peat encountered within the trial pits.

Table 6: Summary of trial pit results

Trial Pit	Depth of Peat (m)	Depth of Trial Pit (m)	Actual Failure Height of Side Wall (m)	Average Insitu Shear Vane Strength c_u of Peat (kPa)		Theoretical Failure Height of Side Wall (m)	
				Full Peat Depth	Within Failure Height	Full Peat Depth	Within Failure Height
T4-TP1	3.3	1.5	1.5	4.4	3.9	1.24	1.08
T7-TP1	3	1.5 to 1.7	1.6	5.1	4.8	1.55	1.41
T18- TP1	2.5	NA	NA	NA	NA	NA	NA
T18-TP2	1.5	1.5	DNF	13.3	13.3	4.83	4.83
T5-TP1	3.5	1.5	1.5	5.1	4.1	1.55	1.15

Notes
(1) T18-TP1 was not excavated as insitu vane testing prior to pitting indicated that the peat was notably strong and that side wall collapse would not occur.
(2) T18-TP2 was excavated to base of peat at 1.5m and did not failure (DNF).
(3) Average insitu shear vane strength c_u of peat is data that excludes all outliers and tests within the acrotelm. The average insitu shear vane data was determined from data within the failure height to 2m below ground level.

5.3 Peat Cores and Peat Humification

Peat core samples were retrieved to confirm the general nature and characteristics of peat on the site. Peat cores were retrieved using the RPS, which is a hand-held sampler which takes a 50mm diameter half core sample of 500mm length in peat. Samples are obtained such as to provide a continuous log with depth. Retrieved samples were logged using the Von Post classification (Hobbs 1986) to determine particularly the degree of peat humification. A shear vane test was also carried out at each RPS location to give strength data for the peat descriptions. All the samples were bagged and sealed for moisture content testing.

Humification of peat results in the decomposition of vegetative fibres resulting in a more amorphous peat which is generally encountered at greater depth within the peat mass. Amorphous peat tends to exhibit lower shear strength and permeability. A qualitative assessment of the humification was assessed using the Von Post classification ranks peat from H1 (no decomposition) to H10 (complete decomposition), see Table 7.

The purpose of the peat coring was to determine in particular the gradation of humification with depth. Fibres are dominant in humification classes H1 to H3, with H4 being transitional between fibre and amorphous dominated peat.

Peat sampling using the RPS was carried out at turbine locations with a summary included in Table 8 and logs included in Appendix A6. The Von Post classification included in the RPS logs comprises essentially the fuller version of the classification and not just the degree of humification.

Table 7: Degree of humification based on Von Post Classification (Hobbs, 1986)

Degree of Humification	Decomposition	Plant Structure	Amorphous Material Present	Material Extruded on Squeezing	Nature of Residue
H_1	None	Easily identified	None	Clear, colourless water	Not pasty
H_2	Insignificant	Easily identified	None	Yellowish water	Not pasty
H_3	Very Slight	Still identifiable	Slight	Brown, muddy water; no peat	Not pasty
H_4	Slight	Not easily identified	Some	Dark brown, muddy water; no peat	Somewhat pasty
H_5	Moderate	Recognisable, but vague	Considerable	Muddy water and some peat	Strongly pasty
H_6	Moderately strong	Indistinct (more distinct after squeezing)	Considerable	About one third of peat squeezed out; water dark brown	Very strongly pasty
H_7	Strong	Faintly recognisable	High	About one half of peat squeezed out; any water very dark brown	
H_8	Very Strong	Very indistinct	High	About two thirds of peat squeezed out; also some pasty water	
H_9	Nearly Complete	Almost unrecognisable	Very High	Nearly all peat squeezed out as fairly uniform paste	
H_{10}	Complete	Not discernible	Complete	All peat passes between fingers; no free water visible	

Table 8: Summary of RPS

Turbine	No.	Depth (m)
T1	RPS-T1-1	2.50
	RPS-T1-2	1.60
T2	RPS-T2-1	2.00
	RPS-T2-2	2.00
T3	RPS-T3-1	3.50
	RPS-T3-2	2.50
T4	RPS-T4-1	4.00
	RPS-T4-2	2.00
	RPS-T4-3	2.00
T5	RPS-T5-1	2.90
T7	RPS-T7-1	2.00
	RPS-T7-2	3.00
	RPS-T7-3	3.20
T10	RPS-T10-1	2.50
T14	RPS-T14-1	1.70
T16	RPS-T16-1	2.70
T18	T18-TP1-RPS	2.50
T19	RPS-T19-1	2.70

The degree of humification as determined from the RPS ranged from no humification (H1) within about the upper 0.5m to H9 at depth, see Table 9. In general, there is an increase in humification with depth, which is to be expected, though the gradation in humification with depth will tend to vary at each location depending on the terrain, drainage, and the dominant peatland vegetation.

The typical range of humification ranges from H3 to H7. Below about 1.5m depth the humification is dominantly H5 or greater, which would signify a considerable amount of amorphous material is present.

About half the RPS results show humification of H8 to H9 at the lower depths. Complete decomposition (H10) is considered rare, as there is invariably some more resistant fibrous material present.

Table 9: Summary of peat humification from RPS

Depth (m)	RPS-T1-1	RPS-T1-2	RPS-T2-1	RPS-T2-2	RPS-T3-1	RPS-T3-2	RPS-T4-1	RPS-T4-2	RPS-T4-3
0.5 to 1	H2	H5	H4-H5	H3	H2-H3	H3	H3	H4	H3
1 to 1.5	H2-H3	H6-H7	H4	H5-H6	H4	H4-H5	H4-H5	H5	H4-H5
1.5 to 2	H3	H8-H9	H5	H7	H4-H5	H5-H6	H4-H5	H6	H6
2 to 2.5	H3-H4		H7	H8-H9	H5-H6	H7-H9	H5-H6	H8-H9	
2.5 to 3					H7-H8		H5-H6		
3 to 3.5					H8-H9		H4-H5		
3.5 to 4							H4-H6		

Depth (m)	RPS-T5-1	RPS-T7-1	RPS-T7-2	RPS-T7-3	RPS-T10-1	RPS-T14-1	RPS-T16-1	RPS-T19-1	RPS-T18-TP1
0.5 to 1	H3	H3-H4	H3	H3	H3	H3	H4	H3	H4-H5
1 to 1.5	H4	H4-H6	H4	H3-H4	H5	H5	H5-H6	H4	H4-H5
1.5 to 2	H5-H6	H7	H5	H5	H8-H9	H8-H9	H6-H7	H4-H5	H3
2 to 2.5	H6-H7		H6-H7	H6			H7	H6-H7	H4
2.5 to 3	H7		H7-H9	H7			H9	H8-H9	
3 to 3.5				H9					
3.5 to 4									

Humification Legend	Amorphous Material Present
H1-H2	None
H3-H4	Slight to some
H5-H6	Considerable
H7-H8	High
H9-H10	Very high to complete

5.4 Comparison of Peat Strength Measurements

A number of different methods were employed to determine the likely operational strength of insitu peat at the location of the 4 nos. trial pits (T4-TP1, T7-TP1, T18-TP2 and T5-TP1). These methods comprised the following:

(1) Insitu shear vane

(2) Laboratory shear vane

(3) Laboratory unconsolidated undrained (UU) triaxial testing

(4) Back-analysis of failure of side wall of trial pits

For practical reasons it was not possible to carry out all the above testing at all trial pits locations, for example at T5-TP1 the retrieved samples were unsuitable for testing due to sample disturbance.

Laboratory test results are included in Appendix A6.

A comparison of the results obtained for the above test methods is summarised in **Table 10** with the results shown graphically in **Figure 12 (a) to (d)**.

Table 10: Average undrained shear strength of peat using variety of test methods

Trial Pit	Insitu Shear Vane (Full Peat Depth) (kPa)	Laboratory Shear Vane (kPa)	Laboratory Unconsolidated Undrained (UU) Triaxial Testing (kPa)	Back-analysis of Failure of Side Wall of Trial Pits (kPa)
T4-TP1	4.4	3.2 (5.1)*	1.4	5
T7-TP1	5.1	2.8	1.8	5.3
T18- TP1	NA	NA	NA	NA
T18-TP2	13.3	7.8	5.8	NA
T5-TP1	5.1	5.5	NS	5

Notes
(1) T18-TP1 was not excavated as insitu vane testing prior to pitting indicated that the peat was notably strong and that side wall collapse would not occur.
(2) T18-TP2 was excavated to base of peat at 1.5m and did not failure (DNF).
(3) Insitu shear vane strength c_u of peat (kPa) is data that excludes all outliers and tests within the acrotelm. The average insitu shear vane data within the failure height uses data to 2m below ground level.
(4) * Laboratory shear vane includes a notably higher value (11kPa) that skews results – the average value with higher results is shown in brackets.
(5) T5-TP1 peat sample was unsuitable for testing due to disturbance.

5.5 Comparison of Peat Strength Measurements and Degree of Humification

In addition to the above, the humification (fibre content) of the peat with depth was recorded at the trial pit locations to allow comparison of insitu and laboratory shear strength with humification. The results (Figure 13) show humification increasing with depth. Where humification is H3 or less, which is typically in the upper 1m, then there is an increase in shear strength with the insitu shear vane though the laboratory triaxial test results appear to be unaffected by the degree of humification. Laboratory triaxial test results are considered to have been affected by disturbance of the sample during retrieval and the difficulties in testing very weak peat samples in the laboratory. As such, laboratory test results are insensitive and do not reflect any notable strength change with the degree of humification. It would be expected that the more fibrous the peat (lower H values) the greater the relative shear strength.

Where humification is greater than about H4 to H5 then there is no appreciable change in measured vane strength. Note that when using the insitu shear vane high readings are typically encountered in the less humified peat at shallow depth, and also possibly towards the base of the peat where more resilient relict plant matter (such as tree fragments) may be encountered. These higher readings should not be used in design, see below. In general, the shear strength test results for the vane only appear to be affected by say humification of H3 or less.

5.6 Summary of Comparison of Peat Strength Measurements

A summary of the results for the various test methods is given below:

(1) The laboratory test results give notably lower bound results. This is likely due to a number of factors such as disturbance of the sample during retrieval and the difficulties in testing very weak peat samples particularly in the laboratory unconsolidated undrained (UU) triaxial test.

(2) The laboratory unconsolidated undrained (UU) triaxial test results for T4-TP1 and T7-TP1 provide strength results which are unrealistic with respect to the observed performance of the peat within the trial pits and are less than 2kPa. The laboratory strength tests results of less than 2kPa would typically represent the undrained strength of remoulded peat. Laboratory test results in this case do not provide a practical means of determining undrained peat strength.

(3) The laboratory shear vane results give a lower test result than the insitu shear vane, again this is likely due to disturbance of the sample. As such, the insitu shear vane would be considered to provide a more realistic result as the insitu peat is less disturbed.

(4) As mentioned above, in general there is a good correlation between the theoretical undrained strength at which failure of the side wall occurs and the undrained strength measured by the insitu shear vane over the full peat depth for the low range of peat strength present.

(5) The effect of peat humification (fibre content) on peat strength test results was assessed. It would be expected that the more fibrous the peat (lower H values) the greater the relative shear strength. The results show that the laboratory test results were insensitive to the degree of humification. The insitu vane showed where humification is H3 or less, which is typically in the upper 1m, then the insitu vane recorded an increase in shear strength.

(6) Based on the above results, the insitu shear vane strength compared to the other tests provides the most reasonable indication of the operational shear strength of peat particularly at the lower shear strength peat encountered within the trial pits. Notwithstanding, the insitu shear vane has limitations and its application for design needs to be used cautiously, see below.

The above shows that insitu shear vane results provide a reasonable correlation with back-analysed results of operational undrained strength of peat based on the above. The need to apply a factor to insitu vane results at this site is therefore not considered necessary provided the use and interpretation of the shear vane is carried out cautiously following the guidelines below. Shear vane strengths have been applied without factoring in previous work on Irish peat (see for example Hanrahan, 1964, Piggott et al, 1992). Factoring of vane results is generally applied in the absence of site-specific correlation; these factors need to be applied judiciously as they can provide misleading results (Jardine, 1998).

Guidelines on the use and interpretation of insitu shear vane with respect to this site based on the results of the further investigation at the site and general previous experience and empirical use are as follows:

(1) Careful scrutiny should be applied in interpreting vane results, particularly where anomalous higher results are obtained due to say high fibre content, presence of wood fragments, rod friction. Upper bound values which are outliers and would likely not control the operational strength of the peat should be discarded.

(2) Lower bound recorded vane strength should be adopted at any location for design purposes. A cautious estimate of the mean strength should not be used for design.

(3) The vane strength should be obtained for the full depth of the peat layer to ensure that zones of weaker peat within the profile have been identified. Notwithstanding, strength profiles with depth in weaker peat generally show that below the acrotelm layer there is a generally an increase in peat strength with depth, see **Figure 16** which shows results for a number of blanket peat sites.

(4) There is generally notable variation in insitu vane results. It is likely that the lower bound values will control the operating shear strength of peat and general previous experience indicates that consistent lower

bound results of less than 4 to 5kPa in an area represent greater potential for undrained peat failure (Figure 16). The lower bound vane strengths in any area shall be considered when assessing peat stability.

Other alternative methods for assessing insitu strength of peat such as cone penetration testing (CPT) using a variety of different shaped cone tips has been examined, for example Long et al (2014). Previous use of CPT on peat sites (such as at the Derrybrien Wind Farm site) have provided mixed results with a notable scatter of data, and it has proven difficult to establish reliable site specific correlation factors.

5.7 Walk-over Survey along Proposed Access to T18

A walk-over geomorphological assessment of the proposed access road to T18 was undertaken on 27 April 2021 by FT. The purpose of the assessment was to identify key geomorphological elements along the proposed access road to T18, which remains a key item of groundworks yet to be completed at the site.

The walk-over survey commenced at T18 with the purpose of recording the geomorphological features, such as morphology, vegetation cover, drainage, proximity of drains and natural watercourses, along the route to identify areas of potential concern.

The proposed road (length about 2.5km) generally runs parallel and along the northern side (left bank) of the Bunadaowen River which flows in a northeasterly direction through the northern part of the site. The valley sides are relatively shallow at T18 but become steeper upstream.

The proposed access road follows an existing forestry road which is proposed to be widened as part of the wind farm development. Part of the road was already under construction for a length of about 550m distance from T18. Within the section of partly constructed road, side casting of arisings was evident on the downside of the road; inspection of the side-casting shows no signs of instability. Where further works are carried out then no side-casting or loading of insitu peat shall be permitted, refer to Section 10.2.

The main area of concern identified was around 350m to 450m distance from T18 where probes indicated peat up to 4.5m.

A summary of the walk-over survey findings is included in Table 11 with sketches included in Appendix A6.

Table 11: Summary of walk-over survey findings along proposed access road to T18

Distance from T18	Geomorphology	Observations
0 – 350m	The road runs along break in valley slope that follows river valley. Slope rises to north. Gentle slope to south to river to thin alluvial valley. Mineral soil observed in drains and ditches.	Road has been widened, side-cast arisings of peat and mineral soil on downside of road to depths of about 1 to 1.5m.
350 – 720m	The valley slope curves away northward, opening valley up to form large bowl feature of flat ground north of road. Deep peat on downside of road – up to 4.5m at 350-450m. Small stream and minor valley parallel to road, peat appears thin and firm in this area.	Road has been widened to 550m. Side cast peat and mineral soil on downside of road to depths of 1m to 1.5m. Deep peat from 350 to 400m requires further investigation (see Ionic report in Appendix D).

Distance from T18	Geomorphology	Observations
720 - 1300	From stream crossing the road rises up hillside (5-10°). Small stream valley runs parallel and to south of road. General slope aspect is to east. Peat shallow and firm downside of road (1.0m depth) and deeper on upside of road. Road turns southward, crosses stream and rises sharply uphill at 15°. Thin peat (<1.0m), mineral soil and rock observed in drains. Road is on side-long ground.	Peat appears generally thin and firm. Slopes are greater than 5°.
1300 - 1800	Road on side-long ground on the northwest side of steeper river valley. Slope inclination is about 3°. Peat depth relatively shallow 0.8 to 1.8m.	Peat appears generally thin and firm.
1800 - 2100	From a high point the run descends slightly before rising over a ridge in the valley slope and crosses several streams. Road is on side-long ground. With slope inclination of about 10°. Slope downslope of road is undulating, likely indicating thin peat cover. The road rises and turns to the southwest	The roughness and undulations of the ground indicate thinner and firmer peat with mineral soil and rock at shallow depth.
2100 - 2500	Road is on side-long ground on relatively shallow slope inclination. Peat depth less than 2.0m.	The flatter topography would indicate potential deeper and softer accumulations of peat.

6. GROUND CONDITIONS AND PEAT STABILITY

6.1 Introduction

A multidisciplinary approach has been adopted for the assessment of ground conditions and peat stability. This has included as appropriate input from relevant disciplines from a number of parties, which has included geotechnical engineers (FT and Ionic), geologists (FT), hydrogeologists (HES), geomorphologists (FT), and ecologists (MKO). The findings of these disciplines have been included in this section and elsewhere within this report.

6.2 General Ground Conditions

The published ground conditions at the site (GSI, 2020) show that the site is covered by blanket peat (Figure 2). The peat is underlain by various strata on the site such as mineral soil, weathered rock or bedrock. The bedrock underlying the site comprises Precambrian quartzites, gneisses and schists with granites and intrusive rocks (GSI, 2020).

As part of the EIAR, investigation of particularly the strength and depth of peat was carried out at the site. In total, about 500 no. peat depth probes were undertaken within the wind farm footprint area for the EIAR. Peat depth recorded from the investigation ranged from 0 to 5.8m with an average of 1.7m. The majority of peat depths (about 73%) ranged from 0.5 to 2m. Further details of the peat conditions are given below.

Based on gouge cores and window sampling, also carried out as part of the EIAR investigation, a thin mineral subsoil layer or intact bedrock was identified underlying the blanket peat. The mineral subsoil layer was typically recorded as 0.1 to 0.45m thick and described as soft to firm to stiff, to locally hard, grey sandy SILT/CLAY, occasionally cobbly or very gravelly. The mineral subsoil in most cases was likely weathered bedrock or a thin glacial till layer. The presence of recorded soft grey sandy SILT/CLAY at a few locations (T1, T9 and construction compound) suggests possible localised normally consolidated mineral subsoil.

Bedrock, or presumed bedrock, was typically encountered at about 50% of all locations investigated, that included locations for turbines, borrow pits, compounds, substation, and at the metrological mast.

Bedrock was exposed at a number of existing borrow pits, and localised road cuttings across the site. Where bedrock was exposed it was described as part of EIAR investigation as typically massive and competent with a thin upper weathered rock layer at some locations. The description of the bedrock as massive would indicate widely spaced discontinuities within the rock mass.

As part of the design and construction works Ionic carried out investigation of the strength and depth of peat. In total out up to the end of April 2021, about 1750 no. peat strength and depth probes were undertaken within the wind farm site with further investigation carried out up to August 2021. See Appendix A1 (for data up to April 2021) with details and further data included in Ionic report in Appendix D.

6.3 Summary of General Ground Conditions

From the above, the general sequence of ground conditions at the site is summarised as follows:

(1) Blanket peat. Extensive covering of blanket peat, with peat depth typically in the range of 0.5 to 2m, though locally variable with areas of shallower and deeper peat (measured maximum depth of 5.8m).

(2) Mineral soil or weathered rock. Underlying the blanket peat was a thin mineral subsoil layer recorded as 0.1 to 0.45m thick of likely glacial till or weathered bedrock, or locally normally consolidated mineral subsoil, which may have been deposited in a lacustrine environment.

(3) Bedrock. Generally bedrock at shallow depth either directly underlying the blanket peat or underlying the mineral soil/weathered rock layer.

6.4 Peat Ground Conditions

As part of the EIAR, an assessment of the peat condition at the site was carried out (MKO, 2017 and AGEC, 2017). In addition, as part of detailed design for the works further investigation of the peat was carried out in advance and during the construction period by the designer (Ionic Consulting), details of which are included in Appendix D. The extent of the investigations for peat stability matters is shown on the ground investigation plan in Appendix A1.

6.4.1 Ground Investigation

The Guide (Scottish Government, 2017) provides guidance on the extent of ground investigations required for peat stability assessment. In the Guide there is reference to the Peatland Survey Guidance on Developments on Peatland (SEPA, 2017) which states for scoping of a site, probing at 1ha centres to assess for example site layout, environmental issues, carbon, drainage, should be carried out.

At the Meenbog site scoping has been completed and the effective site boundary for engineering purposes reduces to essentially the corridor of the infrastructure (zone of influence), or more correctly in Eurocode 7 Part 1 (2007) terms, the extent of the ground that covers the occurrence of the limit state. The critical limit state in this case would be the potential of initiating peat instability. With respect to spacing of investigation points for design of geotechnical works, Eurocode 7 Part 2 (2007) provides guidance with for linear structures, such as access roads. The guidance states investigation points should be spaced not greater than 20 to 200m apart.

Taking into account the total permitted proposed access road length of 14.5km for existing road/tracks requiring upgrading and about 7.7km of new access road (from the EIAR) this gives a total road length of 22.2km. Assuming the zone of influence along the infrastructure corridor is about 100m, this equates to an area of about 222ha.

Considering the about 1750 no. investigation points carried out by Ionic this would equate to a linear spacing of about 13m. Where the investigations points carried out as part of planning are also included (1750 + 500) then the linear spacing is about 10m. In terms of area (222ha), this equates to 8 to 10 investigation points per hectare.

Taking into account the investigation points at the site then the required spacing would readily satisfy the Eurocode 7 guidance. Notwithstanding, a requirement is included in this report to verify the ground conditions by further confirmatory testing and assessment in a zone of influence immediately in advance of construction works (see mitigation measures in Section 10.2).

6.4.2 Ground Investigations Pre-Construction

As part of the EIAR assessment as prepared by AGEC, the peat at the site was described as firm brown/black fibrous PEAT (in the shallow peat areas) and spongy and plastic black amorphous PEAT (in the deeper peat areas). The blanket peat comprised typically shallow peat areas with deeper peat deposits in the flatter areas on site. The identified deeper peat areas were located outside of the wind farm footprint to the southeast of T5, to the northwest of T10 and to the southeast of the substation location. The deeper peat deposits are locally present in the flatter areas on site were identified and highlighted on the construction buffer zone plan included in AGEC (2017). These deeper peat areas were avoided when optimising the wind farm layout for site.

At the EIAR stage, as the deeper peat areas were outside of the wind farm construction footprint they were not considered to represent a peat slide risk. Locally, the peat in the deeper peat areas was recorded as quaking (or buoyant) indicating highly saturated peat, which would be considered to have low strength.

These areas of deeper peat likely represent the locations of shallow depressions in the original post glacial land surface that were possibly relict lakes and that have subsequently been infilled with peat.

Peat strength testing was carried out for the EIAR assessment by AGEC using an insitu Geonor H-60 Hand-Field Vane Tester. Whilst it is recognised that this test gives indicative results for in-situ strength of peat it is generally considered best practice for the field assessment of peat strength, see Section 5. Strength testing was carried out at the selected locations across the site, but most notably at turbine locations, to provide representative coverage of indicative peat strengths (**Figure 3**). The hand vane results indicated undrained shear strengths in the range of 5 to about 50kPa, with an average value of about 15kPa. The lower bound strengths recorded would be typical for deep weak saturated peat and were recorded in the deeper peat areas in the flatter areas of the site.

Typically strengths less than about 4kPa, would indicate a higher potential for instability. The shear vane strengths quoted in this report are unfactored based on the findings of site specific trials and strict guidelines on their interpretation, see Section 5.6. Shear vanes results can be factored to allow for example possible entanglement of fibres in the shear vane. The factor used is typically shear vane x 0.5 (for example Edil (2001), Mesri & Ajlouni (2007), Boylan & Long (2014), Zwanenburg & Jardine (2015)).

6.4.3 Ground Investigations During Construction

During construction and for design purposes, ground investigation of particularly the peat strength and depth was carried out by Ionic. In the previous revision of this report up to the end of November 2020, about 300 no. peat depth probes and insitu hand shear vanes had been carried out. With ongoing testing, the total up to the end of April 2021, is about 1750 no. peat depth probes and insitu hand shear vanes undertaken within the wind farm footprint area (see Appendix A1 and Appendix D, which includes data up to August 2021).

Peat depth recorded from the investigation during construction ranged from 0 to very locally about 7m with an average depth of 1.8m. The majority of peat depths (about 65%) were less than 2m.

Hand vane shear strength test results indicate undrained shear strengths in the range of 2 to 30kPa, with an average value of about 9kPa. In the previous revision of this report up to the end of November 2020, the average value was about 12kPa. The reduction in the average value is due to a focus on testing within more critical areas.

The results are shown in **Figure 3** and are compared to the pre-construction results and for results obtained from the upper scar of the 12 November 2020 peat failure. The results from the 12 November failure for the upper scar area (see Section 8.) are notably less than those recorded from the other ground investigations.

6.4.4 Summary of Peat Ground Conditions

In general, the results of the pre-construction investigations showed higher vane shear strength test results when compared to during construction investigations with average results of 15 and 9kPa, respectively. The reason for this is that during construction investigation, particularly after the 12 November failure, focused on critical areas of potentially weaker peat.

The pre-construction results show a more erratic distribution of peat strength, which is attributed to testing being carried out at essentially turbine bases, where there were notable variations in peat conditions (**Figure 3**). The majority of the investigation during construction was predominantly along access roads where there was a more uniform change in peat conditions The undrained peat strength with depth (**Figure 4**) also shows similar results for both investigations.

The vane shear strength test results for the upper scar of the 12 November 2020 peat failure showed significantly lower results than the pre-construction and during construction investigations, see **Figure 3** and Appendix A2. The upper scar of the peat failure showed an undrained shear strength range from 2 to 9kPa, with an average of slightly less than about 5kPa. These values are notably low and are likely at the lower limit of what can be practically measured with the hand vane. The results show a reasonably consistent strength with depth and represent the lower bound strength profile with depth for all the test results (**Figure 5**).

The test results for the upper scar of the 12 November 2020 failure show no appreciable strength gain with depth which would be typical of a saturated peat mass that has remained essentially water-logged over time. These results represent a body of very weak and saturated peat that was not identified in the previous investigations.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally consistently very low, for example the operational undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from essentially back-analysis, though some testing was carried out, was estimated at 2.5kPa.

6.5 Hydrology

The site is situated within the Bunadaowen River and the Glendergan River catchments. Both catchments are within the larger Mourne River catchment. Most of the site drains directly into the Bunadaowen River which flows in a northeasterly direction through the northern part of the site **Figure 1**.

The hydrology of the site was assessed in the EIAR (2017), by hydrology specialist Hydro Environmental Servicers (HES). The Bunadaowen River joins the Mourne Beg River about 0.3km to the north of the site. Within the Bunadaowen River catchment the site area is also drained by several tributary streams which flow in a general northerly direction towards the Bunadaowen River. Based on EIAR (2017), the streams are typically deeply incised, narrow eroding streams with a width of 0.5 to 1m.

The most southern part of the site drains to the Glendergan River which flows along the southern boundary of the site. A number of tributary streams which rise in the site flow in a southerly direction join the Glendergan River.

The eastern part of the site drains to the Shruhangarve Stream which flows for about 2.4km from the site in a northeasterly direction where it joins the Mourne Beg River. The 12 November peat failure entered the Shruhangarve Stream.

The location of rivers and streams on the site are shown on the geomorphological plan in Appendix B.

Within the site there are numerous manmade drains, mostly installed to drain the existing forestry plantations. The forestry drainage pattern is influenced by the local topography, ground conditions, layout of the forestry plantations and existing access roads. Based on EIAR (2017), the forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantations. The proper functioning of drains is important as it removes surface water from the site, which is important in limiting the potential for peat instability as a result of water build-up within the peat.

The mound drains and ploughed ribbon drains are generally spaced about 15 to 20m and 2m respectively. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of existing forestry access roads.

6.6 Geomorphology

The southern part of the site is dominated by a ridge line that extends northeast from Carrickaduff Hill, see **Figure 1**. Most of the turbines for the wind farm are located along this ridge line. The top of the ridge line varies in elevation from 180 to 310mOD. The northern part of the site is essentially within the Bunadaowen River valley, which runs parallel to the ridge line.

The top of the Carrickaduff Hill ridge line comprises in many places a broad level surface. The broad level surface has notable depths of peat up to locally in excess of 4m. Eastwards the ridge line declines in elevation and a number of broad level benches are present, again with notable depths of peat. Slope gradients along the ridge line are typically from 1 to about 10 degrees, with locally up to about 20 degrees.

Adjacent to the high point (at 313mOD) of the ridge line there is an elongated small water body, Carrickaduff Lough. The lough is located within a short steep-sided narrow valley aligned along the axis of the ridge line. This valley feature is possibly controlled by the structural geology control or is a relict glaciation feature.

The northern side of the ridge line comprises a relatively uniform slope which is drained by a number of tributary streams that flow into the Bunadaowen River. The southern side of the ridge line comprises a more varied slope profile with locally steeper sections as a result of rock near-surface. A limited number of streams are located on the southern slope and drain into the Glendergan River.

The peat cover on the ridge line comprises an almost continuous cover of blanket peat. Rock is exposed at the surface at a few locations. The peat cover shows little signs of erosion, though it has been heavily dissected due to forestry drainage and access roads.

The Bunadaowen River valley in the southern part of the site is a high level river valley with an elevation from about 150 to 230mOD. The valley floor comprises notably flatter ground running along the south side of the river. Peat depths of locally 6m have been recorded in the valley (AGEC, 2017). This indicates that the valley floor has been infilled with peat and that in the past the valley floor was at a lower level and was possibly a post-glacial lake. The extent of peat infilling in the valley floor is not known as there is limited construction in this area.

A geomorphological plan of the site is included in Appendix B.

6.7 Ecology (Habitats)

The ecological habitats of the site are considered most relevant to the multi-disciplinary approach taken in the assessment of ground conditions and peat stability, rather than fauna species which were also assessed in detail at the pre-planning stage of the project.

The Meenbog wind farm is located within an area that is dominated by upland forestry with also some peatland and woodland habitats in the area. The watercourses that arise in or pass through the site flow into sensitive watercourses that are designated for conservation as the Lough Foyle and tributaries SAC and the River Finn SAC. These European Sites are designated for the protection of habitats and species including (3260) Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation, salmon and otter that are known to occur downstream of the site.

Although there are habitats of ecological significance within the study area, the development footprint is dominated by habitats considered to be of low ecological value. 92.5% of the development footprint is dominated by habitat classified as Local importance (lower value). Such habitats include Conifer Plantation (WD4), Wet grassland (GS4), Scrub (WS1) and Spoil and bare ground (ED2). A small percentage of the development footprint is located on peatlands of a higher ecological value. Works within watercourses were avoided entirely in the design of the project. Peatland and aquatic habitats were identified as key ecological receptors.

Active areas of Upland blanket bog (PB2)/Wet Heath (HH3) mosaic were found to correspond to the E.U. Habitats Directive Annex I habitats Active Blanket Bog [7130* priority) and Atlantic Wet Heaths with Erica tetralix (Natura 2000 code 4010). Areas of cutover and degraded blanket peats (PB4) correspond to the E.U. Habitats Directive Annex I habitat Blanket Bog [7130). These habitats have been assigned National Importance on the basis of supporting a 'viable area' of habitats listed in Annex I of the EU Habitats Directive.

The Dystrophic lake (FW1) recorded within the study area was found to correspond to the E.U. Habitats Directive Annex I habitat Natural dystrophic lakes and ponds (Natura 2000 Code 3160). This habitat has been assigned National Importance on the basis of supporting a 'viable area' of a habitat listed in Annex I of the EU Habitats Directive.

The Upland Eroding Rivers (FW1) that flow through the site were assigned Local Importance (higher value) on the basis of supporting semi-natural habitat types with high biodiversity and high degree of naturalness in a local context. In addition, the study in relation to European Sites and the AA Screening identified a pathway for effect on the Annex I riverine habitat Ranunculion fluitantis and Callitricho-Batrachion vegetation that is located downstream of the site in the Lough Foyle & Tributaries SAC. This habitat has been assigned International Significance.

The watercourses also have potential as a habitat for a number of species that are listed on Annex II of the EU Habitats Directive (e.g. otter, salmon, freshwater pearl mussel etc.).

With respect to specific ecological habitat and the susceptibility to peat stability, there is no established relationship. This in part may be related to the fact that the original peatland habitat has been greatly affected by man's activity such as grazing and forestry, hence any potential habitat indicators of potential susceptibility to peat instability have been masked or erased. Historical data for peat instability clearly shows that peat failures occur within many habitats.

7. ASSESSMENT OF CONSTRUCTED WORKS

7.1 Assessment of Constructed Works

A detailed walk-over inspection with ground investigation in selected areas was carried out along all construction works and at the location of any remaining construction works. Given the nature of the construction, any instability or incipient instability of the peat at the site would be associated and local to the construction.

The detailed assessment of the stability of the constructed works involved observations and at selected locations ground investigation by FT of peat using a Geonor H-60 Hand-Field Vane Tester. Detailed findings are included in Appendix A4, with a summary of the findings given below. Any recommendations or mitigation measures given below are included within the Summary and Mitigation Measures section.

A detailed peat stability assessment by Ionic along the infrastructure corridor has also been carried out, a summary of which is also included below.

7.1.1 Floating Roads

Based on visual observations the floating roads show no evidence of instability with no apparent localised signs of incipient peat failure. Mitigation measures are included in this report to provide testing of all floating roads.

Access road to T18 is still in part to be completed. The access road is on sidelong ground. It is recommended that the remaining section of access road is founded on competent stratum, especially at stream and drain crossings.

The ground condition along several lengths of floating road were also examined as well as the condition of the floating roads. Ground conditions recorded along the floating roads were not dissimilar from that recorded during construction.

Given the nature of floating roads there is clear settlement of the roads during construction as would be expected, particularly around T1/T2 junction. Ongoing settlement of the roads will continue over time. This does not represent an increased risk of peat failure as the settlement of the road will result in consolidation of the underlying peat with a subsequent gain in strength over time. As such, the stability of the floating road will increase over time.

Secondary settlement (creep) of the peat would be expected to continue over the full life of the road; secondary settlement (creep) may result in settlement continuing at a progressively slower rate for many years.

7.1.2 Turbines and Hard Stands

No evidence of adverse stability was observed at and around turbines and hard stands. T16 has a small peat slip between the hard stand and the perimeter cut-off drain, resulting in water from the drain flowing into the hard stand, which should be repaired. Tension cracks are present upslope of T5, which would have occurred as a result of movement of peat towards the open turbine and hardstand excavation; the excavation has been backfilled and the turbine base and hardstand completed. The tension cracks would not present a stability risk.

There is a minor slump adjacent to the hard stand at T19, this does not represent a stability risk.

7.1.3 Other Construction Works

Excavated peat has been backfilled into 3 no. borrow pits across the site. There is no evidence of adverse instability. Peat storage berms at T15 and T17 show minor signs of movement/distress and should be monitored or additional material placed to increase berm size.

7.2 Ionic Peat Stability Assessment of Constructed and Proposed Works

A detailed quantitative peat stability assessment has been carried out by Ionic along the infrastructure corridor. Details are included in the Ionic report in Appendix D and a summary is included below.

(1) Ionic have carried out a stability assessment of the overall Meenbog Wind Farm as currently constructed. The civil engineering works were almost completed before all works were suspended on site following a peat slide at T7. Prior to completing the remaining civil works an overall site assessment was carried out to ensure that all the original and deposited peat across the site is stable.

(2) To inform the assessment an as-built survey was carried out of all roads, hardstandings, turbine foundations, peat storage areas, peat stabilisation works, and drainage works carried out to date. The vast majority of the site has been constructed at the time of writing of this report.

(3) The Lidar terrain data, civil engineering design, as-built survey, existing and supplemental peat testing were relied upon to complete the assessment, along with a series of walkovers, visual inspections and review of aerial drone footage.

(4) The assessment focused on the stability of peat under the various scenarios, which include:

- (a) Original undisturbed peat
- (b) Sidecasted peat on original bog
- (c) Construction vehicles directly on bog (wide track machines)
- (d) Floating road permanent dead loading
- (e) Crane loading on floating roads
- (f) Peat Storage Areas (bermed areas)
- (g) Peat Stabilisation (Walls 1, 2, 3, T8 & the raised Spine Road SR00 south of T10), refer to Ionic report for details.

(5) The Ionic assessment was carried out to Eurocode 7 with partial factors applied for materials and loads as applicable. The site has been shown to be stable based upon this quantitative assessment with the exception of a short sections of the T4 floating road which will be upgraded as outlined in Section 5.4.1 of the Ionic report, as well as an area south west of turbine T7 which is outside of the works area and where tracking of vehicles will not be permitted.

(6) Further to the stability analysis described above, Ionic undertook a sensitivity analysis on a site-wide basis to identify defined areas for further consideration/assessment. The sensitivity analysis identified areas which may be sensitive to variability, in particular shear strength. The areas identified were subject to further assessment, the findings of which are included in section 7 of the Ionic report. The findings of the sensitivity analysis supported the original stability results. In areas identified for further assessment, additional shear strength tests were also undertaken to depth in peat.

(7) Ionic can therefore confirm that the overall site is currently stable based upon the detailed assessment carried out along all roads, hardstandings, borrow pits, peat storage areas and peat stabilisation areas. Prior to component deliveries and turbine supplier crane access to T1, T2 and T4 the works outlined in Sections 5.4.1 and 5.4.2 of the Ionic report (Appendix D) should be completed and any outlined mitigation measures adopted.

7.3 Peat Failures on Site During Construction

Prior to the peat failure of 12 November 2020 there were a number of peat failures on the site that occurred during construction of the wind farm on 3 June 2020 or before. These failures are referenced and shown on **Figure 2**. Details of the peat failures based on site inspection observations, construction records and drone surveys are given below. The failures essentially occurred within the forestry plantations, that covers much of the area, and remained within the boundary of the site.

The peat failure of 12 November 2020 is addressed under a separate heading below.

7.3.1 Peat Failures at Borrow Pit Between T5 and T6

These peat failures were the subject of a report produced by the contractor for the works, (MCE, 2020). Altogether 3 peat failures were recorded at this location (**Figure 2**).

Insitu peat was being excavated as part of access road construction at the location of the borrow pit to the east of T5. Excavated peat was being side cast and the road was being backfilled with quarry rock. As part of the road construction the plant operator was placing excavated peat to the north and south of the access road.

The peat failures comprised translational sliding of peat with the basal shear surface at or immediately above the base of the peat. The cause of these failures was undrained loading of the insitu peat due to excessive loading from placed peat, see below a back-analysis of likely loading to cause failure.

Based on MCE (2020), peat failure (reference 1) comprised a minor slide within the borrow pit located on the upslope side of the access road. The mechanism of the failure was triggered by excavated peat being placed on insitu peat. The placed excavated peat caused excessive loading that resulted in an undrained loading failure of the insitu peat which then due led to progressive failure of insitu peat downslope. The approximate size of the failure was 2000m^3. We understand that this failure crossed the line of the access road where failure debris loaded insitu peat downslope.

The failure debris then loaded insitu peat downslope and resulted in a further peat failure (reference 2). Again the failure was caused by undrained loading of the insitu peat, similar to Hutchinson and Bhandari (1971). This failure moved further downslope and covered an area of 1.24ha with an approximate volume of 11,000m^3. This failure extended downslope some 260m.

It is understood that as works approached the centre of the borrow pit, the peat depth increased to about 3m, and for this reason it became difficult to side cast the peat on the upslope side of the road and so the excavated peat was placed on the downslope side. Excavated peat side cast on the downslope side of the access road to the east of the borrow pit resulted in a further peat failure (reference 3). This failure moved downslope about 750m and covered an area of 3ha with an approximate volume of 27,000m^3. To ensure that the peat failure was safely constrained a rock berm was constructed by MCE to prevent any further movement.

It appears at the location of peat failure (reference 3) that localised infilled depression was present in the area.

Following these peat failures a range of mitigation measures were carried out by the contractor to limit further peat failures, these mitigation measures are detailed in MCE (2020).

Site inspection of these failures shows that the extent of the failure was entirely within forestry and that the failed material has come to rest and shows no visible signs of further risk of instability. Inspection of the failure scars shows no retrogression of the failure scars, for example collapse of the side wall of the failure scar.

7.3.2 Peat Failure at T12

This peat failure was located in the area of T12 with the initiation of the failure located downslope of the access road that passes about 60m to the south of T12 (**Figure 2**).

The failure (reference 4) occurred prior to construction of T12. The initiation point corresponds to a location where excavated peat was being side cast downslope of an access road.

The peat failure comprised translational sliding of peat with the basal shear surface at or immediately above the base of the peat. The cause of the failure was undrained loading of the insitu peat due to excessive loading from excavated placed peat. Insitu shear testing of peat at this location by Ionic showed a strength of 8 to 15kPa with peat depth 1.5 to 2m.

The mechanism of the failure was placed excavated peat causing excessive loading that resulted in an undrained loading failure of the insitu peat which then due led to progressive failure of insitu peat downslope. The failure extended about 200m downslope and was about 30m wide (**Figure 6**). The estimated volume of the failure was 10,500m^3.

7.3.3 Minor Instability

A number of minor peat instabilities were identified during the site inspection of the construction works. These generally comprised separate and localised movement of peat with generally the movement of peat limited to a few metres. Such minor movements in peat would generally not be considered uncommon.

Instability at T5

The instability at T5 comprised a series of concentric tension cracks within the insitu peat located around T5, see reference 5 in **Figure 2**. The instability likely occurred during excavation of the turbine base at T5 and represents a movement of the upslope adjacent insitu peat towards the excavation. The affected area extended about 30m, see **Figure 7**. This type of instability in excavations in peat would not be considered uncommon based on inspection of numerous works in peat land areas. The nearest insitu shear testing of peat at this location by Ionic showed a strength of 4 to 7kPa with peat depth 2.6 to 3.7m. The construction of the turbine base and infilling of the excavation has essentially stabilised the adjacent insitu peat.

Instability at T16

The instability at T16 comprised a minor slumping of insitu peat, see reference 6 in **Figure 2**. The instability likely occurred during excavation of the access road into the turbine base for T16. The combination of placed insitu peat from a perimeter drain in combination with undercutting of the peat slope likely caused the instability. The instability affected an area of about 20m by 20m, see **Figure 8**. Insitu shear testing of peat at this location by Ionic showed a strength of less than 4kPa with peat depth 1.4m. The construction of the access road to the turbine has essentially stabilised the insitu peat.

S-bends Roadworks

The Contractor had placed crushed rock at about Ch.2630 on the north side of the S-bends on the approach road into the site (see reference 8 in **Figure 2**). Based on discussions with site operatives, we understand that the crushed rock was placed adjacent to the approach road for the purpose carrying out road widening works. The stockpile caused a localised ground movement in the peat below the stockpile.

7.3.4 Back-analysis of Peat Failures on Site During Construction

A numerical assessment of the peat failures that occurred on site during construction has been carried out to provide an understanding of the likely failure mechanism, and to determine the lessons learned which are to be included in this assessment and future construction at the site.

Altogether 3 no. peat failures occurred at or near the borrow pit between T5 and T6. These failure are described in more detail in Section 7.3.1 and their location shown in **Figure 2**. A record of the failures is presented in a report produced by the contractor for the works MCE (2020).

The peat failures comprised translational sliding of peat with the basal shear surface at or immediately above the base of the peat. The cause of these failures appears to have occurred due to undrained loading of the insitu peat due i.e. placed peat appears to have resulted in excessive loading at the head of the failure. For the purpose of back-analysis peat failure reference 3 in MCE (2020) has been used.

Peat failure (reference 3) also appears to have occurred due to undrained loading of the insitu peat. It is understood that as works approached the centre of the borrow pit, the peat depth increased and for this reason it became difficult to side cast the peat on the upslope side of the road and so the excavated peat was placed on the downslope side. Excavated peat side cast on the downslope side of the access caused a peat failure that moved downslope about 750m and covered an area of 3ha with an approximate volume of 27,000m^3.

The back-analyses has examined the initiation of the failure which is essentially shear failure below the excavated material placed on the downslope side of the access. The following information and assumptions have been used in the back-analysis:

(1) Peat depth determined from peat probing by Ionic adjacent to the head of the failure, that is immediately downslope of the access road.

(2) Peat strength determined by insitu shear vanes carried out by Ionic adjacent to the head of the failure. The upper acrotelm layer of the peat would have been dissected by forestry drains and construction activity so would have a reduced strength.

(3) Ground surface profile determined form LiDAR survey.

(4) Placed material assumed to be excavated peat with a density of 10kN/m^3.

(5) Failure assumed to be initiated by shear within the peat below the placed excavated material. Shear failure modelled by circular failure using Morgenstern and Price method.

(6) Shear failure occurs wholly within the peat. Inspection of the failure scar clearly shows that the shear failure has occurred within the basal layer of the peat.

(7) Sensitivity analyses carried out to determine the range of height of placed material and likely operating undrained shear strength of peat to achieve a global factor of safety of unit (basically failure).

The results of the back-analysis together with an example of stability output are shown in **Figure 14**. The main findings of the back-analysis are as follows:

(1) A review of the nearest insitu shear test vane results (see Ionic report in Appendix D) shows peat strength ranging from about 3 to 20kPa. Based on inspection of the peat in the failure scar and a review of the range of the results it is considered that the higher test results are outliers. This gives most probable range of strength of about 3 to 9kPa, with an average of about 6kPa.

(2) Assuming an operating insitu peat strength of about 6kPa then this would suggest that peat material up to about 4.5m was placed onto the peat surface, assuming that progressive reduction of the peat strength did not occur as the peat deformed below the loading.

(3) Observations at the time of the failure refer to peat up to 3 to 4m being placed downslope of the road. Typically when material is placed onto the peat surface a proportion of this material sinks into the peat, as such it is difficult by observations to determine the real height of material placed.

(4) It is likely also that as material was placed onto the peat surface, and as deformation of the insitu peat occurred, that the intact peat strength reduced progressively as more material was placed.

(5) The back-analysis is considered to provide a reasonable indication of the height of material placed and the likely initial operating strength of the insitu peat, as determined by shear vane.

7.3.5 Summary of Peat Instability on Site During Construction

Summary of peat instability is given below.

(1) A number of peat failures (4 no.) occurred on site during construction. These failures comprised translational sliding of peat with the basal shear surface at or immediately above the base of the peat. These peat failures were recorded by MCE to range in failure volume from 2,000 to 27,000m^3 and extended downslope up to 750m.

(2) The failures essentially occurred within the forestry plantation and remained on the site. Site inspection of these failures show that the failed material has come to rest and is not considered at risk of instability. Inspection of the failure scars shows no retrogression of the failure scars, for example collapse of the side wall of the failure scar.

(3) The mechanism of the failures (references 1, 3 and 4) was placed excavated peat causing excessive loading that resulted in an undrained loading failure of the underlying peat which then led to progressive failure of insitu peat downslope. In particular , placing of excavated peat on the downslope margin of access roads.

(4) The mechanism of the failure (reference 2) was failure debris from upslope (reference 1) loading insitu peat downslope, which caused undrained loading of the insitu peat and subsequent failure.

(5) Observations at the time of the failure refer to peat up to 3 to 4m being placed downslope of the road. The back-analysis of failure reference 3 is considered to provide a reasonable indication of the height of material placed and the likely operating strength of the insitu peat, as determined by shear vane.

(6) Following these peat failures a range of mitigation measures were carried out by the contractor to limit further peat failures, these mitigation measures are detailed in MCE (2020).

(7) A number of minor peat instabilities were identified on site, for example at T5, T16 and at S-bends. These generally comprised localised movement of peat with generally limited movement of peat. Such minor movements in peat would generally not be considered uncommon given the type of construction.

Based on the above, a summary of the likely causes of the identified peat failures at the site during construction are given in Table 12.

Table 12: Summary of likely causes peat failures on site during construction

Location	Ground Conditions	Likely Cause of Failure
Peat failure reference 1 at borrow pit between T5 and T6	Based on MCE (2020), peat depth of 3m is quoted, though the area appears to have exposed mineral soil/rock at shallow depth.	The mechanism of the failure was triggered by excessive excavated arisings (peat) being placed on insitu peat. The placed excavated peat caused excessive loading that resulted in an undrained loading failure of the insitu peat which then due led to progressive failure of insitu peat downslope. The failure initially travelled only a short distance.
Peat failure reference 2 at borrow pit between T5 and T6	Assumed similar to peat failure reference 3.	Taking into account the back-analysis at nearby peat failure reference 3, the likely cause of failure was excessive loading due to surcharging of failed debris from peat failure reference 1 causing undrained shear failure of the underlying peat leading to progressive downslope failure. Downslope run-out distance was controlled by forestry furrows with the failed material coming to rest as insitu peat downslope shallowed/increased in strength.

Location	Ground Conditions	Likely Cause of Failure
Peat failure reference 3 at borrow pit between T5 and T6	Ionic recorded peat depth to the west of T6 varied from 0.2 to 1.9m. Peat strength varied from 3kPa to 20kPa with an average, which discounts outliers of about 6kPa.	Given the recorded peat strength in the area and taking into account the back-analysis at this location, the most likely cause of failure was excessive loading of arisings on the downslope side of the access road causing undrained shear failure of the underlying peat leading to progressive downslope failure. Initial downslope run-out distance was controlled by forestry furrows. Further downslope the failed debris entered a shallow elongate drainage feature with deeper and weaker peat, which caused the failure to change direction and follow the feature further downslope.
Failure at T12 (reference 4)	Ionic results are available for the area around T12. Peat depth varied from 1.5 to 2m. Peat strength varied from 8kPa to 15kPa.	Given the recorded peat strength in the area and taking into account the back-analysis from peat failure reference 3, the most likely cause of failure was excessive loading of arisings on the downslope side of the access road. Downslope run-out distance was controlled by forestry furrows with the failed material coming to rest as insitu peat downslope shallowed/increased in strength.
Minor instability at T5	Nearby Ionic testing showed a strength of 4 to 7kPa with peat depth 2.6 to 3.7m.	The cause of the instability was inappropriate support to the excavation for T5. This resulted in the initiation of an incipient translational slide within the adjacent peat upslope with the onset of tension cracks. The construction of the turbine base and infilling of the excavation essentially stabilised the adjacent insitu peat.
Minor instability at T16	Insitu shear testing of peat at this location by Ionic showed a strength of less than 4kPa with peat depth 1.4m.	The instability likely occurred during excavation of the access road into the turbine base for T16. The combination of loading from excavated peat placed onto the peat surface from a perimeter drain in combination with undercutting of the peat slope likely caused the instability.
Minor instability S-bends Roadworks	Ground conditions are not known but understand that stockpile of placed crushed rock caused a localised ground movement in the peat below the stockpile.	The likely cause of failure was excessive loading of placed material on peat causing undrained shear failure of the underlying peat leading to failure.

7.4 Comparison of Peat Conditions at Selected Locations

Ground investigation of peat strength and depth was carried out by FT at selected locations in November and December 2020 on the site using an insitu Geonor H-60 Hand-Field Vane Tester and depth probes. The selected locations were typically areas of floating roads or locations of peat instability. The purpose of the investigation was to assess the peat depth and strength but also to compare the results with the investigation carried out for design purposes, and to provide the likely cause of failure.

A summary of this data and comparison with data obtained during construction is provided in Table 13.

Table 13: Ground conditions at selected locations on site

Location	FT Data	Construction Data	Comment
Failure at T12 (reference 4)	Peat depth either side of the failure varied from 1 to 1.5m. Peat strength varied from 4kPa to 14kPa with an average of about 9kPa.	Results are available for the area around T12. Peat depth varied from 1.5 to 2m. Peat strength varied from 8kPa to 15kPa.	Results are similar with respect to depth and peat strength. The data from the failure area indicates that peat is thinning downslope, which was one of the likely reasons that the failure lost momentum downslope.
Peat failure reference 3 at borrow pit between T5 and T6	Peat depth to the west of T6 varied from 0.2 to 1.9m. Peat strength varied from 6kPa to 22kPa with an average of about 14kPa.	Peat depth to the west of T6 varied from 1.5 to 2.4m. Peat strength varied from 8kPa to 14kPa with an average of about 11kPa.	Results are similar with respect to peat strength, though peat depth appears to be increasing to the west where the failure occurred.
Floating access road from T3 toT5	Peat depth along access road varied from 2.3 to 3.4m. Peat strength varied from 7kPa to 16kPa with an average of about 10kPa.	Peat depth along access road varied from 2.1 to 4m. Peat strength varied from 4kPa to 9kPa.	Located along floating access road. Results show a difference with the construction results showing slightly deeper and weaker peat.
Short section of floating access road from junction of T1 access to junction to T2 access	Peat depth along access road varied from 1.6. to 4m. Peat strength varied from 10kPa to 22kPa with an average of about 10kPa.	Peat depth along access road varied from 0.8 to 5m. Peat strength varied from typically 5kPa to 11kPa.	Located along floating access road. Results show a difference with the construction results showing slightly deeper and weaker peat.
T4	Peat depth varied from typically 1.6 to 3.2m. Peat strength varied from typically 6kPa to 18kPa with an average of about 11kPa	Peat depth along access road varied from 2 to 3.5m. Peat strength varied from typically 6kPa to 9kPa.	Results show a difference with the construction results showing slightly deeper and weaker peat.
Upper scar of peat failure on 12 November 2020	Peat depth taken along margin of upper scar varied from typically 1.7 to 3.5m. Peat strength varied from typically 2kPa to about 9kPa with an average of about 5kPa	No data	Results obtained from the upper scar show notably weaker peat strength compared to any other location on the site.

Note: Construction data from Ionic Consulting which has been subject to ongoing updates as additional ground investigation has been made completed, see Appendix A1

In general, the results of the FT data show similar results with respect to peat depth and strength recorded during construction (note that since FT carried out their survey further investigation has been carried out by Ionic). At several locations, the construction records showed slightly deeper and weaker peat. The difference in the data at several locations is not considered significant as there is generally a natural variation in peat depth and strength and the data was not recorded at the exact locations.

The peat strength in the location of the peat failures at the borrow pit and at T12 (references 3 and 4) show relatively high strength and would be adequate for the wind farm development with the appropriate construction measures in place. The recorded peat strength at these failure locations would not normally be associated with peat failures. A review of rainfall, which can also cause peat failures, during the preceding period shows that rainfall was limited, see Appendix A5.

Overall the vane shear strength test results, except for those for the upper scar of the 12 November 2020 peat failure, would not be considered notably low and would be considered adequate for the wind farm development with the appropriate construction measures in place.

The strength results for peat, except for the vane shear strength test results for the upper scar of the 12 November 2020 peat failure, would not be considered notably low and would be adequate for the wind farm development with the appropriate construction measures in place.

8. PEAT FAILURE OF 12 NOVEMBER 2020

8.1 General

At the time of the failure, construction work was being carried out on the floating road to T7 (Figure 9). Construction works for the floating road had progressed to essentially the downslope margin of the upper scar prior to the peat failure. The access track and T7 hard stand and base to the south of the peat failure had yet to be constructed though preparatory works had started, such as laying of timbers and brash along the line of the access track to T7.

A summary of the failure is provided below for reference. The failure is reference 7 shown on Figure 2.

8.2 Description of Ground Conditions at Failure Site

8.2.1 Topography

The failure site comprises the upper and lower scars, as shown on plan and in section in Figure 9. The primary source of the failed material, which was essentially peat, was the upper scar. The upper scar is located on a flat plateau area at an elevation of about 266mOD that extends northwards from the highpoint of the site, which is at an elevation of 313mOD.

The flat plateau area had not been planted with forestry and remained as open peat land and covered an area of about 340m by 280m (9.5ha). We understand that a series of drains were installed as part of the forestry plantation, with the drains essentially located in the southern part of the open peat land. The reason why forestry was not planted in this area is not known. Given the flat nature of the area, it would be prone to water-logging.

The head of the upper scar is approximately at the location where there is a local steepening of the ground profile of the flat plateau area. The location of the floating access track under construction at the time of failure is essentially at the convex break of slope. Upslope from this location the average slope angle is less than about 1 degree within the flat plateau area, and downslope of this location the average slope angle is about 4 degrees. The location of floating access track followed the upslope edge of the forestry plantation that was located on the slightly steeper, and better drained, downslope.

8.2.2 Ground Conditions

The sequence of ground conditions at the failure site, that is the upper and lower scars, based on site observations and some limited in situ testing is given below with details provided in Appendix A2.

(1) Blanket peat. Peat depth is typically in the range of 1.5 to greater than 3.5m. The upper scar has notably deeper peat with an average depth of 2.7m, though locally greater than 3 to 3.5m. The lower scar has an average peat depth of 1.8m.

(2) Mineral soil or weathered rock. Underlying the blanket peat a mineral subsoil layer was observed in the floor of the scars which is likely glacial till or weathered bedrock.

(3) Bedrock. Within the floor of particularly the lower scar localised bedrock was observed. In situ testing around the upper scar also indicated possible bedrock directly underlying the peat.

Peat strength testing was carried out in advance of the floating road construction along the line of the road in the area of the peat failure using an in-situ hand vane by the designer, Ionic. The results showed undrained peat strength in the range 7 to 12kPa. The results showed undrained peat strength in the range 7 to 12kPa. These results are not unusually low, and lower results had been recorded on other parts of the site where floating roads had already been constructed. No testing was carried out within the flat plateau area upslope of the road, as it was outside the works footprint and at the time it was not recognised that this area represented a stability risk. A review of the closest results to the failed section of floating road from Ionic (T7-C and T7-5) show vane strength of 4.5 to 7kPa, peat depth of 2.4 to 2.9m with slope inclination of 2.4 to 3.5 degrees.

Following the peat failure in situ vane testing was carried out by FT at selected locations around the perimeter of the upper and lower scars. Shear vane locations were typically within 5m of the furthest tension crack identified at the edge of failure scars, except where noted. At a number of locations the shear vane equipment was falling under its own weight which suggests negligible shear resistance in the peat.

As the primary source of the failed material, which was essentially peat, was the upper scar the results from this location are of most interest. The hand vane results indicate undrained shear strengths in the range 2 to 19kPa, with an average value of about 6kPa. The results for the upper scar are shown in **Figure 3** and are compared to the site wide results obtained for the EIAR.

The higher vane results in the upper scar are typically at the interface of the base of the peat with the underlying mineral soil, or where roots have caught the vane. If these higher results are ignored, then the undrained shear strength ranges from 2 to 9kPa, with average reducing to slightly less than about 5kPa. These values are notably low and are likely at the lower limit of what can be practically measured with the hand vane. A test was also carried out about 30m south of the upper scar within the flat plateau area; the results of this test showed similar vane strength values as recorded around the perimeter of the upper scar.

Hand vane results from the lower scar area indicate undrained shear strengths in the range 4 to 15kPa, with an average value of about 9kPa.

The low recorded peat strengths within the upper scar area are significantly lower than the site-wide results and represent a body of very weak peat.

8.2.3 Description of Failure

The failure scar morphology comprises 3 distinct parts, namely an upper scar and lower scar which provided the source area for the failed peat, and a run-out trail along which the failed peat was essentially deposited. The scar morphology indicates that failure was most likely a flow slide, similar to that described by Meyerhof (1957) for sensitive clays.

Flow slides are commonly recognised due to the scar forming a "bottleneck" morphology as material locally and retrogressively fails by localised sliding from the side and the upslope margins of the initial localised failure at the downslope margin (mouth) of the scar. Failed material subsequently flows out of the mouth of the scar. In this manner, the scar is retrogressively widened with increasing distance from the initial localised failure. This is explained in further detail below.

The 3 distinct parts of the peat failure are shown in **Figure 9**, which should be viewed when reading the description below.

(1) Upper scar. This comprised the primary source area of the failed material. The upper scar was about 260m long by up to about 120m wide. The head of the failure scar was within open peat land. The southern part of the scar was also within open peat land. The northern part of the scar was within forestry plantation. The estimated total area of the upper scar is about 2.4ha.

    Based on visual inspection the central part of the upper scar has probably decreased in elevation by about 3m. The decrease in elevation reduces towards the perimeter of the scar and would be expected to be similar to the existing ground elevation a short distance beyond the scar's perimeter.

    The basal failure surface is within the lower part of the peat, within an estimated 0.2m of the underlying mineral soil. A minor stream now flows through the central portion of the scar and the base of this stream is on the underlying mineral soil. The origin for the water within the stream appears to be mostly from surface run-off and existing drains that feed into the back of the scar.

The pattern of displaced peat within the upper scar forms a series of concentric rafts that have moved laterally and downslope towards the mouth of the scar (**Figure 10**). The concentric rafts have to varying degrees partly detached and moved downslope but would have had insufficient inertia to exit the upper scar. These concentric rafts provide a buttressing effect to the peat behind, and effectively support the side-wall of the upper scar. Typically 1 to 1.5m of vertical exposed peat face is observed. The upper scar forms a saucer shape with the width of the downslope mouth (bottleneck) much narrower (about 43m) than the maximum scar width (120m). This gives a ratio of mouth to maximum width of about 0.17.

Whilst most of the area of the upper scar is within open peat land that has no drainage, the perimeter extent of the upper scar was significantly controlled by existing drainage ditches and forestry furrows in the area (**Figure 10**). To the south there is a series of parallel drainage ditches (less than about 1m deep) that feed water northwards towards the failure scar. These parallel drainage ditches feed into an interceptor drainage ditch aligned west-east. This interceptor has essentially controlled the southern limit of the scar. To the east the scar is controlled by an oblique drainage ditch. To the north the scar follows the line of the forestry perimeter drainage ditch before extending further northwards into the forestry plantation where the scar essentially is controlled by the forestry furrows.

(2) Lower scar. This comprised a secondary source area of the failed material. The lower scar is rectilinear and essentially follows the slope gradient (**Figure 10**). The lower scar was about 260m long by about 43m wide. The head of the lower scar is taken at the downslope mouth of the upper scar and essentially coincides with the upslope boundary of a recently felled forestry plantation. The lateral perimeter of the scar essentially follows the existing forestry furrows. The estimated total area of the lower scar is about 1.18ha.

Based on visual inspection the depth of the lower scar is estimated at 1.5m to 2m. The floor of the scar is undulating and contains some isolated rafts of peat debris. There is evidence of exposed rock within the floor of the scar and a shear surface, which suggests that the shearing has occurred within the basal part of the peat.

The lower scar represents a translational sliding of peat. It is considered likely that the lower scar formed due to an initial failure at the head of the scar at the location of the floating road that was being constructed at the time of the failure. This initial failure caused loss of strength at the head of the lower scar which caused the peat to progressively fail downslope.

The perimeter extent of the lower scar was controlled by existing forestry furrows which are aligned downslope in the direction of peat movement. Adjacent to the scar the existing forestry furrows have generally acted as tension cracks with the furrows opening up. Any localised failure of these tension cracks is unlikely to result in larger scale failure.

At the downslope margin of the lower scar the peat debris impacted an existing stand of forestry plantation causing some trees to topple, however the forestry resisted the impact of the peat debris and prevented the peat debris from continuing on the same path. At this location, the peat debris entered the channel of Shruhangarve Stream which flows in a northeast direction (**Figure 9**). The peat debris would have initially started to accumulate at this location but due to the preferential flow path provided by the stream channel, and in combination with water flowing within the stream, the debris changed direction and followed the stream channel. Inspection of this location shows that there is peat debris accumulation, which as partly blocked the flow in the stream. Below the lower scar and within the Shruhangarve Stream channel there is a net accumulation of failed material.

(3) Run-out trail. The run-trail follows the Shruhangarve Stream for about 2.44km where it passes the Shruhangarve Bridge and then extends a further 0.74km to the Mourne Beg River (**Figure 9**). The total distance along the Shruhangarve Stream is about 3.2km. For the purpose of this report the extent of the run-out is taken to where the peat debris enters the Mourne Beg River.

Inspection of the run-out trail along the channel of the Shruhangarve Stream indicates that whilst there is evidence of scouring and erosion of the floor of the channel there is generally a net accumulation of failed material. The accumulation takes the form of general peat debris and isolated rafts of peat on the banks of the stream which form levees. An approximate estimate of the extent of the accumulated peat debris on the stream banks is about 5 to 10m either side of the stream with a thickness of less than 1m.

It is assumed that on reaching the Mourne Beg River the dilution effect due to the greater flow volume within the river would essentially cause most of the peat debris to go into suspension, and from a geotechnical viewpoint this would not be considered as part of the run-out trail.

8.2.4 Sensitivity Analysis of 12 November Failure

A sensitivity analysis of the 12 November peat failure has been carried out using a simple undrained infinite and circular slope model to provide some insight into the failure mechanism. The actual failure mechanism is considered to be notably complex and would require modelling of the range of strain softening behaviour of peat with the ultimate break-down of peat into a viscous material upon which more intact peat debris is suspended. Characterisation of peat strength and constitutive modelling of peat with respect to landsliding is reviewed in Long (2004), which shows that there is notable contradiction within the literature.

The sensitivity analysis has examined the following:

(1) Initiation of sliding failure of peat within the scar

(2) Sensitivity analyses carried out to determine the range of vertical height of scar side-wall and likely intact operating undrained shear strength of peat.

The following information and assumptions have been used in the analysis:

(1) Peat depth and insitu shear vane strength determined from peat probing by Ionic (Appendix D) and FT adjacent to the upper and lower scars (Appendix A2).

(2) Ground surface profile determined form LiDAR survey.

(3) Shear failure within side-wall of scar modelled by circular failure using Morgenstern and Price method. Sliding modelled using infinite slope analysis.

(4) Shear failure occurs wholly within the peat.

The results of the analysis together with an example of stability output are shown in **Figure 15**. The main findings of the analysis, which are considered indicative only, are as follows:

(1) With respect to initiation of sliding failure of peat within the scar at the location of the floating the following observations are given:

    (h) For the floating road to remain stable assuming slope inclination of 3 degrees and peat depth of 2.7m with construction traffic loading plus material equivalent to 20kPa then for stability the intact peat strength would need to be greater than about 2.5kPa **Figure 15 (a)**. The measured insitu vane strength in the area was about 5kPa.

    (i) For failure to occur the peat strength would need to be about 2.5kPa at the location of the failed section of floating road. The nearby floating road did not fail so there was some localised effect at the failed section. Based on site observations at the time of failure there appeared to be no unusual loading conditions or construction activity at this location.

    (j) The localised effect at the failed section is most likely the presence of underlying weaker ground, which prior to construction of the road was obviously not failing but as the road was constructed likely deformation of the peat below the road occurred causing peat strength to reduce to a remoulded strength.

    (k) The onset of failure of the road then likely reduced support to the upslope peat which caused the peat immediately upslope to move resulting in further loss of strength and disturbance reducing the peat strength to the remoulded strength leading to initially retrogressive failure upslope.

(l) The upper scar is relatively flat, about 1 degree, and for sliding failure to occur the undrained peat strength was equivalent to about 1kPa, which possibly represents the remoulded strength of the peat, basically peat as a viscous material. As mentioned previously, the mechanism that causes sliding at these shallow angles is far more complex than can be reasonably modelled using the simple models here.

(2) A sensitivity analyses was also carried out to determine the range of stable vertical height of scar side-walls, see **Figure 15 (b)**. This shows the following:

(a) With an operating peat strength of about 5kPa, then the side-walls of the upper scar should be less than 2m. Typically vertical faces within the peat in the upper scar are about 1 to 1.5m.

(b) In reality, as the peat fails the intact insitu peat strength would reduce progressively and would likely be notably less than 5kPa. Exposed faces within the upper scar appear to be mostly formed of acrotelm.

(c) It is noted that in the lower scar, where the average peat strength is greater there has been little retrogression of the scar side-walls.

8.3 Failure Volume

The plan extent of the upper and lower failure scars was surveyed on 19 November 2020 using a hand-held GPS. Survey points were taken around the perimeter of the scar together with peat depth probes. Preliminary volumes calculated from this survey are an estimate. A detailed topographic survey of the failure scars will be carried out in due course.

The upper scar is about 260m long measured from the furthest upslope point to the approximate downslope limit at the mouth of the upper scar, at the location of the floating road that was being constructed at the time of the failure. The maximum width of the upper scar is about 120m. The estimated total area of the upper scar is about 2.4ha. Peat depth probes around the perimeter of the upper scar showed an average peat depth of 2.7m, though locally depths of in excess of 3.5m were recorded.

Based on the above assuming that the full depth of peat failed, which is considered the case then the total failure volume from the upper scar is estimated at 2.4 x 10^4m by 2.7m which totals about 65,000m^3.

The lower scar is about 260m long measured from the downslope limit at the mouth of the upper scar to where it meets the Shruhangarve Stream. The width of the lower scar is estimated as 43m. The estimated total area of the lower scar is about 1.18ha. Peat depth probes around the perimeter of the lower scar showed an average peat depth of 1.8m.

Based on the above, assuming that the full depth of peat failed, then the total failure volume from the lower scar is estimated at 1.18 x 10^4m by 1.8m which totals about 21,240m^3.

Total failure volume is therefore 65,000m^3 + 21,240m^3 which is 86,240m^3.

The actual volume of failed material that left the failure scar would be less than the total failure volume as a notable proportion of the failed material still remains in the upper scar. An approximate estimate of failed material remaining in the upper scar is say 30%, which means that about 45,500m^3 of failed material left the upper scar.

Total failure volume that left the failure scars is therefore estimated based on the preliminary survey of 45,500m^3 + 21,240m^3 which is 65,740m^3.

It is difficult to estimate the volume of failed material that has accumulated along the run-out trail due to the variation in accumulation amounts. An approximate estimate of the accumulated failure volume is as follows: 3180m length x 15m wide x 0.5m deep, which gives say 24,000m^3. An amount of failure material has also been retained on site by a check barrage constructed downstream shortly after the failure.

8.4 Rainfall

With respect to landslide initiation, generally high intensity short-duration rainfall is associated with shallow landsliding and longer duration rainfall periods associated with deeper landslides (Postance et al, 2018). High intensity rainfall events triggering particularly peat failures in Ireland have been reported numerous times, most recently by Dykes & Kirk (2001), Long & Jennings (2006), Jennings & Kane (2019).

A review of rainfall data preceding the failure has been carried out using the nearest weather station s.

8.4.1 Rainfall Data

A number of weather stations are in the vicinity of the site, and these have been used to examine recorded rainfall data. The nearest weather station to the site is the Met Eireann Lough Mourne Automatic Climate Station (ASC) some 5.3km to the north of the failure site. The rainfall data from the Met Eireann Weather Station at Finner, near Bundoran some 34km to the southwest of the failure site has also been used.

The rainfall data from the Lough Mourne ASC, which is at an elevation of about 33m OD, has rainfall data available typically in 30 minute intervals. The daily rainfall data from January to November 2020 has been examined.

The Finner Weather Station is at an elevation of about 33m OD, and as such the rainfall pattern at the Weather Station may only provide an indication of the rainfall at the failure site which is at an elevation of generally over 250m OD. Continuous rainfall records are available since about the start of 2011, which has been examined.

Daily rainfall data for the Lough Mourne ASC has been analysed. Rainfall records for the Finner Weather Station for hourly, daily, and monthly amounts were analysed for the period preceding the peat failure on 12 November 2020. In addition, antecedent rainfall amounts (for 7, 14, 21, 28, 60 and 90-day periods) were also examined. Results are included in Appendix A5.

Examination of hydrograph data for the River Derg, in which the failure site is located, was also examined. The hydrograph is located at Castlederg.

8.4.2 Results of Rainfall Analysis

The results of the rainfall analysis are given below.

(1) The rainfall data from the Lough Mourne ASC, shows that the wettest period in 2020 was in February and March 2020. The highest daily rainfall was recorded on 21 February 2020 (68mm). Prior to the peat failure on 11 November 2020 the daily rainfall amount was 28mm. On the day of the failure the daily rainfall amount was only 6mm.

(2) In 2020 from the Lough Mourne ASC, the daily rainfall amount was 30mm or greater on 10 days preceding the failure on 12 November 2020. As such, the daily rainfall amounts immediately preceding the failure are not considered significant.

(3) Using the Finner Weather Station, then for all antecedent rainfall duration periods the rainfall preceding the peat failure on 12 November 2020 was exceeded a number of times during 2020, and also a notable number of times since 2011. This indicates that longer duration (antecedent) period rainfall events were not a significant factor in causing the peat failure.

(4) Examination of hydrograph data for the River Derg (Hydromet Cloud, 2020), in which the failure site is located, showed a peak in the hydrograph on 11 November 2020, which would have corresponded to the high daily rainfall amount recorded the same day. This peak was exceeded on 4 other occasions in 2020 prior to the failure. Again, this would indicate that short duration daily rainfall preceding the failure is not considered significant.

(5) What is particularly notable with respect to rainfall duration periods is the sustained dry spell in April and May 2020, which exceeds all previous dry spells recorded since 2011 at Finner.

(6) The significant and sustained dry spell in April and May 2020 nationally was one of the driest recorded for this period. All rainfall totals across the country were below their Long-Term Average (LTA) for the period with the driest on record for Dublin and Meath. At Finner, rainfall was 58% of the average expected amount (Met Eireann 2020).

(7) The significant and sustained dry spell would have likely caused drying of the peat surface which may have led to cracking of the near surface acrotelm layer in the peat particularly along forestry furrows and drainage lines. The Finner records show the driest recorded 7 and 14-day cumulative rainfall in April 2020.

Whilst there was no clear significant peak rainfall duration period immediately prior to the peat failure on 12 November 2020, the combination of the extended dry spell followed by high daily rainfall amounts (notably in June and September at Lough Mourne ASC) may have contributed to the peat failure. The extended dry spell would have allowed the peat surface to become relatively dry resulting in loss of moisture and shrinkage. This can result in cracking, which is commonly found concentrated along forestry furrows and drainage lines. The cracks would allow the ingress of water to the base of the peat, which can have a destabilising effect.

8.5 Sequence and Mechanism of Peat Failure

Based on the above, the following postulated sequence and mechanism of failure is considered to have resulted in the peat failure of 12 November 2020.

(1) Construction of floating road. A floating road was under construction towards T7 (**Figure 9**). Construction works for the floating road had progressed to essentially the downslope margin of the upper scar prior to the peat failure. The access track and T7 hard stand and base to the south of the peat failure had yet to be constructed though preparatory works had started, such as laying of timbers and brash along the line of the access track to T7. Excavators had laid and passed over the timber and brash a number of times.

Based on witness statements, the failure occurred at about 13:25pm whilst the floating road was being constructed. A localised section of floating road about 20m in length failed, which appears to be the first observed sign of instability.

(2) Localised failure of floating road. The loading from the construction of the floating road would have increased the applied stress through the full depth of the underlying peat over the full width of the road. Where unforeseen weaker peat was present, loading from the floating road likely resulted in localised failure within the peat. The loading from the construction would have comprised a combination of the road material and construction plant. The failure, initially localised beneath the recently loaded area, resulted in the development of a rupture surface and hence a decrease to the residual strength of the peat.

This localised area of peat would have continued to fail along the rupture surface with further loss of shear strength and disturbance reducing the residual strength to the remoulded strength, which would be negligible within the catotelm layer (humified lower layer) in the peat. This would have caused the peat catotelm layer to essentially turn to 'slurry' and a section of the floating road to move downslope.

Where there were drains passing below the floating road, such as the forestry perimeter drainage ditch at the northern end of the open peat land (**Figure 10**), then this would have severed the acrotelm layer (upper fibrous layer) of the peat where most of the intrinsic (tensile) strength of the peat lies.

(3) Retrogressive failure upslope. Once the initial localised failure had occurred below the floating road and the failed peat started to move downslope this removed lateral support to the peat upslope within the flat plateau area, which contained a large body of notably saturated and very weak peat.

The slope immediately upslope of the initial localised bearing failure would have then subsequently failed along a similarly localised rupture surface with further loss of strength and disturbance reducing the residual strength to the remoulded strength, which would again have caused the peat to essentially turn to slurry and move downslope.

This successive localised failure and movement of peat downslope retrogressed upslope until a critical mass of peat had failed that sufficient lateral stress was applied to cause failure of the intact peat on the downslope side of the floating road.

(4) Progressive failure downslope. Once a critical mass of peat had failed upslope then the lateral applied stress would have exceeded the shear strength of the intact peat on the downslope side of the floating road. At this point, the peat downslope would have failed progressively in a not dissimilar localised manner that occurred upslope, that is successive localised failure though along a basal rupture (shear) surface with movement of peat.

(5) Propagation of failure. As the downslope peat progressively failed and moved this caused subsequently more peat to fail within the upper scar. The peat in the margins of the upper scar were significantly weak that they were not self-supporting. As such, the upper scar enlarged as material locally and retrogressively failed by localised sliding then flowing from the side and the upslope margins of the scar into the centre of the scar to form a saucer shape. The enlargement of the saucer was as a result of the large body of notably saturated and very weak peat.

The mouth of the upper scar remained relatively narrow compared to the upslope width chiefly as the mass of the failed material was focused on the mouth. It is also likely that there was a zone, in part, of relatively higher strength peat along the downslope edge of the flat plateau area, due to a greater degree of drainage.

The lower scar remained essentially the same width as the mouth of the upper scar. This in part is because the peat within the lower scar has relatively higher strength and as such collapse of the side walls and lateral enlargement of the scar was not possible.

The flow slide continued to propagate retrogressively upslope and progressively downslope setting in motion a critical mass that essentially continued downslope until it encountered an existing stand of forestry plantation beside the Shruhangarve Stream channel which resisted the further propagation of the failure mechanism.

The failure continued to propagate retrogressively upslope forming the enlarged upper scar until stability was achieved due to accumulated failed debris remaining within the upper scar. The accumulated failed debris acted as a support to the peat on the margins of the upper scar and prevented further enlargement of the upper scar.

As mentioned above, the peat failure is considered to be a flow slide due to the upper scar forming a "bottleneck" morphology as material locally and retrogressively failed by localised sliding from the side and the upslope margins of the scar into the centre of the scar to form a saucer shape. The lower scar failed progressively by essentially translational sliding, which whilst still considered to be a flow slide is slightly different in nature.

The failure occurred entirely within the peat. There was no evidence of underlying soils failing.

The run-out trail below the lower scar followed the Shruhangarve Stream channel and was essentially where there was a net accumulation of failed material as the failure debris moved downstream. There was essentially no substantive failure of in situ material along the run-out trail.

8.6 Contributory Causes of Failure

The following are considered to be the key contributory causes of the peat failure of 12 November 2020. For the peat failure to occur all or at least most of these key contributory factors were required to be present. One or a few of these factors only are highly unlikely to cause the scale of the peat failure that occurred.

(1) Construction of floating road. The construction works for the floating road triggered a localised initial peat failure within the underlying insitu peat. It would not be uncommon for sections of floating road to undergo excessive movement due to localised weakening within the underlying peat, however at this location a number of other contributory factors caused an escalation of the initial localised failure.

(2) Unforeseen zone of weak peat. It is considered that a zone of unforeseen weaker peat was present below the floating road that resulted in localised failure within the underlying insitu peat. The nearest strength testing by Ionic showed undrained shear strengths in the range 7 to 12kPa, which would not be considered sufficiently low to result in failure. Where there were drains passing below the floating road, which occurred at about the location of the failure, then this would have severed the acrotelm layer (upper fibrous layer) of the peat where most of the intrinsic strength of the peat lies.

(3) Body of very weak peat immediately upslope. Essentially immediately upslope of the floating road was a flat plateau area that was partly formed of essentially a large body of notably saturated and very weak peat. This body of saturated and very weak peat relied for lateral stability on the peat slope upon which the floating road was being constructed. Hand vane results by FT post-failure showed undrained shear strengths in the range 2 to 9kPa, with an average value of slightly less than about 5kPa. These low recorded peat strengths are significantly lower than the site-wide results and would represent a body of very weak peat (**Figure 3**).

(4) Rainfall intensity and pattern. A combination of preceding heavy rainfall and the pattern of weather recorded over the preceding months likely contributed to the failure. The failure was not triggered by an intense rainfall event. Whilst there was no clear significant peak rainfall duration period immediately prior to the peat failure, the combination of a significant dry spell (April and May 2020) followed by relatively high daily rainfall amounts (from June 2020 onwards) likely contributed to the peat failure. The significant and sustained dry spell would have caused drying leading to shrinkage and cracking of the near surface acrotelm layer in the peat particularly along forestry furrows and drainage lines. Subsequent run-off from rainfall would have then gained ingress to the peat at depth via the cracking.

(5) Drainage and surface water ingress into peat. The existing forestry drainage pattern, which is present in the 1995 aerial photographs of the site, in the flat plateau area directed surface water from rainfall towards the body of very weak peat that ultimately failed, notably along a series of parallel drainage ditches aligned south-north which run for about 230m and flow towards the southern limit of the upper scar (**Figure 10**). Whilst these forestry drainage ditches meet an forestry interceptor drainage ditch aligned west-east it is not known if this interceptor ditch was functioning.

(6) Topography. The initiation of the failure occurred at a convex break in the peat slope, at the location of the floating road. A convex break in slope is commonly cited as the location for peat failures for a number of reasons. In this particular case, the convex break in slope marks the transition from a plateau area upslope containing deeper and very weak and saturated peat compared to downslope where the peat is not as deep and has relatively greater strength. At the convex break in slope it is likely that in many cases there is a zone of relatively higher strength peat, due to a greater degree of drainage, that essentially acts to support the very weak and saturated peak present in the plateau area upslope.

(7) Downslope felled forestry on peat. The area downslope of the floating road comprised a forestry plantation that had been felled a few years in advance of the wind farm construction. The area comprised forestry furrows and drains aligned downslope on peat slopes with a peat depth of about 1.8m. In itself, this area is not unique nor would it represent an increased stability risk. However the presence of furrows and drains aligned downslope on peat slopes, which have severed the acrotelm layer and the likely blockage of drainage following felling operations allowed the slope to readily fail once localised failure was initiated upslope. The failure through this area exploited the existing forestry furrows which are lines of weakness. Peat failures controlled by existing forestry furrows has been previously recorded many times.

(8) Existing drainage and extent of failure. The existing forestry drainage within the peat is considered to have directed and concentrated surface run-off to the upper scar located in the flat plateau area. To the south of the upper scar a series of parallel drainage ditches (less than about 1m deep) feed water northwards towards the failure scar (**Figure 10**). Following the failure, inspection of these ditches showed water feeding into the scar. Whilst not a direct cause of the peat failure the existing drainage ditches and forestry furrows significantly controlled the extent of the upper scar (**Figure 10**). The extent of the lower scar was essentially controlled by existing forestry furrows aligned downslope in the direction of peat failure movement. Adjacent to the scar the existing forestry furrows have generally acted as tension cracks with the furrows opening up.

9. ASSESSMENT OF PEAT STABILITY HAZARD AND RISK

9.1 General

A detailed site-wide geomorphological plan has been produced as the basis for assessing the peat stability hazard and risk. The geomorphological plan principally shows the morphology of the terrain which is presented as symbols and individual units. The individual units are intended to represent areas of similar character with respect to ground conditions.

The geomorphological plan provides a basis for zoning the site into areas of similar character, and where peat failures or indicators of instability are present, allows a determination of any local specific factors that control their spatial distribution, as noted in the Guide (Scottish Government, 2017).

Preparation of the geomorphological plan requires a level of subjectivity based on the knowledge and experience of the compiler as recognised by the Guide. This approach is a qualitative assessment of the peat stability hazard.

The peat stability hazard assessment provides guidance only with respect to site-wide peat stability. A more detailed deterministic approach in identifying peat stability hazard has been carried out along the infrastructure corridor (zone of influence) by Ionic, see Appendix D . The deterministic approach requires a significant amount of specific ground data input to provide a meaningful result, and for this reason is adopted along the proposed infrastructure corridor. As there is only limited ground data beyond the infrastructure corridor, a qualitative assessment of the peat stability hazard has been adopted for the site-wide assessment.

The results of the peat stability hazard zoning using the geomorphological plans should be read in conjunction with the Ionic stability assessment included in Appendix D.

The results of the peat stability hazard assessment are used to provide an assessment of the risk that may arise as a result of peat instability, this is covered below.

9.2 Peat Stability Hazard

The geomorphological plan has been complied using LiDAR survey data for the site provided by MCE with a 1m contour that shows the layout of the wind farm works. The geomorphological plan of the site is included in Appendix B. The following geomorphological information has typically been included, where present, on the plan:

(1) Position of major and minor slope breaks (e.g. convexities and concavities).

(2) Position and alignment of major and minor natural drainage features (e.g. rivers, streams, peat gullies).

(3) Location and extent of peat erosion complexes where present (e.g. haggs and groughs, areas of bare peat).

(4) Outlines of past peat landslides (including source areas and deposits).

(5) Location, extent and orientation of cracks, fissures, ridges and other pre-failure indicators.

Based on the association of particular geomorphological units to known failures the individual units have been qualitatively ranked with respect to their likelihood to contribute to peat instability.

An estimated probability using expert judgement, whereby general principles are used to assign probabilities to peat stability, has been adopted. This approach uses a ranking system that relates ground factors to the probability of the occurrence of peat instability, e.g. the presence or absence of instability features within certain geomorphological units.

The basis of the expert judgement is provided below (Table 14) which identifies the key considerations in determining the qualitative likelihood of peat failure based on the experience of the compiler but also taking into account the factors that contributed to peat failures that have occurred on site, including some examples of failures from other sites.

The hazard ranking in terms of probability given to the individual geomorphological units is shown in Table 15; this is based on that provided in the Guide. Note that the descriptive terms are relative and should be taken as guidance only. In assigning hazard ranking, it is assumed that inappropriate construction activity or extreme weather events do not occur.

