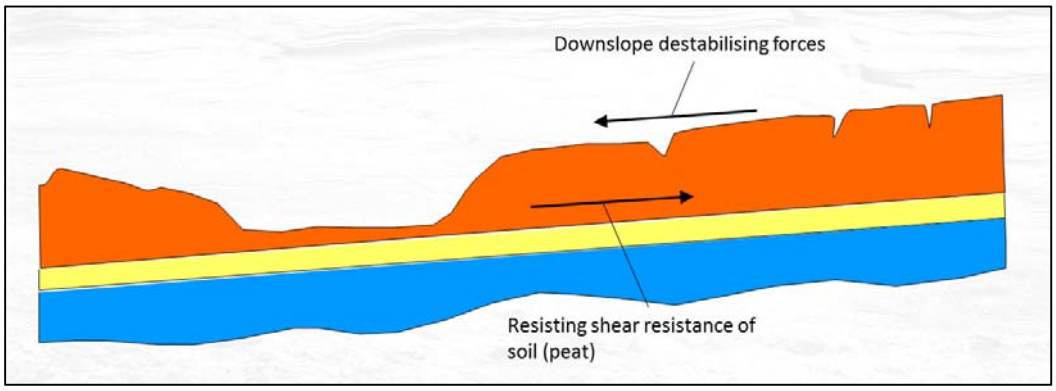


Figure 2-2: Peat Slope Showing Balance of Forces to Maintain Stability

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

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

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

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

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

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

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

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

2.7 Assessment of Intense Rainfall and Extreme Dry Events on the Peat Slopes

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

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

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

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

3 DESK STUDY

3.1 Desk Study

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

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

The desk study also included a review of both published literature and GSI online dataset viewer (GSI, 2019) on peat failures/landslides in the vicinity of the site. In addition, this section of text includes commentary on a number of landslides within the proposed development of the wind farm which were inspected during the site walkover.

The Ordnance Survey Ireland (OSI, 2019) mapping/plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical or hydrology point of view) are present on the site.

The Geological Survey of Ireland (GSI, 1996) geological plans for the site were used to verify the bedrock conditions. The GSI (2019) database was used to verify soil and subsoil types on site.

3.2 Review of Previous Failures

The Lough Allen upland area has a high density of historical landslides (Pellicer, 2006), which are dominantly associated with peat failures from the plateau and surrounding steep slopes outside of the proposed development footprint (Figure 3-1).

A review of the historical landslides in the area indicates the following:

(1) All landslides (except 3 no.) in the area are located on the upland plateau or surrounding slopes.

(2) The landslides from the upland plateau and surrounding slopes are mostly peat slides, with occasional slumping of rock-soil at the steep margin of the plateau.

(3) The peat slides from the upland plateau and surrounding slopes have occurred due to mainly a combination of deeper (and weaker) peat on poorly drained sloping ground. Most of the slides have been triggered by intense rainfall events.

(4) Within the site, there are 3 no. landslides (Figure 3-1). These landslides are described as peat slides (2 no.) and a rotational slide (1 no.). The landslides appear to have been identified from aerial photography. These landslides were inspected by FT/AGEC during a site walkover and are discussed in Section 3.2.1.

Based on a broad assessment of landslide susceptibility the site is generally classified by the GSI (2019) as 'low' to 'moderately low' susceptibility, see Figure 3-1.

3.2.1 Historical Landslides on Site

The walkover inspection included the area of the 3 no. historical landslides within the site. The following observations are given:

(1) In the area of the recorded historical landslides, the inspection noted that the area was well-drained with a cover of heather over a shallow slope with a number of low-level topographic ridges.

(2) One of the historical failures identified is a rotational slide associated with minor erosion of a stream bank.

(3) The other two failures are located within hummocky well-drained terrain and it is not thought that these are actual peat slides. It is likely that these locations have been misidentified from the aerial photography based on the type of terrain present in the area.

(4) From the above, the historical peat slides comprise misidentified locations and minor slumping of a stream bank, and as such would not be indicators of peat instability on the site.

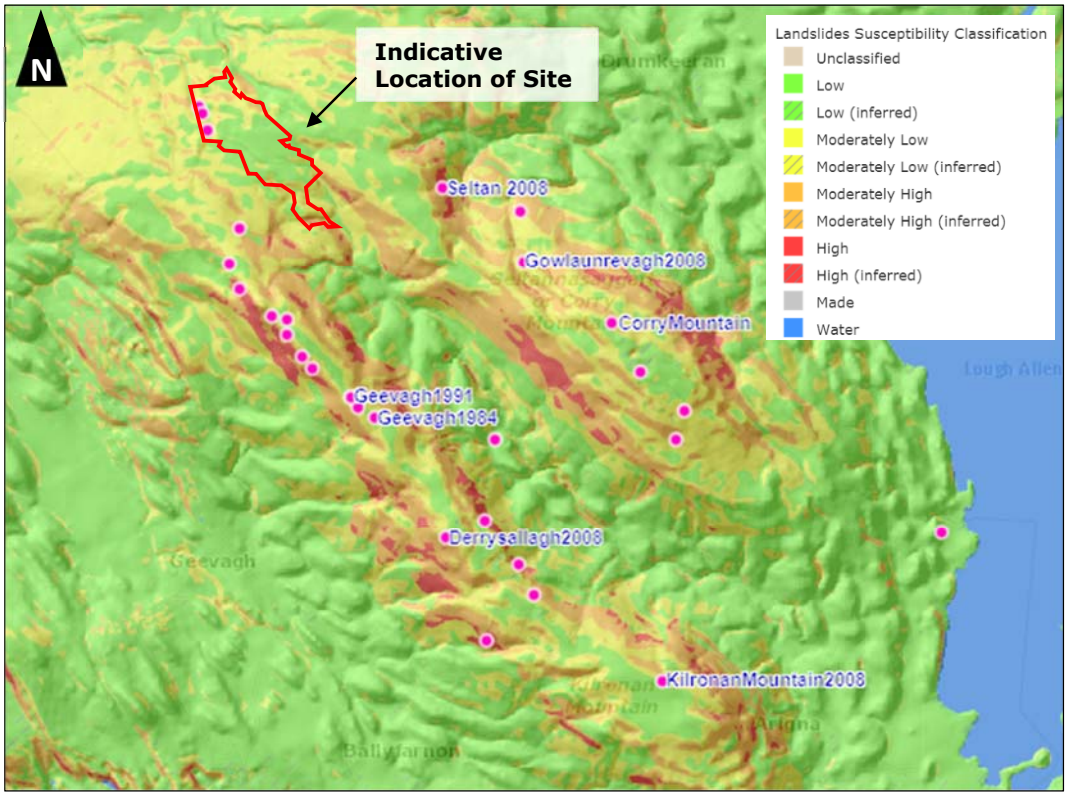


Figure 3-1: Plan showing landslide events and landslide susceptibility (GSI, 2019)

3.2.2 2016 Landslide

A landslide not yet included in the GSI database was identified during a previous walkover of the site by FT/AGEC, referred to hereafter as the 2016 landslide.

A previous walkover inspection identified a peat slide that occurred on the surrounding plateau slopes of Croagh to the southwest on the site in 2016. The slide travelled approximately 1km downslope and into the site (Figure 4-3). The peat slide originated on sloping ground within an area of peat cuttings outside the site boundary.

A combination of contributory factors for the peat slide are discussed in section 4.2 of this report. In summary, the likely cause of the failure was peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure. A number of previous peat failures have been related to 'sausage' cutting.

3.3 Review of OSI Mapping

The site is within the northwest part of the Lough Allen upland, which typically comprises plateau and ridges with steep sides separated by valleys. The proposed site is within the headwaters of the Arigna River valley which is situated between two upland plateaux ridges, namely Carrane Hill/Kilronan Mountain (437m OD) to the southwest and Corry Mountain (428m OD) to the northeast. The elevation at the site varies from 240 to 370m OD.

The site lies on the watershed divide between the Arigna River to the southeast and the Bonet River to the northwest. Lough Nacroagh, a small lochan some 150m long by about 30m wide, lies centrally within the site. The lochan is drained by a stream that flows to the northwest. The Arigna River rises on the site and flows to the southeast.

A number of streams drain the northern part of the site. These streams are generally linear through the site and drain in a northwest direction. Beyond the site, the streams pass across a drumlinised terrain and enter the Bonet River, located about 5km to the northwest, which flows into Lough Gill.

From a review of the OSI mapping for the area, no notable geotechnical features are recorded in the area.

3.4 Soils, Subsoil & Bedrock

From a review of the GSI (2019) database, the soils within the proposed development footprint consist predominantly of blanket peat and glacial till chiefly derived from Namurian sandstones and shales.

The peat is underlain by mineral soil comprising glacial till derived from Namurian bedrock.

The underlying bedrock was described by the Geological Survey of Ireland (GSI, 1996) and shown on Sheet 7 (Geology of Sligo-Leitrim). In the area of the Croagh site, Sheet 7 shows 4 no. bedrock formations.

The dominant bedrock formation is the Dergvone shale formation and is typically described as shale and minor turbiditic sandstone. The three remaining bedrock formations located within the proposed development footprint are Gowlaun shale formation, Lackagh sandstone formation and Carraun shale formation. Rock from the Gowlaun shale formation is typically described as dark grey silty sidenitic shale, from the Lackagh sandstone formation as cyclothemic sandstone, siltstone and coal and from Carraun shale formation is typically described as grey to black fossiliferous shale with subordinate micritic limestones and dolomites.

There is a mapped fault located in the south of the site with a southwest to northeast trend.

The bedrock is not affected by karst. No karst features were identified within the proposed development footprint; a number of karst features are located 2km southwest of the site and are recorded as swallow holes and caves.

Ironstones outcropping are present in the area but no evidence of workings are evident on the site.

Coal workings from mines and at-surface are located to the east and south-east of the site. No coal workings are present on the site.

3.5 Ground Conditions along Grid Connection Route

It is proposed to construct a substation within the site and to connect from here to the existing Garvagh substation. Connection will be via underground cabling located within existing forestry roads. The cabling route measures approximately 6.1km in total.

It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material. The trenches will be 900mm wide and 1220mm deep.

The cable trench route will encounter peat. No peat stability or geotechnical issues are expected as a result of the proposed grid connection works.

4 SITE WALKOVER

As part of the peat stability assessment at the proposed wind farm, numerous site walkovers were carried out by FT/AGEC between 2017 and 2019 with recording of salient geomorphological features with respect to the wind farm development and to provide peat thickness and preliminary assessment of peat strength.

The following salient geomorphological features were considered:

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

The survey covered the proposed locations for the turbine bases, substation, met mast, temporary construction compounds, borrow pit, peat repositories, existing and proposed new access roads and all associated infrastructure.

The method adopted for carrying out the site walkover relied on practitioners carrying out a visual assessment of the site supplemented with peat depth probes, peat strength testing and measurement of slope inclinations.

4.1 Findings of Site Walkover for Wind Farm

The site walkover comprised numerous walkover inspections of the site by FT between 2017 and 2019. The findings from the site walkover have been used to optimise the layout of the infrastructure on site.

The main findings of the site walkover of the wind farm site is as follows:

(1) The site is covered in blanket peat and has undulating terrain. Peat depths vary across the site depending on mainly topography. As expected, deeper peat was encountered in the flatter areas of the site with thinner peat on the surrounding slopes. Young, mature forestry and areas of felled forestry are present across the site (see Appendix A – Photos 1 & 2).