Table 14: Geomorphological units and likelihood of peat instability

Key Geomorphological Unit	General Description	Hazard Description	Likelihood
Elevated plateaux areas	Typically elevated level extensive areas. Associated with convex break in slope which is cited as potential location for initiation of peat failures. Location for deep and weaker peat. Elevated plateaux surrounded or partly surrounded with downslopes.	Source area of 12 November 2020 failure. Similar terrain as Dawn of Hope failure (June 2020). Presence of deep and notably weak peat increases likelihood of failure.	Probable
Potential headwaters of natural drainage features	Typically location of possible spring line or concentrated focus of water. Very localised deep and weaker peat. Generally encountered at upper elevation on slopes. Possibly location of previous failures; though non are recorded on the site	Example of peat failures associated with this terrain are Garvagh Glebe (2008), Derrybrien (2003), Boleynagee (1931). Similar to the above, but more localised deep and notably weak peat increases likelihood of failure.	Probable
Elongate shallow depressions	Typically location of relict or activate stream lines or concentrated focus of water. Very localised linear deep and weaker peat. Generally encountered running perpendicular downslope.	Example of peat failures associated with this terrain are Garvagh Glebe (2008), Derrybrien (2003). Larger failure at T5 partly followed path of elongate shallow depression. Localised deep and notably weak peat increases likelihood of particularly travel distance of failure.	Probable
Elevated level ridges	Similar to elevated plateaux but comprises top of flat ridge lines or isolated level benches. Localised deep and weaker peat. Elevated benches surrounded or partly with downslopes.	Similar to source area of 12 November 2020 failure. Similar terrain as Dawn of Hope failure (June 2020). Presence of deep and notably weak peat increases likelihood of failure.	Probable
Elevated lobate level areas	Similar to elevated plateaux but comprises lobate level features. Localised deep and weaker peat. Elevated area with slope on downslope.	Similar but smaller than source area of 12 November 2020 failure. Presence of deep and notably weak peat increases likelihood of failure.	Probable

Key Geomorphological Unit	General Description	Hazard Description	Likelihood
Low-level lobate and level areas	Localised likely very deep and weaker peat in proximity to water course. Likely infilled hollows (relict lake) leading to deeper and weaker peat deposits. Proximity to watercourse with potential for erosion of slope toe.	Localised likely very deep and weaker peat in proximity to water increases likelihood of failure.	Probable
Upper slope	Undulating relief with variable slope angles. Peat depth variable. Proximity to areas of relatively greater likelihood of peat failure. Elevated position would increase potential for run-out of any failures. Potential for concentrated water within undulating relief. Undulating and rough relief could signify potential previous failures or areas of deeper peat.	Potential for some localised deep and weaker peat though not extensive.	Likely
Lower slope adjacent to water course	Undulating relief with variable slope angles. Peat depth variable but locally potential for notable depth. Proximity to watercourse with potential for erosion of slope toe. Lower position on slope increases potential for possible infilled hollows leading to deeper and weaker peat deposits. Potential for concentrated water within undulating relief. Undulating and rough relief could signify potential previous failures or areas of deeper peat.	Potential for some localised deep and weaker peat though not extensive.	Likely
Mid-slope	Relatively uniform slope with slope angles typically 3 to 5 degrees but locally steeper. Peat depth typically 1 to 2m. Relatively well drained slope. Relief has relatively few undulations and roughness that could signify previous failures or areas of deeper peat.	Reduced to limited potential for some localised deep and weaker peat.	Unlikely

Notes
(1) Likelihood description is for guidance only and assumes that no mitigation measures are in place.
(2) Hazard ranking assumes that inappropriate construction activity or extreme weather events do not occur.
(3) Only key geomorphological units are considered.

Table 15: Peat instability ranges for probability

Scale	Likelihood	Probability of occurrence
5	Almost certain	> 1 in 3
4	Probable	1 in 10 to 1 in 3
3	Likely	1 in 10^2 to 1 in 10
2	Unlikely	1 in 10^7 to 1 in 10^2
1	Negligible	< 1 in 10^7

Notes
(1) Likelihood description is for guidance only and assumes that no mitigation measures are in place.
(2) Probability of occurrence values are for guidance only and assumes that no mitigation measures are in place.

The geomorphological plan showing zonation of hazards for the site is included in Appendix B. The hazard levels vary from 'Unlikely' to 'Probable'. The hazard levels have been used to determine the risk levels given below in accordance with the Guide.

9.3 Adverse Consequences of Peat Instability

Peat stability risk is the potential for adverse consequences, loss, harm, or detriment as a result of a peat failure. Potential adverse consequences, in the event that a peat failure occurs, is estimated based on the impact of the failure on sensitive receptor. It is not the intention of this report to examine the impact on all likely receptors but the following have been taken into consideration, namely potential harm to life, economic costs, reputational loss, and damage to the peat resource .

Based on the experience gained from the 12 November 2020 peat failure, the main impact was on the ecological damage to water courses subject to inundation by peat debris taking into account the proximity of SAC's. All the water courses leaving the site enter larger rivers which pass into SAC's (MKO, 2017). As such, peat failures originating from any part of the site, provided they are of sufficient scale, could have the same impact.

Whilst the recent peat failure did not cause any harm to life, given the potential size of a peat failure, there remains a potential risk of harm to life, particularly during construction.

The range of magnitude of adverse consequence attached to each geomorphological unit to which a peat instability probability has been assigned is given in Table 16 and is based on that provided in the Guide. The impact of a peat failure at the site would be considered to be towards the higher end of a scale of potential adverse consequence, and for all the site the adverse consequence of 'high' has been adopted.

Table 16: Peat instability ranges for adverse consequence

Scale	Adverse consequence	Impact as % damage to (or loss of) receptor
5	Extremely high	> 100%
4	High	10 to 100%
3	Medium	4 to 10%
2	Low	1 to 4%
1	Very low	< 1%

Notes
(1) Adverse consequences description is for guidance only and assumes that no mitigation measures are in place.
(2) Impact as % damage to (or loss of) receptor values are for guidance only and assumes that no mitigation measures are in place.

9.4 Peat Instability Risk

9.4.1 General

The qualitative descriptors for probability or likelihood and adverse consequence of peat instability are combined as given Table 17 to produce a risk level for each of the individual geomorphological units based on the Guide.

Table 17: Peat instability risk levels

		Adverse consequence				
		Extremely High	**High**	**Medium**	**Low**	**Very Low**
Peat instability probability or likelihood	**Almost certain**	High	High	Moderate	Moderate	Low
	Probable	High	Moderate	Moderate	Low	Negligible
	Likely	Moderate	Moderate	Low	Low	Negligible
	Unlikely	Low	Low	Low	Negligible	Negligible
	Negligible	Low	Negligible	Negligible	Negligible	Negligible

The definition of the risk levels used in this assessment are based on those given in the Guide and are given below:

- High: Avoid works at these locations.
- Moderate: Works should not proceed unless risk can be mitigated at these locations, without significant environmental impact, in order to reduce risk ranking to low or negligible.
- Low: Works may proceed pending further investigation to refine assessment and mitigate hazard through re-design at these locations, as required.
- Negligible: Works should proceed with monitoring and mitigation of peat landslide hazards at these locations, as appropriate.

The qualitative descriptors for likelihood and adverse consequence of peat instability are combined in Table 18 to produce a risk level for each of the individual geomorphological units based on the Guide. Given the effect of the 12 November failure on key receptors, that is peat debris entering the Shruhangarve Stream and then into the Mourne Beg River it is considered that the adverse consequences of a failure at any location on the site are 'High'. This results in a risk level of 'Low' to 'Moderate'.

Table 18: Geomorphological units and risk due to peat instability

Key Geomorphological Unit	Likelihood	Adverse Consequence	Risk
Elevated plateaux areas	Probable	High	Moderate
Potential headwaters of natural drainage features	Probable	High	Moderate
Elongate shallow depressions	Probable	High	Moderate
Elevated level ridges	Probable	High	Moderate
Elevated lobate level areas	Probable	High	Moderate
Low-level lobate and level areas	Probable	High	Moderate
Upper slope	Likely	High	Moderate
Lower slope adjacent water course	Likely	High	Moderate
Mid-slope	Unlikely	High	Low

In order to reduce the risk ranking to low or negligible a range of mitigation measures are proposed. The risk mitigation measures are based on the findings of the nature of the peat terrain at this site, causes of peat failure at the site and measures employed successfully on other peat sites where similar construction has been carried out.

The risk mitigation measures are included in Table 19. The risk mitigation measures are to be implemented for all the site where remaining works are to be carried out that could affect peat, irrespective of the hazard and level risk given to any individual geomorphological unit at any location on the site.

The risk mitigation measures provided here should be read in conjunction with mitigation measures included in the Ionic report (Appendix D), and those included within AGEC (2017) in the EIAR, as appropriate.

Details of the risk mitigations are explained in more detail in Section 10.2.

Table 19: Geomorphological units and risk mitigation measures

Key Geomorphological Unit	Likelihood	Adverse Consequence	Risk	Mitigation Measures - Applies to All Site	Risk following Mitigation
Elevated plateaux areas	Probable	High	Moderate	• No further construction of floating roads is to be carried out. Given the potential risk associated with floating road construction alternative methods of construction shall be adopted. • No loading of insitu peat. The instability recorded on site in all cases can be contributed to various degrees to excessive placed construction loading onto the insitu peat surface. • Monitoring of ground movement and constructed works. In order to monitor the performance of the constructed works within the peat areas, and any further construction works to be carried out, a series of monitoring points shall be established throughout the site. • Proof testing of floating roads. Full-scale proof load tests to be carried out on floating roads to verify their capacity under the design loads for the construction traffic and for largest loading to be experienced by the road. • Testing and assessment in zone of influence in advance of construction works. The peat failure of 12 November 2020 occurred due to an unforeseen body of very weak peat adjacent to the working area. • Site supervision and permit to work with respect to peat stability. All construction on site shall be managed and controlled by the construction management team to ensure that all activities have been appropriately assessed with respect to peat stability and related health and safety. • Construction and weather conditions. Restrictions on work during or after periods of heavy or sustained rainfall. Heavy intense rainfall can result in degradation of the works resulting in localised instability, and in extreme cases can trigger large-scale peat failure.	Low to negligible
Potential headwaters of natural drainage features	Probable	High	Moderate		Low to negligible
Elongate shallow depressions	Probable	High	Moderate		Low to negligible
Elevated level ridges	Probable	High	Moderate		Low to negligible
Elevated lobate level areas	Probable	High	Moderate		Low to negligible
Low-level lobate and level areas	Probable	High	Moderate		Low to negligible
Upper slope	Likely	High	Moderate		Low to negligible
Lower slope adjacent water course	Likely	High	Moderate		Low to negligible
Mid-slope	Unlikely	High	Low		Low to negligible

9.4.2 Findings of Risk Assessment

The findings of the risk assessment are given below:

(1) The geomorphological plan showing zonation of risks for the site is included in Appendix B. The risk levels shown are assuming that no mitigation measures are in place. The risk levels vary from 'Low' to 'Moderate'.

(2) Mitigation measures summarised in **Table 19** will be required to reduce the level of risk to an acceptable level, that is 'Low' to 'Negligible'.

(3) Mitigation measures are detailed in Section **10.2**. Note that the mitigation measures included in this report are to be used to supplement the existing mitigation measures in place, or those proposed by Ionic (Appendix D). At any location, the most onerous mitigation measures shall be adopted. All works are subject to detailed design.

(4) Given the potential sensitivity of the site, it is considered that irrespective of the hazard and level risk given to any individual geomorphological unit at any location on the site, that the mitigation measures are implemented for all the site, irrespective of geomorphological unit, where remaining works are to be carried out.

10. FINDINGS AND MITIGATION MEASURES

10.1 Summary of Findings

Following summary of findings are given:

(1) A review of peat stability at the site shows that prior to wind farm construction the site showed no signs of peat instability or recorded peat instability. The Landslide Susceptibility Classification (GSI, 2020) classified the site as dominantly 'low' to 'moderately low' susceptibility.

(2) During construction, a number of peat failures (4 no.) and minor peat instabilities occurred, see **Table 12**. The peat failures occurred in early June 2020 or before and comprised translational slides of peat that were triggered by arisings (mostly peat), or failed peat, being placed on insitu peat. Following these peat failures, a range of mitigation measures were carried out by the contractor to limit further peat failures (MCE, 2020).

(3) It is considered that a key contributory factor to these failures was excavated arisings being placed onto the insitu peat surface, particularly on the downslope side of access roads on peat. The likely cause of failure was excessive loading causing undrained shear failure of the underlying peat leading to progressive downslope failure. Particular mitigation measures are proposed to ensure that this working practice is prevented from re-occurring.

(4) The cause of the peat failure of 12 November 2020 was as a result of notably different contributory factors to the earlier peat failures on the site.

(5) A summary of the key contributory causes of the peat failure of 12 November 2020 are given below.

   (a) The peat failure occurred during the construction of a floating road to T7. The construction of the floating road likely triggered the peat failure as a result of increased loading causing a localised weakening within the underlying insitu peat.

   (b) It is considered that a zone of unforeseen weaker peat was present below the floating road. Upslope of the floating road, within a flat plateau area, a large body of notably saturated and very weak peat was present.

   (c) The body of saturated and very weak peat relied for lateral stability on the peat slope upon which the floating road was being constructed.

   (d) Insitu hand vane test results in the body of saturated and very weak peat showed undrained shear strengths in the range 2 to 9kPa, which are significantly lower than the site-wide results (**Figure 3**).

   (e) Following the initial localised failure below the floating road this removed lateral support to the peat upslope which contained a large body of saturated and very weak peat which subsequently failed.

(6) Further ground investigation was carried out to assess the most effective method to determine the operational strength of insitu peat at the site. A range test methods and back-analyses were carried out. The results indicate that the insitu shear vane strength provides a reasonable indication of the operational shear strength of peat, particularly at the lower shear strength peat. The insitu shear vane test has been used both by FT and Iconic (see Appendix D) to determine the operational strength of insitu peat at the site.

(7) Back-analysis of one of the peat failures that occurred on site in early June 2020 or before during construction was also carried out to determine the most likely cause of failure. For the purpose of back-analysis peat failure reference 3 in MCE (2020) was used. The cause of the failure was undrained loading

of the insitu peat due to excessive loading from placed peat at the head of the failure. The main findings of the back-analysis is as follows:

(a) The nearest insitu shear vane results (see Ionic report in Appendix D) shows most probable range of peat strength of about 3 to 9kPa, with an average of about 6kPa. Assuming an operating insitu peat strength of about 6kPa then this would suggest that peat material up to about 4.5m was placed onto the peat surface.

(b) Observations at the time of the failure refer to peat up to 3 to 4m being placed downslope of the road. Typically when material is placed onto the peat surface a proportion of this material sinks into the peat, as such it is difficult by observations to determine the real height of material placed.

(c) The back-analyses provides a reasonable indication of the height of material placed and the likely operating strength of the insitu peat, as determined by shear vane.

(8) Sensitivity analysis of the 12 November 2020 peat failure was carried out to provide an understanding of the likely failure mechanism. The analysis examined the initiation of the failure at the floating road and the stability of the side-walls of the upper failure scar. The main findings of the analysis, which are considered indicative due to the complexity of modelling the failure, are as follows:

(a) For the floating road to remain stable the intact peat strength would need to be greater than about 2.5kPa, see **Figure 15 (a)**.which is notably less than the measured insitu vane strength in the area.

(b) For failure to occur the peat strength would need to be locally lower at the location of the failed section of floating road. This is most likely due to the presence of underlying weaker ground, as the road was obviously not failing prior to construction it is likely deformation of the peat below the road occurred causing peat strength to reduce to a remoulded strength.

(c) The onset of failure of the road then likely reduced support to the upslope peat which caused the peat immediately upslope to move resulting in further loss of strength and disturbance reducing the peat strength to the remoulded strength leading to initially retrogressive failure upslope.

(9) A site-wide peat stability hazard zoning using geomorphological plans has been carried out to provide guidance on potential peat instability (Appendix B). The results of the peat stability hazard zoning should be read in conjunction with the Ionic report in Appendix D, which provides a detailed quantitative peat stability assessment along the proposed infrastructure at the site.

(10) The results of the peat stability hazard assessment have been used to provide an assessment of the risk that may arise as a result of peat failure. The risk level prior to mitigation varies from 'Low' to 'Moderate'. Taking account of the remaining works and stability of the site, mitigation measures have been produced, and presented below, to allow for the safe completion of the works and to reduce the risk to an acceptable level. The mitigation measures are to be implemented for all the site, irrespective of the assessed risk level, where remaining works are to be carried out.

10.2 Mitigation Measures

Following an assessment of the site with respect to peat stability as presented in this report and the Ionic report (Appendix D) it is considered that the construction of the wind farm can be completed safely without further peat instability provided the mitigation measures given below are adhered to.

The mitigation measures are based on the findings and lessons learned from the stability assessment of the site together with examination of the cause of the 12 November peat failure and other instabilities identified on the site. A summary of the lessons learned and accompanying mitigation measures are included in **Table 20**. Details of the mitigation measures are provided below.

Table 20: Lessons learned and accompanying mitigation measures

Peat Stability - Lessons learned	Mitigation Measures
Excessive loading of insitu peat	• No further construction of floating roads is to be carried out. Given the potential risk associated with floating road construction alternative methods of construction shall be adopted. • No loading of insitu peat. The instability recorded on site in all cases can be contributed to various degrees to excessive placed construction loading onto the insitu peat surface.
Identifying body of weak peat in proximity to proposed works	• Confirmatory re-testing and assessment in zone of influence in advance of construction works. The peat failure of 12 November 2020 occurred due to an unforeseen body of very weak peat adjacent to the working area. Further confirmatory re-testing to be completed immediately prior to works recommencing in each area of site to ensure no change in ground conditions.
Accidental excessive loading of insitu peat during construction	• Site supervision and permit to work with respect to peat stability. All construction on site shall be managed and controlled by the construction management team to ensure that all activities have been appropriately assessed with respect to peat stability and related health and safety.
Identifying areas of potential weak peat in advance of works completion of works	• Monitoring of ground movement and constructed works. In order to monitor the performance of the constructed works within the peat areas, and any further construction works to be carried out, a series of monitoring points shall be established throughout the site. • Proof testing of floating roads. Full-scale proof load tests to be carried out on floating roads to verify their capacity under the design loads for the construction traffic and for largest loading to be experienced by the road.
Degradation of work due to inclement weather	• Construction and weather conditions. Restrictions on work during or after periods of heavy or sustained rainfall. Heavy intense rainfall can result in degradation of the works resulting in localised instability, and in extreme cases can trigger large-scale peat failure.

Note that the mitigation measures included below are to be used to supplement any existing mitigation measures or construction management practices already in place. At any location, the most onerous mitigation measures shall be adopted.

Detailed stability assessment of the site has been carried out by Ionic (see Appendix D) as part of the design of the works, which takes into account the mitigation measures below. Similarly, MCE have provided their proposed construction control measures, also taking into account the mitigation measures below, which are presented in Appendix E.

The following mitigation measures are given:

(1) Remaining construction works. The remaining construction works are summarised in **Table 3**. The remaining works are generally minor in nature and do not require extensive groundworks, except for the works at T7 and the access to T18.

(a) Any remaining works shall be subject to the mitigation measures given below, or any other such related requirements.

(b) Where there are further works not included in the above, that may adversely affect ground stability, then these further works shall also be subject to the mitigation measures given below, or any other such related requirements.

(c) All works shall be subject to detailed design.

(2) No further construction of floating roads is to be carried out. Given the potential risk associated with floating road construction alternative methods of construction shall be adopted.

(a) Where alternative methods of construction are proposed these shall be subject to the mitigation measures given below, or any other such related requirements.

(b) Detailed design shall be carried out and appropriate method statements produced to mitigate against the risk of peat and ground instability.

(c) Alternative road construction would typically comprise road founded on competent strata below peat which will require excavate and replacement techniques. For alternative road construction the following items, which are non-exhaustive, shall be included:

(i) No side casting of arisings onto insitu peat surface. All arisings to be placed into designated storage areas.

(ii) Use of low permeability plugs along line of road at suitability spaced intervals to avoid longitudinal transmission of surface water.

(iii) Site observations to be used to monitor side-wall stability of peat in excavations to validate design approach.

(iv) Construction programmed to minimise the time peat excavations are exposed prior to filling with suitable fill.

(3) No loading of insitu peat. The instability recorded on site in all cases can be attributed to various degrees to excessive placed construction loading onto the insitu peat surface.

(a) The remaining works on the site shall be carried out without placing of any arisings or loading on to the insitu peat. Placing of any load particularly onto the downslope margin of any works within peat shall be avoided.

(b) It is recommended that the tracking of construction machinery onto the insitu peat is kept to a minimum and limited to the installation or maintenance of site drainage using appropriate low ground pressure plant. In the event that construction machinery has to track onto the insitu peat then the peat shall be inspected and assessed by a competent[1] person to avoid excessive loading. If the competent person is in any doubt as to the suitability of the peat for tracking of machinery, no tracking of machines onto the peat should take place.

(c) The definition of excessive loading shall be determined by the competent person and shall take into account the nature and type of loading and the nature and type of the insitu peat and general ground conditions.

(d) Where required the assessment shall include visual inspection and appropriate testing of insitu peat with respect to depth and strength to full peat depth. For example, thin peaty soil (less than 0.5m thick) over mineral soil would not represent a notable risk of peat instability. The results of the assessment, pending satisfactory findings, shall be completed prior to any works commencing. A record of all such assessments shall be maintained.

[1] A competent person shall be a person who has a recognised degree qualification in civil engineering and/or an earth science degree with at least 10 years' experience of which there has been at least 2 years' experience of construction work on peat.

(4) Monitoring of ground movement and constructed works. In order to monitor the performance of the constructed works within the peat areas, and any further construction works to be carried out, a series of monitoring points shall be established throughout the site.

(a) Monitoring is proposed to provide advance warning of potential instability or possible longer term movement, that may represent potential for degradation of the works over time that could lead to instability.

(b) Monitoring shall be sited at critical locations typically adjacent to the constructed works as given in Table 21. The exact location of the monitoring shall be determined following inspection. Other locations may be included as required by the designer or contractor.

Table 21: Ground monitoring locations

No	Location	Comments
1	Junction of access road to T1 with spur to T2 and T4 along downslope margin	Area of deepest peat in close proximity to concave break in slope
2	Along access to T3 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
3	Along access to T2 about 100m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
4	Along access to T4 about 150m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
5	Along access from T5 to T3 about 200m from T5 along downslope margin	Area of deeper peat in close proximity to concave break in slope
6	Junction of access road to T7 about 100m along access to T7 along downslope margin	Area of deeper peat in close proximity to concave break in slope, within potential area of 12 November failure
7	South side of upper scar of 12 November failure	To monitor potential retrogression of scar upslope
8	On downslope margin of T7 base and hard stand prior to construction	To be installed in advance of any works
9	On downslope margin of T10 base and hard stand	Area of peat in close proximity to concave break in slope
10	Along access to T14 about 100m from hard stand along downslope margin	Area of peat in close proximity to concave break in slope
11	Along access to T18 at about chainage 1600m along downslope margin	Area of potential peat close to river
12	Along access to T16 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope and minor instability
13	Peat storage berms at T15	Minor signs of movement/distress. Where necessary the berm size is to be increased.
14	Peat storage berms at T17	Minor signs of movement/distress. Where necessary the berm size is to be increased.
15	Peat failure scar above road to T7	Upper scar of 12 November 2020 peat failure. Potential for retrogression of failure scar.

No	Location	Comments
16	Peat failures at Borrow Pit between T5 and T6	Comprises 3 peat failures at this location. Monitoring at the head of each failure.
17	Peat failure at T12	Head of failure downslope of access road. Monitoring at the head of failure.
18	Instability at T5	Series of concentric tension cracks within the insitu peat
19	Instability at T16	Minor slumping of insitu peat
20	Ch.2630 on the north side of the S-bends on the approach road into the site	Stockpile caused a localised ground movement in the peat below the stockpile

(c) Monitoring shall consist of a series of wooden posts (say 4 no.) inserted into the ground to create a straight line, ideally obliquely across the slope. A string line shall be tied to the first and last post. The line of posts shall be placed such that they can be sighted along from the position of the road. Any deviation of the posts would indicate potential movement of the peat.

(d) The monitoring is intended to be easy to install, readily read without any equipment, and where required can be readily maintained and replaced.

(e) The monitoring locations shall be read weekly or following heavy rainfall. Readings shall be carried out until completion of the works.

(f) A record of the readings shall be maintained. The record shall include time, date, movement of any posts (or no movement), any follow-up inspections. Accidental movement of the posts shall be noted and the posts moved back into alignment, where possible.

(g) Trigger levels shall be taken as indicatively 100mm or continued rate of creep movement, as determined by the designer. Where trigger levels have been reached, the designer shall be notified and the reason for the movement established to determine whether the movement warrants further investigation.

(h) Where there are remaining works to be completed then monitoring shall be installed adjacent to the works at critical locations. Operatives shall be made aware of the monitoring and shall be required to observes the monitoring at a regular intervals and to report any unusual observations to the construction management team.

(i) Where monitoring shows ground movement has occurred in an area where construction works is underway then works shall cease in that area and operatives and plant moved to a safe location and the designer notified and the reason for the movement established prior to re-commencing works.

(j) Inspection of constructed works indicated a number of locations where monitoring is required, these are included above. In addition, at T16 a small peat slip between the hard stand and the perimeter cut-off drain is causing water to flow into the hard stand, this shall be repaired.

(5) Confirmatory testing and assessment in zone of influence in advance of construction works to be completed. The peat stability assessment within this report and the Ionic report (Appendix D) have concluded that the site is safe and the remaining works can be completed safely in accordance with the recommendation and mitigation measures contained herein. Notwithstanding, the following confirmation testing and assessment shall be carried out immediately in advance of construction. The confirmation testing and assessment is in addition to that already carried out in the peat stability assessment.

(a) In advance of the construction of any remaining works, a zone of influence extending 50m minimum in all directions from the proposed works area shall be re-inspected and assessed by a competent person in advance of any works.

(b) Where deemed necessary by the competent person, the zone of influence shall be extended to include any ground that is considered to be affected by the works.

(c) The assessment within the zone of influence shall include visual inspection and appropriate testing of insitu peat with respect to depth and strength to full peat depth. The assessment shall include but not be limited to recording morphology, vegetation cover, drainage, proximity of drains and natural watercourses (an example of such an assessment for the proposed access road to T18 is included in Section 5.7). The results of the assessment shall be considered by the designer.

(d) The further confirmatory testing of insitu peat with respect to depth and strength to full peat depth shall typically comprise the following within the zone of influence and shall be carried out immediately in advance of works commencing:

(i) Peat depth determined at typically at 20m spacing using peat probes or alternatively using continuous depth profiling such as ground penetrating radar (GPR).

(ii) Insitu shear vane testing, or similar technique that measures the operational shear strength of the peat, typically at 20m spacing depending on the encountered peat condition.

(iii) Spacing of probes and insitu shear vane testing, or similar, to be reduced where areas of deeper peat are encountered.

(e) A hydrological assessment carried out by appropriate experienced and competent person, which will include but not be limited to drainage, proximity of drains and natural watercourses shall be carried out in advance of construction works. This work is being carried out by hydrological specialists HES.

(f) The results of the assessment, pending satisfactory findings, shall be completed prior to any works commencing. Works shall only commence following a permit to work being issued.

(g) A record of all such assessments shall be maintained.

(6) Site supervision and permit to work with respect to peat stability. All construction on site shall be managed and controlled by the construction management team to ensure that all activities have been appropriately assessed with respect to peat stability and related health and safety. Procedures shall be put in place to clearly demonstrate how this has been achieved, for example:

(a) Procedures that provide an auditable chain of command shall be put in place to clearly demonstrate that peat stability and related health and safety have been assessed in the construction management.

(b) For any construction activity where peat stability and related health and safety have been assessed, then a permit to work shall be issued to the construction operative by the appropriate personnel.

(c) No construction works shall be started until a permit to work has been issued to the construction operative by the appropriate personnel.

(d) All works that may affect the stability of the site shall be routinely inspected and supervised on site by appropriate personnel.

(e) The above procedure shall be independently audited by a suitably competent and experienced person(s). The competent person shall have suitable professional qualifications and have experience of carrying out similar roles for construction projects in peatland. Planree proposed to use suitably competent and experienced person from FT.

(f) All persons involved in the assessment of peat stability on site shall have sufficient expertise, competency, and experience for the tasks to which they have been assigned.

(7) Proof testing of floating roads. Full-scale proof load tests to be carried out on floating roads to verify their capacity under the design loads for the construction traffic and for largest loading to be experienced by the road. Such testing may already be required under the design or contract. A suggested outline methodology is given below.

(a) Rolling load test for all floating roads. Tests to be carried out using a fully ladened dump truck. The weight of any truck should be recorded at a weighbridge. Typical test procedure as follows:

- Condition and deflection of the floating road observed visually as the truck travels continuously over the floating road at a constant low speed.
- The performance of the floating road hall be qualitatively classified as Good, Fair or Poor based on the condition of the road and the observed deflection under the weight of th e truck.

(b) Static load test at selected sections, if deemed appropriate by the designer. Sections of floating roads where the road performance was classified as Fair or Poor are selected for detailed static loading of placed fill as follows, as appropriate:

- Loading (such as rock fill) placed incrementally up to the design limit as specified by the designer.
- Deflection of road recorded following each load increment.
- Maintained static loading for 24 hour period with measurement of deflection at en d of period.

(c) The results of the proof testing shall be analysed by the designer and any mitigation measures , which may include replacement with founded road on competent strata, to be incorporated into the design. All tests shall be carried out under controlled conditions to ensure that the road is not adversely damaged and that instability does not occur.

(8) Construction and weather conditions. Restrictions on work during or after periods of heavy or sustained rainfall as recorded from weather station located on site, or from Met Eireann weather forecasts. Heavy intense rainfall can result in degradation of the works resulting in localised instability, and in extreme cases can trigger large-scale peat failure.

(a) Following periods of heavy intense rainfall, such as 10mm/hr, >25mm in a 24 hour period, or >50% of monthly average in a 7 day period and in following 24 hours, no groundworks may take place and any ongoing works should be restricted to hardstanding areas.

(b) When periods of heavy intense rainfall are predicted then works shall be ceased in advance and any construction works in critical areas with respect to stability are secured in advance.

(c) Following periods of heavy intense rainfall the site shall be inspected prior to resumption of construction works by a competent person to ensure that all drainage is working, and critical areas with respect to stability are stable with no signs of ground movement.

MCE have provided their proposed construction control measures, also taking into account the mitigation measures above, which are presented in Appendix E to this report.

11. FINDINGS OF STABILITY ASSESSMENT

Following an assessment of the site with respect to peat stability as presented in this report and the Ionic report (Appendix D) it is considered that the construction of the wind farm can be completed safely without further peat instability provided the mitigation measures included above and within the Ionic report (Appendix D) are adhered to, including existing mitigation measures associated with the design and construction of the works.

Within the Ionic report prior to component deliveries and turbine supplier crane access to T1, T2 and T4 the works outlined in Sections 5.4.1 and 5.4.2 of the Ionic report (Appendix D) should be completed and any mitigation measures adopted. The Ionic report in Section 7 also includes a number of mitigation measures required at critical locations identified following a sensitivity analysis.

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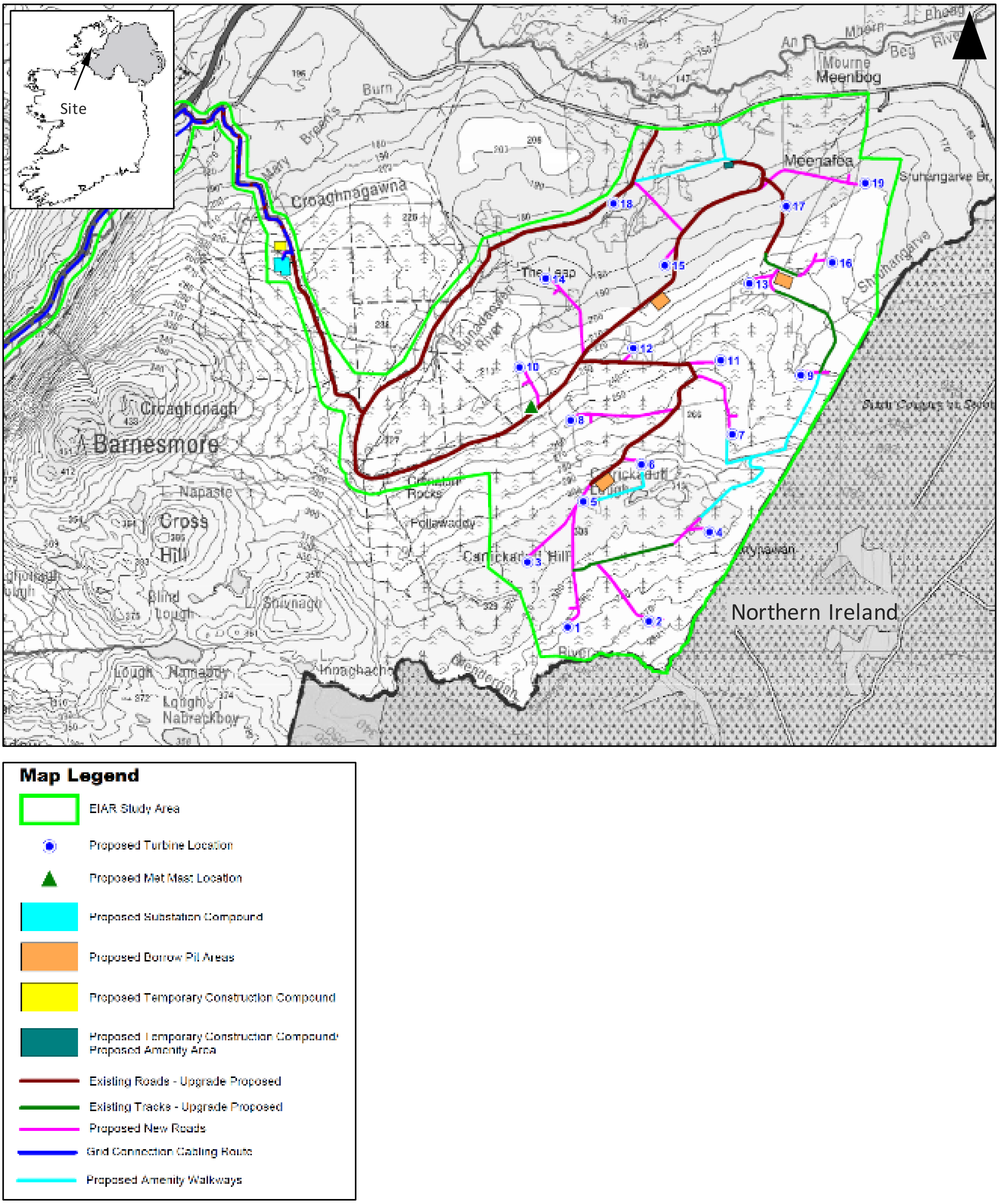
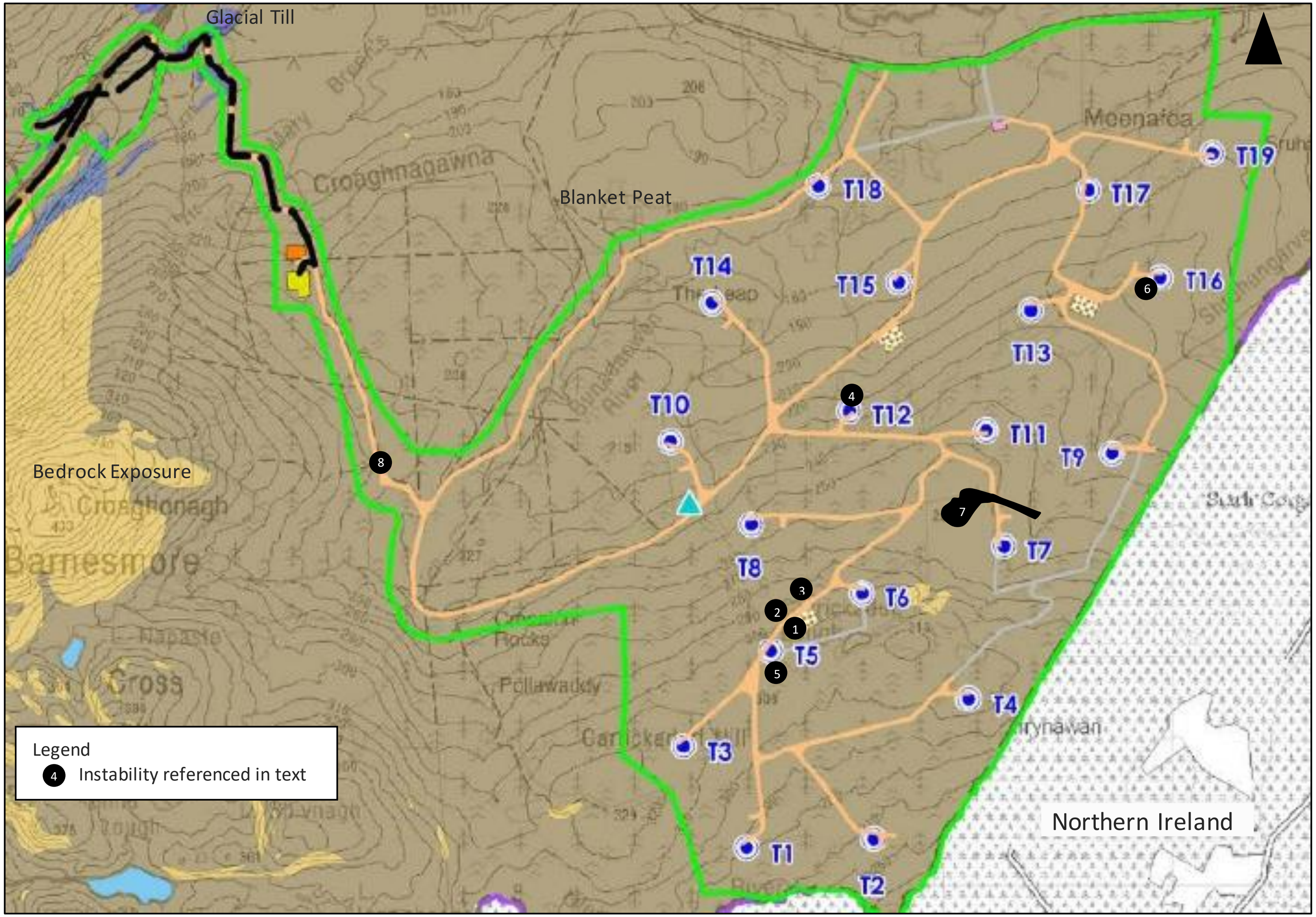
FIGURES

Figure 1: Meenbog Wind Farm showing general layout and turbine locations (from EIAR)



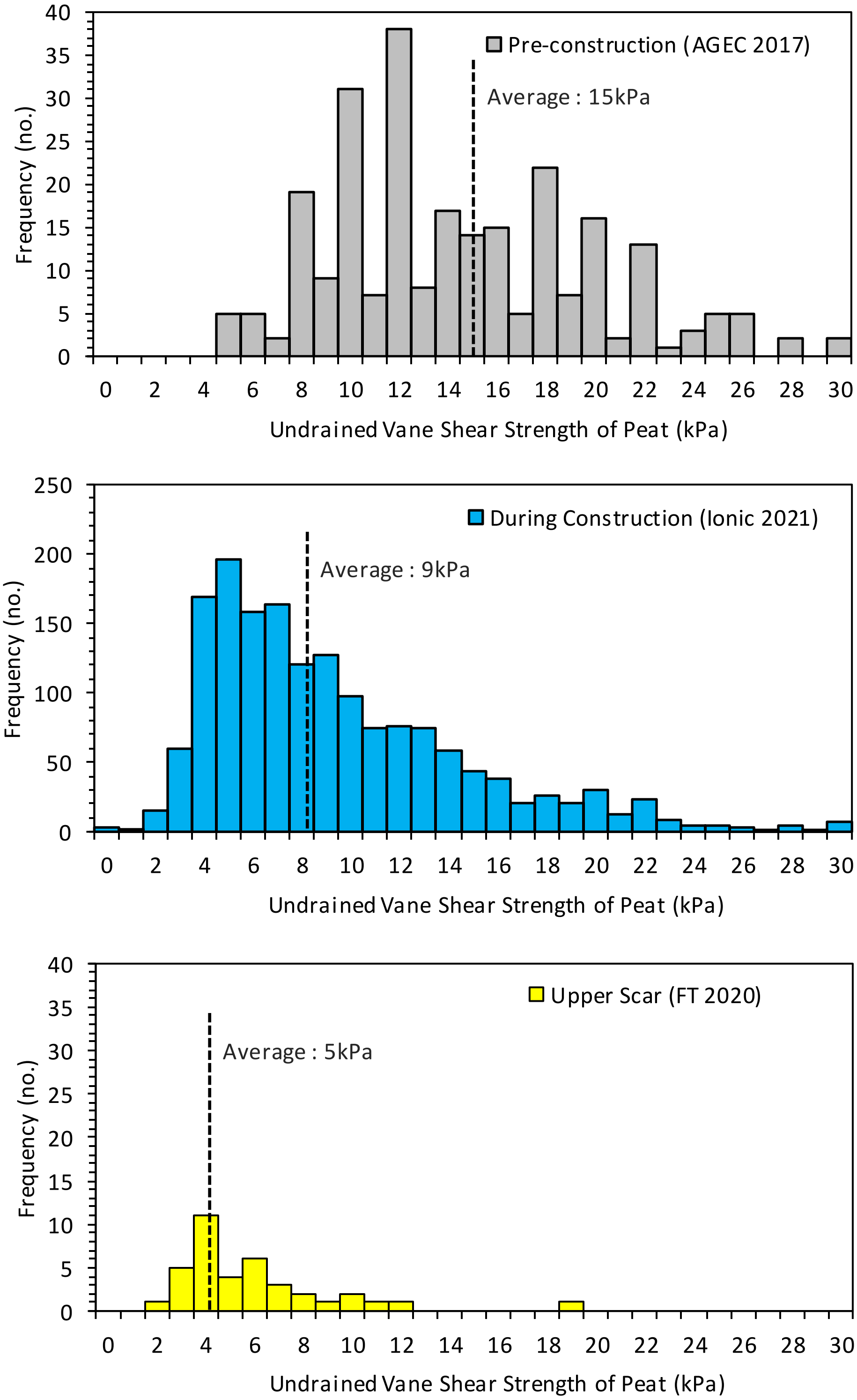
Source: MKO (2017)

Figure 2: General ground conditions (including peat failures)



Source: MKO (2017)

Figure 3: Range of undrained peat strength



Source: AGEC (2017), Ionic (2020) and this report (FT 2020)

Figure 4: Undrained peat strength with depth

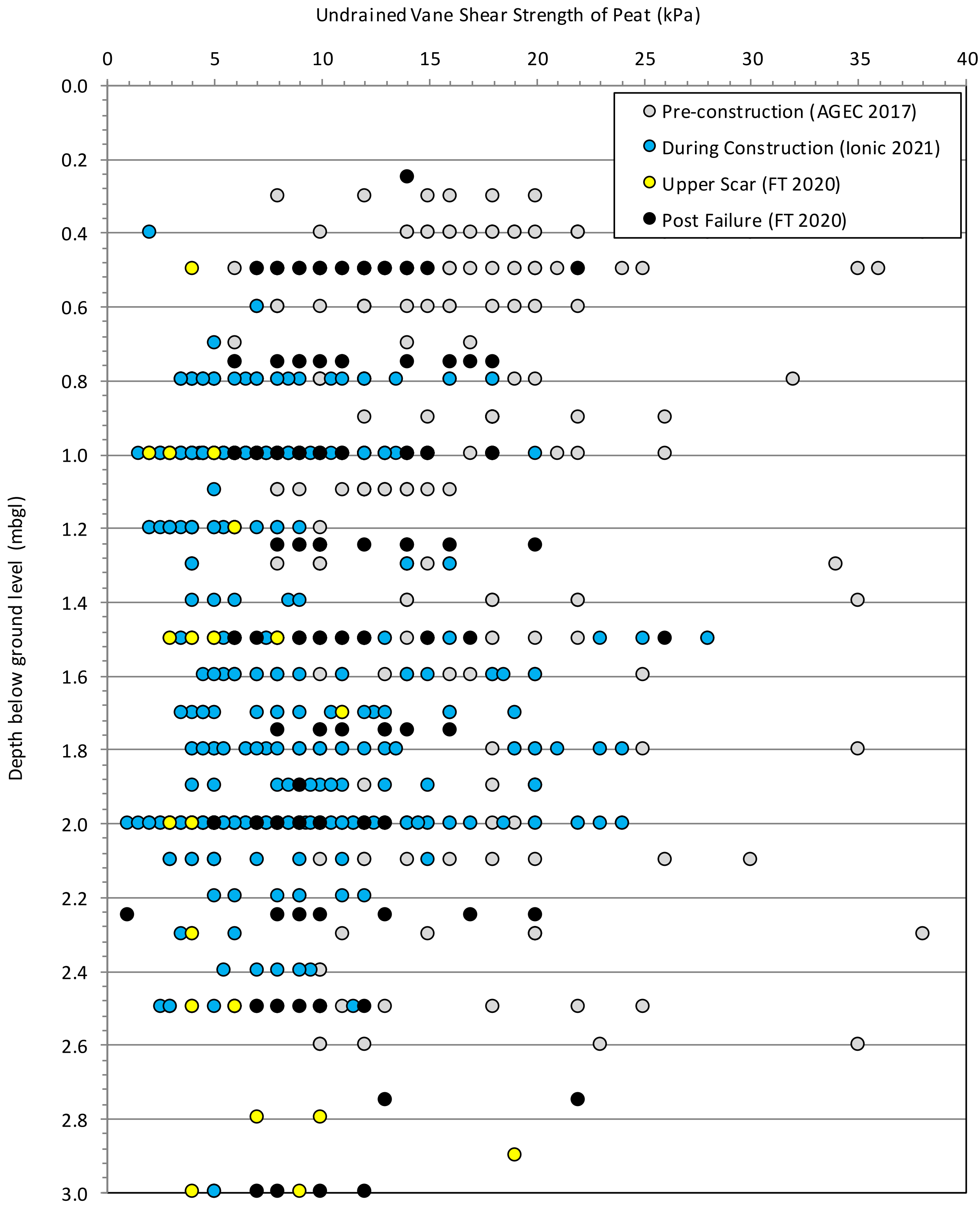
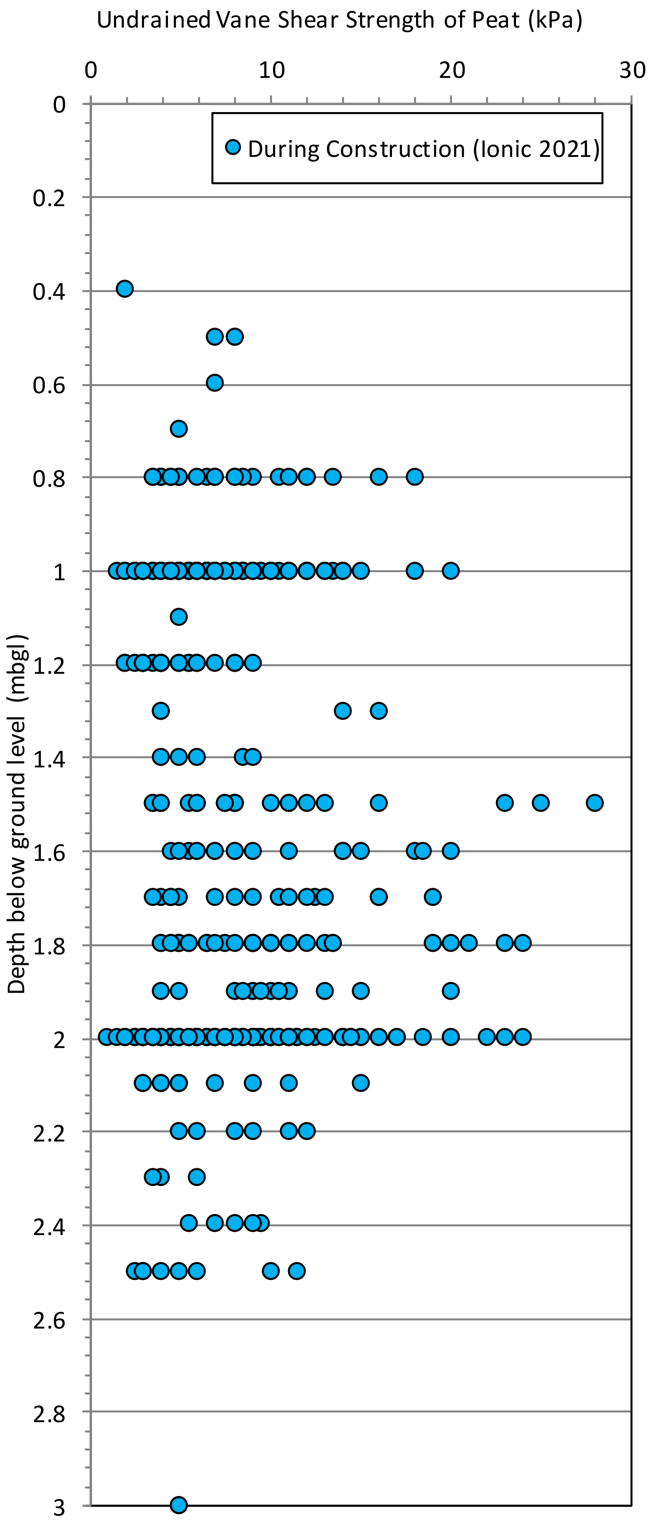


Figure 5: Undrained peat strength with depth for preconstruction & for upper scar



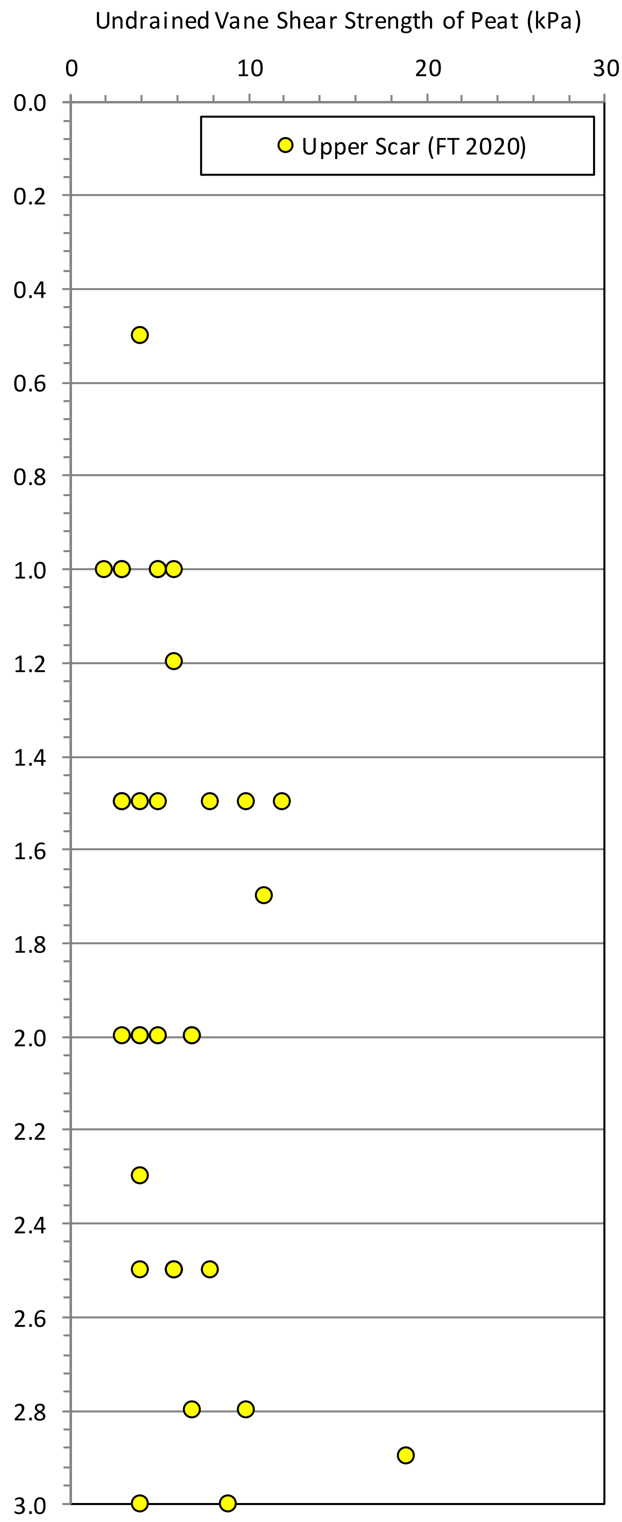


Figure 6: Peat Failure at T12

Figure 7: Peat Failure at T5

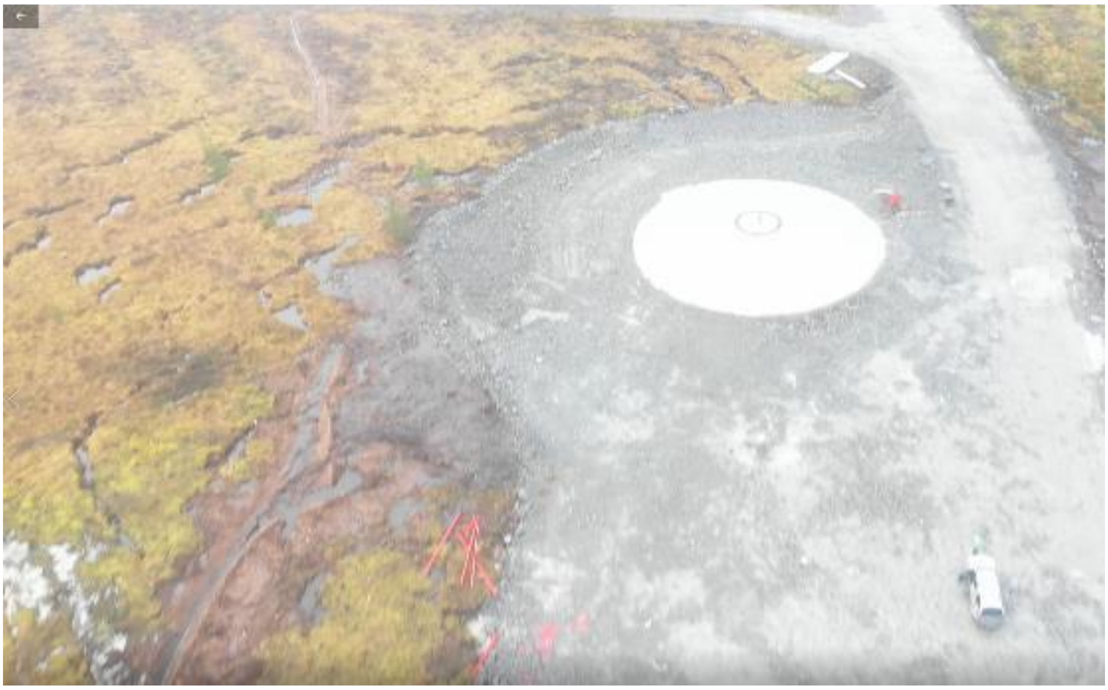


Figure 8: Peat Failure at T16

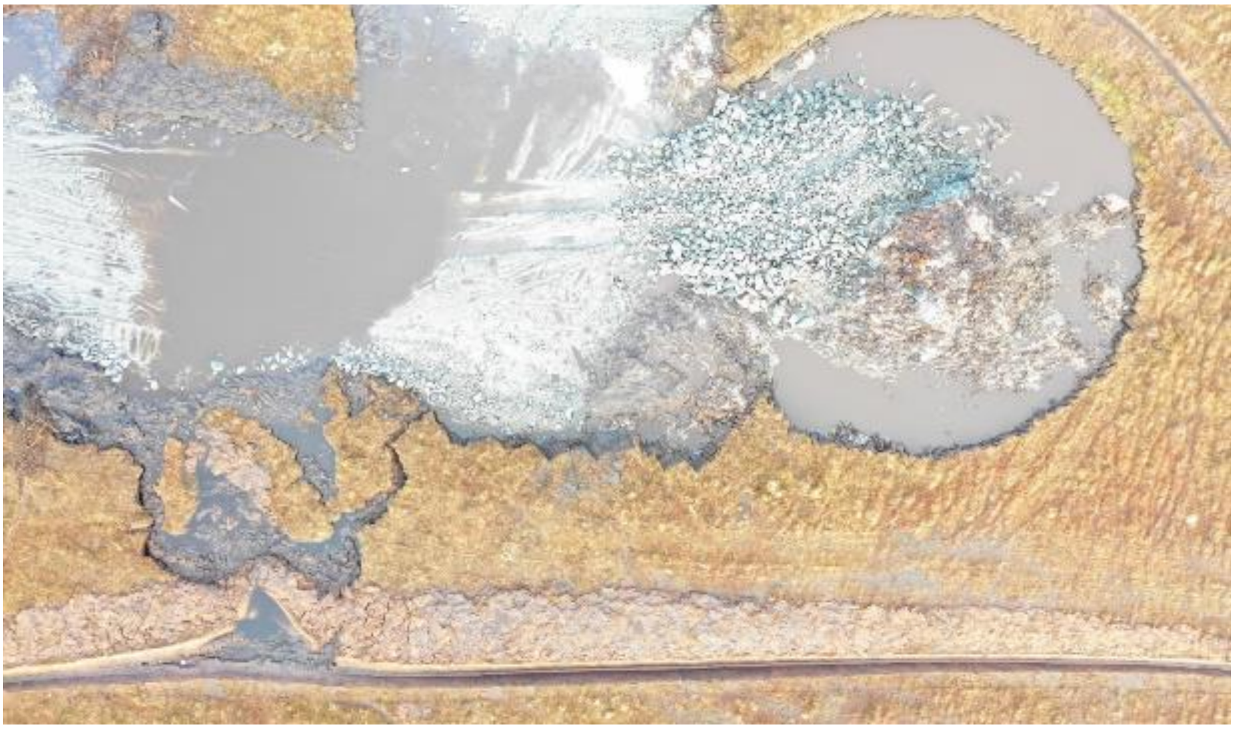
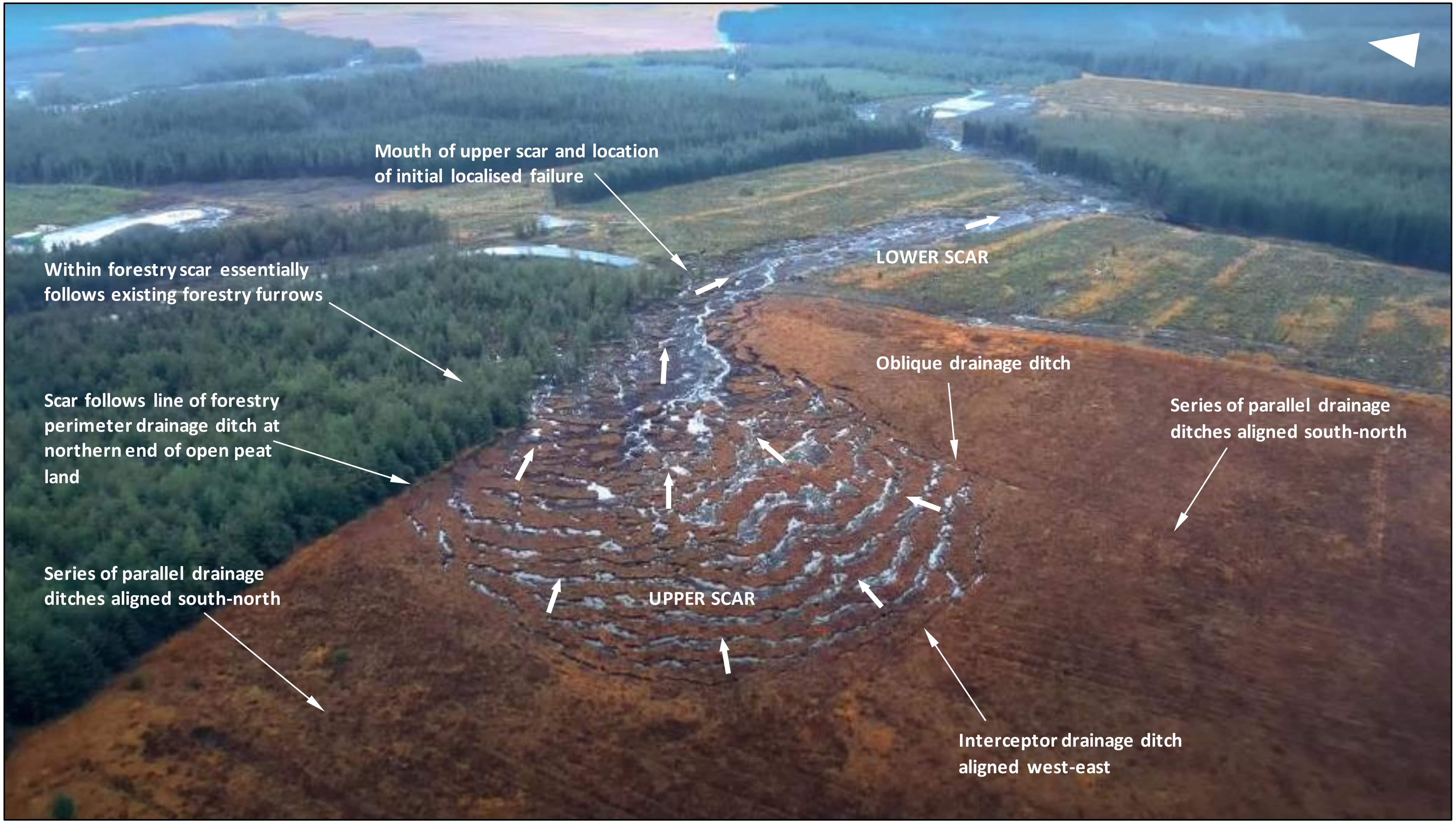


Figure 9: Extent of peat failure of 12 November 2020

Source: Google Earth Pro CNES/Airbus image from 20 September 2020. Copyright CNES/Airbus image

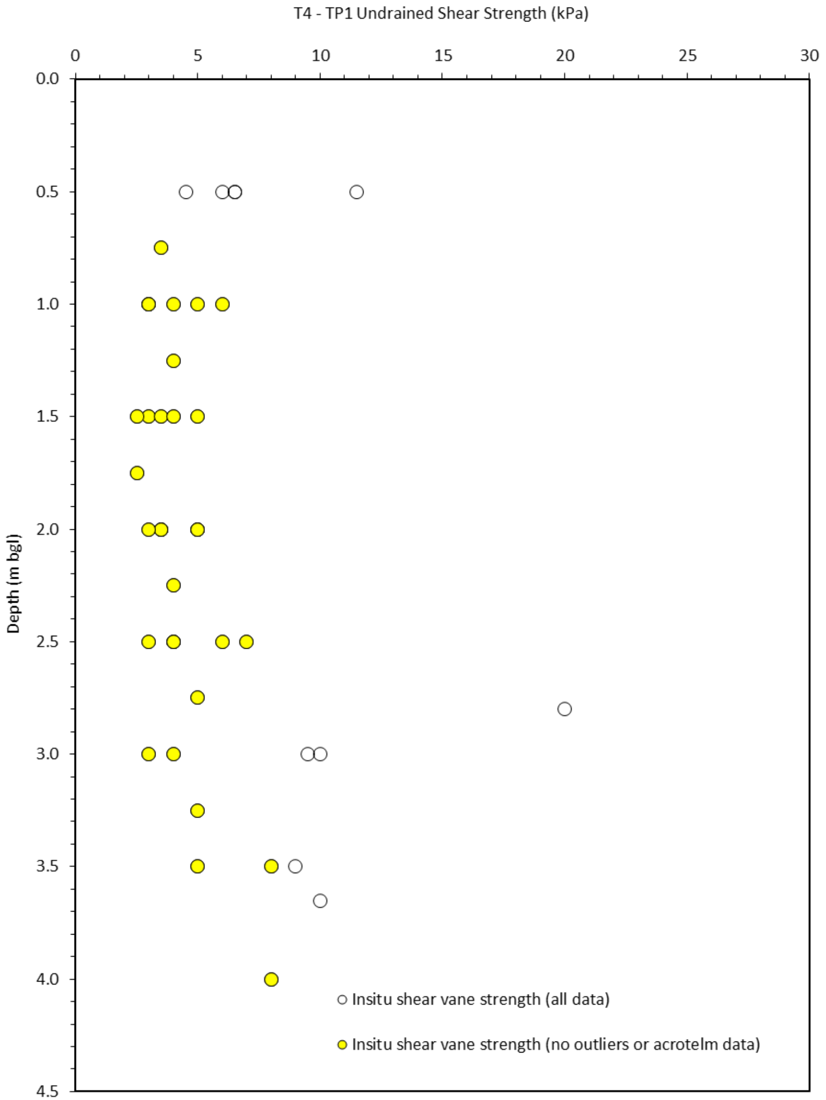
Figure 10: Aerial image of upper and lower scars



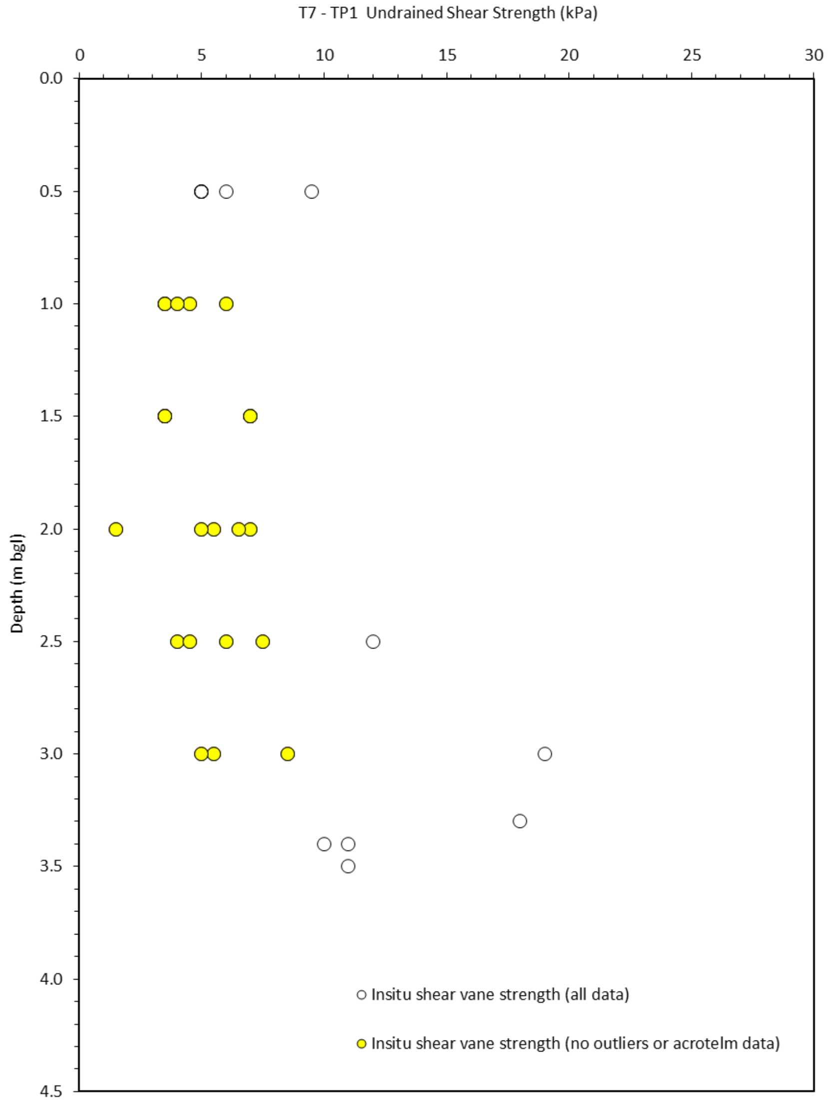
Source: Derg Media (2020)

Figure 11: Further investigation - insitu shear strength vane testing of peat at trial pit locations

(a) T4-TP1

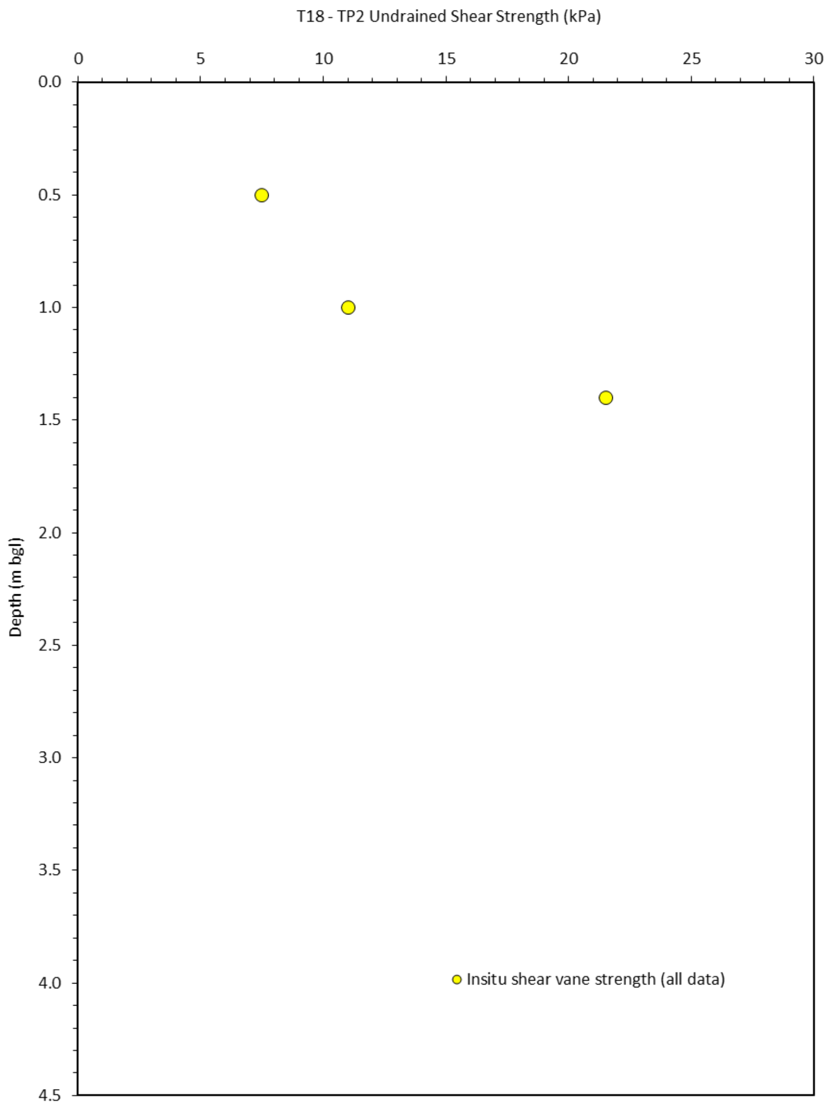


(b) T7-TP1



(c) T18-TP2

(d) T5-TP1



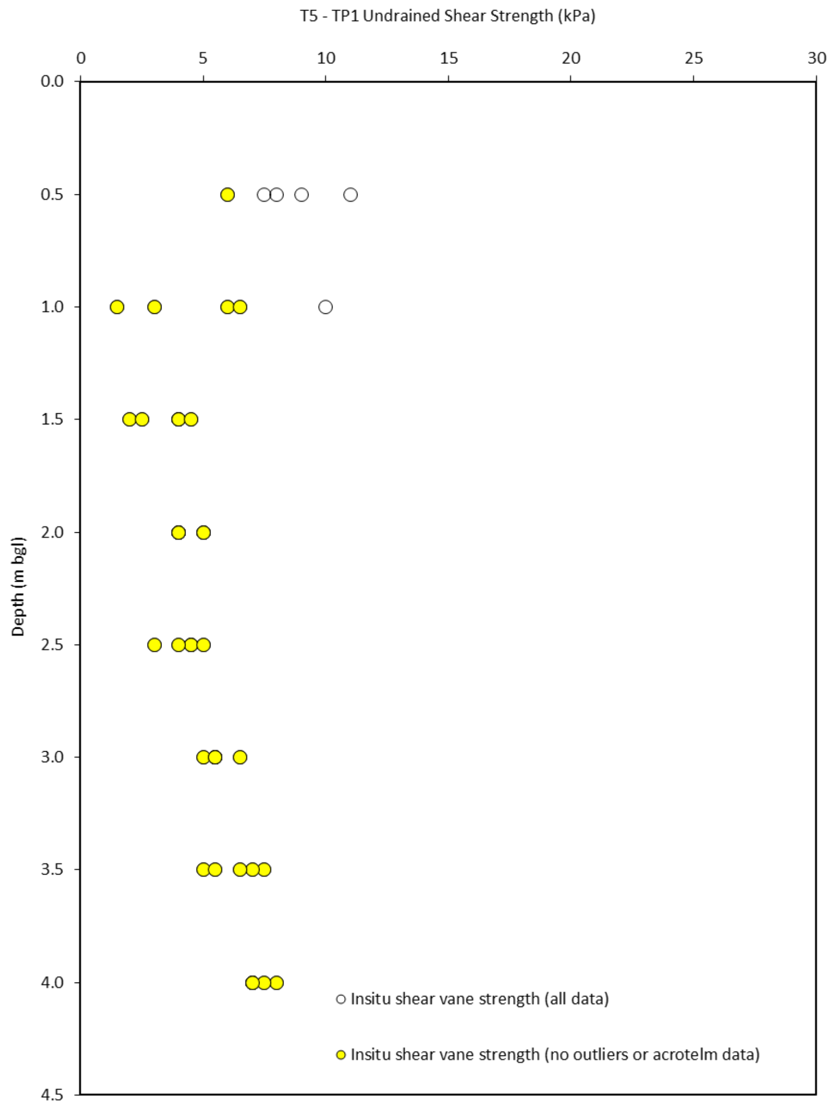
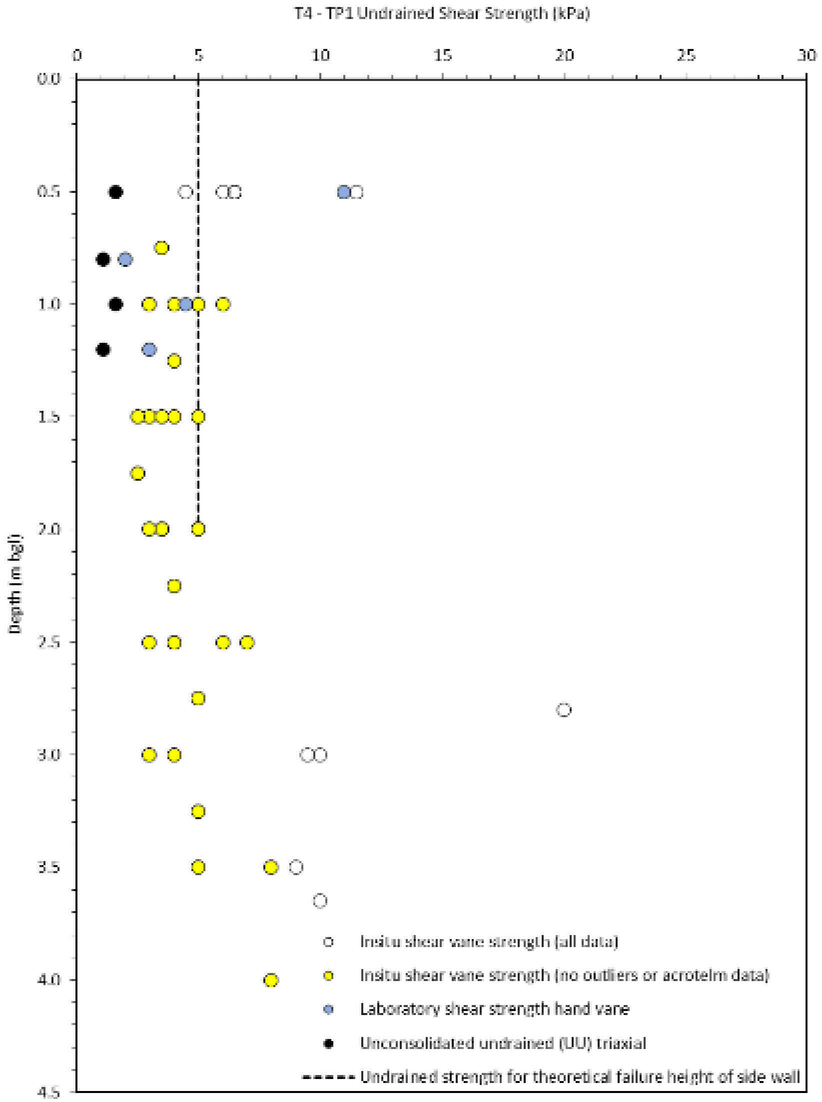
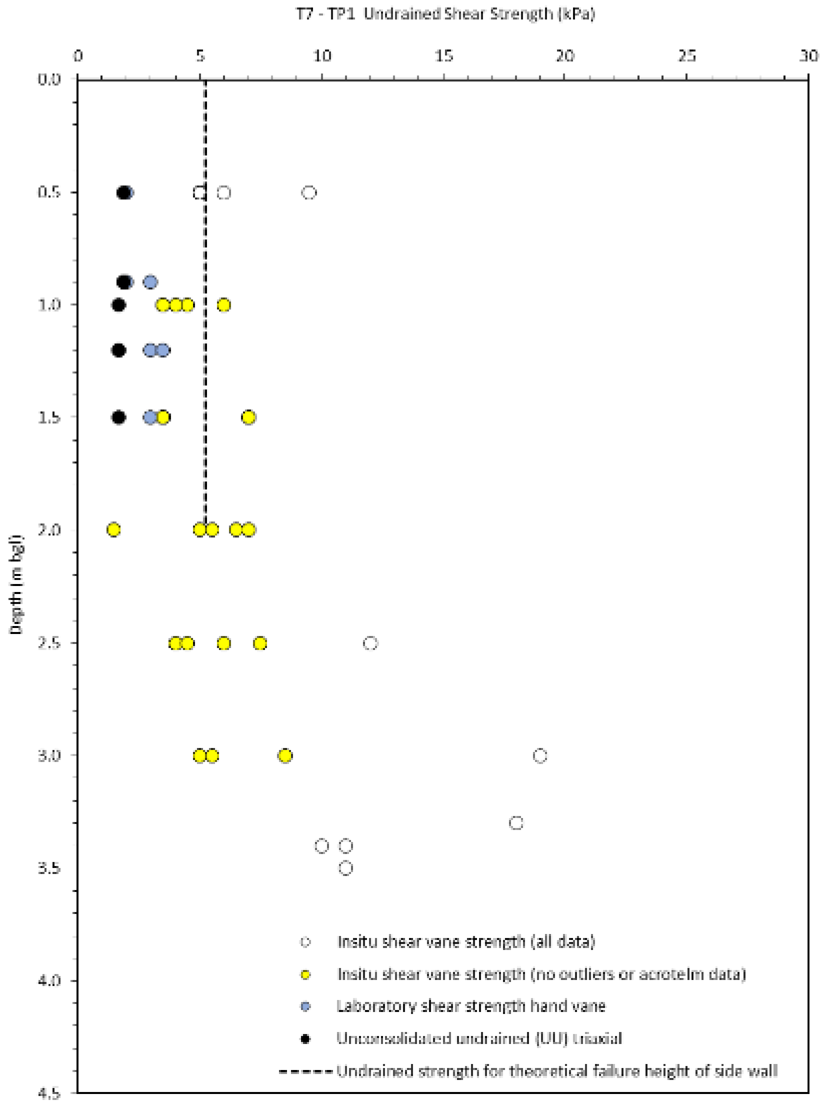


Figure 12: Further investigation - shear strength testing of peat using a variety of methods

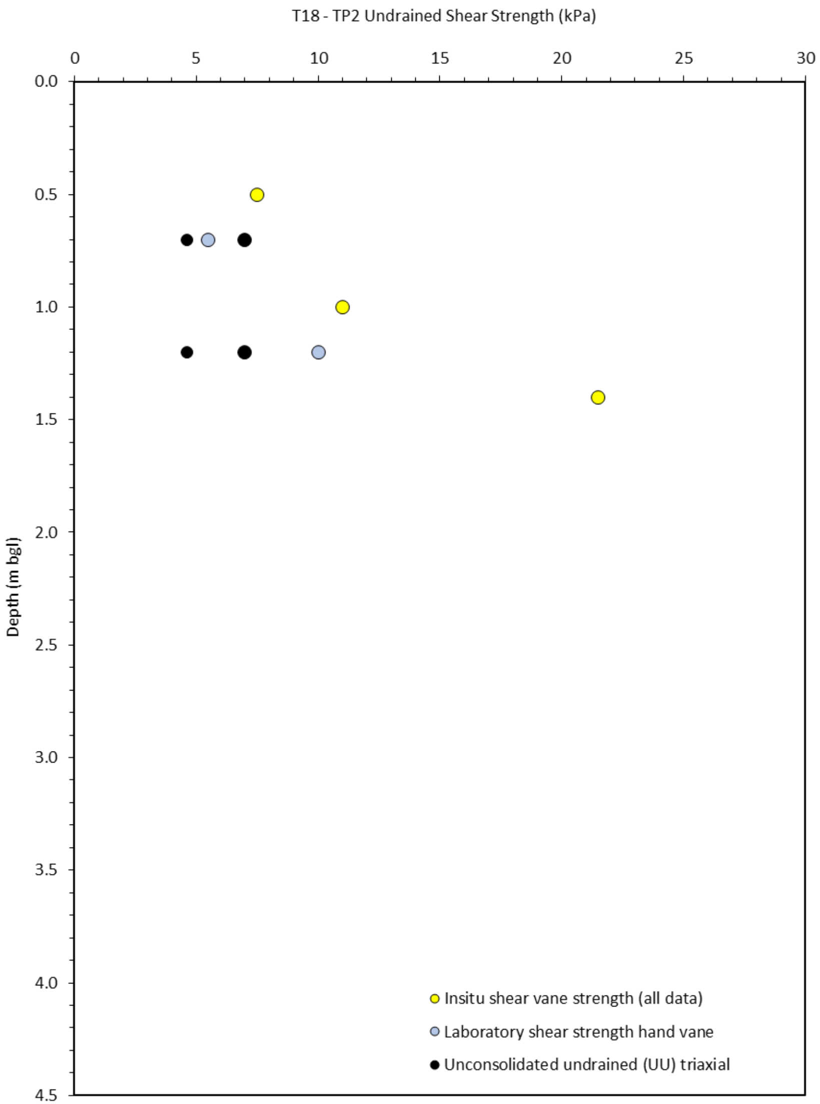
(a) T4-TP1



(b) T7-TP1



(c) T18-TP2



(d) T5-TP1

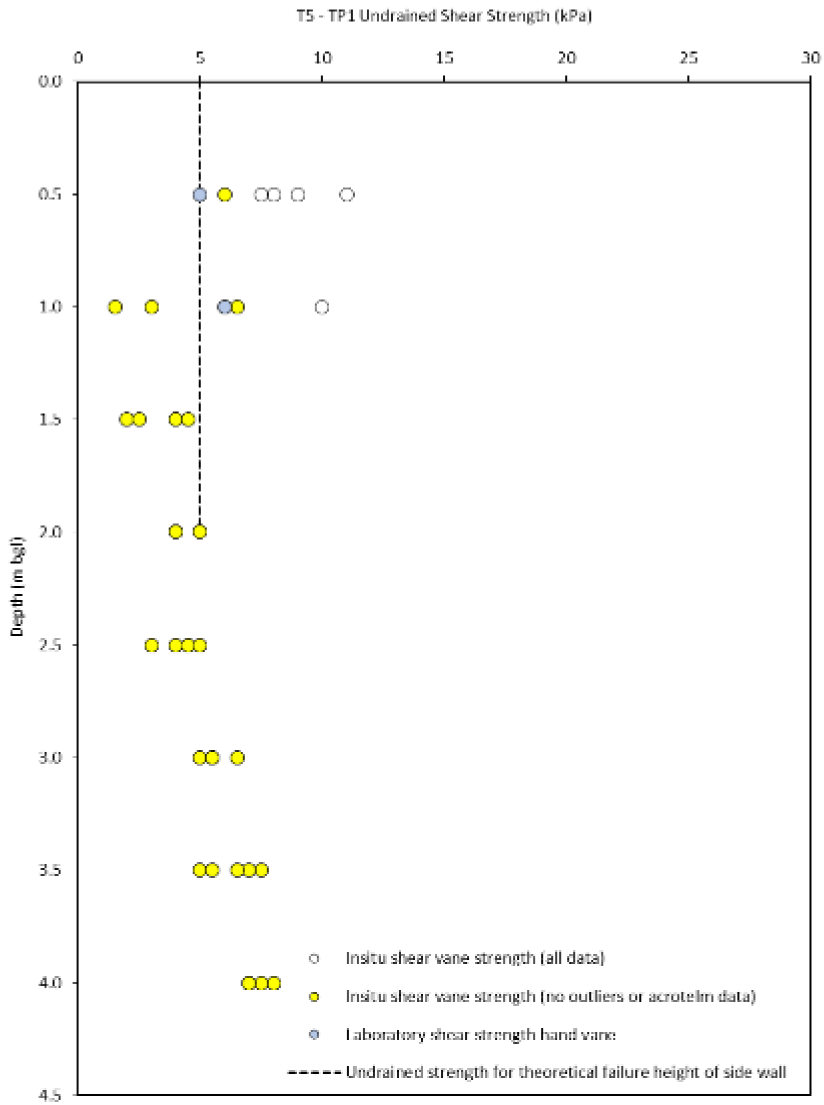
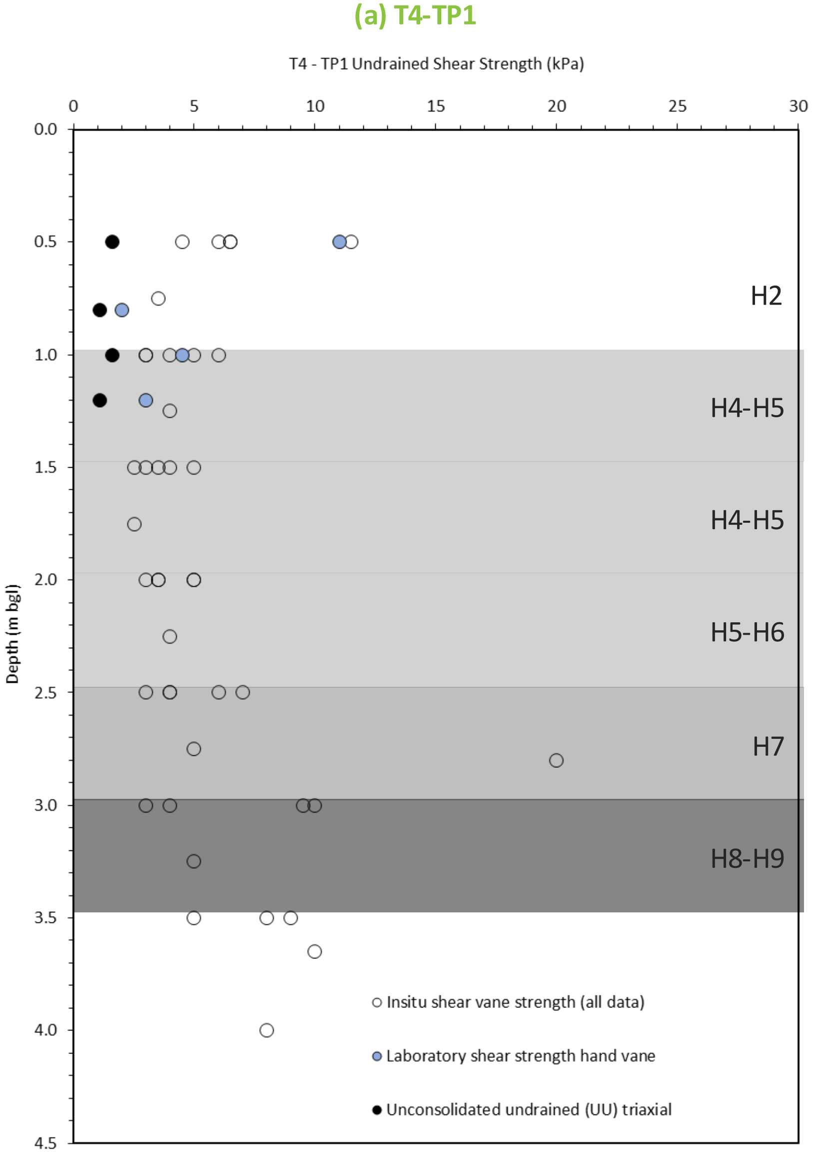