(2) Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m (figure 4-1). Peat depths recorded across the site and outside the proposed infrastructure footprint from over 850 no. peat depth probes ranged from 0 to 8.2m with an average of 2.2m. The deeper peat areas were avoided when optimising the wind farm layout and main infrastructure elements for site.

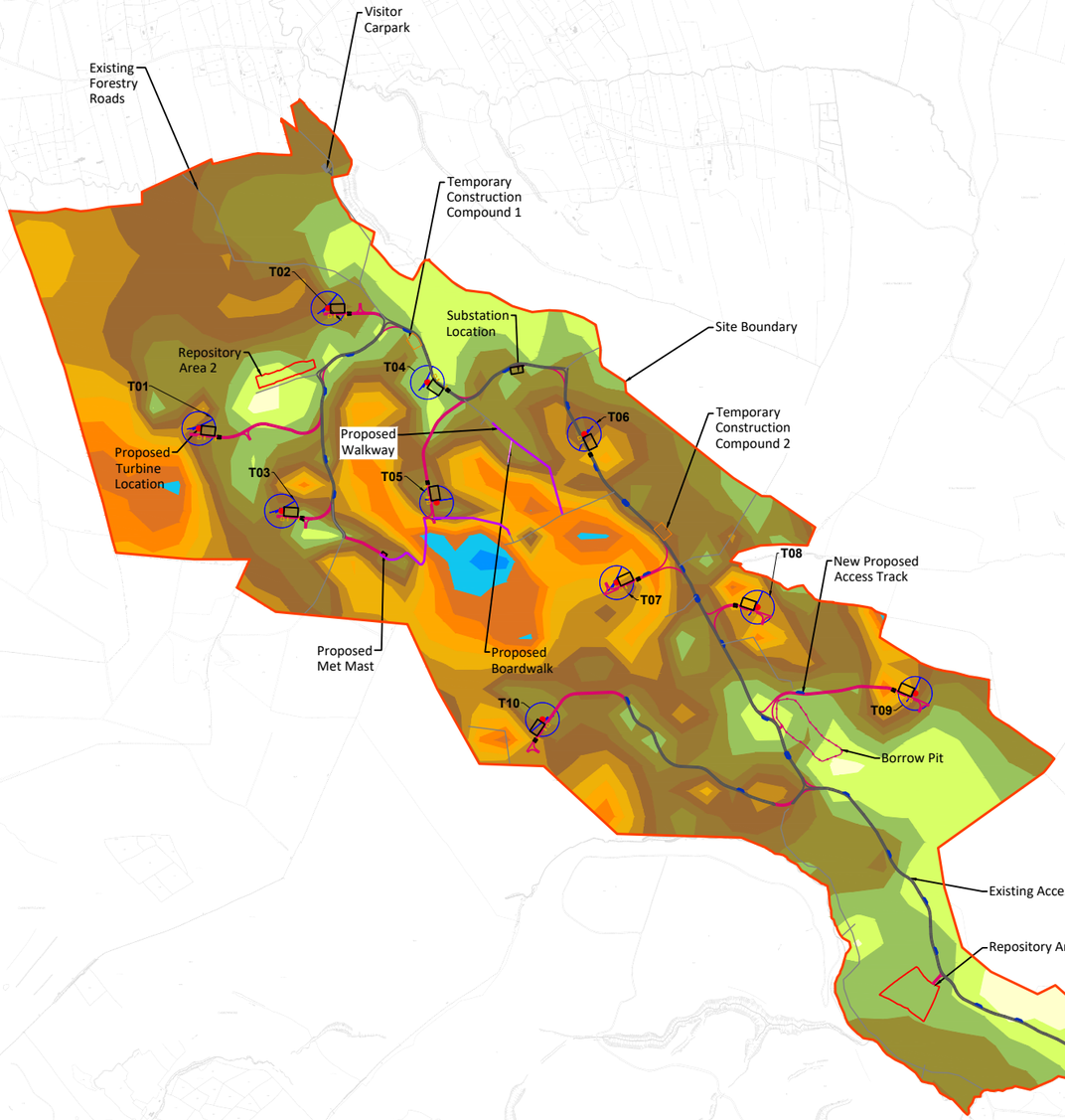
(3) The peat depths recorded at the turbine locations varied from 0.3 to 4.5m with an average depth of 2.0m. The slope angle at the turbine locations range from 2 to 12 degrees, locally up to 12 degrees where the peat depth is shallow.

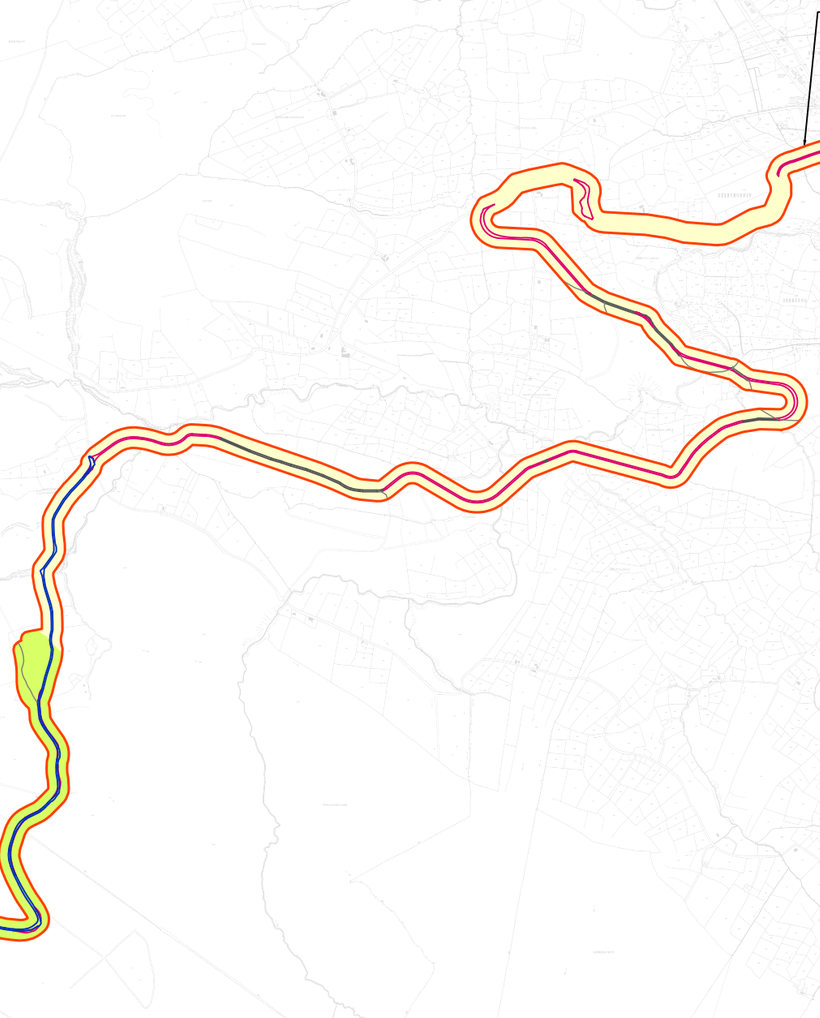
(4) The access tracks for the wind farm will comprise upgrading of existing and construction of new tracks. The existing tracks were noted as being in relatively good condition and consist of both excavated/founded and floated tracks. An example of the existing tracks are shown in Photos 6 and 7.

(5) With respect to the new proposed and existing tracks, peat depths are typically less than 3m with localised depths of up to 5m recorded.

(6) At a number of the deeper peat areas on site, quaking (or buoyant) peat was noted. Quaking peat is indicative of highly saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability. The areas identified as having quaking peat are highlighted on Figure 4-3 and were avoided when optimising/selecting infrastructure locations on site.

FEHILY TIMONEY Cork | Dublin | Carlow
www.fehilytimoney.ie





Peat Depth Legend:

- ≥ 0 < 0.5
- ≥ 0.5 < 1
- ≥ 1 < 1.5
- ≥ 1.5 < 2
- ≥ 2 < 2.5
- ≥ 2.5 < 3
- ≥ 3 < 3.5
- ≥ 3.5 < 4
- ≥ 4 < 4.5
- ≥ 4.5 < 5
- ≥ 5 < 5.5
- ≥ 5.5 < 6
- ≥ 6 < 6.5

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

Scale (@ A3) 1:24000

Date - 03.07.20

FIGURE 4-1 : PEAT DEPTH CONTOUR PLAN

Drawn - POR

Checked - IH

Rev - D

Friday 3 July 2020

O:\ACAD\2019\P1989\P1989-0600-0001

(7) Mechanically cut peat is locally present in an area adjacent to the proposed location for turbine T1. Mechanically cut peat is typically cut using a sausage machine which is used to extract peat for harvesting. The machine cuts, which vary in depth essentially sever the acrotelm layer (upper fibrous layer of peat) where most of the intrinsic strength of peat lies. It should however be noted that the area where the mechanically cut peat is recorded as relatively flat, and that the works to construct T1 will not encroach on this area. The area is highlighted on Figure 4-3.

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

(9) A peat slide that occurred in 2016 on the surrounding plateau slopes of Croagh to the southwest of the site was inspected during the FT walkovers. An exclusion zone, where no development is recommended, around the landslide is shown on Figure 4-3. Section 4.2 of this report contains the main observations of the peat slide. In addition, see Photos 8 and 9 within Appendix A.

(10) A watercourse crossing is present along the proposed access route to turbine T1 (Photo 10). A suitably sized culvert with structural up-fill to allow the construction of the access road will be required at this location. See Chapter 4 of the EIAR for details.

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

(a) The site is typically covered in blanket peat with undulating terrain and widespread young, mature and felled forestry. Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m (figure 4-1).

(b) A construction buffer zone plan has been produced for the site (Figure 4-3). This Figure shows areas on the site where no development is proposed and areas with an elevated or higher construction risk. The above identified areas are based on qualitative factors identified during the walkover survey e.g. relatively deep peat, quaking peat, mechanically cut peat, historic peat landslides, etc.

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

4.2 Findings of Site Walkover for 2016 Landslide

The landslide of October 2016 identified during a previous walkover of the site by FT/AGEC was inspected during the site walkovers (Photos 8 and 9). The following findings from the site walkover are given:

(1) The slide travelled approximately 1km downslope, away from any forestry, and into the proposed Croagh wind farm site. The peat slide originated on sloping ground within an area of mechanically cut peat outside the site boundary.

(2) Based on anecdotal information from a local landowner, the failure/landslide is thought to have occurred in October 2016.

(3) Peat thicknesses recorded at the head of the failure typically ranged from 2.2 to 2.5m.

(4) Based on an inspection of the shear plane/failure surface, the failure is thought to have occurred within the silt/clay underlying the peat deposits. Photo 8 shows the failure surface.

(5) Following a review of the failure source area, an estimated plan area of 25,000m^2 with a typical peat depth of 2.3m is given. This gives an estimated failure volume of 57,500m^3. It should be noted that further material within the scar and downslope of the initial the scar is likely to have been mobilised during the failure. As an approximate guide the potential volume mobilised downslope of the failure source area could be in excess of 18,000m^3 (assumed 900m length, 20m width and 1m peat depth).

(6) It should be noted that the failed material was deposited along the edges of the failure scar, within the failure and towards the end of the failure run-off.

(7) The following combination of contributory factors to the peat slide are as follows:

(a) Peat cutting. 'Sausage' machine cutting was carried out within the source area of the failure. This cutting severs particularly the upper fibrous layer (acrotelm) reducing shear strength and allows ingress of surface water. The peat appears to have been cut in multiple directions.