Figure 13: Further investigation - shear strength and humification



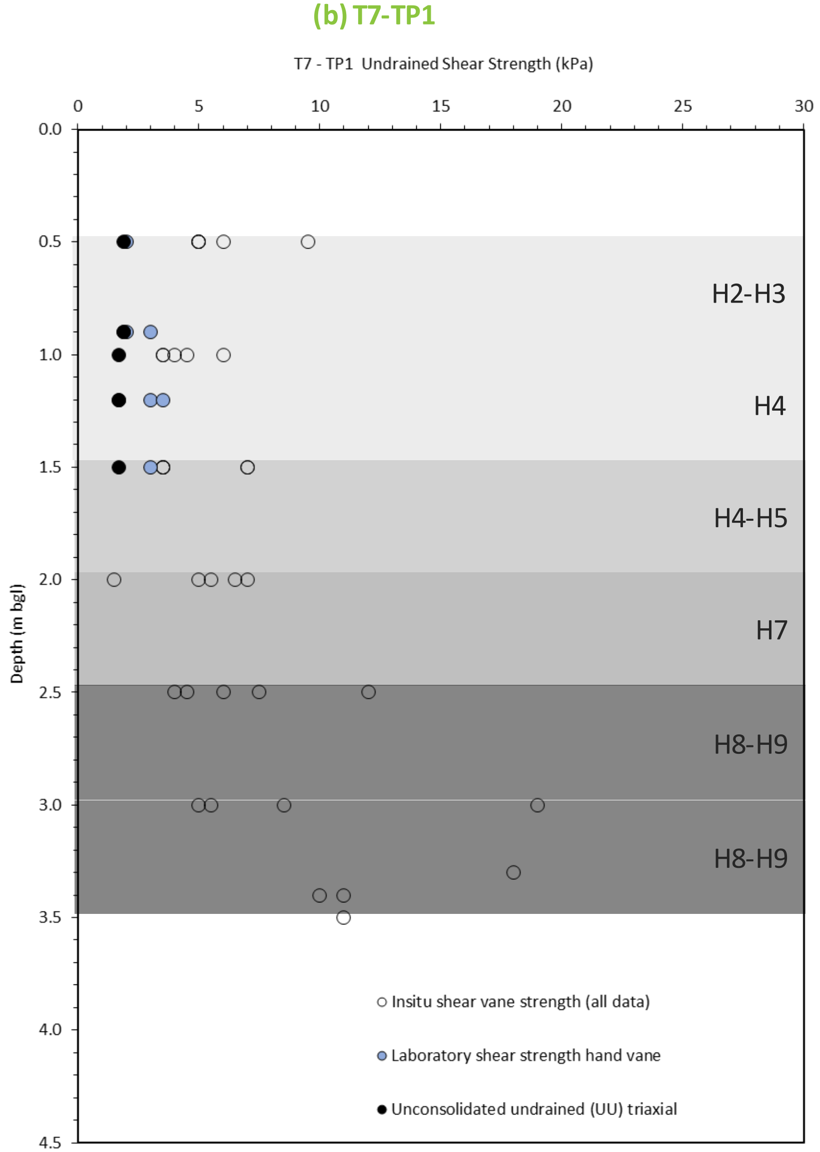
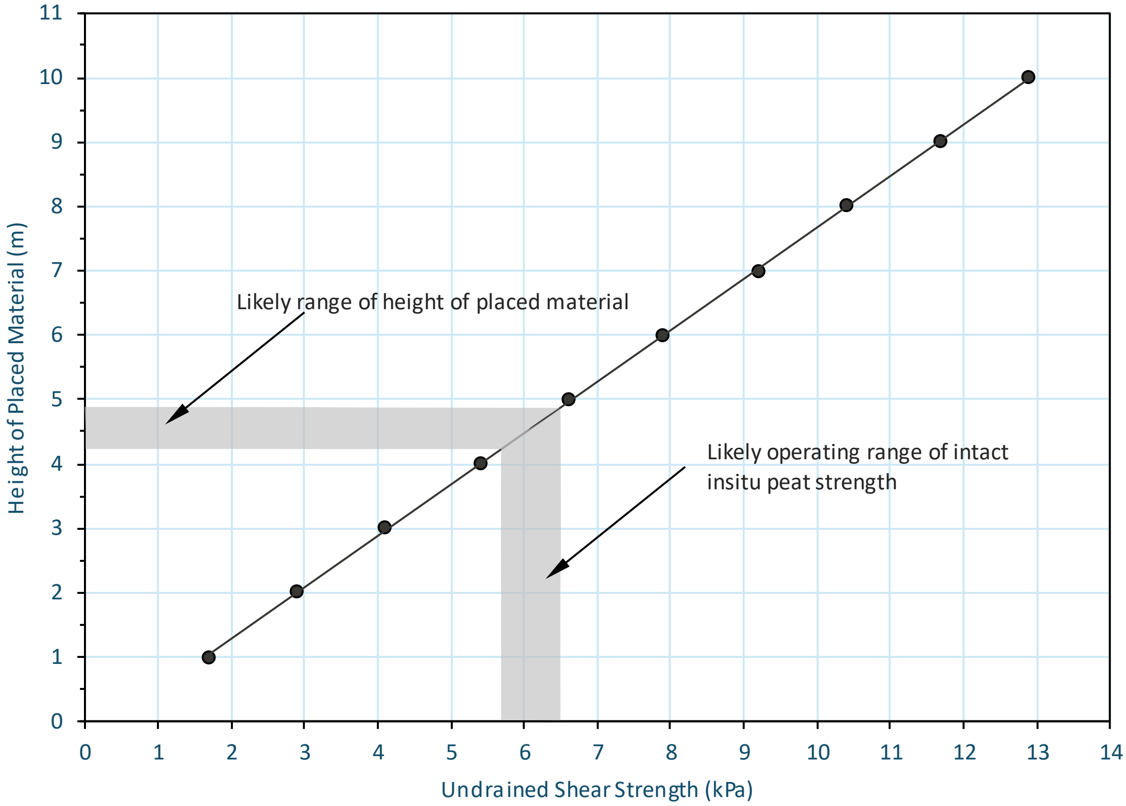


Figure 14: Further investigation - results of back-analysis of peat failure near T5



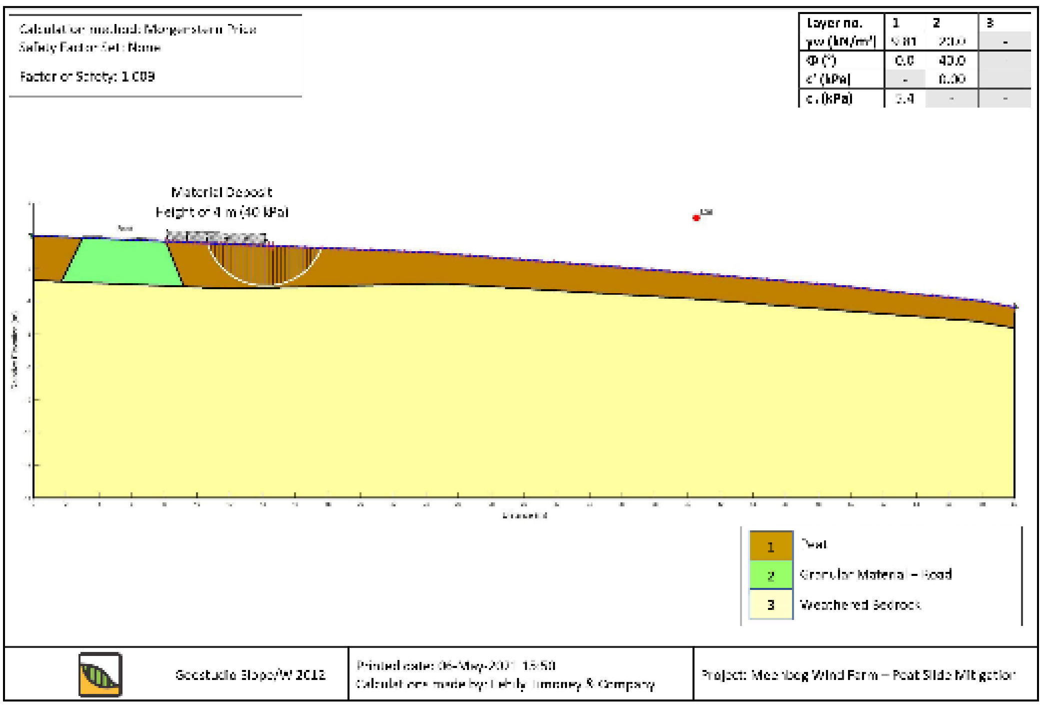
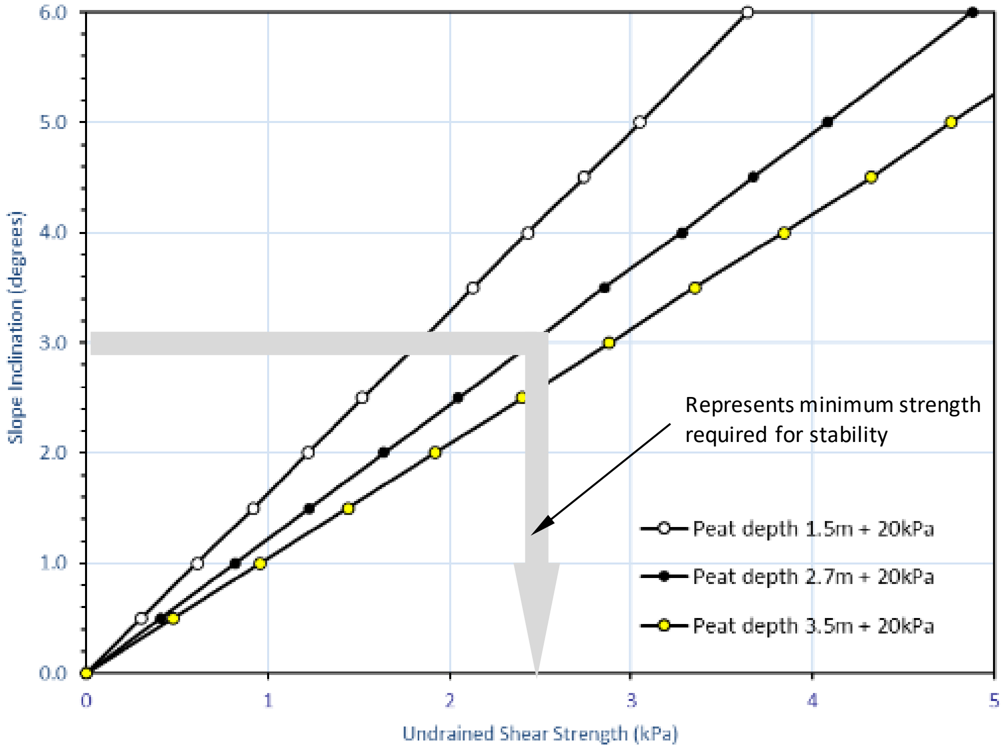


Figure 15: Further investigation - results of sensitivity analysis of peat failure of 12 November 2020

(a) Sliding analysis - plot lines represent onset of stablity for various peat depths at floating road to T7



(b) Stable vertical height of peat in upper scar

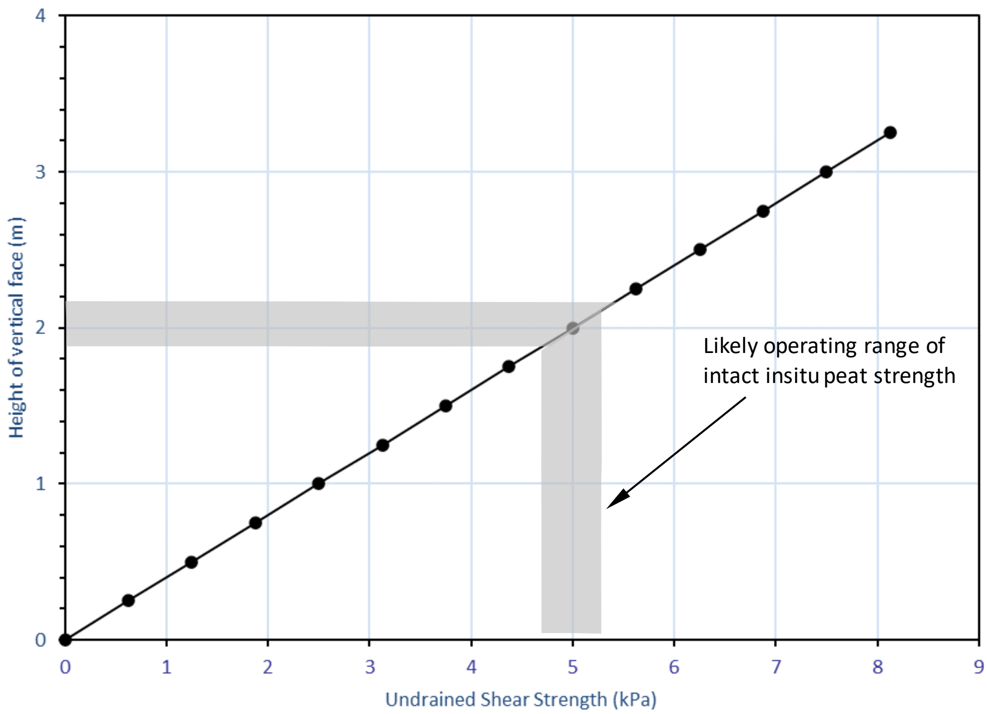
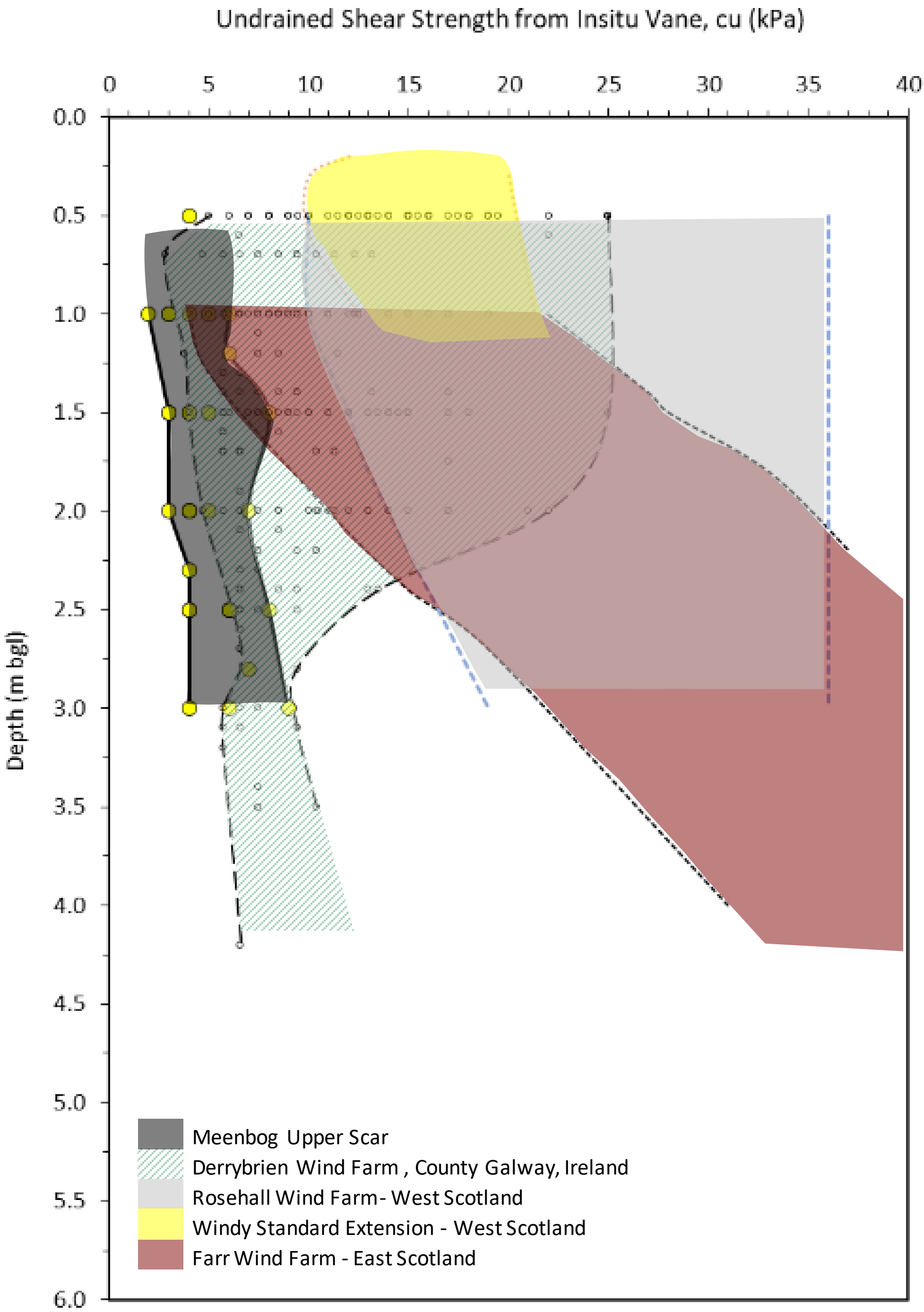


Figure 16: Further investigation – comparison of insitu vane strength for different peat sites



Notes

(1) Results above based on insitu shear vane testing of peat sites in Ireland and Scotland.

(2) The Scottish sites comprised a range of peat depth but overall were well-drained with peat strength increasing with depth. These sites were not affected by undrained peat failure.

(3) The Derrybrien and Meenbog site were both affected by peat failure.

APPENDIX A1

Investigation Data for Peat (Ionic Consulting)

Notes

(1) For details refer to Ionic report (Appendix D).

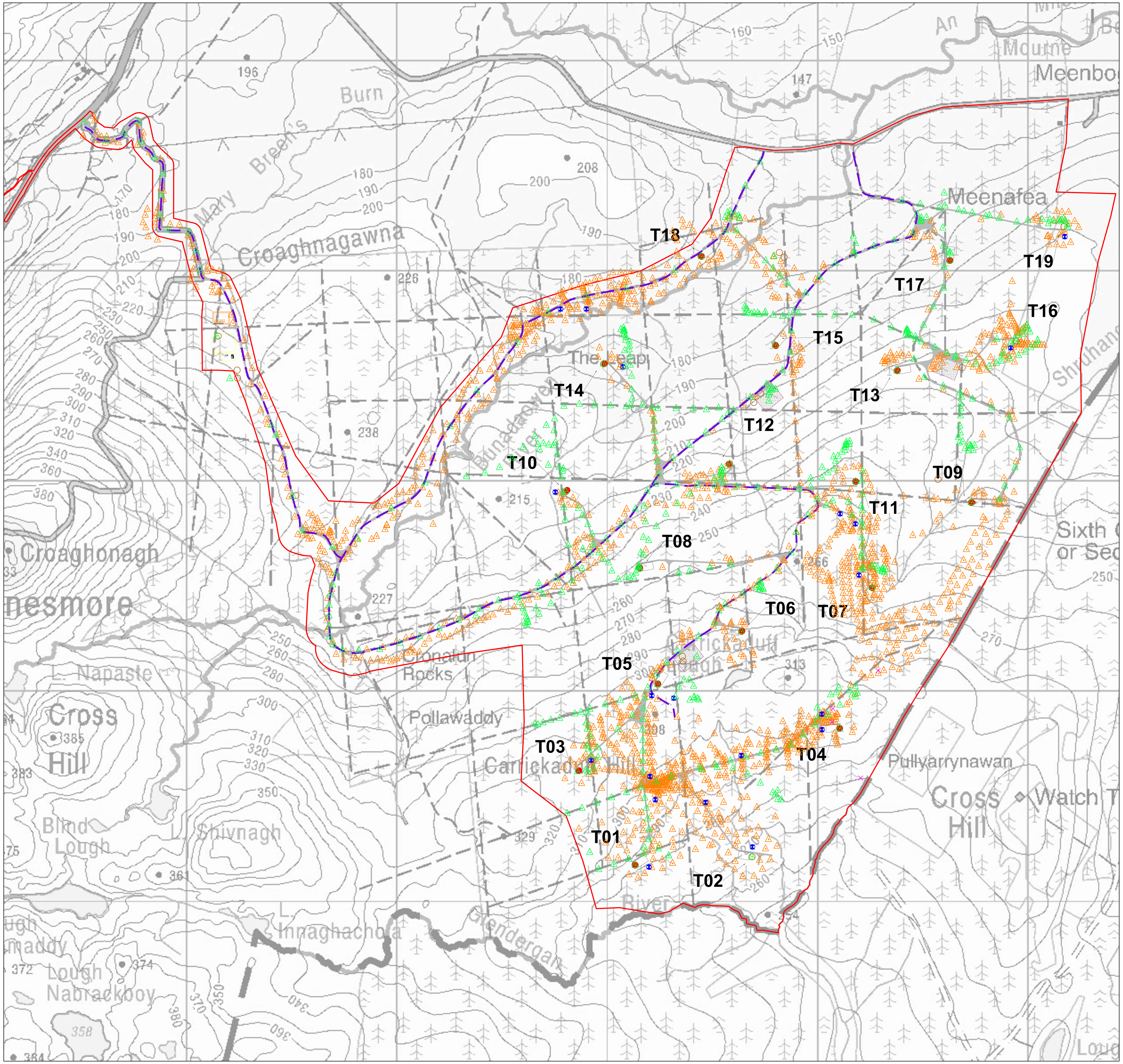
(2) Results are from insitu hand held vane testing and peat depth probing.

(3) All results co-ordinated to easting (E) and northing (N).

(4) PD – peat depth (m), SV – shear vane test result (kPa).

(5) Where no vane test result carried out or available this is shown with a 0 beside SV.

(6) Outline extent of 12 November 2020 peat failure shown approximately.



SITE INVESTIGATION LEGEND

- Boreholes
- Peat Probes (Planning)
- Peat Probes & Shear Vanes(Ionic)
- Fehily Timoney 2021 Russian Core Peat Samples
- Fehily Timoney Shear Strength Trial Holes 2021
- Gouge Core 2017 Locations
- GPR Ground Penetrating Radar

NOTES

REV	DATE	DRAWN BY	CHECKED BY	DETAILS
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CLIENT

PROJECT: MEENBOG WIND FARM

TITLE: SITE INVESTIGATION MAP OVERALL SITE

REVISION: A

DRAWN BY	DATE	PAPER SIZE	SCALE
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CHECKED AND APPROVED	DATE	STATUS
J. SHANAHAN	05/05/2021	INFORMATION

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APPENDIX A2

Ground Conditions at Location of 12 November 2020 Peat Failure

Table A2.1 In situ test results upper scar

Scar	GPS Waypoint	Easting	Northing	Depth to base of Peat (m bgl)		Vane test depth (m bgl)	Vane Strength (kPa)	Material at base of peat	Notes
Upper	19 NOV 12:39p	1,035,050	580,893						No measurements
Upper	19 NOV 12:42p	1,035,070	580,892	>	3.0	0.5	4.0	NK	
						1.0	3.0		
						1.5	3.0		
						2.0	3.0		
						2.5	6.0		
						3.0	4.0		
Upper	19 NOV 1:01p	1,035,113	580,848		2.8	1.0	2.0	Soil	
						1.5	3.0		
						2.0	4.0		
						2.5	4.0		
						2.8	10.0		
Upper	19 NOV 1:04p	1,035,107	580,806		2.0			Rock	
Upper	19 NOV 1:10p	1,035,064	580,767		1.7	1.0	3.0	Rock	Fall of vane under self-weight
						1.5	4.0		
						1.7	11.0		
Upper	19 NOV 1:16p	1,035,014	580,764		1.7				
Upper	19 NOV 1:20p	1,034,992	580,774		3.2				
Upper	19 NOV 1:28p	1,034,970	580,814	>	3.5	1.0	5.0	NK	Fall of vane under self-weight
						1.5	12.0		
						2.0	5.0		
						2.5	6.0		
						3.0	9.0		
Upper	19 NOV 1:31p	1,034,949	580,838		3.4			Rock	
Upper	19 NOV 1:35p	1,034,913	580,881		3.0			NK	
Upper	19 NOV 1:40p	1,034,883	580,894		2.8	1.0	6.0	Rock	
						1.5	8.0		
						2.0	7.0		
						2.5	8.0		
						2.8	7.0		
Upper	19 NOV 2:51p	1,035,050	580,893						No measurements
Upper	19 NOV 3:00p	1,034,999	580,897		2.3	1.0	5.0	NK	Fall of vane under self-weight
						1.5	10.0		
						2.0	4.0		
						2.3	4.0		
Upper	19 NOV 3:07p	1,034,997	580,935	>	3.0			NK	
Upper	19 NOV 3:10p	1,034,956	580,946		2.9	1.2	6.0	NK	
						1.5	5.0		
						2.0	7.0		
						2.5	6.0		
						2.9	19.0		
Upper	19 NOV 2:38p	1,035,080	580,720	>	3.0	1.0	4.0		Located about 30m south of upper scar within open peat land
						1.5	4.0		
						2.0	4.0		
						2.5	4.0		
						3.0	6.0		
				Average	2.7	1.9	5.9		
				Max	3.5	3.0	19.0		
				Min	1.7	0.5	2.0		

Table A2.2 In situ test results lower scar

Scar	GPS Waypoint	Easting	Northing	Depth to base of Peat (m bgl)		Vane test depth (m bgl)	Vane Strength (kPa)	Material at base of peat	Notes
Lower	19 NOV 1:54p	1,034,822	580,881		2.0				
Lower	19 NOV 2:04p	1,034,769	580,860		1.5	1.0	4.0	NK	
						1.5	12.0		
Lower	19 NOV 2:13p	1,034,725	580,839		1.6	1.0	5.0	NK	
						1.5	15.0		
Lower	19 NOV 2:18p	1,034,657	580,813		2.0				
				Average	1.8	1.3	9.0		
				Max	2.0	1.5	15.0		
				Min	1.5	1.0	4.0		

Notes:

(1) Material below peat has been estimated based on results of probe/vane. Where NK the material is not known.

(2) Shear vane locations were typically within 5m of the furthest tension crack identified at edge of failure scars, except where noted.

(3) Strength testing carried out using a Geonor H-60 Hand-Field Vane to determine undrained vane strength.

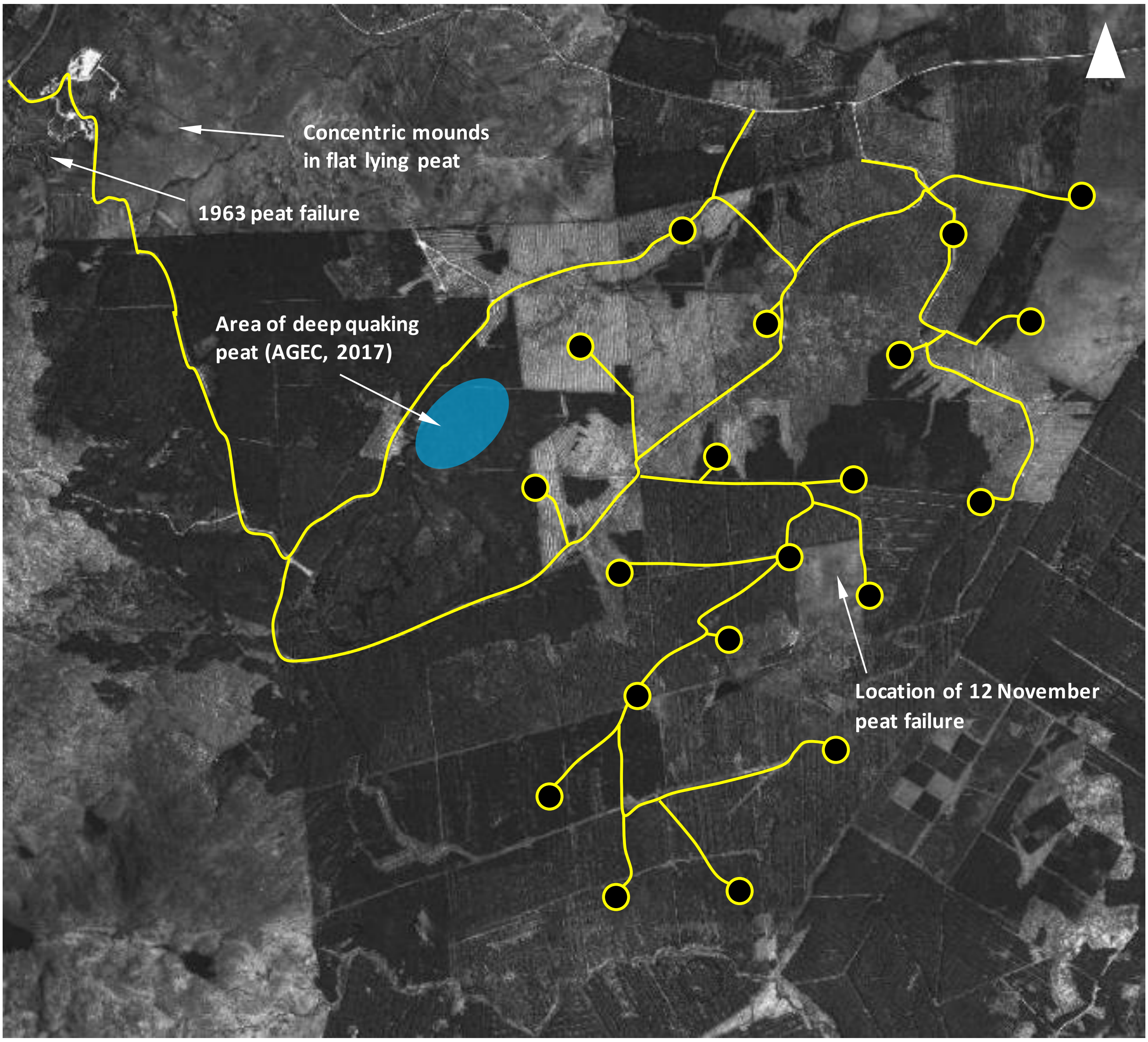
(4) At a number of locations the shear vane was falling under its own weight which suggests negligible shear resistance in the peat.

(5) At a number of locations the base of the peat was not encountered this is identified by ">" which means peat depth is greater than the maximum depth recorded.

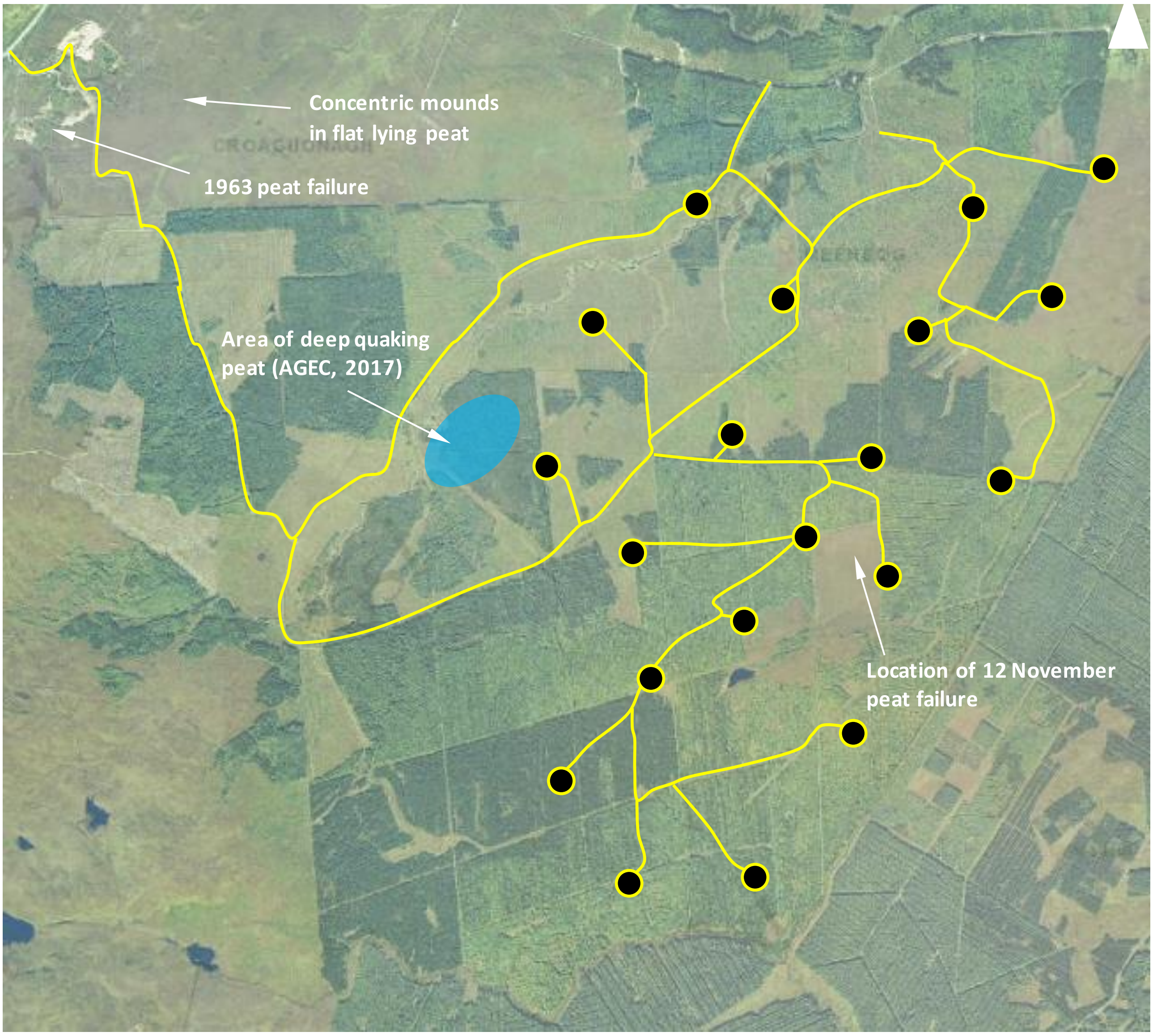
APPENDIX A3

Historical Aerial Photography

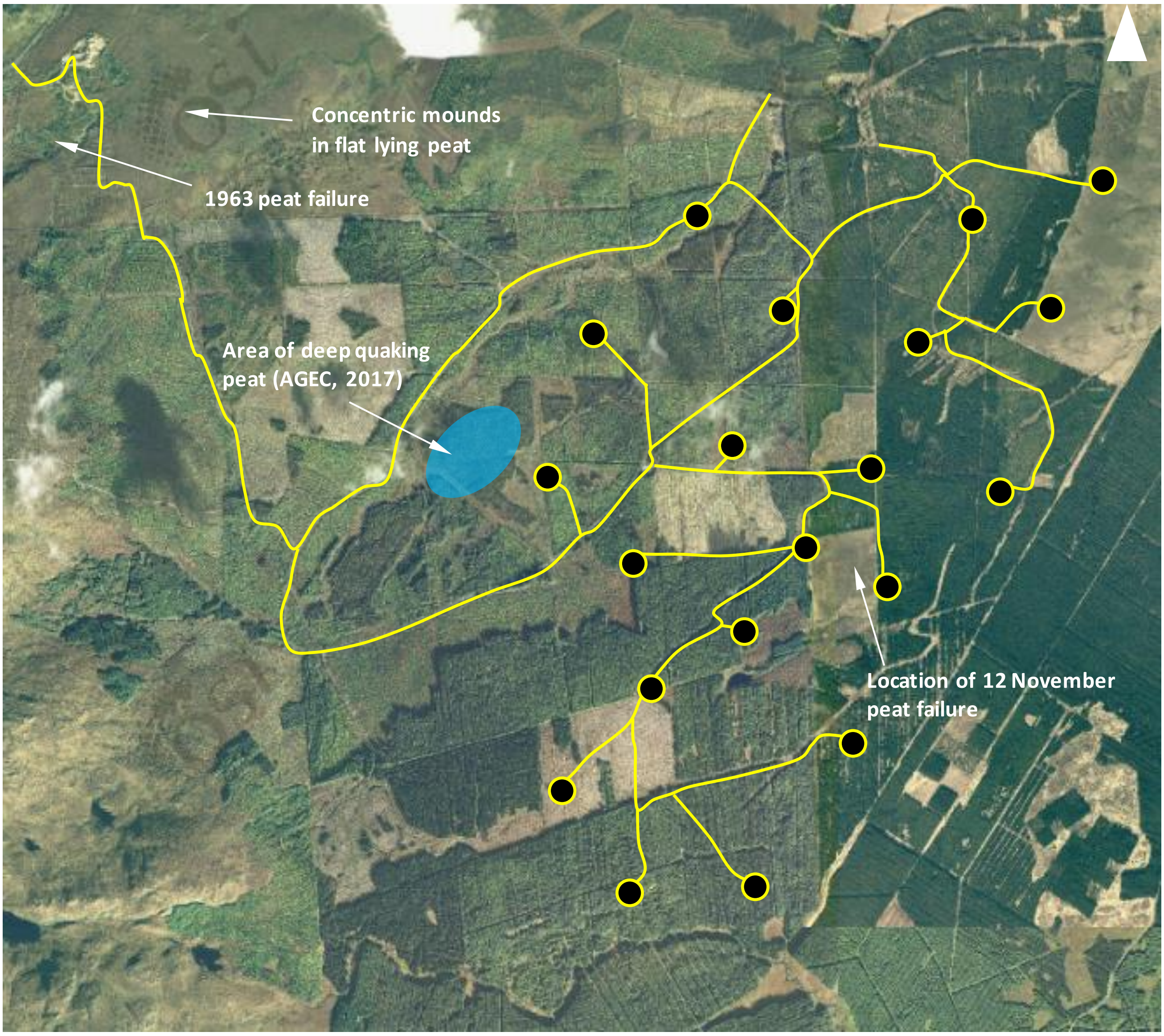
Aerial photograph 1995 (GeoHive, 2020)



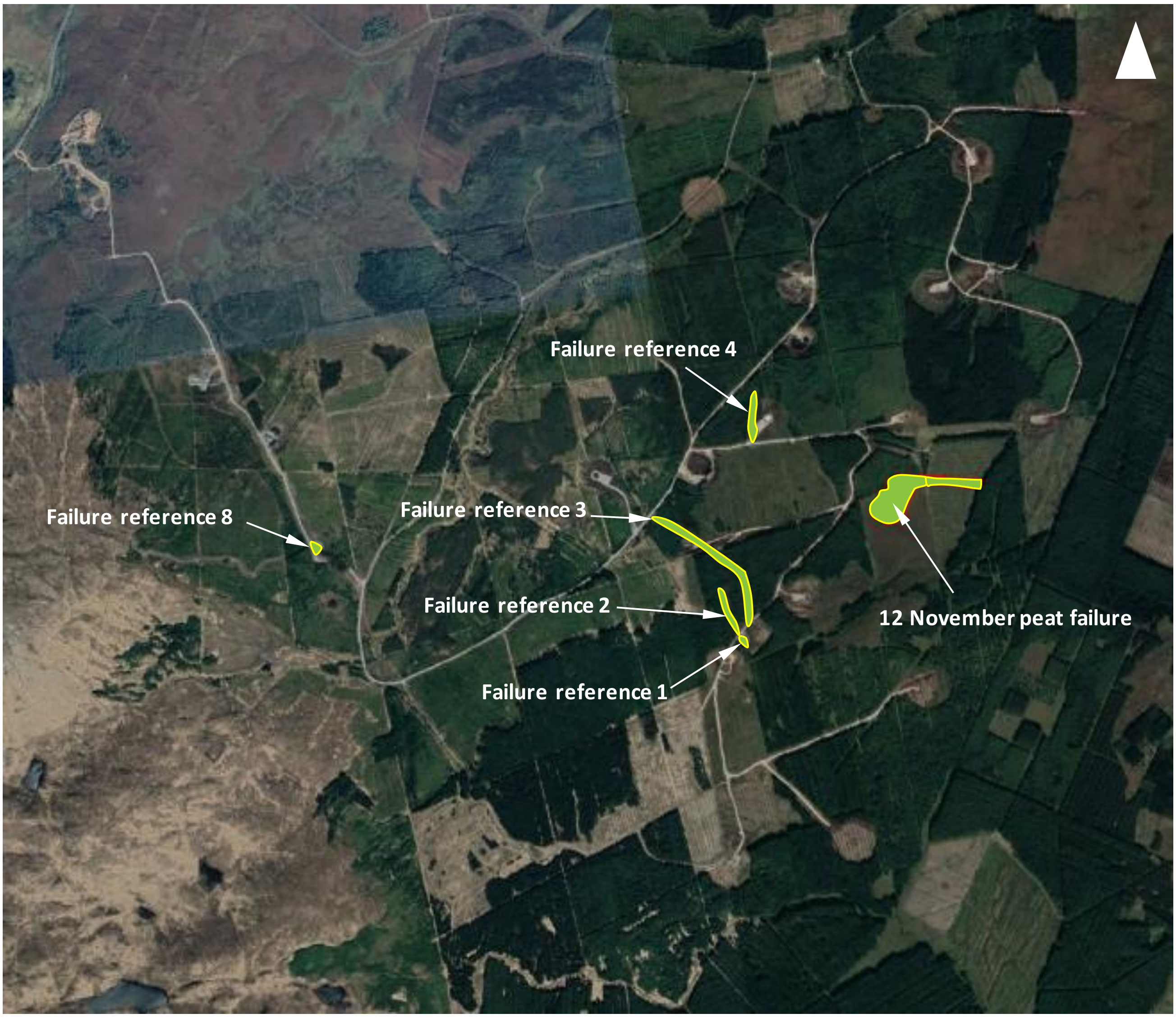
Aerial photograph 2005 (GeoHive, 2020)



Aerial photograph 2013 to 2018 (GeoHive, 2020)



Aerial photograph September 2020 (Google Earth, 2020)

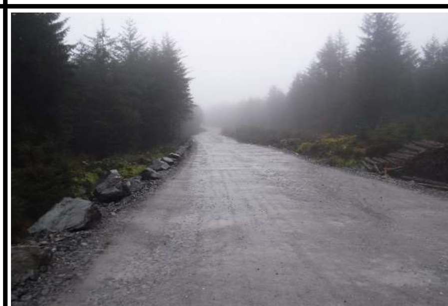


APPENDIX A4

Findings of Assessment of Constructed Works

Site Location: **Date: 19/01/2021** Weather: Wet.

Location ID	**General Notes**	**Photos**		
Track to T1	Floating track to T1. Side casting of peat both sides. No evidence of stability issues.			
Track to T2	Floating track to T2. Side casting of peat both sides. No evidence of stability issues.			
Track to T3	Floating track. Peat side cast (approx 1m deep) on both sides of access track. 4 degree slope.			

Track to T4	Floating track. No side casting. 4 degree slope.			
Junction between T1 and T2/4	Floating road, evidence of settlement of underlying peat.			
Track T6-T8	5 degree slope, no side casting, no evidence of stability issues.			

Track to T8	3 degree slope, side casting both sides. Not evidence of stability issues.			
Track to T9	View towards T9. Slope 2-4 degrees, side casting both sides, <1m. No evidence of stability issues.			
T10-T14	Minor area of side casting downslope			

Track near T12	6 degree slope. Minor area of side casting downslope. No evidence of stability issues.			
T14 access track	Side casting both sides, 6 degree slope, <1m side cast. No evidence of stability issues.			
T15-T19	Founded section of track, rock visible in drain on upslope side. No evidence of stability issues.			

T16-T17	View towards T17, no evidence of stability issues.			
Upgrade of existing to T18	Existing track appears to be floated on sidelong ground, upslope of stream.	 View W from closer to main access track	 Condition of existing track	 Upgraded section close to T18
T19	Side casting alongside track. 2-3 degree slope, peat up to 2m in height, not sealed.			

Site Location: **Date: 19/01/2021** Weather: Wet.

Location ID	**General Notes**	**Photos**		
T1	Upslope of H/S - 3 degree slope. H/S side slopes 40 degrees. Flat, saturated area downslope of H/S. No evidence of stability issues.	 T1 Turbine	 T1 hardstand	 Downslope of T1 hardstand
T2	3 degree slope around hardstand. Turbine excavation flooded, pump turned off. No evidence of stability issues.	 T2 Turbine	 T2 Hardstand	
T3	Relatively flat, 1-2 degree slopes around hardstand. No evidence of stability issues.	 Looking S	 Looking N	

T4	Relatively flat, 1-2 degree slopes around hardstand. Peat 1-2m in thickness. No evidence of stability issues.	 T4 Turbine	 T4 Hardstand	
T5	3 degree slope around hardstand. Evidence of instability around hardstand - tension cracks visible to 25-30m away from hardstand.	 T5 Turbine	 T5 Hardstand	 Tension cracks around hardstand
T6	5 degree slope around hardstand. Minor side casting of peat (<0.5m). No evidence of stability issues.	 T6 Turbine	 T6 Hardstand	

T8	5 degree slope upslope for hardstand. Minor side casting around hardstand. Barrage close to hardstand to retain material that failed upslope.	 T8 Turbine	 T8 hardstand	 Barrage
T9	2 degree slope around hardstand. Peat side cast upslope of hardstand, <1m thick. No evidence of stability issues.	 T9 Turbine	 T9 Hardstand	
T10	1-2 degree slope around hardstand. Shallow side casting of peat around hardstand and access track. No evidence of stability issues.	 T10 Turbine	 T10 Hardstand	

T11	2-3 degree slopes around hardstand. Small area of side casting upslope from hardstand. No evidence of stability issues.	 T11 Turbine	 T11 Hardstand	
T12	4 degree slope around hardstand. Small peat slide downslope of hardstand	 T12 Turbine	 T12 Hardstand	 Downslope Failure
T13	3-4 degree slopes around hardstand. Small area of side casting upslope from hardstand. No evidence of stability issues.	 T13 Turbine	 T13 Hardstand	

T14	2-3 degree slope around hardstand. Peat side cast around hardstand and access track. No evidence of stability issues.	 T14 Turbine	 T14 Hardstand	
T15	2-4 degree slope around hardstand. Peat stored both north and west of the hardstand. Area to the north shows signs of movement in perimeter berm.	 Turbine T15	 T15 Hardstand	 Peat Repository
T16	3 degree slope around hardstand. Small failure between cut-off drain and hardstand in peat. Water from drain now draining into hardstand.	 Turbine T16	 T16 Hardstand	 Failure between drain and hardstand

T17	3 degree slope around turbine and hardstand. Peat side cast upslope and hardstand. Peat storage area downslope, berm shows evidence of minor movement.	 Turbine T17	 T17 Hardstand	
T18	3 degrees slope around hardstand. Peat side cast both upslope and downslope, towards stream.	 Turbine T18	 Side cast Peat	
T19	2-3 degree slope around hardstand. Rock at surface at turbine location, 1.5-2m of peat adjacent to hardstand. Minor slump between cut-off drain and hardstand.	 T19 Turbine	 T19 Hardstand	 Minor failure along edge of drain

Site Location: **Date: 19/01/2021** Weather: Wet.

Location ID	**General Notes**	**Photos**		
T15 Peat Repository	2-4 degree slope around hardstand. Peat stored both north and west of the hardstand. Area to the north shows signs of movement in perimeter berm.	 Peat Repository	 Peat Repository	 Surface of stored peat
T17 Peat Repository	3 degree slope around turbine and hardstand. Peat side cast upslope and hardstand. Peat storage area downslope, berm shows evidence of minor movement.	 Peat Repository	 Peat Repository	
Backfilled BP (Main)	Peat backfilled into borrow pit. Berm alongside access track, around 4m in height. No evidence of stability issues.			

Backfilled BP (near T15)	Peat backfilled into borrow pit. Berm alongside access track, around 4m in height. No evidence of stability issues.			
Backfilled BP (near T16)	Peat backfilled into borrow pit. Berm alongside section of access track, around 4m in height. No evidence of stability issues.			
Drain crossing of track to T18	Narrow drain crossed by existing track. Shallow (<0.5m) peat.			

Side casting upslope of track close to T18	General view			
Failure T6-T8	General views of peat failures - see report text for details	 Downslope at head of failure	 View close to T8	

APPENDIX A5

Rainfall Data

Table A5.1 Daily rainfall preceding failure at Lough Mourne ASC

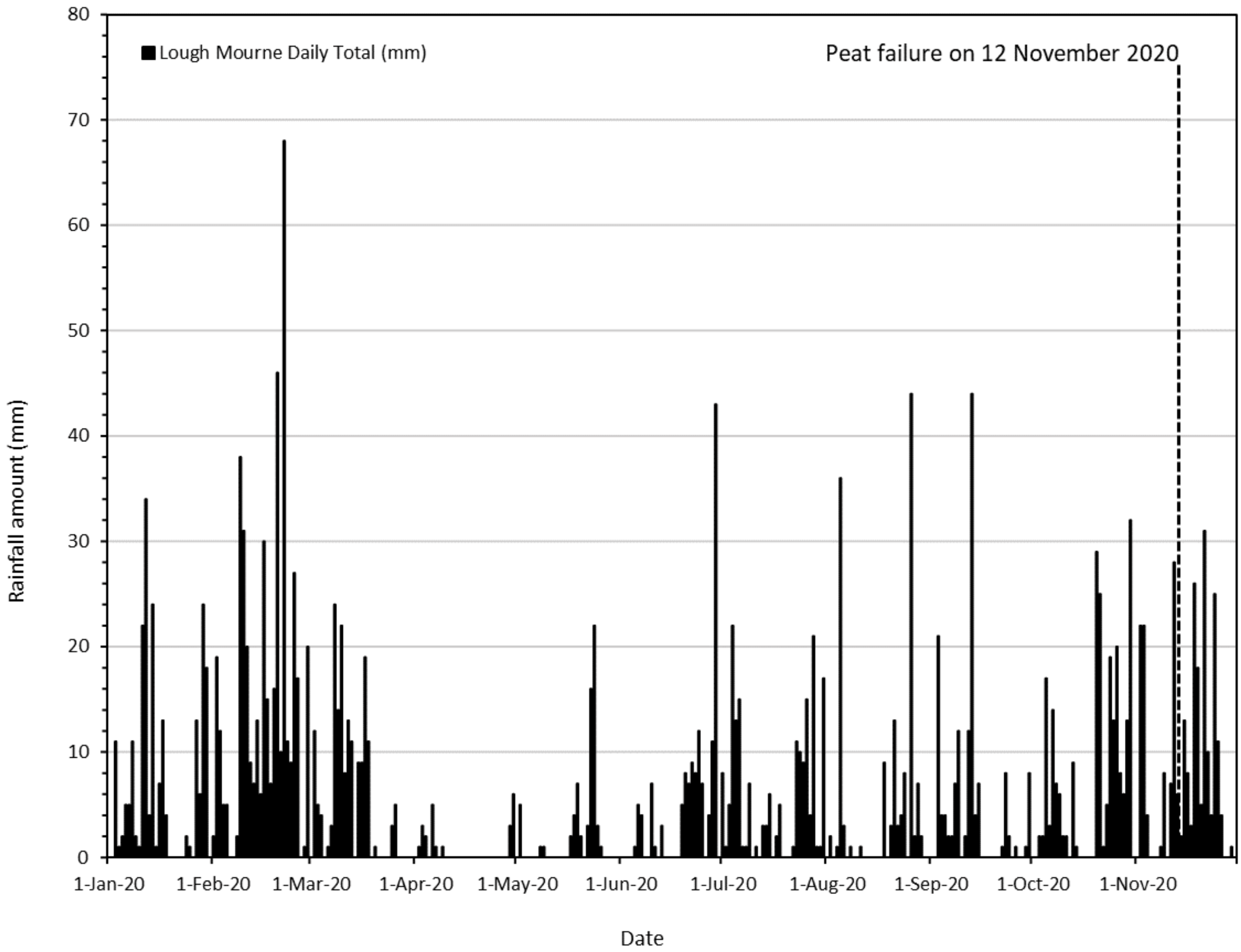


Table A5.2 Daily rainfall preceding failure at Finner WS

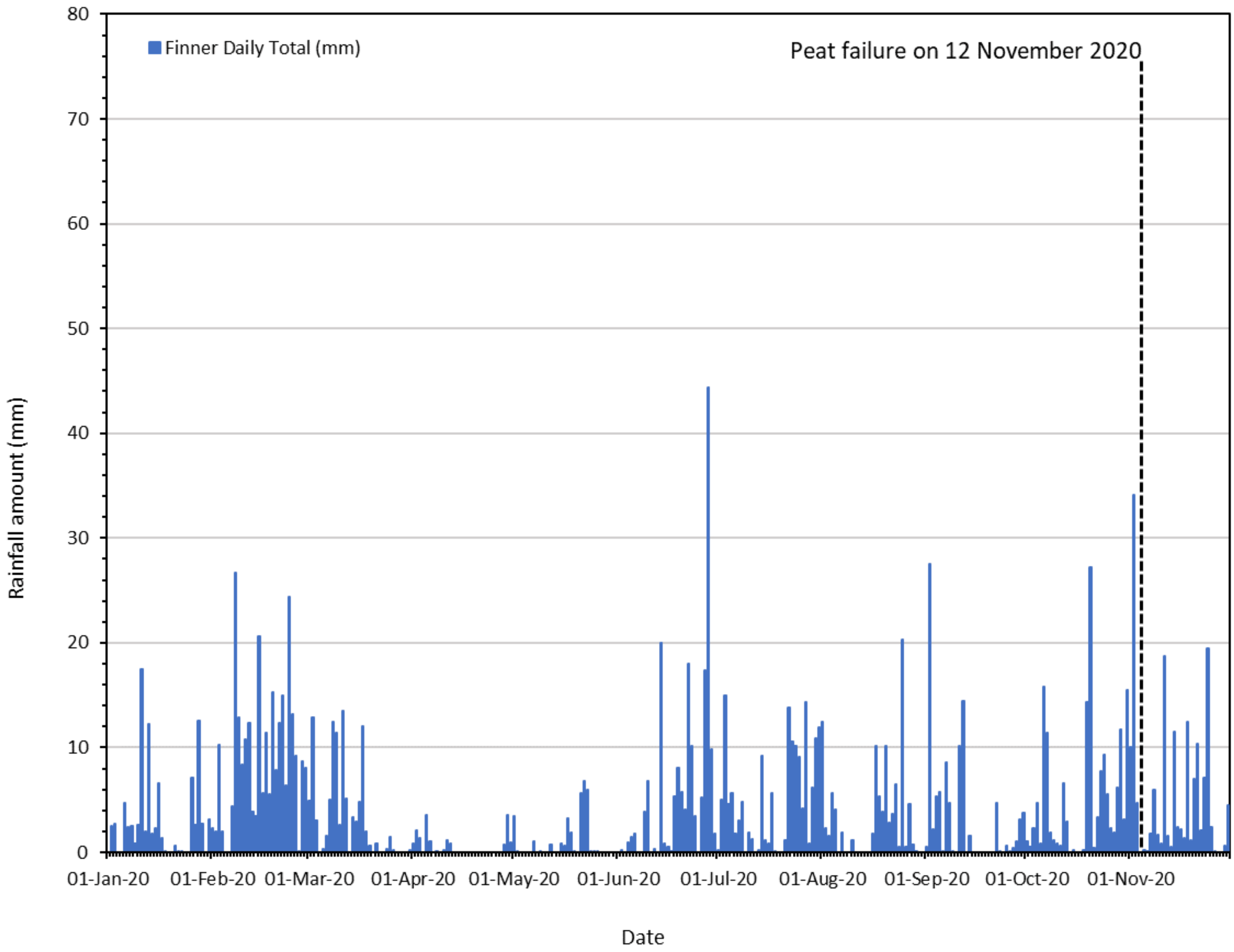
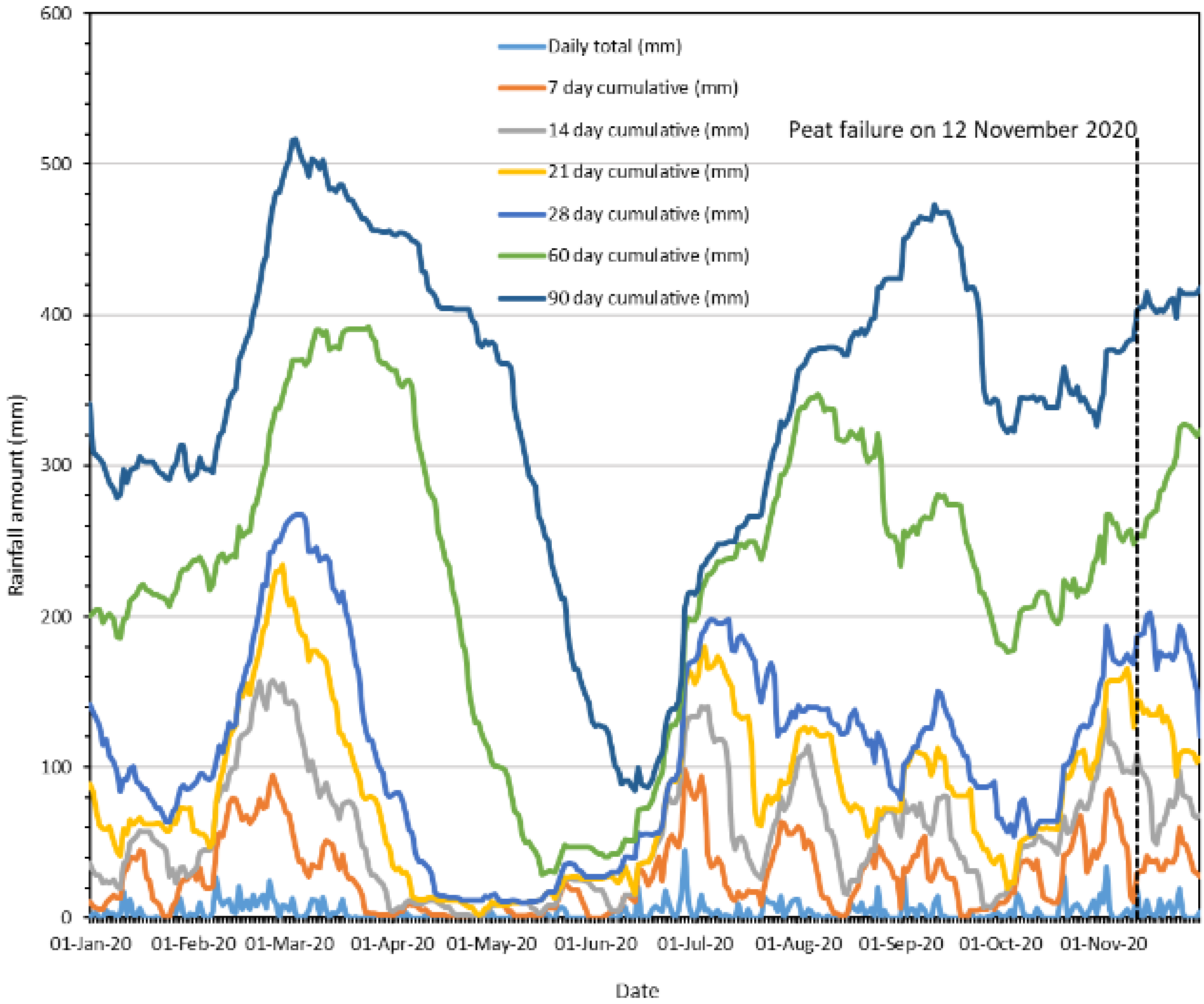


Table A5.3 Antecedent rainfall preceding failure



APPENDIX A6

Further Ground Investigation Data

Trial Pit Logs and Associated RPS Logs

Russian Peat Sample Log

FEHILY TIMONEY	Russian Peat Sample Log		Russian Peat Sample No. T4 TP1 (RPS) Sheet 1 of 1
Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 08021, 84893 **Level:**	**Date:** 22/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 3.5	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.50	SV (P) SV (R)	11.5 4	0.50			Very wet (much free water) very stringy very slightly decomposed, slightly amorphous very soft brown PEAT with many fine and course fibres. Von Post: H2 - H3, F3, R3, W0, Tv2, Th2, A1, P0
	1.00	SV (P) SV (R)	6 3	1.00			Very wet (free water) stringy slightly to moderately decomposed with some to considerable amorphous material very soft brown PEAT with many fine and coarse fibres. Von Post: H4 - H5, F3, R2 - R3, W0, Tv2, Th1, A1, P0
	1.50	SV (P) SV (R)	5 3	1.50			Very wet (free water) stringy slightly to moderately decomposed with some to considerable amorphous material very soft brown PEAT with many fine and some coarse fibres. Von Post: H4 - H5, F3, R2, W0, Tv2, Th1, A1, P0
	2.00	SV (P) SV (R)	5 3.5	2.00			Very wet (free water) moderately to moderately strongly decomposed with considerable amorphous material, very soft brown PEAT with some fine and occasional coarse fibres. Von Post:H5 - H6,F2 - F3,R1,W0,Tv1,Th1,A0 - A1,P0
	2.50	SV (P) SV (R)	7 3.5	2.50			Very wet (free water) strongly decomposed with highly amorphous, very soft dark brown PEAT with some fine fibres. Von Post: H7, F2, R0 - R1, W0, Tv0 - Tv1, Th0, A0 - A1, P0
	3.00	SV (P) SV (R)	10 6.5	3.00			Wet very strongly decomposed with highly amorphous, very soft dark brown PEAT with some fine fibres and occasional shrub fragments. Von Post: H8, F2, R0, W0 (n1), Tv0, Th0, A1, P1
				3.30			Almost completely decomposed with amorphous very soft black PEAT. Von Post: H9, F1, R0, W0 (N0), Tv0, Th0, A1, P1
	3.50	SV (P) SV (R)	8 6	3.50			End of sample at 3.50m
	4.00	SV (P) SV (R)	10 6				

Remarks: Russian Peat sample taken in centre of trial pit (T4-TP1) as log of the trial pit.

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **T7 TP1 (RPS)**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: O8198, 85554** **Level:**	**Date:** 22/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 3.5	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.50	SV (P) SV (R)	9.5 2	0.50			Wet stringy very slightly decomposed, slightly amorphous very soft brown PEAT with many fine and course fibres. Von Post: H2 - H3, F3, R3, W0, Tv2, Th2, A1, P0
	1.00	SV (P) SV (R)	4 1	1.00			Slightly to moderately decomposed with some to considerable amorphous material very soft brown PEAT with many fine and coarse fibres. Von Post: H4, F3, R2, W0, Tv2, Th1, A1, P1
	1.50	SV (P) SV (R)	3.5 1	1.50			Slightly becoming moderately decomposed with some to considerable amorphous material very soft brown PEAT with some fine and occasional coarse fibres. Von Post: H4 - H5, F2, R1, W0, Tv1, Th1, A2, P0
	2.00	SV (P) SV (R)	5 3.5	2.00			Strongly decomposed highly amorphous very soft brown PEAT with some fine fibres. Von Post: H7, F2, R0, W0, Tv1, Th0, A2, P1
	2.50	SV (P) SV (R)	6 4.5	2.50			Very strongly to almost completely decomposed, highly amorphous, very soft dark brown PEAT with occasional fine fibres. Von Post: H8 - H9, F1, R0, W0, Tv0 - Tv1, Th0 - Th1, A1, P1
	3.00	SV (P) SV (R)	8.5 4.5	3.00			Almost completely decomposed, amorphous very soft black PEAT. Von Post: H9, F0, R0, W0, Tv0, Th0, A1, P1
	3.50	SV (P) SV (R)	11 7	3.50			End of sample at 3.50m

Remarks: Russian Peat sample taken in centre of trial pit (T7-TP1) as log of the trial pit.

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Project Name: Meenbog Wind Farm	Meenbog Wind Farm	**Co-ords: 06901, 86820** **Level:**	**Russian Peat Sample No.** T18 TP2 (RPS) Sheet 1 of 1 **Date:** 22/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 1.5	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
				0.50			Dry, very soft brown moderately decomposed with considerable amorphous material PEAT with many fine and some coarse fibres. Von Post: H4, F3, R2, W0, Tv1, Th1, A1, P1
				0.80			Very soft brown Slightly decomposed with some amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H3, F3, R1, W2, Tv1, Th1, A1, P1
				1.50			End of sample at 1.50m

Remarks: Russian Peat sample taken in centre of trial pit (T18-TP2) as log of the trial pit.

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Project Name: Meenbog Wind Farm	Project No. P20-328	Co-ords: 07317, 84969 Level:	Russian Peat Sample No. T5 TP1 (RPS) Sheet 1 of 1 Date: 22/04/2021
Location: Co. Donegal		Dimensions (m):	Scale: N/A
Client: Planree Ltd.		Depth (m): 3.5	Logged: ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.50	SV (P) SV (R)	6 3.5	0.50			Very soft brown very wet stringy insignificantly decomposed, PEAT with many fine and coarse fibres. Von Post: H2, F3, R3, W0, Tv3, Th1, A2, P0
	1.00	SV (P) SV (R)	6.5 4.5	1.00			Very soft brown very wet very slightly decomposed slightly amorphous PEAT with many fine and coarse fibres. Von Post: H2-H3, F3, R3, W0, Tv2, Th1, A1, P0
	1.50	SV (P) SV (R)	2.5 1	1.50			Very soft brown very Slightly to slightly decomposed with slight to some amorphous material PEAT with some fine and occasional coarse fibres . Von Post: H3 - H4, F2, R1, W0, Tv1, Th0, A1, P0
	2.00	SV (P) SV (R)	5 3	2.00			Very soft brown moderately decomposed with considerable amorphous material PEAT with some fine and occasional coarse fibres. Von Post: H5, F2, R1, W0, Tv0, Th0, A1, P1
	2.50	SV (P) SV (R)	4 4	2.50			Very soft dark brown moderately to moderately strongly decomposed, considerably amorphous, PEAT with some fine and occasional coarse fibres. Von Post: H5 - H6, F2, R1, W1, Tv1, Th0, A1, P1
	3.00	SV (P) SV (R)	5.5 4	3.00			Very soft brown moderately decomposed with some amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H4, F3, R1, W0, Tv0, Th0, A0, P1
	3.50	SV (P) SV (R)	5.5 2.5	3.50			Very soft brown Moderately decomposed with some amorphous material PEAT with many fine and some coarse fibres. Von Post: H4, F3, R2, W0, Tv1, Th0, A0, P1
	4.00	SV (P) SV (R)	7 4.5	4.00			End of sample at 4.00m

Remarks: Russian Peat sample taken in centre of trial pit (T5-TP1) as log of the trial pit.

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Trial Pit Log

Trial Pit No. **T4 - TP1**
Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 08021, 84893 **Level:**	**Date:** 22/04/2021
Location: Co. Donegal		Dimensions (m): 1.0 / 3.0 Depth (m): 1.5	**Scale:** N/A
Client: Planree Ltd.			**Logged:** ML / AW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - vegetation and roots, very wet very fibrous very soft brown PEAT.
	0.5 - 1	U100		0.50			Very wet, very fibrous (stringy), very soft brown PEAT.
	0.8 - 1.2	U100					
				1.00			
				1.50			End of pit at 1.50m

Remarks Pit located on a flat area, within a fire break, no trees or tree roots. Vegetation mainly grass and some heather. Likely the area has been previously tracked. Acrotelm cut parallel to pit at 1.0m and 2.0m distance from edge of pit. Movement approx. 200mm at 1.0m and 100mm at 2.0m. Notable movement of peat surface due to action of excavator. For detailed log of trial pit refer to Russian Peat Sample T4-TP1

Stability Pit partially failed at 1.50m. Material coming up from base (upwelling), no depth progress beyond 1.30 - 1.50m with continuing excavation. Side walls slumping. Ground level slumped approx. 400mm.

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Trial Pit Log

Trial Pit No. **T7 - TP1**
Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 07314, 84969** **Level:**	**Date:** 22/04/2021
Location: Co. Donegal		Dimensions (m): 1.0 × 4.0	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 1.5 - 1.7	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - vegetation and roots, very wet very fibrous very soft wet brown PEAT.
	0.5 - 0.9	U100		0.50			
							Very soft fibrous/amphous PEAT.
	0.9 - 1.2	U100		1.00			
	1.2 - 1.6	U100					
				1.50			
							End of pit at 1.50m - 1.70m

Remarks: Pit located greater 50m from T5 due the significant peat failure around/uphill of T5. Pit located in flattist area. No trees or tree roots. Vegetation mainly heather with some grass. Acrotelm cut parallel to pit at 0.5m and 1.0m and in an arc from the TP. For detailed log of trial pit refer to Russian Peat Sample T5-TP1

Stability: Pit partially failed at approx. 1.50m - 1.70m. Material coming up from base (upwelling), no depth progress much beyond 1.50m with continuing excavation. Side walls slumping. Ground Level slumped approx. 500mm.

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RPS Logs at Turbine Locations

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T1-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 07199, 84166** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.5	**Logged:** ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	14 3	0.50			
							Very soft brown very wet insignificantly decomposed fibrous PEAT with many fine and coarse fibres Von Post: H2, F3, R3, W0, Tv3, Th3, A1, P0
	1	SV (P) SV (R)	12 4	1.00			
							Very soft light brown very wet insignificantly to very slightly decomposed fibrous to slightly amorphous PEAT with many fine and coarse fibres . Von Post: H2-H3, F3, R3, W0, Tv3, Th2, A2, P0
	1.5	SV (P) SV (R)	11 5	1.50			
							Very soft light brown very wet very slightly decomposed slightly amorphous PEAT with many fine and coarse fibres and reeds . Von Post: H3, F3, R3, W1, Tv3, Th2, A0, P1
	2	SV (P) SV (R)	11 4	2.00			
							Very soft brown very wet very slightly to slightly decomposed slightly to some amorphous material PEAT with many fine and some coarse fibres and reeds and shrub fragments. Von Post: H3-H4, F2, R2, N1, Tv2, Th1, A1, P0
	2.5	SV (P) SV (R)	10 5	2.50			
							End of sample at 2.50m

Remarks: Disturbed ground - tree roots, base of sharp rise. Shear vane refused at 2.50m.

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Russian Peat Sample Log

Russian Peat Sample No. **RPS-T1-2**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 07229, 84486** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 1.6	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	6 2	0.50			Very soft brown moderately decomposed with considerable amorphous material PEAT with many fine and some coarse fibres Von Post: H5, F3, R2, W0, Tv2, Th2, A1, P1
	1	SV (P) SV (R)	5 2	1.00			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine and occasional coarse fibres. Von Post: H6-H7, F3, R2, W0, Tv2, Th1, A0, P1
	1.5	SV (P) SV (R)	14 4	1.50			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous PEAT with some fine and occasional coarse fibres. Von Post: H8-H9, F2, R1, W0, Tv1, Th0, A0, P1
							End of sample at 1.60m

Remarks: Disturbed ground - tree roots, very wet underfoot. Shear vane refused at 1.6m.

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Russian Peat Sample Log

FEHILY TIMONEY	Russian Peat Sample Log		Russian Peat Sample No. **RPS-T2-1** Sheet 1 of 1
Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 07468, 84473 **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.0	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	8 3	0.50			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and many coarse fibres Von Post: H4-H5, F3, R3, W0, Tv3, Th2, A2, P1
	1	SV (P) SV (R)	6 3.5	1.00			Very soft brown slightly decomposed with some amorphous material PEAT with many fine and many coarse fibres . Von Post: H4, F3, R3, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	9 4	1.50			Very soft light brown moderately strongly decomposed considerably amorphous PEAT with some fine and occasional coarse fibres. Von Post: H5, F2, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	12.5 8	1.90 2			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine and occasional coarse fibres. Von Post: H7, F2, R1, W0, Tv1, Th0, A1, P1
							End of sample at 2.00m

Remarks: Disturbed ground - tree roots, between forestry and road side castings. Shear vane refused at 2.20m.

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T2-2**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 07691, 84261** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.0	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	6 2.5	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A1, P1
	1	SV (P) SV (R)	5 2.5	1.00			Very soft brown moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and some coarse fibres. Von Post: H5-H6, F3, R2, W0, Tv2, Th1, A0, P1
	1.5	SV (P) SV (R)	7 3.5	1.50			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine and occasional wood fragments. Von Post: H7, F2, R0, W1, Tv0, Th0, A1, P1
	2	SV (P) SV (R)	14 6	1.80 2			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous PEAT with occasional fine fibres. Von Post: H8-H9, F2, R0, W0, Tv0, Th0, A1, P1
							End of sample at 2.00m

Remarks: Disturbed ground - tree roots. Shear vane refused at 2.05m.

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T3-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 06924, 84674** **Level:**	**Date:** 23/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 3.5	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	5 3.5	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and coarse fibres. Von Post: H2-H3, F3, R3, W0, Tv3, Th3, A0, P0
	1	SV (P) SV (R)	4 2.5	1.00			Very soft brown slightly decomposed with some amorphous material PEAT with many fine and some coarse fibres . Von Post: H4, F3, R2, W0, Tv1, Th1, A1, P0
	1.5	SV (P) SV (R)	4.5 3	1.50			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres . Von Post: H4-H5, F3, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	9 4.5	2.00			Very soft brown moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H5-H6, F3, R1, W0, Tv1, Th1, A1, P1
	2.5	SV (P) SV (R)	6.5 3.5	2.50			Very soft dark brown strongly to very strongly decomposed, considerably to highly amorphous, PEAT with some fine and occasional woody shrub fragments. . Von Post: H7-H8, F2, R0, N1, Tv0, Th0, A0, P1
	3 3.25	SV (P) SV (R) SV (P) SV (R)	9 6 10 7	3.00			Very soft brown Very strongly to near completely decomposed amorphous PEAT with some fine fibres. Von Post: H8-H9, F2, R0, W0, Tv0, Th0, A1, P1
				3.50			End of sample at 3.50m

Remarks: Relatively undisturbed ground. Shear vane refused at 3.30m

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T3-2**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 07199, 84166 **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.5	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	10 4	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A0, P1
	1	SV (P) SV (R)	7.5 4	1.00			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and some coarse fibres. Von Post: H4-H5, F3, R2, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	9 5	1.50			Very soft brown moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H5-H6, F3, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	10 6	2.00			Very soft dark brown strongly decomposed, highly amorphous, PEAT with occasional fine fibres. Von Post: H7, F1-2, R0, Tv1, Th0, A0, P1
	2.5	SV (P) SV (R)	9 5	2.25			Very soft very dark brown very strongly to near completely decomposed amorphous PEAT with occasional fine and coarse fibres Von Post: H8-H9, F1, R1, W0, Tv0, Th0, A1, P1
				2.50			End of sample at 2.50m

Remarks: Disturbed ground - tree roots. Shear vane refused at 2.65m.

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FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T4-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 07204, 84596 **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 4.0	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	6.5 3	0.50			Very soft light brown very slightly decomposed slightly amorphous PEAT with many fine and some fibres and reeds. Von Post: H3, F3, R3, W0, Tv3, Th2, A1, P0
	1	SV (P) SV (R)	5.5 2.5	1.00			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with some fine and occasional coarse fibres. Von Post: H4-H5, F3, R1, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	4.5 3	1.50			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H4-H5, F2, R1, W0, Tv1, Th1, A0, P1
	2	SV (P) SV (R)	5 3	2.00			Very soft brown moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H5-H6, F3, R1, W0, Tv1, Th1, A1, P1
	2.5	SV (P) SV (R)	5 2.5	2.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H5-H6, F2, R1, W0, Tv1, Th1, A1, P1
	3	SV (P) SV (R)	5.5 3	3.00			Very soft brown very wet slightly to moderately decomposed with some to considerable amorphous material PEAT with some fine and occasional coarse fibres. Von Post: H4-H5, F2, R1, W1, Tv1, Th1, A0, P1
	3.5	SV (P) SV (R)	9 6.5	3.50			Very soft brown slightly to moderately strongly decomposed with some to considerable amorphous material PEAT with some fine and occasional coarse fibres. Von Post: H4-H6, F2, R1, W1, Tv0, Th0, A1, P1
	4	SV (P) SV (R)	13 6.5	4.00			End of sample at 4.00m

Remarks: Relatively undisturbed ground. Shear vane refused at 4.30m

FEHILY TIMONEY

Russian Peat Sample Log

Project Name: Meenbog Wind Farm	Project No. P20-328	Co-ords: 07638, 84696 Level:	Russian Peat Sample No. RPS-T4-2 Sheet 1 of 1 Date: 26/04/2021
Location: Co. Donegal		Dimensions (m):	Scale: N/A
Client: Planree Ltd.		Depth (m): 2.0	Logged: ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	11.5 4	0.50			Very soft brown very wet slightly decomposed with some amorphous material PEAT with many fine and many coarse fibres. Von Post: H4, F3, R3, W0, Tv3, Th3, A0, P1
	1	SV (P) SV (R)	7 4	1.00			Very soft brown moderately decomposed with considerable amorphous material PEAT with many fine and some coarse fibres. Von Post: H5, F3, R2, W0, Tv2, Th2, A1, P1
	1.5	SV (P) SV (R)	6.6 3.5	1.50			Very soft light brown moderately strongly decomposed considerably amorphous PEAT with some fine and occasional coarse fibres. Von Post: H6, F2, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	14 4	1.80			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous PEAT with occasional fine fibres. Von Post: H8-H9, F1, R0, W0, Tv0, Th0, A0, P1
				2			End of sample at 2.00m

Remarks: Relatively undisturbed ground. Shear vane refused at 2.05m

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T4-3**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 08022, 84819** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.0	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	13 5	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A0, P0
	1	SV (P) SV (R)	8 4	1.00			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H4-H5, F3, R1, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	7 4.5	1.50			Very soft light brown moderately strongly decomposed considerably amorphous PEAT with some fine and occasional coarse fibres . Von Post: H6, F2, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	8 4				End of sample at 2.00m

Remarks: Tree roots. Shear vane refused at 2.05m.

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FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T5-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 07212, 84981 **Level:**	**Date:** 27/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.9	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	20 7.5	0.50			Very soft wet brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th2, A0, P0
	1	SV (P) SV (R)	6.5 3.5	1.00			Very soft wet brown slightly decomposed with some amorphous material PEAT with many fine and some coarse fibres. Von Post: H4, F3, R2, W0, Tv2, Th2, A0, P1
	1.5	SV (P) SV (R)	5 3	1.50			Very soft brown wet moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and occasional coarse fibres and shrub fragments. Von Post: H5-H6, F3, R1, N1, Tv1, Th0, A0, P1
	2	SV (P) SV (R)	5 3	2.00			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine fibres. Von Post: H6-H7, F2, R0, W0, Tv0, Th0, A1, P1
	2.5	SV (P) SV (R)	5.5 4	2.50			Very soft very dark brown to black near completely decomposed amorphous PEAT. Von Post: H9, F0, R0, W0, Tv0, Th0, A0, P1
	2.95	SV (P) SV (R)	12.5 7	2.90			End of sample at 2.90m

Remarks: Tree stumps. Shear vane refused at 2.95m

FEHILY TIMONEY

Russian Peat Sample Log

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 08274, 08515** **Level:**	**Russian Peat Sample No.** **RPS-T7-1** Sheet 1 of 1 **Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.0	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	13.5 4	0.50			Very soft brown very slightly to slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3-H4, F3, R3, W0, Tv3, Th3, A1, P1
	1	SV (P) SV (R)	8.5 5	1.00			Very soft brown slightly to moderately strongly decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H4-H6, F3, R1, W0, Tv1, Th1, A0, P1
	1.5	SV (P) SV (R)	10 5.5	1.50			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine and occasional coarse fibres. Von Post: H7, F3, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	14 6				End of sample at 2.00m

Remarks: Tree roots. Shear vane refused at 2.05m.

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T7-2**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 08181, 85798 **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 3.0	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	18 8.5	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A1, P0
	1	SV (P) SV (R)	7.5 4.5	1.00			Very soft brown slightly decomposed with some amorphous material PEAT with many fine and some coarse fibres Von Post: H4, F3, R2, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	6 4	1.50			Very soft brown moderately strongly decomposed considerably amorphous PEAT with some fine and occasional coarse fibres. Von Post: H5, F2, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	6 4	2.00			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine fibres. Von Post: H6-H7, F2, R0, W0, Tv0, Th0, A1, P1
	2.5	SV (P) SV (R)	4 2	2.50			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine fibres. Very wet 2.75m Von Post: H7, F2, R0, W0, Tv1, Th0, A1, P1
	3	SV (P) SV (R)	11 6	2.75 3			Very soft very dark brown to black near completely decomposed amorphous PEAT with occasional fine fibres. Von Post: H9, F1, R0, W0, Tv0, Th0, A1, P1
							End of sample at 3.00m

Remarks: Shear vane refused at 3.00m

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T7-3**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 08108, 85846 **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 3.2	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	10 4	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A1, P1
	1	SV (P) SV (R)	8 5	1.00			Very soft brown very slightly to slightly decomposed slightly amorphous PEAT with many fine and occasional coarse fibres. Von Post: H3-H4, F3, R1, W0, Tv2, Th1, A1, P1
	1.5	SV (P) SV (R)	2 1	1.50			Very soft brown moderately strongly decomposed considerably amorphous PEAT with many fine and occasional coarse fibres and some small wood fragments. Von Post: H5, F3, R1, W1, Tv1, Th1, A1, P1
	2	SV (P) SV (R)	3 1	2.00			Very soft brown moderately strongly decomposed considerably amorphous PEAT with some fine and occasional coarse fibres and some small wood/shrub fragments. Von Post: H6, F2, R1, W1 (N), Tv1, Th0, A0, P1
	2.5	SV (P) SV (R)	7 5	2.50			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine fibres. Von Post: H7, F2, R0, W0, Tv0, Th0, A1, P1
	3	SV (P) SV (R)	11 5	2.75			Very soft very dark brown to black near completely decomposed amorphous PEAT. Von Post: H9, F0, R0, W0, Tv0, Th0, A0, P1
	3.5	SV (P) SV (R)	27	3.20			End of sample at 3.20m

Remarks: Shear vane refused at 3.20m

Russian Peat Sample Log

FEHILY TIMONEY			Russian Peat Sample No. **RPS-T10-1** Sheet 1 of 1
Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 06753, 85949** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.5	**Logged:** ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	4 2	0.50			Very soft dark brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres. Von Post: H4-H5, F3, R1, W0, Tv2, Th1, A1, P1
	1	SV (P) SV (R)	4.5 3	1.00			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine fibres and occasional coarse fibres. . Von Post: H6-H7, F2, R1, W0, Tv1, Th0, A1, P1
	1.5	SV (P) SV (R)	7 4.5	1.50			Very soft very dark brown strongly decomposed highly amorphous woody PEAT with some fine fibres and occasional coarse fibres. Von Post: H7, F2, R1, W2, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	17 5.5	2.00			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous woody PEAT with occasional fine fibres. . Von Post: H8-H9, F1, R0, W2, Tv0, Th0, A1, P1
							End of sample at 2.50m

Remarks: Disturbed ground. Shear vane refused at 2.10m.

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T14-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 07075, 86545** **Level:**	**Date:** 26/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 1.7	**Logged:** ML

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.50	SV (P) SV (R)	11 3	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres. Von Post: H3, F3, R3, W0, Tv3, Th3, A2, P0
	1.00	SV (P) SV (R)	13 5	1.20			Very soft brown moderately strongly decomposed considerably amorphous PEAT with many fine and some coarse fibres . Von Post: H5, F3, R2, W1, Tv2, Th1, A1, P1
	1.50	SV (P) SV (R)	12 4	1.50			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous PEAT with occasional fine fibres. Von Post: H8-H9, F1, R0, W0, Tv0, Th0, A1, P1
	2.00	SV (P) SV (R)	11 6	1.70			End of sample at 1.70m

Remarks: Disturbed ground, tree stumps. Shear vane refused at 1.70m

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T16-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 08920, 86636 **Level:**	**Date:** 27/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.7	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	9 5	0.50			Very soft wet brown slightly decomposed with some amorphous material PEAT with many fine and many coarse fibres. Von Post:H4, F3, R3, W0, Tv3, Th3, A1, P1
	1	SV (P) SV (R)	5 2	1.00			Very soft brown wet moderately to moderately strongly decomposed with considerable amorphous material PEAT with many fine and some coarse fibres. Von Post: H5-H6, F3, R2, W0, Tv2, Th1, A0, P1
	1.5	SV (P) SV (R)	5 3	1.50			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine fibres and occasional coarse fibres. Von Post: H6-H7, F2, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	5 3.5	2.00			Very soft very dark brown strongly decomposed highly amorphous PEAT with some fine fibres. Von Post: H7, F2, R0, W0, Tv2 Th0, A1, P1
	2.5	SV (P) SV (R)	7 4	2.50			Very soft very dark brown to black near completely decomposed amorphous PEAT with occasional fine fibres. Von Post: H9, F1, R0, W0, Tv0, Th0, A0, P1
				2.70			End of sample at 2.70m

Remarks: Undisturbed ground. Shear vane refused at 2.70m

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **RPS-T19-1**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords:** 09177, 87164 **Level:**	**Date:** 27/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.7	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
	0.5	SV (P) SV (R)	11 3	0.50			Very soft brown very slightly decomposed slightly amorphous PEAT with many fine and many coarse fibres . Von Post: H3, F3, R3, W0, Tv3, Th3, A0, P0
	1	SV (P) SV (R)	9 4	1.00			Very soft wet brown slightly decomposed with some amorphous material PEAT with many fine and some coarse fibres. Von Post: H4, F3, R2, W0, Tv2, Th2, A0, P0
	1.5	SV (P) SV (R)	8 3.5	1.50			Very soft dark brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and occasional coarse fibres . Von Post: H4-H5, F3, R1, W0, Tv1, Th0, A1, P1
	2	SV (P) SV (R)	9.5 7	2.00			Very soft dark brown moderately strongly to strongly decomposed considerably to highly amorphous PEAT with some fine fibres and occasional coarse fibres. Von Post: H6-H7, F2, R1, W0, Tv0, Th0, A1, P1
	2.5	SV (P) SV (R)	16.5 6.5	2.50			Very soft very dark brown to black very strongly to near completely decomposed very highly amorphous PEAT with occasional fine fibres. Von Post: H8-H9, F1, R0, W2, Tv0, Th0, A1, P1
				2.70			End of sample at 2.70m

Remarks: Undisturbed ground. Shear vane refused at 2.70m

FEHILY TIMONEY

FEHILY TIMONEY

Russian Peat Sample Log

Russian Peat Sample No. **T18-TP1 (RPS)**

Sheet 1 of 1

Project Name: Meenbog Wind Farm	**Project No.** P20-328	**Co-ords: 06778, 86820** **Level:**	**Date:** 23/04/2021
Location: Co. Donegal		Dimensions (m):	**Scale:** N/A
Client: Planree Ltd.		Depth (m): 2.5	**Logged:** ML / AW

Water Strike	Samples and In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Acrotelm - not sampled
				0.50			Dry, very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and coarse fibres Von Post: H4 - H5, F3, R3, W0, Tv3, Th2, A2, P1
				1.00			Very soft brown slightly to moderately decomposed with some to considerable amorphous material PEAT with many fine and coarse fibres and much reedy material. Von Post: H4 - H5, F3, R3, W0, Tv2, Th2, A2, P1
				1.50			Very wet, very soft brown very slightly decomposed slightly amorphous PEAT with many fine and coarse fibres and some reedy material. Von Post: H3, F3, R3, W0, Tv2, Th1, A2, P1
				2.00			Very soft brown moderately decomposed with considerable amorphous material PEAT with some fine and occasional coarse fibres. Von Post:H4, F2, R1, W0, Tv0, Th0, A3, P1
				2.50			End of sample at 2.50m

Remarks: Generally dry underfoot. Hard to push in peat sampler. 5m from road, 3m from road drainage ditch, 20-30m from stream .