(b) Drainage. Several ditches drain into the area, including a downslope drain that feeds directly into the head of the failure.

(c) Previous failures. The area of the 2016 slide corresponds with a notable break (step) in the peat cover along the slope. This is identified further south as an historical 'peat burst'. It is likely that this break in the peat cover represents the back-scarp to previous multiple peat slides. At the location of the 2016 slide the break in peat cover extended downslope as a spur of peat, this spur failed in the slide.

(d) Rainfall. High intensity rainfall is usually associated with such failures. A review of rainfall data shows no significant rainfall in October 2016 based on data from Markree Rainfall Station in Sligo. The possibility of a localised rainfall event at the site cannot however be discounted.

(8) In summary, the likely major contributory causes of the failure were peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure.

4.3 Findings of Walkover for Upland Slopes (outside of site boundary)

A walkover survey of the upland slopes outside of the Croagh wind farm site boundary was carried out on 26th and 27th October 2017. The upland slopes outside of the proposed development covered by the FT/AGEC walkover are shown on Figure 4-2.

The walkover findings presented in this section of the report have been separated into the following upland slopes (both of which are outside the proposed site boundary for the Croagh site):

(1) Southwestern upland slopes

(2) Eastern upland slopes

4.3.1 Southwestern Upland Slopes

The following findings were recorded from the site walkover:

(1) The upland slopes to the southwest of the development boundary are covered in blanket peat with peat depths ranging from 0.7 to 4.5m with an average of 3m.

(2) Areas of mechanically cut and cut-over peat are present on the slopes. In some cases, the peat has been cut in a direction parallel to the slope contours which encourages water to build-up within the mechanical cuts. This area is highlighted and further discussed below.

(3) There is evidence of relict (likely multiple) failures along the slope.

(4) A peat slide which occurred in 2016 is present on the slope. The slide travelled approximately 1km downslope into the proposed footprint of the Croagh wind farm site, as described in Section 4.2. The likely cause of the failure was peat cutting using a 'sausage' machine in combination with high intensity rainfall in an area prone to failure.

(5) Given the high density of relict failures and the 2016 failure noted on the south-western slopes, the risk of peat instability/failure on the remaining areas of the slope is considered medium risk provided the natural state of the peat slopes remains unchanged i.e. no construction works, change in drainage regime or similar activities take place on the slopes. However, as stated above, this area is outside of the site boundary and as such no works are proposed in this area.

4.3.2 Eastern Upland Slopes

The following findings were recorded from the site walkover:

(1) The upland slopes to the east of the site boundary are covered in blanket peat with peat depths ranging from 0.9 to in excess of 7.5m with an average of 3.3m. The deeper peat was encountered in the flatter areas with thinner peat on the steeper surrounding slopes.

(2) Quaking peat was noted at a number of the deeper peat areas. Quaking peat has previously been linked with peat instability/failure however with the presence of the flat terrain in these areas, the risk of peat failure is considered low.

(3) No significant signs of previous peat instability/failure were noted on the slopes.

(4) Notwithstanding the significantly deep peat recorded on the eastern slopes, the risk of peat instability/failure in this area is low provided the natural state of the peat slopes remains unchanged i.e. no construction works, change in drainage regime or similar activities take place on the slopes. The low risk in the deeper peat areas is attributed to the flat terrain present.

(5) Where construction works are proposed within this area, the implementation of appropriate construction measures will maintain a low risk of peat instability.

It should be noted that the findings presented above are based on the condition of the slopes at the time of the FT/AGEC site inspection. Alterations to the surrounding slopes such as construction activities, change in the drainage regime, harvesting of peat, etc, can change the condition and stability of the slopes.

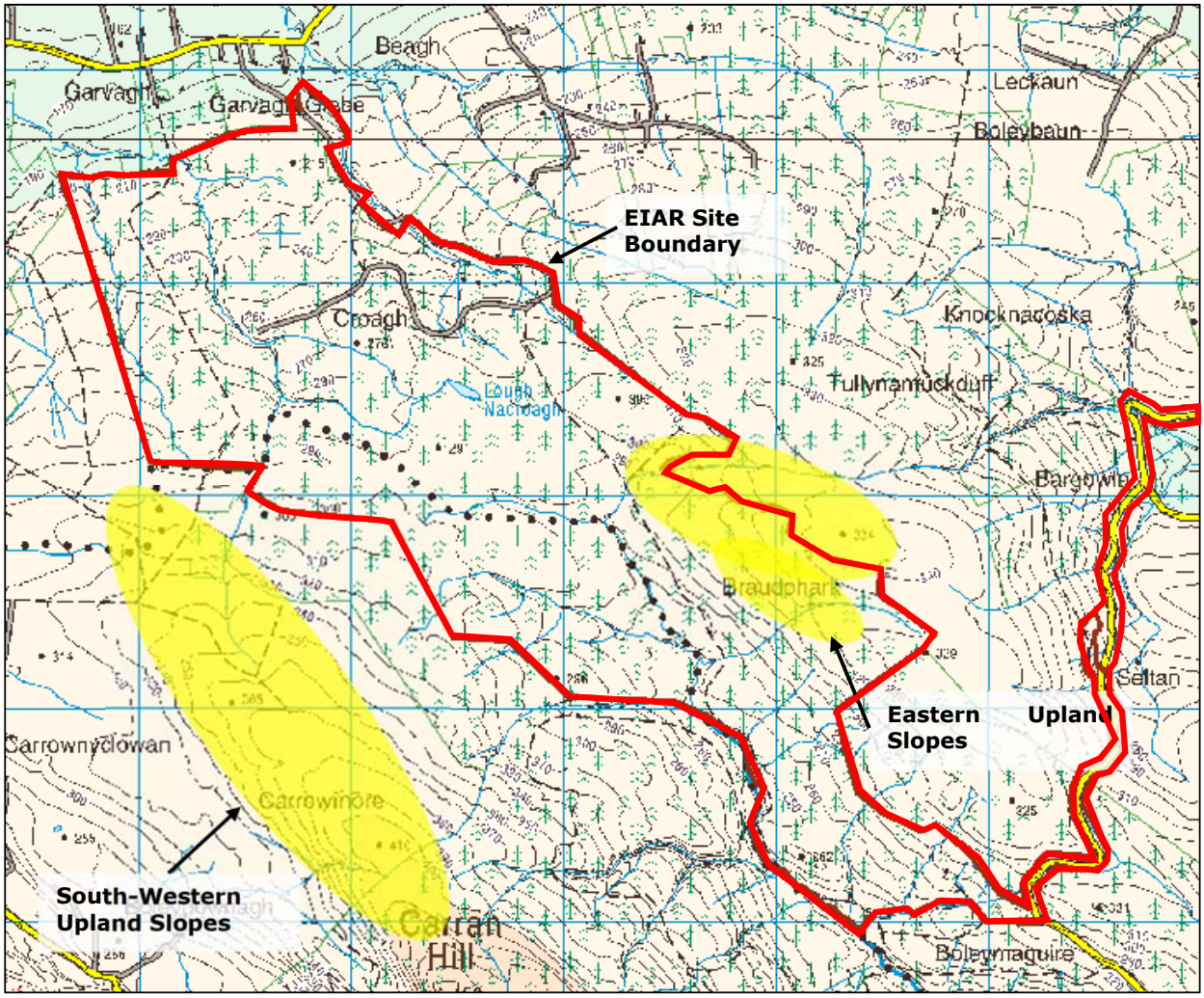


Figure 4-2: Indicative extent of adjacent upland slopes inspected by FT

Legend

Indicative extent of adjacent upland slopes inspected by FT

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10

Site Boundary

Construction Buffer Zone Legend:

Areas which have an elevated or higher construction risk (areas with deep weak and occasionally quaking peat). Areas where no development is proposed.

Area of 2016 peat slide where no development is proposed.

Areas which have an elevated or higher construction risk (area with mechanically cut peat). Area where no development is proposed.

Areas which have an elevated or higher construction risk. Marginally low FOS calculated, see section 7 of report for futher details.

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

Scale (@ A3)
1:24000

Date - 03.07.20

FIGURE 4-3 : CONSTRUCTION BUFFER ZONE PLAN

Drawn - POR
Checked - IH
Rev - D

O:\ACAD\2019\P1989\P1989-0600-0002

Friday 3 July 2020

5 GROUND INVESTIGATION

A number of phased ground investigations were carried out at the site by FT/AGEC, National Material Testing Laboratory (NMTL) and Irish Drilling Ltd (IDL). A summary of the ground investigation is presented below.

Table 5-1: Summary of Geotechnical Parameters

Investigation Type	Number
Peat Probe	850
Hand Shear Vane	54
Trial Pit	40
Borehole	4

The initial phase of ground investigation comprised 11 no. trial pits and was carried out on 24th and 25th October 2017. Laboratory testing of samples was carried out by NMTL. A 13-tonne tracked excavator was used for the ground investigation works. The trial pits were carried out at various locations across the site to depths of 4.4m bgl. The laboratory testing comprised classification testing of the soft silt/clay underlying the peat. The trial pit logs, photographs and laboratory test results from the 2017 ground investigation are included in Appendix B.

The second phase of ground investigation comprised 21 no. trial pits and was carried out on 29th April and 2nd May 2019 and 29th and 30th May 2019. Laboratory testing of samples was carried out by IDL. A 13-tonne tracked excavator was used for the ground investigation works. The trial pits were carried out at various locations across the site to depths of 4.4m bgl. The laboratory testing comprised classification and density testing of the non-peat overburden deposits. The trial pit logs, photographs and laboratory test results from the 2019 ground investigation (trial pits) are included in Appendix C.

The third phase of ground investigation comprised 4 no. boreholes/rotary cores and were carried out between 28th May and 13th June 2019. Laboratory testing of samples was carried out by IDL. The boreholes/rotary cores were carried out at potential borrow pit locations across the site to depths of 30m bgl. The laboratory testing comprised strength and reusability testing of rock core recovered. In-situ standard penetration testing (SPT) was carried out in the non-peat overburden at typically 1.5m intervals. In-situ permeability testing was also carried out at each of the boreholes. The borehole/rotary core logs, photographs and laboratory and in-situ test results from the 2019 ground investigation are included in Appendix D.

Two trial pits were excavated under the supervision of MKO at potential borrow pit locations in September 2019. An additional 6 no. trial pits were excavated along the construction access route in March 2020.

The purpose of the ground investigations was to assess the ground conditions across the site in particular the extent, characteristics and strength of the soil immediately underlying the peat, to determine the potential founding stratum of various infrastructure elements across the site and to determine the potential to develop borrow pits at the site.

The ground investigations were carried out in accordance with the principles in BS 5930:2015 and Eurocode 7 Part 2. A ground investigation location plan showing all trial pit and borehole locations is included as Figure 5-2 in this report.

5.1 Summary of In-situ & Laboratory Tests

As part of the 3 no. phases of ground investigation carried out at the site, laboratory testing was carried out as part of the works. The laboratory testing carried out included:

- Soil classification tests
- Soil density tests
- Rock strength tests

- Rock reusability tests

Laboratory testing was scheduled on bulk samples recovered from the trial pits and rock core recovered from the boreholes/rotary cores.

Particle size distribution (PSD) tests and Atterberg limit classification tests were carried out on samples from the trial pits. The PSD tests showed that the material is a slightly gravelly slightly sandy clayey Silt/silty Clay based on the percentage of the particle sizes. The Atterberg limit test results show the material as either a clay or silt of low to intermediate plasticity.

5.2 Interpretation & Summary of Ground Conditions

The ground conditions and stratigraphy at the site can be typically categorised into the following sequence:

Peat

Typically described as firm and spongy locally plastic black & brown fibrous to amorphous peat. Peat thicknesses from the trial pits ranged from 0.3 to 4.2m.

Soft Silt/Clay Deposit

Described as very soft and soft, locally firm, light brown/grey clayey silt. The thickness of the layer generally varies from 0.3 to 0.6m, locally up to 0.8m, with an average thickness of 0.5m. The soft silt/clay deposit was recorded in all but one of the 15 no. trial pits. This layer is locally known as 'Leitrim daub'.

Undrained shear strength recordings within this layer range from 6 to 51 with an average of 25kPa. Locally a number of relatively higher strength readings (greater than 40kPa) were recorded.

The soft silt/clay deposit frequently has a lower strength than the overlying peat. No clear separation was noted between the soft silt/clay deposit and the overlying peat.

This material would be unsuitable as a founding stratum for all infrastructure elements on site e.g. access tracks, hardstands, turbine bases, etc.

Glacial Till

Described as firm and stiff, locally very stiff, sandy very gravelly silt/clay with occasional to frequent cobbles and locally occasional boulders. Cobbles and boulders were typically noted as angular and sub-rounded and rounded. The thickness of the layer is variable across the site depending on topography and depth to bedrock. The base of the glacial till was not encountered in most of the trial pits; noted as "not bottomed out' in trial pits logs.

Gravel and cobbles comprised fragments of weathered shale. The till is essentially derived from the underlying Namurian sandstones and shales.

The till would be suitable for a founding stratum for some of the infrastructure elements on site e.g. access tracks, hardstands, etc.

SPT 'N' values within this layer ranged from 5 to 50 (refusal), indicating a strength range of soft to very stiff.

Bedrock

Possible weathered bedrock was encountered in 2 of the 15 no. trial pits (TP6 & TP13) and was typically described as highly weathered grey/blue shale.

The weathered shale rock recovered during the ground investigation is considered poor quality shale based on its physical properties from a visual inspection. Higher quality rock is likely to be present at depth.

Bedrock was recovered from rotary boreholes drilled at 4 no. locations across the site to provide an overview and comprised a medium strong thinly laminated fine-grained Limestone with closely spaced horizontal and

subvertical discontinuities. A medium strong thinly laminated calcareous Siltstone with closely to very closely spaced discontinuities was also recorded.

Rock strength and durability testing was undertaken on core samples taken from the four boreholes. A single Uniaxial Compressive Strength (UCS) test was carried out on a sample from BH3 and recorded a strength of 80MPa (strong). Five sets of Point Load Index (PLI) testes were undertaken on rock core samples. Each set comprised five tests, with strengths ranging from 0 to 1.9MPa (very weak to medium strong).

A total of six number Los Angeles abrasion tests were carried out on samples from the rotary boreholes, with results ranging from 33 to 48.

A total of three Slake Durability tests were carried out with results ranging from 70.5 to 98.3%. A total of three Magnesium Sulphate Soundness tests were undertaken with results ranging from 55 to 91.

Groundwater & Permeability

Groundwater monitoring locations were installed in the 4 no. rotary boreholes. Groundwater readings ranged from 1.76 in BH4 to 12.56m bgl in BH2.

Two rising head and two falling head permeability tests were undertaken in the boreholes.

Other Comments and Observations

The stability of the excavation faces of the trial pits was frequently noted as unstable.

5.3 Overview of Ground Conditions

The site is covered with blanket bog. Based on in excess of 850 probes carried out during previous walkover surveys the peat depth ranged from 0 to 6.0m with an average peat depth from probes of 1.7m.

Peat depths vary across the site depending on mainly topography. Generally deeper peat was encountered in the flatter areas of the site with thinner peat on sloping ground. Localised variations in peat depth over short distances were recorded, which reflects the undulations in the underlying surface of the mineral soil/rock topography.

The peat is immediately underlain by a soft silt/clay deposit and glacial till derived from Namurian sandstones and shales. The soft silt/clay deposit appears to be present across the site. Based on a desk study, bedrock on the site comprises dominantly shale with interbedded minor sandstone. Bedrock recorded in the rotary boreholes was a mixture of fine-grained Limestone and calcareous Siltstone

5.4 Summary of Geotechnical Parameters

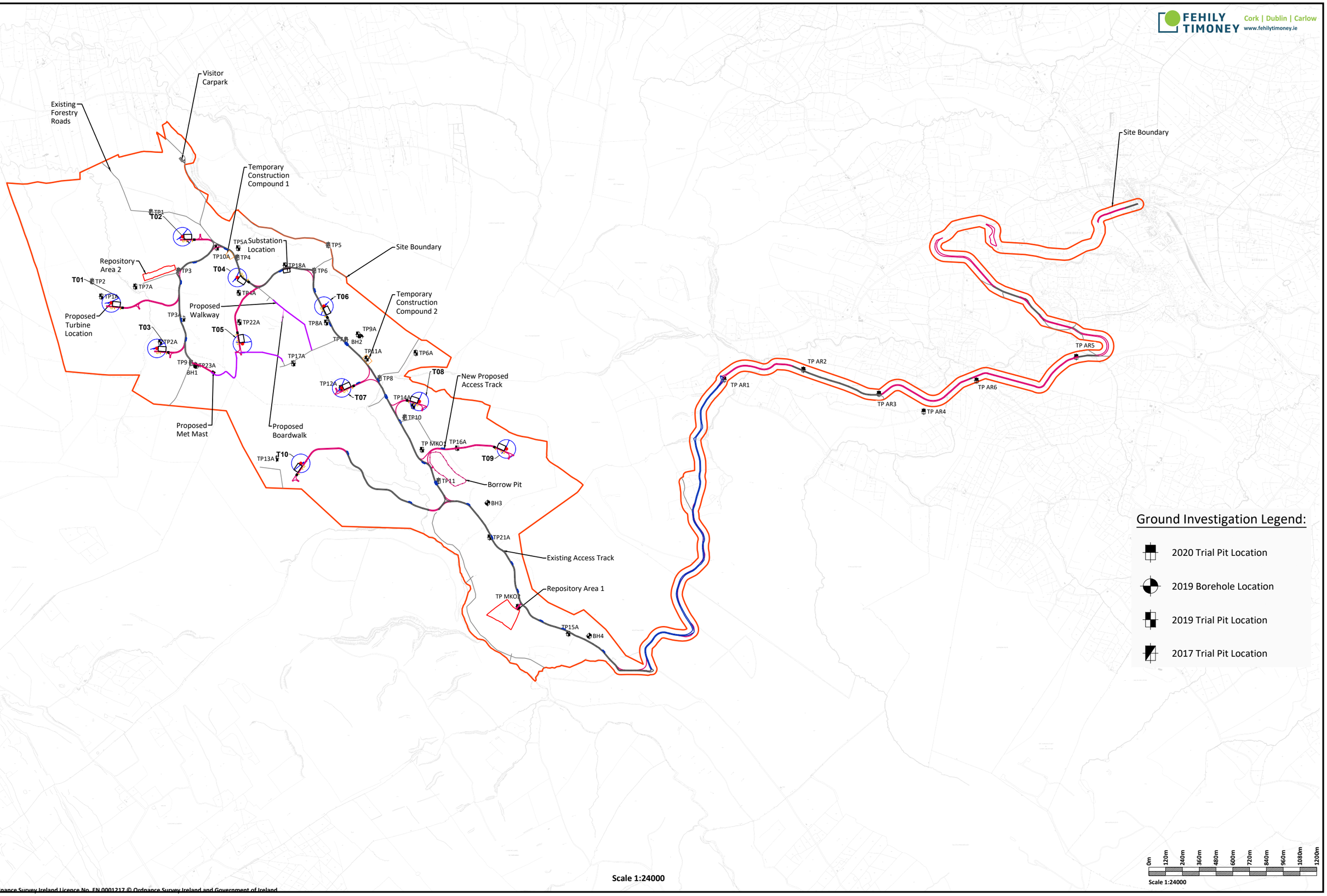
Table 5-1 contains characteristic geotechnical parameters for the main material types likely to be encountered on the Croagh Wind Farm site. Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values. Characteristic values are defined as a cautious estimate of the value affecting the occurrence of limit state based on clause 2.4.5.2 from Eurocode 7.

Table 5-2: Summary of Geotechnical Parameters

Material Type/Strata	Unit Weight	Geotechnical Parameters		
		Undrained Parameters	Drained Parameters	
	γ (kN/m^3)	c_u (kPa)	φ' (°)	c' (kPa)
Peat	11	6	25	4
Soft Silt/Clay	18	20	26	0
Glacial Till	19	75	30	0
Bedrock	21	-	34	250

Notes
Note (1) The above parameters are indicative only and have been derived based on experience and from a review of the ground investigation carried out at the site.
Note (2) Where direct measurement of parameters has not been carried out, established correlations with measured properties have been used to derive values.

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie



Scale (@ A3)
1:24000

Date - 03.07.20

FIGURE 5-1 : GROUND INVESTIGATION LOCATION PLAN

Drawn - POR
Checked - IH
Rev - D

O:\ACAD\2019\P1989\P1989-0600-0003

Friday 3 July 2020

6 PEAT DEPTH, STRENGTH & SLOPE AT PROPOSED INFRASTRUCTURE LOCATIONS

Based on the peat depths recorded within the proposed infrastructure envelope by FT/AGEC, HES and MKO, the peat varied in depth from 0 to 6m with an average of 1.7m. All peat depth probes (in excess of 850 no. probes) carried out on site have been utilised to produce a peat depth contour plan for the site (Figure 4-1).

A summary of the peat depths at the proposed infrastructure locations is given in Table 6-1. The data presented in Table 6-1 is used in the peat stability assessment of the site; see Section 7 of this report.

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

Turbine	Easting	Northing	Peat Depth Range (m) (1) (4)	Average Peat Depth (m)	Slope Angle (o) (2)
T1	583322	823639	1.8 to 2.2	2.0	3
T2	583831	824112	1.8 to 2.8	2.4	2
T3	583648	823314	1.9 to 2.8	2.2	2
T4	584223	823820	0.5 to 1.0	0.8	12
T5	584259	823347	0.3 to 1.3	0.8	2
T6	584841	823616	1.8 to 2.4	2.0	2
T7	584968	823032	2.0 to 2.8	2.4	4
T8	585523	822935	3.3 to 3.9	3.5	4
T9	586144	822595	2.1 to 4.5	3.2	3
T10	584676	822493	0.8 to 1.0	0.9	6
Substation	584584	823867	0.9 to 1.7	1.2	6
Temporary Construction Compound 1	584170	823980	0.7 to 1.6	1.2	12
Temporary Construction Compound 2	585150	823232	1.3 to 1.9	1.6	5
Met Mast	584059	823136	0.6 to 1.5	1.2	3
Borrow Pit	585697	822449	Typ. 0.5	0.5	4-12
Repository Area 1	586141	821416	1 to 1.5	1.25	1-4
Repository Area 2	583669	823855	0.9 to 1.5	1.2	6-10

Note (1) Based on probe results from the site walkovers. The range of peat depths for the infrastructure locations are generally based on a 10m grid carried out around the infrastructure element.
Note (2) Slope angle obtained during site survey by FT using handheld equipment or from slope contour survey data. The slope angle quoted reflects the slope immediately around the infrastructure location.
Note (3) The data presented in the Table above is used in the peat stability assessment of the site; see Section 8 of this report.