FEHILY TIMONEY

Laboratory Test Results

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

BH/TP No	Sample	Depth m	Moisture %	Particle Density Mg/m3	<425um %	Index Properties LL %	PL %	PI %		Remarks			Shear Strength Hand Vane Cu-kPa	Von Post Classification
TP1-T4	U-Top	0.50	1694										11.0	H4-H5
TP1-T4	U-Base	1.00	1694										4.5	H5-H6
TP1-T4	U-Top	0.80	1840										2.0	
TP1-T4	U-Base	1.20	1840										3.0	
TP1-T4	B	0.5-1.0	1717		Natural	818	346	472						H4-H5
TP1-T4	B	1.0-1.50	1905		Natural	900	379	521						H5-H6
TP1-T4	B	1.50-2.0	2136		Natural	905	341	564						H3-H4
TP1-T4	B	2.0-2.5	2151		Natural	994	361	633						H5-H6
TP1-T4	B	2.5-3.0	1766		Natural	980	381	599						H9
TP1-T4	B	3.0-3.5	1152		Natural	810	274	536						H9
TP1-T7	U-Top	0.50	1768										2.0	
TP1-T7	U-Base	0.90	1637										2.0	
TP1-T7	U-Top	0.90	1510										3.0	
TP1-T7	U-Base	1.20	1510										3.0	
TP1-T7	U-Top	1.20	1547										3.5	
TP1-T7	U-Base	1.50	1547										3.0	
TP1-T7	B	0.5-1.0	1666		Natural	940	421	515						H2
TP1-T7	B	1.0-1.50	1642		Natural	886	311	575						H8
TP1-T7	B	1.50-2.0	1554		Natural	1025	408	617						H8-H9
TP1-T7	B	2.0-2.5	1170		Natural	842	353	489						H8-H9
TP1-T7	B	2.5-3.0	1255		Natural	775	357	418						H9
TP1-T7	B	3.0-3.5	964		Natural	678	433	245						H10
TP2-T18	U-Top	0.70	483										5.5	
TP2-T18	U-Base	1.20	562										10.0	
TP2-T18	B	0.5-0.80	1097		Natural	928	300	628						H7/H8
TP2-T18	B	0.8-1.50	961		Natural	690	272	418						H8/H9

NMTL	Notes :	Job ref No.	NMTL 3369	Table
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Meenbog Wind Farm, Donegal	

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

BH/TP No	Sample	Depth m	Moisture %	Particle Density Mg/m3	<425um %	Index Properties LL %	PL %	PI %		Remarks			Shear Strength Hand Vane Cu-kPa	Von Post Classification
TP3/RS1	B	0.5-1.0	1788		Natural	1033	398	635						H7/H8
TP3/RS1	B	1.0-1.50	1824		Natural	578	335	243						H7/H8
TP3/RS1	B	1.5-2.0	1649		Natural	700	363	337						H7/H8
TP3/RS1	B	2.0-2.50	1655		Natural	915	381	534						H8
TP3/RS1	B	2.5-3.0	1339		Natural	730	349	381						H8/H9
TP3/RS1	B	3.0-3.50	1162		Natural	860	326	534						H9
TP5/T1	U-Top	N/A	1330							Unsuitable for UU Triaxial			5.0	
TP5/T1	U-Base	N/A	1330										6.0	
TP5/T1	B	1.0-1.50	1917		Natural	1017	412	605						H5
TP5/T1	B	1.50-2.0	2002		Natural	1045	362	683						H5/H6
TP5/T1	B	2.0-2.50	2075		Natural	1110	404	706						H6/H7
TP5/T1	B	2.5-3.0	1714		Natural	937	363	574						H7/H8
TP5/T1	B	3.0-3.50	1721		Natural	950	389	561						H8
TP5/T1	B	3.50-4.0	1774		Natural	960	356	604						H5/H6
T18-RS1	B	0.50-1.0	1055		Natural	975	300	675						H9
T18-RS1	B	1.0-1.50	1204		Natural	940	344	596						H5/H6
T18-RS1	B	1.50-2.0	1158		Natural	900	360	540						H5/H6
T18-RS1	B	2.0-2.50	1399		Natural	775	364	411						H5/H6

NMTL		Notes :	Job ref No.	NMTL 3369	Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Meenbog Wind Farm, Donegal	

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle		Index Properties							Shear Strength	
BH/TP	Sample	Depth	Moisture	Density	<425um	LL	PL	PI					Hand Vane	Von Post
No		m	%	Mg/m3	%	%	%	%					Cu-kPa	Classification
TP1-RPS1	B	0.5-1.0	1404											
TP1-RPS1	B	1.0-1.50	1394											
TP1-RPS1	B	1.50-2.0	1444											
TP1-RPS1	B	2.0-2.25	1459											
TP1-RPS2	B	0.5-1.0	1185											
TP1-RPS2	B	1.0-1.50	1023											
TP2-RPS1	B	0.5-1.0	1231											
TP2-RPS1	B	1.0-1.50	1389											
TP2-RPS1	B	1.50-2.0	1224											
TP2-RPS2	B	0.5-1.0	1282											
TP2-RPS2	B	1.0-1.50	1608											
TP2-RPS2	B	1.50-2.0	1149											
TP3-RPS2	B	0.5-1.0	1231											
TP3-RPS2	B	1.0-1.50	1003											
TP3-RPS2	B	1.50-2.0	1384											
TP3-RPS2	B	2.0-2.5	1076											
TP3-RPS2	B	2.25-2.50	1048											
TP4-RPS1	B	0.5-1.0	1247											
TP4-RPS1	B	1.0-1.50	1207											
TP4-RPS1	B	1.5-2.0	1472											
TP4-RPS1	B	2.0-2.50	1370											
TP4-RPS1	B	2.5-3.0	1190											
TP4-RPS1	B	3.0-3.50	1183											
TP4-RPS1	B	3.5-4.0	1521											
TP4-RPS2	B	0.5-1.0	1368											
TP4-RPS2	B	1.0-1.50	1201											

NMTL		Notes :	Job ref No.	NMTL 3369	Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Meenbog Wind Farm, Donegal	

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle			Index Properties						Shear Strength	
BH/TP	Sample	Depth	Moisture	Density	<425um	LL	PL	PI					Hand Vane	Von Post
No		m	%	Mg/m3	%	%	%	%					Cu-kPa	Classification
TP4-RPS2	B	1.5-2.0	1405											
TP4-RPS3	B	0.5-1.0	1020											
TP4-RPS3	B	1.0-1.5	883											
TP4-RPS3	B	1.5-2.0	691											
TP5-RPS1	B	0.5-1.0	1480											
TP5-RPS1	B	1.0-1.5	1493											
TP5-RPS1	B	1.5-2.0	1156											
TP5-RPS1	B	2.0-2.5	1151											
TP5-RPS1	B	2.5-2.9	1026											
TP7-RPS1	B	0.5-1.0	1141											
TP7-RPS1	B	1.0-1.5	1055											
TP7-RPS1	B	1.5-2.0	1259											
TP7-RPS2	B	0.5-1.0	1141											
TP7-RPS2	B	1.0-1.5	1157											
TP7-RPS2	B	1.5-2.0	1150											
TP7-RPS2	B	2.0-2.5	1445											
TP7-RPS2	B	2.5-3.0	772											
TP7-RPS3	B	0.5-1.0	1159											
TP7-RPS3	B	1.0-1.50	1425											
TP7-RPS3	B	1.5-2.0	1335											
TP7-RPS3	B	2.0-2.5	752											
TP7-RPS3	B	2.5-3.0	699											
TP7-RPS3	B	3.0-3.5	791											
TP10-RPS1	B	0.5-1.0	1109											
TP10-RPS1	B	1.0-1.5	1045											
TP10-RPS1	B	1.5-2.0	1071											

NMTL		Notes :	Job ref No.	NMTL 3369	Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Meenbog Wind Farm, Donegal	

National Materials Testing Laboratory Ltd.

SUMMARY OF TEST RESULTS

				Particle			Index Properties						Shear Strength	
BH/TP	Sample	Depth	Moisture	Density	<425um	LL	PL	PI					Hand Vane	Von Post
No		m	%	Mg/m3	%	%	%	%					Cu-kPa	Classification
TP10-RPS1	B	2.0-2.5	827											
TP14-RPS1	B	0.5-1.0	1445											
TP14-RPS1	B	1.0-1.5	1085											
TP14-RPS1	B	1.5-1.6	790											
TP16-RPS1	B	0.5-1.0	1328											
TP16-RPS1	B	1.0-1.5	1775											
TP16-RPS1	B	1.5-2.0	1489											
TP16-RPS1	B	2.0-2.5	1051											
TP19-RPS1	B	0.5-1.0	1258											
TP19-RPS1	B	1.0-1.5	1682											
TP19-RPS1	B	1.5-2.0	1424											
TP19-RPS1	B	2.0-2.50	1027											

NMTL		Notes :	Job ref No.	NMTL 3369	Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Meenbog Wind Farm, Donegal	

National Materials Testing Laboratory Ltd

Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of the Undrained Shear Strength in Triaxial Compression

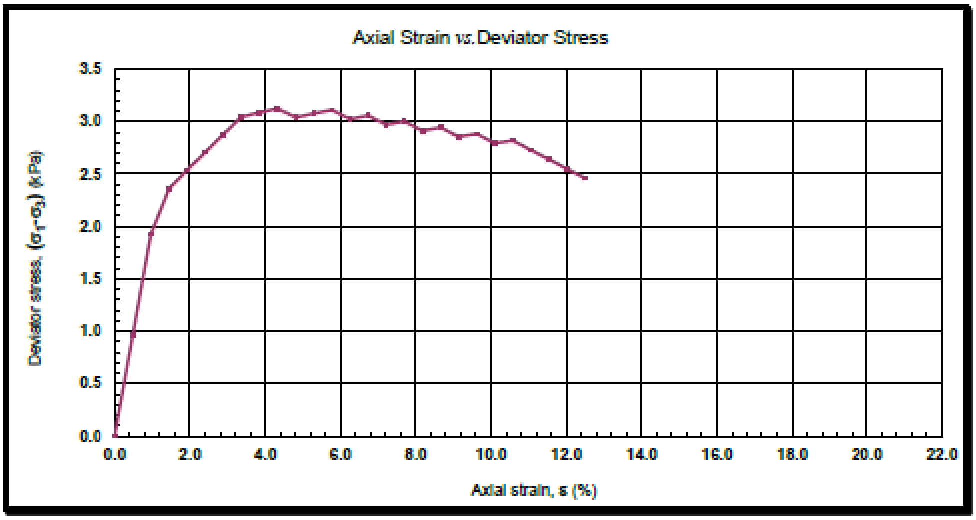
BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP1-T4	Depth:	0.50-1.0m	File Reference:	NMTL 3369

Sample Description:	Soft brown fiberous PEAT		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T4-U-0.50-1.0m	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	26 April 2021

Specimen						Test		
Length:	208.0	mm	Diameter:	103.0	mm	Membrane type:	Latex	
Area:	8325.8	mm^2	Volume:	1731.8	cm^3	Membrane thickness:	0.3	mm
Mass:	1722.0	g				Membrane correction:	0.81	
Moisture content:	1693.8	%				Sample state:	Undisturbed	
Bulk density:	0.99	$Mg\ m^{-3}$				Number of stages:	Single	
Dry density:	0.06	$Mg\ m^{-3}$				Rate of strain:	1.0	$\%\ min^{-1}$
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1					Cell pressure: σ_3	10	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	3.11	kPa
Strain at Failure:	ε	5.77	%
Maximum Cohesion / Shear Strength:	C_u	1.6	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
☐ N Chana
☐ B Chana

For NMTL Ltd

29 April 2021

Original to: Client Rep.
Copy 1 to: File copy

Page 1 of 1

National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

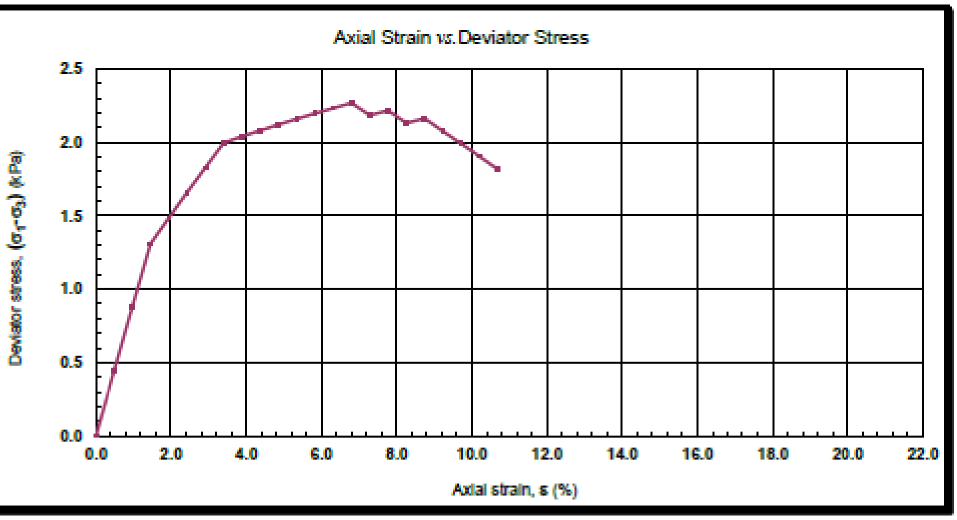
Determination of the Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP1-T4	Depth: 0.80-1.20	File Reference: NMTL 3369
Sample Description:	Soft brown/black fiberous PEAT		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T4-U-0.80-1.20m	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	26 April 2021

Specimen		Test	
Length:	206.0 mm	Membrane type:	Latex
Diameter:	103.8 mm	Membrane thickness:	0.3 mm
Area:	8455.7 mm^2	Membrane correction:	0.95
Volume:	1741.9 cm^3	Sample state:	Undisturbed
Mass:	1805.0 g	Number of stages:	Single
Moisture content:	1840.9 %	Rate of strain:	1.0 % min^{-1}
Bulk density:	1.04 Mg m^{-3}	Cell pressure: σ_3	10 kPa
Dry density:	0.05 Mg m^{-3}		
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1		



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	2.27	kPa
Strain at Failure:	ε	6.80	%
Maximum Cohesion / Shear Strength:	C_u	1.1	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
☐ N Chana
☐ B Chana

For NMTL Ltd

29 April 2021

Original to: Client Rep.
Copy 1 to: File copy

Page 1 of 1

National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of the Undrained Shear Strength in Triaxial Compression

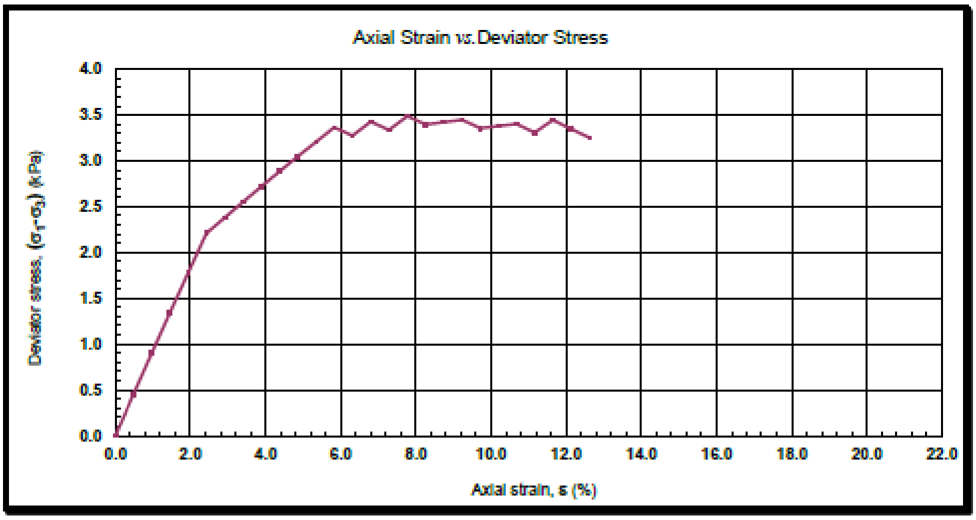
BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	**TP1-T7**	Depth:	**0.50-0.90m**	File Reference:	**NMTL 3369**

Sample Description:	**Soft brown fiberous PEAT**		
Location:	**Meenbog Wind Farm, Donegal**	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T7-U-0.50-0.90m-TOP	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	26 April 2021

Specimen		**Test**	
Length:	206.0 mm	Membrane type:	Latex
Diameter:	102.8 mm	Membrane thickness:	0.3 mm
Area:	8293.5 mm^2	Membrane correction:	1.63
Volume:	1708.5 cm^3	Sample state:	Undisturbed
Mass:	1700.0 g	Number of stages:	Single
Moisture content:	1768.1 %	Rate of strain:	1.0 % min^{-1}
Bulk density:	1.00 Mg m^{-3}	Cell pressure: σ_3	10 kPa
Dry density:	0.05 Mg m^{-3}		
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1		



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	3.44	kPa
Strain at Failure:	ε	11.65	%
Maximum Cohesion / Shear Strength:	C_u	1.7	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
☐ N Chana
☐ B Chana

For NMTL Ltd

29 April 2021

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National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

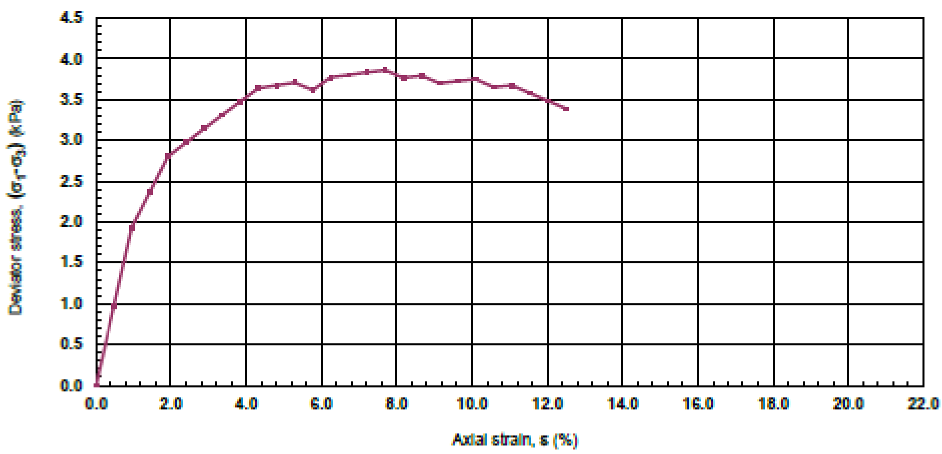
Determination of the Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP1-T7	Depth: 0.50-0.90m	File Reference: NMTL 3369
Sample Description:	Soft brown fiberous PEAT		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T7-U-0.50-0.90m-BASE	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	26 April 2021

Specimen				Test		
Length:	208.0 mm	Diameter:	102.8 mm	Membrane type:	Latex	
Area:	8293.5 mm^2	Volume:	1725.0 cm^3	Membrane thickness:	0.3	mm
Mass:	1772.0 g			Membrane correction:	1.08	
Moisture content:	1637.3 %			Sample state:	Undisturbed	
Bulk density:	1.03 $Mg\,m^{-3}$			Number of stages:	Single	
Dry density:	0.06 $Mg\,m^{-3}$			Rate of strain:	1.0	% min^{-1}
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1			Cell pressure: σ_3	10	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	3.86	kPa
Strain at Failure:	ε	7.69	%
Maximum Cohesion / Shear Strength:	C_u	1.9	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
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National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

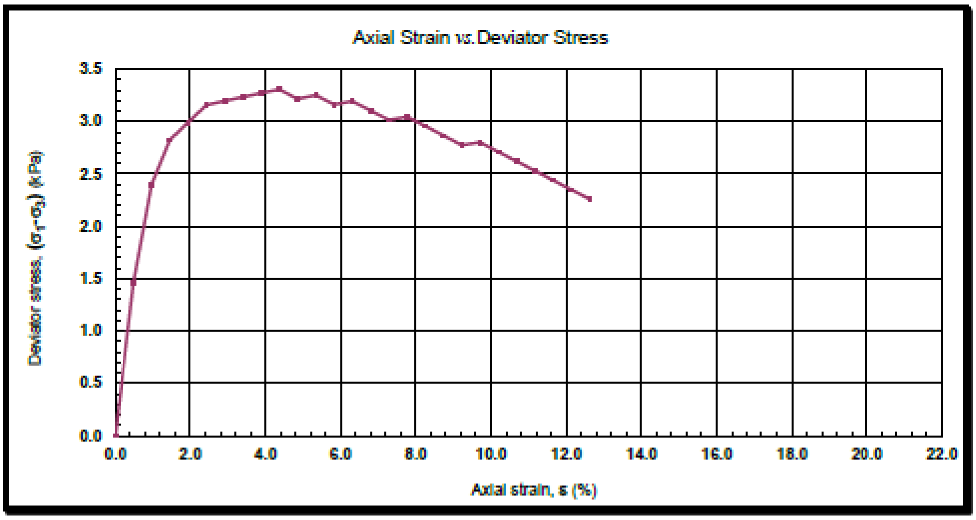
Determination of the Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP1-T7	Depth:	0.90-1.20m
File Reference:	NMTL 3369		
Sample Description:	Soft brown/black fiberous PEAT		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T7-U-0.90-1.20m	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	27 April 2021

Specimen				Test		
Length:	206.0 mm	Diameter:	103.8 mm	Membrane type:	Latex	
Area:	8455.7 mm^2	Volume:	1741.9 cm^3	Membrane thickness:	0.3	mm
Mass:	1674.0 g			Membrane correction:	0.61	
Moisture content:	1509.6 %			Sample state:	Undisturbed	
Bulk density:	0.96 $Mg\,m^{-3}$			Number of stages:	Single	
Dry density:	0.06 $Mg\,m^{-3}$			Rate of strain:	1.0	% min^{-1}
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1			Cell pressure: σ_3	10	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	3.31	kPa
Strain at Failure:	ε	4.37	%
Maximum Cohesion / Shear Strength:	C_u	1.7	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
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For NMTL Ltd

29 April 2021

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Page 1 of 1

National Materials Testing Laboratory Ltd

Unit 18C Tullow Industrial Estate

Tel.: 059 9180822

Certificate of Test

Determination of the Undrained Shear Strength in Triaxial Compression

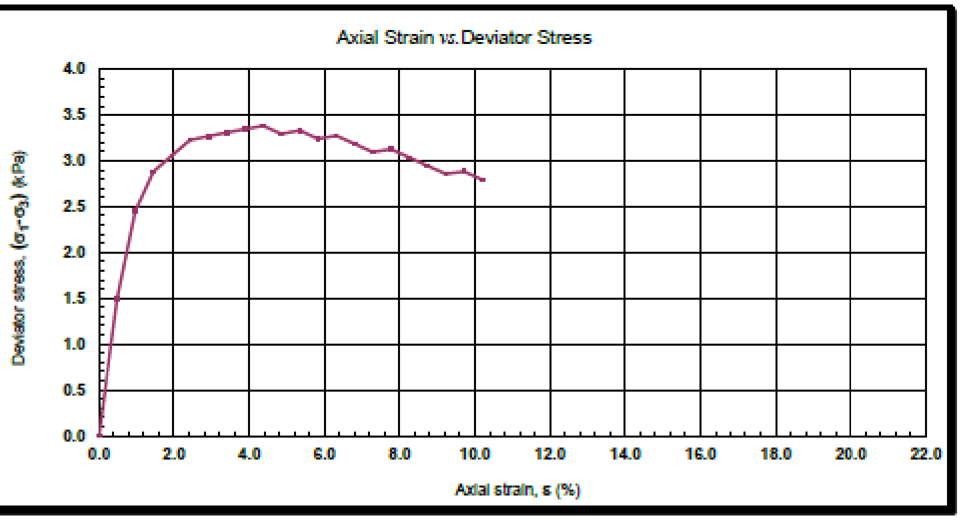
BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP1-T7	Depth:	1.20-1.50m	File Reference:	NMTL 3369

Sample Description:	Soft brown/black fiberous PEAT		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP1-T7-U-1.20-1.50m	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	27 April 2021

Specimen				Test		
Length:	206.0 mm	Diameter:	102.8 mm	Membrane type:	Latex	
Area:	8293.5 mm^2	Volume:	1708.5 cm^3	Membrane thickness:	0.3	mm
Mass:	1713.0 g			Membrane correction:	0.61	
Moisture content:	1547.1 %			Sample state:	Undisturbed	
Bulk density:	1.00 $Mg\,m^{-3}$			Number of stages:	Single	
Dry density:	0.06 $Mg\,m^{-3}$			Rate of strain:	1.0	% min^{-1}
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1			Cell pressure: σ_3	10	kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	3.38	kPa
Strain at Failure:	ε	4.37	%
Maximum Cohesion / Shear Strength:	C_u	1.7	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories

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For NMTL Ltd

29 April 2021

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Page 1 of 1

National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

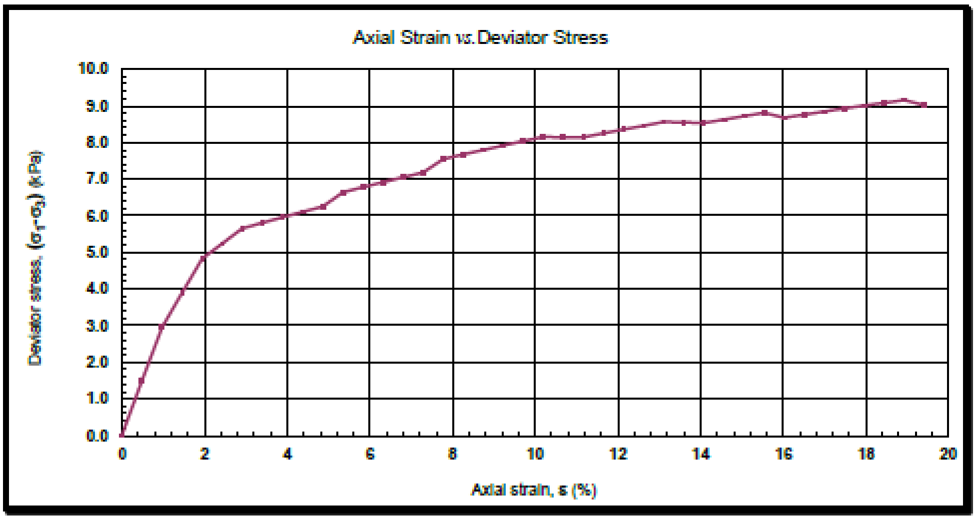
Determination of the Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP2-T18	Depth: 0.70-1.20m	File Reference: NMTL 3369
Sample Description:	Brown/black slightly fiberous PEAT with some decomposed vegetation		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP2-T18-0.70-1.20m-Top	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	27 April 2021

Specimen		Test	
Length:	206.0 mm	Membrane type:	Latex
Diameter:	103.0 mm	Membrane thickness:	0.3 mm
Area:	8325.8 mm^2	Membrane correction:	2.65
Volume:	1715.1 cm^3	Sample state:	Undisturbed
Mass:	1737.6 g	Number of stages:	Single
Moisture content:	483.1 %	Rate of strain:	1.0 % min^{-1}
Bulk density:	1.01 Mg m^{-3}	Cell pressure: σ_3	10 kPa
Dry density:	0.17 Mg m^{-3}		
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1		



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	9.15	kPa
Strain at Failure:	ε	18.93	%
Maximum Cohesion / Shear Strength:	C_u	4.6	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
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For NMTL Ltd 29 April 2021

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Page 1 of 1

National Materials Testing Laboratory Ltd
Unit 18C Tullow Industrial Estate
Tel.: 059 9180822

Certificate of Test

Determination of the Undrained Shear Strength in Triaxial Compression

BS 1377 : Part 7 : 1990 Clause 8

Client Name:	Enerco Energy Ltd	Contract:	Meenbog Wind Farm, Donegal
Address:	Lissarda Business Park Lissarda, Co Cork, Ireland. P14 YN56	Site Address:	N/A

Sample No.:	TP2-T18	Depth:	0.70-1.20m	File Reference:	NMTL 3369

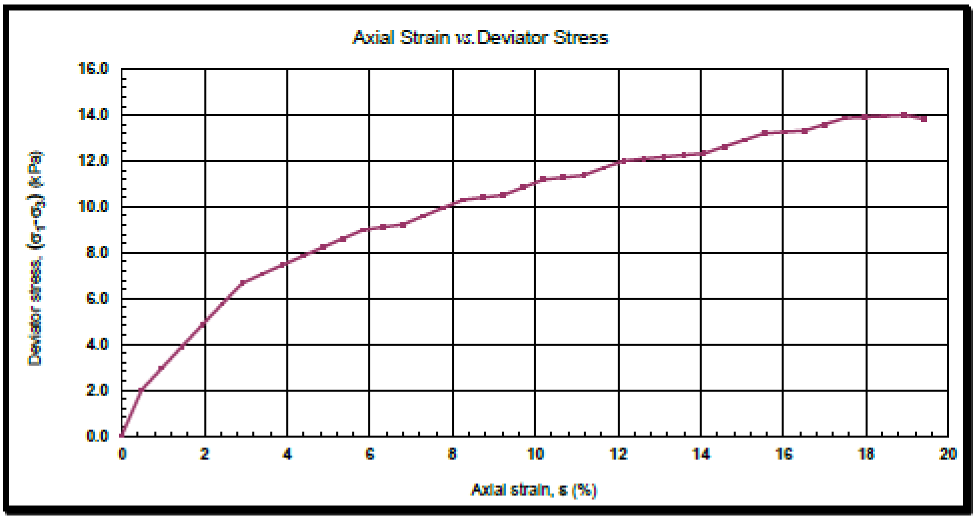
Sample Description:	Dark brown/black slightly fiberous PEAT with some decomposed vegetation		
Location:	Meenbog Wind Farm, Donegal	Date Sampled:	23 April 2021
Sample Type:	U	Sampled by:	Fehily Timoney
Client Sample Ref.:	TP2-T18-0.70-1.20m-Base	Sampling Cert. Recd.:	No
Source / Supplier:	Fehily Timoney	Date Received:	23 April 2021
Specification:	BS 1377: Part 7: 1990 Clause 8	Date Tested:	27 April 2021

Specimen

Length:	206.0 mm	Diameter:	103.0 mm
Area:	8325.8 mm^2	Volume:	1715.1 cm^3
Mass:	1708.0 g		
Moisture content:	562.0 %		
Bulk density:	1.00 Mg m^{-3}		
Dry density:	0.15 Mg m^{-3}		
Preparation Method:	BS 1377: Part 1: 1990 Clause 8 .3.1		

Test

Membrane type:	Latex
Membrane thickness:	0.3 mm
Membrane correction:	2.65
Sample state:	Undisturbed
Number of stages:	Single
Rate of strain:	1.0 % min^{-1}
Cell pressure: σ_3	10 kPa



Maximum Corrected Deviator Stress at Failure:	$(\sigma_1-\sigma_3)_f$	14.00	kPa
Strain at Failure:	ε	18.93	%
Maximum Cohesion / Shear Strength:	C_u	7.0	kPa
Type of Failure:		Plastic	

Signed

Remarks: Natural

Authorised Signatories
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For NMTL Ltd

29 April 2021

Original to: Client Rep.
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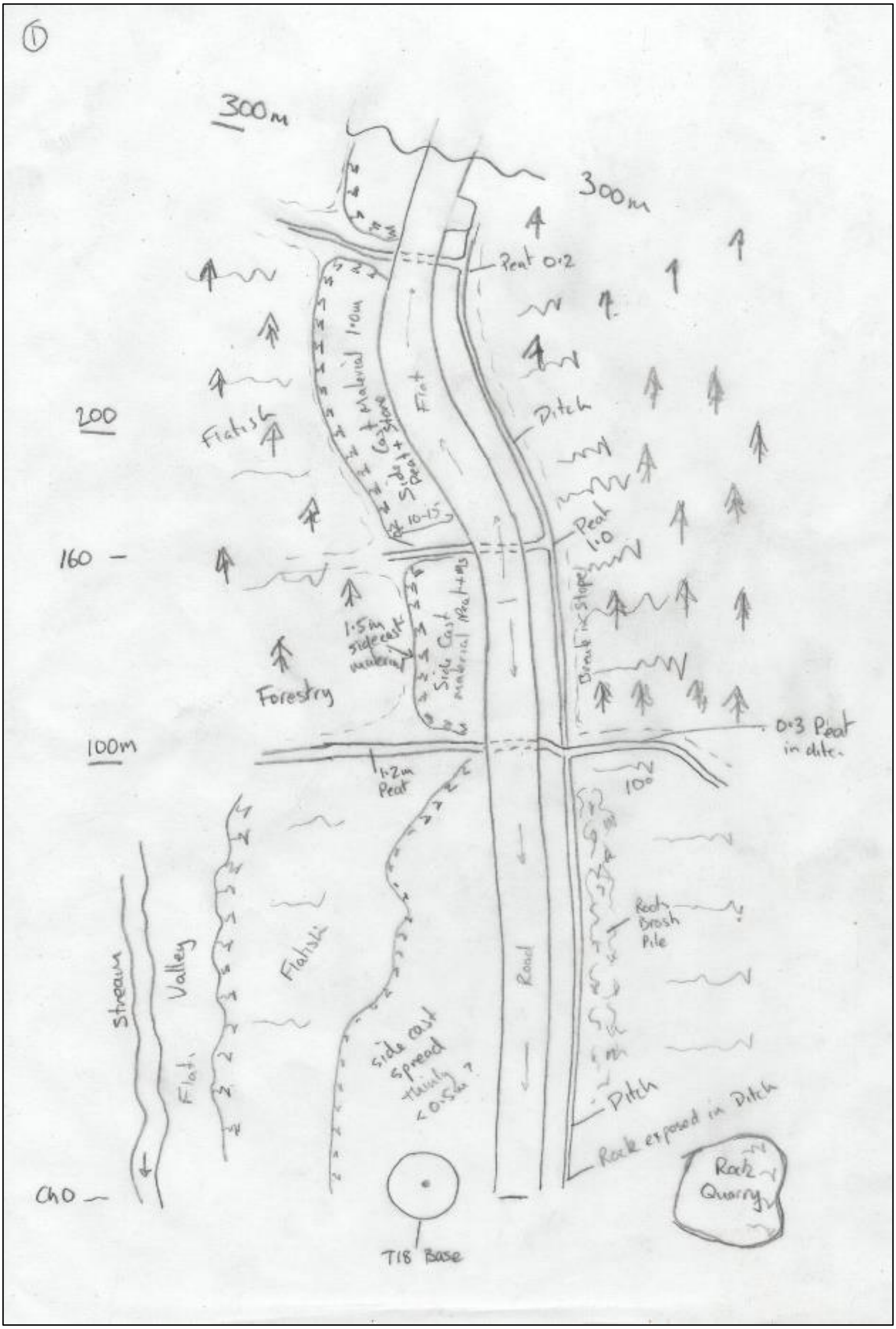
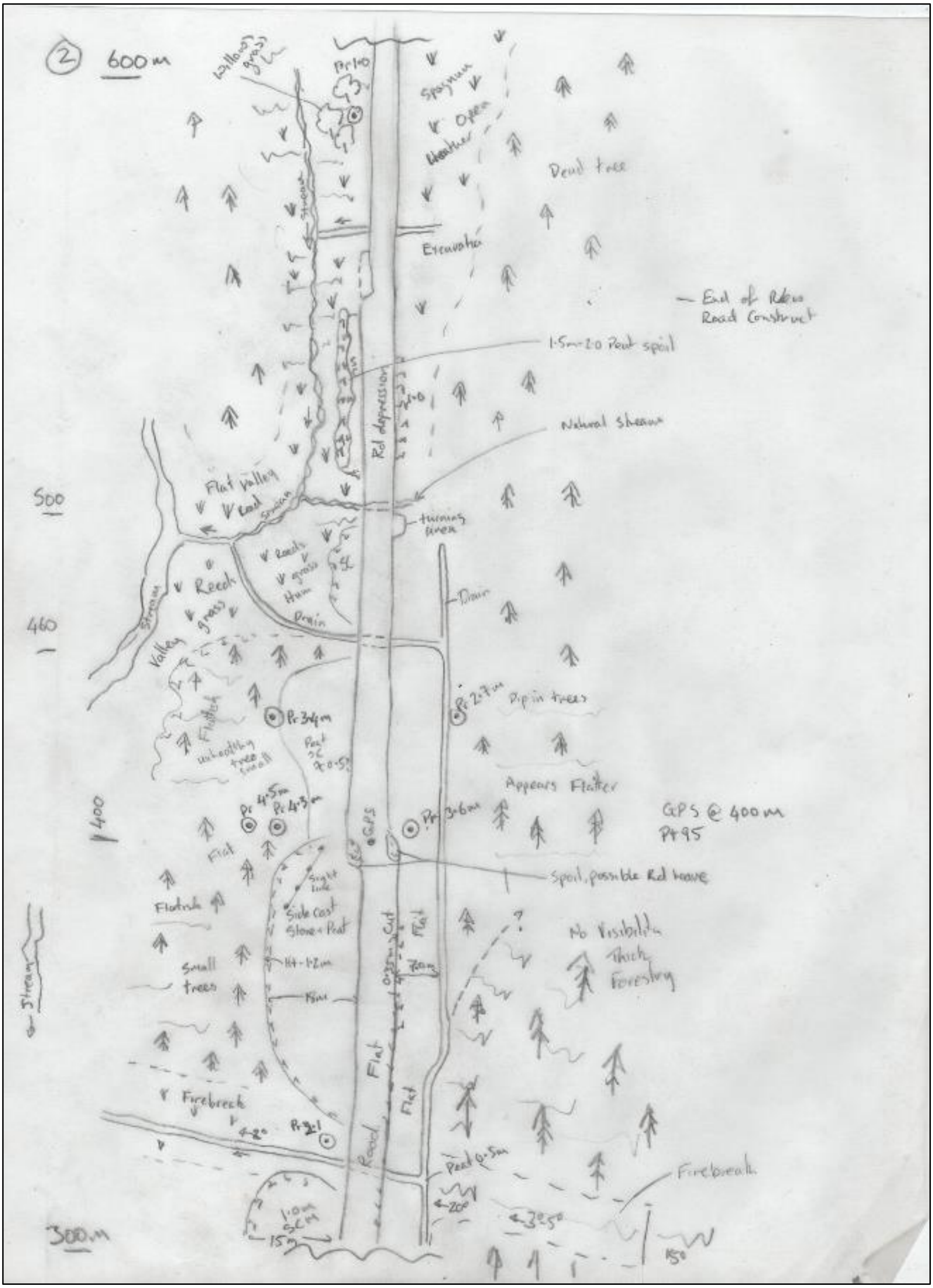
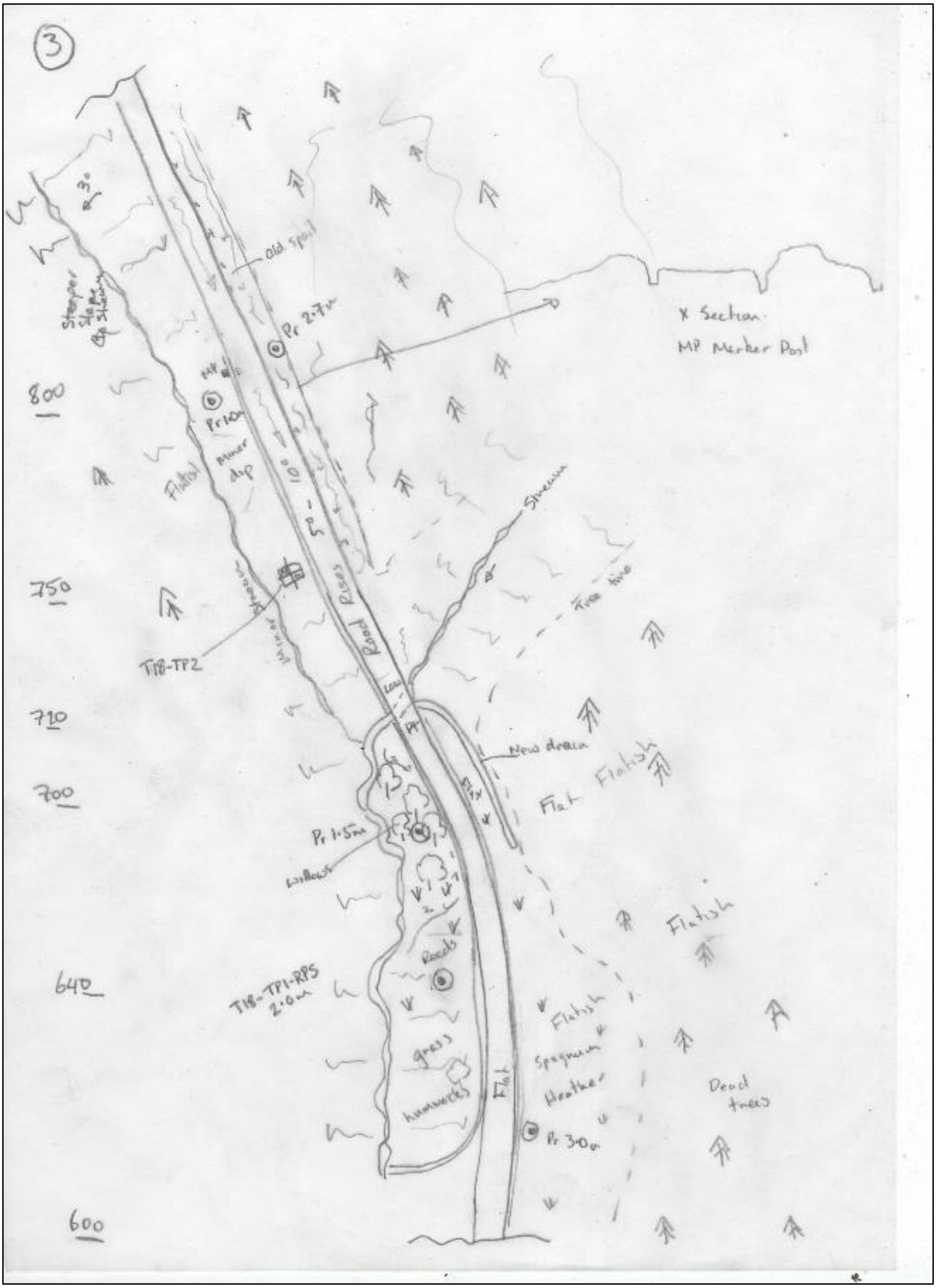
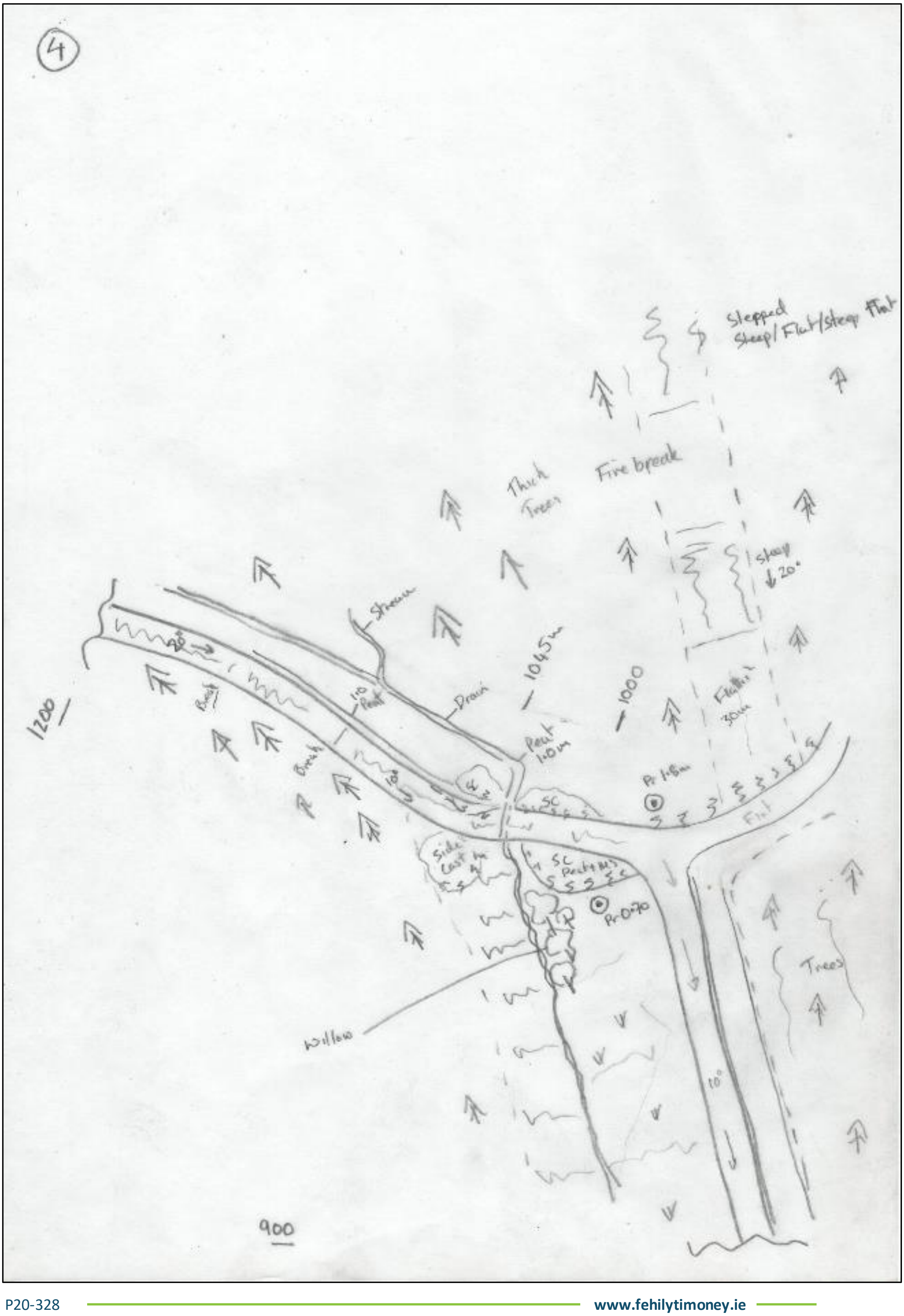
Page 1 of 1

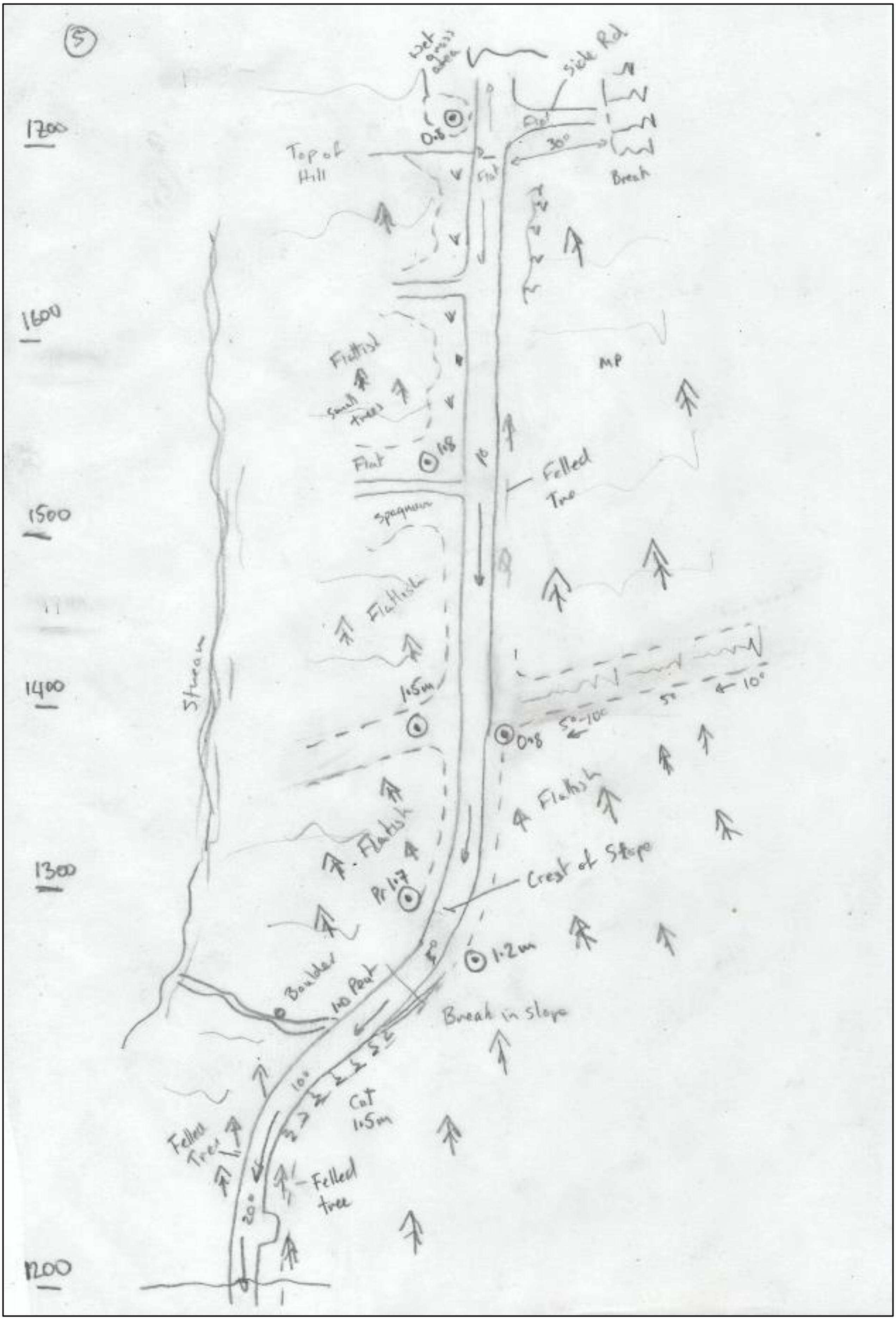
Field Sketches of Walk-over Survey of Geomorphology along Proposed Access Road to T18

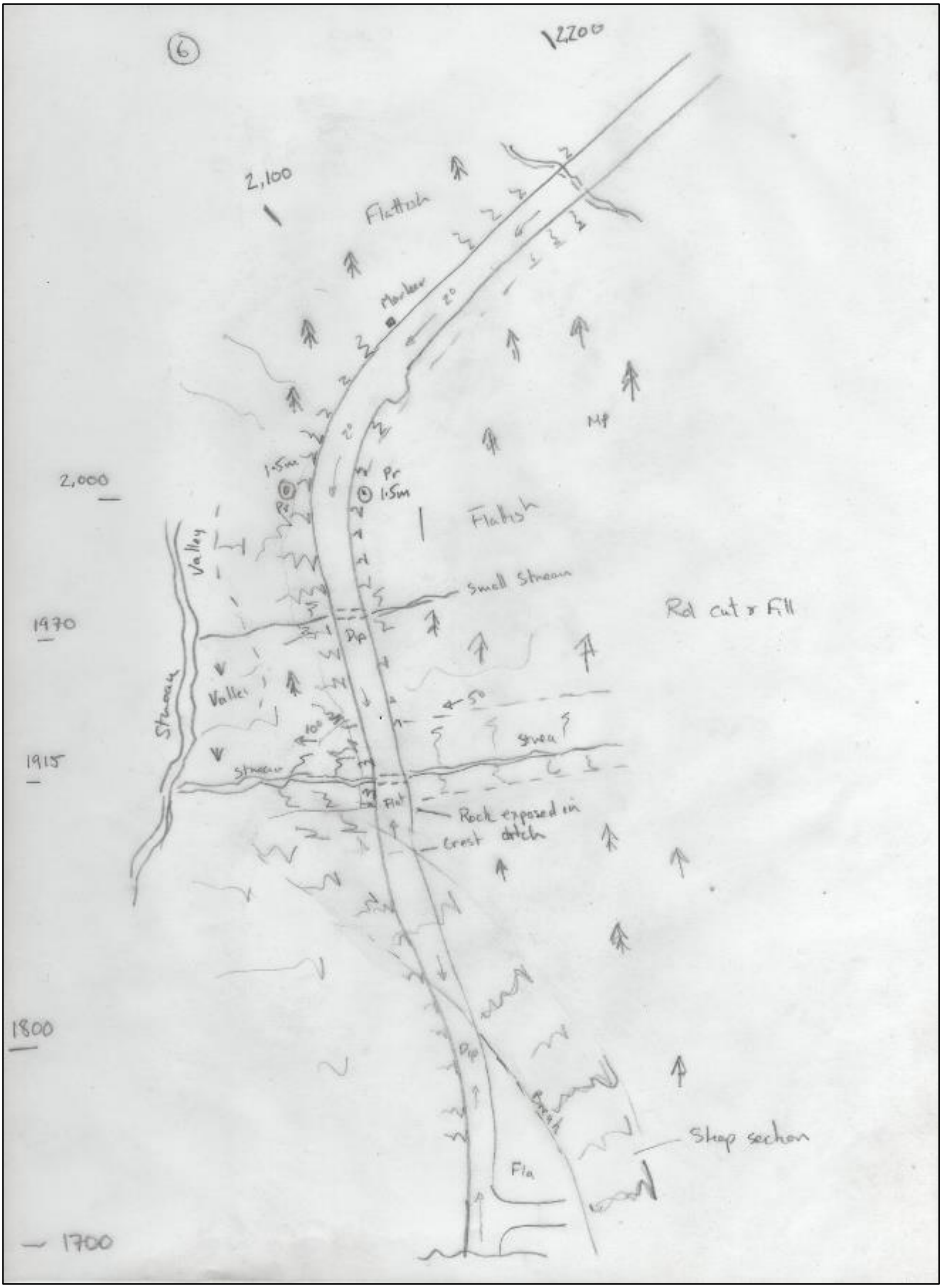

1
300m
300m
Peat 0.2
Side Cast Peat + Stone Material 1.0m
Flat
Flatish
200
Ditch
10-15
Peat 1.0
160 -
1.5m side cast material
Side Cast Material Peat + Ms
Bank in Slope
Forestry
0.3 Peat in ditch
100m
1.2m Peat
10°
Rock Brush Pile
Stream
Valley
Flatish
Flat
side cast spread thinly <0.5m?
Road
Ditch
Rock exposed in Ditch
Rock Quarry
CHO -
T18 Base

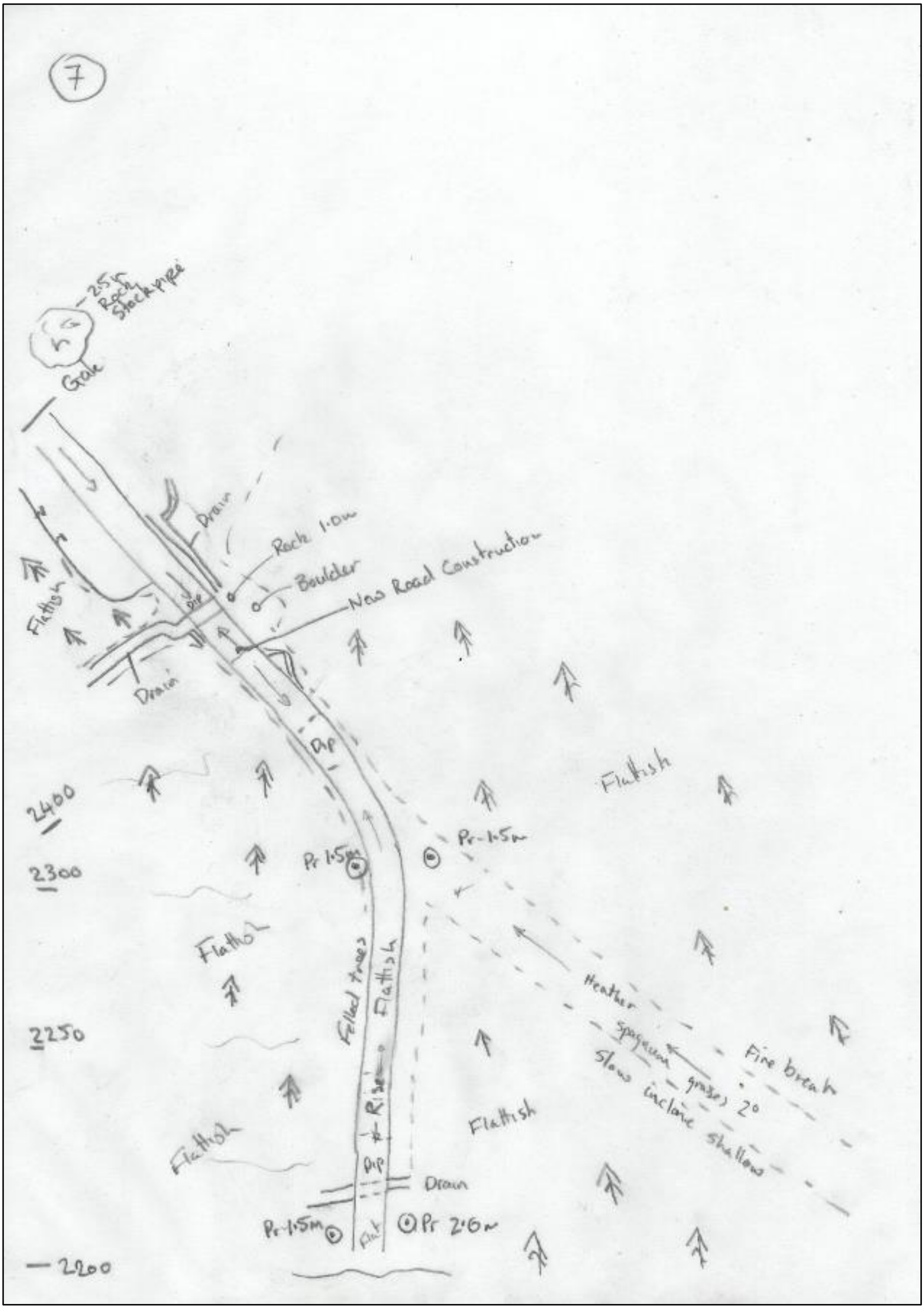

600m
500
400
300m
Flat valley
Natural Stream
Excavator
End of Rks Road Construct
1.5m-2.0 Peat spoil
turning area
Drain
Dip in trees
Appears Flatter
GPS @ 400m
Pt95
Spoil, possible Rd heave
No Visibility Thick Forestry
Firebreak
Small trees
Flat
Road
Stream


3
Old spoil
Pr 2.7m
X Section
MP Marker Post
800
MP
Pr 1.0m
Minor dip
Flatter
10°
Road Rises
Stream
Tree line
750
T18-TP2
710
New drain
Flat
Flatish
700
Pr 1.5m
Willows
Reeds
Flatish
640
T18-TP1-RPS 2.0m
Flatish
Sphagnum
Heather
grass
hummocks
Flat
Dead trees
Pr 3.0m
600


4
Stepped
Steep/ Flat/steep Flat
Thick Trees
Fire break
Steep
20°
Stream
1045m
1000
Drain
Peat
1.0m
Peat
1.0m
1200
900
SC
Side Cast
SC
Peat
Pr 0.70
Pr 1.8m
Flat
Trees
Willow
10°


5
Wet grass area
Side Rd
1700
0.8
Top of Hill
Flat
30°
Break
1600
Flattish
Small trees
MP
Flat
1.8
Felled Tree
1500
Spagnum
Flattish
1400
Stream
1.5m
0.8
5°-10°
5°
10°
1300
Flattish
Flattish
Crest of Slope
Pr 1.7
1.2m
Boulder
No Peat
Break in slope
10°
Cut 1.5m
Felled Tree
Felled tree
20°
1200


6
2200
2,100
Flattish
Marker
2,000
1.5m
Pr
1.5m
Flatish
Valley
Small Stream
1970
Rd cut & Fill
Dip
Valley
50
Stream
1915
Stream
Stream
Flat
Rock exposed in ditch
Crest
1800
Dip
Break
Steep section
Fla
1700

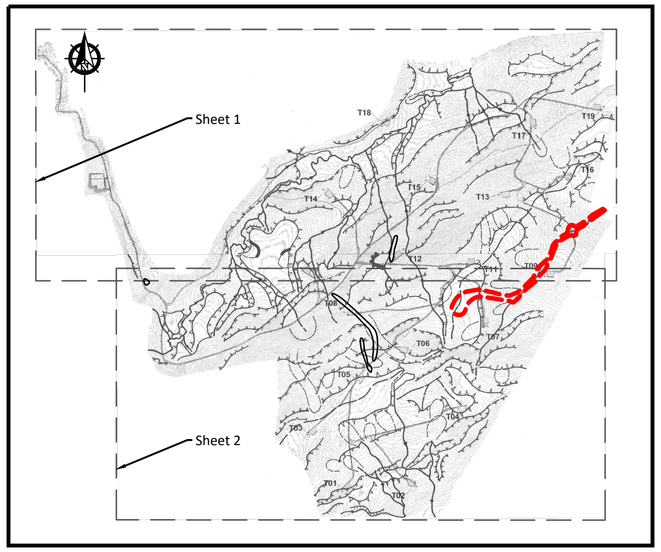

7
Rock Stockpile
Gate
Drain
Rock 1.0m
Boulder
New Road Construction
Dip
Flattish
Drain
Dip
Flattish
2400
2300
Pr 1.5m
Pr-1.5m
Flattish
Felled trees
Flattish
Heather
Sphagnum grasses 2°
Slow incline shallow
Fire break
2250
Rise
Flattish
Flattish
Dip
Drain
Pr-1.5m
Pr 2.6m
2200

APPENDIX B

Peat Hazard and Risk Assessment (Geomorphological Plans)

KEY PLAN

Scale 1:60000

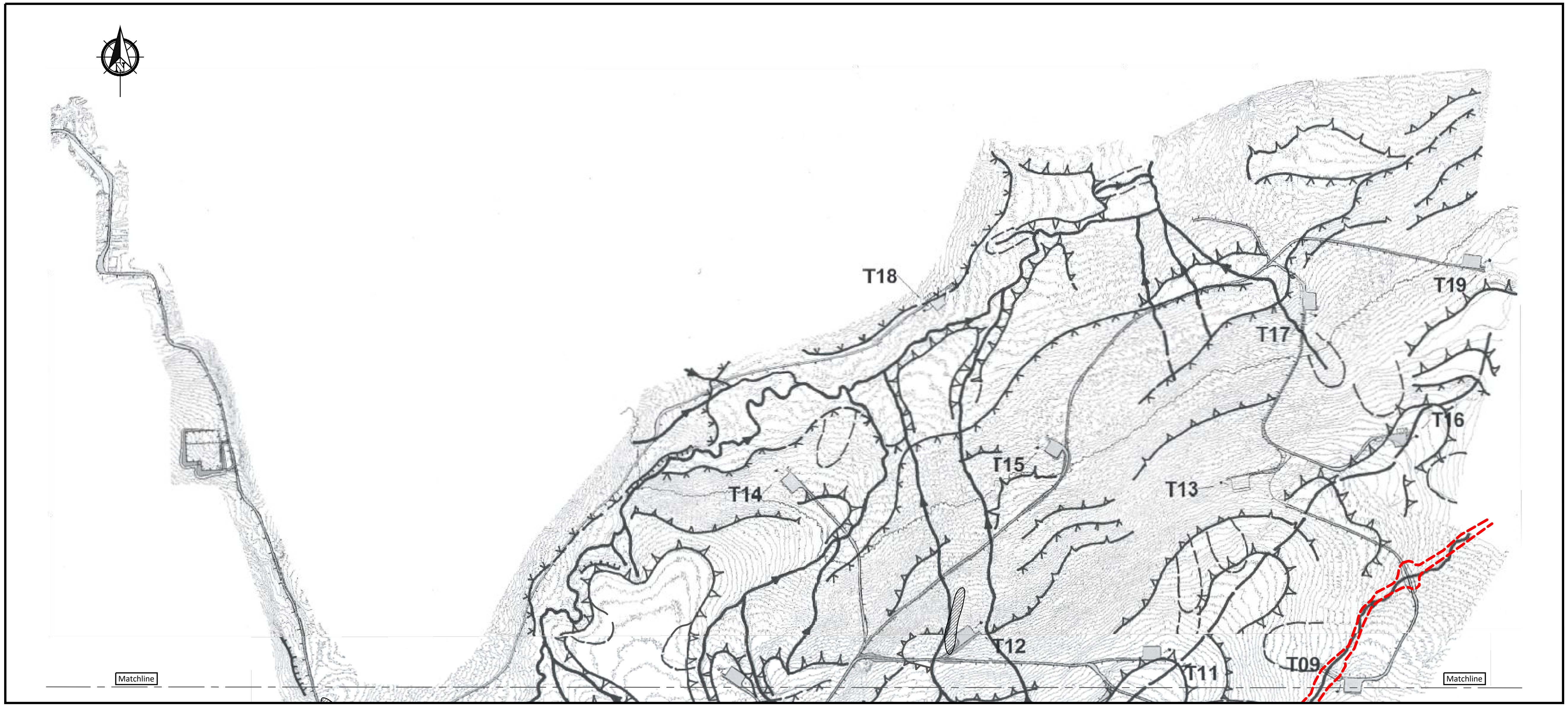


Symbol Legend -

- Major ridge line
- Scarp (sharp convex change in slope)
- Convex break in slope (major)
- Convex break in slope (minor)
- Concave break in slope
- Shallow concave depression (possible headwaters of stream)
- Water course
- 12 November 2020 peat failure extent (approximate)
- Previous peat failure extent (approximate)

Notes -

1. Preparation of the geomorphological plan requires a level of subjectivity based on the knowledge and experience of the compiler. This approach is a qualitative assessment of the peat stability and is for use as guidance only.
2. The geomorphological plan principally shows the morphology of the terrain which is presented as symbols and individual units. The individual units are intended to represent areas of similar character with respect to ground conditions. These ground conditions need to be confirmed by appropriate ground investigation.
3. The geomorphological plan should be read in conjunction with any previous stability assessment for the site.
4. For any construction works, detailed design is required to be carried out. The geomorphological plan is not to be used as a substitute for ground investigation.
5. For derivation of the geomorphological plan refer to the accompanying report.
6. Base plan comprises LiDAR topographic survey showing 1m contour lines and wind farm layout.



PLAN

Scale 1:14000

0m 70m 140m 210m 280m 350m 420m 490m 560m 630m 700m

Scale 1:14000

FEHILY TIMONEY

Cork | Dublin | Carlow

www.fehilytimoney.ie

Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	22.01.21

PROJECT

PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT

PLANREE LTD.

SHEET

GEOMORPHOLOGICAL PLAN SHEET 1 OF 2

Date 22.01.21	Project number P20-328	Scale (@ A3) 1:14000	
Drawn by POR	Drawing Number P20-328-0600-0001		Rev A
Checked by PJ			

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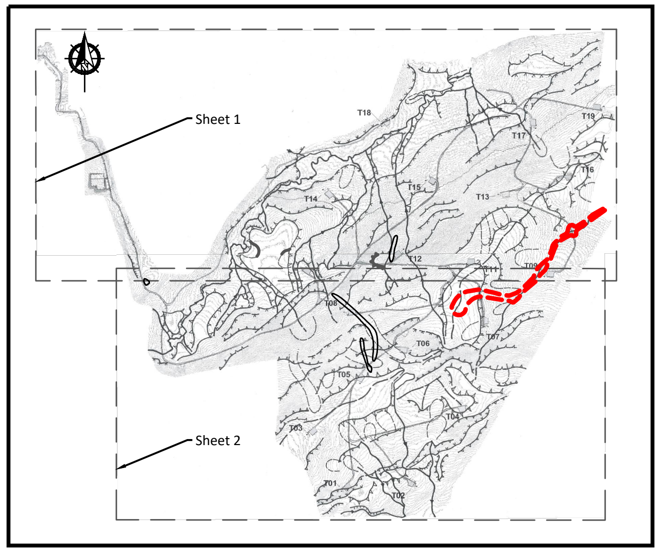
Friday 22 January 2021

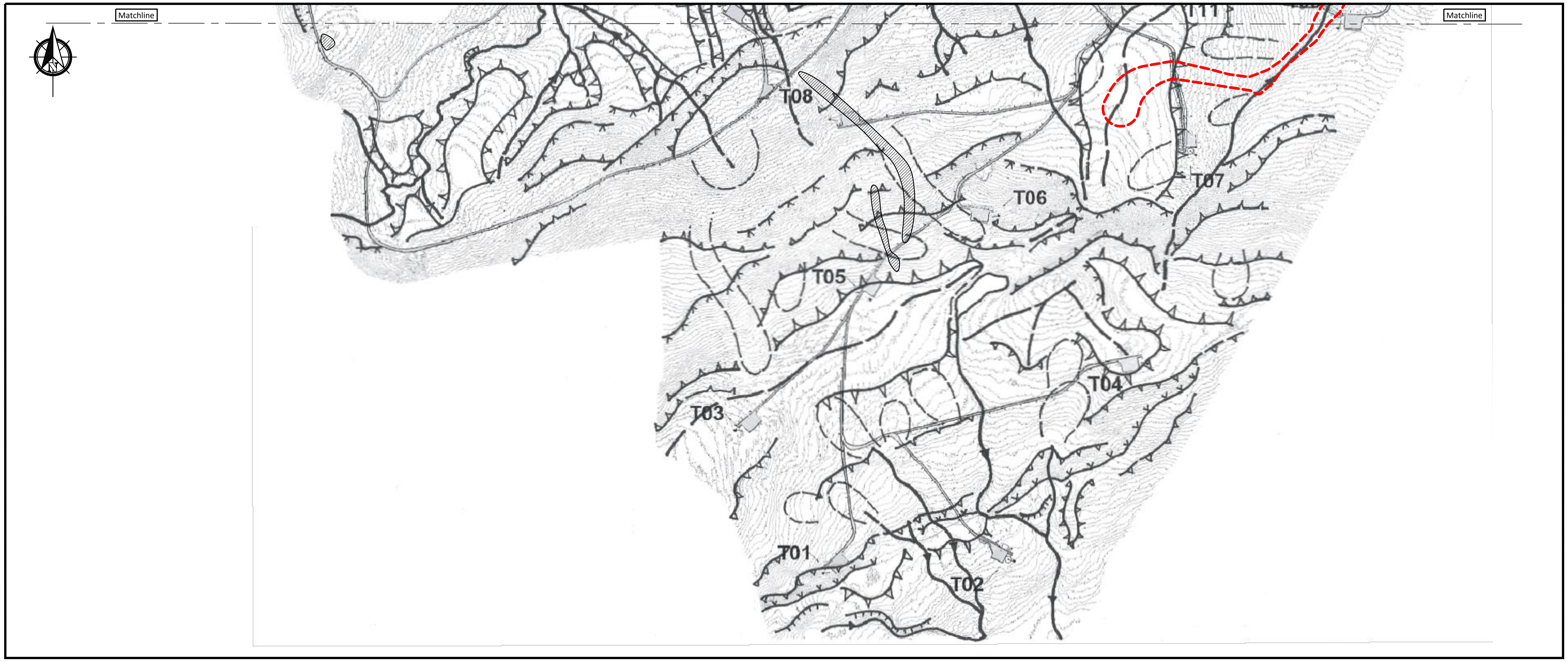


KEY PLAN

Scale 1:60000

Symbol Legend -

- Major ridge line
- Scarp (sharp convex change in slope)
- Convex break in slope (major)
- Convex break in slope (minor)
- Concave break in slope
- Shallow concave depression (possible headwaters of stream)
- Water course
- 12 November 2020 peat failure extent (approximate)
- Previous peat failure extent (approximate)



PLAN

Scale 1:14000

Notes -

1. Preparation of the geomorphological plan requires a level of subjectivity based on the knowledge and experience of the compiler. This approach is a qualitative assessment of the peat stability and is for use as guidance only.
2. The geomorphological plan principally shows the morphology of the terrain which is presented as symbols and individual units. The individual units are intended to represent areas of similar character with respect to ground conditions. These ground conditions need to be confirmed by appropriate ground investigation.
3. The geomorphological plan should be read in conjunction with any previous stability assessment for the site.
4. For any construction works, detailed design is required to be carried out. The geomorphological plan is not to be used as a substitute for ground investigation.
5. For derivation of the geomorphological plan refer to the accompanying report.
6. Base plan comprises LiDAR topographic survey showing 1m contour lines and wind farm layout.

0m 70m 140m 210m 280m 350m 420m 490m 560m 630m 700m

Scale 1:14000

FEHILY TIMONEY

Cork | Dublin | Carlow

www.fehilytimoney.ie

Rev.	Description	App By	Date
A	FOR INFORMATION	PJ	22.01.21

PROJECT

PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT

PLANREE LTD.

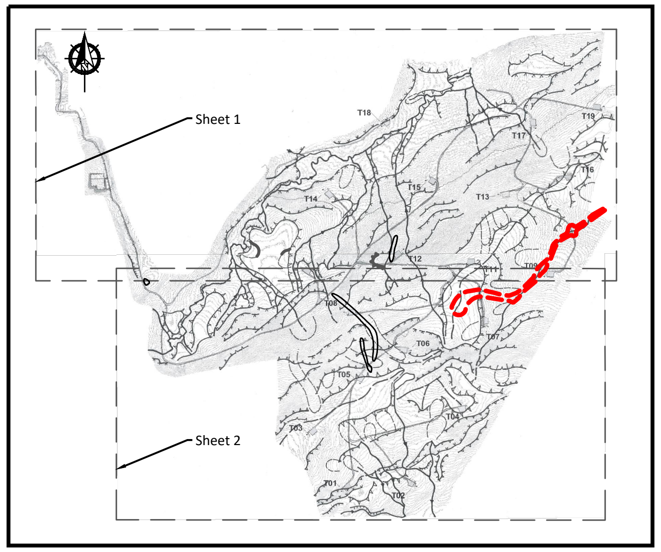
SHEET

GEOMORPHOLOGICAL PLAN SHEET 2 OF 2

Date 22.01.21	Project number P20-328	Scale (@ A3) 1:14000	
Drawn by POR	Drawing Number P20-328-0600-0002		Rev A
Checked by IH			

O:\ACAD\2020\P20-328\P20-328-0600-0002

Friday 22 January 2021



KEY PLAN

Scale 1:60000

Symbol Legend -

- Major ridge line
- Scarp (sharp convex change in slope)
- Convex break in slope (major)
- Convex break in slope (minor)
- Concave break in slope
- Shallow concave depression (possible headwaters of stream)
- Water course
- 12 November 2020 peat failure extent (approximate)
- Previous peat failure extent (approximate)

Notes -

1. Preparation of the geomorphological plan requires a level of subjectivity based on the knowledge and experience of the compiler. This approach is a qualitative assessment of the peat stability and is for use as guidance only.
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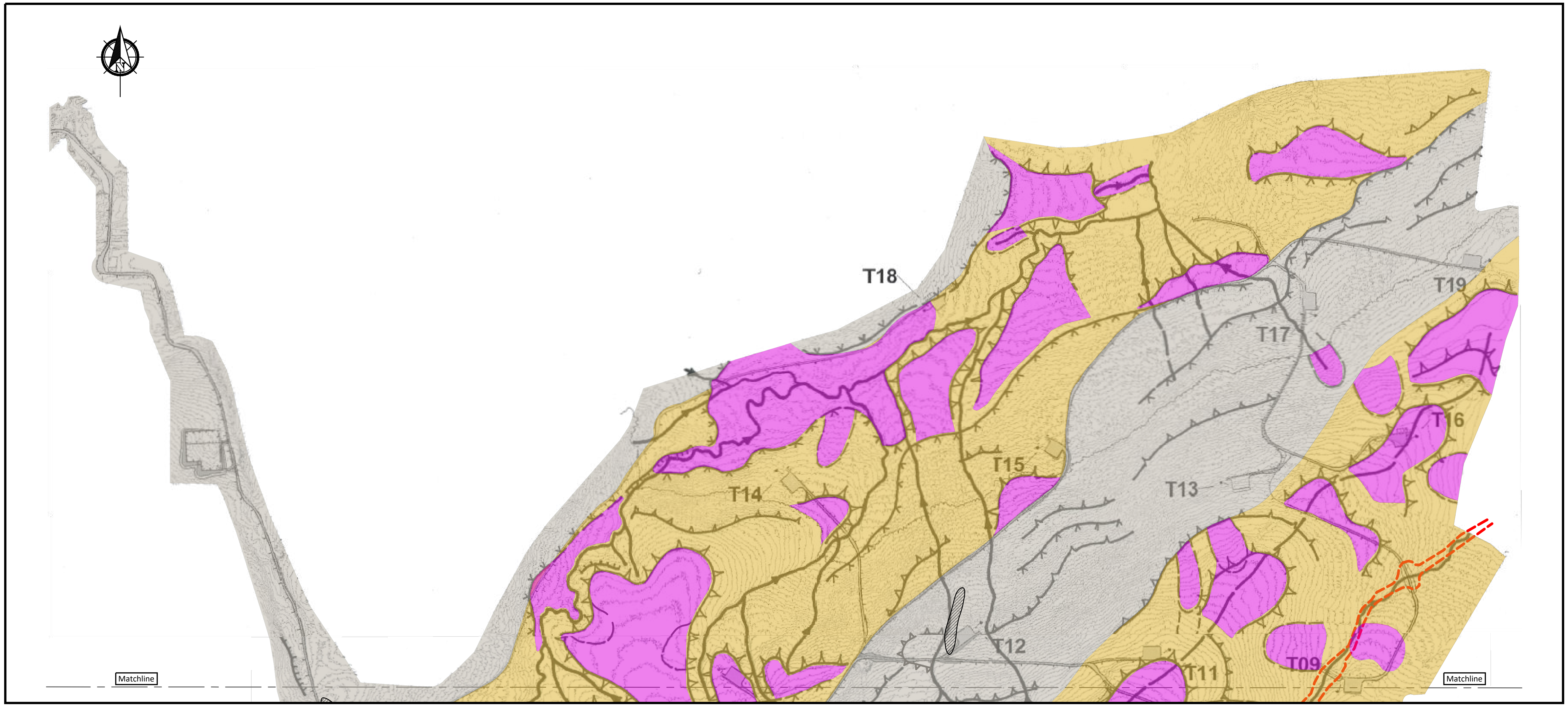
3. The geomorphological plan should be read in conjunction with any previous stability assessment for the site.
4. For any construction works, detailed design is required to be carried out. The geomorphological plan is not to be used as a substitute for ground investigation.
5. For derivation of the geomorphological plan refer to the accompanying report.
6. Base plan comprises LiDAR topographic survey showing 1m contour lines and wind farm layout.

Legend - Relative Potential Peat Stability Hazard

- Probable
- Likely
- Unlikely

Note - For explanation of legend refer to report text.



PLAN

Scale 1:14000

0m 70m 140m 210m 280m 350m 420m 490m 560m 630m 700m

Scale 1:14000

FEHILY TIMONEY

Cork | Dublin | Carlow

www.fehilytimoney.ie

Rev.	Description	App By	Date
A	FOR INFORMATION	PJ	22.01.21

PROJECT: PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT: PLANREE LTD.

SHEET: GEOMORPHOLOGICAL PLAN SHOWING ZONATION OF PEAT STABILITY HAZARD (SHEET 1 OF 2)

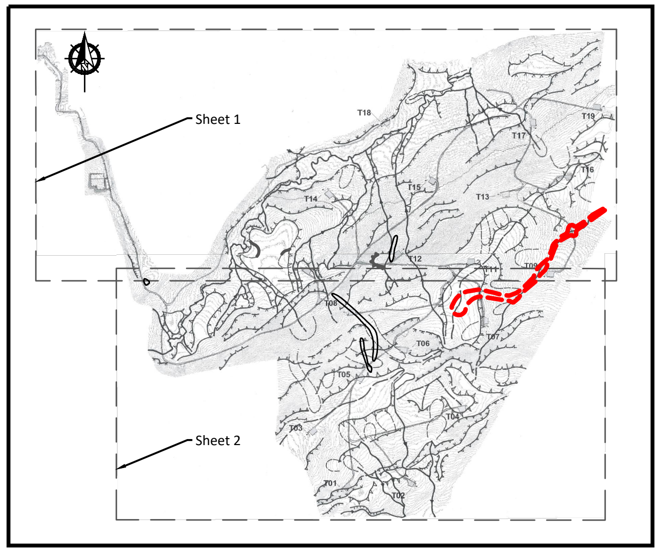
Date: 22.01.21	Project number: P20-328	Scale (@ A3): 1:14000	
Drawn by: POR	Drawing Number: P20-328-0600-0003		Rev: A
Checked by: IH			

O:\ACAD\2020\P20-328\P20-328-0600-0003

Friday 22 January 2021

KEY PLAN

Scale 1:60000



Symbol Legend -

- Major ridge line
- Scarp (sharp convex change in slope)
- Convex break in slope (major)
- Convex break in slope (minor)
- Concave break in slope
- Shallow concave depression (possible headwaters of stream)
- Water course
- 12 November 2020 peat failure extent (approximate)
- Previous peat failure extent (approximate)

Notes -

1. Preparation of the geomorphological plan requires a level of subjectivity based on the knowledge and experience of the compiler. This approach is a qualitative assessment of the peat stability and is for use as guidance only.
2. The geomorphological plan principally shows the morphology of the terrain which is presented as symbols and individual units. The individual units are intended to represent areas of similar character with respect to ground conditions. These ground conditions need to be confirmed by appropriate ground investigation.
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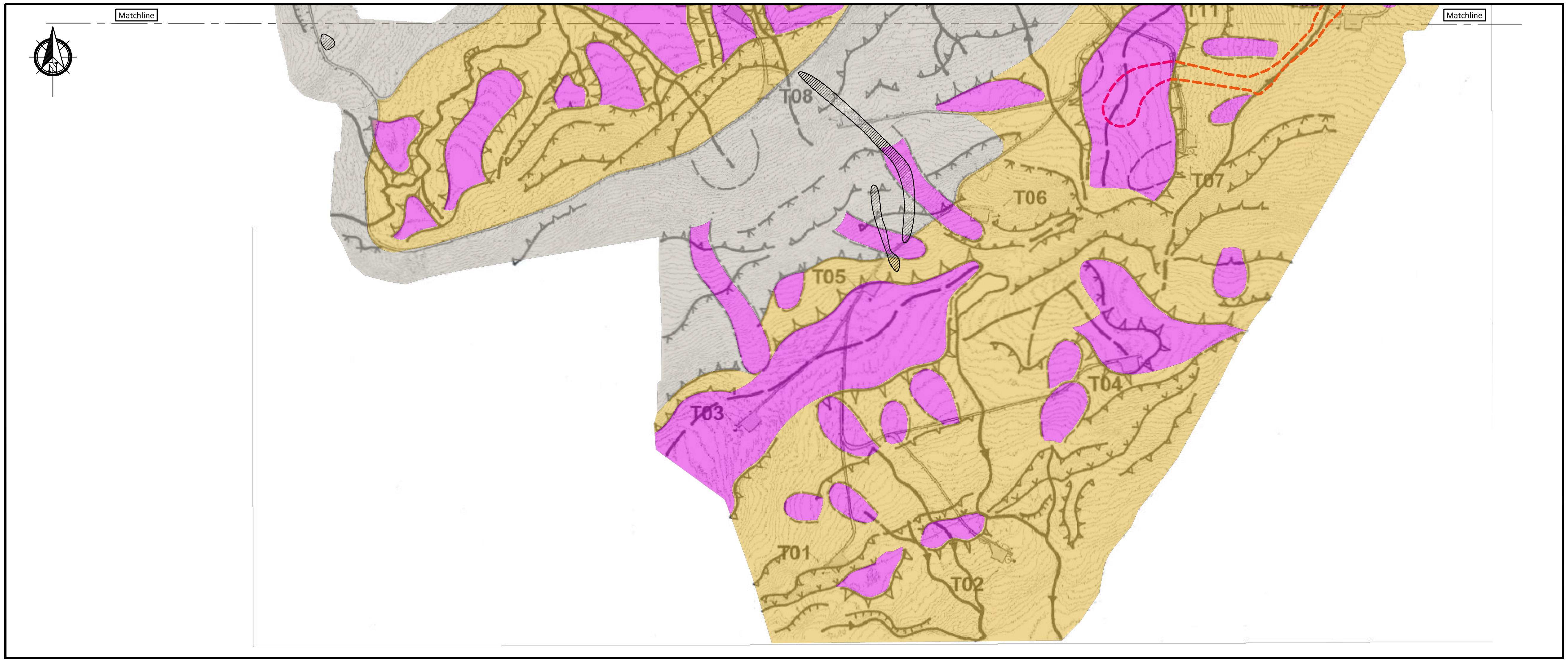
6. Base plan comprises LiDAR topographic survey showing 1m contour lines and wind farm layout.