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

The hand vane results indicate undrained shear strengths in the range 5 to 45kPa, with an average value of about 18kPa. The lower bound strengths recorded would be typical of deep weak saturated peat and were recorded in the deeper peat deposits in the flatter areas of the site.

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

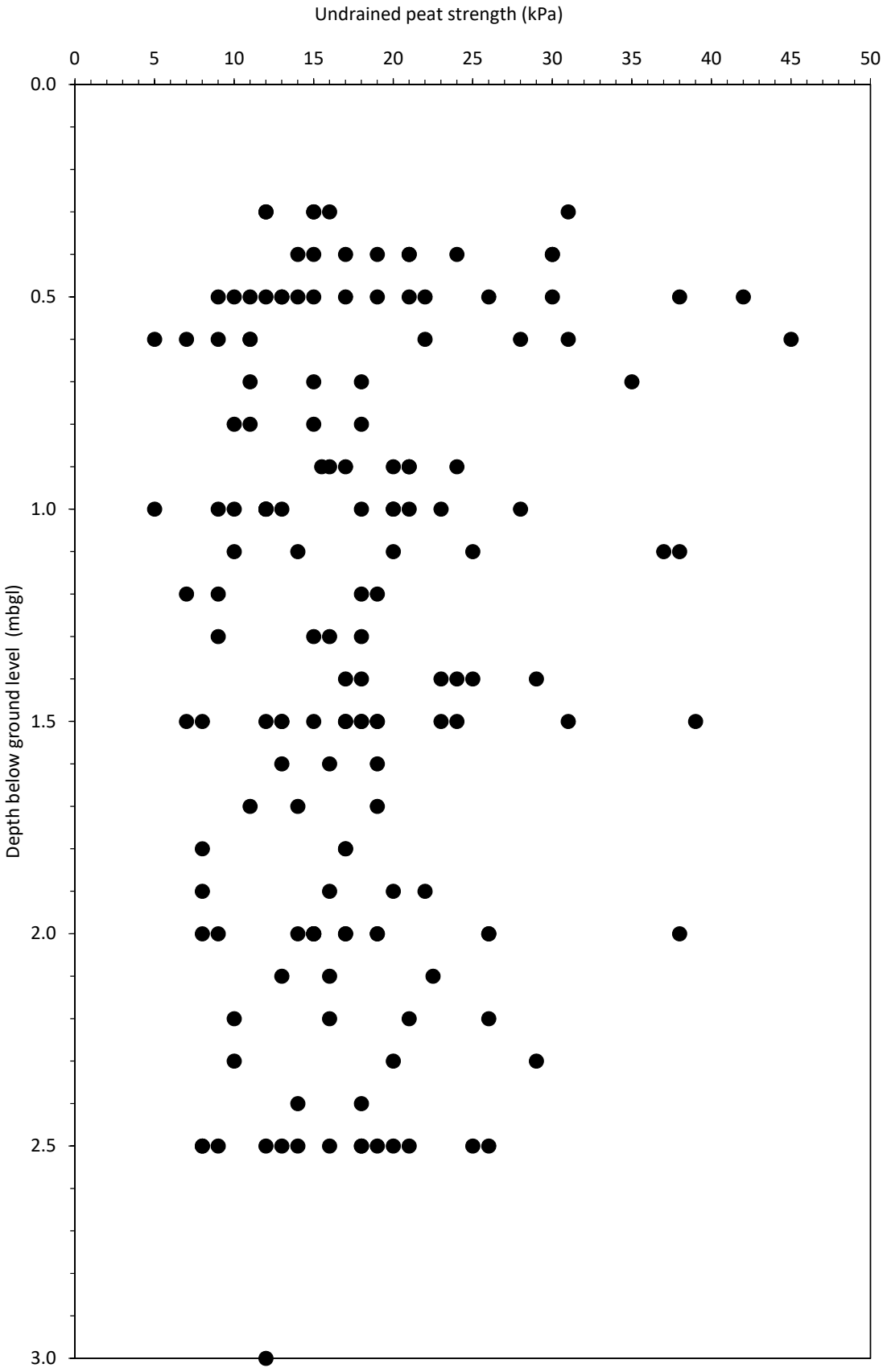


Figure 6-1: Undrained shear strength (C_u) profile for peat with depth

7 PEAT STABILITY ASSESSMENT

The peat stability assessment analyses the stability of the natural peat slopes for individual parcels across the site including at the turbine locations, along the proposed access roads, at the other main infrastructure elements and at various locations across the site. The assessment also analyses the stability of the natural peat slopes with a surcharge loading of 10kPa, equivalent to placing 1m of stockpiled peat on the surface of the peat slope.

7.1 Methodology for Peat Stability Assessment

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

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

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

1. The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.
2. The drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the 2003 Derrybrien failure, and other failures in peat, undrained loading during construction was found to be the critical failure mechanism.

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

Table 7-1 shows a summary of the published information on peat together with drained strength values.

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

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus/ Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-

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

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

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

$c' =$ 4kPa
$ø' =$ 25 degrees

7.2 Analysis to Determine Factor of Safety (Deterministic Approach)

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

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

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

As a general guide the FoS limits for peat slopes in this report are summarised in Table 7-2.

Table 7-2: Factor of Safety Limits for Slopes

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

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

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

A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment based on the c_u values recorded at the site. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat generally has a higher undrained strength.

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

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

Where,

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

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

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

Where,

F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material

z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

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

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

(1) Peat depths are based on the maximum peat depth recorded at each location from the walkover surveys carried out by FT/AGEC, MKO and HES.
(2) A lower bound undrained shear strength, c_u for the peat of 6kPa was selected for the assessment based on the c_u values recorded at the site. It should be noted that a c_u of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat generally has a higher undrained strength.
(3) Slope angle on base of sliding assumed to be parallel to ground surface.

For the stability analysis two load conditions were examined, namely;

Condition (1): no surcharge loading
Condition (2): surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.

7.3 Results of Analysis

7.3.1 Undrained Analysis for the Peat

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

The calculated FoS for load condition (1) is in excess of 1.30 for each of the 332 no. locations analysed with a range of FoS of 1.53 to in excess of 10, indicating a low risk of peat instability.

The calculated FoS for load condition (2) for the 332 no. locations analysed, only 7 no. FoS points were less than 1.3 where FoS's of 1.05 and 1.28 were calculated. In relation to the marginally low FoS's, 6 no. of the FoS points are located alongside existing access roads on site which have been in operation for a number of years and hence are not considered areas at risk of peat instability. However, these areas have an elevated construction risk and are highlighted on the construction buffer zone plan (Figure 4-3).

Areas with marginally low FoS's frequently coincide with steeper slope angles of between 7.6 and 12.1 degrees or localised deeper pockets of peat. The slope angles are based on lidar survey data for the area and the steeper slope angles calculated are likely as a result of localised undulations or variations in vegetation at those particular locations. Applying slope angles reflective of site conditions at these locations in the assessment would likely result in FoS's greater than 1.3 in these areas.

The remaining 1 no. marginally low FoS is located along the new proposed access road to turbine T9 and coincides with a deeper pocket of peat. This area has an elevated construction risk and is highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E).

The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

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

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	583322	823639	5.22	3.59
T2	583831	824112	6.14	4.53
T3	583648	823314	6.14	4.53
T4	584223	823820	2.95	1.48
T5	584259	823347	13.23	7.48
T6	584841	823616	7.17	5.06
T7	584968	823032	11.16	8.23
T8	585523	822935	2.39	1.90
T9	586144	822595	2.55	2.09
T10	584676	822493	5.77	2.89
Substation	584584	823867	13.69	5.13
Temporary Construction Compound 1	584170	823980	3.84	1.92
Temporary Construction Compound 2	585150	823232	3.87	2.19
Met Mast	584059	823136	20.78	7.79

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10

Site Boundary

Factor of Safety Legend:

0 < 1.0	
≥ 1.0 < 1.3	
≥ 1.3	
No Peat Recorded At This Location	

Increasing Stability

Scale 1:24000

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale (@ A3) 1:24000

Date - 03.07.20

FIGURE 7-1 : FACTOR OF SAFETY PLAN - SHORT TERM CRITICAL CONDITION (UNDRAINED)

Drawn - POR

Checked - IH

Rev - D

Friday 3 July 2020

O:\ACAD\2019\P1989\P1989-0600-0004

7.3.2 Drained Analysis for the Peat

The results of the drained analysis for the peat are presented in Appendix F. The results from the main infrastructure locations are summarised in Table 7-4. As stated previously, the drained loading condition examines the effect of in particular, rainfall on the existing stability of the natural peat slopes.

The calculated FoS for load condition (1) for the 332 no. locations analysed, only 10 no. FoS points were less than 1.3 where FoS's of between 1.02 and 1.17 were calculated. In relation to the marginally low FoS's, 6 no. of the FoS points are located alongside existing access roads on site which have been in operation for a number of years and hence are not considered areas at risk of peat instability. However, these areas have an elevated construction risk and are highlighted on the construction buffer zone plan (Figure 4-3).

Areas with marginally low FoS's frequently coincide with steeper slope angles of between 7.6 and 12.1 degrees or localised deeper pockets of peat. It should be noted that the slope angles quoted for these locations are not generally a reflection of the topography at these locations. The slope angles are based on lidar survey data for the area and the steeper slope angles calculated and are likely as a result of localised undulations or variations in vegetation at those particular locations. Applying slope angles reflective of site conditions at these locations in the assessment would result in FoS's greater than 1.3 in these areas.

The remaining 2 no. marginally low FoS's are located along the new proposed access road to turbine T9 and coincides with a deeper pocket of peat. This area has an elevated construction risk and is highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E).

The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

The calculated FoS for load condition (2) is in excess of 1.30 for each of the 332 no. locations analysed with a range of FoS of 1.47 to in excess of 10, indicating a low risk of peat instability.

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

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	583322	823639	3.48	5.17
T2	583831	824112	4.10	6.53
T3	583648	823314	4.10	6.53
T4	584223	823820	1.97	2.08
T5	584259	823347	8.82	10.79
T6	584841	823616	4.78	7.30
T7	584968	823032	7.44	11.88
T8	585523	822935	1.59	2.74
T9	586144	822595	1.69	2.99
T10	584676	822493	3.85	4.14
Substation	584584	823867	9.13	7.39
Temporary Construction Compound 1	584170	823980	2.56	2.74
Temporary Construction Compound 2	585150	823232	2.58	3.13
Met Mast	584059	823136	16.63	13.49

8 PEAT STABILITY RISK ASSESSMENT

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

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

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated and rated as shown in Table 8-1. Where a subsection is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', only routine control measures are required.

Table 8-1: Risk Rating Legend

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

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

8.1 Summary of Risk Assessment Results

The results of the risk assessment for potential peat failure at the main infrastructure elements is presented as a Peat Stability Risk Register in Appendix E and summarised in Table 8-2.

The risk rating for each infrastructure element at the Croagh wind farm is designated negligible and low following some mitigation/control measures being implemented. Sections of access roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element.