PLAN

Scale 1:14000

Legend - Relative Potential Peat Stability Hazard

- Probable
- Likely
- Unlikely

Note - For explanation of legend refer to report text.

0m 70m 140m 210m 280m 350m 420m 490m 560m 630m 700m

Scale 1:14000

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Rev.	Description	App By	Date
A	FOR INFORMATION	PJ	22.01.21

PROJECT

PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT

PLANREE LTD.

SHEET

GEOMORPHOLOGICAL PLAN SHOWING ZONATION OF PEAT STABILITY HAZARD (SHEET 2 OF 2)

Date	22.01.21	Project number	P20-328	Scale (@ A3)	1:14000
Drawn by	POR	Drawing Number	P20-328-0600-0004	Rev	A
Checked by	IH				

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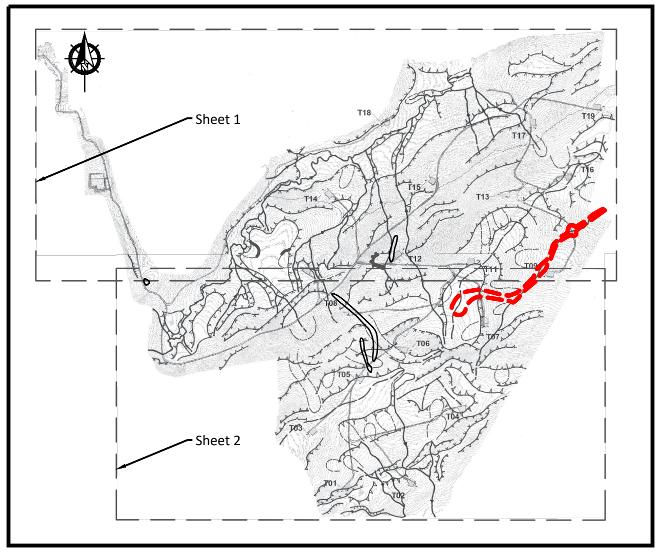
Friday 22 January 2021



KEY PLAN

Scale 1:60000

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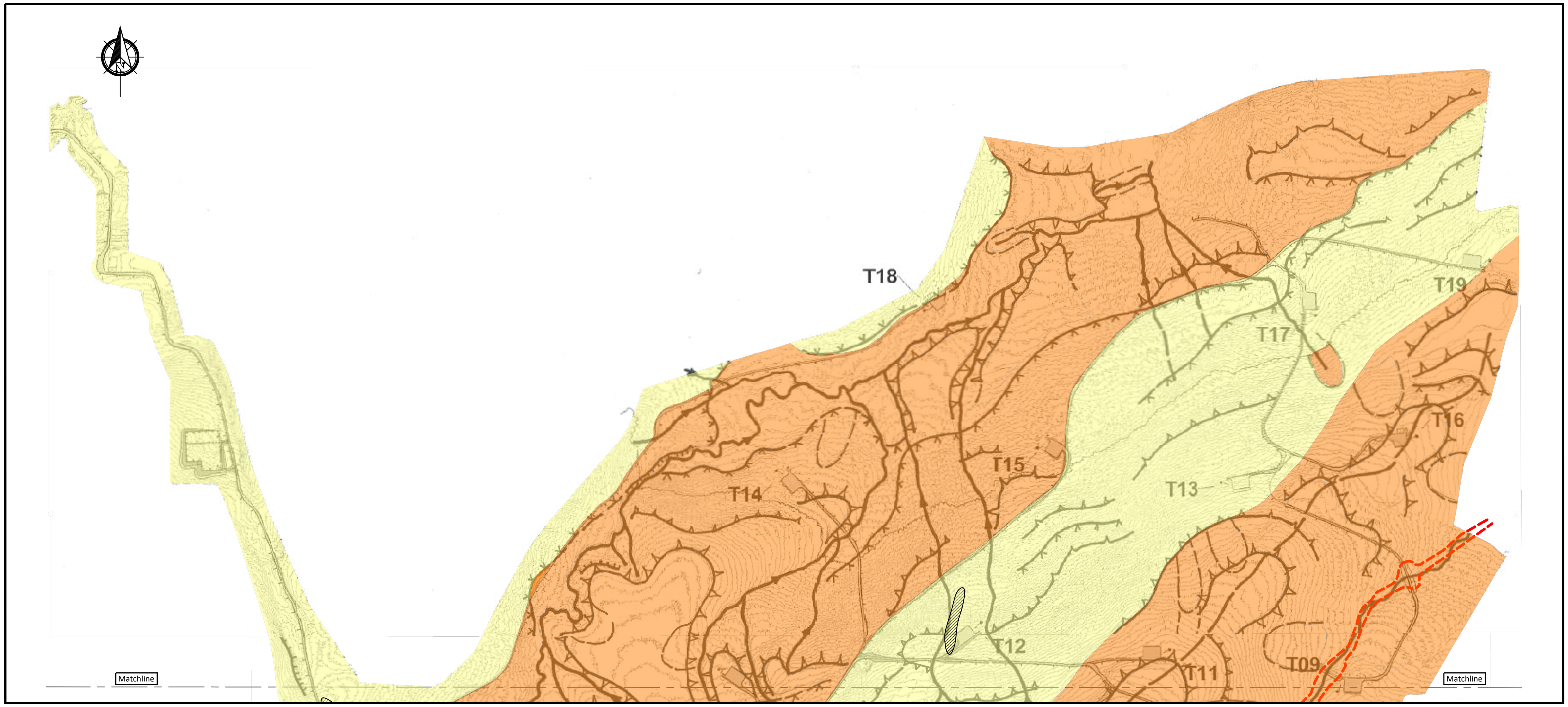
6. Base plan comprises LiDAR topographic survey showing 1m contour lines and wind farm layout.

Legend - Zonation of Peat Stability Risk

- Moderate
- Low

Note - For explanation of legend refer to report text.



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Scale 1:14000

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Rev.	Description	App By	Date
A	FOR INFORMATION	PJ	22.01.21

PROJECT

PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT

PLANREE LTD.

SHEET

GEOMORPHOLOGICAL PLAN SHOWING ZONATION OF PEAT STABILITY RISK (SHEET 1 OF 2)

Date 22.01.21	Project number P20-328	Scale (@ A3) 1:14000	
Drawn by POR	Drawing Number P20-328-0600-0005		Rev A
Checked by IH			

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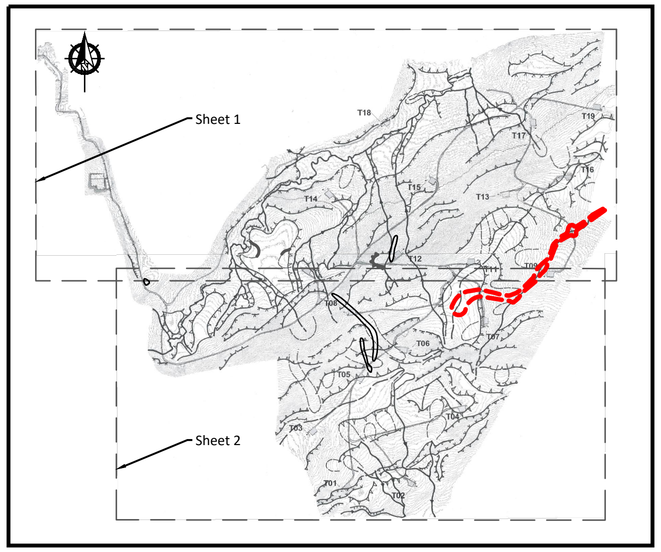
Friday 22 January 2021



KEY PLAN
Scale 1:60000

Symbol Legend -
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Notes -

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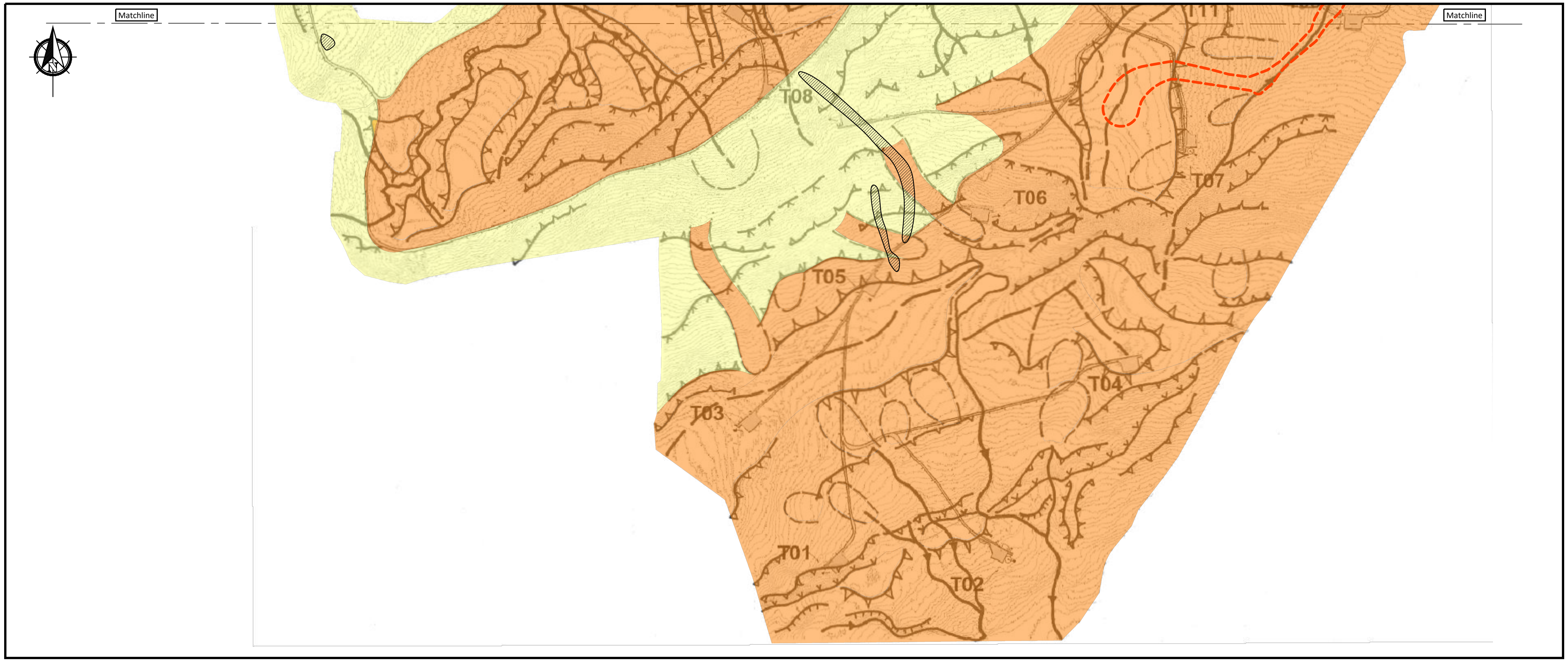
- Low

Note - For explanation of legend refer to report text.



PLAN
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Rev.	Description	App By	Date
A	FOR INFORMATION	PJ	22.01.21

PROJECT
PEAT STABILITY ASSESSMENT OF MEENBOG WIND FARM SITE

CLIENT
PLANREE LTD.

SHEET
GEOMORPHOLOGICAL PLAN SHOWING ZONATION OF PEAT STABILITY RISK (SHEET 2 OF 2)

Date	22.01.21	Project number	P20-328	Scale (@ A3)	1:14000
Drawn by	POR	Drawing Number	P20-328-0600-0006	Rev	A
Checked by	IH				

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Friday 22 January 2021

APPENDIX C

Comments and Responses to EPA

Meenbog Wind Farm

Intended Approach to Addressing the Conclusions and Recommendations of the EPA Report

by way of response to the EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021 (the Direction)

Introduction

Planree Limited shall arrange for the completion, by an appropriately qualified and independent person, being Dr Paul Jennings of Fehily Timoney, of a revised and updated peat stability assessment in line with best practice and guidance and addressing the conclusions and recommendations of the EPA Report[1], as defined in the Direction.

The EPA Report consists of a high-level review of two reports prepared on behalf of the wind farm developer (Planree Limited) for the Meenbog Wind Farm, being the December 2017 AGEC report, and the peat stability assessment report of January 2021 prepared by Fehily Timoney (FT).

Background

The EPA Report reviewed the December 2017 AGEC report, and the peat stability assessment produced by FT (2021)[2] in January 2021. The EPA Report considered their compliance with best practise and applicable guidance, as well as the adequacy of the recommendations and mitigation measures referenced in the January 2021 report for the remaining construction works. The January 2021 FT report provided a number of recommendations, which included the carrying out of further ground investigation (GI) and assessment in a zone of influence in advance of further works proceeding in areas that may adversely impact on peat stability. The results of the GI and assessment, with satisfactory findings, were to be considered prior to FT confirming that relevant construction works could commence.

Since the January 2021 report, the further GI and assessment have been and are currently being carried out by Ionic Consulting, designers for the Meenbog wind farm. The final results of the further GI and assessment will be included in a report to be prepared by Ionic, which will in turn inform the final detailed stability assessment of the site to be carried out by FT. That GI and assessment will be expanded to address the issues raised in the EPA Report.

Intended Approach

The intended approach to addressing the conclusions and recommendations in the EPA Report is provided in Table 1. For each relevant comment in the EPA Report we have inserted a response explaining the approach to be adopted, and the subsequent action that arises from that response.

A revised peat stability assessment report will be produced by FT on behalf of Planree Limited. This will reference and be supported by the detailed GI and assessment of the site being carried out by Ionic Consulting. The revised and updated FT report will fully address the issues raised in the EPA report.

[1] Arup (2021). Environmental Protection Agency. Meenbog Windfarm. Review of Peat Stability Assessments. REP/001. Issue 2. 26 March 2021.

[2] Fehily Timoney (2021). Meenbog Wind Farm - Assessment of Site with Respect to Peat Stability. January 2021.

Table 1 - Intended approach to addressing the conclusions and recommendations

Item	Report Section	Report Comment	Response	Action
1	5.1 Conclusions	• There are a number of aspects of the FTC 2021 report and peat stability assessment that are not in line with best practice and the recommendations of the PLHRA guidance. These include:	See below	See below

Item	Report Section	Report Comment	Response	Action
2		○ The extent, quantity, and methodology of the ground investigations (pre- and post-construction combined) is not adequate for a site-wide assessment, and is not in line with best practice.	The January 2021 FT report zoned the site using geomorphological mapping and taking into account the nature and extent of the proposed construction works and recommended that further GI be carried out prior to commencement of further works that may adversely impact the stability of the peat, see Recommendation (5) in FT report, amongst others. In essence it was recommended in the FT report that no works that could result in an adverse condition to the peat shall commence until such time as sufficient GI had been carried out and assessed by Ionic as per FT report recommendations. Since the January 2021 FT report was issued, GI has been carried by Ionic out as per the recommendations. It is noted that a more site wide assessment is required by the EPA Report and this will be responded to by amending the scope of the GI and assessment being carried out by Ionic. See response to Item 11 with respect to GI and site wide assessment.	Significant amount of additional GI is currently underway which will be used to inform the Ionic report. Ionic are currently carrying out GI at critical locations across the site, most notably at: • Access to T18 • Area of T1 to T4 At all locations where remaining works are to be carried out that may impact the stability of the peat (see FT report, Table 2) further GI shall be carried out. This shall comprise (as per FT report Recommendation 5): a) In advance of any remaining works, a zone of influence extending 50m minimum in all directions from the proposed works area shall be inspected and assessed by a competent person in advance of any works. b) Where deemed necessary by the competent person, the zone of influence shall be extended to include any ground that is considered to be affected by the works. c) The assessment within the zone of influence shall include visual inspection and appropriate testing of insitu peat with respect to depth and strength to full peat depth. The assessment shall include but not be limited to recording morphology, vegetation cover, drainage, proximity of drains and natural watercourses. d) The results of the assessment, pending satisfactory findings, shall be completed prior to any works commencing. Works shall only commence following a permit to work being issued. e) A record of all such assessments shall be maintained. Further to the above: • Peat depth probes are to be used to validate GPR survey (where available along access roads). • Micro-grid of probes in areas of deeper /weaker peat to define extent of area of deeper/ weaker peat, and assessment thereof on peat stability with respect to the proposed works. For example, GI along access to T18 includes a GPR survey along the full length of the access, which will be validated by further peat depth probes.

Item	Report Section	Report Comment	Response	Action
3		○ The peat strengths measured in the shear vane tests may not be reliable, and it is not good practice to rely solely upon these tests for the purposes of the assessment	PLHRA recognises difficulties in determining peat strength and as such is intentionally non-prescriptive with respect to the testing carried out. Vane testing in peat is recognised as being an index tool (Boylan, Jennings & Long)[4] and remains the most practical means of assessing peat strength. Reduction factors for say entanglement of peat fibres on vane would only be meaningful where vane is in acrotelm (say upper 1m or less), which is not the critical depth for controlling failure. Strength in the underlying catotelm is critical, particularly the lower bound values, and there are minimal fibres in the catotelm. The use of other testing such as laboratory testing provides results which would be considered by many practitioners as more unreliable. Use of empirical evidence is considered the most useful means of assessing peat strength/ behaviour. This comprises for example previous use of floating roads, stand-up height of peat faces, etc. Notwithstanding the above, comparative testing of peat strength is proposed, see opposite.	In addition to vane test results, site specific empirical evidence to include back-analysis of 2020 failure to determine shear strength at failure. This will also include for example peat side wall stability in the 2020 failure scar. The results of the back-analyses will be used to compare with shear vanes tests carried out by FT after failure. For testing of comparative peat strength methods, trial pits are to be carried out in selected locations where further work is required. For these trail pits the following shall be undertaken: a) Detailed logging of peat with depth. b) Extract undisturbed block samples for laboratory (triaxial) and shear vane testing. c) Compare laboratory (triaxial) and shear vane test results. d) Carry out localised controlled failure of pit side wall, where safe to do so. e) Back-analysis of localised failure of pit side wall and comparison with laboratory (triaxial) and shear vane test results. f) References to previous use of shear vanes at other peat sites. References to previous use of shear vanes to provide peat strength for back analysis of peat failure.
4		○ The qualitative approach to the Peat Stability Hazard and Risk Assessment is not in accordance with the PLHRA guidance. The summary output of the assessment is provided, but no supporting information to demonstrate how the assessment was undertaken.	This is in fact included, in section 8.2 of the FT report and is based on the association of particular geomorphological units to known failures. The individual units have been qualitatively ranked with respect to their likelihood to contribute to peat instability. The key considerations in determining this qualitative ranking are based on the experience of the compiler but also taking into account the factors that contributed to peat failures that have occurred on the site, such as: (1) Potential headwaters of natural drainage features (typically elongate shallow depressions). (2) Areas of deeper peat (typically elevated level areas such as top of flat ridge lines or isolated level benches).	More details to be included on qualitative ranking in revised and updated FT report. Note that report will also reference and rely on significant additional GI (see Item 2) which will be used to determine site stability, which will be within the Ionic report.

[4] Boylan, Jennings, & Long (2008). Peat slope failure in Ireland, Quarterly Journal of Engineering Geology and Hydrogeology, v41 p93-108, 2008

Item	Report Section	Report Comment	Response	Action
5		○ The Risk Rating is determined to be either Low or Moderate across the site. FTC do not adopt the recommended actions from the PLHRA for these zones, and do not demonstrate how the proposed mitigation measures reduce risk to an acceptable level.	It is not required to adopt the PLHRA requirements, as noted in introduction to 5.1 PLHRA, which is intentionally presented in bold in the PLHRA, and states: **It should be noted that examples provided in the following sections are illustrative only and should not be taken as prescriptive or used as a substitute for a developer's preferred methodology**. The mitigation measures are the recommendations. These have been developed to minimise the probability of further failure based on best practice and taking into account the failures that have already occurred on site. Provided that these recommendations are followed and appropriate detailed design is carried out it is considered this will reduce risk of instability to an acceptable level.	Text to be clarified in FT report. In particular care will be taken to ensure that it is clear how it is expected that the proposed mitigation measures will reduce risk to an acceptable level
6		• FTC's assessment of the failure mechanism and contributory factors of the November 2020 failure appears reasonable. However, the assertion that this could not have been reasonably foreseeable is not supported by the available information. Had an appropriate site-wide assessment been undertake, the likelihood of identifying the risk at this location would have been enhanced.	It is not accepted that an "appropriate" site wide assessment would necessarily have identified the risk at the location of the peat failure, and it is considered that the assessment carried out was reasonable in the circumstances. Inevitably, a detailed testing of the entire site would have meant that the likelihood of identifying the risk of deeper peat would have been enhanced. However the combination of factors that lead to the failure of November 2020 was unusual. That said, following the November 2020 failure and having identified the contributory factors, it is acknowledged in the January 2021 report that further GI work is required. The FT report recommends further GI which extends a minimum of 50m either side of proposed infrastructure to identify potential bodies of deeper/weaker peat that could be affected by construction, see Item 2 above. It is the combination of a body of weak/deep peat immediately upslope to and that possibly extended below the works that is a key lesson learnt from the failure. As such, further GI is proposed in the FT report to identify this combination, as given in the responses above. See Item 2 for further proposed GI.	See Item 2 above with respect to additional GI and assessment being carried out by Ionic, including that in response to the EPA reports concerns relative to the need for more testing, which will inform that revised and updated peat stability assessment.

Item	Report Section	Report Comment	Response	Action
7		• A number of mitigation measures are recommended by FTC which could be beneficial in mitigating the risk of instability. However, the rationale for adopting a number of these is not clear, and further consideration should be given to how the measures will be adopted in practice.	Noted	The revised and updated peat stability assessment report will ensure that the rationale for adopting all mitigation measures is clear, and that how they will be adopted in practise is explained.
8		• The peat stability assessment presented in the FTC report is not sufficient to demonstrate that construction works can resume safely.	FT accepts that the EPA report requires further information to justify a conclusion that construction works can resume safely in areas where those works may adversely impact on peat stability at the site, over and above the GI and assessment included in its January 2021 recommendations.	See Item 2 with respect to additional GI and assessment being carried out by Ionic, including that in response to the EPA reports concerns relative to the need for more testing, which will inform that revised and updated peat stability assessment. See Item 3 above that addresses investigation techniques to be adopted.
9	5.2 Recommendations	• An investigation layout plan is prepared which shows the location of all ground investigations undertaken which have been considered in the FTC report. This should be accompanied by drawings summarising the peat depth and strengths across the site.	FT report considered peat depth/strength from AGEC/EIAR and more recent Ionic data which shows depth and strength across site and this is included in Appendix A of the January 2021 Report. An investigation layout plan is currently being produced by Ionic in the context of the GI and assessment which will include the completed further GI.	An investigation layout plan with peat depth/strength will be produced as part of the updated and revised peat stability assessment being prepared. Details of further GI are given above in Item 2.
10		• As notes above, our review has identified a number of aspects where the FTC report is not in line with best practice. It is recommended that an update assessment is undertaken to address these issues.	See responses to Conclusions above	An updated and revised peat stability assessment is to be produced, which will include a detailed stability assessment of the site by Ionic following completion of further GI.

Item	Report Section	Report Comment	Response	Action
11		• The assessment should include an appropriate ground investigation, in line with the recommendations of the PLHRA guidance. Careful consideration should be given to the investigation techniques to be adopted, and the scope and extent of investigations.	The PLHRA refers to Scottish Govt (2014)[5] which was republished in 2017. In essence that document says for scoping of site, probing at 1ha centres to assess site layout, environmental issues, carbon, drainage, etc should be carried out. Following scoping the effective site boundary for engineering purposes reduces to essentially the corridor of the infrastructure, or more correctly in EC7[6] terms, the extent of the ground that covers the occurrence of the limit state. The critical limit state in this case would be the potential of initiating peat instability. Points to note (and also see responses above): a) FT January 2021 report recognises that site wide GI has not been carried out. b) FT January 2021 report Recommendation (5)... in advance of any remaining works, a zone of influence extending 50m minimum in all directions from the proposed works is tested, inspected, etc. c) GI has been targeted using the geomorphological mapping and the proposed construction works, as per PLHRA 4.4.2. d) PLHRA is intentionally not overly prescriptive with respect to GI that is carried out as it recognises the issues with testing peat strength. e) Investigation techniques. Vane testing has been used to determine peat strength (see Item 3). Vane testing using hand-held vane is practical to typically about 3m. Below that depth extrapolation of realistic results, where required, can be carried out to determine strength at depth. Typically peat strength increases with depth due to consolidation effect, in some cases in buoyant peat there may be little strength gain with depth. Alternative testing techniques are to be provided, see Item 3.	See Item 2 with respect to additional GI and assessment being carried out by Ionic, including that in response to the EPA reports concerns relative to the need for more testing, which will inform that revised and updated peat stability assessment. See Item 3 above that addresses investigation techniques to be adopted.

[5] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland
[6] I.S. EN 1997-1:2007 Eurocode 7: Geotechnical Design - Part 1: General Rules.

Item	Report Section	Report Comment	Response	Action
12		• The Peat Stability Assessment should be undertaken in line with the PLHRA guidance. Where a qualitative approach is adopted, this should clearly set out the basis for the expert judgement made.	This is included in FT January 2021 report section 8.2 and is based on the association of particular geomorphological units to known failures. The individual units have been qualitatively ranked with respect to their likelihood to contribute to peat instability. The key considerations in determining this qualitative ranking are based on the experience of the compiler but also taking into account the factors that contributed to peat failures that have occurred on the site, such as: (1) Potential headwaters of natural drainage features (typically elongate shallow depressions). (2) Areas of deeper peat (typically elevated level areas such as top of flat ridge lines or isolated level benches).	More details to be included on qualitative ranking in the updated and revised FT report.
13		• A multidisciplinary approach should be adopted for the assessment, with appropriate input from relevant professionals. These may include geotechnical engineers, geologists, hydrogeologists, geomorphologists, or ecologists.	The December 2017 AGEC report and related EIAR site assessment had the benefit of supporting data from geotechnical engineers, geologists, hydrogeologists, geomorphologists and ecologists. The Meenbog wind farm project continues to be supported by a full team of specialist disciplines.	The input received from these relevant professionals will be clearly outlined in the updated and revised FT report.
14		• Further consideration should be given to the proposed mitigation measures prior to construction resuming. The rationale for these measures, and consideration of their practical implementation on site should be considered.	Noted.	The updated revised peat stability assessment will include a detailed report of the site prepared by Ionic following completion of further GI, see Item 2.
15		• The above issues should be addressed by the developer prior to resumption of any construction activities which could adversely impact on stability at the site.	See responses above.	Prior to commencing works, updated and revised peat stability assessment will be completed.

Site Visit Report
(Environmental Liability Regulations)

Site Visit Details	
Reference	200005/SV(4)
Area visited	Meenbog Wind Farm, Meenbog, Co Donegal and surrounding environs
Name of Potential Operator(s) for ELR purposes	Planree Ltd Mid-Cork Electrical Ltd Invis Energy
Occupational activity of Operator(s) (NACE code)	D35.1.1 Production of Electricity
Case Number	ELD200005
Purpose of Visit	Discussion on peat stability
Date Of Visit	16th April 2021
Time	Approximately 09:45am – 15:00pm
EPA Inspector(s)	Ms Linda Dalton O'Regan (Inspector, Waste, Financial Provision and Producer Responsibility Team) Mr Jim Moriarty (Manager, Waste, Financial Provision and Producer Responsibility Team)
Additional Visitors (EPA Affiliated)	Mr John O'Connor (Arup) Mr Greg Balding (Arup)
Other Persons and Role	Mr Bryan Cannon, Donegal County Council Mr Martin McDermott, Donegal County Council Mr Michael Murnane (Planree Ltd) Mr Chris O Mahony (Mid-Cork Electrical Ltd) Mr Brian Keville (Consultant, MKO) Mr Cormac O'Dubhthaigh (Ionic Consulting)

Report Detail	
Issue Date	16/04/2021
Prepared By	Ms Linda Dalton O'Regan
Reviewed By	Mr Jim Moriarty

Background

Meenbog Wind Farm is located approximately 20 km north east of Donegal town, adjacent to the border of Northern Ireland (Figure 1, Appendix 1). As notified by Planree Ltd. to the EPA on the 29/11/2020, a peat slide occurred during construction activities at Meenbog Windfarm on the 12/11/2020 resulting in a significant loss of suspended solids and sediment to the environment.

On the 01/04/2021, the EPA issued a Direction under Regulation 8(1) of the European Communities (Environmental Liability) Regulations (S.I. 547/2008) to Planree Ltd. (ref: ELD200005/Dirn8(1)/Planree). The Direction requires the preparation and submission of an updated peat stability assessment for the site by the operator.

The main purpose of this site visit was to facilitate a site visit for Arup personnel, acting on behalf on the EPA in relation to peat stability issues on site, and discuss the methodologies proposed by the operator in conducting their updated assessment.

Areas Inspected

The following areas were visited:

1. Barrage walls 1, 2 and 3 (See Figure 2, Appendix 1).
2. The head of the peat slide which occurred on the 12/11/2020.
3. The peat slide which occurred between T05 and T06 in June 2020, and barrage wall constructed in response in the vicinity of T08.
4. The peat slide at T12.
5. Area proposed for turbine base at T07 and surrounding infrastructure.
6. Haul road to T04.
7. Haul road to T18.

Documents Inspected

No documents were inspected during the course of this visit.

Summary of Visit

Throughout the course of this visit, Fehily Timoney correspondence entitled "Intended Approach to Addressing the Conclusions and Recommendations of the EPA Report by way of response to the EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021", submitted to Jim Moriarty (EPA) by Michael Murnane (Planree Ltd) via email on the 13/04/2020, was discussed.

Particular attention was paid to:

1. the various peat instabilities reported at the site,
2. the methodologies employed and proposed for the assessment of peat strength and depths across the site,
3. how peat strength, depts and other parameters are utilised when assessing peat stability,
4. and areas where construction activities remain to be completed.

There was significant discussion around the ground investigations underway and planned to complement work already done. The importance of interpretation of any investigative results was stressed in the context of the updated assessment.

Action Required

The EPA notes the Fehily Timoney correspondence entitled "Intended Approach to Addressing the Conclusions and Recommendations of the EPA Report by way of response to the EPA Direction issued under Article 8(1) of SI 547/2008 dated 1 April 2021". This is useful and sets out how the issues identified in the EPA report supplied with the 1 April 2021 direction are to be addressed.

As well as addressing the issues highlighted in the EPA report, the operator shall, in preparing the updated peat stability assessment, consider the following issues:

1. The undertaking of core samples to confirm the nature and characteristics of peat on site would provide useful additional information.
2. While trial pits and triaxial testing are proposed in the FT correspondence, no information is provided on the number/location of these. An appropriate number of samples for each proposed methodology should be employed and described/justified in the updated stability assessment.
3. It is likely that the additional investigations/alternative methodologies will provide different results for peat strength. This should be discussed in the updated assessment. A sensitivity analysis should be completed to examine the impact that differing peat strengths would have on, for example, factors of safety and the design of infrastructure
4. An assessment of the adequacy and stability of the berm at T08 to demonstrate that it is fit-for-purpose.
5. An analysis of the peat failures that happened in advance of the November incident should be included with lessons learned from those discussed and factored into the assessment
6. A comprehensive multidisciplinary approach to assess peat stability risks on site during and after windfarm construction e.g .changes in hydrology due to the proposed construction methodologies at T18 and T4.
7. Persons involved in the assessment of peat stability on site shall have sufficient expertise, competency, and experience, for the tasks to which they have been assigned. As set out in the FT correspondence, assessments will include recording of morphology, vegetation cover

It is critical that all information is compiled, discussed and presented in a single updated peat stability assessment to be prepared by the end of April. Cross-referencing other reports completed at other times for different purposes should be avoided.

It is recommended that areas where failures have happened should be subject to ongoing routine inspection to monitor for potential new slippages. Records should be maintained of these.

Appendix 1: Figures

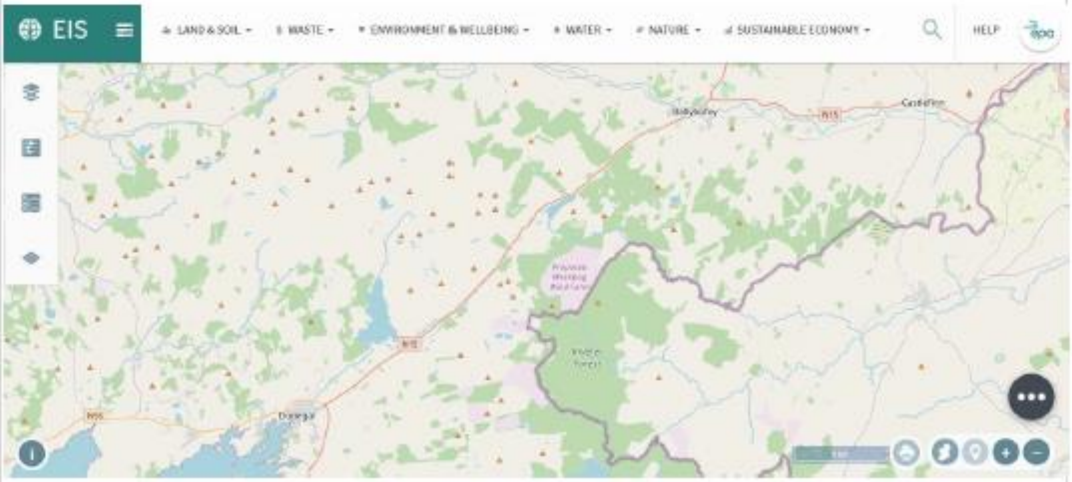

Figure 1: Map from EPA GIS system showing the approximate location of Meenbog Windfarm relative to Donegal town and Ballybofey, Co Donegal (in purple)

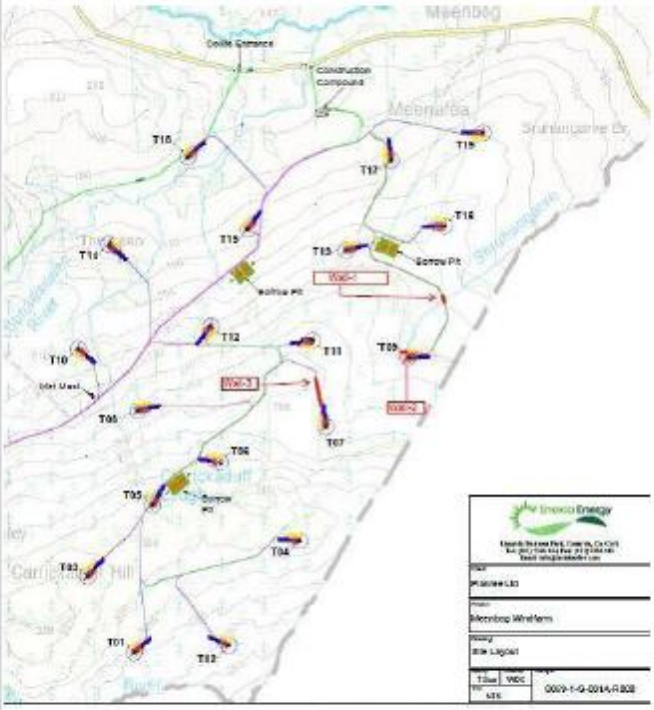

Figure 2: Schematic received by email from Donegal County Council on the 17th November 2020 showing proposal from operator to construct 3 walls to mitigate against further damage and peat instability (note: Wall 1 constructed on the 12th/13th November 2020, Wall 2 and Wall 3 proposed).

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PER REGISTERED POST
and via e-mail to michaelmurnane@turnkeydev.com

29th July 2021

To: Planree Limited
Lissarda Industrial Estate
Lissarda
Co Cork

EPA Reference Number ELD200005/Corr(1) /Planree

The EPA Direction issued pursuant to Regulation 8(1) of the European Communities (Environmental Labilities) Regulations 2008 (as amended), dated 1st April 2021 required, inter alia, that

1. **Planree Limited** shall arrange for the completion, by an appropriately qualified independent person, of a revised and updated peat stability assessment in line with best practice and guidance and addressing the conclusions and recommendations of the EPA report.
2. **Planree Limited** shall arrange for the submission of a report on the assessment in 1 above which shall provide all relevant information and evidence necessary for the EPA to assess the adequacy of the peat stability assessment. This report shall be submitted by the 30th April 2021

The Environmental Protection Agency refers to:

A. email correspondence to the Agency from MKO, consultants acting on behalf of Planree Limited, received in response to EPA Regulation 8(1) Direction issued 1st April 2021, dated 26/05/2021 attaching *Peat Stability Assessment of Meenbog Windfarm Site* (May 2021; Fehily Timoney); and
B. the report entitled *Environmental Protection Agency Meenbog Windfarm Review of Peat Stability Assessment (May 2021); Rev 01, 29 July 2021* prepared by ARUP (here after referred to as the Arup report, appended to this correspondence)

I am to advise that, following review of material submitted, and notwithstanding some issues identified and set out in the Arup report, the revised Peat Stability Assessment prepared by FTC and submitted to the EPA pursuant to 1 and 2 above addresses the conclusions/recommendations set out in previous EPA correspondence. The mitigation measures proposed by FTC (Tables 19 and 20) are reasonable and will be of benefit in managing risk for remaining works to be completed at the site.

There are a number of deficiencies identified in the quantitative assessment prepared by Ionic that are required to be addressed. While the Arup report lists all relevant issues, the priority ones are, for ease of reference, tabulated here;

Item	Issue	Action required
1	Ionic have adopted Design Approach 1 of Eurocode 7, but have only carried out calculations for Combination 2. It is a requirement of Eurocode 7 that both Combination 1 and Combination 2 are considered.	Undertake calculations for both Combination 1 and Combination 2, in accordance with EN 1997-1.
2	Ionic have stated that 'lower-bound' values have been used in design, but have not presented an analysis of the data to demonstrate this, and it appears that the analysis instead considers the lowest test result at each location. Furthermore, the majority of the peat strength data is based on tests located in the upper 2.0m The report also states that an ODR greater than 1.0 is considered acceptable. While this is in accordance with EN 1997-1, it should be noted that this is contingent on appropriate values of design parameters and loads being used in the analysis. It is noted that a considerable proportion of the analysis results show an ODR less than 1.2, indicating that the design is close to the limit. This is particularly relevant given the potential for significant variability in the peat strength and depth.	Undertake an assessment of the data on either a site-wide basis or considering defined areas of the site (with justification for same) to determine appropriate characteristic or lower-bound values for use in design. Consideration should be given to the depth at which tests were undertaken relative to the depth of peat. The assumption of peat strength increasing with depth should not be relied upon unless this can be reliably demonstrated for the site – noting that the data currently presented in the report does not support this assumption~~.~~, and that evidence from the site to date (including in the vicinity of the November 2020 failure) is that peat strength reduces with depth. Undertake a sensitivity analysis to assess the impact of variations in these parameters on the stability. The designer should give consideration to adopting a higher minimum ODR in the analysis, with due regard to the parameter values

		used in the analysis, and the degree of variability associated with these.
3	The basis for selecting a uniformly distributed pressure of 10.7 kPa for crane loading is not sufficient. This value would appear to be lower than that which would typically be used in design for similar situations.	In addition to considering a uniformly distributed load, consideration should also be given to line loads or loading of a smaller area by crane wheels/tracks etc. Reference should be made to data sheets for the proposed plant.
4	Construction of solid roads will require temporary excavations in peat. The stability of these has not been considered in the report.	Undertake a stability analysis of the proposed temporary excavations. This should inform the design of these excavations, including temporary slope angles, support measures, extent of excavation which can remain open, and groundwater control.
5	It is stated that an observational approach is to be adopted in the design. If this is the design approach, then this should be fully documented in a design report, including the designer's assessment of all possible scenarios, a series of measures to be implemented for each, and clear criteria for where these measures can be applied. This has not been presented in the report.	Undertake a design using the observational method which addresses the issues identified. The designer should refer to relevant guidance on the use of the Observational Method – for example Chapter 100 of the ICE Manual of Geotechnical Engineering, or C760 Guidance on Embedded Retaining Wall Design (noting that C760 is not directly relevant to this project, but the general guidance on the Observational Method may be useful) Alternatively, if it is not intended to adopt an observational approach in the design, this should be clarified appropriately.

The issues identified above, and in the Arup report appended with this correspondence, should be considered/addressed and the quantitative assessment updated in order to assure the adequacy of the overall Peat Stability Assessment. The *Peat Stability Assessment of Meenbog Windfarm Site May 2021* should be updated where required, paying particular regard to the quantitative assessment. The updated Peat Stability Assessment should be submitted to the EPA when complete. This should be accompanied by a cover letter detailing the changes made so that compliance with the EPA Direction from 1st April can be confirmed.

While the detailed design for civil works need not be submitted to the EPA, it should be confirmed that the detailed design for civil works will be informed by this updated assessment.

This correspondence is without prejudice to any legislative obligations on the operator other than under the Environmental Liability Regulations, or interactions with other Regulatory Authorities in respect of Meenbog Wind Farm.

You are reminded of your obligations under Regulation 7(1) of the European Communities (Environmental Liability) Regulations 2008 (S.I. 547 of 2008) to take necessary preventive measures to deal with any imminent threat of environmental damage.

Dated this 29th day of July 2021

Signed on behalf of the Agency:

Jim Moriarty

Jim Moriarty
Senior Inspector
Office of Environmental Enforcement, EPA

APPENDIX D

Ionic Consulting Report

For Appendix D

(Ionic Consulting Report)

see rEIAR Appendix 6-3

APPENDIX E

Construction Control Procedures

Meenbog Wind Farm

CONSTRUCTION RESPONSE TO FEHILY TIMONY MITIGATION MEASURES

Revised August 2021

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Introduction:

Mitigation measures have been set out in the FT Assessment of Site with Respect to Peat Stability for Meenbog Wind Farm. This document outlines the response to the individual mitigation measures which will be applied to the remaining on-site civil works during civil construction.

In addition to the below it is noted that Paul Jennings will complete a fortnightly audit of the construction activities relevant to site stability and Martin Lyttle will have a full-time site role for the supervision of remaining civil works where excavation of peat is required. CV's are provided in the supporting documentation in Appendix 1 for reference.

Mitigation Measure 1:

Remaining construction works. The remaining construction works are summarised in **Error! Reference source not found.**. The remaining works are generally minor in nature and do not require extensive groundworks, except for the works at T7 and the access to T18.

(a) Any remaining works shall be subject to the mitigation measures given below, or any other such related requirements.
(b) Where there are further works not included in the above, that may adversely affect ground stability, then these further works shall also be subject to the mitigation measures given below, or any other such related requirements.
(c) All works shall be subject to detailed design.

Response 1:

(a) Responses are provided to each of the detailed mitigation measures below confirming adherence to same
(b) Responses are provided to each of the detailed mitigation measures below confirming adherence to same
(c) All remaining works will be subject to detailed design. Designs will be provided by MCE subcontractor Ionic Consulting and where necessary input from the Designer will be provided for the MCE methodology for conducting the works (Sample Method Statements provided in Appendix 2). Designs for the remaining works will also be subject to review by both HES and MKO in terms of potential hydrology or ecology input where deemed necessary.

Mitigation Measure 2:

No further construction of floating roads is to be carried out. Given the potential risk associated with floating road construction alternative methods of construction shall be adopted.

(d) Where alternative methods of construction are proposed these shall be subject to the mitigation measures given below, or any other such related requirements.
(e) Detailed design shall be carried out and appropriate method statements produced to mitigate against the risk of peat and ground instability.
(f) Alternative road construction would typically comprise road founded on competent strata below peat which will require excavate and replacement techniques. For alternative road construction the following items, which are non-exhaustive, shall be included:

   (i) No side casting of arisings onto insitu peat surface. All arisings to be placed into designated storage areas.

   (ii) Use of low permeability plugs along line of road at suitability spaced intervals to avoid longitudinal transmission of surface water.

   (iii) Observational approach adopted to monitor side-wall stability of peat in excavations.

   (iv) Construction programmed to minimise the time peat excavations are exposed prior to filling with suitable fill.

Response 2:

a) As per the updated Peat Stability assessment provided by Ionic (Report reference: MNBG r057 – See Appendix D) no further construction of floating roads will be carried out on site.

b) Detailed design for all remaining works is being undertaken by Ionic Consulting and associated RAMS for each element of works will be in place by MCE ahead of construction. This will be the case for any additional works that may arise on site. Appropriate checks and supervision in line with these recommendations are set out in the RAMS.

   Please see attached sample design drawings and RAMS for the following works (Documentation included in Appendix 2):
   - Upgrade of the access road for turbine no. 18
   - Re-alignment of T4 access road section and construction to solid formation
   - Construction of barrage south of T4 access road between the junction to T1 and junction to T2

c) Alternative dig-and-replace construction methodology is assumed for all remaining road construction in areas of peat. Side casting will not be permitted and all peat arising from the construction works will be removed to the on-site peat deposition area. A competent foreman appointed by MCE will be present for all works. Martin Lyttle will also have a full-time supervisory role on site for remaining works in areas of peat (See appendix 1 for CV).

Mitigation Measure 3:

No loading of insitu peat. The instability recorded on site in all cases can be attributed to various degrees to excessive placed construction loading onto the insitu peat surface.

(a) The remaining works on the site shall be carried out without placing of any arisings or loading on to the insitu peat. Placing of any load particularly onto the downslope margin of any works within peat shall be avoided.

(b) It is recommended that the tracking of construction machinery onto the insitu peat is kept to a minimum and limited to the installation or maintenance of site drainage using appropriate low ground pressure plant. In the event that construction machinery has to track onto the insitu peat then the peat shall be inspected and assessed by a competent person to avoid excessive loading. If the competent person is in any doubt as to the suitability of the peat for tracking of machinery, no tracking of machines onto the peat should take place.

(c) The definition of excessive loading shall be determined by the competent person and shall take into account the nature and type of loading and the nature and type of the insitu peat and general ground conditions.

(d) Where required the assessment shall include visual inspection and appropriate testing of insitu peat with respect to depth and strength to full peat depth. For example, thin peaty soil (less than 0.5m thick) over mineral soil would not represent a notable risk of peat instability. The results of the assessment, pending satisfactory findings, shall be completed prior to any works commencing. A record of all such assessments shall be maintained.

Response 3:

No loading of in-situ peat will take place for the remainder of the works on site. There shall be no side casting permitted on site. All peat extracted during the works shall be removed and transported directly to the dedicated Borrow Pit area.

Tracking of machinery on in-situ peat will be minimised in so far as reasonably practicable however it will be necessary for some limited works e.g. construction of drainage in advance of construction of T18 access road. Where movement of machinery on in-situ peat is necessary in a given area, a competent MCE representative will assess the area prior to the works and shall consult the Designer Ionic Consulting prior to works where necessary to confirm if loading of the in-situ peat is acceptable for a specific area. John Shanahan or Cormac O'Dubhthaigh from Ionic Consulting will complete a site visit once a week while remaining construction works in peat are ongoing. On site supervision of works will also be available from FT representative Martin Lyttle as previously noted.

It is noted that the load case for tracking of machinery across all remaining construction areas has been assessed as part of the additional site testing completed to date and areas have been identified where tracking of vehicles will not be permitted (See sections 4, 5 and 6 of Ionic report MNBG r057 in Appendix D).

Mitigation Measure 4:

Monitoring of ground movement and constructed works. In order to monitor the performance of the constructed works within the peat areas, and any further construction works to be carried out, a series of monitoring points shall be established throughout the site.

(a) Monitoring is proposed to provide advance warning of potential instability or possible longer term movement, that may represent potential for degradation of the works over time that could lead to instability.

(b) Monitoring shall be sited at critical locations typically adjacent to the constructed works as given in Table 21 (refer to FT report). The exact location of the monitoring shall be determined following inspection. Other locations may be included as required by the designer or contractor.

Table 21 (FT report): Ground Monitoring Locations:

No	Location	Comments
1	Junction of access road to T1 with spur to T2 and T4 along downslope margin	Area of deepest peat in close proximity to concave break in slope
2	Along access to T3 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
3	Along access to T2 about 100m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
4	Along access to T4 about 150m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
5	Along access from T5 to T3 about 200m from T5 along downslope margin	Area of deeper peat in close proximity to concave break in slope
6	Junction of access road to T7 about 100m along access to T7 along downslope margin	Area of deeper peat in close proximity to concave break in slope, within potential area of 12 November failure
7	South side of upper scar of 12 November failure	To monitor potential retrogression of scar upslope
8	On downslope margin of T7 base and hard stand prior to construction	To be installed in advance of any works
9	On downslope margin of T10 base and hard stand	Area of peat in close proximity to concave break in slope
10	Along access to T14 about 100m from hard stand along downslope margin	Area of peat in close proximity to concave break in slope
11	Along access to T18 at about chainage 1600m along downslope margin	Area of potential peat close to river
12	Along access to T16 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope and minor instability
13	Peat storage berms at T15	Minor signs of movement/distress. Where necessary the berm size is to be increased.
14	Peat storage berms at T17	Minor signs of movement/distress. Where necessary the berm size is to be increased.
15	Peat failure scar above road to T7	Upper scar of 12 November 2020 peat failure. Potential for retrogression of failure scar.
16	Peat failures at Borrow Pit between T5 and T6	Comprises 3 peat failures at this location. Monitoring at the head of each failure.
17	Peat failure at T12	Head of failure downslope of access road. Monitoring at the head of failure.
18	Instability at T5	Series of concentric tension cracks within the insitu peat
19	Instability at T16	Minor slumping of insitu peat
20	Ch.2630 on the north side of the S-bends on the approach road into the site	Stockpile caused a localised ground movement in the peat below the stockpile

(c) Monitoring shall consist of a series of wooden posts (say 4 no.) inserted into the ground to create a straight line, ideally obliquely across the slope. A string line shall be tied to the first and last post. The line of posts shall be placed such that they can be sighted along from the position of the road. Any deviation of the posts would indicate potential movement of the peat.

(d) The monitoring is intended to be easy to install, readily read without any equipment, and where required can be readily maintained and replaced.
(e) The monitoring locations shall be read weekly or following heavy rainfall. Readings shall be carried out until completion of the works.
(f) A record of the readings shall be maintained. The record shall include time, date, movement of any posts (or no movement), any follow-up inspections. Accidental movement of the posts shall be noted and the posts moved back into alignment, where possible.
(g) Trigger levels shall be taken as indicatively 100mm or continued rate of creep movement, as determined by the designer. Where trigger levels have been reached, the designer shall be notified and the reason for the movement established to determine whether the movement warrants further investigation.
(h) Where there are remaining works to be completed then monitoring shall be installed adjacent to the works at critical locations. Operatives shall be made aware of the monitoring and shall be required to observes the monitoring at a regular intervals and to report any unusual observations to the construction management team.
(i) Where monitoring shows ground movement has occurred in an area where construction works is underway then works shall cease in that area and operatives and plant moved to a safe location and the designer notified and the reason for the movement established prior to re-commencing works.
(j) Inspection of constructed works indicated a number of locations where monitoring is required, these are included above. In addition, at T16 a small peat slip between the hard stand and the perimeter cut-off drain is causing water to flow into the hard stand, this shall be repaired.

Response 4:

Monitoring posts have been installed at 14 previously recommended locations identified specifically by FT and weekly monitoring has commenced. Posts shall be installed at the additional locations identified and monitoring will continue at the 20 no. locations outlined above. These line-of-sight posts will continue to be inspected weekly. A sample of weekly inspection sheets covering the previous 14 locations identified by FT in April are provided for reference – See Appendix 3. This monitoring will be increased at monitoring locations adjacent to ongoing works. Where works are ongoing/scheduled, daily checks will be completed each morning prior to the commencement of works.

Records of monitoring by MCE will be provided to Ionic Consulting on a weekly basis. In the event of a breach of trigger levels or signs of any continuous movement any works ongoing in the area in question will cease and the Designer will be consulted prior to the continuation of works. A copy of all records will also be kept on site.

Prior to the commencement of remaining works, Ionic Consulting will advise on additional line of sight monitoring locations which will be inspected daily also. The small peat slip noted adjacent to T16 will be repaired prior to any further works in that area.

Mitigation Measure 5:

Confirmatory testing and assessment in zone of influence in advance of construction works to be completed. The peat stability assessment within this report and the Ionic report (Appendix D) have concluded that the site is safe and the remaining works can be completed safely in accordance with the recommendation and mitigation measures contained herein. Notwithstanding, the following confirmation testing and assessment shall be carried out immediately in advance of construction. The confirmation testing and assessment is in addition to that already carried out in the peat stability assessment.

(a) In advance of the construction of any remaining works, a zone of influence extending 50m minimum in all directions from the proposed works area shall be re-inspected and assessed by a competent person in advance of any works.

(b) Where deemed necessary by the competent person, the zone of influence shall be extended to include any ground that is considered to be affected by the works.

(c) The assessment within the zone of influence shall include visual inspection and appropriate testing of insitu peat with respect to depth and strength to full peat depth. The assessment shall include but not be limited to recording morphology, vegetation cover, drainage, proximity of drains and natural watercourses (an example of such an assessment for the proposed access road to T18 is included in Section **Error! Reference source not found.**). T he results of the assessment shall be considered by the designer.

(d) The further confirmatory testing of insitu peat with respect to depth and strength to full peat depth shall typically comprise the following within the zone of influence and shall be carried out immediately in advance of works commencing:

(i) Peat depth determined at typically at 20m spacing using peat probes or alternatively using continuous depth profiling such as ground penetrating radar (GPR).

(ii) Insitu shear vane testing, or similar technique that measures the operational shear strength of the peat, typically at 20m spacing depending on the encountered peat condition.

(iii) Spacing of probes and insitu shear vane testing, or similar, to be reduced where areas of deeper peat are encountered.

(e) A hydrological assessment carried out by appropriate experienced and competent person, which will include but not be limited to drainage, proximity of drains and natural watercourses shall be carried out in advance of construction works. This work is being carried out by hydrological specialists HES.

(f) The results of the assessment, pending satisfactory findings, shall be completed prior to any works commencing. Works shall only commence following a permit to work being issued.

(g) A record of all such assessments shall be maintained.

Response 5:

Extensive zone of influence testing has been completed since November 2020 including peat probing, shear vane testing, trial holes and cores as set out in the report provided. This testing has informed the design for remaining works areas. Ionic Consulting will provide a Geotechnical Engineer on site one day per week to assess upcoming works areas and advise on necessary inspection and testing requirements.

Prior to commencement of works in the remaining areas where peat is present MCE shall appoint a competent supervisor to each relevant works area (areas of new construction or works in areas deemed high risk in terms of peat stability). This person will be responsible for a daily inspection of the area of intended works per Mitigation Measure 5c) above and will ensure that zone of influence testing is completed daily in advance of works where necessary. A daily record sheet (similar to the attached example in Appendix 4) will be kept and a copy will be made available to the Design Team along with daily photos of the works. Periodic drone inspection (every 2-3days weather permitting) of critical work areas will be conducted; the arial imagery will be provided to the Designer for remote oversight of the works. A copy of all records will be kept on site.

The results of additional peat probing and shear vane tests will be compared against prior records to determine if the results are comparable (within an allowable tolerance). Where results differ significantly from expected values, works will cease and the Designer will be consulted prior to continuing with the construction in the relevant area. A record will be kept on site of additional shear vane testing completed in advance of works. testing will be completed on an approximate 20 x 20m grid spacing. Where very shallow peat depths are noted or where risks have been identified as low by the Designer the spacing of tests may be increased accordingly in line with the level of risk.

John Shanahan or Cormac O'Dubhthaigh (Ionic) will be on site weekly during construction works in peat and will assess ongoing works along with works to take place the following week. Martin Lyttle (FTC) will be on site while works within peat are taking place. Ionic will have a resident engineer on site daily who will be reviewing previous test data and conducting further tests as required on an ongoing basis. The MCE site management team will coordinate works in conjunction with Ionic/FTC to ensure adequate testing and assessment is being conducted in advance of and during excavation.

Mitigation Measure 6:

Site supervision and permit to work with respect to peat stability. All construction on site shall be managed and controlled by the construction management team to ensure that all activities have been appropriately assessed with respect to peat stability and related health and safety. Procedures shall be put in place to clearly demonstrate how this has been achieved, for example:

(a) Procedures that provide an auditable chain of command shall be put in place to clearly demonstrate that peat stability and related health and safety have been assessed in the construction management.

(b) For any construction activity where peat stability and related health and safety have been assessed, then a permit to work shall be issued to the construction operative by the appropriate personnel.

(c) No construction works shall be started until a permit to work has been issued to the construction operative by the appropriate personnel.

(d) All works that may affect the stability of the site shall be routinely inspected and supervised on site by appropriate personnel.

(e) The above procedure shall be independently audited by a suitably competent and experienced person(s). The competent person shall have suitable professional qualifications and have experience of carrying out similar roles for construction projects in peatland. Planree proposed to use suitably competent and experienced person from FT.

(f) All persons involved in the assessment of peat stability on site shall have sufficient expertise, competency, and experience for the tasks to which they have been assigned.

Response 6:

a) Please refer to the updated (August 2021) Organogram and separate design/ construction process flowchart for works on site in Appendix 6. This includes Designs, RAMS, daily checks and Supervision.

b) A Permit to work system will be implemented (See Appendix 5). Permit to works will be issued and controlled by MCE site management (Chris O'Mahony / Gearoid White / Sean O'Driscoll). All personnel working under a permit to work will be briefed on the permit and associated RAMS. A copy of the permit to works will be held on site.

c) No works will commence prior to a permit being issued.

d) Full time supervision of critical works areas is outlined in the response to Mitigation Measure 5 above. As noted, daily records will be kept on site and a copy provided to the Designer for review. Martin Lyttle will be independently appointed as a supervisor for the works and will have a full time role on site while critical works are taking place.

e) An independent auditor will be appointed to audit the site on a fortnightly basis. It is proposed that Paul Jennings of FT will complete this independent auditing (CV attached – see Appendix 1).

f) Peat stability assessment will be completed only by suitably qualified, competent and experienced personnel.

g) Martin Lyttle (FTC), who will be the competent person, will be on-site to assess and supervise works within peat.

h) Given the fact that the vast majority of roads and hardstands are complete and that there will be no side casting of peat for the remainder of the works, requirements for tracking over peat etc. are unlikely and any proposed tracking of peat can be appropriately assessed during weekly Ionic site visits. Should an unforeseen circumstance arise where tracking over peat is required, Martin Lyttle will be available on site to assess the area, Ionic site engineer can conduct whatever testing is required and a call can be arranged with Cormac O'Dubhthaigh/John Shannahan to ascertain whether it is acceptable or not. (see project organogram for clarity on roles/responsibilities)

Mitigation Measure 7:

Proof testing of floating roads. Full-scale proof load tests to be carried out on floating roads to verify their capacity under the design loads for the construction traffic and for largest loading to be experienced by the road. Such testing may already be required under the design or contract. A suggested outline methodology is given below.

(a) Rolling load test for all floating roads. Tests to be carried out using a fully ladened dump truck. The weight of any truck should be recorded at a weighbridge. Typical test procedure as follows:

- Condition and deflection of the floating road observed visually as the truck travels continuously over the floating road at a constant low speed.
- The performance of the floating road hall be qualitatively classified as Good, Fair or Poor based on the condition of the road and the observed deflection under the weight of the truck.

(b) Static load test at selected sections, if deemed appropriate by the designer. Sections of floating roads where the road performance was classified as Fair or Poor are selected for detailed static loading of placed fill as follows, as appropriate:

- Loading (such as rock fill) placed incrementally up to the design limit as specified by the designer.
- Deflection of road recorded following each load increment.
- Maintained static loading for 24 hour period with measurement of deflection at end of period.

(c) The results of the proof testing shall be analysed by the designer and any mitigation measures, which may include replacement with founded road on competent strata, to be incorporated into the design. All tests shall be carried out under controlled conditions to ensure that the road is not adversely damaged and that instability does not occur.

Response 7:

Rolling load testing (deflection testing) will be completed for validation of all floating roads constructed to date on the site. The results of the tests will be analysed by Ionic Consulting prior to sign off on these sections of access road.

Static load testing of floating roads is not deemed appropriate by the Designer for the site and such testing will not be completed.

For rolling load tests, the fully laden weight of dump trucks will either be calculated based on loading of a standard lorry with a loader equipped with a load cell or through use of a weighbridge where available.

A review of the full method statement(s) for all proposed works will be carried out by Ionic/ FTC to confirm that all recommendations of the peat stability assessment have been implemented, and the design requirements are reflected in the proposed methodology.

Mitigation Measure 8:

Construction and weather conditions. Restrictions on work during or after periods of heavy or sustained rainfall as recorded from weather station located on site, or from Met Eireann weather forecasts. Heavy intense rainfall can result in degradation of the works resulting in localised instability, and in extreme cases can trigger large-scale peat failure.

(a) Following periods of heavy intense rainfall, such as 10mm/hr, >25mm in a 24 hour period, or >50% of monthly average in a 7 day period and in following 24 hours, no groundworks may take place and any ongoing works should be restricted to hardstanding areas.

(b) When periods of heavy intense rainfall are predicted then works shall be ceased in advance and any construction works in critical areas with respect to stability are secured in advance.

(c) Following periods of heavy intense rainfall the site shall be inspected prior to resumption of construction works by a competent person to ensure that all drainage is working, and critical areas with respect to stability are stable with no signs of ground movement.

Response 8:

The MCE site manager will be responsible for assessing the weather forecast on a daily basis no less than 24 hours ahead of works. Records of weather forecasts will be kept to confirm ongoing monitoring. The MCE site manager and supervisors will monitor the weather conditions on site as works are progressing. Site management have been briefed on the rainfall limits.

A rainfall gauge has been installed on the site and a remote text alert system has been set up to notify HES, MKO and MCE Site manager Chris O'Mahony of daily rainfall records every morning for the previous 24hour period. These records will be assessed daily to assess long cumulative rainfall within the 24hr and 7day limits specified. A record of these values will be kept on record for reference purposes – please see sample records provided ("Meenbog Rainfall data 28.04.2021" in Appendix 7).

Where heavy rainfall is forecast for the day ahead or where heavy rainfall is noted on the site during works, a proxy rainfall monitoring station (the local Lough Mourne OWS) will be assessed hourly by MCE Site management in consultation with the ECOW for potential breaches in instantaneous rainfall levels.

Where trigger levels are breached a decision to cease works will be taken by the Site Manager Chris O'Mahony. Similarly, where heavy rainfall event is forecast which would breach the trigger levels noted above, Works shall be restricted. This process has already been validated in practice following an intense rainfall event in March 2021*. Please refer to appended email circulation from MKO to site staff dated 29/03/21 notifying of a breach in the 24hr trigger level (See Appendix 7). Works were stood down immediately following the notification by the ECOW and all areas assessed before re-commencing works on site.

In the event of a failure of the on-site rain gauge monitor, the local Lough Mourne OWS shall be used as the reference for rainfall trigger levels on site.

*NOTE: It was agreed in writing with DCC that these works at bridge crossing EC5 could be completed in March 2021 to ensure safe access and egress of forestry vehicles still accessing the wind farm site.

Whilst monitoring will be carried out and is considered of benefit, it is only one element of the integrated peat stability measures that have been put in place to prevent or provide an early warning of potential failures.

Monitoring will take place after periods of heavy rainfall.

All RAMS, site supervision and a permit to work system produced by MCE shall be reviewed by FTC and Ionic with MCE to ensure that all parties are satisfied with the proposed approach, and that the intent behind FTC's recommendation has been fully captured in the methodology.

Appendix 1: CV’s for FT personnel:

- Paul Jennings - CV
- Martin Lyttle - CV

Dr. Paul Jennings

Technical Director/Geotechnical Engineer

FEHILY TIMONEY
30 YEARS
CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

Profile

Paul is a geotechnical engineer with over 30 years' experience of design and construction of sub-surface structures, foundations, earthworks, infrastructure and earth-retaining structures; planning, supervision and interpretation of ground investigation; and providing expert geotechnical advice and reporting. Paul has particular experience in providing expert advice for slope stability problems, soft ground engineering, infrastructure, deep-excavations and forensic investigation of ground failure.

Educational and Professional Qualifications

BEng. (Tech) (Hons) (First Class) Civil Engineering University of Wales Institute of Science and Technology (UWIST) 1986
PhD, Predication of Landslide Hazard in the Rhondda South Wales UWIST 1991
DipArb. Diploma in Arbitration, College of Estate Management, Reading University 1999
CEng, Chartered Engineer
MIEI, Member of the Institution of Engineers of Ireland
Member of the Geotechnical Society of Ireland
UK Registered Ground Engineering Professional (RoGEP) – Advisor
Project Supervisor Design Process (PSDP) Course, Institute of Engineers Ireland 2015

Selection of Previous Experience

- **Derrybrien Landslide REIAR, Ireland:** Following 2019 ECJ ruling a remedial impact assessment report (REIAR) was produced following landslide at wind farm site. Contributor as expert on geotechnical matters for REIAR with respect to ground conditions and stability for ESB.

- **High Speed (HS) 2, England:** Geotechnical Team Lead member for contract Lots C2 and C3 for Eiffage/Kier. Responsible for sections of geotechnical scheme design of embankments and cuttings along HS2. Total scheme cost about £1.34 billion.

- **Expert Evidence, Kazakhstan:** independent expert at arbitration on assessment of embankment fill material and excavation for 112km length of dual carriageway for the East-West Roads Project Almaty – Khorgos. Provided oral evidence and report at arbitration hearing for International Chamber of Commerce (ICC), Paris. Estimated project cost about €200 million.

- **Expert Evidence, Ireland:** expert report on assessment of viability of proposed rock borrow area along the route of the N18 Oranmore to Gort Dual Carriageway project. In support of adjudication action by Lagan Construction Group Limited. Total scheme cost about €430 million.

- **Expert Evidence, Ireland:** engaged by ESB Networks Ltd. to provide an expert opinion with respect to collapsed reservoir bank and alleged personal injury incident that was purported to have occurred at the Poulaphouca Reservoir in ESB -v- McCurtin. Expert witness in High Court, Dublin. Expert report on stability of reservoir bank and site assessment and inspection of reservoir perimeter bank.

- **Expert Evidence, Scotland:** expert report for adjudication. Report examines the use and feasibility of ground improvement by soil mixing in works at Muck Bridge on the B741 road. In support of legal action by NRS Group (NRS).

Key Information

Qualifications

BEng. (Tech) (Hons) First Class, Civil Engineering, University of Wales, Institute of Science and Technology (UWIST), 1986

PhD, Prediction of Landslide Hazard in the Rhondda South Wales, UWIST, 1991

DipArb, Diploma in Arbitration, College of Estate Management, Reading University, 1999

Project Supervisor Design Process (PSDP) Course, Institute of Engineers, Ireland, 2015

Professional Memberships

Chartered Engineer

Member of the Institution of Engineers of Ireland

Member of the Geotechnical Society of Ireland

UK Registered Ground Engineering Professional (RoGEP) - Advisor

Employment History

2019- Present
Fehily Timoney & Company, Ireland

2000 – 2019
Applied Ground Engineering Consultants Ltd. (AGEC), Ireland

1992 – 1999
Halcrow China Ltd, Hong Kong

1989 – 1992
Sir William Halcrow & Partners, UK

- **Expert Evidence, Ireland:** report on engineering appraisal of rock to determine use in engineering works in case of Elliott Construction Ltd. -v- Lagan and others. Provided advice to solicitors Maples and Calder.

- **M8 M74 M73 PPP Motorway Scheme, Scotland:** geotechnical analyses and design of permanent and temporary works. Assessment of design of remedial works for failed highway slope as part of scheme. Expert report on cracking of secant piled wall at Raith Junction. Total scheme cost about £400 million.

- **N3 Butlersbridge to Belturbet Road Improvement Scheme, Ireland:** arbitration involving geotechnical assessment and expert witness report related to the construction of bridge pier over soft ground (Aghnaguig Bog).

- **M17 M18 Gort to Tuam PPP Motorway Scheme, Ireland:** AGEC technical director for the geotechnical analyses and check of permanent works design and check certification for 57km scheme with cost of about €550 million.

- **Dublin Waste to Energy Incinerator Project, Ireland**: geotechnical assessment of ground conditions, procurement of ground investigation, design of piled foundations, design load transfer platform and reinforced earth structures. Project cost estimated at €500 million.

- **Diyar Al Muharraq Project, Bahrain**: assessment of ground conditions and site investigation data for a deep sewer line particularly regarding the environmental impact on the local aquifer.

- **Expert Advice, United Kingdom:** geotechnical expert report with respect to ground conditions encountered during tunnelling on the North St. Helier Flood Alleviation Scheme, Channel Islands. In support of J. Murphy & Sons Limited.

- **Expert Evidence, Ireland:** assessment report on engineering remediation of stability and backfilling of sand & gravel quarry, which was in breach of planning conditions. Court attendance and expert reports in case of Fowler -v- Keegan. Provided advice to solicitors Maples and Calder.

- **Expert Report, Ireland:** assessment and expert report on fatal slope collapse at Derrysallagh Wind Farm. Appointed by insurers to the contractor of the wind farm.

- **Kilgarvan Wind Farm, Ireland:** inspection of peat failure and assessment of remedial measures required.

- **Wind Farms (General), Ireland & United Kingdom:** geotechnical design of over 100 wind farm projects in Ireland and throughout the British Isles. Most sites comprised variable depths of soft ground. Design includes assessment of site stability (landslide), road/embankment design, bearing capacity appraisal, management of earthworks, construction supervision, planning advice/reporting (EIA/EIS) and technical expert advice at public planning hearings.

- **Expert Witness, Ireland:** geotechnical expert witness for geotechnical matters at planning hearing for Oweninny Wind Farm (about 100 turbines). Project cost estimated at €100 million.

- **Expert Witness, Ireland & United Kingdom:** geotechnical expert review report with respect to building distress. Expert report produced, and evidence given in legal proceedings. Geotechnical expert review report with respect to failure of fill slope behind dwelling houses for NHBC in UK. Expert report produced and attendance at mediation.

- **Tievebrack Sub-station earthworks (ESBI), Ireland:** Geotechnical design for sub-station platform located on stability sensitive slope. Design includes platform formation/retaining structures for multiple retaining bunds for storage of platform arising (peat).

- **Expert Report, Ireland:** geotechnical expert review report with respect to large scale peat failure during construction for Ballincollig wind farm. Expert reports produced on behalf of insurers ACE Group. Project cost estimated at +€10 million.

- **Design Co-ordinator – Corrib Gas (Shell Exploration and Production Ireland Ltd.), Ireland:** Management of engineering (civil) design deliverables and co-ordination of consultants for onshore section of gas pipeline. Pipeline includes 9km length comprising

buried pipe in peatland/sandy soils and within tunnel. Geotechnical reviewer/checker for works which included fill platforms/road in peat, tunnel geotechnics, secant/piled wall for tunnel starter pit. Total project cost estimated at €3.6 billion.

- **Gas Pipeline Route Assessment – Corrib Gas, Ireland**. Compilation/author of stability reports for pipeline route through blanket peat for planning application and Environmental Impact Statement. Included walkover survey and geomorphological mapping of route. Technical support at planning Public Hearing. Pipeline cost estimated at €1.5 billion.

- **Power Station Site Appraisal (ESBI), United Kingdom**: Geotechnical site appraisal for gas turbine power station in Northern England. Site located within active coalfield, in proximity to waterway and disused chemical works. Site appraisal report produced.

- **DART Underground Rail Line (Irish Rail), Ireland:** geotechnical expert/reviewer for pre-oral hearing review for proposed underground metro. Project comprises approximately 8.6km of new rail (7.6km in tunnels) through Dublin from Inchicore to the Docklands area. Project cost estimated at €3 billion.

- **Stabilisation of Soils, Ireland:** Providing specialist geotechnical advice to ground stabilisation contractor for alternative design solutions to achieve sustainable/economic solutions. Role includes value engineering using stabilisation options for commercial/retail and highway.

- **Bay Lane Quarry Litigation, Ireland:** Investigation into the causes of cracking in residential properties related to floor slab movement. Tasks included inspection of remediated house, assessment of ground conditions, quarry visits, and finite element modelling of the behaviour of construction material.

- **Landslide Investigations, Ireland:** Geotechnical advisor/investigator for landslides in upland areas associated with blanket peat (for example peat/landslides on Corry/Kilronan Mountains, Garvagh Glebe Wind Farm, Hunters Hill Wind Farm, peat slide at Glencolmcille, multiple landslides (+38) at Croaghmoyle/Buckoogh Mountains.

- **Expert Witness, Ireland:** geotechnical expert review report with respect to remediation of lands following peat failure, Derrybrien, County Galway. Expert report produced, and evidence given in legal proceedings. Total project cost estimated at +€70 million.

- **Donegal 110kV Project, Ireland:** Reporting and walkover survey of 100km of proposed line including an assessment of peat stability. Geotechnical assessment report produced for planning application and Environmental Impact Statement. Technical support and expert witness at planning oral hearing. Project cost estimated at €100 million.

- **Connemara 110kV Project, Ireland:** Reporting and walkover survey of 48km of proposed line including an assessment of peat stability. Technical support and expert witness at planning oral hearing. Project cost estimated at €100 million.

- **Expert Report, Ireland:** geotechnical expert review report with respect to alleged settlement of foundations of industrial building due to dewatering from adjacent pipelaying works carried out at Roches Feeds, Limerick.

- **Ballincollig Wind Farm, Ireland:** Geotechnical advisor for wind farm project on blanket peat following large-scale peat failure during construction. Provided engineering advice for landslide remedial works, report into failure, and re-commencement of construction works with appropriate design and construction mitigation measures.

- **A4/A5 NI DBFO Scheme 3 Realignment, Northern Ireland:** Geotechnical Manager for 21km of dual/single carriageway. Included value engineering, earthworks design reports/specifications for cutting/embankment design, stability analysis of slopes, settlement, pavement foundations, acceptability of material re-use, design for special measures such as soft ground issues. Scheme cost estimated at £135 million.

- **N6 Kilbeggan to Athlone Dual Carriageway, Ireland:** Project manager responsible for design and implementation of band drain solution for 700m long embankment over soft ground.

- **M3 Clonee to North of Kells Bypass, Ireland:** Geotechnical Project Manager responsible for design of 60km of motorway and 50km of ancillary and access roads for M3 Motorway JV on €1 billion construction contract.

- **Clonsilla to Dunboyne Railway Scheme, Ireland:** Geotechnical Project Manager/Designer for interpretation and design of 34km railway scheme. Includes interpretation of ground conditions, design recommendations for earthworks along the rail route, proposed bridge/culvert foundations, proposed and existing stations and proposed new roads. Estimated cost €156 million

- **Assessment of Upland Peat Stability, United Kingdom/Ireland:** Assessment of peat stability on upland sites for proposed wind farm developments at Rothes II, Moray, Scotland; Mid Hill, Aberdeenshire, Scotland; Corry Mountain, County Leitrim/Roscommon.

- **Waterford Outer Ring Road, Ireland:** Assessment of rock excavatability for contractor. Design of rockfall protection measures.

- **Limerick Southern Relief Road, Ireland:** geotechnical checker for highway earthworks on 12km scheme with immersed tunnel involving construction of staged constructed and monitored embankments over soft estuarine deposits. Project cost estimated at €600 million.

- **N9 Powerstown to Prumplestown Geotechnical Advice, Ireland:** review of geotechnical design for Design and Build contractor Ascon Ltd. 20km motorway scheme. Estimated cost of €100 million.

- **Kavarna, Bulgaria:** appraisal of ground conditions and inspection of coastal site in Bulgaria in landslide prone terrain. Review of ground investigation and stabilisation measures.

- **Quarry Inspections, Ireland:** inspection of quarry face stability/incidences of instability at sites in Ballymoe, Arklow.

- **Rock and Soil Slope Support, Ireland:** design of support measures (gabion, soil nails, ground anchors) and inspection of failed slopes at sites in N8 Cashel-Mitchelstown, Cashel, Cork, Strancally Castle, Tralee.

- **Glounthaune to Midleton Railway Scheme, Ireland:** Geotechnical designer for re-generation of existing 20km railway line. Comprised walkover survey, inspection and risk assessment of existing earthworks, ground investigation, design of earthworks, karst risk assessment. Estimated cost €100 million.

- **N30 Moneytucker, Ireland:** Assessment of ground conditions and design of structure foundations and approach embankment foundations for Tramore House Regional Design Office.

- **N8 Cashel to Mitchelstown (ECI), Ireland:** Team Leader for walkover and reporting of preliminary sources study on Ireland's first early contractor involvement (ECI) road scheme, 38km dual carriageway N8 improvement and new 3.3km N24 link. Estimated scheme cost €240 million.

- **N15 Bundoran to Ballyshannon, Ireland:** Part of team for geotechnical design check for Contractor.

- **N22 Farranfore to Inchiveena, Ireland:** Assessment of temporary works slope for Contractor.

- **Expert Witness, Derrybrien Landslide, Galway, Ireland:** Expert Witness at District Court case for ESBI.

- **Dundalk Western Bypass, Ireland:** Review of designer's proposals for push-in structure on behalf of Irish Rail.

- **M3 Clonee to North of Kells, Ireland:** Geotechnical team Leader for Tender Design for PPP Scheme covering 52km on mainline and side roads. Supervision of walkover and reporting of potential Borrow Areas. Estimated €1 billion construction contract.

- **Waste Spoil Tip, Blessington, Ireland:** inspection of waste tips stability for Bord na Mona.

- **Corrib Gas Terminal, Ireland:** Management of +€1 million ground investigation for gas terminal site located on blanket peat. Works included trial pits, rotary and cable percussion boreholes, in situ vane testing, pumping test, and peat storage and transportation trials.

- **Pollatomish Landslide, Ireland:** Geomorphological survey, risk assessment and reporting for natural landslide in North Mayo. Natural landslide included multiple failures of peat/soil slopes above village that occurred following high intensity rainfall event.

- **Derrybrien Landslide, Galway, Ireland:** Geomorphological survey, stability assessment and reporting of major peat slide on windfarm site. Engaged by developer to identify the probable causes of the peat slide and to assess the stability of the remaining site. Report produced giving recommendations to mitigate the probability of further failure.

- **M4/M6 Kinnegad-Enfield-Kilcock Motorway:** Earthworks design for 35km of motorway with estimated €300 million construction cost. Design included embankment and cutting slope geometrics in soil and rock and associated slope drainage, earthworks acceptability, road pavement foundation requirements.

- **Irish Rail Framework, Ireland:** Geotechnical advisor and call-out service to Irish Rail.

- **Corrib Field Development, Bellanaboy Bridge Gas Terminal, Ireland:** Specialist advice on access roads and stability of peat bog site for use as repository for surplus excavated material for ASI Corrib JV. Acted as Expert Witness for Shell-Enterprise Energy Ireland at An Bord Pleanala's re-opened Public Planning Hearing. Total project cost estimated at €3.6 billion.

- **Ground Water Supply Schemes, Ireland:** Geotechnical advice on buried pipeline routes in Northwest and Western Ireland for Jennings O'Donovan & Partners.

- **Kilkenny Ring Road Rail Diversion, Iarnród Éireann, Ireland:** Earthworks design for new railway alignment. Included ground investigation, geotechnical interpretive and design report, bill of quantities and contract specification. Estimated scheme cost €5 million.

- **Dundalk Western Bypass PPP, Ireland:** Providing geotechnical advice for bidding consortia, SIAC/Ferrovial. Advice involved assessment of potential borrow areas along the proposed road corridor, supervision of ground investigation and reporting of findings. Total project cost estimated at €340 million.

- **Settlement/collapse of ground above tunnel, St. Fintan's High School, Dublin, Ireland:** Geotechnical consultant for the remediation of ground following partial surface collapse as a result of about 0.5km length of shallow depth micro-tunnelling through loose sand deposits.

- **Cuttings & Embankments Assessment, Iarnród Éireann, Ireland:** Geotechnical Advisor for earthworks assessment programme encompassing over 700 slopes within the Limerick Division of Iarnród Éireann. Responsible for all geotechnical aspects of project including field inspections of slopes, stability assessment, design of stabilisation measures and reporting on findings.

- **Review of seismic design for Huntstown Power Station, Ireland:** Power station sited within blast influence area of working quarry.

- **Methods of Integrating Man-made Slopes into their Surroundings, GEO, Hong Kong**: Project Manager/author responsible for study to review the state-of-the-art for landscaping methods on man-made slopes in Hong Kong. Study involved assessment of 200 local slopes and the preparation and publication of report on study findings.

- **Landslip Investigation Consultancy, GEO, Hong Kong** – Study Team Leader responsible for inspecting/reporting on landslide incidents during 1997. Involved detailed study reports of critical landslide incidents. Included geomorphological mapping, groundwater assessment, geological modelling, rainfall analysis, slope stability and determination of likely causal factors.

- **Landslip Preventive Measures (LPM), GEO, Hong Kong**: Design Team Leader responsible for site investigation, design and reporting on soil/rock cut slope with history of previous multiple failures (11NE-A/C35 & C77) at Kwun Tong Road (estimated works cost HK$30 million). Independent reviewer for slope design (LPM) reports.

- **Shum Wan Road Landslide, GEO, Hong Kong**: Geomorphological field assessment of hillside surrounding the 1995 fatal landslide site. Included API and reporting of findings including groundwater engineering assessment. Subsequent design of slope drainage and slope stabilisation measures.

- **North East New Territories (NENT) Landfill, FELT Ltd., Hong Kong**: Independent Checking (IC) geotechnical engineer on site for earthworks operation involving excavation of 6 million cubic metres of material and formation of rock/soil slopes within landfill bowl. Responsibilities included site checking/verification of geotechnical design, site monitoring.

- **Airport Roads (Contract 110), Airport Authority, Hong Kong**: Geotechnical engineer responsible for compiling foundation inspection procedures for bridge and retaining wall structures on intact/ blast fractured rock and rock fill.

- **Analysis of performance of railway, MTRC, Hong Kong**: Embankment over marine reclamation on man-made island, Chek Lap Kok Airport. Involved review of instrumentation readings, analysis of data, assessment of settlement and reporting.

- **Ap Lei Chau Bridge Road Improvement, Secan Ltd, Hong Kong:** Geotechnical Team Leader for the assessment of a hillside with a prior history of instability to identify geological, hydrogeological and physical factors controlling stability.

- **Tsing Yi and East Lantau Tunnels, MTRC, Hong Kong**: Geotechnical design Team Leader for preparation of geotechnical reports for twin hard rock rail tunnels in granitic/volcanic rock, Lantau Island, as part of the airport railway to Chek Lap Kok. Analysis of stresses in tunnel lining in shear/fault zone for extreme geotechnical loading conditions. Responsible for preparation of tunnel tender drawings for East Lantau and Tsing Yi Tunnels (Contracts 512 & 514).

- **Lantau Port Development, (CED), Hong Kong**: Study manager for geotechnical assessment of slopes bordering reclamation area, Pennys Bay (Hong Kong Disneyland Park). Produced geotechnical appraisal report and design for 0.9km of rock/soil cutting, 0.4km of reinforced concrete retaining wall, slope-dewatering scheme, 0.8km of embankment over reclamation.

- **Tenderer's Design Bid, Ting Kau Bridge, Paul Y Construction, Hong Kong**: Responsible for design of ship protection island around central pier in Rambler Channel and foundation report for main piers. Ship protection island designed to be founded on soft mud, design included staged construction, wick drains, toe trenches and pressure berms.

- **Geotechnical Advisory Service 1991-93, Housing Authority, Hong Kong**: Project Manager/Engineer involved in slope stability assessment and providing specialist geotechnical advice. Included management of costs and geotechnical teams, preparation/ checking of reports, development of slope inspection methodology.

- **Kings Cross Project, United Kingdom**: Resident Engineer for site investigation for low-level interchange for Kings Cross area. Responsible for on-site works which included high quality thin-wall push sampling, self-boring pressuremeter testing, test programme and geotechnical interpretation.

- **Second Severn Crossing Site Investigation, United Kingdom**: Site engineer for contract valued in excess of £1 million including both marine and on land.

- **Pithouse West, British Coal Open Cast Executive, United Kingdom**: Site engineer on earthworks compaction operations at Pithouse West, South Yorkshire. In charge of programming and supervision of in situ and site laboratory testing of compacted fill material and interpretation of results.

Publications

Jennings P J, Siddle H J and Bentley S P: Application of landslip potential maps to Rhondda Borough: a technology impact assessment. UWIST, Cardiff (1987).

Jennings P J, Bentley S P and Siddle H J. A comparative study of indirect methods of landslip potential assessment. Int. Conf. Slope stability engineering developments and applications, Isle of Wight, UK, ICE (1991).

Jennings P J and Siddle H J: The use of landslide inventory data to define the spatial location of landslide sites, South Wales, UK. EGAC 1995 Geohazards and Engineering Geology Conference Proceedings (1997).

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Jennings P J: Villa de Cascade (Shatin College), Shatin. In Investigation of Some Selected Landslide Incidents in 1997 (Volume 3). The Government of the Hong Kong Special Administrative Region (1999).

Jennings P J and Thompson J: Ma On Shan, Shatin. In Investigation of Some Selected Landslide Incidents in 1997 (Volume 3). The Government of the Hong Kong Special Administrative Region (1999).

Jennings P J (main author): Review of Effective Methods of Integrating Man-made Slopes and Retaining Walls (Particularly for Roadside Slopes) into their Surroundings. GEO Report No. 116. Produced by Halcrow China Ltd for Geotechnical Engineering Office, Civil Engineering Department, The Government of the Hong Kong Special Administrative Region (2001).

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Dr. Paul Jennings

Technical Director/Geotechnical Engineer

FEHILY TIMONEY
30 YEARS
CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

Dykes A P and Jennings P: Peat slope failures and other mass movements in western Ireland, August 2008. Quarterly Journal of Engineering Geology and Hydrogeology 2011; v. 44; p. 5-16, (2011).

Long M, Jennings P and Carroll R: Irish peat slides 2006 - 2010. Landslides, Journal of the International Consortium on Landslides, 8 (3) 2011-03-02, pp 391-401, (2011).

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Jennings P, Kieran P, Gill M and Johnston T: Natural gas pipeline construction in sensitive peatland environment, Western Ireland. XVI European Conference on Soil Mechanics and Geotechnical Engineering, Edinburgh, September 2015 (poster).

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Martin Lyttle

Senior Engineering Geologist

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

Profile

Martin is an Engineering Geologist with 30 years' experience of ground investigation design, construction supervision, desk studies; planning, supervision and interpretation of ground investigations and providing geotechnical advice for site RE staff.

Previous Experience Essential for this Project

- **Derrysallagh Wind Farm**
  Construction supervision (peat stability)

- **Maams Cross Road Scheme**
  Site investigation supervision

- **Harburn Head, Wind Farm, Scotland, Dersalloch Wind Farm, Scotland**
  Turbine foundation inspections

- Leanamore Wind Farm, Gortfinbar Wind Farm
  Turbine foundation inspections

- **Kilgallioch 129 Turbine WF., Scotland**
  DSR - Responsible for signing off on all geotechnical aspects of construction works (Turbine Foundation inspections, peat stability, road construction)

- **Tievenameenta Wind Farm Project**
  Geotechnical Supervisor – Supervision of site investigation for turbine base foundations and temporary construction works.

- **Dublin Waste to Energy Project**
  Geotechnical Representative – Provision of specialist geotechnical advice to the clients Resident Engineer with respect to supervision of construction and acceptability of the works in accordance with approved designs and specifications including site excavations, temporary and permanent works and piling works.

- **Corrib Gas Onshore Pipeline Project**
  Geotechnical Representative – Provision of specialist geotechnical advice to the clients Resident Engineer with respect to supervision of construction and acceptability of the works in accordance with approved designs and specifications, and to advice on any geotechnical issues pertaining to the works. Also responsible for monitoring geotechnical hazards, material recording and selection, ongoing inspection and monitoring and ensuring construction and reinstatement of works is undertaken in accordance with conditions of consent.

- **N3 Butlersbridge to Belturbet Realignment**
  Cavan County Council's Geotechnical Advisor for construction of the N3 realignment over an ecologically protected area (cSAC bog). The role involves reviewing design and construction methodologies for works over soft ground during construction.

Key Information

Qualifications

BEng (Hons) in Engineering Geology and Geotechnical Engineering, Portsmouth Polytechnic, 1990

National Diploma in Mineral Engineering, Athlone RTC, 1987

Professional Memberships

Fellow of Geological Society (FGS)

Training Agreement (1991-1994) & Training Review (1995), Institution of Civil Engineers

ICE Experience Appraisal (1997)

Committee member of the Ground Engineering Group, South Wales Association of ICE (1998-1999)

Employment History

2016-Present
Independent Geotechnical Engineering Consultant

2001 – 2016
Applied Ground Engineering Consultants Ltd. (AGEC)
Senior Geotechnical Engineer

1999 – 2001
Geotechnics Ireland Ltd.
Geotechnical Engineer

1996– 1999
Gwent Consultancy
Geotechnical Engineer

1990 – 1996
Gwent Co. Council
Senior Assistant Engineer (Geotechnical) & Assistant Engineer (Geotechnical)

- **A4/A5 Dungannon to Ballygawley DBFO 2**
  Supervision of earthworks, monitoring of earthworks material acceptability assessment/soft ground investigations. Inspection of formations for foundations and roads and management of NCR approval.

- **Corrib Sruwaddacon Bay Site Investigation (Tunnel)**
  Verification logging of all soil samples and rock core and reporting from near shore drilling.

- **N25 Waterford to Glenmore Rock Cut**
  Discontinuity survey of rock cutting with included recording scanlines, dips and dip direction. Survey results were used to assess rock slope stability measures and to determine the excavatability of the rock where the existing carriageway was proposed to be widened. Findings were presented in a report to the client.

- **Tievebrack Substation, Donegal**
  Management and supervision of ground investigation and site trials on behalf of the employer. Collated specific geotechnical parameters for detail design of slope stability of peat storage area and retaining structures.

- **N69 Rea to Tullig Realignment Scheme**
  Preparation of ground investigation specification. Management and supervision of a ground investigation contract for a 2.3km road realignment scheme.

- **Derrybrien Landslide**
  Geomorphological survey, stability assessment and reporting of major peat slide on wind farm site. Engaged by developer to identify the probable causes of the peat slide and to assess the stability of the remaining site. Report produced giving recommendations to mitigate the probability of further failure. Assessment of ground conditions around foundation bases of wind turbines.

- **Fullabrook Wind Farm, Devon, England**
  Supervision of site investigation for a 24 turbine Wind Farm, scheduling of all testing and checking of factual report.

- **Corrib Peat Permeability Research**
  Design and supervision of field tests to investigate the in-situ permeability of Peat at the Corrib Gas Terminal and supervision other site investigation works.

- **Muirhall Wind Farm Site Investigation, Scotland**
  Supervision of site investigation over karst terrain, scheduling of tests and checking factual report.

- **Barna Wind Farm, Co. Cork**
  Proposed wind farm site inspection including an assessment of peat stability. Geotechnical assessment of site by walkover inspection and reporting of findings including slope stability assessment. Supervision of ground investigation, logging of trial pits, interpretation of ground conditions and drafting of report.

- **Shanakeever Mountain Wind Farm, Co. Galway**
  Proposed wind farm site inspection including an assessment of peat stability. Geotechnical assessment of site by walkover inspection and reporting of findings including slope stability assessment.

- **Corkermore Wind Farm, Co. Donegal**
  Proposed wind farm site inspection. Geotechnical assessment of site by walkover inspection and reporting of findings.

- **Briska & Uggool Wind Farms, Co. Mayo**
  Proposed wind farm site inspection including an assessment of peat stability. Geotechnical assessment of site by walkover inspection and reporting of findings including slope stability assessment.

- **Drynam Pyrite**
  Supervision of expert investigations of buildings for court case.

- **N18 Gort**
  Earthwork materials assessment to design specification requirements for claim.

- **Black Sea site investigation, Odessa, Ukraine**
  Supervision of site investigation of large scale slope failure on the Black Sea near Odessa, Ukraine.

- **Site investigation procurement, Zaporozhye, Ukraine**
  Procurement of site investigation for a development in Zaporozhye, Ukraine.

- **Site visit and geotechnical walkover reports in Ukraine**
  Potential development sites were visited and geotechnically assessed at Zaporozhye, Kiev, Chernivsti, Poltava and Rivne, Ukraine.

- **Metro North Site Investigation**
  Seconded to IGSL to manage Metro North (Ballymun to Swords) site investigation.

- **N9 rock excavation assessment**
  Scanlines and reporting.

- **M3 Clonee to North of Kells**
  Borrow pit material assessment (trial pitting, laboratory scheduling and reporting).

- **Waterville sewer walkover and additional Site Investigation**
  Appraisal of site investigation data, walk over, additional site investigation and reporting.

- **Sewage Treatment works site investigations**
  Supervision of site investigations for Fenagh, Rathtoe and Clonegal.

- **NDEG**
  Senior RE – Supervision of site investigation for road scheme, scheduling of tests, checking factual report and finalizing measure.

- **Development site investigations, (Moat, Donore road, Cong, Clonakilty)**
  Supervision of site investigations, scheduling of tests, checking factual report and finalizing measure.

- **Midleton to Glounthaun Railway**
  Senior RE – Supervision of site investigation over karst terrain, scheduling of tests, checking factual report and finalizing measure.

- **Donegal County Council**
  Site investigation for culvert crossings, logging and reporting of ground conditions at various locations.

- **Kilsellagh WTP**
  Senior RE – Supervising the site investigation and checking factual report.

- **N8 Cashel to Mitchelstown ECI**
  Senior RE - Supervision of Supplementary Ground Investigation contractor on Ireland’s first early contractor involvement (ECI) road scheme, €300 million 38 km dual carriageway N8 improvement and new 3.3km N24 link.

- **N9 Kilcullen to Powerstown**
  Senior RE - Supervision of Supplementary Ground Investigation contractor.

- **M3 Clonee to North of Kells**
  Geomorphological Walkover for Borrow Area assessment.

- **Corrib Gas Terminal**
  Site management and supervision of site investigation. Laboratory scheduling, trial-pit logging and groundwater monitoring.

- **Corrib Gas Pipeline**
  Site management and supervision of site investigation.

- **Adamstown Development**
  Site supervision and trial-pit logging.

- **Takeda, Bray**
  Site supervision, laboratory scheduling, and geotechnical reporting for pharmaceutical development.

- **Tyrellstown, Co Dublin**
  Site supervision, lab scheduling, geotechnical reporting for supermarket development.

- **Newcastlewest, Co Limerick**
  Site supervision, lab scheduling, geotechnical reporting for supermarket development.

- **Larne Link Road, Ballymena**
  Report checking

- **Buncranna Way, Derry**
  Site supervision, lab scheduling, and geotechnical reporting for supermarket development.

- **N4 N6 Kinnegad to Kilcock Motorway Quarry Investigations**
  Lab scheduling for material acceptability / classification.

- **Limerick Main Drainage 4.1**
  Assessment of “As built” ground conditions.

- **N4 N6 Kinnegad to Kilcock Motorway Borrow Areas**
  Trial pitting and assessment of material suitability.

- **N4 N6 Kinnegad to Kilcock Motorway Additional Structure**
  Site supervision, lab scheduling.

- **Southeast Sligo GWSS**
  Walkover and reporting (Geomorphological / geotechnical)

- **Carrickfergus**
  Site supervision, lab scheduling and geotechnical reporting for supermarket development.

- **Liscasey GWSS**
  Walkover and reporting (Geomorphological / geotechnical)

- **N4 N6 Kinnegad to Kilcock Motorway additional borehole structures**
  Site supervision, lab scheduling.

- **N4 N6 Kinnegad to Kilcock Motorway Royal Oak Underpass**
  Site supervision, lab scheduling.

- **Supermarket Development Site**
  Supervision of Contractor and logging and reporting of ground conditions for geotechnical design in Northern Ireland.

- **Corrib Field Development, Bellanaboy Bridge Gas Terminal**
  Supervision of site investigation and scheduling of laboratory testing for subsequent geotechnical reporting on access roads and stability of peat bog site for use as repository for surplus excavated material for ASI Corrib jv.

- **R158 Trim – Summerhill - Kilcock**
  Senior Resident Engineer supervising site investigation. Contract value €507,000 (£400,000) and co-author of the Geotechnical Interpretative Report.

- **M4 Kinnegad to Kilcock**
  Supervision of geotechnical investigations of cuts and potential borrow pits to assess suitability of soils for reuse. Assessment of soils and rock for reuse and methods of excavation of rock material.

- **A4046 Cwm Relief Road, Meridog Viaduct**
  Geotechnical assessment of Viaduct over landslip.

- **M1 Lissenhall to Balbriggan Northern Motorway**
  Geotechnical Engineer responsible for supervision of geotechnical investigations of cuts and potential borrow pits to assess suitability of soils for reuse

- **M1 Dundalk Western Bypass**
  Senior Resident Engineer for IR£600k Site Investigation.

- **N25 Waterford Bypass**
  Senior Resident Engineer for IR£500k Site Investigation.

- **N9 Carlow Eastern Bypass**
  Geotechnical Walkover Survey and preliminary Geotechnical Interpretative Report.

- **Kilkenny Ring Road**
  Geotechnical Walkover Survey, Geotechnical Interpretative Report on Preliminary Site Investigation and design of Main **Site Investigation.**

- **N25 Kilmacthomas Design and Construct Project**

- **West Duffryn Link, SDR (Southern Distributor Road), Phase K, LG Site, £6.2 million**
  Procedural Statement. Design and management of site investigation. Supervision and logging. Interim interpretive report. Factual report. Earthworks design, slope stability, materials classification, settlement analysis. Advice during construction.

- **Usk River Crossing, SDR - Phase E, estimated cost - £25 million**
  Procedural statement. Desk study. Design of site investigation & preparation of contract documents. Engineer's Representative for SI (Investigation cost £34,000). Interpretive Report

- **Pontymoile Improvement, estimated cost - £12 million**
  Advice during construction. Assessment of foundation conditions. Assessment of ground conditions behind anchored retaining wall and determination of anchor bonds. Assessment for unforeseen ground conditions claim (landslip in the temporary works for retaining wall).

- **SDR - Phase J, East Duffryn Link**
  Procedural statement. Preliminary site Investigation & Factual report (Site investigation cost £10,000). Assessment of materials from Lucky Goldstar (LG) site, Preloading assessment, Geotechnical design options and costs.

- **SDR, West of the River Usk**
  Procedural Statement, Desk Study, Site investigation across Newport docks and Newport Municipal Refuse Tip, Factual /Interpretive Report.

- **Desk Studies and Site Investigations and Interpretative Reports**
  Reports for schools, housing and industrial developments mainly in Coal Mining Areas.

- **A4043 Abersychan Regeneration, estimated works cost - £3.5 million**
  Procedural statement and desk study. Planned site investigation. Preparation of contract documents for site investigation. Engineer's representative for the contract (Site investigation cost £48,000). Planned and managed supplementary site investigation for investigation of mine workings. Mining search and interpretive report on supplementary site investigation.

- **A4046 Aberbeeg to Cwm Improvement, Estimated works cost - £9 million**
  Planned and managed preliminary site investigation. Production of factual report. Preliminary Interpretive report (slope stability and earthworks design).

- **A4046 Cwm Bypass, estimated works cost - £17 million**
  Logging and site supervision. Managed part of site investigation works. Organisation of monitoring (piezometers and inclinometers) and analysis. Production of factual report. Stability analysis (earthworks design and anchor forces for landslip). Assisted with Interpretive report

- **A4042 Llantarnam Bypass. works cost - £12 million**
  Slope stability analysis. Planned supplementary site investigations. Preparation of contract documents for supplementary site investigations. Engineer's Representative, the supplementary site investigation. Interpretive report on supplementary site investigations. Foundation design and earthworks design. Advice during construction.

- **A40 Abergavenny Western Bypass, estimated works cost - £8 million**
  Assisted in pile design for 290m long multi-span viaduct of composite construction.

- **A472 Pontymoile Improvement, cost - £14 million**
  Assisted with desk study. Managed preliminary site investigation (SI cost £60,000). Site supervision and logging. Factual report for Preliminary Investigation. Partly managed Main site investigation. (SI cost £70,000). Assisted with interpretive report (foundation and earthworks design, geological interpretation and materials classification).

- **A472 Maesycwmmer Newbridge Scheme, works cost - £19 million**
  Assisted senior geotechnical engineer with interpretive report which included geological interpretation, foundation design, stability analysis/earthworks design and materials classification. Slope stability analysis/earthworks design. Drawdown assessment. Assessment for rock excavation (claim assessment - post construction).

- **A4043 Pontypool Western Bypass , Works cost - £10 million**
  Site supervision and logging of final stages of main investigation. Managed supplementary site investigation for Crane street car park retaining wall. Compiled factual report for entire investigation. During construction advice.

- **Tredegar Bypass, estimated works cost - £ 7 million**
  Site supervision and soil and rock core logging, Slope stability analysis/earthworks design, assisted senior engineer with interpretive report (geological interpretation, mining studies)

- **Road failures & landslip assessments**
  Investigation, analysis and design and supervision of remedial works

- **Geophysics (EM-VLF and Magnetometry) field work and data processing for gold and base metal deposits.**
  Field Technician. Gold Exploration involving soil and stream sampling (panning).

Appendix 2 - Sample MCE RAMS & Ionic Consulting Ltd. Design Drawings:

- MNBG MS 16030 Road Excavation Rev.6
- MNBG d007.18.1- Spur to T18 - Sheet1_RevB
- MNBG d007.18.2- Spur to T18 - Sheet2_RevB
- MNBG d007.18.3- Spur to T18 - Sheet2_RevB
- MNBG d007.18.4- Spur to T18 - Sheet4_RevA
- MNBG d007.18.5- Spur to T18 - Sheet5_RevA
- MNBG d007.18.6- Spur to T18 - Sheet6_RevA
- MNBG d007.18.7- Spur to T18 - Sheet7_RevA
- MNBG d018.2.1 T18 Road Upgrade Design_RevA
- MNBG d027.18.1 Peat Profile @ Spur to T18_RevA

- MNBG MS 16037 T1 – T2 Barrage Rev.4
- MNBG d018.4.4 - T4 Junction - Peat Depth Map & Section_RevB
- MNBG d018.4.5 - T4 Junction - Peat Analysis Longsection_RevA

- MNBG MS 16038 T4 Road Upgrade Rev.4
- MNBG d018.4.1 - Spur to T4 Road Layout_RevA
- MNBG d018.4.1 - Spur to T4 Road Layout_RevA
- MNBG d018.4.3 - Spur to T4 - Upgraded Adjacent Solid Road Section_RevA

MCE Ltd.

MS MNG 16030

T18 ROAD CONSTRUCTION

Prepared By: Christopher O'Mahony

Signed: ……………………………… **Date: … …………………** 26/08/2021

Reviewed By: Sean O'Driscoll

Signed: ……………………………… **Date: … …………………** 26/08/2021

1.0 Method Statement-MNG 16030

Project Name:	Meenbog Wind Farm.		
Contractor:	MCE Ltd, Lissarda Industrial Estate, Lissarda, Co. Cork		
Method Statement Title:	**T18 Road Construction**		
Method Statement No.:	MNG - 16030		
Prepared by:	Chris O'Mahony		
Date Prepared:	26/08/2021	**Revision**	006-26/08/2021
Specific Training Required:	Solas Safe Pass, Site Induction, EIA Training, CSCS Plant Ticket (where required).		
Relevant Legislation:	Safety, Health & Welfare at Work Act 2005 Safety, Health & Welfare at Work (General Application) Regulations 2007 Safety, Health & Welfare at Work (Construction) Regulations 2013		

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2.0 Statement Brief

Meenbog wind farm is comprised of 19 wind turbine generators, one 110kv substation and one meteorological mast along with associated roads, hardstands and other associated infrastructure. The wind farm access roads are designed to facilitate delivery of the 65m WTG blades using a ‘super wing’ delivery unit. This Method statement details the construction of the access road to turbine 18.

The Meenbog Site is primarily made up of rural and agricultural land, upland bog, commercial bog and forestry. Access to site may be shared with local domestic and commercial traffic and due care and attention should be taken at such access points. There is public access to the site and all contractors must conduct their activities in a manner that both protects and facilitates the general public in their enjoyment of the site. See site layout, Figure 1.0.

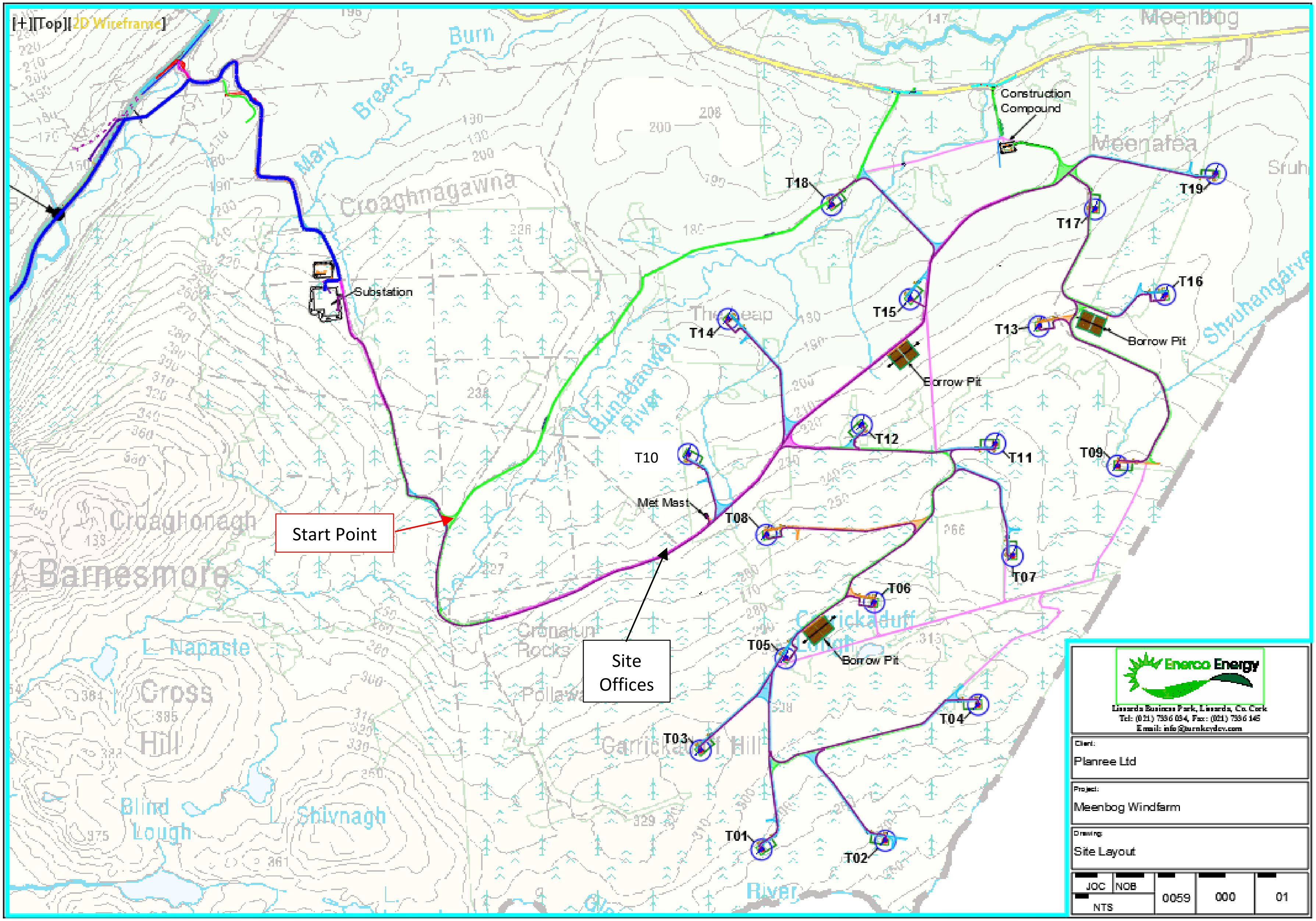


Fig 1.0 Meenbog Site Layout

2.1 Works Location

Meenbog Wind Farm & Substation entrance is located approximately 13km South West of Ballybofey and 14km North East of Donegal Town. All operatives are to text MCE ltd operational controller when arriving onto site and again when leaving in the evening. The contact number is 086-8032620.

3.0 Restrictions / Precautions

Description	Yes	No
Work located near **Underground services**		√*
Work located near **Overground services**		√**
Work located near **SAC / NHA**	√***	
Work located near **Watercourses / Streams**	√****	
Work located near **Steep Slopes**	√*****	
Work located near **Hillwalkers**	√******	

* = underground cables.
** = overhead power lines.
*** = Special Area of Conservation / National Heritage Area.
**** = Drainage measures to be put in place to ensure that no damage is caused to local watercourses in conjunction with Environmental consultant recommendations.
***** = Some road surfaces may be in close proximity to steep slopes.
****** = Hillwalkers frequent the development area and operatives have been made aware of their presence.

3.1 General Precautions

Prior to any works commencing all personnel onsite will be inducted by a MCE supervisor and will sign up to the relevant RAMS before commencing any work onsite. A number of other points to note include;

- GA2 forms to be completed weekly with a copy of the GA1 left in the machine at all times.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have SOLAS Safe Pass training or equivalent training
- First aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times with additional PPE as required.
- A competent foreman will be on site at all times.

4.0 Environmental Emergency Procedures

4.1 Excessive Peat Movement

There are a series of 20 monitoring locations across the site with trigger levels of 100mm recommended. (see appendix F). Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All construction activities shall cease within the affected area.
(2) Further peat stability assessment completed
(3) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
(4) Recommencement of limited construction activity shall only start following a cessation of movement completion of a geotechnical risk assessment by a geotechnical engineer.

4.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Where considered possible, action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on land prevention measures, in this case a watercourse check barrage will be implemented.

(3) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

4.3 Reaction to Peat Slide

In the event that there is a significant movement of peat, MCE will follow a specific set of procedures, namely,

- MCE Site management will be contacted
    - Gearoid White: 086-0211525
    - Chris O'Mahony: 086-0329552
- Site management will ensure all employees and equipment are accounted for
- Area will be designated a 'no-go' zone until instructed otherwise
- An initial rapid assessment will be made to determine the immediate risks to personnel within the site, members of the public and the local environment
- If deemed necessary, measures may be taken to make the area safe in the short term
- MCE management and consultant engineers, will be contacted, notified of the situation and site staff will await further instruction
- In the event of a notable peat movement, the relevant statutory bodies will be notified.

4.4 Fuel / Oil Spill

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- On-site refuelling will be conducted in a controlled and safe manner. Where possible fuel will be delivered by bunded mobile tanker. Bowsers and plant will be refuelled on a level platform away from any watercourses and areas susceptible to run-off.
- Refuelling to be conducted by competent and trained personnel
- Plant on site will be regularly inspected for leaks and fitness for purpose. Any defects to be reported to site management and plant owner immediately
- Emergency spill kits will be available to deal with any potential accidental spillage or discharge.
- Where there is a leak of any hazardous material all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- The area will be sealed off so that no watercourses are affected, and the contaminated peat/land excavated and removed. Fuel spill kits will be used to clean up the area.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.

- The ECoW will notify the appropriate regulatory body such as Donegal County Council, Department of the Environment, Climate and Communications (DECC), if deemed necessary.

5.0 Sequence of Works

5.1 Site Setup

1. The site has already been set up prior to works. MCE have a site compound set up with all required welfare and first aid facilities
2. A number of signs and fencing have been erected around the site so as to limit the risk of hill walkers from coming into the work area.
3. Site Safety signs have also been erected at a number of points alerting members of the public of dangers and the need for PPE as they are entering a construction site.
4. The assembly point for personnel involved in these works is at the MCE site offices
5. A rain guage monitoring system is set up on site. Works will cease based on triggers set out in CEMP section 5.2.2 i.e. >25mm in 24 hours, 10mm in 1 hour or greater then the monthly average rainfall in the past 7 days.
6. 14nr. Peat Monitoring locations have been installed across the site in line with FTCO recommendations. There are to be monitored weekly site wide. Daily monitoring will be conducted on locations in the vicinity of works zone. (See appendix G)
7. In line with FTCO recommendation nr. 3. The remaining works on the site shall be carried out without placing of excessive loading onto the in-situ peat surface. Where loading is to be placed onto an area of in-situ peat then that area shall be inspected and assessed by a competent person. Where in doubt no loading shall be placed onto in-situ peat.
8. No further construction of floating roads is to be carried out. A number of the failures on site are related to construction of floating roads. Given the potential risk associated with floating road construction alternative methods of construction shall be adopted.
9. Zone of influence testing will be completed daily in advance of works. This will involve peat probing, shear vaning and inspecting the ground to 50m outside the works area along the path of the works to be completed. Probing and shear vaning will be carried out at 20m centres depending on the encountered peat conditions. The number of shear vaning carried out may vary depending on for example the depth and weakness of the encountered peat. The morphology, drainage, vegetation, and proximity to drains/watercourses will be checked. Tests will be cross-referenced to those completed to date.
10. Zone of influence testing and inspection shall be completed in a reasonable time in advance of the proposed works to allow assessment of the results to be completed.
11. All results, such as probing and vaning shall be documented on site using a standard template and transferred to digital medium (e.g. Excel spreadsheet), all of which shall be readily available for auditing.

5.2 Methodology

- All operatives are to read, understand and sign the RAMS before commencing any work and if unsure about any item they are to discuss with the site manager, Sean O'Driscoll / Chris O'Mahony/Gearoid White
- Works will be sequenced based on project organogram (see appendix G)
- Zone of influence testing will be conducted prior to works commencement. The area will be inspected by competent person, no works to take place until assessment is completed and signed off by Martin Lyttle (FTCO).
- The zone of influence testing will be cross referenced to the testing previously conducted along this road section which will back up the existing data. (see appendix C)
- The assessment of the findings of the zone of influence testing shall be assessed by a competent person who shall determine based on comparison with previous data contained within the Ionic report and recently completed data that works within the tested section can be commenced, or otherwise. Where there are adverse variations in the data then the designer (Ionic) shall be consulted as part of the assessment.
- No works can commence until the assessment is complete and the assessment has clearly demonstrated that the proposed works are safe to commence.
- The result of the assessment shall be documented using a standard template, which shall be in a suitable medium that can be readily audited.
- Excavation will begin at the T-junction on the T18 approach (205748.709, 385036)
- See Ionic construction drawing ref. MNBG d007.18.1 Rev B (see appendix C)
- The peat will be excavated min 2.5m wide. Depending on the depth, the excavation will be extended in order to allow the fill to be 'battered' to the roadside.
- Articulated dump trucks will reverse down along the road from the T-junction
- They will be loaded with peat and haul it to peat deposition area 1.
- Rock will be brought back from borrow pit B. It will be tipped along the road and excavator will place it.
- No construction machinery will track onto in-situ peat. In the event that machinery must track onto peat e.g. for pre-drainage works, the peat will be inspected and assessed by a competent person to avoid excessive loading. If in doubt machinery will not be tracked onto peat.
- Any drainage works required will be conducted under supervision of MKO. Silt containment measures will be installed as required. MCE will pre-empt any issues as far as reasonably practicable.

- Works will be conducted in a 'dig and replace manner'
- To avoid unsupported excavation faces and potential for tension cracks to develop, the excavation and filling will be sequenced to minimise the time that the excavation faces are unsupported. This will require limiting the amount of excavation to the available volume of fill at the point of excavation. If required there may be a need to place fill into the in-situ peat (using displacement method) at the toe of temporary excavation face to avoid excessive height of unsupported excavation face.
- As excavation proceeds to the North East, deep peat will be encountered (>3m) with a low shear vane value.
- As excavation progresses, a v-drain will be formed along the road side. The road will be cambered to bring the surface water across to this drain. It will join the existing drains flowing south towards the Bunadowen.
- MCE/MKO will monitor the works at all times to ensure there are no unwanted discharges to the roadside drainage. If there are any issues with drainage and or unwanted discharges, works will cease, and remedial measures will be put in place to the satisfaction of the ECoW prior to recommencement of works
- Road construction will simultaneously take place from T18 heading South west (207417.994, 387109.889)
- It will continue in the same manner as with the North East bound construction with the rock source and peat deposition situated to the North of T18.
- Once constructed the ducting will be installed along the road.
- The duct trench will be excavated within the newly formed track, ref MNBG d018.2.1 (See Appendix E)
- The trench will be excavated to a depth of 900mm.
- Once backfilled to road level, a layer of seci-grid 40/40 will rolled out and covered with 300mm of 6N. this will provide adequate cover to the cable duct.
- The newly formed alignment will be levelled, capped and CBR tested.
- Martin Lyttle (FTCO) and Gearoid White (MCE) will monitor excavation works. John Shanahan/Cormac O'Dubhthaigh (Ionic) will be present for works commencement to ensure the methodology is satisfactory.
- Once completed a final inspection will be conducted by Ionic consulting (John Shanahan & Cormac O'Dubhthaigh), FTCO (Martin Lyttle) and MCE management (Sean O'Driscoll & Chris O'Mahony)

6.0 Covid-19

Coronavirus/Covid-19 is an infectious disease which affects the upper respiratory system. It is potentially fatal and is particularly dangerous to those with underlying conditions and the elderly/infirmed. 63% of confirmed cases have spread through community transmission. The infection is highly contagious and easily transmitted from person to person through close contact with either an infected individual or a contaminated area. For this reason, a set of standard operated procedures are to be adopted at Meenbog WF. Refer to construction stage safety plan for SOPs on Covid-19. Briefly summarised below,

- All workers are to sign in/out at the designated area
- Personnel will be asked to make a declaration which assess the key risk factors in virus transmission
- Hand sanitizer and gloves will be provided for instances where personnel must use a shared space i.e. toilets
- There will be no communal areas for eating in use for the foreseeable future
- Personnel will take their designated breaks at their own individual work area e.g. digger cab
- Site will be closed for access in the morning and opened at the end of the day, any entries/exits are to be notified to site management
- Anyone displaying symptoms of Covid-19 are to immediately notify site management and proceed to self-isolate

7.0 Plant / Equipment

1.	Various Size Excavators
2.	Roller / Plate Compactor / Generator
3.	25 Tonne Dumper
4.	Lorries / Dumpers
7.	Loadall
8.	Rock Breaker

7.1 Personal Protective Equipment (PPE)

1.	Hard Hat. (Worn at all times)
2.	Hi Visibility Jacket/Vest. (Worn at all times)
3.	Steel Toe Cap Boots. (Worn at all times)
4.	Gloves. (Worn when required)
5.	Eye Protection. (Worn when required)
6.	Ear Protection. (Worn when required)
7.	P3 Dust Masks. (Worn when required)

7.2 Extra Safety Equipment to be used

Additional PPE such as hearing protection and dust masks to be used as required depending on operative activities.

8.0 Emergency Arrangements

In the case of an emergency, all operatives are to follow the emergency procedures as detailed in the site induction for Fire, Injury or Bog slide. General arrangements are;

- Assess/Attend to casualty if one is present
- Raise the alarm and call 999/112
- Alert the other site personnel as to the emergency
- Locate at the site assembly point and do not return to work until instructed that it is safe to do so
- Substation construction assembly point located at the site entrance gate

First Aid

First aid kits are located in the MCE Site Vehicle in addition to the MCE site office.

Emergency Contacts

1.	Emergency Numbers – 999/112
2.	Letterkenny University Hospital – 074 912 5888
3.	NowDoc – 1850 400 911
4.	Donegal Town Garda Station – 074 974 0190
5.	Sean O'Driscoll – Project Manager – 086 8528329
6.	Chris Murnane – Safety Officer – 086 7955083

Who Information Will be Communicated to.

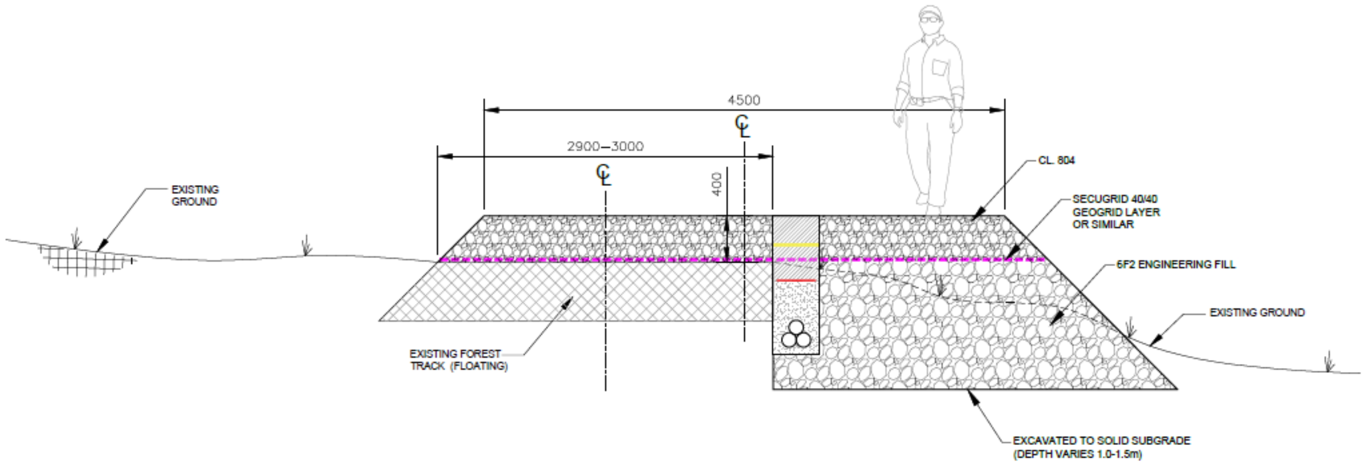
Chris O'Mahony/Sean O'Driscoll will communicate the method statement and risk assessment to the work force before the work commences on site.

Monitoring and Compliance

Chris O'Mahony/Sean O'Driscoll will ensure that method Statements will be adhered to by all MCE staff including any updates/changes made to the Method Statement.

9.0 Appendices

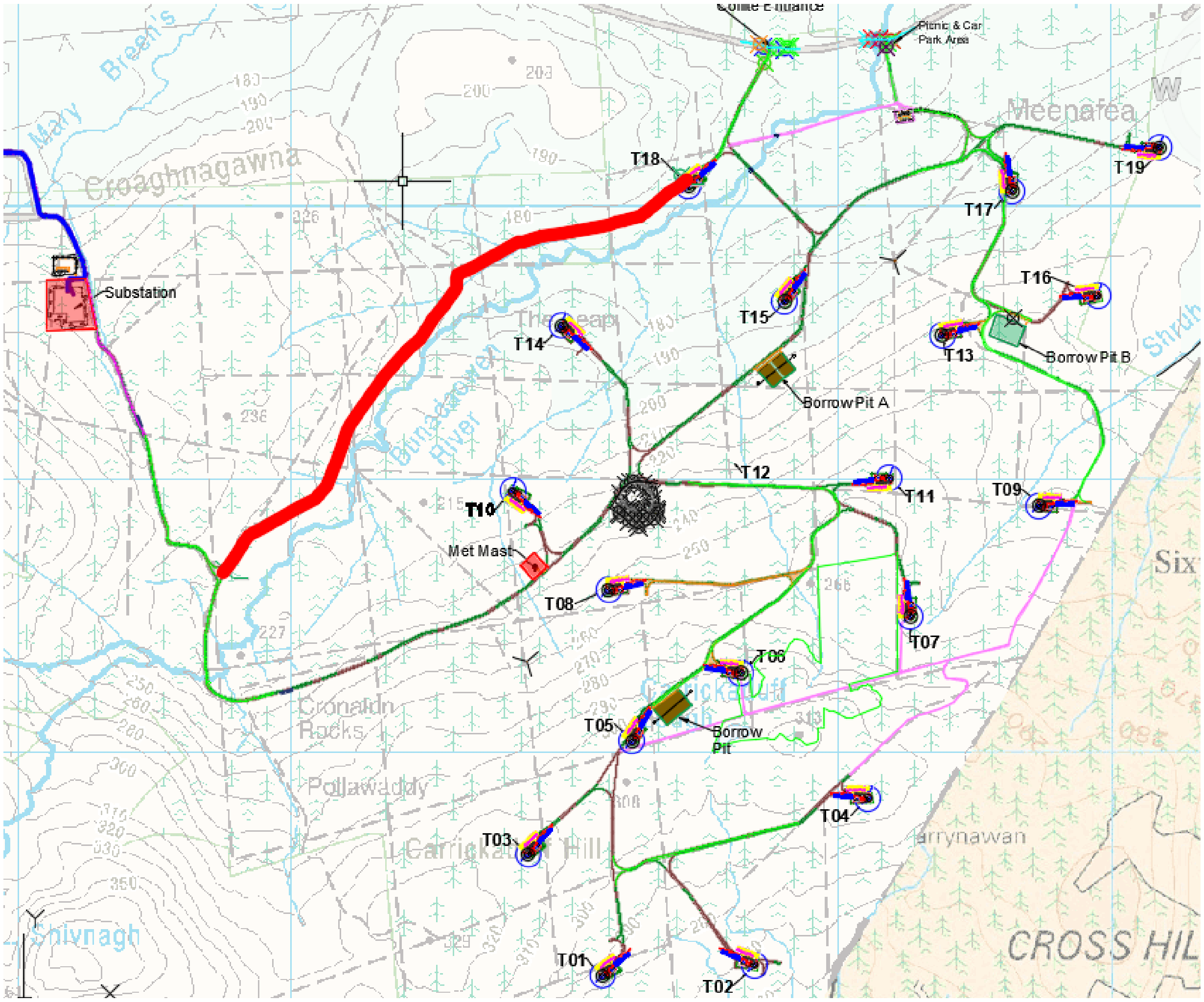
Appendix A Road Cross Section



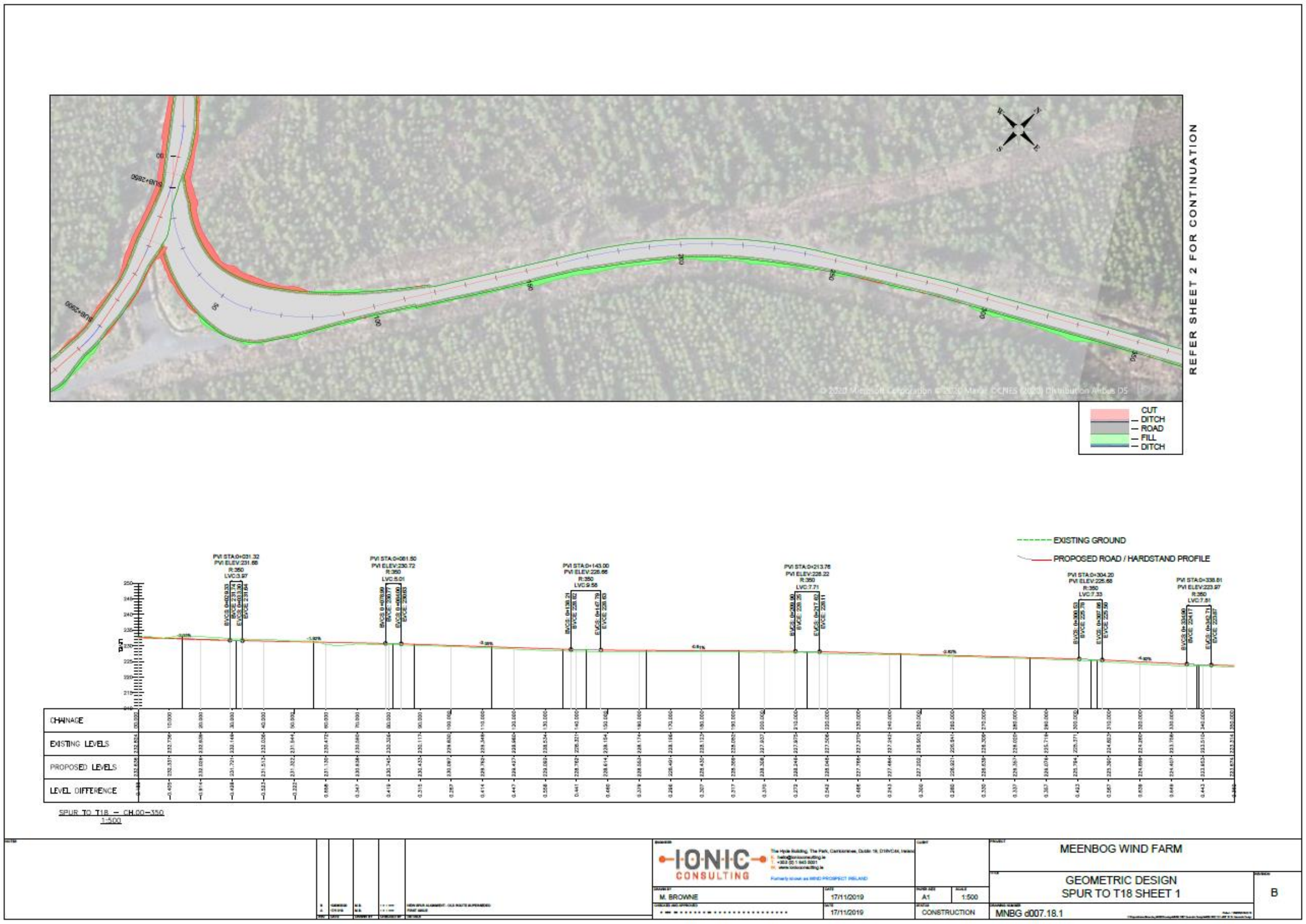
T18 PROPOSED ROAD UPGRADE SECTION
(FLOATING ROAD WIDENED TO SOLID)
Scale 1:50

REF: Ionic Construction MNBG d018.2.1

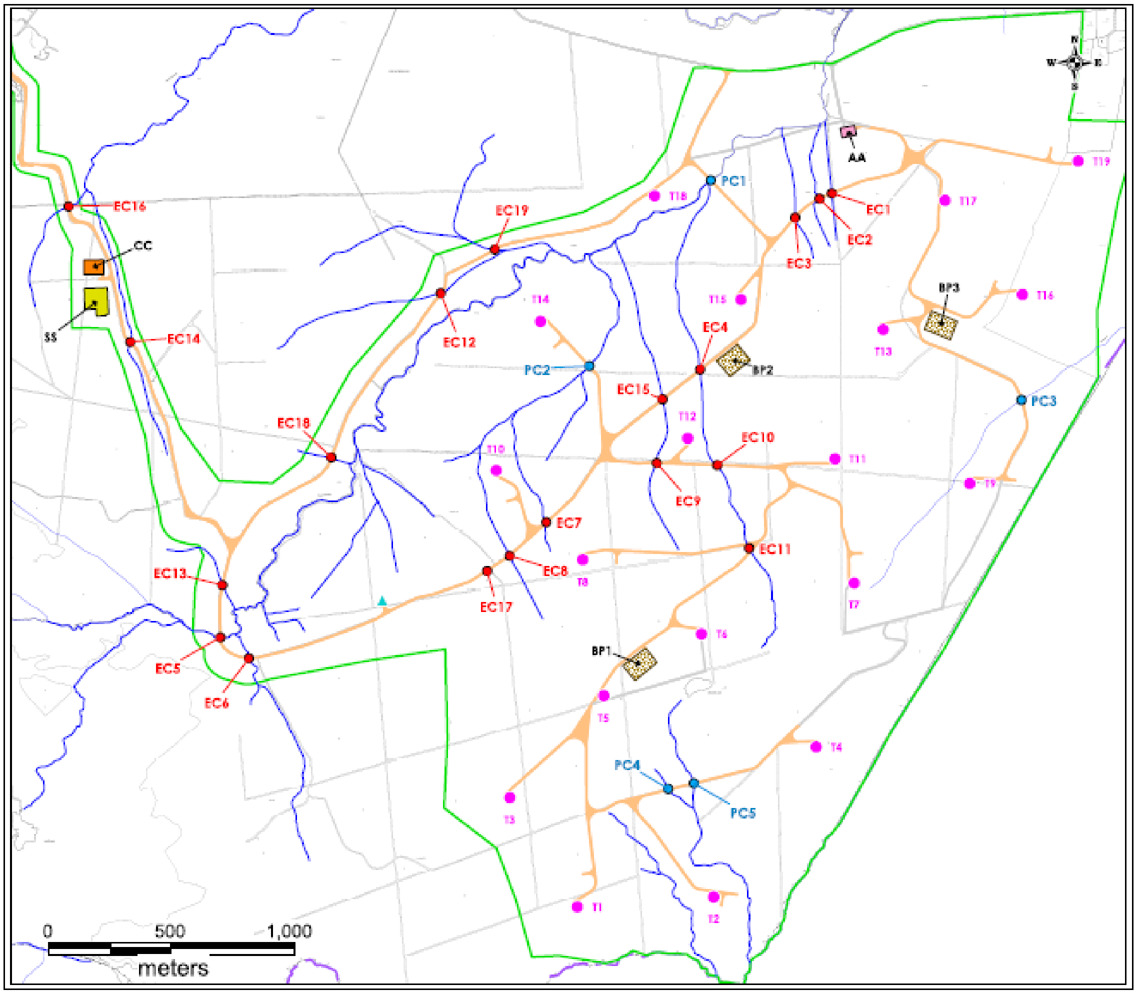
Appendix B Road Section to be Upgraded



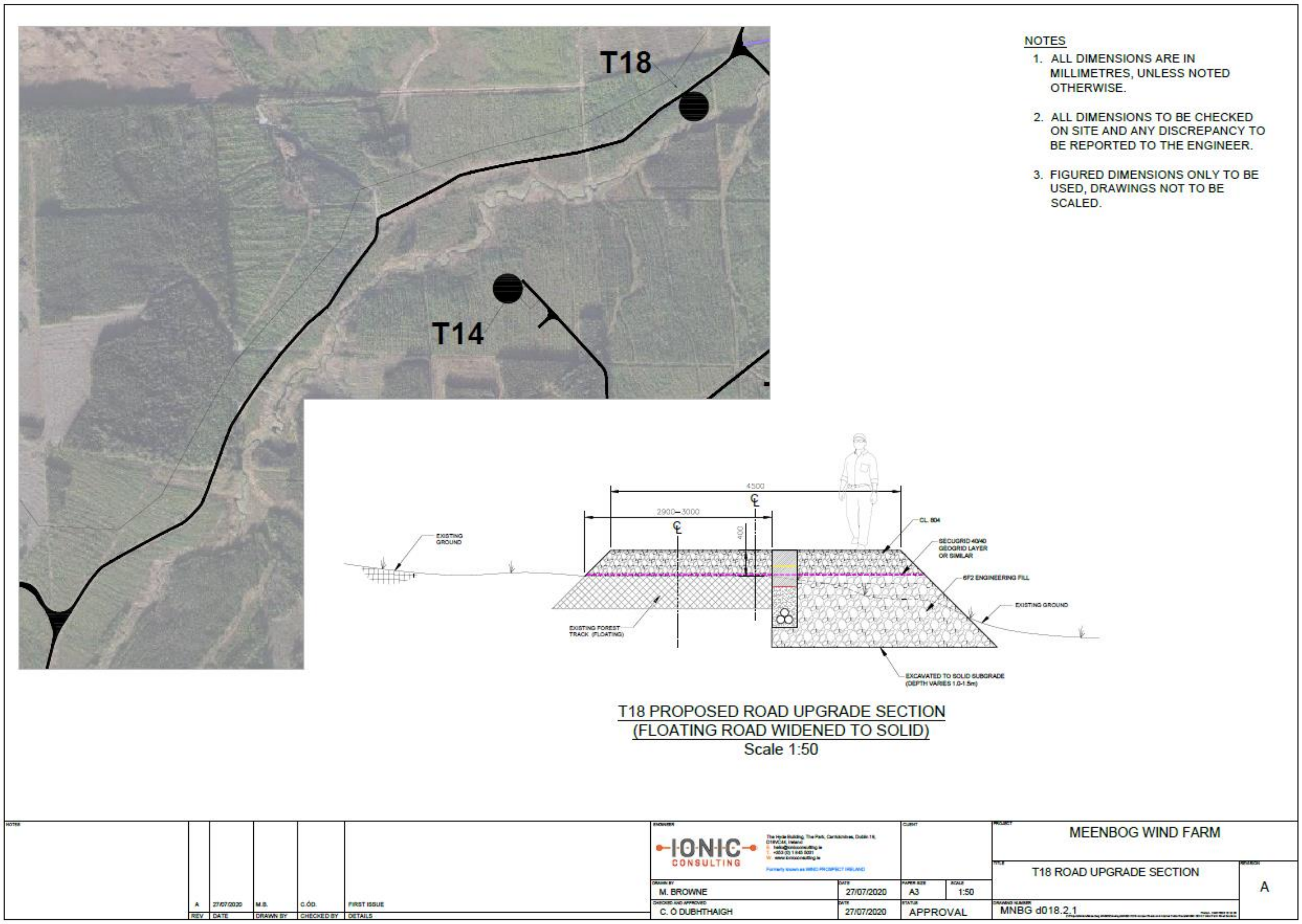
Appendix C Bend at T18 Spur Road



Appendix D Main Site Drainage



Appendix E Main Site Drains



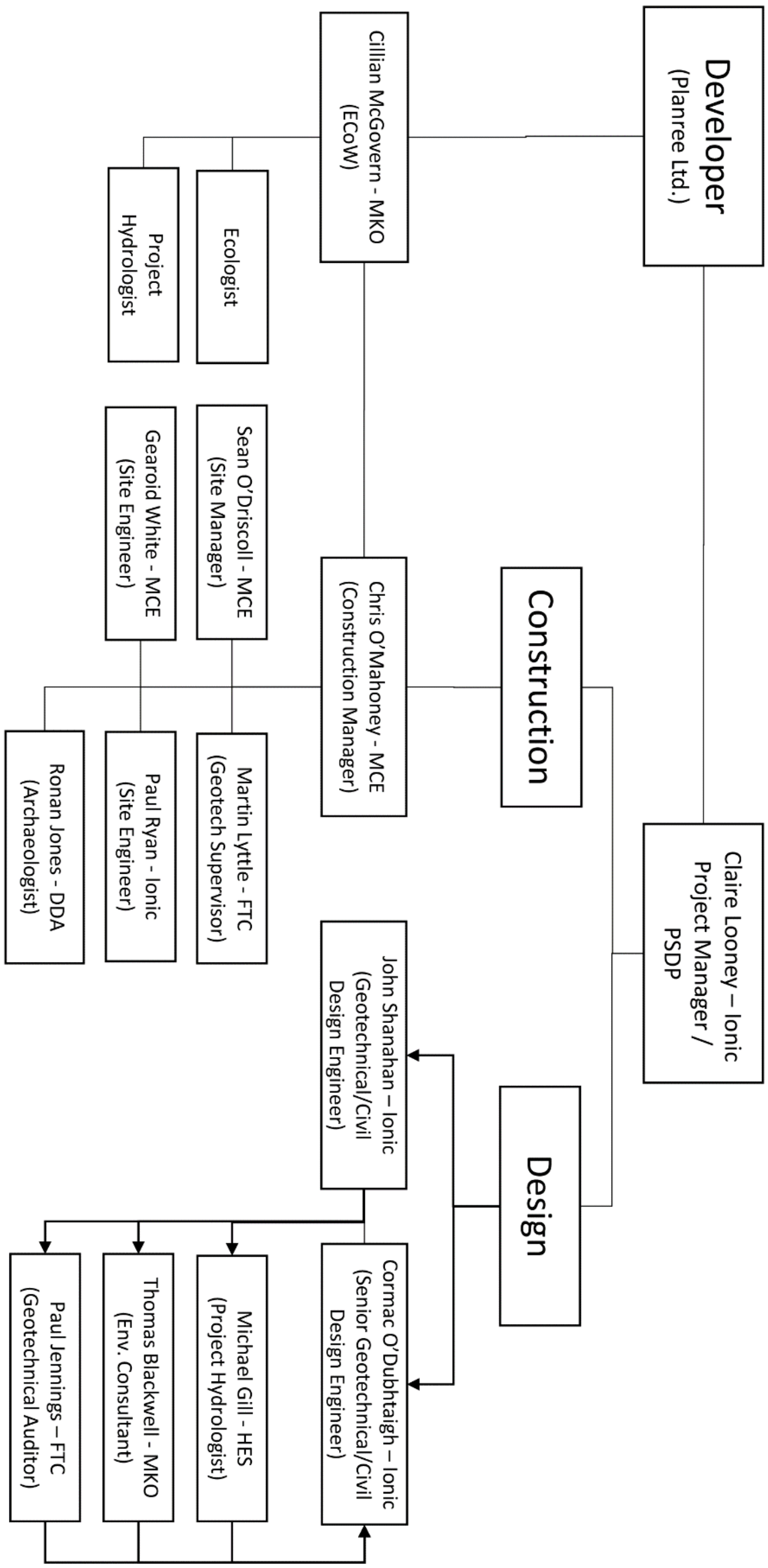
Appendix F Peat Monitoring Locations

No	Location	Comments
1	Junction of access road to T1 with spur to T2 and T4 along downslope margin	Area of deepest peat in close proximity to concave break in slope
2	Along access to T3 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
3	Along access to T2 about 100m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
4	Along access to T4 about 150m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
5	Along access from T5 to T3 about 200m from T5 along downslope margin	Area of deeper peat in close proximity to concave break in slope
6	Junction of access road to T7 about 100m along access to T7 along downslope margin	Area of deeper peat in close proximity to concave break in slope, within potential area of 12 November failure
7	South side of upper scar of 12 November failure	To monitor potential retrogression of scar upslope
8	On downslope margin of T7 base and hard stand prior to construction	To be installed in advance of any works
9	On downslope margin of T10 base and hard stand	Area of peat in close proximity to concave break in slope
10	Along access to T14 about 100m from hard stand along downslope margin	Area of peat in close proximity to concave break in slope
11	Along access to T18 at about chainage 1600m along downslope margin	Area of potential peat close to river
12	Along access to T16 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope and minor instability
13	Peat storage berms at T15	Minor signs of movement/distress. Where necessary the berm size is to be increased.
14	Peat storage berms at T17	Minor signs of movement/distress. Where necessary the berm size is to be increased.
15	Peat failure scar above road to T7	Upper scar of 12 November 2020 peat failure. Potential for retrogression of failure scar.
16	Peat failures at Borrow Pit between T5 and T6	Comprises 3 peat failures at this location. Monitoring at the head of each failure.
17	Peat failure at T12	Head of failure downslope of access road. Monitoring at the head of failure.
18	Instability at T5	Series of concentric tension cracks within the insitu peat
19	Instability at T16	Minor slumping of insitu peat
20	Ch.2630 on the north side of the S-bends on the approach road into the site	Stockpile caused a localised ground movement in the peat below the stockpile

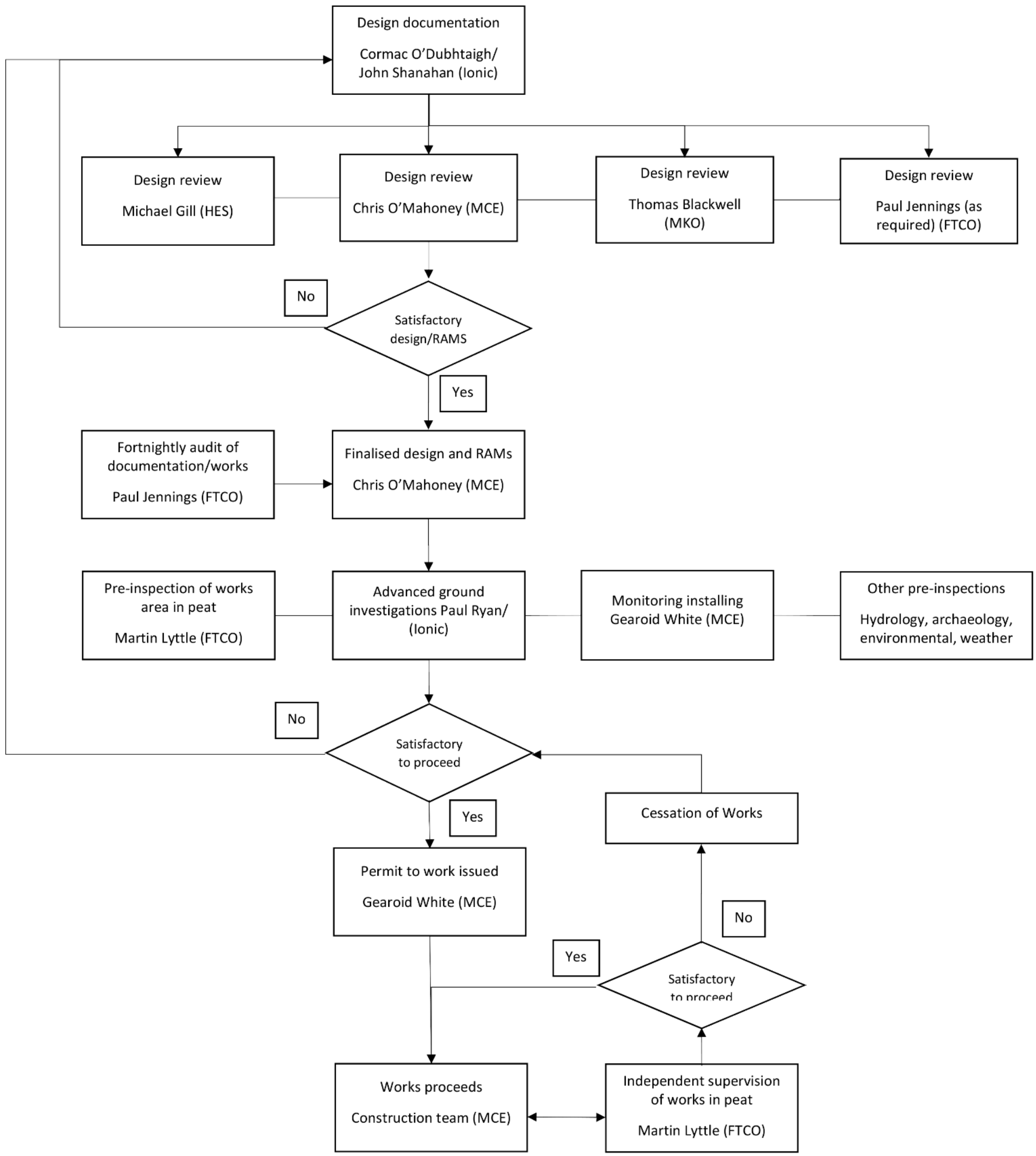
Ref: Fehily Timoney Peat Stability Assessment of Meenbog wind farm Jan 2021

Appendix G Project Organogram & Flow Chart

Organogram:



Design & Construction Flow Chart:



10.0 Risk Assessments

Assessing Level of Risk

Likelihood →

Severity ↓

0	1	2	3
1	1	2	3
2	2	4	6
3	3	6	9

Likelihood			Severity		
1	=	Low	1	=	Slight
2	=	Medium	2	=	Serious
3	=	High	3	=	Major

Likelihood x Severity = Risk Rating

1 to 3	**Low**	**Work can proceed with control measure in place.**
4 to 6	**Medium**	**Work can proceed with control measures in place to reduce risk.**
7 to 9	**High**	**More control measures needed to reduce risk.**

Controls

Management must determine the controls required to eliminate or mitigate against the risks identified in the risk assessment. These controls must be consistent with the operational experience of employees and in accordance with the principles of prevention detailed below. They should also indicate any facility requirements and training needs. These controls are documented on the risk assessments.

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY

THIS RISK ASSESSMENT TAKES ACCOUNT OF THE FOLLOWING:
MCE SAFETY STATEMENT, MCE FULL SAFETY STATEMENTS HAZARD IDENTIFICATION & RISK ASSESSMENT, THE METHOD STATEMENT FOR THESE WORKS & THE PSCS CONSTRUCTION STAGE SAFETY PLAN.

Hazard: Peat Movement **Risk:** ➢ Slippage of peat ➢ Engulfment of personell or machinery ➢ Damage to the environment	2	3	6	➢ 14nr. peat monitoring stations installed ➢ Checked weekly. Stations in immediate vicinity checked daily. ➢ Works location probed and shear vaned – 50m grid outside of works area ➢ No works during periods of excessive rainfall see CEMP 5.2.2 ➢ No stockpiling of peat on top of in-situ material	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Excavation / Trenches **Risk:** ➢ Falls. ➢ Entrapment. ➢ Suffocation. ➢ Crushing. ➢ Impact with machinery. ➢ Drowning. ➢ Electrocution. ➢ Serious bodily injury / fatality.	3	3	9	The Construction Regulations, 2013 must be complied with regarding all excavations. Verify ground conditions and soil type before excavating. No ground to be considered safe until investigated by a competent person. ➢ Schedule work so that excavations are not open for longer than necessary. ➢ Find, locate and mark all underground services. ➢ Organise suitable plant, equipment and required working space. ➢ Organise delivery and inspection of support materials / equipment.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Provide appropriate protective clothing and equipment. ➢ Provide suitable barriers to protect against the fall of persons at work, materials or objects, including the inrush of water into the excavation. ➢ Provide adequate secured ladder and/or ramp access/egress to excavations. ➢ Most extracted spoil will be hauled away but any residual material will be stockpiled away from excavation edge at all times. ➢ Safe System of Work Plan should be completed for each task or a specific method statement completed and a new SSWP should be completed when the task or the environment changes. ➢ AF 3 to be completed as required by a competent person. ➢ Where there is a risk involved with a trench and/or an excavation, adequate precautions must be taken to protect against danger to persons at work from a fall or dislodgement of earth, rock, or peat, by suitable shoring or batter back edge to a safe angle of repose. ➢ If other methods are to be specified they must be selected based on the results of a risk assessment and a Temporary Works Design				

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				Certificate will be prepared & issued. ➢ Appropriate precaution to be in place to protect the person carrying out the shoring				
Hazard: Movement & Use of Excavator **Risk**: ➢ Collisions. ➢ Overturning. ➢ Loss of Control. ➢ Risk of serious or fatal injury to the operator and bystanders in the vicinity due to Overturning. ➢ Collisions and loss of control or collision with other plant or vehicles.	3	3	9	➢ Excavators to be driven by trained, experienced operators, trained to CSCS level, as per the Construction Regulations, 2006. ➢ Driver to carry out weekly documented checks. ➢ Defects or suspected defects to be reported immediately to the Supervisor. ➢ Regular servicing and maintenance to be carried out and properly recorded. ➢ Warning signs to be posted at strategic locations to alert persons to the movements of excavators. ➢ Drivers of smaller vehicles must ensure that excavator drivers, when operating nearby, can see them. ➢ Where a workplace or a site road is close to an open edge, the edge must be clearly marked and lined with boulders and safety barriers. ➢ Site roads not to exceed a gradient of 1 in 5.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
				➢ Test certificates and form GA2 required for excavators used as lifting equipment.				
Hazard: Excavator – Various Risks **Risk:** ➢ Falls - Injury to driver entering or getting out of the cab ➢ Passengers ➢ Noise Partial /Total loss of hearing ➢ Dust ➢ Risk of serious ➢ Health damage from dust	2	3	6	➢ Hand and footholds to be fitted and maintained in good condition. ➢ Machine lights to be properly maintained. ➢ Carriage of passengers on any part of an excavator is not allowed. ➢ Machine to be stopped and switched off before any person including maintenance persons are permitted on the footsteps. ➢ Earmuffs to be provided and their wearing compulsory where noise levels reach 85Db or more. ➢ Cabs to be maintained to keep out dust. ➢ Proper masks to be provided and worn.	2	1	2	- Site Supervisor (Foreman) - Site Operative

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HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Site Dumper / Lorries **Risk**: ➢ Overturning/Loss of control ➢ Collision ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Pedestrians ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Passengers ➢ Fall from dumper ➢ Fall underneath ➢ Loading ➢ Falling material ➢ Fire	3	3	9	➢ Only trained, experienced and authorised drivers to operate dump trucks/dumpers/lorries. ➢ Drivers must hold a CSCS Ticket (or recognised alternative). ➢ Each driver to carry out daily visual checks on their vehicles, to ensure that they are in safe working order. ➢ All dump trucks/dumpers must have all safety devices fitted as required in the Construction Regulations, 2006, S.I. 504, Schedule 6, Regulation 87. ➢ Safety belts are recommended for all existing and new dump trucks and where fitted they must be worn. ➢ Suspected defects must be immediately reported to your Supervisor. ➢ Regular recorded maintenance to be carried out. ➢ As a general rule, all other traffic gives way to loaded dump trucks. ➢ Lay-bys to be provided where dump trucks are likely to meet other traffic. ➢ Where a haul road passes near open edges, the edges are to be clearly marked and lined with large boulders or other safety measures and kept clean.	3	1	3	- Site Supervisor (Foreman) - Site Operative

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HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Workings must be designed so that gradients do not exceed 1 in 5. ➢ Safety warning signs are to be posted at strategic areas to alert persons to movements of dump trucks and other vehicles. ➢ Pedestrians told to ensure that they keep clear of dump trucks, wear high visibility clothing, and ensure that the driver can see them. ➢ No pedestrians may go under an open edge while a dump truck is in operation above. ➢ Persons driving small vehicles must ensure that the driver of dump trucks can see them. ➢ No persons to be carried on any part of a dump truck, unless there is provision in the cab and they are authorised to be carried. No riding permitted on the foot steps. ➢ Drivers cab must always be protected by an overhead shield built into the body of the truck. ➢ Driver to remain inside the cab at all times during loading. ➢ Hand and foot-holds must always be provided to aid safe ascent to/decent from the dump truck.				

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HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Tractor & Trailer **Risk:** ➢ Falls. ➢ Entrapment. ➢ Crushing. ➢ Impact with machinery. ➢ Serious bodily injury / Fatality. ➢ Collision.	3	3	9	➢ Wear hi-visibility vest and hardhat when working with moving equipment. ➢ Keep in operator's line of view. ➢ Don't travel on equipment. ➢ Watch out for objects nearby, particularly when reversing. ➢ Don't overload a trailer or stack it too high. Secure any loose loads. ➢ Use flashing amber beacon ➢ Trailer must be correctly attached to tractor (i.e safety chain, brakes and lights). ➢ Competent operators must only operate tractor. ➢ Tractors and trailers must be inspected before use.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Persons affected by the works **Risk:** ➢ Struck by site traffic. ➢ Fatalities ➢ Serious injuries	3	3	9	➢ Traffic Management Plans and Drawings are approved and made available. These plans will detail access routes both internal and external. ➢ All warning signs, cones with barriers are in place prior to the commencement of work on site. ➢ All signs will be clean and clearly visible. ➢ Once signs are in place the site access route will be assessed to ensure adequate visibility for drivers and pedestrians.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ All signs will be secure and weighted down where appropriate. ➢ All personnel onsite & on public roads will wear high visibility vests or jackets. . ➢ Contractor vehicles will be parked with consideration given to site traffic access.				
Hazard: Lifting Equipment **Risk:** ➢ Serious personal injury. ➢ Fatalities. ➢ Collision. ➢ Machine overturning. ➢ Material falling from height.	3	3	9	➢ The site management of MCE Ltd must ensure a competent person inspects the lifting equipment every 12 months and a GA1 is obtained. This must be available for inspection. ➢ Under the Construction Regulations, 2006 the lifting equipment must be inspected weekly by the operator and the results must be recorded on a GA2. ➢ A thorough visual inspection should take placed before the driver operates the machine. ➢ The driver must be trained and competent to operate the machine (FAS CSCS standard or alternative excepted standard). ➢ All telescopic handlers/excavators must have safety devices fitted as per the Construction Regulations, 2006 S.I 504, Schedule 6, Regulation 87.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Noise created in the workplace - Rock Breaker **Risk:** ➢ Hearing impairment. ➢ Deafness. ➢ Tinnitus. ➢ Loss of concentration and annoyance leading to work ➢ place accidents and / or loss of production.	3	2	6	➢ MCE Ltd is aware that equipment such as consaws, angle grinders, etc. are over the 2nd Action Level and hearing protection must be worn. ➢ It is not anticipated that any member of our staff are exposed to such a dose that they will either daily or weekly require monitoring. ➢ Consult with staff and provide training where necessary. ➢ Signpost all excessively loud equipment, machinery, areas and processes which exceed the upper exposure action level of 85dB(A) and the lower exposure action level of 80dB(A). ➢ Reduce the worker exposure levels by reducing the amount of time spent near sources of excessive noise (job rotation). (Note: this should be considered as a last resort). ➢ Hearing protective equipment must be provided if deemed necessary, as per the Noise Regulations. ➢ Ensure hearing protection is worn for short-term noise exposures (this should also be a last resort). ➢ Remove other people from such noisy areas, unless their presence	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				is required. They must wear hearing protection whilst in such areas.				
Hazard: Working in reduced light **Risk:** ➢ Fatalities ➢ Serious injury	3	3	9	➢ Working in diminished light is not permitted under the normal work rules. ➢ In cases where permission is granted so as enable MCE Ltd to remain in keeping with the project program or for special activities, concrete pours for turbine bases, etc and work in hours of reduced light is conducted, adequate lighting will be provided at all times. ➢ Any temporary work lighting will be erected with due regard to the visibility of plant operators and other traffic on site. This shall be the duty of MCE Ltd and any special arrangements will be documented in method statements, SSOW or traffic management plans. ➢ High visibility jackets are to be worn at all times regardless.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix				
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd.

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Chemicals **Risk:** ➢ Eye injury / loss. ➢ Skin infection. ➢ Burns. ➢ Inhalation. ➢ Ingestion with food. ➢ Fire. ➢ Explosion. ➢ Serious personal injury. ➢ Fatalities.	3	3	9	➢ Safety Data Sheets to be obtained for all chemicals and strictly followed. ➢ Copies to be available in case of an emergency. ➢ Containers to be properly labelled (hazard signs). ➢ Safe storage and dispensing of chemicals to be practiced. ➢ Follow manufacturer's requirements for handling, mixing, storage and first aid etc. ➢ Personal Protective Equipment to be provided and used. ➢ Training to be provided for staff working with chemicals. ➢ Familiarisation to be provided with the emergency procedure to all staff. ➢ Best possible hygiene procedures to be in place and enforced by Management. ➢ Sources of flame / ignition to be eliminated where flammable materials are used and / or stored. ➢ Spillage's to be immediately dealt with.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Lone Working **Risk:** ➢ Personal injury. ➢ Fatalities. ➢ Violence toward staff. ➢ Delay in treating medical emergencies.	3	2	6	➢ The company policy is that lone work is a last resort and must only be used for minor tasks. A system for communication with management must always be maintained. If lone working is required in keeping with the project programme it will be pursued under the following controls: ➢ The person must be trained & competent to carry out the tasks required. ➢ A means of communication must be available for the lone worker to contact foreman and the lone worker will be contacted at regular intervals during the anticipated work period. ➢ The lone worker must report he is leaving site to a designated person, this will be either the site manager or an appointed person. ➢ Periodic visits must be made to the lone worker, where possible. ➢ The lone worker must be furnished with the telephone numbers & emergency procedures information.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Roadworks **Risk:** ➢ Obstruction of Public. ➢ Injury to Public. ➢ Insufficient clearance between traffic routes. ➢ Collision. ➢ Accident or Bodily Injury.	3	3	9	➢ A Traffic Management Plan will be formulated for internal site roads. ➢ The main bulk of traffic will be generated with concrete pours and a traffic management plan will be created with concrete supplier and MCE Ltd. ➢ Communication will be maintained between MCE Ltd., and other civil contractors about traffic activities and all parties will be notified when pouring is taking place.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Fuel storage / refuelling **Risk:** ➢ Fire ➢ Burns ➢ Skin & Eye Irritant ➢ Dermatitis ➢ Environmental ➢ Slip / Fall	3	3	9	The risk of spilling fuel is at its greatest during refuelling of plant. To minimise this risk MCE Ltd will implement the following: this list is not exhaustive: ➢ Refuel will take place on a base away from drains or watercourses. ➢ A bunded bowser will be used. ➢ All refuelling and bulk deliveries will be are to be supervised. ➢ Check the available capacity in the tank before refuelling ➢ Check hoses and valves regularly for signs of wear ➢ Turn off valves after refuelling and lock them when not in use ➢ Position drip trays under pumps to catch minor spills	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Keep a spill kit with sand, earth or commercial products for containment of spillages.				
Hazard: Public accessibility to work area on site. **Risk:** ➢ Serious personal injury. ➢ Fatality. ➢ Slips, trips, fall over goods, materials, rough terrain. ➢ Electrocution. ➢ Theft.	3	3	9	➢ Warning signs must be posted to highlight the dangers involved in entering work area, where MCE Ltd are responsible for site conditions e.g. turbine bases. ➢ All access points to work areas to be closed / barricaded to prevent access to unauthorised persons. ➢ Entrances must be fully secured each evening / end of each work shift. ➢ Only authorised personnel are allowed on site. Signs must be erected re same. ➢ A responsible person must check site boundaries on a regular basis.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Visitors **Risk:** ➢ Personal Injury ➢ Property damage ➢ Cuts	3	3	9	➢ All visitors must report to an employee or authorised person of MCE Ltd before entering the premises or area where we work. ➢ Those making deliveries must report to site office.	3	1	3	- Site Supervisor (Foreman)

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Puncture ➢ Entanglement ➢ Eye Injuries ➢ Electrocution				➢ No visitor to the premises is allowed to use company equipment without permission of the company staff and instruction on its use. ➢ Each visitor is requested to abide by the Company Safety Policy and Regulations laid down therein. ➢ They must also abide by a request by a company employee in relation to their own Safety and Health and that of the company employees. ➢ In the event of an emergency or evacuation, all visitors must report to our designated Assembly Point in car park				- Site Operative
Hazard: Contractors **Risk:** Serious personal injury.	3	3	9	➢ We will monitor the ongoing activities of all sub contractors to MCE Ltd on our projects. ➢ Induction training must be provided for Contractors, their staff and all others on site. ➢ Presentation of Site Safety Plan by Sub-Contractor to the Supervisor. ➢ A Method Statement must be prepared for each necessary job by the Contractor and Sub-Contractors.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd – T18 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: First Aid Equipment. **Risk:** ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Adequate first aid kits to be provided and filled to HSA guidelines. ➢ They must be regularly checked and refilled by a designated person.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Lack / Absence of First Aiders **Risk:** ➢ Improper diagnosis ➢ Improper treatment ➢ Delay in seeking professional ➢ medical help. ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Sean O'Driscoll and Chris Murnane are trained first aiders ➢ Arrangements to be in place with local doctor for emergencies. ➢ All employees to be aware of emergency procedures.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Personal Protective Equipment (P.P.E.) **Risk:** ➢ Impact from flying particles. ➢ Head injury. ➢ Foot injury. ➢ Falls from height.	2	3	6	➢ All necessary Personal Protective Equipment to be provided and used. ➢ Safety Signs to be put up to highlight this requirement. ➢ COMPULSARY SITE P.P.E.: ○ Hard hat. ○ High visibility clothing. ○ Safety boots / shoes.	2	1	2	- Site Supervisor (Foreman) - Site Operative

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HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Burns or skin irritation etc.								
Hazard: Manual Handling **Risk:** ➢ Back. ➢ Neck. ➢ Shoulder Injury. ➢ Prolapsed Disk. ➢ Permanent Injury. ➢ Trip / Fall. ➢ Hit Against. ➢ Dropped Object.	3	2	6	➢ All MCE Ltd staff and subcontractors employees must be trained in Manual Handling. ➢ In Accordance with the General Application Regulations 2007, No 69, an employer must ensure that he/she takes appropriate organisational measures, or use the appropriate means, in particular mechanical equipment, to avoid the need for the manual handling of loads. ➢ Minimise all manual-handling tasks where possible. ➢ Provide suitable mechanical handling equipment Ensure these are used. ➢ Provide Manual Handling training to all staff whom have not received it. ➢ Personal Protective Equipment including gloves to be provided and used.	3	1	3	- Site Supervisor (Foreman) - Site Operative

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HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Poor Hand Hygiene **Risk:** ➢ Skin complaints. ➢ Dermatitis. ➢ Eczema. ➢ Ingestion of chemicals. ➢ Biological agents: • toxins, • bacteria and • viruses.	2	2	4	➢ Good hand hygiene is essential in the workplace. The hands are the most likely part of the body to come into contact with harmful substances. ➢ Wash hands before eating or smoking. ➢ Suitable gloves should be worn when handling potentially hazardous materials. ➢ Dirty hands should be cleaned using proper skin cleansing products. ➢ Do not clean hands with petrol, white spirits, thinners, turpentine etc. ➢ Always ensure you wash your hands after visiting the toilet.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Animals • Rats /mice. • Wasps /bees. • Small animals. • Dogs. **Risk:** ➢ Leptospirosis(Weil's Disease) ➢ Stings. ➢ Histoplasmosis ➢ (droppings) ➢ Fall from height. ➢ Sudden 'fright'.	2	2	4	➢ When working near water or where rats have been seen, care is to be taken to disinfect all cuts and cover them with waterproof plasters. ➢ Be aware that sudden movements of birds or small animals can cause a reflex action in the operator, which may overbalance them. ➢ Check for signs of nests, birds or other small animals. ➢ Practice caution if dogs are present.	2	1	2	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Bites.								
Hazard: Weather ➢ Sun ➢ Wind ➢ Rain ➢ Ice / snow **Risk:** ➢ Sun burn. ➢ Sunstroke. ➢ Skin cancer. ➢ Fall from height. ➢ Slip / fall. ➢ Bodily injury. ➢ Hit by object. ➢ Hypothermia.	2	2	4	➢ In sunny weather, cover the back of the neck and keep a shirt on at all times. ➢ Avoid sunburn and sun stroke where possible by keeping covered and wearing a high factor sun block. ➢ Be aware that strong winds or gusts can overbalance an operator. ➢ Don't work in heavy rain unless adequately protected. ➢ Be prepared for slippery conditions in icy weather. Salt or grit should be used where necessary.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Working near Water **Risk:** ➢ Drowning: ➢ Public and Workers	3	2	6	➢ Fencing and warning signs to be in place around deep water. ➢ Workers must operate in pairs at all times. ➢ Where necessary, suitable lifebuoys to be available in case of emergency and checked regularly.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix				
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

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HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Portable Electricity Generator **Risk:** ➢ Fire. ➢ Burns. ➢ Re-fuelling. ➢ Electrocution. ➢ Bodily injury. ➢ Back injury. ➢ Trip / fall.	3	3	9	➢ Store in a dry position and away from pedestrian routes. ➢ Fill petrol tank when the generator is cold. ➢ Avoid spillages when re-fuelling. Clean up any overspill immediately. ➢ Move fuel can a safe distance away. ➢ Ensure filler cap is securely replaced. ➢ To be operated by trained personnel only. ➢ To be maintained in good condition. ➢ Always inspect before use (i.e. oil / petrol level, electric connections not broken).	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Abrasive Wheels, Consaws and Angle Grinders **Risk:** ➢ Wheels shattering at high speed. ➢ Serious facial / head injury. ➢ Cuts / wounds to hands, arms, upper body. ➢ Eye injury. ➢ Fire / explosion. ➢ Electric shock.	3	3	9	➢ Training must be provided as per the Abrasive Wheels Regulations, 1982 by MCE Ltd. ➢ Only trained and authorised personnel must be allowed to use abrasive wheels. ➢ The operator must carry out daily inspection. ➢ Guards must be in place at all times, when machine is being used. ➢ If electrically powered use 110v equipment only.	3	1	3	- Site Supervisor (Foreman) - Site Operative

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HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Hand Arm Vibration Syndrome – white finger. ➢ Respiratory problems. ➢ Injury to bystanders.				➢ Store petrol for consaw in correct approved containers. ➢ Always refuel away from the work area. ➢ Do not use consaw close to other people. ➢ Correct Personal Protective Equipment must be worn at all times. (Gloves, ear protection, eye protection and steel toe capped boots). ➢ Inspect work area for all dangers prior to using abrasive wheels. ➢ A hot work permit may be required from management/site foreman. ➢ Use correct discs. Store them safely when not in use. ➢ Turn off consaws and unplug grinders when not in use.				

"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
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18.		

"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
19.		
20.		
21.		
22.		
23.		

Risk Matrix				
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

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HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	

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HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY

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MCE Ltd.

MS MNG 16037

REINFORCING BARRAGE AT T1-T2 SPUR ROAD

Prepared By: Christopher O'Mahony

Signed: ……………………………… **Date: … …………………** 26/08/2021

Reviewed By: Sean O'Driscoll

Signed: ……………………………… **Date: … …………………** 26/08/2021

1.0 Method Statement-MNG 16037

Project Name:	Meenbog Wind Farm.		
Contractor:	MCE Ltd, Lissarda Industrial Estate, Lissarda, Co. Cork		
Method Statement Title:	**Construction of reinforcing barrage at T1 – T2 Spur**		
Method Statement No.:	MNG - 16037		
Prepared by:	Chris O'Mahony		
Date Prepared:	26/08/2021	**Revision**	004–26/08/2021
Specific Training Required:	Solas Safe Pass, Site Induction, EIA Training, CSCS Plant Ticket (where required).		
Relevant Legislation:	Safety, Health & Welfare at Work Act 2005 Safety, Health & Welfare at Work (General Application) Regulations 2007 Safety, Health & Welfare at Work (Construction) Regulations 2013		

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2.0 Statement Brief

Meenbog wind farm is comprised of 19 wind turbine generators, one 110kv substation and one meteorological mast along with associated roads, hardstands and other associated infrastructure. The road infrastructure to the south of T5 has been designed and constructed as 'floating roads'. At the junction of T1/T2 and area of significantly deep peat was encountered. Additional testing and analysis of this area indicates stability factors >1. However, given the topography, potential flow paths and proximity to water courses a higher degree of caution is warranted. It has therefore been decided that a stabilising barrage will be constructed along the South-East of the existing road which will reinforce the road from T1-T2. This method statement details the construction of barrage.

The Meenbog Site is primarily made up of rural and agricultural land, upland bog, commercial bog and forestry. Access to site may be shared with local domestic and commercial traffic and due care and attention should be taken at such access points. There is public access to the site and all contractors must conduct their activities in a manner that both protects and facilitates the general public in their enjoyment of the site. See site layout, Figure 1.0.

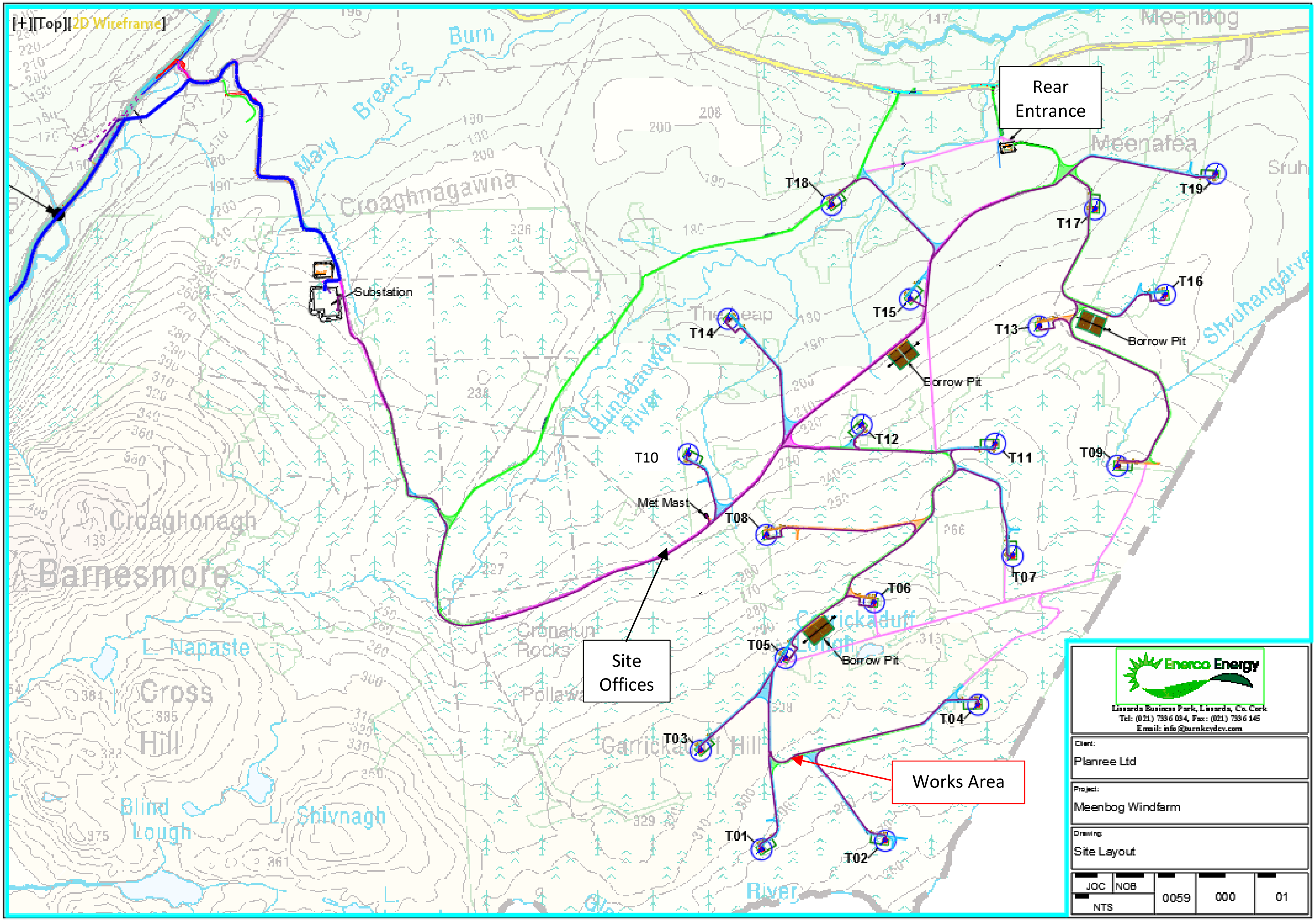


Fig 1.0 Meenbog Site Layout

2.1 Works Location

Meenbog Wind Farm & Substation entrance is located approximately 13km South West of Ballybofey and 14km North East of Donegal Town. All operatives are to text MCE ltd operational controller when arriving onto site and again when leaving in the evening. The contact number is 086-8032620.