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

Table 8-2: Summary of Peat Stability Risk Register

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Turbine T1	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T2	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T3	Low	5 to 10	Yes	Low	5 to 10
Turbine T4	Negligible	1 to 4	No	Negligible	1 to 4
Turbine T5	Low	5 to 10	No	Negligible	1 to 4
Turbine T6	Negligible	1 to 4	No	Negligible	1 to 4

Infrastructure	Pre-Control Measure Implementation Risk Rating	Pre-Control Measure Implementation Risk Rating Category	Notable Control Measures Required	Post-Control Measure Implementation Risk Rating	Post-Control Measure Implementation Risk Rating Category
Turbine T7	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T8	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T9	Negligible	1 to 4	Yes	Negligible	1 to 4
Turbine T10	Low	5 to 10	No	Low	5 to 10
Met Mast	Negligible	1 to 4	No	Negligible	1 to 4
Substation	Negligible	1 to 4	No	Negligible	1 to 4
Temporary Construction Compound 1	Negligible	1 to 4	No	Negligible	1 to 4
Temporary Construction Compound 2	Negligible	1 to 4	No	Negligible	1 to 4
Construction access road	Low	5 to 10	No	Low	5 to 10

9 COMPARISON OF SITE CONDITIONS WITH KNOWN FAILED SITES

A comparison of conditions at the Croagh site was carried out with sites of known significant failures namely Garvagh Glebe, Derrybrien and Ballincollig Hill. Given the close proximity of the Garvagh Glebe site to Croagh, this comparison is deemed pertinent.

Site and ground conditions at the Croagh site are described as blanket peat on undulating terrain. Peat depths across the site vary based mainly on topography with depths within the proposed infrastructure envelope ranging from 0 to 6m with an average of 2.1m. Undrained shear strengths for the peat recorded using a Geonor H-60 hand-held vane range from 5 to 45kPa with an average of 18kPa.

There is a soft silt/clay deposit immediately underlying the peat on the Croagh site which is typically described as very soft and soft, locally firm, light brown/grey clayey silt. The thickness of the layer varies from 0.3 to 0.6m, locally up to 1m. Undrained shear strength recordings within this layer range from 6 to 50 with an average of 25kPa. Locally a number of relatively higher strength readings (greater than 40kPa) were recorded.

The Garvagh Glebe wind farm site is located to the northeast of the proposed Croagh wind farm site. The failure at Garvagh Glebe occurred in 2008 in a low strength deep peat area at the head of a watercourse/natural drainage route. The failure took place following the construction of a section of access track. Undrained shear strengths of 2 to 4kPa were reported in the failure area along with peat thicknesses of up to 6.3m. Ground conditions comprised blanket peat over a thin soft clay layer with an approximate thickness of 0.2m. The failure occurred within the soft clay layer underlying the peat.

A second, and notably smaller peat failure, occurred at the Garvagh Glebe site whilst constructing an access road along a ridge line in the southwest of the site. This failure occurred on relatively thin peat on steep ground.

With respect to the major failure at Garvagh Glebe the key characteristics are as follows:

(1) Head of a watercourse/natural drainage route
(2) Peat thicknesses of up to 6.3m.
(3) Weak clay below peat
(4) Undrained shear strengths of 2 to 4kPa

As stated above and as per the Garvagh Glebe site there is a soft silt/clay deposit underlying the peat at Croagh. The deposit recorded on the Croagh site, based on descriptions from trial pits, appears similar to the deposit present on the Garvagh Glebe site. It should however be noted that the presence of an underlying soft deposit would be quite common on peatland sites and such sites have been successfully developed in the past.

In summary, in comparison to the location where the major failure occurred on the Garvagh Glebe site, the proposed development footprint at the Croagh site has significantly less likelihood of a similar failure due to:

(1) Head of watercourse/natural drainage routes have been avoided
(2) Reduced peat thicknesses (deeper peat deposits on the Croagh site are located in areas of flat terrain)
(3) Relatively higher strength clay below peat
(4) Higher undrained shear strengths in peat (5 to 45kPa with an average of 18kPa recorded on the Croagh wind farm site)

Peat strength at other sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from essentially back-analysis, though some testing was carried out, was estimated at 2.5kPa. Derrybrien wind farm is located in county Galway and the failure occurred in 2003. The recorded undrained strengths at Croagh are significantly greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is significantly less likelihood of failure on the Croagh site.

Another peat failure, namely Ballincollig Hill in county Kerry occurred in 2008, and is included here for comparison purposes. In-situ shear strength (undrained) measurements showed high but typically variable peak strength within the upper 1.5m (acrotelm) that varied from about 5 to 40kPa. Within peat below 1.5m

(catotelm) the results show a narrower variation in peak strength that varied between 2.5kPa and about 6kPa. A number of factors were considered to have contributed to the failure namely mechanically cut/harvested peat, high rainfall preceding the failure, weak peat and construction works. The recorded undrained strengths at Croagh are significantly greater than the lower bound values for Ballincollig indicating that there is significantly less likelihood of failure on the Croagh site.

Figure 9-1 shows a comparison of peat strengths with depth recorded at the site compared to sites that have experienced significant failures, as outlined above. The results show that the failed sites have a notably greater proportion of lower recorded strengths, with lower strengths extending to greater depth.

This distribution of recorded strength with depth is illustrated more clearly in Figure 9-2; this shows at failed sites that about 40% of all recorded strengths are less than 10kPa. At the Croagh site approximately 15% of the recorded strengths are below 10kPa.

Whilst the difference between sites may not appear significant in absolute strength terms (the values represent very low soil strengths) the lower bound strengths for the Croagh site are considerably greater than those for the failed sites, which is significant in terms of stability.

For all the cases presented above, construction activities were the common triggering factor for the failures/landslides. The management of peat stability and appropriate construction practices will be inherent in the construction phase of the wind farm to ensure peat failures do not occur on site.

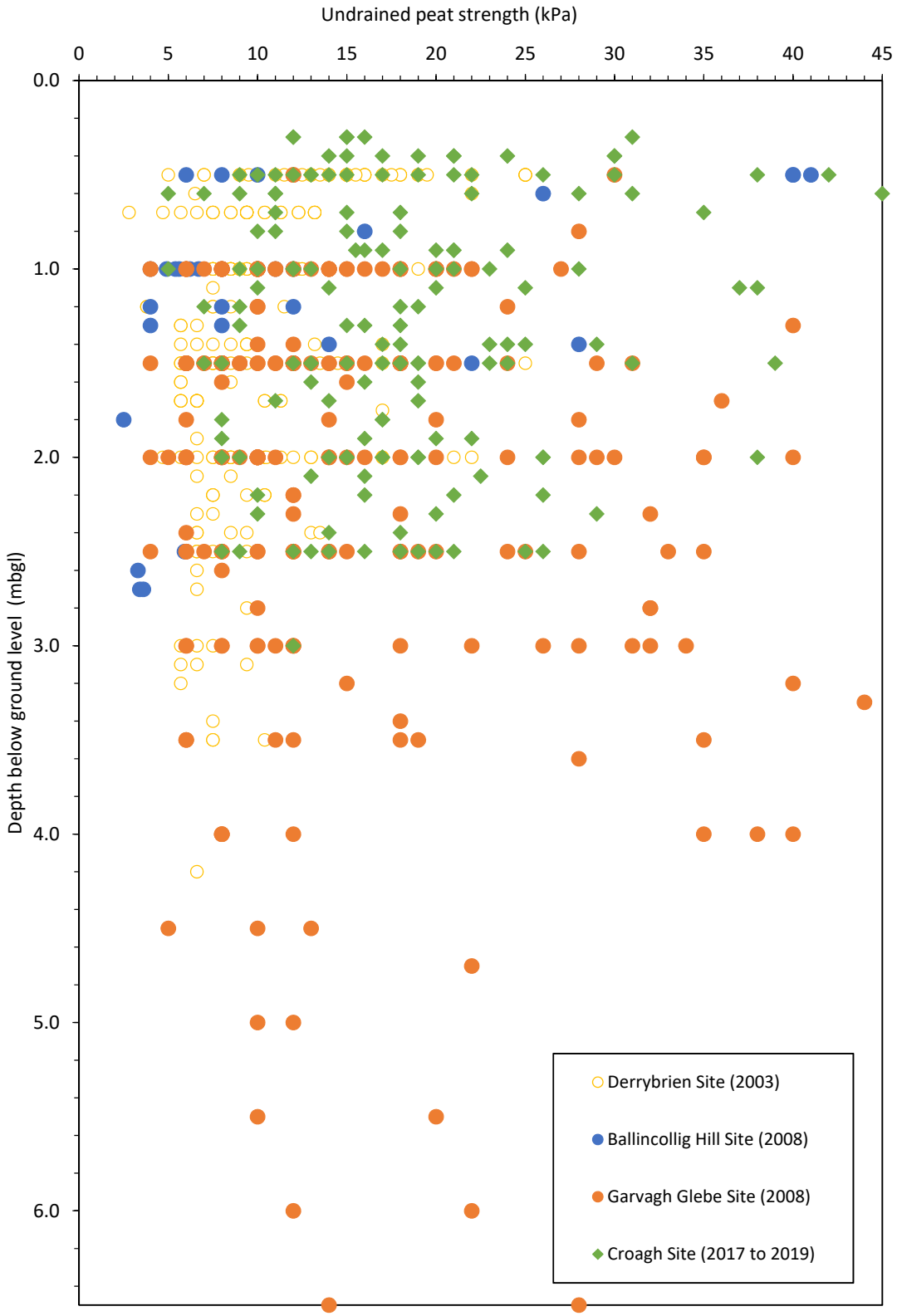


Figure 9-1: Comparison of peat strength (shear vane) with depth from other sites

Notes:
(1) Peat strength measured using a Geonor hand-head shear vane (H60).
(2) Shear strength is unfactored.

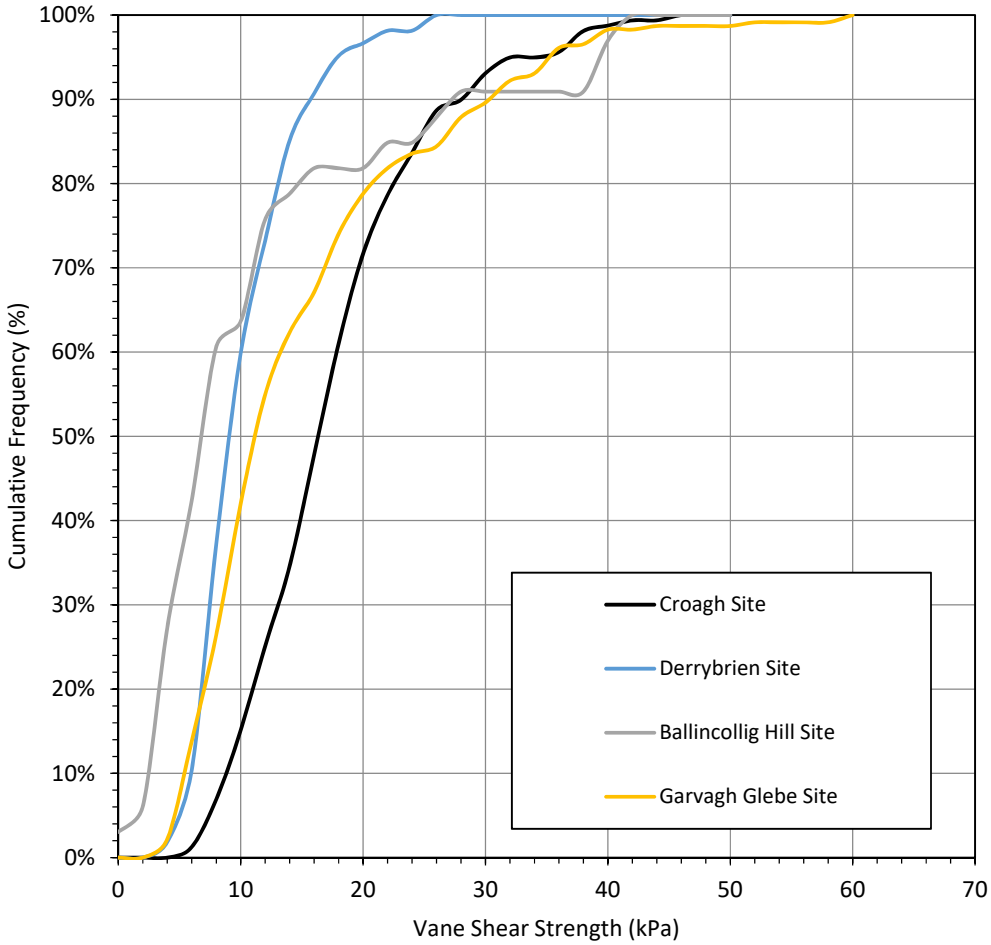


Figure 9-2: Comparison of distribution of peat strength (shear vane) from other sites

Notes:
(1) Peat strength measured using a Geonor hand-head shear vane (H60).
(2) Shear strength is unfactored.