3.0 Restrictions / Precautions

Description	Yes	No
Work located near **Underground services**		√*
Work located near **Overground services**		√**
Work located near **SAC / NHA**	√***	
Work located near **Watercourses / Streams**	√****	
Work located near **Steep Slopes**	√*****	
Work located near **Hillwalkers**	√******	

* = underground cables.
** = overhead power lines.
*** = Special Area of Conservation / National Heritage Area.
**** = Drainage measures to be put in place to ensure that no damage is caused to local watercourses in conjunction with Environmental consultant recommendations.
***** = Some road surfaces may be in close proximity to steep slopes.
****** = Hillwalkers frequent the development area and operatives have been made aware of their presence.

3.1 General Precautions

Prior to any works commencing all personnel onsite will be inducted by a MCE supervisor and will sign up to the relevant RAMS before commencing any work onsite. A number of other points to note include;

- GA2 forms to be completed weekly with a copy of the GA1 left in the machine at all times.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have SOLAS Safe Pass training or equivalent training
- First aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times with additional PPE as required.
- A competent foreman will be on site at all times.
- No excavations to be left open.

4.0 Environmental Emergency Procedures

4.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out. There are a series of 20 monitoring locations across the site with trigger levels of 100mm recommended. (see appendix F). For this section of work a number of additional posts will be installed (see appendix H)

(1) All construction activities shall cease within the affected area.
(2) Further peat stability assessment completed
(3) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
(4) Recommencement of limited construction activity shall only start following a cessation of movement and completion of a geotechnical risk assessment by a geotechnical engineer.

4.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Where considered possible, action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on land prevention measures, in this case a watercourse check barrage will be implemented.

(3) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

4.3 Reaction to Peat Slide

In the event that there is a significant movement of peat, MCE will follow a specific set of procedures, namely,

- MCE Site management will be contacted
    - Gearoid White: 086-0211525
    - Chris O'Mahony: 086-0329552
- Site management will ensure all employees and equipment are accounted for
- Area will be designated a 'no-go' zone until instructed otherwise
- An initial rapid assessment will be made to determine the immediate risks to personnel within the site, members of the public and the local environment
- If deemed necessary, measures may be taken to make the area safe in the short term
- MCE management and consultant engineers, will be contacted, notified of the situation and site staff will await further instruction
- In the event of a notable peat movement, the relevant statutory bodies will be notified.

4.4 Fuel / Oil Spill

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- On-site refuelling will be conducted in a controlled and safe manner. Where possible fuel will be delivered by bunded mobile tanker. Bowsers and plant will be refuelled on a level platform away from any watercourses and areas susceptible to run-off.
- Refuelling to be conducted by competent and trained personnel
- Plant on site will be regularly inspected for leaks and fitness for purpose. Any defects to be reported to site management and plant owner immediately
- Emergency spill kits will be available to deal with any potential accidental spillage or discharge.
- Where there is a leak of any hazardous material all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- The area will be sealed off so that no watercourses are affected, and the contaminated peat/land excavated and removed. Fuel spill kits will be used to clean up the area.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.

- The ECoW will notify the appropriate regulatory body such as Donegal County Council, Department of Communications, Climate Action and Environment (DCCAE), if deemed necessary.

5.0 Sequence of Works

5.1 Setup

1. The site has already been set up prior to works. MCE have a site compound set up with all required welfare and first aid facilities
2. A number of signs and fencing have been erected around the site so as to limit the risk of hill walkers from coming into the work area.
3. Site Safety signs have also been erected at a number of points alerting members of the public of dangers and the need for PPE as they are entering a construction site.
4. The assembly point for personnel involved in these works is at the MCE site offices
5. A rain guage monitoring system is set up on site. Works will cease based on triggers set out in CEMP section 5.2.2 i.e. >25mm in 24 hours, 10mm in 1 hour or greater than the monthly average rainfall in the past 7 days.
6. 20nr. Peat Monitoring locations have been installed across the site in line with FTCO recommendations. There are to be monitored weekly site wide. Daily monitoring will be conducted on locations in the vicinity of works zone. (See appendix G & H)
7. In line with FTCO recommendation nr. 3. The remaining works on the site shall be carried out without placing of excessive loading onto the in-situ peat surface. Where loading is to be placed onto an area of in-situ peat then that area shall be inspected and assessed by a competent person. Where in doubt no loading shall be placed onto in-situ peat.
8. An additional series of monitoring locations will be installed in the area directly adjacent to works zone. These will be monitored on an ongoing basis throughout the workday.
9. Zone of influence testing will be completed daily in advance of works. This will involve peat probing, shear vaning and inspecting the ground to 50m outside the works area along the path of the works to be completed. Probing and shear vaning will be carried out at 20m centres depending on the encountered peat conditions. The number of shear vaning carried out may vary depending on for example the depth and weakness of the encountered peat. The morphology, drainage, vegetation, and proximity to drains/watercourses will be checked. Tests will be cross-referenced to those completed to date.
10. Zone of influence testing and inspection shall be completed in a reasonable time in advance of the proposed works to allow assessment of the results to be completed.
11. All results, such as probing and vaning shall be documented on site using a standard template and transferred to digital medium (e.g. Excel spreadsheet), all of which shall be readily available for auditing.

5.2 Methodology

- All operatives are to read, understand and sign the RAMS before commencing any work and if unsure about any item they are to discuss with the site manager, Sean O'Driscoll / Chris O'Mahony/Gearoid White
- Works will be sequenced based on project organogram (see appendix I)
- Zone of influence testing will be conducted prior to works commencement. The area will be inspected by competent person, no works to take place until assessment is completed.
- The zone of influence testing will be cross referenced to the testing previously conducted along this road section which will back up the existing data. (see appendix C)
- The assessment of the findings of the zone of influence testing shall be assessed by a competent person who shall determine based on comparison with previous data contained within the Ionic report and recently completed data that works within the tested section can be commenced, or otherwise. Where there are adverse variations in the data then the designer (Ionic) shall be consulted as part of the assessment.
- No works can commence until the assessment is complete and the assessment has clearly demonstrated that the proposed works are safe to commence.
- The result of the assessment shall be documented using a standard template, which shall be in a suitable medium that can be readily audited.
- The barrage will be constructed to solid stratum using the 'displacement' method.
- The excavation and filling will be sequenced to minimise potential for tension cracks to develop.
- The top layer of acrotelm and an amount of the peat beneath will be excavated. Large rocks will be pushed into the peat until competent bearing has been achieved. The peat will be forced upward and will then be removed to peat deposition area.
- The initial layer of peat to be removed is a function of the estimated shear strength of the peat. This is determined using on-site shear vane testing. The values can be taken as a relative value and not an absolute value for shear strength.
- The side wall collapse depth of an excavation in peat can be estimated using the formula below,

$$D = 2 \text{ to } 4 \times cu/\text{peat density}$$

Where:

D=Depth
Cu=shear strength
2 to 4 are derivative values where 2 can be taken as more conservative.

Peat density taken as $10KN/m^3$

- For example, at the start point of the construction, a value of 6kpa has been given, therefore,

$$2 \times 6/10 = 1.2m$$

- This will be checked against pre-commencement testing. The more conservative value will be taken and excavation will be continued to 75% of the indicated depth thereby minimising the risk for side wall failure.
- Excavation will begin at CH 100 which has a peat depth of 1.4m and approx. Cu of 6Kpa. (see appendix B)
- Excavator will sit on existing floating road and load peat into articulated dump truck directly to the North. The road will not be surcharged along the lower side (barrage side).
- There is a ration of approx. 2 x peat to 1 x rock meaning approximately every two loads of peat removed will require one load of rock to replace.
- Waiting trucks will not be parked along the spur road within the risk area CH 00 – CH 100. This will be controlled by supervisor and requirements will be conveyed to operatives.
- Once peat is removed and rock is required, excavator will move away road leaving space for rock to be deposited. It will be unloaded at the road edge and placed by the excavator.
- ***Rock will not be deposited directly onto the floating road.***
- Rock will not be tipped directly into open excavation in an uncontrolled manner. Its placement will be controlled by excavator operator.
- A platform will be constructed allowing excavator to move off floating road. Barrage construction will turn towards T2 and approx. 20m will be constructed towards CH 150 providing a base for construction to continue into the deeper peat towards T1
- Construction will then continue towards CH 00 in the same manner.
- Traffic will be strictly controlled. Dump trucks will travel at the opposite side of the road to barrage construction, minimising loading of the barrage side of the floating road.
- The barrage will be min 4m wide on top with the base width determined by the depth of peat. W:D, 1.5:1 (See appendix A)
- Two nr. 450mm pipes will be installed at CH 60 to allow free passage of water through the barrage to an existing drain at this location (See appendix E).
- Between CH 00 and CH 40 there is a pocket of deep peat. It is largely contained within a bowl shape in the subsurface profile. There is a potential subsurface flow path at CH 40 (C-C). Beyond this point

the peat depth increases. The potential risk decreases once the flow path has been intercepted. (See appendix F)

- The peat excavated will be brought to on-site peat deposition areas. Rock will be sourced from on-site borrow pits, adjacent to T15 and T13. Given the long distance from each borrow pit, rock may be stockpiled for use at T5.
- No construction machinery will track onto in-situ peat. In the event that machinery must track onto peat the peat will be inspected and assessed by a competent person to avoid excessive loading. If in doubt machinery will not be tracked onto peat.
- Drainage works required will be conducted under supervision of MKO. A series of preventative measures will be put in place to protect water courses. Silt traps will be required within the existing forestry drains particularly within the drains at CH 60.
- MCE/MKO will monitor the works at all times to ensure there are no unwanted discharges to the roadside drainage. If there are any issues with drainage and or unwanted discharges, works will cease and remedial measures will be put in place to the satisfaction of the ECoW prior to recommencement of works.
- Barrage construction will continue to CH 00 on the T1 spur road.
- Martin Lyttle (FTCO) and Gearoid White (MCE) will monitor excavation works. John Shanahan/Cormac O'Dubhthaigh (Ionic) will be present for works commencement to ensure the methodology is satisfactory.
- Once completed a final inspection will be conducted by Ionic consulting (John Shanahan & Cormac O'Dubhthaigh), FTCO (Martin Lyttle) and MCE management (Sean O'Driscoll & Chris O'Mahony)

6.0 Covid-19

Coronavirus/Covid-19 is an infectious disease which affects the upper respiratory system. It is potentially fatal and is particularly dangerous to those with underlying conditions and the elderly/infirmed. 63% of confirmed cases have spread through community transmission. The infection is highly contagious and easily transmitted from person to person through close contact with either an infected individual or a contaminated area. For this reason, a set of standard operated procedures are to be adopted at Meenbog WF. Refer to construction stage safety plan for SOPs on Covid-19. Briefly summarised below,

- All workers are to sign in/out at the designated area
- Personnel will be asked to make a declaration which assess the key risk factors in virus transmission
- Hand sanitizer and gloves will be provided for instances where personnel must use a shared space i.e. toilets
- There will be no communal areas for eating in use for the foreseeable future
- Personnel will take their designated breaks at their own individual work area e.g. digger cab
- Site will be closed for access in the morning and opened at the end of the day, any entries/exits are to be notified to site management
- Anyone displaying symptoms of Covid-19 are to immediately notify site management and proceed to self-isolate

7.0 Plant / Equipment

1.	Various Size Excavators
2.	Roller / Plate Compactor / Generator
3.	25 Tonne Dumper
4.	Lorries / Dumpers
7.	Loadall
8.	Drainage equipment (Pumps, silt bags etc.)

7.1 Personal Protective Equipment (PPE)

1.	Hard Hat. (Worn at all times)
2.	Hi Visibility Jacket/Vest. (Worn at all times)
3.	Steel Toe Cap Boots. (Worn at all times)
4.	Gloves. (Worn when required)
5.	Eye Protection. (Worn when required)
6.	Ear Protection. (Worn when required)
7.	P3 Dust Masks. (Worn when required)

7.2 Extra Safety Equipment to be used

Additional PPE such as hearing protection and dust masks to be used as required depending on operative activities.

8.0 Emergency Arrangements

In the case of an emergency, all operatives are to follow the emergency procedures as detailed in the site induction for Fire, Injury or Bog slide. General arrangements are;

- Assess/Attend to casualty if one is present
- Raise the alarm and call 999/112
- Alert the other site personnel as to the emergency
- Locate at the site assembly point and do not return to work until instructed that it is safe to do so
- Substation construction assembly point located at the site entrance gate

First Aid

First aid kits are located in the MCE Site Vehicle in addition to the MCE site office.

Emergency Contacts

1.	Emergency Numbers – 999/112
2.	Letterkenny University Hospital – 074 912 5888
3.	NowDoc – 1850 400 911
4.	Donegal Town Garda Station – 074 974 0190
5.	Sean O'Driscoll – Project Manager – 086 8528329
6.	Chris Murnane – Safety Officer – 086 7955083
7.	Chris O'Mahony – Site Manager – 086 0329552
8.	Gearoid White – Site Foremena – 086 0211525

Who Information Will be Communicated to.

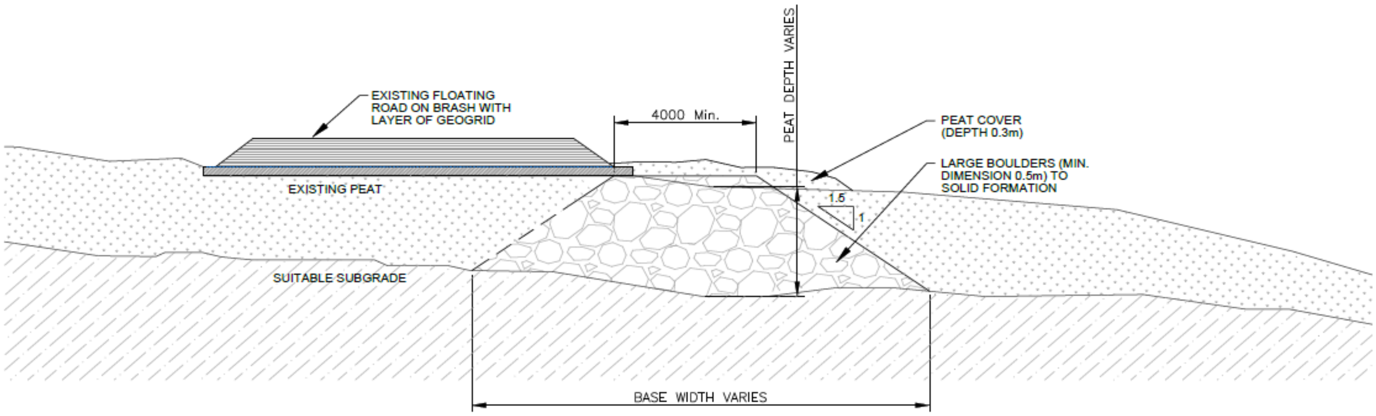
Chris O'Mahony/Sean O'Driscoll will communicate the method statement and risk assessment to the work force before the work commences on site.

Monitoring and Compliance

Chris O'Mahony/Sean O'Driscoll will ensure that method Statements will be adhered to by all MCE staff including any updates/changes made to the Method Statement.

9.0 Appendices

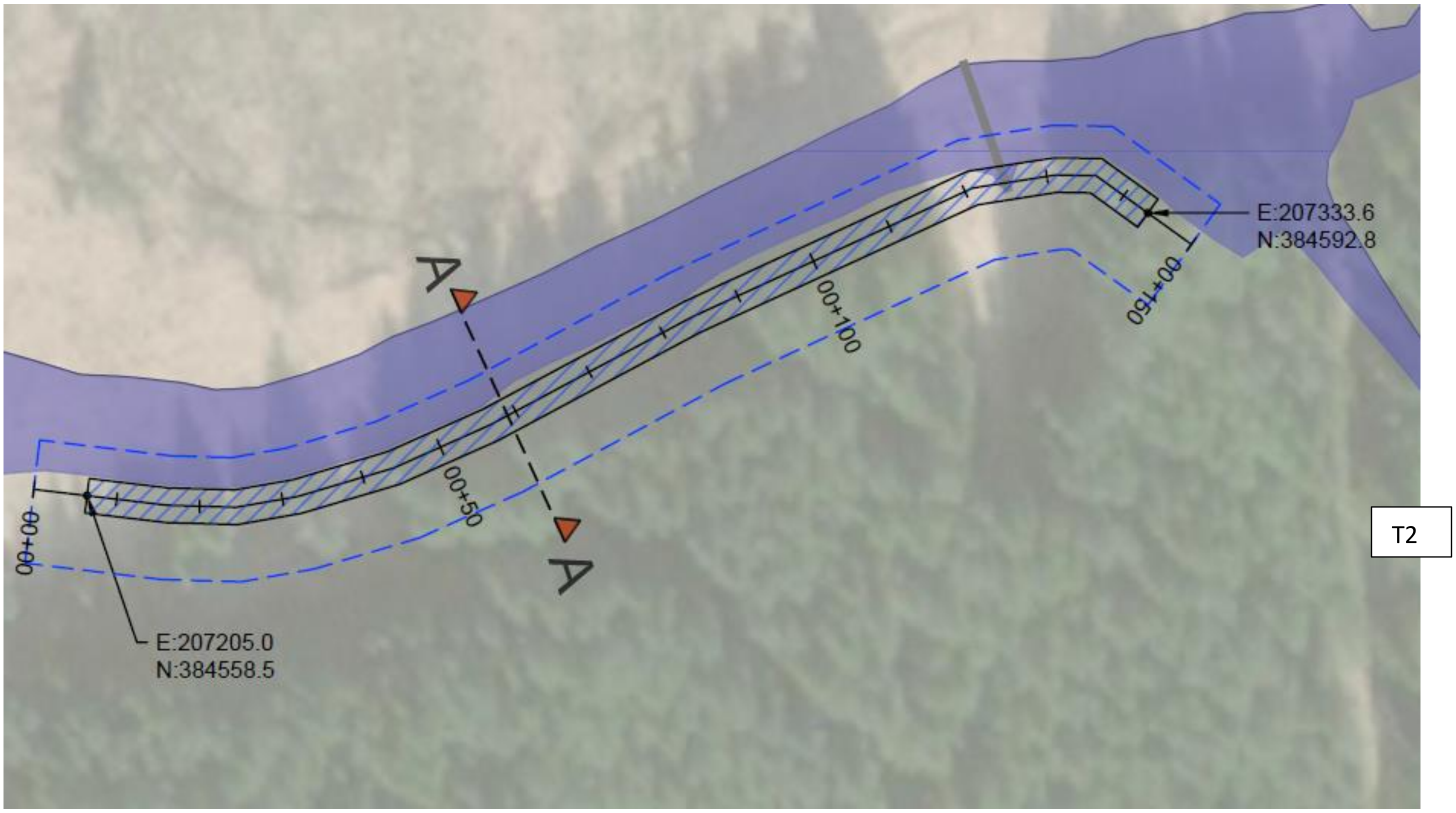
Appendix A Section Through Barrage



ILLUSTRATIVE SECTION A-A - PROPOSED BERM
Scale 1:100

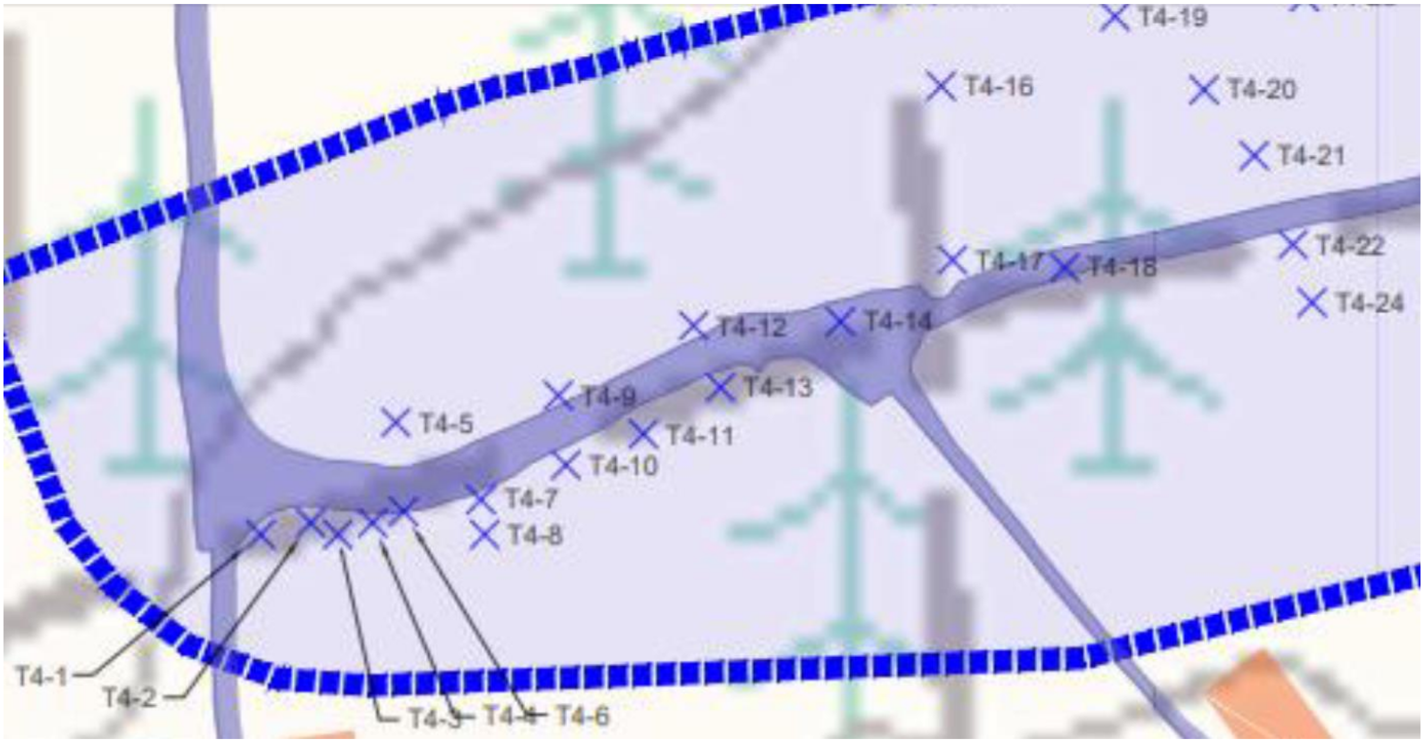
REF: Ionic Construction MNBG d018.4.4

Appendix B Plan View of Barrage



REF: Ionic Construction MNBG d018.4.4

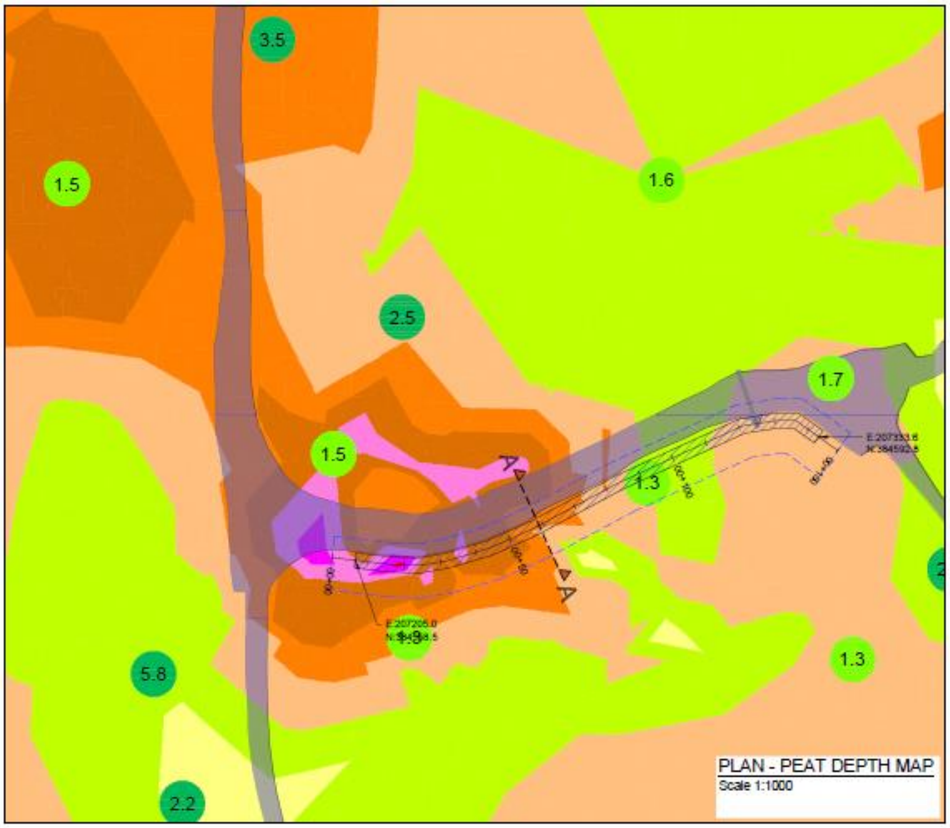
Appendix C Prior Testing



MEENBOG WIND FARM - PEAT ASSESSMENT TO EUROCODE 7 - ODF (overdesign factor)															
LOCATION			DATA				LOADING				ANALYSIS				
Location Ref.	Easting	Northing	Peat Depth (m)	Unit Weight Peat (kN/m3	Undrained Shear Strength (kPa)	Slope (degrees)	Permanent Surcharge Peat Deposition I	Variable Load Construction (kPa) II	Permanent Surcharge Floating Road (kPa) III	Variable Load Crane (kPa) IV	ODF Existing (Self-weight Peat Only) 0	ODF Permanent Surcharge Peat 0+I	ODF Variable Load Construction 0+II	ODF Permanent Surcharge Floating Road 0+III	ODF Variable Load Crane 0+III+IV
T4-1	207187	384554	4.5	10	3	1.2	10	13.3	20.7	10.3	2.27		1.64		
T4-2	207200	384557	5.9	10	2	1	10	13.3	20.7	10.3	1.39		1.07		
T4-3	207207	384554	5.7	10	3.5	1.7	10	13.3	20.7	10.3	1.48		1.13		
T4-4	207216	384557	7.3	10	5.5	1.7	0	13.3	20.7	10.3	1.81	1.81	1.47	1.41	1.24
T4-5	207222	384583	5.2	10	3.5	1.8	10	13.3	20.7	10.3	1.53		1.15		
T4-6	207224	384560	5.0	10	6	2	0	13.3	20.7	10.3	2.46	2.46	1.83	1.74	1.46
T4-7	207244	384563	4.8	10	4	1.9	0	13.3	20.7	10.3	1.80	1.80	1.32	1.26	1.05
T4-8	207245	384554	4.1	10	4.5	3.1	10	13.3	20.7	10.3	1.45		1.02		
T4-9	207264	384590	3.0	10	7	3.2	0	13.3	20.7	10.3	2.99	2.99	1.90	1.77	1.40
T4-10	207266	384572	3.0	10	7	4.4	0	13.3	20.7	10.3	2.18	2.18	1.38	1.29	1.02
T4-11	207286	384580	2.2	10	7	3.8	0	13.3	20.7	10.3	3.44	3.44	1.92	1.77	1.35
T4-12	207299	384608	2.0	10	5	3.6	0	13.3	20.7	10.3	2.85	2.85	1.53	1.40	1.05
T4-13	207306	384592	3.0	10	6	3.8	0	13.3	20.7	10.3	2.16	2.16	1.37	1.28	1.01
T4-14	207337	384609	3.0	10	8	3	0	13.3	20.7	10.3	3.64	3.64	2.31	2.16	1.71
T4-15	207358	384695	4.9	10	3.5	1.5	10	13.3	20.7	10.3	1.95		1.44		
T4-16	207363	384670	3.6	10	4	2	10	13.3	20.7	10.3	2.28		1.54		
T4-17	207366	384625	1.0	10	9	3	0	13.3	20.7	10.3	12.30	12.30	4.51	4.01	2.79
T4-18	207395	384623	0.7	10	15	2.2	0	13.3	20.7	10.3	39.90	39.90	11.50	10.08	6.80
T4-19	207408	384688	4.0	10	3	1.5	10	13.3	20.7	10.3	2.05		1.43		
T4-20	207431	384669	1.1	10	7	2.3	10	13.3	20.7	10.3	11.34		4.41		
T4-21	207444	384652	1.6	10	5	3.0	10	13.3	20.7	10.3	4.27		2.05		
T4-22	207454	384629	1.4	10	9	3.0	10	13.3	20.7	10.3	8.79	5.13	3.93	3.54	2.56
T4-23	207457	384693	3.5	10	4	2.2	10	13.3	20.7	10.3	2.13		1.42		
T4-24	207459	384614	1.8	10	5	3	10	13.3	20.7	10.3	3.80		1.94		

REF: Ionic Construction MNBG r057 Rev B Peat Stability

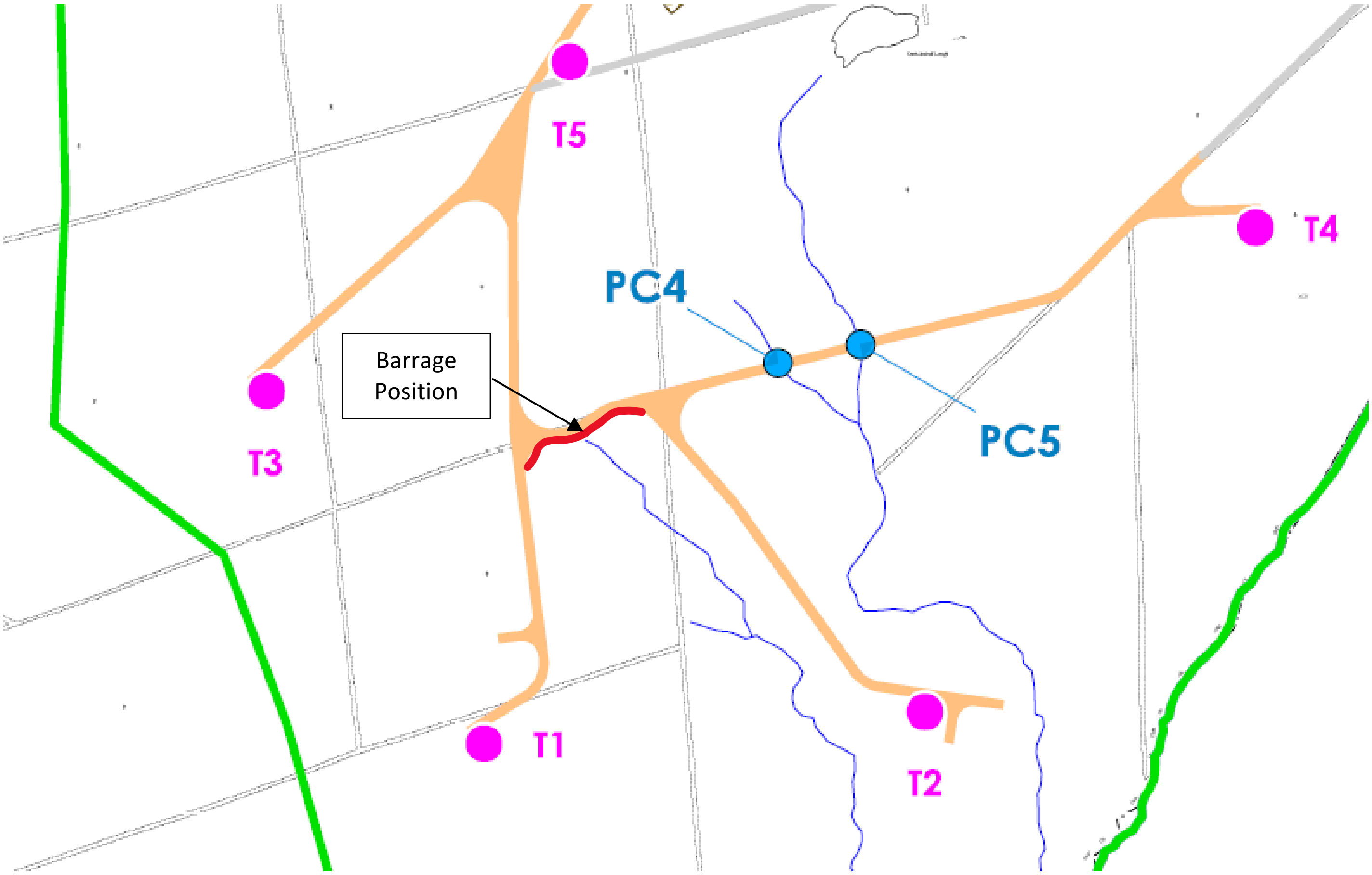
Appendix D Peat Depth Map



SURFACE LEVEL DATA			
NUMBER	MIN. PEAT DEPTH	MAX. PEAT DEPTH	COLOUR
1	0.00	1.00	
2	1.00	2.00	
3	2.00	3.00	
4	3.00	4.00	
5	4.00	5.00	
6	5.00	6.00	
7	6.00	7.00	
8	7.00	20.00	

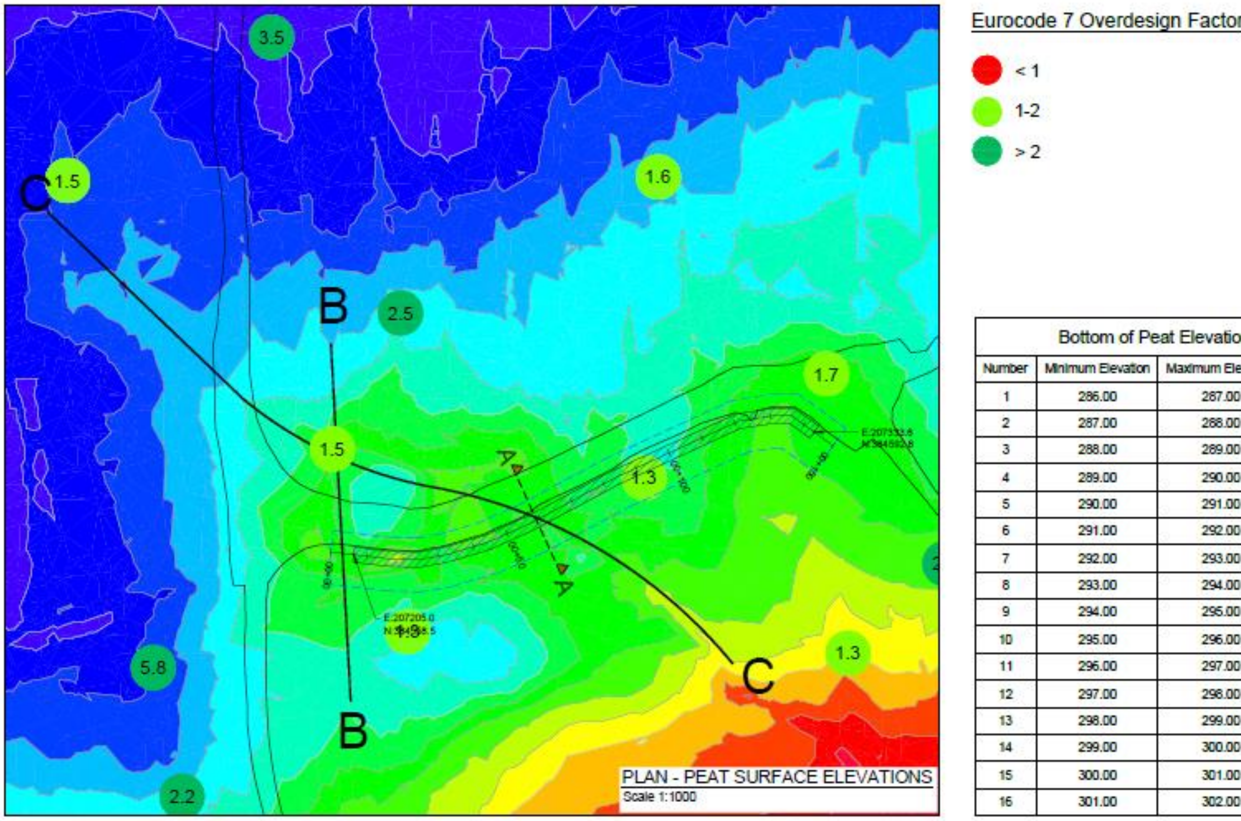
REF: Ionic Construction MNBG d018.4.4

Appendix E Site Drainage



Ref: HES DWG Nr. P1249-2-1117-A3-909-00A

Appendix F Potential Flow Path



Bottom of Peat Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area	Color
1	286.00	287.00	260.39	
2	287.00	288.00	700.11	
3	288.00	289.00	1308.27	
4	289.00	290.00	1360.19	
5	290.00	291.00	1217.11	
6	291.00	292.00	1676.63	
7	292.00	293.00	3056.39	
8	293.00	294.00	5016.27	
9	294.00	295.00	4812.44	
10	295.00	296.00	6526.49	
11	296.00	297.00	7322.17	
12	297.00	298.00	6205.29	
13	298.00	299.00	7980.21	
14	299.00	300.00	9786.20	
15	300.00	301.00	4141.62	
16	301.00	302.00	2.13	

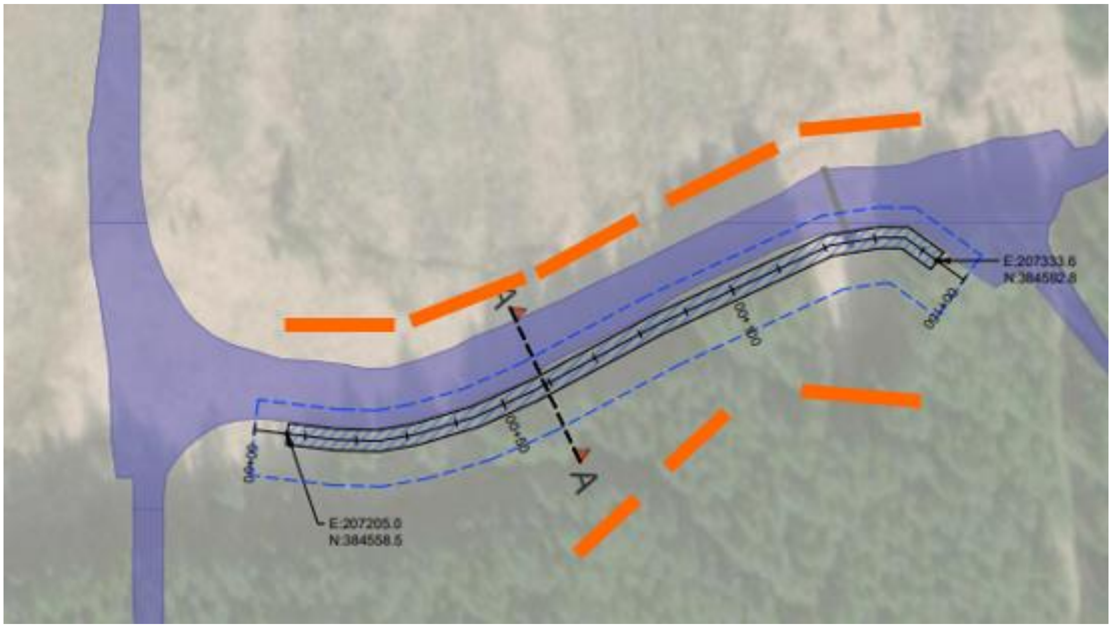
REF: Ionic Construction MNBG d018.4.4

Appendix G Peat Monitoring Locations

No	Location	Comments
1	Junction of access road to T1 with spur to T2 and T4 along downslope margin	Area of deepest peat in close proximity to concave break in slope
2	Along access to T3 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
3	Along access to T2 about 100m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
4	Along access to T4 about 150m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
5	Along access from T5 to T3 about 200m from T5 along downslope margin	Area of deeper peat in close proximity to concave break in slope
6	Junction of access road to T7 about 100m along access to T7 along downslope margin	Area of deeper peat in close proximity to concave break in slope, within potential area of 12 November failure
7	South side of upper scar of 12 November failure	To monitor potential retrogression of scar upslope
8	On downslope margin of T7 base and hard stand prior to construction	To be installed in advance of any works
9	On downslope margin of T10 base and hard stand	Area of peat in close proximity to concave break in slope
10	Along access to T14 about 100m from hard stand along downslope margin	Area of peat in close proximity to concave break in slope
11	Along access to T18 at about chainage 1600m along downslope margin	Area of potential peat close to river
12	Along access to T16 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope and minor instability
13	Peat storage berms at T15	Minor signs of movement/distress. Where necessary the berm size is to be increased.
14	Peat storage berms at T17	Minor signs of movement/distress. Where necessary the berm size is to be increased.
15	Peat failure scar above road to T7	Upper scar of 12 November 2020 peat failure. Potential for retrogression of failure scar.
16	Peat failures at Borrow Pit between T5 and T6	Comprises 3 peat failures at this location. Monitoring at the head of each failure.
17	Peat failure at T12	Head of failure downslope of access road. Monitoring at the head of failure.
18	Instability at T5	Series of concentric tension cracks within the insitu peat
19	Instability at T16	Minor slumping of insitu peat
20	Ch.2630 on the north side of the S-bends on the approach road into the site	Stockpile caused a localised ground movement in the peat below the stockpile

Ref: Fehily Timoney Peat Stability Assessment of Meenbog wind farm Jan 2021

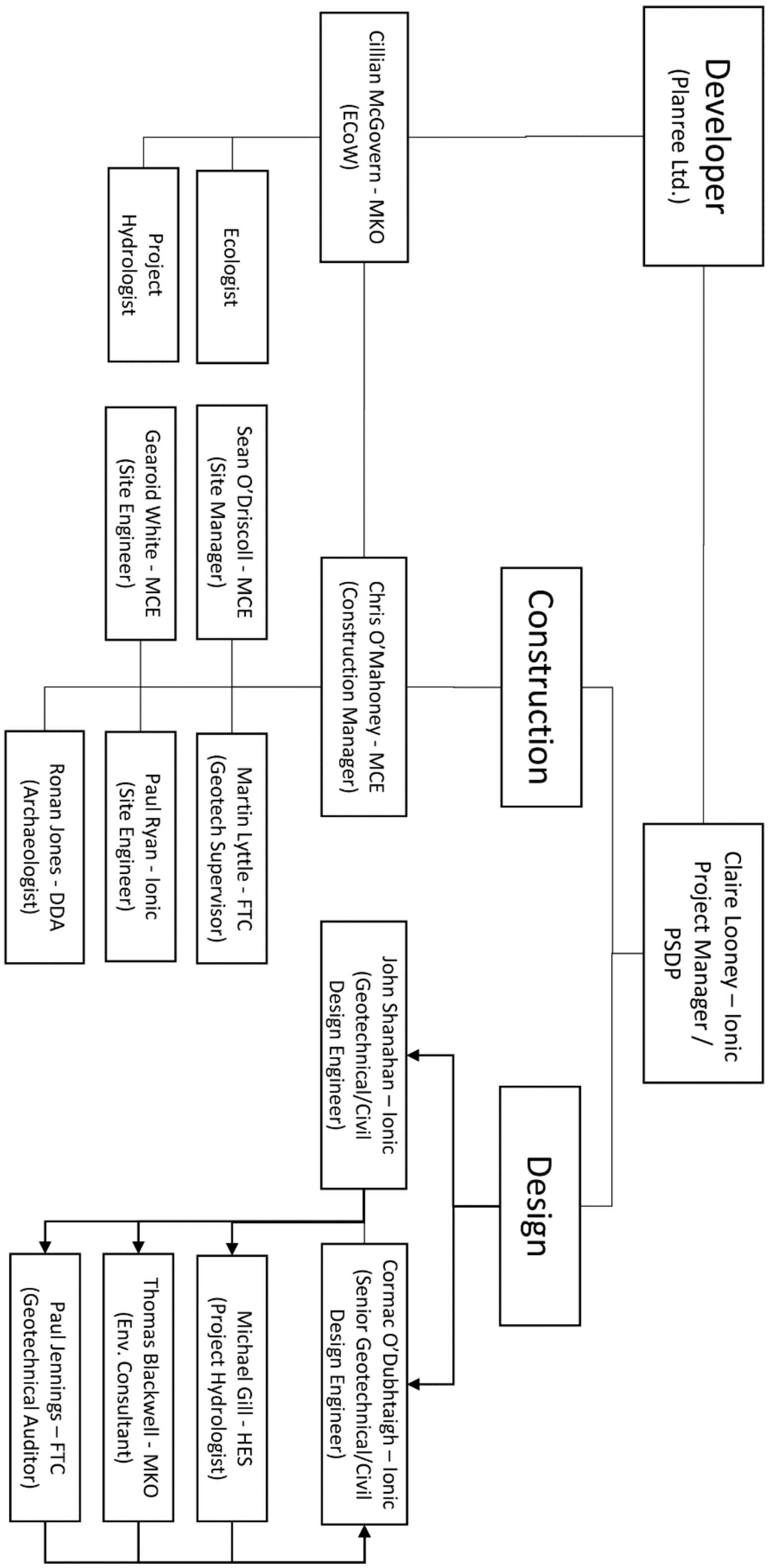
Appendix H Additional Peat Monitoring Locations



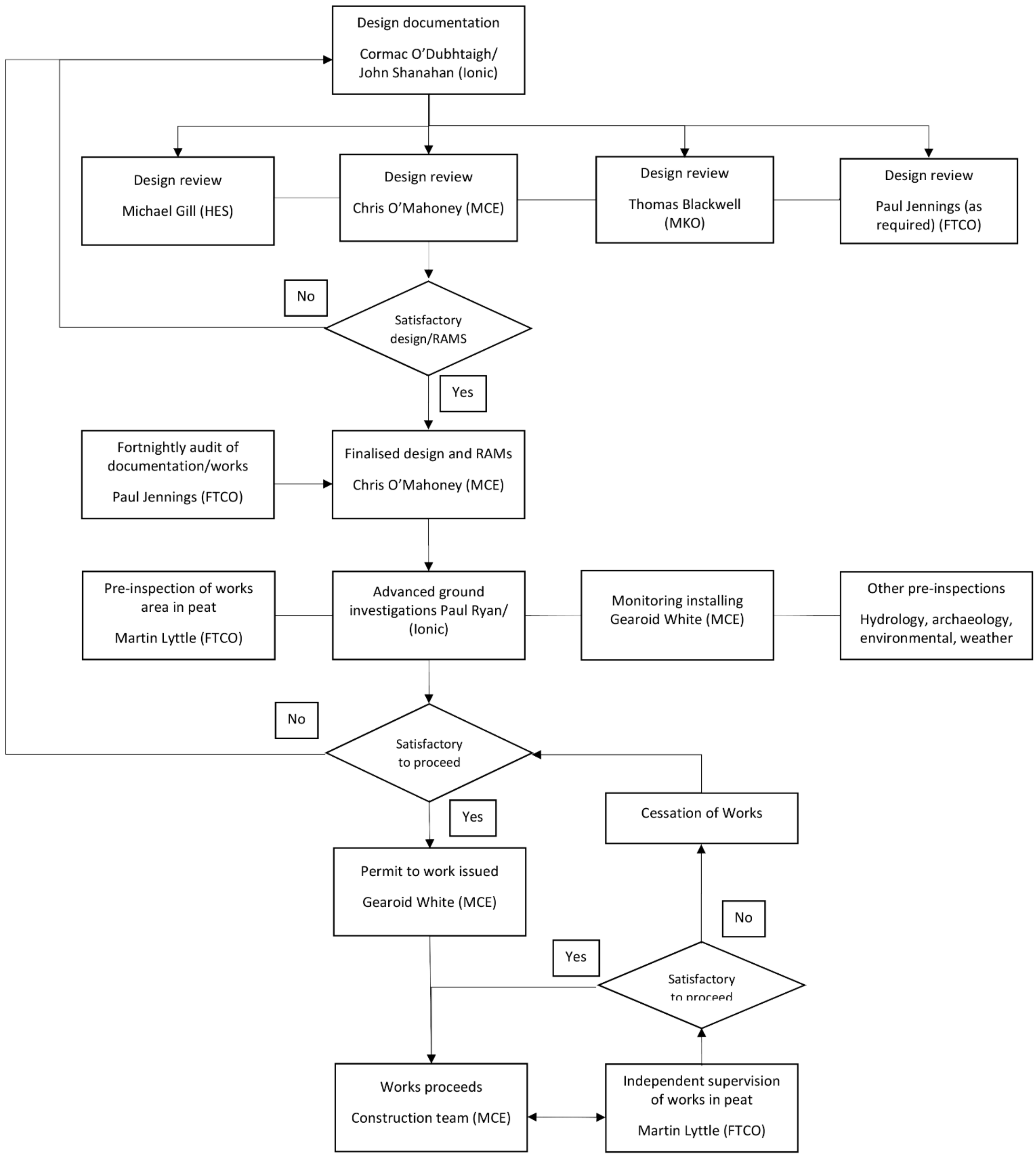
Additional Peat Monitoring Posts

Appendix I Project Organogram & Flow Chart

Organogram:



Design & Construction Flow Chart:



10.0 Risk Assessments

Assessing Level of Risk

Likelihood →

Severity ↓

0	1	2	3
1	1	2	3
2	2	4	6
3	3	6	9

Likelihood			Severity		
1	=	Low	1	=	Slight
2	=	Medium	2	=	Serious
3	=	High	3	=	Major

Likelihood x Severity = Risk Rating

1 to 3	**Low**	**Work can proceed with control measure in place.**
4 to 6	**Medium**	**Work can proceed with control measures in place to reduce risk.**
7 to 9	**High**	**More control measures needed to reduce risk.**

Controls

Management must determine the controls required to eliminate or mitigate against the risks identified in the risk assessment. These controls must be consistent with the operational experience of employees and in accordance with the principles of prevention detailed below. They should also indicate any facility requirements and training needs. These controls are documented on the risk assessments.

MCE Ltd – T1 – T2 Road Upgrade

THIS RISK ASSESSMENT TAKES ACCOUNT OF THE FOLLOWING:
MCE SAFETY STATEMENT, MCE FULL SAFETY STATEMENTS HAZARD IDENTIFICATION & RISK ASSESSMENT, THE METHOD STATEMENT FOR THESE WORKS & THE PSCS CONSTRUCTION STAGE SAFETY PLAN.

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Peat Movement **Risk:** ➢ Slippage of peat ➢ Engulfment of personell or machinery ➢ Damage to the environment	2	3	6	➢ 14nr. peat monitoring stations installed ➢ Checked weekly. Stations in immediate vicinity checked daily. ➢ Works location probed and shear vaned – 50m grid outside of works area ➢ No works during periods of excessive rainfall see CEMP 5.2.2 ➢ No stockpiling of peat on top of in-situ material	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Excavation / Trenches **Risk:** ➢ Falls. ➢ Entrapment. ➢ Suffocation. ➢ Crushing. ➢ Impact with machinery. ➢ Drowning. ➢ Electrocution. ➢ Serious bodily injury / fatality.	3	3	9	The Construction Regulations, 2013 must be complied with regarding all excavations. Verify ground conditions and soil type before excavating. No ground to be considered safe until investigated by a competent person. ➢ Schedule work so that excavations are not open for longer than necessary. ➢ Find, locate and mark all underground services. ➢ Organise suitable plant, equipment and required working space. ➢ Organise delivery and inspection of support materials / equipment.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	
				➢ Provide appropriate protective clothing and equipment. ➢ Provide suitable barriers to protect against the fall of persons at work, materials or objects, including the inrush of water into the excavation. ➢ Provide adequate secured ladder and/or ramp access/egress to excavations. ➢ Most extracted spoil will be hauled away but any residual material will be stockpiled away from excavation edge at all times. ➢ Safe System of Work Plan should be completed for each task or a specific method statement completed and a new SSWP should be completed when the task or the environment changes. ➢ AF 3 to be completed as required by a competent person. ➢ Where there is a risk involved with a trench and/or an excavation, adequate precautions must be taken to protect against danger to persons at work from a fall or dislodgement of earth, rock, or peat, by suitable shoring or batter back edge to a safe angle of repose. ➢ If other methods are to be specified they must be selected based on the results of a risk assessment and a Temporary Works Design				

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				Certificate will be prepared & issued. ➢ Appropriate precaution to be in place to protect the person carrying out the shoring				
Hazard: Movement & Use of Excavator **Risk**: ➢ Collisions. ➢ Overturning. ➢ Loss of Control. ➢ Risk of serious or fatal injury to the operator and bystanders in the vicinity due to Overturning. ➢ Collisions and loss of control or collision with other plant or vehicles.	3	3	9	➢ Excavators to be driven by trained, experienced operators, trained to CSCS level, as per the Construction Regulations, 2006. ➢ Driver to carry out weekly documented checks. ➢ Defects or suspected defects to be reported immediately to the Supervisor. ➢ Regular servicing and maintenance to be carried out and properly recorded. ➢ Warning signs to be posted at strategic locations to alert persons to the movements of excavators. ➢ Drivers of smaller vehicles must ensure that excavator drivers, when operating nearby, can see them. ➢ Where a workplace or a site road is close to an open edge, the edge must be clearly marked and lined with boulders and safety barriers. ➢ Site roads not to exceed a gradient of 1 in 5.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
				➢ Test certificates and form GA2 required for excavators used as lifting equipment.				
Hazard: Excavator – Various Risks **Risk:** ➢ Falls - Injury to driver entering or getting out of the cab ➢ Passengers ➢ Noise Partial /Total loss of hearing ➢ Dust ➢ Risk of serious ➢ Health damage from dust	2	3	6	➢ Hand and footholds to be fitted and maintained in good condition. ➢ Machine lights to be properly maintained. ➢ Carriage of passengers on any part of an excavator is not allowed. ➢ Machine to be stopped and switched off before any person including maintenance persons are permitted on the footsteps. ➢ Earmuffs to be provided and their wearing compulsory where noise levels reach 85Db or more. ➢ Cabs to be maintained to keep out dust. ➢ Proper masks to be provided and worn.	2	1	2	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Site Dumper / Lorries **Risk**: ➢ Overturning/Loss of control ➢ Collision ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Pedestrians ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Passengers ➢ Fall from dumper ➢ Fall underneath ➢ Loading ➢ Falling material ➢ Fire	3	3	9	➢ Only trained, experienced and authorised drivers to operate dump trucks/dumpers/lorries. ➢ Drivers must hold a CSCS Ticket (or recognised alternative). ➢ Each driver to carry out daily visual checks on their vehicles, to ensure that they are in safe working order. ➢ All dump trucks/dumpers must have all safety devices fitted as required in the Construction Regulations, 2006, S.I. 504, Schedule 6, Regulation 87. ➢ Safety belts are recommended for all existing and new dump trucks and where fitted they must be worn. ➢ Suspected defects must be immediately reported to your Supervisor. ➢ Regular recorded maintenance to be carried out. ➢ As a general rule, all other traffic gives way to loaded dump trucks. ➢ Lay-bys to be provided where dump trucks are likely to meet other traffic. ➢ Where a haul road passes near open edges, the edges are to be clearly marked and lined with large boulders or other safety measures and kept clean.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	
				➢ Workings must be designed so that gradients do not exceed 1 in 5. ➢ Safety warning signs are to be posted at strategic areas to alert persons to movements of dump trucks and other vehicles. ➢ Pedestrians told to ensure that they keep clear of dump trucks, wear high visibility clothing, and ensure that the driver can see them. ➢ No pedestrians may go under an open edge while a dump truck is in operation above. ➢ Persons driving small vehicles must ensure that the driver of dump trucks can see them. ➢ No persons to be carried on any part of a dump truck, unless there is provision in the cab and they are authorised to be carried. No riding permitted on the foot steps. ➢ Drivers cab must always be protected by an overhead shield built into the body of the truck. ➢ Driver to remain inside the cab at all times during loading. ➢ Hand and foot-holds must always be provided to aid safe ascent to/decent from the dump truck.				

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd.

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Tractor & Trailer **Risk:** ➢ Falls. ➢ Entrapment. ➢ Crushing. ➢ Impact with machinery. ➢ Serious bodily injury / Fatality. ➢ Collision.	3	3	9	➢ Wear hi-visibility vest and hardhat when working with moving equipment. ➢ Keep in operator's line of view. ➢ Don't travel on equipment. ➢ Watch out for objects nearby, particularly when reversing. ➢ Don't overload a trailer or stack it too high. Secure any loose loads. ➢ Use flashing amber beacon ➢ Trailer must be correctly attached to tractor (i.e safety chain, brakes and lights). ➢ Competent operators must only operate tractor. ➢ Tractors and trailers must be inspected before use.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Persons affected by the works **Risk:** ➢ Struck by site traffic. ➢ Fatalities ➢ Serious injuries	3	3	9	➢ Traffic Management Plans and Drawings are approved and made available. These plans will detail access routes both internal and external. ➢ All warning signs, cones with barriers are in place prior to the commencement of work on site. ➢ All signs will be clean and clearly visible. ➢ Once signs are in place the site access route will be assessed to ensure adequate visibility for drivers and pedestrians.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
				➢ All signs will be secure and weighted down where appropriate. ➢ All personnel onsite & on public roads will wear high visibility vests or jackets. . ➢ Contractor vehicles will be parked with consideration given to site traffic access.				
Hazard: Lifting Equipment **Risk:** ➢ Serious personal injury. ➢ Fatalities. ➢ Collision. ➢ Machine overturning. ➢ Material falling from height.	3	3	9	➢ The site management of MCE Ltd must ensure a competent person inspects the lifting equipment every 12 months and a GA1 is obtained. This must be available for inspection. ➢ Under the Construction Regulations, 2006 the lifting equipment must be inspected weekly by the operator and the results must be recorded on a GA2. ➢ A thorough visual inspection should take placed before the driver operates the machine. ➢ The driver must be trained and competent to operate the machine (FAS CSCS standard or alternative excepted standard). ➢ All telescopic handlers/excavators must have safety devices fitted as per the Construction Regulations, 2006 S.I 504, Schedule 6, Regulation 87.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Working in reduced light **Risk:** ➢ Fatalities ➢ Serious injury	3	3	9	➢ Working in diminished light is not permitted under the normal work rules. ➢ In cases where permission is granted so as enable MCE Ltd to remain in keeping with the project program or for special activities, concrete pours for turbine bases, etc and work in hours of reduced light is conducted, adequate lighting will be provided at all times. ➢ Any temporary work lighting will be erected with due regard to the visibility of plant operators and other traffic on site. This shall be the duty of MCE Ltd and any special arrangements will be documented in method statements, SSOW or traffic management plans. ➢ High visibility jackets are to be worn at all times regardless.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Chemicals **Risk:** ➢ Eye injury / loss. ➢ Skin infection. ➢ Burns. ➢ Inhalation. ➢ Ingestion with food. ➢ Fire.	3	3	9	➢ Safety Data Sheets to be obtained for all chemicals and strictly followed. ➢ Copies to be available in case of an emergency. ➢ Containers to be properly labelled (hazard signs). ➢ Safe storage and dispensing of chemicals to be practiced.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Explosion. ➢ Serious personal injury. ➢ Fatalities.				➢ Follow manufacturer's requirements for handling, mixing, storage and first aid etc. ➢ Personal Protective Equipment to be provided and used. ➢ Training to be provided for staff working with chemicals. ➢ Familiarisation to be provided with the emergency procedure to all staff. ➢ Best possible hygiene procedures to be in place and enforced by Management. ➢ Sources of flame / ignition to be eliminated where flammable materials are used and / or stored. ➢ Spillage's to be immediately dealt with.				
Hazard: Lone Working **Risk:** ➢ Personal injury. ➢ Fatalities. ➢ Violence toward staff. ➢ Delay in treating medical emergencies.	3	2	6	➢ The company policy is that lone work is a last resort and must only be used for minor tasks. A system for communication with management must always be maintained. If lone working is required in keeping with the project programme it will be pursued under the following controls: ➢ The person must be trained & competent to carry out the tasks required.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ A means of communication must be available for the lone worker to contact foreman and the lone worker will be contacted at regular intervals during the anticipated work period. ➢ The lone worker must report he is leaving site to a designated person, this will be either the site manager or an appointed person. ➢ Periodic visits must be made to the lone worker, where possible. ➢ The lone worker must be furnished with the telephone numbers & emergency procedures information.				
Hazard: Roadworks **Risk:** ➢ Obstruction of Public. ➢ Injury to Public. ➢ Insufficient clearance between traffic routes. ➢ Collision. ➢ Accident or Bodily Injury.	3	3	9	➢ A Traffic Management Plan will be formulated for internal site roads. ➢ The main bulk of traffic will be generated with concrete pours and a traffic management plan will be created with concrete supplier and MCE Ltd. ➢ Communication will be maintained between MCE Ltd., and other civil contractors about traffic activities and all parties will be notified when pouring is taking place.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Fuel storage / refuelling **Risk:** ➢ Fire ➢ Burns ➢ Skin & Eye Irritant ➢ Dermatitis ➢ Environmental ➢ Slip / Fall	3	3	9	The risk of spilling fuel is at its greatest during refuelling of plant. To minimise this risk MCE Ltd will implement the following: this list is not exhaustive: ➢ Refuel will take place on a base away from drains or watercourses. ➢ A bunded bowser will be used. ➢ All refuelling and bulk deliveries will be are to be supervised. ➢ Check the available capacity in the tank before refuelling ➢ Check hoses and valves regularly for signs of wear ➢ Turn off valves after refuelling and lock them when not in use ➢ Position drip trays under pumps to catch minor spills ➢ Keep a spill kit with sand, earth or commercial products for containment of spillages.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix				
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd.

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	
Hazard: Public accessibility to work area on site. **Risk:** ➢ Serious personal injury. ➢ Fatality. ➢ Slips, trips, fall over goods, materials, rough terrain. ➢ Electrocution. ➢ Theft.	3	3	9	➢ Warning signs must be posted to highlight the dangers involved in entering work area, where MCE Ltd are responsible for site conditions e.g. turbine bases. ➢ All access points to work areas to be closed / barricaded to prevent access to unauthorised persons. ➢ Entrances must be fully secured each evening / end of each work shift. ➢ Only authorised personnel are allowed on site. Signs must be erected re same. ➢ A responsible person must check site boundaries on a regular basis.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Visitors **Risk:** ➢ Personal Injury ➢ Property damage ➢ Cuts ➢ Puncture ➢ Entanglement ➢ Eye Injuries ➢ Electrocution	3	3	9	➢ All visitors must report to an employee or authorised person of MCE Ltd before entering the premises or area where we work. ➢ Those making deliveries must report to site office. ➢ No visitor to the premises is allowed to use company equipment without permission of the company staff and instruction on its use. ➢ Each visitor is requested to abide by the Company Safety Policy and Regulations laid down therein. ➢ They must also abide by a request by a company	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				employee in relation to their own Safety and Health and that of the company employees. ➢ In the event of an emergency or evacuation, all visitors must report to our designated Assembly Point in car park				
Hazard: Contractors **Risk:** Serious personal injury.	3	3	9	➢ We will monitor the ongoing activities of all sub contractors to MCE Ltd on our projects. ➢ Induction training must be provided for Contractors, their staff and all others on site. ➢ Presentation of Site Safety Plan by Sub-Contractor to the Supervisor. ➢ A Method Statement must be prepared for each necessary job by the Contractor and Sub-Contractors.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: First Aid Equipment. **Risk:** ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Adequate first aid kits to be provided and filled to HSA guidelines. ➢ They must be regularly checked and refilled by a designated person.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Lack / Absence of First Aiders **Risk:** ➢ Improper diagnosis ➢ Improper treatment ➢ Delay in seeking professional ➢ medical help. ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Sean O'Driscoll and Chris Murnane are trained first aiders ➢ Arrangements to be in place with local doctor for emergencies. ➢ All employees to be aware of emergency procedures.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Personal Protective Equipment (P.P.E.) **Risk:** ➢ Impact from flying particles. ➢ Head injury. ➢ Foot injury. ➢ Falls from height. ➢ Burns or skin irritation etc.	2	3	6	➢ All necessary Personal Protective Equipment to be provided and used. ➢ Safety Signs to be put up to highlight this requirement. ➢ COMPULSARY SITE P.P.E.: ○ Hard hat. ○ High visibility clothing. ○ Safety boots / shoes.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Manual Handling **Risk:** ➢ Back. ➢ Neck. ➢ Shoulder Injury.	3	2	6	➢ All MCE Ltd staff and subcontractors employees must be trained in Manual Handling. ➢ In Accordance with the General Application Regulations 2007, No 69, an employer must ensure that	3	1	3	- Site Supervisor (Foreman)

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
➢ Prolapsed Disk. ➢ Permanent Injury. ➢ Trip / Fall. ➢ Hit Against. ➢ Dropped Object.				he/she takes appropriate organisational measures, or use the appropriate means, in particular mechanical equipment, to avoid the need for the manual handling of loads. ➢ Minimise all manual-handling tasks where possible. ➢ Provide suitable mechanical handling equipment Ensure these are used. ➢ Provide Manual Handling training to all staff whom have not received it. ➢ Personal Protective Equipment including gloves to be provided and used.				- Site Operative
Hazard: Poor Hand Hygiene **Risk:** ➢ Skin complaints. ➢ Dermatitis. ➢ Eczema. ➢ Ingestion of chemicals. ➢ Biological agents: • toxins, • bacteria and • viruses.	2	2	4	➢ Good hand hygiene is essential in the workplace. The hands are the most likely part of the body to come into contact with harmful substances. ➢ Wash hands before eating or smoking. ➢ Suitable gloves should be worn when handling potentially hazardous materials. ➢ Dirty hands should be cleaned using proper skin cleansing products.	2	1	2	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Do not clean hands with petrol, white spirits, thinners, turpentine etc. ➢ Always ensure you wash your hands after visiting the toilet.				
Hazard: Animals • Rats /mice. • Wasps /bees. • Small animals. • Dogs. **Risk:** ➢ Leptospirosis(Weil's Disease) ➢ Stings. ➢ Histoplasmosis ➢ (droppings) ➢ Fall from height. ➢ Sudden 'fright'. ➢ Bites.	2	2	4	➢ When working near water or where rats have been seen, care is to be taken to disinfect all cuts and cover them with waterproof plasters. ➢ Be aware that sudden movements of birds or small animals can cause a reflex action in the operator, which may overbalance them. ➢ Check for signs of nests, birds or other small animals. ➢ Practice caution if dogs are present.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Weather ➢ Sun ➢ Wind ➢ Rain ➢ Ice / snow **Risk:** ➢ Sun burn. ➢ Sunstroke. ➢ Skin cancer. ➢ Fall from height. ➢ Slip / fall.	2	2	4	➢ In sunny weather, cover the back of the neck and keep a shirt on at all times. ➢ Avoid sunburn and sun stroke where possible by keeping covered and wearing a high factor sun block. ➢ Be aware that strong winds or gusts can overbalance an operator. ➢ Don't work in heavy rain unless adequately protected.	2	1	2	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Bodily injury. ➢ Hit by object. ➢ Hypothermia.				➢ Be prepared for slippery conditions in icy weather. Salt or grit should be used where necessary.				
Hazard: Working near Water **Risk:** ➢ Drowning: ➢ Public and Workers	3	2	6	➢ Fencing and warning signs to be in place around deep water. ➢ Workers must operate in pairs at all times. ➢ Where necessary, suitable lifebuoys to be available in case of emergency and checked regularly.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Portable Electricity Generator **Risk:** ➢ Fire. ➢ Burns. ➢ Re-fuelling. ➢ Electrocution. ➢ Bodily injury. ➢ Back injury. ➢ Trip / fall.	3	3	9	➢ Store in a dry position and away from pedestrian routes. ➢ Fill petrol tank when the generator is cold. ➢ Avoid spillages when re-fuelling. Clean up any overspill immediately. ➢ Move fuel can a safe distance away. ➢ Ensure filler cap is securely replaced. ➢ To be operated by trained personnel only. ➢ To be maintained in good condition. ➢ Always inspect before use (i.e. oil / petrol level, electric connections not broken).	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Abrasive Wheels, Consaws and Angle Grinders **Risk:** ➢ Wheels shattering at high speed. ➢ Serious facial / head injury. ➢ Cuts / wounds to hands, arms, upper body. ➢ Eye injury. ➢ Fire / explosion. ➢ Electric shock. ➢ Hand Arm Vibration Syndrome – white finger. ➢ Respiratory problems. ➢ Injury to bystanders.	3	3	9	➢ Training must be provided as per the Abrasive Wheels Regulations, 1982 by MCE Ltd. ➢ Only trained and authorised personnel must be allowed to use abrasive wheels. ➢ The operator must carry out daily inspection. ➢ Guards must be in place at all times, when machine is being used. ➢ If electrically powered use 110v equipment only. ➢ Store petrol for consaw in correct approved containers. ➢ Always refuel away from the work area. ➢ Do not use consaw close to other people. ➢ Correct Personal Protective Equipment must be worn at all times. (Gloves, ear protection, eye protection and steel toe capped boots). ➢ Inspect work area for all dangers prior to using abrasive wheels. ➢ A hot work permit may be required from management/site foreman. ➢ Use correct discs. Store them safely when not in use. ➢ Turn off consaws and unplug grinders when not in use.	3	1	3	- Site Supervisor (Foreman) - Site Operative

"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
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MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	

"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
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MCE Ltd – T1 – T2 Road Upgrade

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	

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MCE Ltd.

MS MNG 16038

T4 FLOATING ROAD UPGRADE

Prepared By: Christopher O'Mahony

Signed: ………………………………　　　　**Date: … …26/08/2021…………**

Reviewed By: Sean O'Driscoll

Signed: ………………………………　　　　**Date: … …26/08/2021…………**

1.0 Method Statement-MNG 16038

Project Name:	Meenbog Wind Farm.		
Contractor:	MCE Ltd, Lissarda Industrial Estate, Lissarda, Co. Cork		
Method Statement Title:	**T4 Floating Road Upgrade**		
Method Statement No.:	MNG - 16038		
Prepared by:	Chris O'Mahony		
Date Prepared:	26/08/2021	**Revision**	004-26/08/2021
Specific Training Required:	Solas Safe Pass, Site Induction, EIA Training, CSCS Plant Ticket (where required).		
Relevant Legislation:	Safety, Health & Welfare at Work Act 2005 Safety, Health & Welfare at Work (General Application) Regulations 2007 Safety, Health & Welfare at Work (Construction) Regulations 2013		

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2.0 Statement Brief

Meenbog wind farm is comprised of 19 wind turbine generators, one 110kv substation and one meteorological mast along with associated roads, hardstands and other associated infrastructure. The road infrastructure to the south of T5 has been designed and constructed as ‘floating roads’. Onn recommendation from Ionic Consulting, a short section of the T4 access road is to be upgraded as it is potentially unstable under the heavy loading imposed by turbine erection crane. The road has an overdesign factor of >1 for all other load cases including permanent and construction loading. A cautious approach is being taken to increase the factor of safety before any cranes or heavy turbine components are delivered. It is proposed to rebuild the section of road to solid sub-base and realign the final 100m to the original planning alignment correcting a deviation imposed by the turbine supplier specifications during the design process. This method statement details the methodology for these works.

The Meenbog Site is primarily made up of rural and agricultural land, upland bog, commercial bog and forestry. Access to site may be shared with local domestic and commercial traffic and due care and attention should be taken at such access points. There is public access to the site and all contractors must conduct their activities in a manner that both protects and facilitates the general public in their enjoyment of the site. See site layout, Figure 1.0.

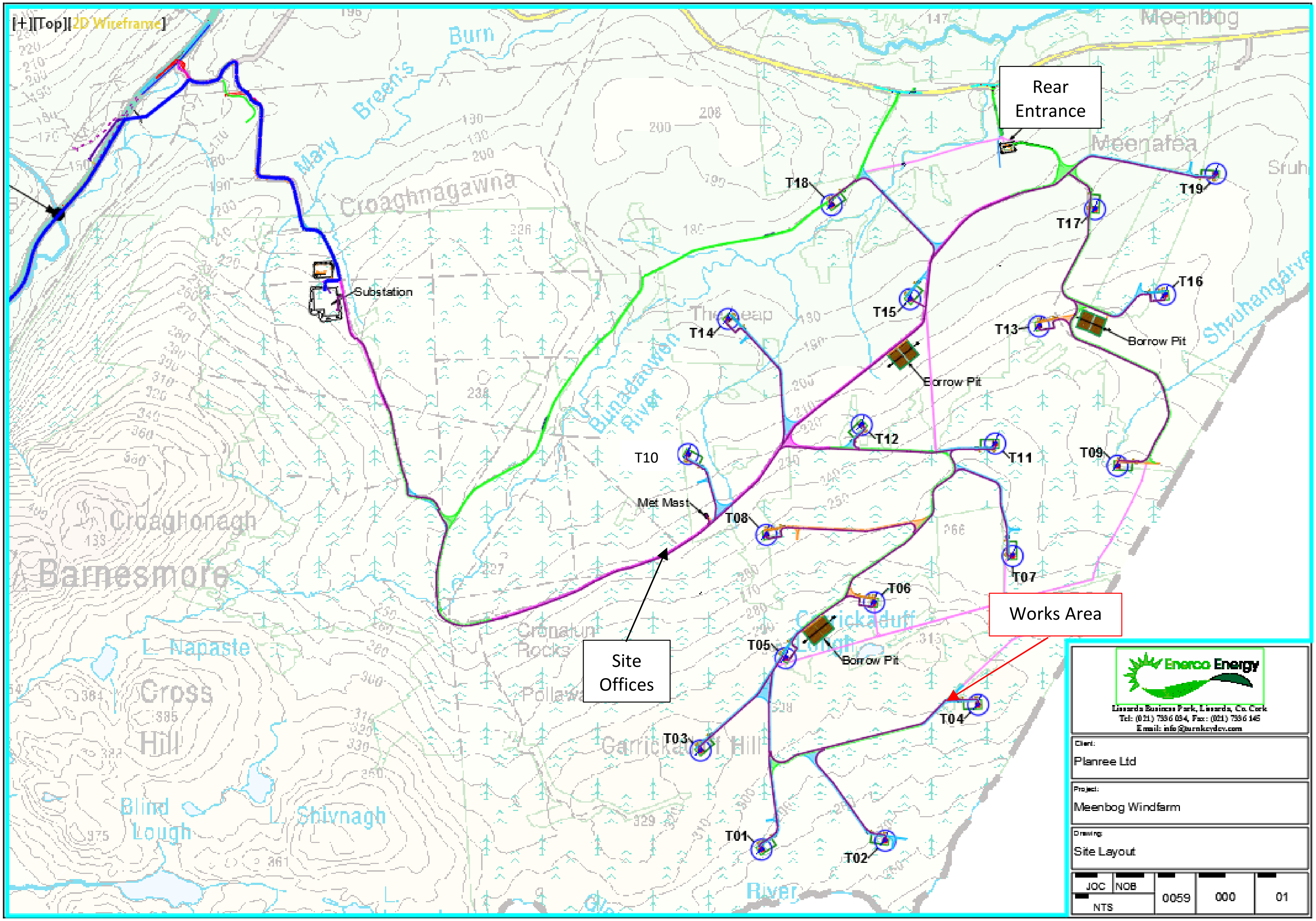


Fig 1.0 Meenbog Site Layout

2.1 Works Location

Meenbog Wind Farm & Substation entrance is located approximately 13km South West of Ballybofey and 14km North East of Donegal Town. All operatives are to text MCE ltd operational controller when arriving onto site and again when leaving in the evening. The contact number is 086-8032620.

3.0 Restrictions / Precautions

Description	Yes	No
Work located near **Underground services**		√*
Work located near **Overground services**		√**
Work located near **SAC / NHA**	√***	
Work located near **Watercourses / Streams**	√****	
Work located near **Steep Slopes**	√*****	
Work located near **Hillwalkers**	√******	

* = underground cables.
** = overhead power lines.
*** = Special Area of Conservation / National Heritage Area.
**** = Drainage measures to be put in place to ensure that no damage is caused to local watercourses in conjunction with Environmental consultant recommendations.
***** = Some road surfaces may be in close proximity to steep slopes.
****** = Hillwalkers frequent the development area and operatives have been made aware of their presence.

3.1 General Precautions

Prior to any works commencing all personnel onsite will be inducted by a MCE supervisor and will sign up to the relevant RAMS before commencing any work onsite. A number of other points to note include;

- GA2 forms to be completed weekly with a copy of the GA1 left in the machine at all times.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have SOLAS Safe Pass training or equivalent training
- First aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times with additional PPE as required.
- A competent foreman will be on site at all times.
- No excavations to be left open at the end of each day.

4.0 Environmental Emergency Procedures

4.1 Excessive Peat Movement

There are a series of 20 monitoring locations across the site with trigger levels of 100mm recommended. (see appendix F). For this section of work a number of additional posts will be installed (see appendix H). Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All construction activities shall cease within the affected area.
(2) Further peat stability assessment completed
(3) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
(4) Recommencement of limited construction activity shall only start following a cessation of movement and completion of a geotechnical risk assessment by a geotechnical engineer.

4.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Where considered possible, action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on land prevention measures, in this case a watercourse check barrage will be implemented.

(3) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

4.3 Reaction to Peat Slide

In the event that there is a significant movement of peat, MCE will follow a specific set of procedures, namely,

- MCE Site management will be contacted
    - Gearoid White: 086-0211525
    - Chris O'Mahony: 086-0329552
- Site management will ensure all employees and equipment are accounted for
- Area will be designated a 'no-go' zone until instructed otherwise
- An initial rapid assessment will be made to determine the immediate risks to personnel within the site, members of the public and the local environment
- If deemed necessary, measures may be taken to make the area safe in the short term
- MCE management and consultant engineers, will be contacted, notified of the situation and site staff will await further instruction
- In the event of a notable peat movement, the relevant statutory bodies will be notified.

4.4 Fuel / Oil Spill

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- On-site refuelling will be conducted in a controlled and safe manner. Where possible fuel will be delivered by bunded mobile tanker. Bowsers and plant will be refuelled on a level platform away from any watercourses and areas susceptible to run-off.
- Refuelling to be conducted by competent and trained personnel
- Plant on site will be regularly inspected for leaks and fitness for purpose. Any defects to be reported to site management and plant owner immediately
- Emergency spill kits will be available to deal with any potential accidental spillage or discharge.
- Where there is a leak of any hazardous material all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- The area will be sealed off so that no watercourses are affected, and the contaminated peat/land excavated and removed. Fuel spill kits will be used to clean up the area.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.

- The ECoW will notify the appropriate regulatory body such as Donegal County Council, Department of the Environment, Climate and Communications (DECC), if deemed necessary.

5.0 Sequence of Works

5.1 Setup

1. The site has already been set up prior to works. MCE have a site compound set up with all required welfare and first aid facilities
2. A number of signs and fencing have been erected around the site so as to limit the risk of hill walkers from coming into the work area.
3. Site Safety signs have also been erected at a number of points alerting members of the public of dangers and the need for PPE as they are entering a construction site.
4. The assembly point for personnel involved in these works is at the MCE site offices
5. A rain guage monitoring system is set up on site. Works will cease based on triggers set out in CEMP section 5.2.2 i.e. >25mm in 24 hours, 10mm in 1 hour or greater than the monthly average rainfall in the past 7 days.
6. 20nr. Peat Monitoring locations have been installed across the site in line with FTCO recommendations. There are to be monitored weekly site wide. Daily monitoring will be conducted on locations in the vicinity of works zone. (See appendix F & G)
7. In line with FTCO recommendation nr. 3. The remaining works on the site shall be carried out without placing of excessive loading onto the in-situ peat surface. Where loading is to be placed onto an area of in-situ peat then that area shall be inspected and assessed by a competent person. Where in doubt no loading shall be placed onto in-situ peat.
8. An additional series of monitoring locations will be installed in the area directly adjacent to works zone. These will be monitored on an ongoing basis throughout the workday.
9. Zone of influence testing will be completed daily in advance of works. This will involve peat probing, shear vaning and inspecting the ground to 50m outside the works area along the path of the works to be completed. Probing and shear vaning will be carried out at 20m centres depending on the encountered peat conditions. The number of shear vaning carried out may vary depending on for example the depth and weakness of the encountered peat. The morphology, drainage, vegetation, and proximity to drains/watercourses will be checked. Tests will be cross-referenced to those completed to date.
10. Zone of influence testing and inspection shall be completed in a reasonable time in advance of the proposed works to allow assessment of the results to be completed.
11. All results, such as probing and vaning shall be documented on site using a standard template and transferred to digital medium (e.g. Excel spreadsheet), all of which shall be readily available for auditing.

5.2 Methodology

- All operatives are to read, understand and sign the RAMS before commencing any work and if unsure about any item they are to discuss with the site manager, Sean O'Driscoll / Chris O'Mahony/Gearoid White
- Works will be sequenced based on project organogram (see appendix H)
- Zone of influence testing will be conducted prior to works commencement. The area will be inspected by competent person, no works to take place until assessment is completed and signed off by Martin Lyttle (FTCO).
- The zone of influence testing will be cross referenced to the testing previously conducted along this road section which will back up the existing data. (see appendix C)
- The assessment of the findings of the zone of influence testing shall be assessed by a competent person who shall determine based on comparison with previous data contained within the Ionic report and recently completed data that works within the tested section can be commenced, or otherwise. Where there are adverse variations in the data then the designer (Ionic) shall be consulted as part of the assessment.
- No works can commence until the assessment is complete and the assessment has clearly demonstrated that the proposed works are safe to commence.
- The result of the assessment shall be documented using a standard template, which shall be in a suitable medium that can be readily audited.
- The road will be upgraded using the 'excavate and replace method'.
- The turbine hardstanding at T4 is constructed to solid sub-formation. Along the North-West edge at CH 970 there is a turbine blade storage platform (blade finger) also constructed on solid strata. (see Appendix A).
- This blade finger will be used as a start point for the road re-alignment.
- Both sides of the new road alignment will be marked using GPS equipment.
- There is approx. 2.0m of in situ peat in the area surrounding the blade finger.
- Excavator will move onto blade finger and begin to excavate peat. Articulated dump truck will be sitting on turbine hardstanding and will move along the blade finger and onto new road alignment as excavation progresses.
- There is a ratio of approx. 2 x peat to 1 x rock meaning approximately every two loads of peat removed will require one load of rock to replace.

- Although the FOS is deemed acceptable, waiting trucks will not be parked along the floating road. They will wait on the hardstanding area. This will be controlled by supervisor and requirements will be conveyed to operatives.
- Once peat is removed and rock is required, excavator will move away from open excavation road leaving space for rock to be deposited. It will be unloaded onto the solid road and placed by the excavator.
- ***No rock to be deposited directly onto floated road section.***
- Rock will not be tipped directly into open excavation in an uncontrolled manner. Its placement will be controlled by excavator operator.
- The road will be minimum 5m wide. The base width will vary depending on peat depth. Where the ratio will be W:D, 1.5:1 (See Appendix A)
- The excavation will continue along the road alignment to CH 850.
- A ‘key’ will be excavated into the existing floating road at this point. Once keyed in, excavator will move South-West and begin to remove the floating road at CH 750. The rationale for moving further along the floating road is that there is a degree of protection by isolating the section of road deemed less stable.
- There is a culvert at approx. CH 750 which has been installed atop solid strata. The peat depths are <1.
- Excavator will remove the layers of engineered fill. It will be loaded into articulated dump trucks removed to a nearby hardstand for reuse.
- The peat will then be excavated, and the road will be reconstructed on solid sub-formation in a manner similar to above.
- The road will be constructed to solid stratum using the ‘displacement’ method
- To avoid unsupported excavation faces and potential for tension cracks to develop, the excavation and filling will be sequenced to minimise the time that the excavation faces are unsupported. This will require limiting the amount of excavation to the available volume of fill at the point of excavation. If required there may be a need to place fill into the in-situ peat (using displacement method) at the toe of temporary excavation face to avoid excessive height of unsupported excavation face.
- Excavation will continue to join the prior constructed re-aligned section at CH 850.

- Once the entire road has been upgraded the remaining floating road will be removed. This will start at the key installed at CH 850. Machinery will stay on existing road section and move back towards T4.
- Excavator will move along the floating road from the T4 side. Engineered fill will be loaded into articulated dump trucks which will then be able to travel along the realigned road, bringing the fill to another location for reuse.
- The peat beneath the floating will be reinstated and reseeded.
- Traffic will be strictly controlled. Dump trucks will not be 'stacked' along floating road section.
- The peat excavated will be brought to on-site peat deposition areas. Rock will be sourced from on-site borrow pit adjacent to T13.
- No construction machinery will track onto in-situ peat. In the event that machinery must track on to peat the peat will be inspected and assessed by competent person (Martin Lyttle FTCO) to avoid excessive loading. If in doubt machinery will not be tracked onto peat.
- Drainage works required will be conducted under supervision of MKO. A series of preventative measures will be put in place to protect water courses. Silt traps will be required at the water courses adjacent to the culver at CH 750.
- MCE/MKO will monitor the works at all times to ensure there are no unwanted discharges to the roadside drainage. If there are any issues with drainage and or unwanted discharges, works will cease, and remedial measures will be put in place to the satisfaction of the ECoW prior to recommencement of works.
- Martin Lyttle (FTCO) and Gearoid White (MCE) will monitor excavation works. John Shanahan/Cormac O'Dubhthaigh (Ionic) will be present for works commencement to ensure the methodology is satisfactory.
- Once completed a final inspection will be conducted by Ionic consulting (John Shanahan & Cormac O'Dubhthaigh), FTCO (Martin Lyttle) and MCE management (Sean O'Driscoll & Chris O'Mahony)

6.0 Covid-19

Coronavirus/Covid-19 is an infectious disease which affects the upper respiratory system. It is potentially fatal and is particularly dangerous to those with underlying conditions and the elderly/infirmed. 63% of confirmed cases have spread through community transmission. The infection is highly contagious and easily transmitted from person to person through close contact with either an infected individual or a contaminated area. For this reason, a set of standard operated procedures are to be adopted at Meenbog WF. Refer to construction stage safety plan for SOPs on Covid-19. Briefly summarised below,

- All workers are to sign in/out at the designated area
- Personnel will be asked to make a declaration which assess the key risk factors in virus transmission
- Hand sanitizer and gloves will be provided for instances where personnel must use a shared space i.e. toilets
- There will be no communal areas for eating in use for the foreseeable future
- Personnel will take their designated breaks at their own individual work area e.g. digger cab
- Site will be closed for access in the morning and opened at the end of the day, any entries/exits are to be notified to site management
- Anyone displaying symptoms of Covid-19 are to immediately notify site management and proceed to self-isolate

7.0 Plant / Equipment

1.	Various Size Excavators
2.	Roller / Plate Compactor / Generator
3.	25 Tonne Dumper
4.	Lorries / Dumpers
7.	Loadall
8.	Drainage equipment (pumps, silt bags etc.)