10 IMPLICATIONS OF SOFT DEPOSIT UNDERLYING PEAT

A summary of the main implications for the development of a site with the presence of a soft deposit underlying the peat is given below.

(1) Firstly, it should be noted that the presence of a soft silt/clay layer underlying the peat would be quite common on peatland sites and many such sites have been successfully developed in the past.

(2) A cautious design and construction approach has been adopted for site.

(3) The soft deposit underlying the peat has been taken into account in the geotechnical design of all infrastructure elements.

(4) A ground investigation and subsequent interpretation to confirm the ground conditions predicted in the EIAR, with particular emphasis on peat and underlying soft material stability, will be required prior to the development of the site.

(5) Risk assessments and registers carried out for the site will take the soft deposit underlying the peat into account.

(6) From the ground investigation data, silt is present within the soft material underlying the peat. The strength and deformation behaviour of silt is very susceptible to instability caused by disturbance and the presence of groundwater or surface water.

(7) The use of founded access tracks on competent strata beneath the peat and soft material will be the dominant road construction type on site. The use of floated tracks is limited to areas of flatter terrain on site (i.e. areas less than 5 degrees gradient).

(8) Suitable storage of excavated arisings generated during the construction of the wind farm is pertinent. The side casting and temporary storage of excavated arisings on peat slopes will be limited on site to suitable areas (i.e. flat terrain with competent underlying strata) to avoid triggering instability.

11 INDICATIVE FOUNDATION TYPE FOR TURBINES

Based on a review of the ground investigation information for site, an assessment of the likely foundation type and founding depths for each turbine location was carried out. A summary of this assessment is provided in Table 11-1.

Table 11-1: Summary of Indicative Turbine Foundation Type

Turbine No.	Indicative Turbine Foundation Type	Relevant GI	Ground Conditions
T1	Gravity type foundation	TP24A	Peat to 2.2m overlying firm, locally soft, silt/clay to 2.7m overlying stiff, locally firm, silt/clay
T2	Gravity type foundation	TP1	Peat and soft silt/clay to 1.2m, underlain by firm to very stiff sandy very gravelly Silt/Clay to 3.2m
T3	Possible piled foundation	TP 2A (closest trial pit)	Peat and soft silt/clay to in excess of 4.4m
T4	Gravity type foundation	TP4A (closest trial pit)	Peat and soft silt/clay to 0.8m overlying firm silt/clay to 1.9m overlying stiff silt/clay to 3.1m overlying very stiff silt/clay
T5	Gravity type foundation	TP25A	Peat and soft silt/clay to 1.1m overlying firm, locally stiff, silt/clay to 2.1m overlying very stiff silt/clay
T6	Gravity type foundation	TP26A	Peat and soft silt/clay to 1.9m overlying firm, locally stiff, silt/clay to 2.9m overlying stiff silt/clay
T7	Gravity type foundation	TP12A	Peat and soft silt/clay to 2.8m overlying firm and stiff silt/clay to 3.7m overlying stiff silt/clay
T8	Possible piled foundation	TP14A (closest trial pit)	Peat and soft silt/clay to 2.4m overlying firm, locally stiff, silt/clay
T9	Possible piled foundation	TP16A	Peat to 1.3m overlying firm silt/clay to 1.9m overlying stiff, locally very stiff, silt/clay
T10	Gravity type foundation	TP27A	Peat and very soft and soft silt/clay to 1.2m overlying firm silt/clay to 2.0m overlying stiff silt/clay. Material at base of trial pit recovered as residual soil/extremely weathered shale

It should be noted that confirmatory ground investigation will be carried out at each turbine location in the form of boreholes with in-situ SPT testing at 1 to 1.5m intervals in the overburden and follow-on rotary cores through bedrock to confirm the foundation types outlined in Table 11-1.

For gravity type turbine foundations, where the depth of excavation exceeds the minimum required founding depth for the proposed turbine base, up-fill material consisting of granular fill (6N/6P) in accordance with Transport Infrastructure Ireland (TII) requirements shall be used to backfill the excavation to the required founding depth.

12 FOUNDING DETAILS FOR OTHER INFRASTRUCTURE ELEMENTS

12.1 Access Roads

Up to 11.1km of existing access tracks requiring upgrade are present across the Croagh wind farm site and based on Coillte records have been in operation for a number of years. The existing access tracks were constructed using both excavate and replace and floated construction techniques.

Up to 7.5km of new proposed access roads will be constructed as part of the wind farm construction. The new proposed access roads will be constructed using both excavate and replace and floated construction techniques (see Figure 2-1 of the Peat & Spoil Management Plan). A founded access road will be constructed to provide access the site.

The typical make-up of the new proposed access roads is typically a minimum stone thickness of 1000mm. The requirement for a layer of geotextile and geogrid and the necessary stone thickness will be confirmed by confirmatory investigations.

See the Peat & Spoil Management Plan for Croagh wind farm for further details on the existing and new proposed access roads on site.

12.2 Crane Hardstands

The crane hardstands will be constructed using the founded technique (i.e. not floated technique). Crane hardstands are generally constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance. The hardstands will be designed for the most critical loading combinations from the crane.

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

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

12.3 Substation Foundations & Platforms

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

Substation platforms are constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance. The substation platforms will be founded on material underlying the peat deposits.

Given the ground conditions present at the proposed substation, the foundations will be founded on glacial till. The peat and underlying soft silt/clay are not suitable founding strata for the substation foundations.

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

12.4 Temporary Construction Compound Platforms

The temporary construction compound platforms will be constructed using the founded technique (i.e. not floated technique). The construction compound platforms are generally constructed using compacted Class 1/6F material in accordance with Transport Infrastructure Ireland (TII) requirements on a suitable sub-formation to achieve the required bearing resistance.

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

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

12.5 Met Mast Foundation

The met mast foundation will comprise gravity type foundation. Given the ground conditions present at the proposed met mast, the foundation will require to be founded on glacial till. The peat and soft silt/clay are not suitable founding strata for the met mast foundation.

Typical founding depth for the met mast foundation is envisaged to be 3.0m. At the underside of the met mast foundation, a layer of structural up-fill (class 6N/6P) material in accordance with Transport Infrastructure Ireland (TII) requirements will likely be required.

12.6 Potential for Development of a Borrow Pit

A number of potential borrow pit locations were reviewed as part of the assessment of the site. A number of trial pits and boreholes were carried out as part of the ground investigation at the site.

A number of the potential borrow pit areas investigated were not progressed further based on ground conditions, in particular the depth to competent rock, or based on the ground profile/topography present.

Ground conditions at the proposed borrow pit location were described as peat to 0.35m overlying very soft and soft clayey Silt to 0.85m overlying firm very gravelly Silt/Clay with occasional cobbles (fragments of shale to 2.2m) overlying weathered shale. Photo 4 of Appendix A shows the shale rock present at a shallow depth at the proposed borrow pit location. The presence of rock at a relatively shallow depth makes this location suitable for development as a borrow pit.

An estimated volume of suitable granular deposits for use during construction was determined from the available ground investigation data and the topographical survey of the area. In addition, it is proposed that the borrow pit will be reinstated using excavated peat and spoil from site.

Further discussion on the proposed borrow pit is provided in the Peat and Spoil Management Plan (FT, 2020) for the site.

12.7 Peat Repository Areas

A number of potential peat repository locations were reviewed as part of the assessment of the site. Two locations were selected and are shown on the site layout plans.

Ground conditions at the repository locations comprise up to 1.5m of peat overlying overburden. Perimeter buttresses required for the repositories will be founded on a competent stratum below the peat deposits. Buttresses will be constructed of well graded granular rock fill.

Further discussion on the peat repositories is provided in the Peat and Spoil Management Plan (FT, 2020) for the site.

12.8 Recreational Infrastructure

A series of walkways/trails are also proposed as part of the development. This includes the construction of car parking area at the northern end of the site. The car park will be constructed of a crushed rock fill placed on a competent stratum. No significant excavations are proposed for the walkways/trails.

13 SUMMARY AND RECOMMENDATIONS

13.1 Summary

The following summary is given.

FT was engaged by McCarthy Keville O'Sullivan to undertake an assessment of the proposed wind farm site with respect to peat stability.

The findings of the geotechnical and peat stability assessment showed that the site generally has an acceptable margin of safety and is suitable for the proposed wind farm development. A number of areas where no development is proposed and areas with an elevated or higher construction risk were identified and are presented in Figure 4-3.

The site is typically covered in blanket peat with undulating terrain. Peat depths vary across the site depending on mainly topography. Peat depths recorded within the proposed infrastructure envelope ranged from 0 to 6m with an average of 2.1m. Peat depths recorded across the site and outside the proposed infrastructure footprint from over 850 no. peat depth probes ranged from 0 to 8.2m with an average of 2.2m. The deeper peat areas were avoided when optimising the wind farm layout and main infrastructure elements for site.

As part of the geotechnical and peat stability assessment at the site the following activities were undertaken:

- Numerous site walkovers
- Extensive peat depth probing across the site (in excess of 850 no. probes)
- Ground investigation in the form of trial pits and boreholes along with in-situ and laboratory tests
- Desk study including a review of historical landslides in the area
- Inspection of historical landslides within the area
- Assessment of peat stability of upland slopes outside of the Croagh site boundary
- Comparison of ground conditions on the Croagh site with known failed sites

In addition, an analysis of peat sliding was carried out at the main infrastructure locations on site for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The findings of the analyses, which involved analysis of 324 no. locations, showed that the site has an acceptable margin of safety.

For both the undrained and drained condition, all 324 no. locations showed an acceptable FoS of greater than 1.3 except for 10 no. marginally low FoS's. The locations of the marginally low FoS's are highlighted on the construction and buffer zone plan (Figure 4-3) and are typically located alongside existing access roads on site which have been in operation for a number of years and hence are not considered to be areas at risk of peat instability. In addition, 2 no. marginally low FoS's are located along the new proposed access road to turbine T9 and coincide with a deeper pocket of peat. This area has an elevated construction risk and is also highlighted on the construction buffer zone plan (Figure 4-3). This location is subject to additional control and mitigation measures as per the adjacent turbine T9 (Appendix E). The remainder of the locations analysed had acceptable FoS's of greater than 1.3, indicating a low risk of peat instability.

The peat stability risk assessments at each of the main infrastructure locations identified a number of mitigation/control measures to reduce the potential risk of peat failure (see Appendix E).

Whilst there is a high density of historical landslides in the area, no peat failures/landslides are recorded on the Croagh site. A peat slide occurred in 2016 on the surrounding plateau slopes of Croagh to the southwest of the site (outside the site boundary). The likely cause of the peat slide was peat cutting using a 'sausage' machine (mechanically cut peat) in combination with high intensity rainfall. No areas of mechanically cut peat are located within the proposed infrastructure envelope for site.