7.1 Personal Protective Equipment (PPE)

1.	Hard Hat. (Worn at all times)
2.	Hi Visibility Jacket/Vest. (Worn at all times)
3.	Steel Toe Cap Boots. (Worn at all times)
4.	Gloves. (Worn when required)
5.	Eye Protection. (Worn when required)
6.	Ear Protection. (Worn when required)
7.	P3 Dust Masks. (Worn when required)

7.2 Extra Safety Equipment to be used

Additional PPE such as hearing protection and dust masks to be used as required depending on operative activities.

8.0 Emergency Arrangements

In the case of an emergency, all operatives are to follow the emergency procedures as detailed in the site induction for Fire, Injury or Bog slide. General arrangements are;

- Assess/Attend to casualty if one is present
- Raise the alarm and call 999/112
- Alert the other site personnel as to the emergency
- Locate at the site assembly point and do not return to work until instructed that it is safe to do so
- Substation construction assembly point located at the site entrance gate

First Aid

First aid kits are located in the MCE Site Vehicle in addition to the MCE site office.

Emergency Contacts

1.	Emergency Numbers – 999/112
2.	Letterkenny University Hospital – 074 912 5888
3.	NowDoc – 1850 400 911
4.	Donegal Town Garda Station – 074 974 0190
5.	Sean O'Driscoll – Project Manager – 086 8528329
6.	Chris Murnane – Safety Officer – 086 7955083
7.	Chris O'Mahony – Site Manager – 086 0329552
8.	Gearoid White – Site Foremena – 086 0211525

Who Information Will be Communicated to.

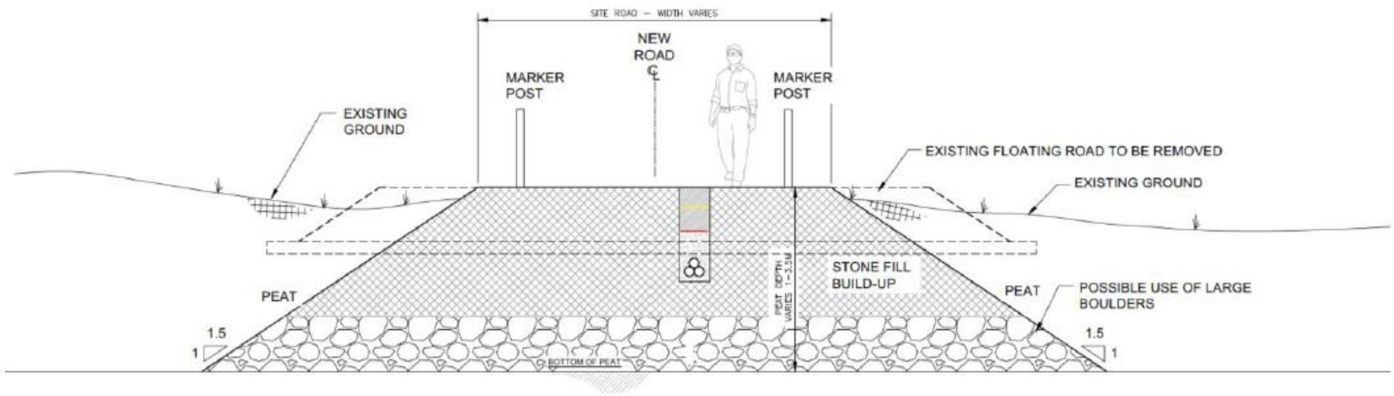
Chris O'Mahony/Sean O'Driscoll will communicate the method statement and risk assessment to the work force before the work commences on site.

Monitoring and Compliance

Chris O'Mahony/Sean O'Driscoll will ensure that method Statements will be adhered to by all MCE staff including any updates/changes made to the Method Statement.

9.0 Appendices

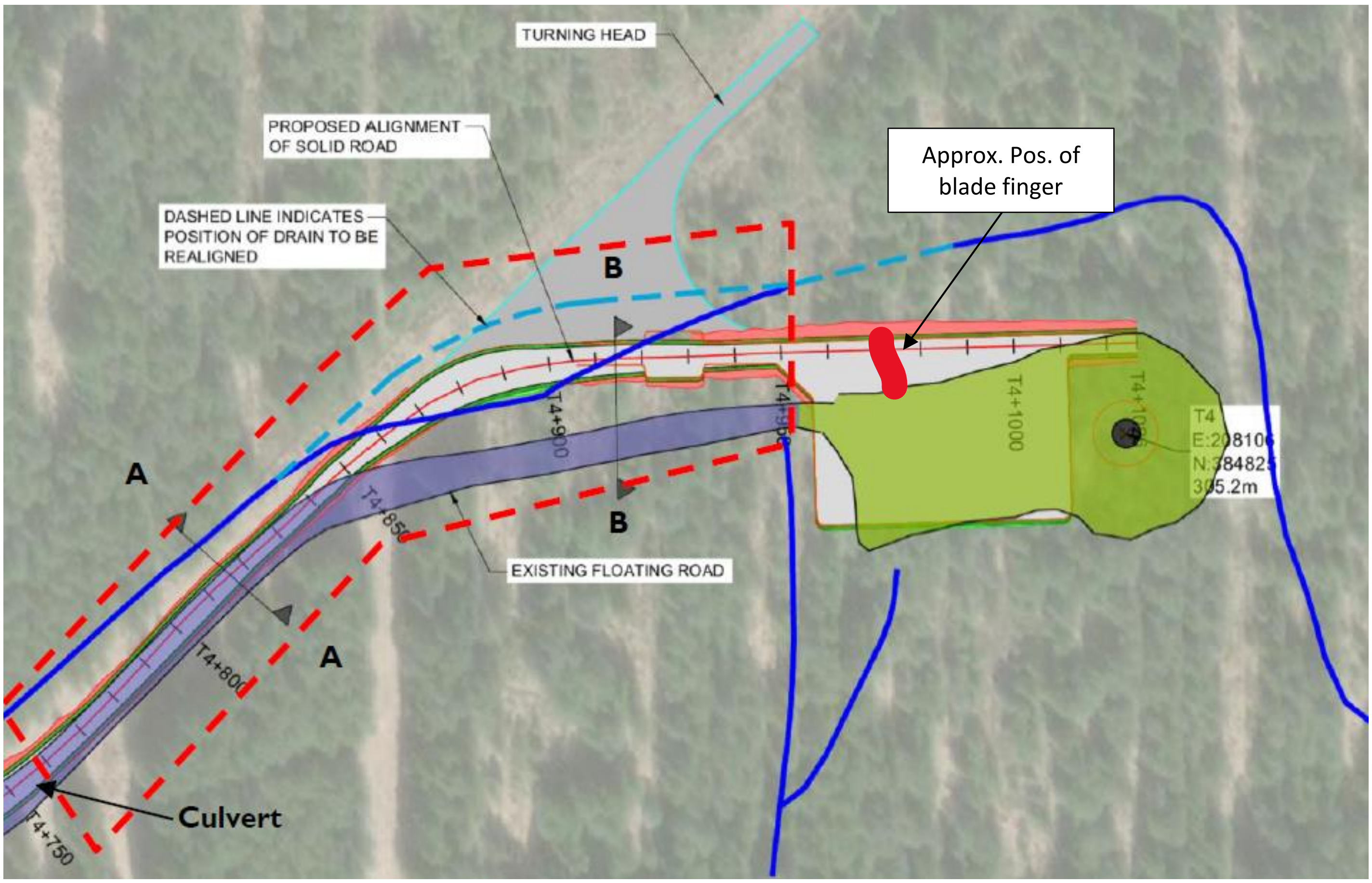
Appendix A Section Through Road



ILLUSTRATIVE SECTION THROUGH UPGRADED SOLID ROAD INCLUDING GRID ROUTE TRENCH

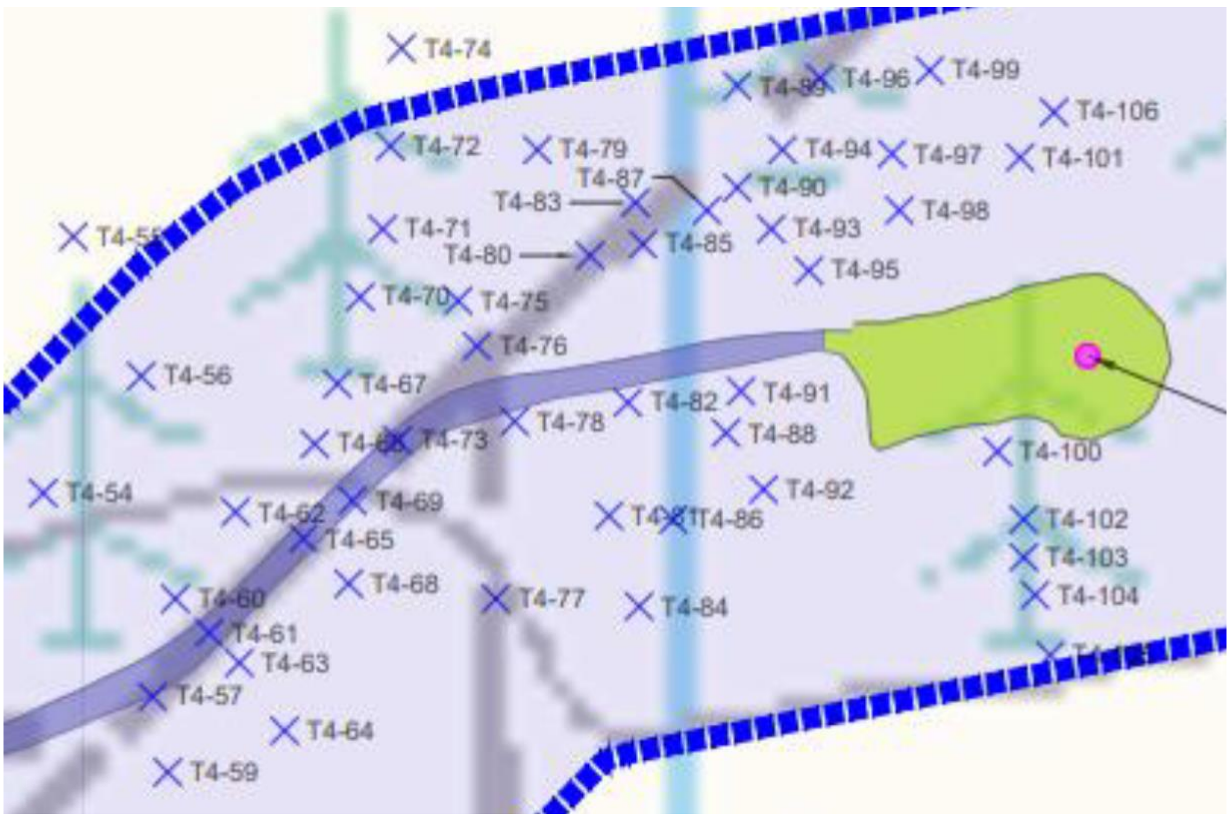
REF: Ionic Construction MNBG d018.4.4

Appendix B Plan View of Berm



REF: Ionic Construction MNBG d018.4.4

Appendix C Prior Testing

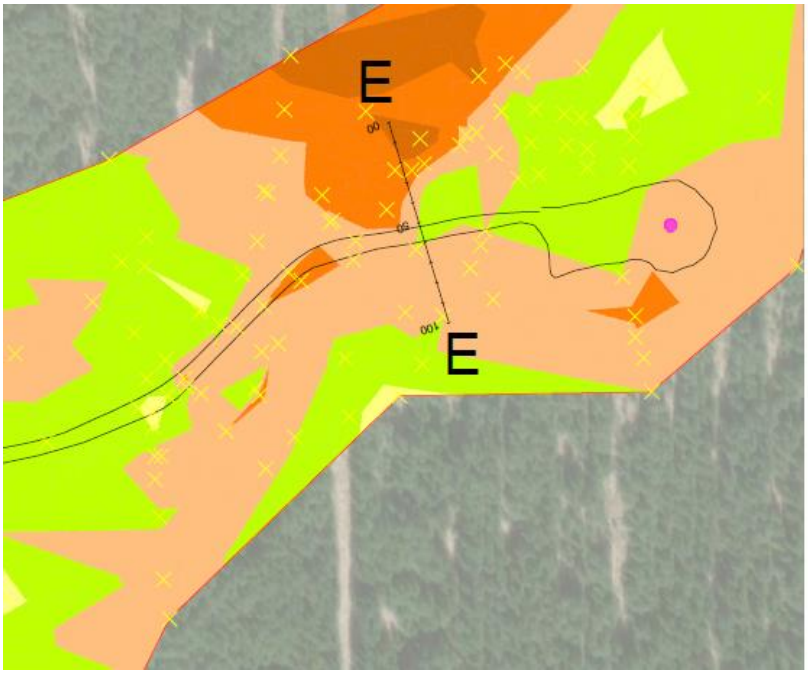


REF: Ionic Construction MNBG r057 Rev B Peat Stability

MEENBOG WIND FARM - PEAT ASSESSMENT TO EUROCODE 7 - ODF (overdesign factor)															
LOCATION			DATA				LOADING				ANALYSIS				
Location Ref.	Easting	Northing	Peat Depth (m)	Unit Weight Peat (kN/m3	Undrained Shear Strength (kPa)	Slope (degrees)	Permanent Surcharge Peat Deposition I	Variable Load Construction (kPa) II	Permanent Surcharge Floating Road (kPa) III	Variable Load Crane (kPa) IV	ODF Existing (Self-weight Peat Only) 0	ODF Permanent Surcharge Peat 0+I	ODF Variable Load Construction 0+II	ODF Permanent Surcharge Floating Road 0+III	ODF Variable Load Crane 0+III+IV
T4-61	207873	384752	3.1	10	4	3.1	10	13.3	20.7	10.3	1.71		1.10		
T4-62	207880	384784	2.0	10	5	3.5	10	13.3	20.7	10.3	2.93		1.57		
T4-63	207881	384744	2.5	10	7	4	10	13.3	20.7	10.3	2.87		1.70		
T4-64	207893	384726	3.0	10	6	3.8	10	13.3	20.7	10.3	2.16		1.37		
T4-65	207898	384777	2.5	10	9	5.6	0	13.3	20.7	10.3	2.65	2.65	1.57	1.45	1.12
T4-66	207901	384802	1.7	10	5	5.7	10	13.3	20.7	10.3	2.13		1.05		
T4-67	207907	384818	2.8	10	4	3.4	10	13.3	20.7	10.3	1.72		1.07		
T4-68	207910	384765	3.0	10	5	4	10	13.3	20.7	10.3	1.71		1.09		
T4-69	207911	384787	3.0	10	9	4.8	0	13.3	20.7	10.3	2.57	2.57	1.63	1.52	1.20
T4-70	207913	384841	2.3	10	9	3.6	10	13.3	20.7	10.3	4.46		2.55		
T4-71	207919	384859	2.6	10	5.5	3.4	10	13.3	20.7	10.3	2.55		1.53		
T4-72	207921	384881	3.7	10	3.5	1.9	10	13.3	20.7	10.3	2.04		1.39		
T4-73	207923	384803	3.0	10	7	5.6	0	13.3	20.7	10.3	1.72	1.72	1.09	1.02	0.80
T4-74	207924	384907	4.3	10	3	1.9	10	13.3	20.7	10.3	1.50		1.07		
T4-75	207939	384840	3.3	10	5	3.4	10	13.3	20.7	10.3	1.83		1.20		
T4-76	207944	384828	2.8	10	7	3.8	0	13.3	20.7	10.3	2.70	2.70	1.67	1.55	1.22
T4-77	207949	384761	1.7	10	8	8.2	10	13.3	20.7	10.3	2.38		1.18		
T4-78	207954	384808	2.9	10	9	5.7	0	13.3	20.7	10.3	2.24	2.24	1.41	1.31	1.03
T4-79	207960	384880	3.9	10	4	1.7	10	13.3	20.7	10.3	2.47		1.71		
T4-80	207974	384852	3.6	10	3.5	2.4	10	13.3	20.7	10.3	1.66		1.12		
T4-81	207979	384783	2.1	10	8	5.2	10	13.3	20.7	10.3	3.01		1.65		
T4-82	207984	384813	2.0	10	6	3	0	13.3	20.7	10.3	4.10	4.10	2.20	2.01	1.52
T4-83	207986	384866	4.8	10	3.5	1.7	10	13.3	20.7	10.3	1.76		1.29		
T4-84	207987	384759	1.9	10	7	5	10	13.3	20.7	10.3	3.03		1.59		
T4-85	207988	384855	3.2	10	5	2.4	10	13.3	20.7	10.3	2.67		1.73		
T4-86	207996	384782	2.0	10	7	3.4	10	13.3	20.7	10.3	4.22		2.26		
T4-87	208005	384864	2.9	10	5.5	1.6	0	13.3	20.7	10.3	4.85	4.85	3.04	2.83	2.23
T4-88	208010	384805	2.1	10	7	4.3	10	13.3	20.7	10.3	3.18		1.75		
T4-89	208013	384897	4.1	10	3.5	1.9	10	13.3	20.7	10.3	1.84		1.29		
T4-90	208013	384870	2.7	10	3.5	1.6	10	13.3	20.7	10.3	3.32		2.02		
T4-91	208014	384816	2.3	10	3.5	2.1	10	13.3	20.7	10.3	2.97		1.69		
T4-92	208020	384790	2.4	10	5	2.1	10	13.3	20.7	10.3	4.06		2.36		
T4-93	208022	384859	2.2	10	7.5	1.7	10	13.3	20.7	10.3	8.21		4.60		
T4-94	208025	384880	2.0	10	6	3.5	10	13.3	20.7	10.3	3.52		1.89		
T4-95	208032	384848	2.0	10	5	1.7	10	13.3	20.7	10.3	6.02		3.23		
T4-96	208035	384899	2.2	10	6	1.7	10	13.3	20.7	10.3	6.57		3.68		
T4-97	208054	384879	1.9	10	5	1.6	10	13.3	20.7	10.3	6.73		3.53		
T4-98	208056	384864	1.7	10	6.5	2.1	0	13.3	20.7	10.3	7.46	7.46	3.70	3.36	2.48
T4-99	208064	384901	2.1	10	7	2.3	10	13.3	20.7	10.3	5.94		3.26		
T4-100	208082	384800	2.0	10	5.5	3.0	10	13.3	20.7	10.3	3.76		2.02		
T4-101	208088	384878	1.9	10	10	3	10	13.3	20.7	10.3	7.19		3.77		
T4-102	208089	384782	3.3	10	4.5	3	10	13.3	20.7	10.3	1.86		1.22		
T4-103	208089	384772	2.4	10	5	3.8	10	13.3	20.7	10.3	2.25		1.31		
T4-104	208092	384762	2.3	10	5	3.8	10	13.3	20.7	10.3	2.35		1.34		

REF: Ionic Construction MNBG r057 Rev B Peat Stability

Appendix D Peat Depth Map

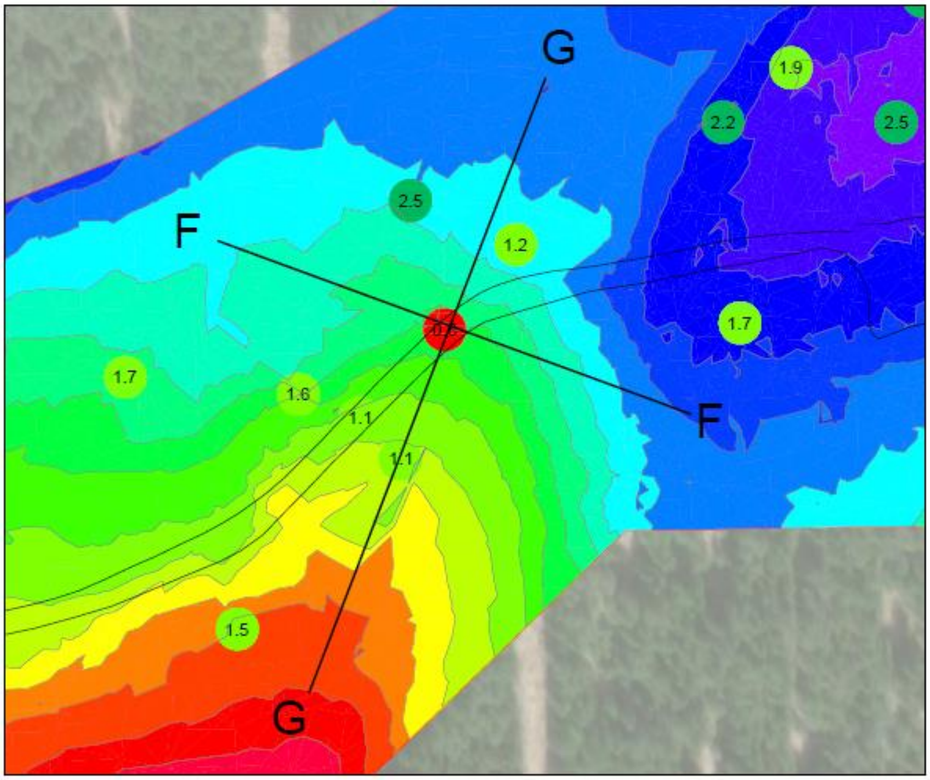


SURFACE LEVEL DATA

NUMBER	MIN. PEAT DEPTH	MAX. PEAT DEPTH	COLOUR
1	0.00	1.00	
2	1.00	2.00	
3	2.00	3.00	
4	3.00	4.00	
5	4.00	5.00	
6	5.00	6.00	
7	6.00	7.00	
8	7.00	20.00	

REF: Ionic Construction MNBG d018.4.4

Appendix E Potential Flow Path



Eurocode 7 Overdesign Factor

- < 1
- 1-2
- > 2

Bottom of Peat Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area	Color
1	289.00	290.00	394.70	
2	290.00	291.00	1177.83	
3	291.00	292.00	2230.77	
4	292.00	293.00	1816.12	
5	293.00	294.00	2042.40	
6	294.00	295.00	2367.19	
7	295.00	296.00	2523.61	
8	296.00	297.00	2599.86	
9	297.00	298.00	2136.86	
10	298.00	299.00	2777.92	
11	299.00	300.00	3911.83	
12	300.00	301.00	5598.48	
13	301.00	302.00	9078.49	
14	302.00	303.00	3128.22	
15	303.00	304.00	3102.97	
16	304.00	305.00	2665.31	
17	305.00	306.00	1072.92	

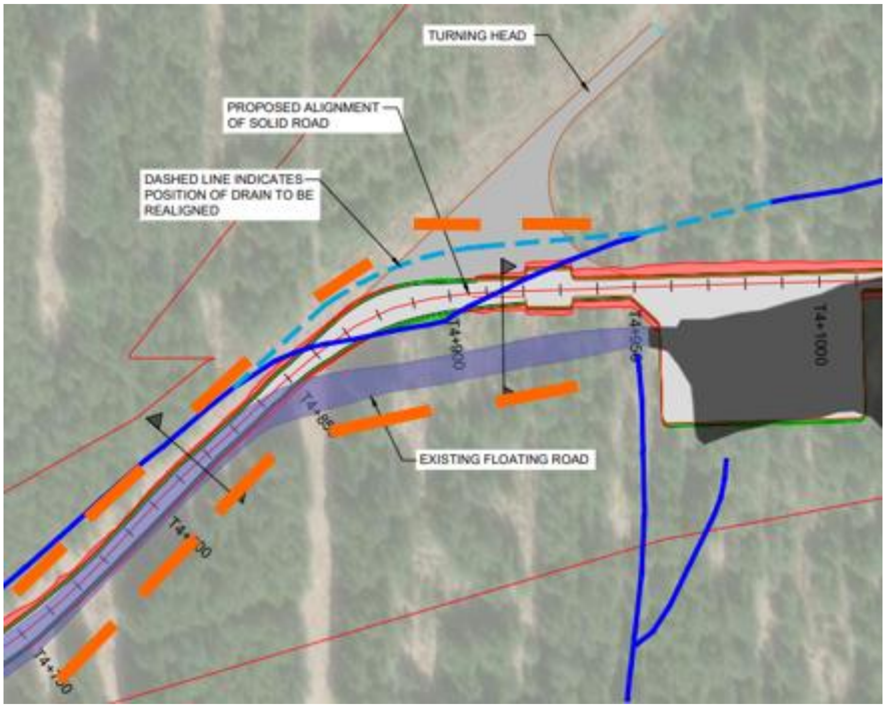
REF: Ionic Construction MNBG d018.4.4

Appendix F Peat Monitoring Locations

No	Location	Comments
1	Junction of access road to T1 with spur to T2 and T4 along downslope margin	Area of deepest peat in close proximity to concave break in slope
2	Along access to T3 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
3	Along access to T2 about 100m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
4	Along access to T4 about 150m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope
5	Along access from T5 to T3 about 200m from T5 along downslope margin	Area of deeper peat in close proximity to concave break in slope
6	Junction of access road to T7 about 100m along access to T7 along downslope margin	Area of deeper peat in close proximity to concave break in slope, within potential area of 12 November failure
7	South side of upper scar of 12 November failure	To monitor potential retrogression of scar upslope
8	On downslope margin of T7 base and hard stand prior to construction	To be installed in advance of any works
9	On downslope margin of T10 base and hard stand	Area of peat in close proximity to concave break in slope
10	Along access to T14 about 100m from hard stand along downslope margin	Area of peat in close proximity to concave break in slope
11	Along access to T18 at about chainage 1600m along downslope margin	Area of potential peat close to river
12	Along access to T16 about 50m from hard stand along downslope margin	Area of deeper peat in close proximity to concave break in slope and minor instability
13	Peat storage berms at T15	Minor signs of movement/distress. Where necessary the berm size is to be increased.
14	Peat storage berms at T17	Minor signs of movement/distress. Where necessary the berm size is to be increased.
15	Peat failure scar above road to T7	Upper scar of 12 November 2020 peat failure. Potential for retrogression of failure scar.
16	Peat failures at Borrow Pit between T5 and T6	Comprises 3 peat failures at this location. Monitoring at the head of each failure.
17	Peat failure at T12	Head of failure downslope of access road. Monitoring at the head of failure.
18	Instability at T5	Series of concentric tension cracks within the insitu peat
19	Instability at T16	Minor slumping of insitu peat
20	Ch.2630 on the north side of the S-bends on the approach road into the site	Stockpile caused a localised ground movement in the peat below the stockpile

Ref: Fehily Timoney Peat Stability Assessment of Meenbog wind farm Jan 2021

Appendix G Additional Peat Monitoring Locations

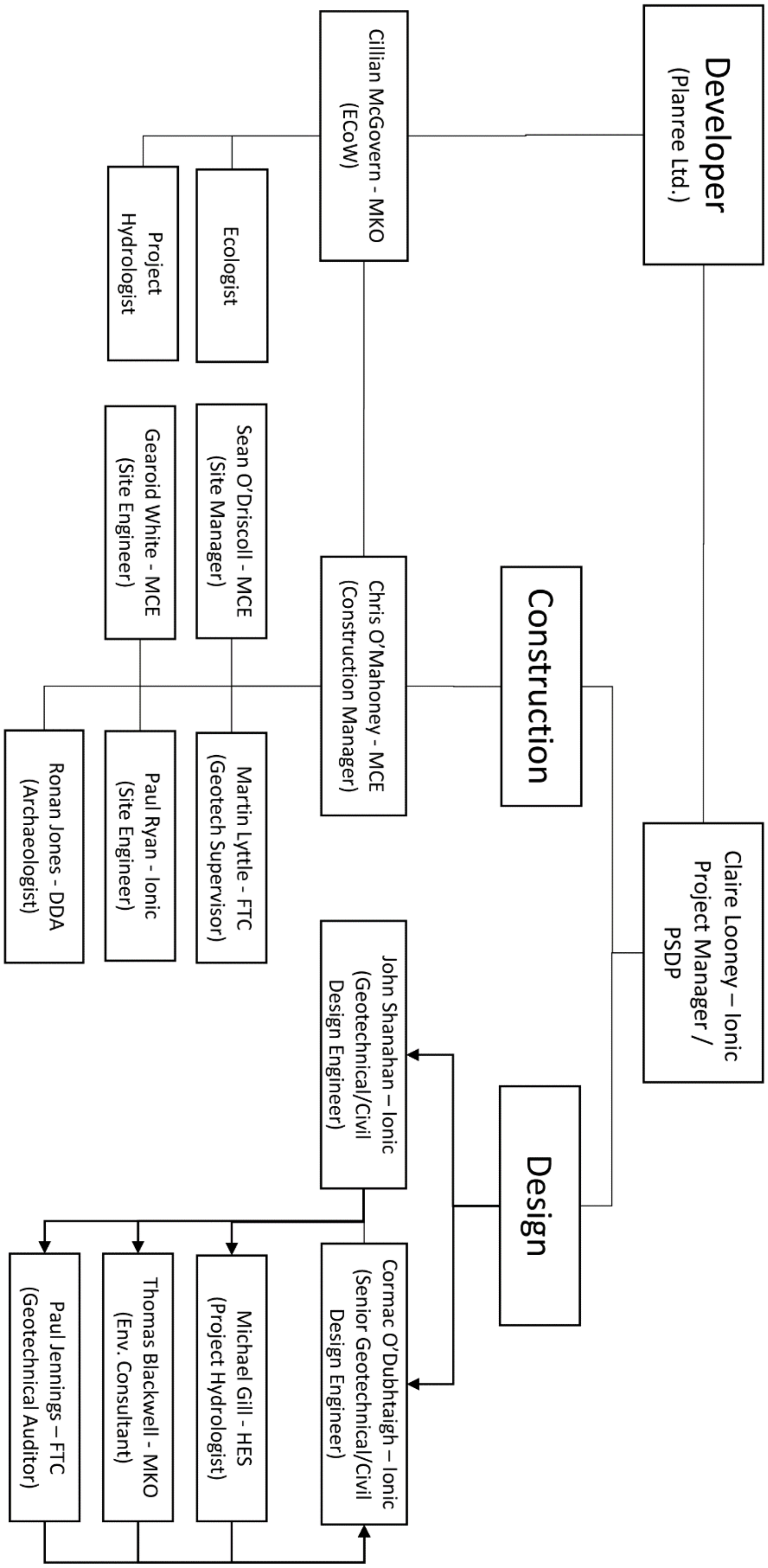


Additional Peat Monitoring Posts

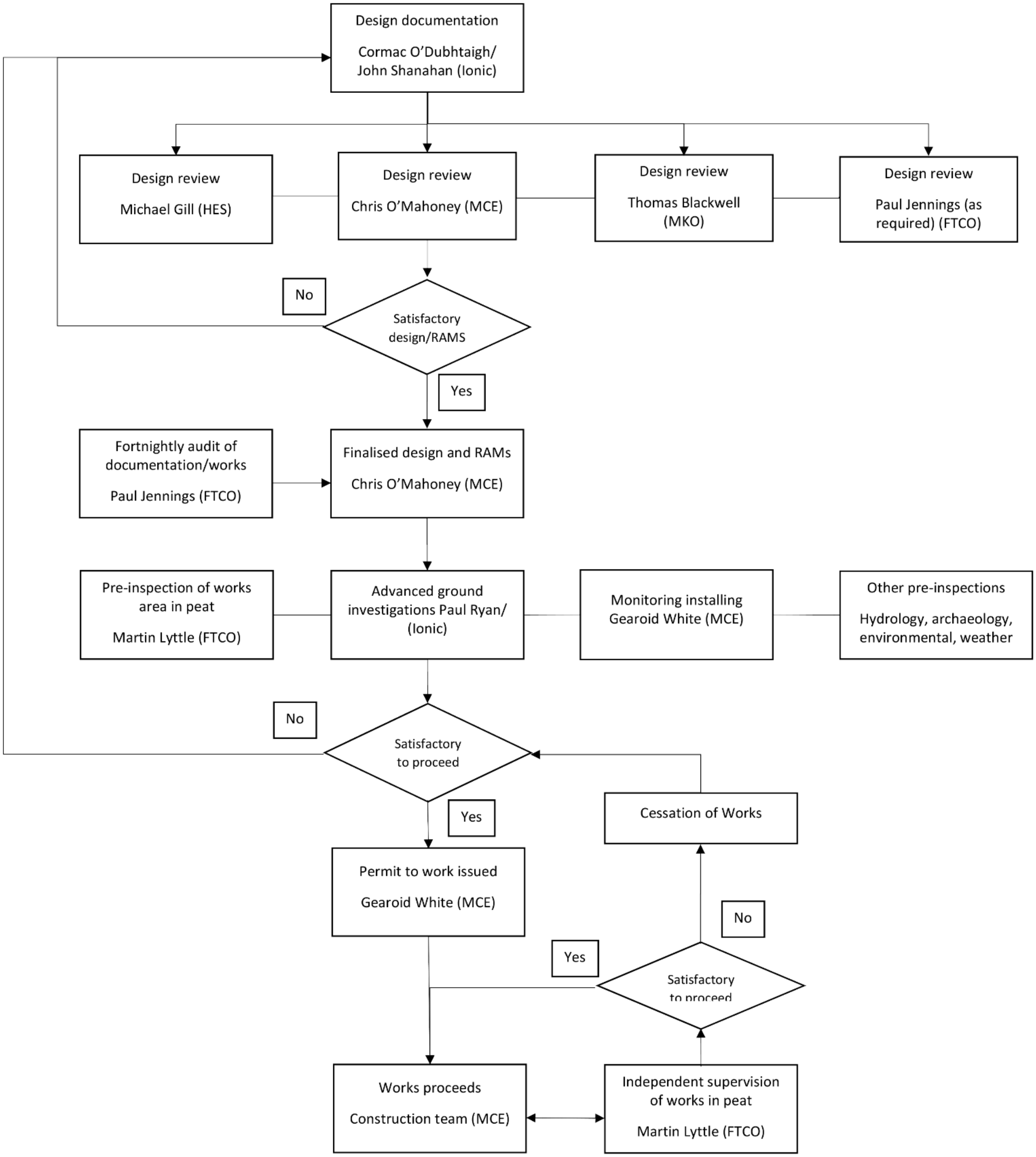
Note: Monitoring post locations are indicative. They will be adjusted to suit topography, ensuring adequate distance from active works zone.

Appendix H Project Organogram & Flow Chart

Organogram:



Design & Construction Flow Chart:



10.0 Risk Assessments

Assessing Level of Risk

Likelihood

Severity

0	1	2	3
1	1	2	3
2	2	4	6
3	3	6	9

Likelihood			Severity		
1	=	Low	1	=	Slight
2	=	Medium	2	=	Serious
3	=	High	3	=	Major

Likelihood x Severity = Risk Rating

1 to 3	**Low**	**Work can proceed with control measure in place.**
4 to 6	**Medium**	**Work can proceed with control measures in place to reduce risk.**
7 to 9	**High**	**More control measures needed to reduce risk.**

Controls

Management must determine the controls required to eliminate or mitigate against the risks identified in the risk assessment. These controls must be consistent with the operational experience of employees and in accordance with the principles of prevention detailed below. They should also indicate any facility requirements and training needs. These controls are documented on the risk assessments.

Risk Matrix				
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd.

MCE Ltd – T4 Road Upgrade

THIS RISK ASSESSMENT TAKES ACCOUNT OF THE FOLLOWING:
MCE SAFETY STATEMENT, MCE FULL SAFETY STATEMENTS HAZARD IDENTIFICATION & RISK ASSESSMENT, THE METHOD STATEMENT FOR THESE WORKS & THE PSCS CONSTRUCTION STAGE SAFETY PLAN.

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Peat Movement **Risk:** ➢ Slippage of peat ➢ Engulfment of personell or machinery ➢ Damage to the environment	2	3	6	➢ 14nr. peat monitoring stations installed ➢ Checked weekly. Stations in immediate vicinity checked daily. ➢ Works location probed and shear vaned – 50m grid outside of works area ➢ No works during periods of excessive rainfall see CEMP 5.2.2 ➢ No stockpiling of peat on top of in-situ material	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Excavation / Trenches **Risk:** ➢ Falls. ➢ Entrapment. ➢ Suffocation. ➢ Crushing. ➢ Impact with machinery. ➢ Drowning. ➢ Electrocution. ➢ Serious bodily injury / fatality.	3	3	9	The Construction Regulations, 2013 must be complied with regarding all excavations. Verify ground conditions and soil type before excavating. No ground to be considered safe until investigated by a competent person. ➢ Schedule work so that excavations are not open for longer than necessary. ➢ Find, locate and mark all underground services. ➢ Organise suitable plant, equipment and required working space. ➢ Organise delivery and inspection of support materials / equipment.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Provide appropriate protective clothing and equipment. ➢ Provide suitable barriers to protect against the fall of persons at work, materials or objects, including the inrush of water into the excavation. ➢ Provide adequate secured ladder and/or ramp access/egress to excavations. ➢ Most extracted spoil will be hauled away but any residual material will be stockpiled away from excavation edge at all times. ➢ Safe System of Work Plan should be completed for each task or a specific method statement completed and a new SSWP should be completed when the task or the environment changes. ➢ AF 3 to be completed as required by a competent person. ➢ Where there is a risk involved with a trench and/or an excavation, adequate precautions must be taken to protect against danger to persons at work from a fall or dislodgement of earth, rock, or peat, by suitable shoring or batter back edge to a safe angle of repose. ➢ If other methods are to be specified they must be selected based on the results of a risk assessment and a Temporary Works Design				

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				Certificate will be prepared & issued. ➢ Appropriate precaution to be in place to protect the person carrying out the shoring				
Hazard: Movement & Use of Excavator **Risk**: ➢ Collisions. ➢ Overturning. ➢ Loss of Control. ➢ Risk of serious or fatal injury to the operator and bystanders in the vicinity due to Overturning. ➢ Collisions and loss of control or collision with other plant or vehicles.	3	3	9	➢ Excavators to be driven by trained, experienced operators, trained to CSCS level, as per the Construction Regulations, 2006. ➢ Driver to carry out weekly documented checks. ➢ Defects or suspected defects to be reported immediately to the Supervisor. ➢ Regular servicing and maintenance to be carried out and properly recorded. ➢ Warning signs to be posted at strategic locations to alert persons to the movements of excavators. ➢ Drivers of smaller vehicles must ensure that excavator drivers, when operating nearby, can see them. ➢ Where a workplace or a site road is close to an open edge, the edge must be clearly marked and lined with boulders and safety barriers. ➢ Site roads not to exceed a gradient of 1 in 5.	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
				➢ Test certificates and form GA2 required for excavators used as lifting equipment.				
Hazard: Excavator – Various Risks **Risk:** ➢ Falls - Injury to driver entering or getting out of the cab ➢ Passengers ➢ Noise Partial /Total loss of hearing ➢ Dust ➢ Risk of serious ➢ Health damage from dust	2	3	6	➢ Hand and footholds to be fitted and maintained in good condition. ➢ Machine lights to be properly maintained. ➢ Carriage of passengers on any part of an excavator is not allowed. ➢ Machine to be stopped and switched off before any person including maintenance persons are permitted on the footsteps. ➢ Earmuffs to be provided and their wearing compulsory where noise levels reach 85Db or more. ➢ Cabs to be maintained to keep out dust. ➢ Proper masks to be provided and worn.	2	1	2	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Site Dumper / Lorries **Risk**: ➢ Overturning/Loss of control ➢ Collision ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Pedestrians ➢ Personal injury ➢ Disablement ➢ Fatality ➢ Passengers ➢ Fall from dumper ➢ Fall underneath ➢ Loading ➢ Falling material ➢ Fire	3	3	9	➢ Only trained, experienced and authorised drivers to operate dump trucks/dumpers/lorries. ➢ Drivers must hold a CSCS Ticket (or recognised alternative). ➢ Each driver to carry out daily visual checks on their vehicles, to ensure that they are in safe working order. ➢ All dump trucks/dumpers must have all safety devices fitted as required in the Construction Regulations, 2006, S.I. 504, Schedule 6, Regulation 87. ➢ Safety belts are recommended for all existing and new dump trucks and where fitted they must be worn. ➢ Suspected defects must be immediately reported to your Supervisor. ➢ Regular recorded maintenance to be carried out. ➢ As a general rule, all other traffic gives way to loaded dump trucks. ➢ Lay-bys to be provided where dump trucks are likely to meet other traffic. ➢ Where a haul road passes near open edges, the edges are to be clearly marked and lined with large boulders or other safety measures and kept clean.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
				➢ Workings must be designed so that gradients do not exceed 1 in 5. ➢ Safety warning signs are to be posted at strategic areas to alert persons to movements of dump trucks and other vehicles. ➢ Pedestrians told to ensure that they keep clear of dump trucks, wear high visibility clothing, and ensure that the driver can see them. ➢ No pedestrians may go under an open edge while a dump truck is in operation above. ➢ Persons driving small vehicles must ensure that the driver of dump trucks can see them. ➢ No persons to be carried on any part of a dump truck, unless there is provision in the cab and they are authorised to be carried. No riding permitted on the foot steps. ➢ Drivers cab must always be protected by an overhead shield built into the body of the truck. ➢ Driver to remain inside the cab at all times during loading. ➢ Hand and foot-holds must always be provided to aid safe ascent to/decent from the dump truck.				

Risk Matrix				
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Tractor & Trailer **Risk:** ➢ Falls. ➢ Entrapment. ➢ Crushing. ➢ Impact with machinery. ➢ Serious bodily injury / Fatality. ➢ Collision.	3	3	9	➢ Wear hi-visibility vest and hardhat when working with moving equipment. ➢ Keep in operator's line of view. ➢ Don't travel on equipment. ➢ Watch out for objects nearby, particularly when reversing. ➢ Don't overload a trailer or stack it too high. Secure any loose loads. ➢ Use flashing amber beacon ➢ Trailer must be correctly attached to tractor (i.e safety chain, brakes and lights). ➢ Competent operators must only operate tractor. ➢ Tractors and trailers must be inspected before use.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Persons affected by the works **Risk:** ➢ Struck by site traffic. ➢ Fatalities ➢ Serious injuries	3	3	9	➢ Traffic Management Plans and Drawings are approved and made available. These plans will detail access routes both internal and external. ➢ All warning signs, cones with barriers are in place prior to the commencement of work on site. ➢ All signs will be clean and clearly visible. ➢ Once signs are in place the site access route will be assessed to ensure adequate visibility for drivers and pedestrians.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ All signs will be secure and weighted down where appropriate. ➢ All personnel onsite & on public roads will wear high visibility vests or jackets. . ➢ Contractor vehicles will be parked with consideration given to site traffic access.				
Hazard: Lifting Equipment **Risk:** ➢ Serious personal injury. ➢ Fatalities. ➢ Collision. ➢ Machine overturning. ➢ Material falling from height.	3	3	9	➢ The site management of MCE Ltd must ensure a competent person inspects the lifting equipment every 12 months and a GA1 is obtained. This must be available for inspection. ➢ Under the Construction Regulations, 2006 the lifting equipment must be inspected weekly by the operator and the results must be recorded on a GA2. ➢ A thorough visual inspection should take placed before the driver operates the machine. ➢ The driver must be trained and competent to operate the machine (FAS CSCS standard or alternative excepted standard). ➢ All telescopic handlers/excavators must have safety devices fitted as per the Construction Regulations, 2006 S.I 504, Schedule 6, Regulation 87.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix				
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd.

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Noise created in the workplace - Rock Breaker **Risk:** ➢ Hearing impairment. ➢ Deafness. ➢ Tinnitus. ➢ Loss of concentration and annoyance leading to work ➢ place accidents and / or loss of production.	3	2	6	➢ MCE Ltd is aware that equipment such as consaws, angle grinders, etc. are over the 2nd Action Level and hearing protection must be worn. ➢ It is not anticipated that any member of our staff are exposed to such a dose that they will either daily or weekly require monitoring. ➢ Consult with staff and provide training where necessary. ➢ Signpost all excessively loud equipment, machinery, areas and processes which exceed the upper exposure action level of 85dB(A) and the lower exposure action level of 80dB(A). ➢ Reduce the worker exposure levels by reducing the amount of time spent near sources of excessive noise (job rotation). (Note: this should be considered as a last resort). ➢ Hearing protective equipment must be provided if deemed necessary, as per the Noise Regulations. ➢ Ensure hearing protection is worn for short-term noise exposures (this should also be a last resort). ➢ Remove other people from such noisy areas, unless their presence	3	1	3	- Site Supervisor (Foreman) - Site Operative

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				is required. They must wear hearing protection whilst in such areas.				
Hazard: Working in reduced light **Risk:** ➢ Fatalities ➢ Serious injury	3	3	9	➢ Working in diminished light is not permitted under the normal work rules. ➢ In cases where permission is granted so as enable MCE Ltd to remain in keeping with the project program or for special activities, concrete pours for turbine bases, etc and work in hours of reduced light is conducted, adequate lighting will be provided at all times. ➢ Any temporary work lighting will be erected with due regard to the visibility of plant operators and other traffic on site. This shall be the duty of MCE Ltd and any special arrangements will be documented in method statements, SSOW or traffic management plans. ➢ High visibility jackets are to be worn at all times regardless.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Chemicals **Risk:** ➢ Eye injury / loss. ➢ Skin infection. ➢ Burns. ➢ Inhalation. ➢ Ingestion with food. ➢ Fire. ➢ Explosion. ➢ Serious personal injury. ➢ Fatalities.	3	3	9	➢ Safety Data Sheets to be obtained for all chemicals and strictly followed. ➢ Copies to be available in case of an emergency. ➢ Containers to be properly labelled (hazard signs). ➢ Safe storage and dispensing of chemicals to be practiced. ➢ Follow manufacturer's requirements for handling, mixing, storage and first aid etc. ➢ Personal Protective Equipment to be provided and used. ➢ Training to be provided for staff working with chemicals. ➢ Familiarisation to be provided with the emergency procedure to all staff. ➢ Best possible hygiene procedures to be in place and enforced by Management. ➢ Sources of flame / ignition to be eliminated where flammable materials are used and / or stored. ➢ Spillage's to be immediately dealt with.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd.

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Lone Working **Risk:** ➢ Personal injury. ➢ Fatalities. ➢ Violence toward staff. ➢ Delay in treating medical emergencies.	3	2	6	➢ The company policy is that lone work is a last resort and must only be used for minor tasks. A system for communication with management must always be maintained. If lone working is required in keeping with the project programme it will be pursued under the following controls: ➢ The person must be trained & competent to carry out the tasks required. ➢ A means of communication must be available for the lone worker to contact foreman and the lone worker will be contacted at regular intervals during the anticipated work period. ➢ The lone worker must report he is leaving site to a designated person, this will be either the site manager or an appointed person. ➢ Periodic visits must be made to the lone worker, where possible. ➢ The lone worker must be furnished with the telephone numbers & emergency procedures information.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		**Severity of injury (S)**		**Risk = LXS**	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd.

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Roadworks **Risk:** ➢ Obstruction of Public. ➢ Injury to Public. ➢ Insufficient clearance between traffic routes. ➢ Collision. ➢ Accident or Bodily Injury.	3	3	9	➢ A Traffic Management Plan will be formulated for internal site roads. ➢ The main bulk of traffic will be generated with concrete pours and a traffic management plan will be created with concrete supplier and MCE Ltd. ➢ Communication will be maintained between MCE Ltd., and other civil contractors about traffic activities and all parties will be notified when pouring is taking place.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Fuel storage / refuelling **Risk:** ➢ Fire ➢ Burns ➢ Skin & Eye Irritant ➢ Dermatitis ➢ Environmental ➢ Slip / Fall	3	3	9	The risk of spilling fuel is at its greatest during refuelling of plant. To minimise this risk MCE Ltd will implement the following: this list is not exhaustive: ➢ Refuel will take place on a base away from drains or watercourses. ➢ A bunded bowser will be used. ➢ All refuelling and bulk deliveries will be are to be supervised. ➢ Check the available capacity in the tank before refuelling ➢ Check hoses and valves regularly for signs of wear ➢ Turn off valves after refuelling and lock them when not in use ➢ Position drip trays under pumps to catch minor spills	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
				➢ Keep a spill kit with sand, earth or commercial products for containment of spillages.				
Hazard: Public accessibility to work area on site. **Risk:** ➢ Serious personal injury. ➢ Fatality. ➢ Slips, trips, fall over goods, materials, rough terrain. ➢ Electrocution. ➢ Theft.	3	3	9	➢ Warning signs must be posted to highlight the dangers involved in entering work area, where MCE Ltd are responsible for site conditions e.g. turbine bases. ➢ All access points to work areas to be closed / barricaded to prevent access to unauthorised persons. ➢ Entrances must be fully secured each evening / end of each work shift. ➢ Only authorised personnel are allowed on site. Signs must be erected re same. ➢ A responsible person must check site boundaries on a regular basis.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Visitors **Risk:** ➢ Personal Injury ➢ Property damage ➢ Cuts	3	3	9	➢ All visitors must report to an employee or authorised person of MCE Ltd before entering the premises or area where we work. ➢ Those making deliveries must report to site office.	3	1	3	- Site Supervisor (Foreman)

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
➢ Puncture ➢ Entanglement ➢ Eye Injuries ➢ Electrocution				➢ No visitor to the premises is allowed to use company equipment without permission of the company staff and instruction on its use. ➢ Each visitor is requested to abide by the Company Safety Policy and Regulations laid down therein. ➢ They must also abide by a request by a company employee in relation to their own Safety and Health and that of the company employees. ➢ In the event of an emergency or evacuation, all visitors must report to our designated Assembly Point in car park				- Site Operative
Hazard: Contractors **Risk:** Serious personal injury.	3	3	9	➢ We will monitor the ongoing activities of all sub contractors to MCE Ltd on our projects. ➢ Induction training must be provided for Contractors, their staff and all others on site. ➢ Presentation of Site Safety Plan by Sub-Contractor to the Supervisor. ➢ A Method Statement must be prepared for each necessary job by the Contractor and Sub-Contractors.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix					
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS	
Low	1	Slight	1	LOW = 1 - 3	
Medium	2	Serious	2	MED = 4 - 6	
High	3	Major	3	HIGH = 7 - 9	

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: First Aid Equipment. **Risk:** ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Adequate first aid kits to be provided and filled to HSA guidelines. ➢ They must be regularly checked and refilled by a designated person.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Lack / Absence of First Aiders **Risk:** ➢ Improper diagnosis ➢ Improper treatment ➢ Delay in seeking professional ➢ medical help. ➢ Worsening of condition. ➢ Onset of infection. ➢ Fatality. ➢ Permanent injury / illness.	3	3	9	➢ Sean O’Driscoll and Chris Murnane are trained first aiders ➢ Arrangements to be in place with local doctor for emergencies. ➢ All employees to be aware of emergency procedures.	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Personal Protective Equipment (P.P.E.) **Risk:** ➢ Impact from flying particles. ➢ Head injury. ➢ Foot injury. ➢ Falls from height.	2	3	6	➢ All necessary Personal Protective Equipment to be provided and used. ➢ Safety Signs to be put up to highlight this requirement. ➢ COMPULSARY SITE P.P.E.: ○ Hard hat. ○ High visibility clothing. ○ Safety boots / shoes.	2	1	2	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
➢ Burns or skin irritation etc.								
Hazard: Manual Handling **Risk:** ➢ Back. ➢ Neck. ➢ Shoulder Injury. ➢ Prolapsed Disk. ➢ Permanent Injury. ➢ Trip / Fall. ➢ Hit Against. ➢ Dropped Object.	3	2	6	➢ All MCE Ltd staff and subcontractors employees must be trained in Manual Handling. ➢ In Accordance with the General Application Regulations 2007, No 69, an employer must ensure that he/she takes appropriate organisational measures, or use the appropriate means, in particular mechanical equipment, to avoid the need for the manual handling of loads. ➢ Minimise all manual-handling tasks where possible. ➢ Provide suitable mechanical handling equipment Ensure these are used. ➢ Provide Manual Handling training to all staff whom have not received it. ➢ Personal Protective Equipment including gloves to be provided and used.	3	1	3	- Site Supervisor (Foreman) - Site Operative

Risk Matrix				
Likelihood of accident (L)		Severity of injury (S)		Risk = LXS
Low	1	Slight	1	LOW = 1 - 3
Medium	2	Serious	2	MED = 4 - 6
High	3	Major	3	HIGH = 7 - 9

MCE Ltd.

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
Hazard: Poor Hand Hygiene **Risk:** ➢ Skin complaints. ➢ Dermatitis. ➢ Eczema. ➢ Ingestion of chemicals. ➢ Biological agents: • toxins, • bacteria and • viruses.	2	2	4	➢ Good hand hygiene is essential in the workplace. The hands are the most likely part of the body to come into contact with harmful substances. ➢ Wash hands before eating or smoking. ➢ Suitable gloves should be worn when handling potentially hazardous materials. ➢ Dirty hands should be cleaned using proper skin cleansing products. ➢ Do not clean hands with petrol, white spirits, thinners, turpentine etc. ➢ Always ensure you wash your hands after visiting the toilet.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Animals • Rats /mice. • Wasps /bees. • Small animals. • Dogs. **Risk:** ➢ Leptospirosis(Weil's Disease) ➢ Stings. ➢ Histoplasmosis ➢ (droppings) ➢ Fall from height. ➢ Sudden 'fright'.	2	2	4	➢ When working near water or where rats have been seen, care is to be taken to disinfect all cuts and cover them with waterproof plasters. ➢ Be aware that sudden movements of birds or small animals can cause a reflex action in the operator, which may overbalance them. ➢ Check for signs of nests, birds or other small animals. ➢ Practice caution if dogs are present.	2	1	2	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
➢ Bites.								
Hazard: Weather ➢ Sun ➢ Wind ➢ Rain ➢ Ice / snow **Risk:** ➢ Sun burn. ➢ Sunstroke. ➢ Skin cancer. ➢ Fall from height. ➢ Slip / fall. ➢ Bodily injury. ➢ Hit by object. ➢ Hypothermia.	2	2	4	➢ In sunny weather, cover the back of the neck and keep a shirt on at all times. ➢ Avoid sunburn and sun stroke where possible by keeping covered and wearing a high factor sun block. ➢ Be aware that strong winds or gusts can overbalance an operator. ➢ Don't work in heavy rain unless adequately protected. ➢ Be prepared for slippery conditions in icy weather. Salt or grit should be used where necessary.	2	1	2	- Site Supervisor (Foreman) - Site Operative
Hazard: Working near Water **Risk:** ➢ Drowning: ➢ Public and Workers	3	2	6	➢ Fencing and warning signs to be in place around deep water. ➢ Workers must operate in pairs at all times. ➢ Where necessary, suitable lifebuoys to be available in case of emergency and checked regularly.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	L	Risk	ACTIONS TO CONTROL RISKS	After control measures S	L	Risk	RESPONSIBILITY
Hazard: Portable Electricity Generator **Risk:** ➢ Fire. ➢ Burns. ➢ Re-fuelling. ➢ Electrocution. ➢ Bodily injury. ➢ Back injury. ➢ Trip / fall.	3	3	9	➢ Store in a dry position and away from pedestrian routes. ➢ Fill petrol tank when the generator is cold. ➢ Avoid spillages when re-fuelling. Clean up any overspill immediately. ➢ Move fuel can a safe distance away. ➢ Ensure filler cap is securely replaced. ➢ To be operated by trained personnel only. ➢ To be maintained in good condition. ➢ Always inspect before use (i.e. oil / petrol level, electric connections not broken).	3	1	3	- Site Supervisor (Foreman) - Site Operative
Hazard: Abrasive Wheels, Consaws and Angle Grinders **Risk:** ➢ Wheels shattering at high speed. ➢ Serious facial / head injury. ➢ Cuts / wounds to hands, arms, upper body. ➢ Eye injury. ➢ Fire / explosion. ➢ Electric shock.	3	3	9	➢ Training must be provided as per the Abrasive Wheels Regulations, 1982 by MCE Ltd. ➢ Only trained and authorised personnel must be allowed to use abrasive wheels. ➢ The operator must carry out daily inspection. ➢ Guards must be in place at all times, when machine is being used. ➢ If electrically powered use 110v equipment only.	3	1	3	- Site Supervisor (Foreman) - Site Operative

MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures S	Before control measures L	Before control measures Risk	ACTIONS TO CONTROL RISKS	After control measures S	After control measures L	After control measures Risk	RESPONSIBILITY
➢ Hand Arm Vibration Syndrome – white finger. ➢ Respiratory problems. ➢ Injury to bystanders.				➢ Store petrol for consaw in correct approved containers. ➢ Always refuel away from the work area. ➢ Do not use consaw close to other people. ➢ Correct Personal Protective Equipment must be worn at all times. (Gloves, ear protection, eye protection and steel toe capped boots). ➢ Inspect work area for all dangers prior to using abrasive wheels. ➢ A hot work permit may be required from management/site foreman. ➢ Use correct discs. Store them safely when not in use. ➢ Turn off consaws and unplug grinders when not in use.				

"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
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"I understand the above method statement, risk assessment and the control measures and will undertake to carry out my work safely and in accordance with the control measures. I have been given the opportunity to raise any concerns that I may have and I realize that I can do this at anytime".

Safe working is a condition of employment

Print Name	Signature	Date
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MCE Ltd – T4 Road Upgrade

HAZARD / RISK	Before control measures			ACTIONS TO CONTROL RISKS	After control measures			RESPONSIBILITY
	S	L	Risk		S	L	Risk	

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Appendix 3 - Sample Peat Monitoring Checksheets:

- Peat monitoring posts - Checksheet 30-3-2021
- Peat monitoring posts - Checksheet 07-4-2021
- Peat monitoring posts - Checksheet 09-4-2021
- Peat monitoring posts - Checksheet 14-4-2021

PEAT MONITORING POSTS - CHECKSHEET
(MEENBOG WIND FARM)

Date:	30/03/2021

Line of Sight Posts Location no.	Location Ref	Movement Noted (Y/N)	Comment (If posts have moved, note approx amount of post movement / other relevant info)
#1	T1	N	Heavy rainfall on 28-3-21 & 29-3-21, no effect on peat stability, works suspended on site on 29-3-21
#2	T3	N	
#3	T2	N	
#4	T4	N	
#5	T5	N	
#6	T7	N	
#7	T7b	N	
#8	T7c	N	
#9	T10	N	
#10	T14	N	
#11	T18	N	
#12	T16	N	
#13	T15	N	
#14	T17	N	

Signed: ____________

NOTE: Photo of each set of posts to be taken & sent to mark.cobbe@ionicconsulting.ie for records

PEAT MONITORING POSTS - CHECKSHEET
(MEENBOG WIND FARM)

Date:	07/04/2021

Line of Sight Posts Location no.	Location Ref	Movement Noted (Y/N)	Comment (If posts have moved, note approx amount of post movement / other relevant info)
#1	T1	N	
#2	T3	N	
#3	T2	N	
#4	T4	N	
#5	T5	N	
#6	T7	N	
#7	T7b	N	
#8	T7c	N	
#9	T10	N	
#10	T14	N	
#11	T18	N	
#12	T16	N	
#13	T15	N	
#14	T17	N	

Signed: ____________________

NOTE: Photo of each set of posts to be taken & sent to mark.cobbe@ionicconsulting.ie for records

PEAT MONITORING POSTS - CHECKSHEET
(MEENBOG WIND FARM)

Date:	09/04/2021

Line of Sight Posts Location no.	Location Ref	Movement Noted (Y/N)	Comment (If posts have moved, note approx amount of post movement / other relevant info)
#1	T1	N	Heavy rainfall on 08-04-2021, no effect on peat stability
#2	T3	N	
#3	T2	N	
#4	T4	N	
#5	T5	N	
#6	T7	N	
#7	T7b	N	
#8	T7c	N	
#9	T10	N	
#10	T14	N	
#11	T18	N	
#12	T16	N	
#13	T15	N	
#14	T17	N	

Signed: ______________

NOTE: Photo of each set of posts to be taken & sent to mark.cobbe@ionicconsulting.ie for records

PEAT MONITORING POSTS - CHECKSHEET
(MEENBOG WIND FARM)

Date:	14/04/2021

Line of Sight Posts Location no.	Location Ref	Movement Noted (Y/N)	Comment (If posts have moved, note approx amount of post movement / other relevant info)
#1	T1	N	Low rainfall at all locations over previous days
#2	T3	N	
#3	T2	N	
#4	T4	N	
#5	T5	N	
#6	T7	N	
#7	T7b	N	
#8	T7c	N	
#9	T10	N	
#10	T14	N	
#11	T18	N	
#12	T16	N	
#13	T15	N	
#14	T17	N	

Signed: ______

NOTE: Photo of each set of posts to be taken & sent to mark.cobbe@ionicconsulting.ie for records

Appendix 4 - Sample Daily Works Inspection Sheet:

Daily Works Record

Daily Works Record		
Works Location:		
Date:	Time:	
Contractor to undertake work:		
Persons involved/supervisor:		
Pre Works-Inspection		
Primary Checks	Yes	No
Has the forecast been checked and is the weather acceptable?		
Have the pre-works ground investigations been completed?		
Have peat monitoring points been checked and noted?		
Is the ECOW aware of the works?		
Is there a plan in place to stop works should conditions deteriorate?		
Are there adequate environmental protections in place?		
Is specific PPE required?		
Notes on inspection of ground conditions including morphology, vegetation cover, drainage, proximity of drains and natural watercourses:		

Photographs to be uploaded to sharefile weekly.

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Post Works-Inspection		
	Yes	No
Have there been any excess peat movements?		
Has the works area been made safe?		
Have there been any environmental impacts from works?		
Is the ECOW aware of the works completion?		
Has it been necessary to cease works?		
Have photographs been taken during works and on completion?		
Authorisation and Acceptance		
I confirm that the above information is correct and I have done as much as is reasonably practicable to ensure works are undertaken safely and successfully.		
Company:	Date	Time
Signature:		

Photographs to be uploaded to sharefile weekly.

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Appendix 5 - Sample Permit to Work:

Excavation Permit to Work

Site:	PTW No.	
Precise Location:	Issue date/duration:	
Contractor to undertake work:		
Persons involved/supervisor:		
Equipment to be used:		

Hazard Identification

Primary Hazards	Yes	No
Are you qualified/competent to undertake works?		
Have you signed on to relevant RAMS?		
Have you been briefed on the specific risks in your works area?		
Are you aware of the emergency procedures in the event of an accident/incident?		
Has the area been checked for overhead lines or underground services where applicable?		
Are there adequate environmental protections in place?		
Is there safe access/egress to the works area?		
Is specific PPE required?		
Are excavation protection measures available?		
Has site supervisor briefed you on your specific tasks?		
Comment on any additional hazards and controls		

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Authorisation and Acceptance

I confirm that the above information is correct and I have done as much as is reasonably practicable to ensure works are undertaken safely and successfully. I commit to explaining this permit and its' requirements to all workers involved and accept responsibility for the works described herein

Person Authorizing PTW:		
Company:	Date	Time
Signature:		
Person Accepting PTW:		
Company:	Date	Time
Signature:		

Hand back and Cancellation

I confirm that work has been completed/partially completed, checked by myself and the area left safe and in a tidy condition

	Signature	Date	Time
Person in Charge			
Issuing person			

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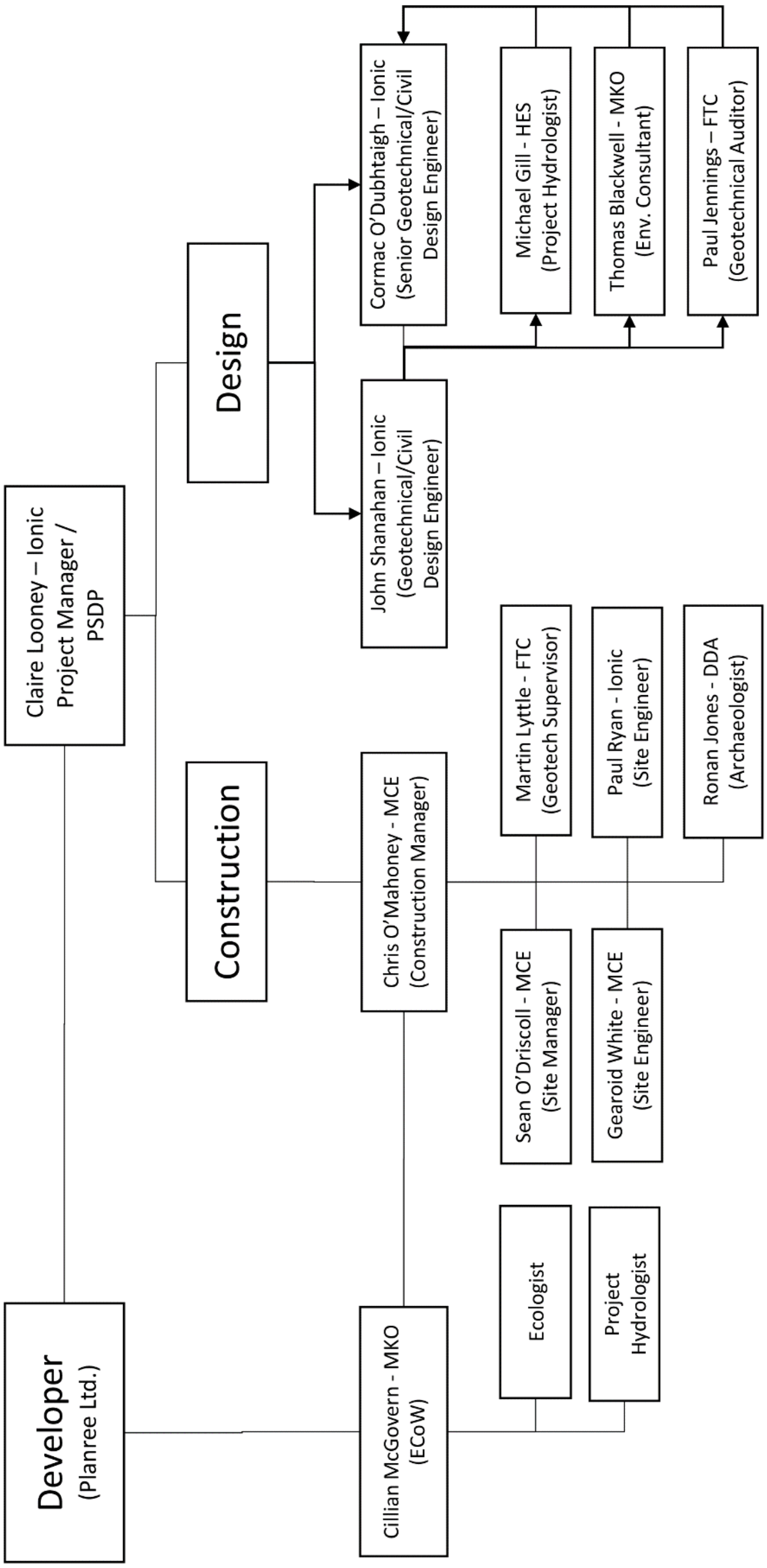
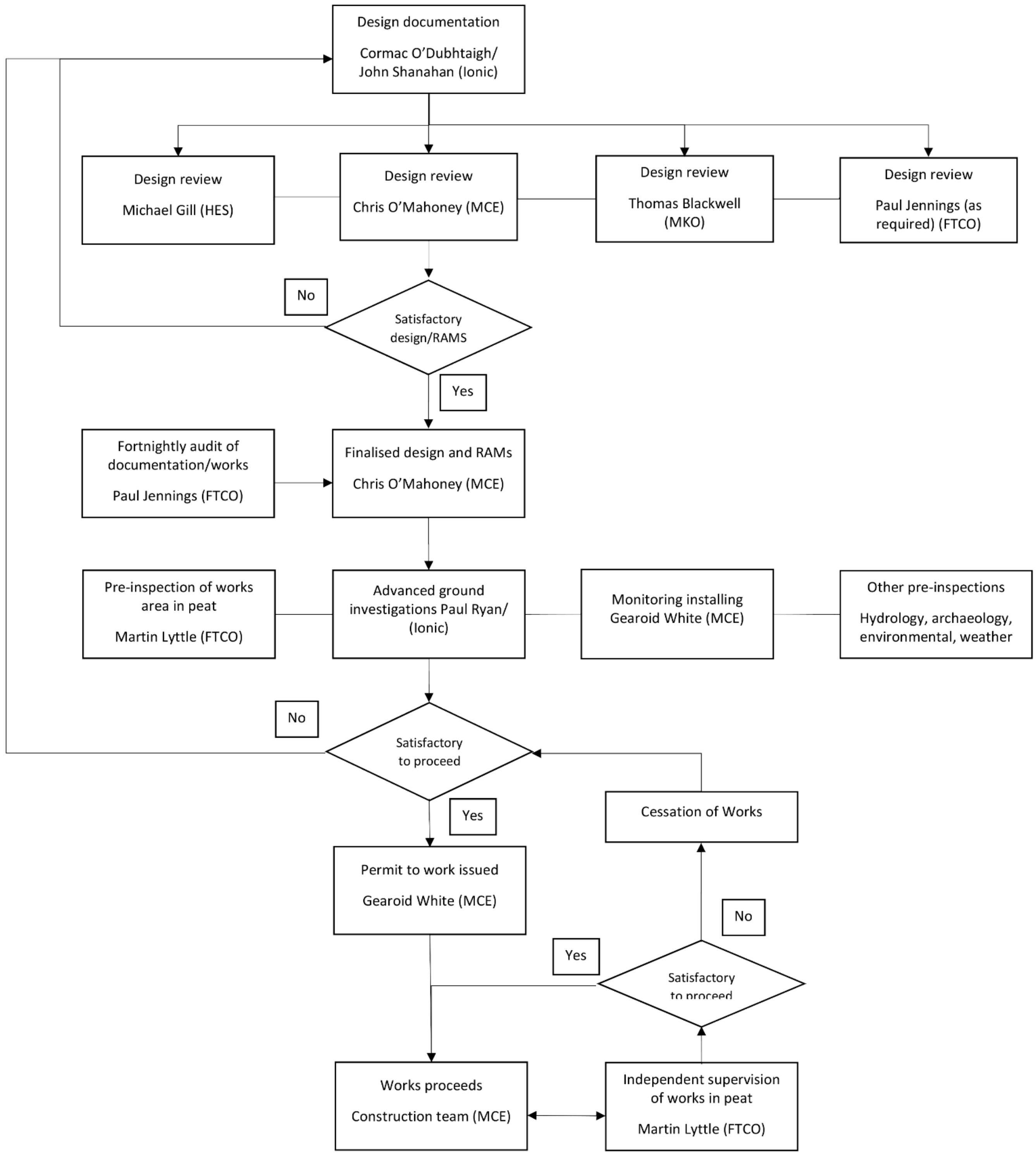
Appendix 6 – Meenbog Organogram & Flow Chart:

<u>Organogram:</u>



Design & Construction Flow Chart:



Outline of Roles/Responsibilities

This section outlines the updated roles and responsibilities of the construction team to ensure that the remaining works are completed in accordance with the mitigation measures and recommendations in the peat stability assessment report.

Claire Looney (Ionic)

Project Manager and PSDP. Claire is the Project Manager for the windfarm as appointed by the developer Planree Ltd. Her responsibilities include scoping the project and managing the execution of this scope until all construction works are complete. She also acts as PSDP and therefore has responsibility for the coordination of designs and must ensure a communication channel is open between all designers and constructors in an orderly and controlled manner. Her responsibilities further extend to the communication and coordination of all main contractors and PSCS, escalation of all issues to the developer and other authorities as required and acting as the Engineer under the contracts.

Construction Manager (MCE)

The MCE Construction Manager for the site is Chris O'Mahony, supported by Sean O'Driscoll, Site Manager and Gearoid White, Site Engineer. The construction manager has responsibility for the organisation and execution of elements of construction including environmental and health & Safety requirements. He is responsible for the preparation of appropriate RAMS for all works to the satisfaction of the design team and the full implementation of the RAMS during construction.

Comac O'Dubhthagigh & John Shanahan (Ionic)

Cormac O'Dubhthaigh is the Senior Geotechnical/ civil design engineer supported by John Shanahan, Geotechnical/ civil design engineer. They are responsible for assessment of peat and providing appropriate civil design for approval by the entire design team prior to finalising the design and proceeding to construction. They also fulfil a supervisory/ advisory role with a site visit at least once per week during works in peat and will remain available to the contractor as required throughout the construction of the development. They will be responsible for verifying the stability of the site infrastructure prior to and during the erection of the wind turbines.

Paul Ryan (Ionic)

Paul Ryan is the Ionic Site Engineer and is responsible for surveying and site testing as required by the consultant engineers and site management. He will assess current status versus previous investigative data on each section of proposed works areas and discuss the results with Martin Lyttle (FT), Ionic and MCE management.

Paul Jennings (FTCO)

Reviews RAMS where required. Conducts periodic audits of project documentation and site activities.

Martin Lyttle (FTCO)

Martin Lyttle will be present during construction works in peat. His responsibility will include assessing zone of influence prior to works commencing and to observe ongoing works. He will have the authority to halt works where there is the potential for peat instability.

Hydro Environmental Services (HES)

HES are the project hydrologists, led by Michael Gill. HES are part of the design team and provide the detailed drainage design for the construction phase of the project, while also supporting the ECoW in monitoring, overseeing and auditing the effective implementation of the detailed drainage design on site. The Project Hydrologist will not be full time on site but will be required to visit as necessary to oversee the implementation of their drainage design.

Thomas Blackwell (MKO)

Thomas Blackwell is the MKO environmental consultant appointed to co-ordinate MKO inputs on the project, including review design documents from an environmental perspective.

Killian McGovern (MKO)

MKO are the appointed Environmental Clerk of Works (ECoW), the ECoW role is fulfilled by Killian McGovern. The ECoW works closely with the Construction Manager in relation to the contractor's day-to-day implementation of the CEMP. He undertakes environmental monitoring, inspections and reviews to audit that the works are carried out in compliance with the CEMP and ensures the necessary environmental records are maintained throughout the construction period. He also coordinates the required inputs and site visits from the Project Ecologist or Project Hydrologist etc. as required.

Project Ecologist (MKO)

MKO are the Project Ecologist, led by Pat Roberts. MKO ecologists will be available to support the ECoW on matters relating to the protection of sensitive habitats and species encountered prior to or during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will undertake pre-commencement surveys and visit the site as required.

Archaeologist (DDA)

Dominic Delany and Associates are the project archaeologists, represented on site by Ronan Jones. The archaeologist monitors all ground works at the construction phase of development to avoid any potential direct or indirect impacts on sub-surface archaeological finds, features or deposits which may exist on the site.

Project Ecologist (MKO)

MKO are the Project Ecologist, led by Pat Roberts. MKO ecologists will be available to support the ECoW on matters relating to the protection of sensitive habitats and species encountered prior to or during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will undertake pre-commencement surveys and visit the site as required.

Appendix 7 - Records & Correspondence:

- Email Correspondence of rainfall records
- Email Correspondence evidencing stop works instruction from ECOW for rainfall totals

Mark Cobbe

From: Conor McGettigan <conor@hydroenvironmental.ie>
Sent: 21 May 2021 09:51
To: Michael Gill; Christopher O'Mahony
Cc: Stephen Corrigan; Killian McGovern; Mark Cobbe; Thomas Blackwell; michaelmurnane@turnkeydev.com
Subject: Re: Meenbog WF - rainfall totals

All,

Date	Daily rainfall (mm)	
20/05/2021	15.4	
21/05/2021	2.2	total until 8.30am this morning

Kind Regards
Conor McGettigan – HES
058-44122 / 086-2457718

From: Michael Gill <michael@hydroenvironmental.ie>
Sent: 20 May 2021 09:45
To: Christopher O'Mahony <christopher.omahony@turnkeydev.com>; Conor McGettigan <conor@hydroenvironmental.ie>
Cc: Stephen Corrigan <scorrigan@mkoireland.ie>; Killian McGovern <kmcgovern@mkoireland.ie>; Mark Cobbe <mark.cobbe@ionicconsulting.ie>; Thomas Blackwell <tblackwell@mkoireland.ie>; michaelmurnane@turnkeydev.com <michaelmurnane@turnkeydev.com>
Subject: Meenbog WF - rainfall totals

All,
See below. These are all the daily rainfall totals to date, including a plot of same.
In response to recent requests for data transfer, Conor or I will provide a daily update by email of the daily total for the preceding day, and accumulated total for the current day each morning around this time (if we are not on site somewhere, but you will get the WhatsApp message anyway). The spreadsheet updates are purely for audit purposes.

I trust this is in order, if anyway requires the data in any other form then please let me know.

Date	Daily rainfall (mm)	
19/05/2021	2.2	
20/05/2021	5.6	total till 8.30am this morning

(Highlighted is an example of what you will get each morning going forward).

All data to date (for your records)

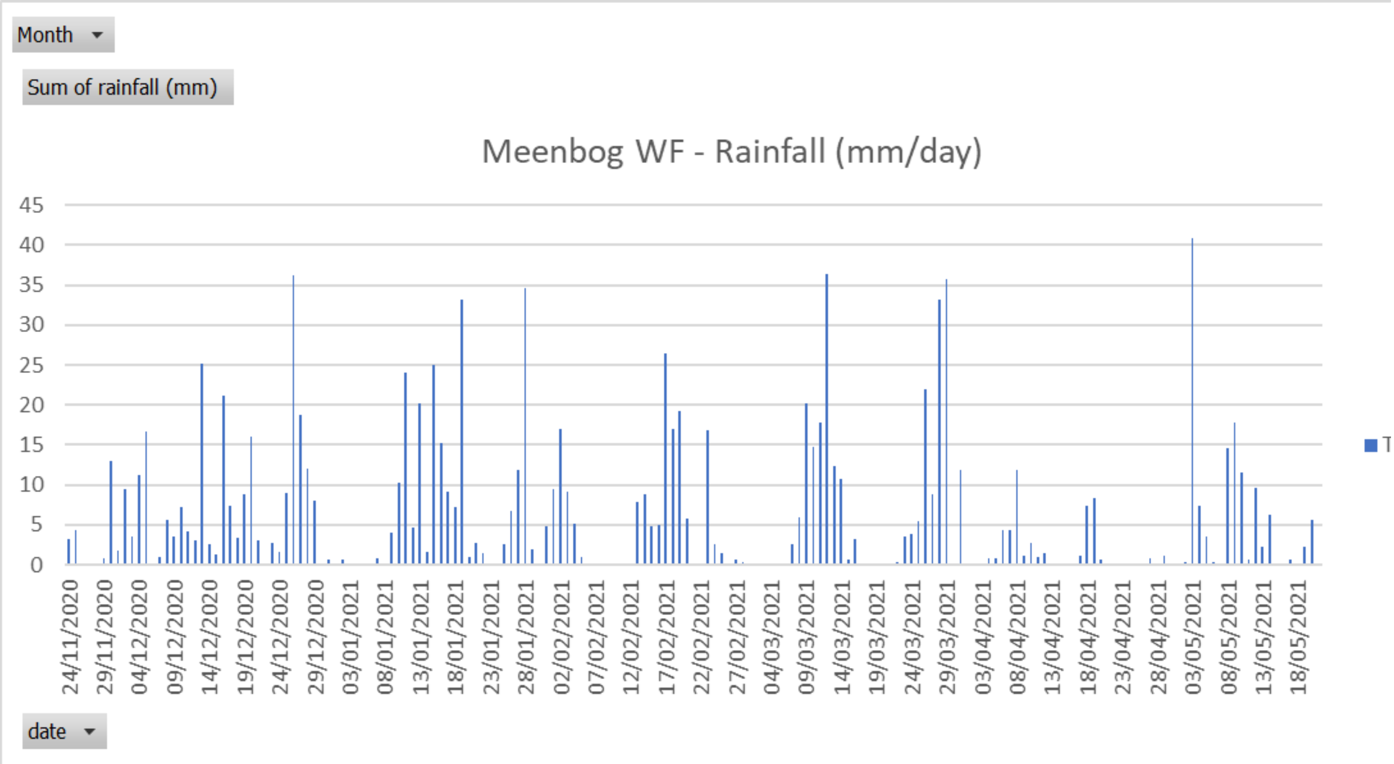
24/11/2020	3.2
25/11/2020	4.4
26/11/2020	0.2
27/11/2020	0
28/11/2020	0.2
29/11/2020	0.8

30/11/2020	13
01/12/2020	1.8
02/12/2020	9.4
03/12/2020	3.6
04/12/2020	11.2
05/12/2020	16.6
06/12/2020	0.2
07/12/2020	1
08/12/2020	5.6
09/12/2020	3.6
10/12/2020	7.25
11/12/2020	4.25
12/12/2020	3
13/12/2020	25.25
14/12/2020	2.5
15/12/2020	1.25
16/12/2020	21.2
17/12/2020	7.4
18/12/2020	3.4
19/12/2020	8.8
20/12/2020	16
21/12/2020	3
22/12/2020	0.2
23/12/2020	2.8
24/12/2020	1.6
25/12/2020	9
26/12/2020	36.2
27/12/2020	18.8
28/12/2020	12
29/12/2020	8
30/12/2020	0
31/12/2020	0.6
01/01/2021	0.2
02/01/2021	0.6
03/01/2021	0.2
04/01/2021	0.2
05/01/2021	0.2
06/01/2021	0
07/01/2021	0.8
08/01/2021	0.2
09/01/2021	4
10/01/2021	10.2
11/01/2021	24
12/01/2021	4.6
13/01/2021	20.2
14/01/2021	1.6
15/01/2021	25
16/01/2021	15.2
17/01/2021	9.2
18/01/2021	7.2
19/01/2021	33.2
20/01/2021	1
21/01/2021	2.8
22/01/2021	1.4
23/01/2021	0
24/01/2021	0

25/01/2021	2.6
26/01/2021	6.8
27/01/2021	11.8
28/01/2021	34.6
29/01/2021	2
30/01/2021	0
31/01/2021	4.8
01/02/2021	9.4
02/02/2021	17
03/02/2021	9.2
04/02/2021	5.2
05/02/2021	1
06/02/2021	0
07/02/2021	0
08/02/2021	0
09/02/2021	0
10/02/2021	0
11/02/2021	0
12/02/2021	0
13/02/2021	7.8
14/02/2021	8.8
15/02/2021	4.8
16/02/2021	5
17/02/2021	26.4
18/02/2021	17
19/02/2021	19.2
20/02/2021	5.8
21/02/2021	0.2
22/02/2021	0.2
23/02/2021	16.8
24/02/2021	2.6
25/02/2021	1.4
26/02/2021	0
27/02/2021	0.6
28/02/2021	0.4
01/03/2021	0
02/03/2021	0.2
03/03/2021	0
04/03/2021	0.2
05/03/2021	0
06/03/2021	0
07/03/2021	2.6
08/03/2021	6
09/03/2021	20.2
10/03/2021	14.8
11/03/2021	17.8
12/03/2021	36.4
13/03/2021	12.4
14/03/2021	10.8
15/03/2021	0.6
16/03/2021	3.2
17/03/2021	0
18/03/2021	0
19/03/2021	0
20/03/2021	0
21/03/2021	0.2

22/03/2021	0.4
23/03/2021	3.6
24/03/2021	3.8
25/03/2021	5.4
26/03/2021	22
27/03/2021	8.8
28/03/2021	33.2
29/03/2021	35.8
30/03/2021	0
31/03/2021	11.8
01/04/2021	0
02/04/2021	0.2
03/04/2021	0
04/04/2021	0.8
05/04/2021	0.8
06/04/2021	4.4
07/04/2021	4.4
08/04/2021	11.8
09/04/2021	1.2
10/04/2021	2.8
11/04/2021	1
12/04/2021	1.4
13/04/2021	0
14/04/2021	0
15/04/2021	0
16/04/2021	0
17/04/2021	1.2
18/04/2021	7.4
19/04/2021	8.4
20/04/2021	0.6
21/04/2021	0
22/04/2021	0
23/04/2021	0
24/04/2021	0
25/04/2021	0
26/04/2021	0
27/04/2021	0.8
28/04/2021	0
29/04/2021	1.2
30/04/2021	0
01/05/2021	0.2
02/05/2021	0.4
03/05/2021	40.8
04/05/2021	7.4
05/05/2021	3.6
06/05/2021	0.4
07/05/2021	0
08/05/2021	14.6
09/05/2021	17.8
10/05/2021	11.6
11/05/2021	0.6
12/05/2021	9.6
13/05/2021	2.2
14/05/2021	6.2
15/05/2021	0.2
16/05/2021	0

17/05/2021	0.6	
18/05/2021	0	
19/05/2021	2.2	
20/05/2021	5.6	total till 8.30am this morning



Mark Cobbe

From: Stephen Corrigan <scorrigan@mkoireland.ie>
Sent: 29 March 2021 10:36
To: Thomas Blackwell; Christopher O'Mahony; Garry Mangan; Darren Gallagher; bothar; 'geoffreysheridan01@gmail.com'; G White
Cc: Michael Murnane; Michael Watson; Claire Looney; Mark Cobbe; Brian Keville; Michael Watson; Owen Cahill; Killian McGovern
Subject: 190501 - Meenbog Windfarm Co.Donegal - Heavy Rainfall Event - Temporary Halt of Works - 29/03/21

Hi all,

Due to 55mm of rainfall recorded in the past 24 hours on Meenbog Windfarm Co.Donegal and the continued heavy rainfall today I am recommending a halt of all ground works on site. Please contact me if you have any questions.

Best Regards,

Stephen Corrigan.

Stephen Corrigan
Environmental Scientist

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