In relation to the failure which occurred on the Garvagh Glebe site. This failure occurred in a low strength (2 to 4kPa) deep peat (in excess of 6m) area at the head of a watercourse/natural drainage route. Based on data and site findings recorded on the Croagh site, similar site conditions to those recorded at the Garvagh Glebe failure are not present within the proposed infrastructure envelope hence there is a very low likelihood of a similar type failure occurring.

In summary, the findings of the geotechnical and peat stability assessment showed that the proposed Croagh wind farm site has an acceptable margin of safety and is suitable for wind farm development. However, due to the historical landslides in the area around the site, management of peat stability and appropriate

construction practices will be required in the construction phase of the wind farm to ensure peat failures do not occur on site. Overall, the peat characteristics and ground conditions on the Croagh site are similar to those encountered on successfully developed wind farm sites in the area, i.e. sites that were developed without peat instability occurring.

13.2 Recommendations

The following general recommendations are given.

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

Suitable storage of excavated arisings generated during the construction of the wind farm is pertinent. Recommendations and guidelines given in FT's report 'Peat & Spoil Management Plan for Croagh Wind Farm, County Leitrim/Sligo' (FT 2019) will be implemented during the design and construction stage of the wind farm development.

A construction buffer zone plan has been produced for the site (Figure 4-3). This Figure shows areas which have an elevated or higher construction risk due to the terrain and features encountered during the site walkover and are areas where additional mitigation/control measures will be required (Appendix E). In addition, Figure 4-3 shows areas on the site where no development is proposed. The above identified areas are based on qualitative factors identified during the site walkover e.g. relatively deep peat, quaking peat, mechanically cut peat and historical peat landslides in the area.

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

14 REFERENCES

Applied Ground Engineering Consultants (AGEC) (2004). Derrybrien Wind Farm Final Report on Landslide of October 2003.

British Standards Institute (1981). BS 6031:1981 Code of practice for earthworks.

Bromhead, E.N. (1986). The Stability of Slopes.

Carling, P.A. (1986). Peat slides in Teesdale and Weardale, northern Pennines, July 1983: Description and failure mechanisms. Earth Surface Processes and Landforms, 11.

Den Haan EJ and Grognet M (2014). A large direct simple shear device for the testing of peat at low stresses. Géotechnique Letters 4(4): 283–288, http://dx.doi.org/10.1680/geolett. 14.00033.

Dykes, A.P. and Kirk, K.J. (2006). Slope instability and mass movements in peat deposits. In Martini, I.P., Martinez Cortizas, A. and Chesworth, W. (Eds.) Peatlands: Evolution and Records of Environmental and Climatic Changes. Elsevier, Amsterdam.

Farrell, E.R. & Hebib, S. (1998). The determination of the geotechnical parameters of organic soils. Proceedings of International Symposium on problematic soils, IS-TOHOKU 98, Sendai, Japan.

Fehily Timoney and Company (FT) (2020). Peat & Spoil Management Plan for Croagh Wind Farm, County Leitrim/Sligo (rev 1). March 2020.

Geological Survey of Ireland (1996). Sheet 7 Geology of Sligo-Leitrim.

Geological Survey of Ireland (2006). Landslides in Ireland. Geological Survey of Ireland -Irish Landslides Group. July 2006.

Geological Survey of Ireland (2019). Online dataset public viewer http://spatial.dcenr.gov.ie/imf/imf.jsp?site=GSI_Simple August 2019.

Hanrahan, E.T., Dunne, J.M. and Sodha, V.G. (1967). Shear strength of peat. Proc. Geot. Conf., Oslo, Vol. 1.

Hendry MT, Sharma JS, Martin CD and Barbour SL (2012). Effect of fibre content and structure on anisotropic elastic stiffness and shear strength of peat. Canadian Geotechnical Journal 49(4): 403–415, http://dx.doi.org/10.1139/t2012-003.

Hungr, O. and Evans, S.G. (1985). An example of a peat flow near Prince Rupert, British Columbia. Canadian Geotechnical Journal, 22.

Komatsu J, Oikawa H, Tsushima M and Igarashi M (2011). Ring shear test on peat. In Proceedings of the 21st International Offshore and Polar Engineering Conference, Maui, Hawaii, USA (Chung JS, Hong SY, Langen I and Prinsenberg SJ (eds)). International Society of Offshore and Polar Engineers, Cupertino, CA, USA, vol. 2, pp. 393–396.

Landva, A.O. (1980). Vane testing in peat. Canadian Geotechnical Journal, 17(1).

MacCulloch, F. (2005). Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads over Peat. RoadEx 11 Northern Periphery.

McGeever J. and Farrell E. (1988). The shear strength of an organic silt. Proc. 2nd Baltic Conf., 1, Tallin USSR.

O'Kelly BC and Zhang L (2013). Consolidated-drained triaxial compression testing of peat. Geotechnical Testing Journal 36(3): 310–321, http://dx.doi.org/10.1520/ GTJ20120053.

PLHRA (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Prepared for Energy Consents Unit Scottish Government, 2nd Edition. Dated April 2017.

Rowe, R.K. & Mylleville, B.L.J (1996). A geogrid reinforced embankment on peat over organic silt; a case history. Can. Geotech. J. 33 (1), 106 – 122.

Rowe, R.K., MacLean, M.D., Soderman, K.L. (1984). Analysis of a geotextile reinforced embankment constructed on peat. Can. Geotech. J. 21 (3), 563 – 576.

Skempton, A. W. and DeLory, F. A. (1957). Stability of natural slopes in London Clay. Proc 4th Int. Conf. On Soil Mechanics and Foundation Engineering, Rotterdam, vol. 2, pp.72-78.

Warburton, J., Higgett, D. and Mills, A. (2003). Anatomy of a Pennine Peat Slide. Earth Surface Processes and Landforms.

Warburton, J., Holden, J. and Mills, A. J. (2003). Hydrological controls of surficial mass movements in peat. Earth-Science Reviews 67 (2004), pp. 139-156.

Zwanenburg C, Den Haan EJ, Kruse GAM and Koelewijn AR (2012). Failure of a trial embankment on peat in Booneschans, the Netherlands. Géotechnique 62(6): 479–490, http://dx.doi.org/10.1680/geot.9.P.094.

Appendix A

Photos from FT/AGEC Site Walkovers

Photo 1 Overview of site conditions

Photo 2 Overview of site conditions

Photo 3 Example of ground profile at an existing excavation on site

Photo 4 Example of shale rock present at proposed borrow pit

Photo 5 Example of ground conditions on site (peat overlying till)

Photo 6 Example of founded access track on site

Photo 7 Example of floated access track on site

Photo 8 Overview of failure in the southwest of the site (looking south) – no development proposed for this area

Photo 9 Overview of failure in the southwest of the site (looking north) – no development proposed for this area

Photo 10 Watercourse crossing along proposed access route to turbine T1

Appendix B

Ground Investigation (2017) – Trial Pit Logs, Laboratory Testing & Photographs




FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 1
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583605.00 824288.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous and amorphous Peat
				0.70			Very soft, locally soft, light brown/grey sandy clayey Silt. Shear vane strength recordings of 16, 10, 20 & 22kPa
				1.20			Firm grey sandy Silt/Clay
				1.70			Stiff, locally very stiff, sandy very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles noted as angular, sub-rounded and rounded
				3.20			End of Pit at 3.200m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 2
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583185.00 823794.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m): Depth 2.90		Scale 1:25
Client:	Coillte			Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm and spongy brown fibrous and amorphous Peat
				0.80			Very soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 6, 8, 12, 9 & 20kPa
				1.40			Firm grey slightly sandy gravelly Silt/Clay with occasional cobbles
				2.20			Stiff, locally very stiff, grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Cobbles noted as angular and sub-rounded
				2.90			End of Pit at 2.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 3
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583802.00 823870.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
	0.30 - 0.70	B	B1	0.30			Firm brown fibrous Peat
				0.70			Soft light grey/brown sandy clayey Silt. Shear vane strength recordings of 30, 28, 32 & 33kPa
				2.10			Firm and stiff grey slightly sandy very gravelly Silt/Clay with occasional cobbles
				3.20			Stiff, locally very stiff grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Traces of orange mottling noted in layer.
							End of Pit at 3.200m

1
2
3
4

Remarks: No groundwater encountered, small flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 4
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584223.00 823964.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Firm brown fibrous Peat
				0.60			Soft light grey/brown sandy clayey Silt. Shear vane strength recordings of 32, 36, 30 & 31kPa
				2.60			Firm and stiff sandy gravelly Silt/Clay with occasional cobbles
				3.90			Stiff grey gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings
							End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered, small flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 5
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584872.00 824052.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 2.30		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm & spongy brown fibrous Peat
				0.80			Firm grey sandy clayey Silt. Shear vane strength recordings of 44, 50, 42kPa
				1.60			Stiff grey sandy gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings
				2.30			End of Pit at 2.300m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.
Due to location of trial pit (alongside edge of existing track and close to fence line) difficult to excavate trial pit to a deeper level.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 6
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584772.00 823870.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 2.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			Firm brown fibrous Peat
				1.20			Soft grey sandy clayey Silt. Shear vane strength recordings of 22, 24, 31, 25, 27kPa
				2.10			Firm and stiff sandy gravelly Silt/Clay with frequent cobbles. Fragments of weathered shale noted in arisings. Potential weathered shale rock encountered at 2.1m bgl
							End of Pit at 2.100m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 7
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 584998.00 823376.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.40			Firm brown fibrous Peat
				0.80			Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 16, 18, 18, 20, 17kPa
				1.50			Firm grey sandy clayey Silt
				2.20			Firm and stiff grey slightly sandy gravelly Silt/Clay with occasional cobbles
				3.00			Stiff grey very gravelly Silt/Clay with frequent cobbles. Cobbles noted as angular and sub-rounded. Fragments of weathered shale noted in arisings. Boulders noted at 3.0m depth.
							End of Pit at 3.000m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 8
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585240.00 823102.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 4.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous Peat
				0.90			Plastic and spongy /black amorphous Peat
				4.20			Soft grey sandy clayey Silt. No undisturbed lumps of material recovered for shear vane testing
				4.40			End of Pit at 4.400m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 9
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 583891.00 823211.00 Level:	Date 25/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			Firm brown fibrous Peat
				0.90			Soft, locally firm, grey sandy clayey Silt. Shear vane strength recordings of 28, 31, 29 & 40kPa
				1.70			Firm, locally stiff, grey sandy gravelly Silt/Clay with occasional cobbles
				3.10			Stiff and very stiff grey slightly sandy gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles noted as angular & sub-rounded and fragments of weathered shale noted in arisings
							End of Pit at 3.100m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 10
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585419.00 822821.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown and black fibrous and amorphous Peat
				1.20			Very soft and soft light grey/grey sandy clayey Silt. Shear vane strength recordings of 10, 12, 10, 18, 20, 25 & 19kPa
				1.80			Firm light grey/grey sandy clayey Silt
				3.10			Stiff grey sandy gravelly Silt/Clay with occasional cobbles
				3.40			End of Pit at 3.400m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP 11
Sheet 1 of 1

Project Name:	**Carrane Hill Wind Farm**	Project No. 1726	Coords (E,N): 585661.00 822368.00 Level:	Date 24/10/2017
Location:	Carrane Hill Co. Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	Coillte	Depth 3.20		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown and black fibrous and amorphous Peat
				0.90			Soft to firm light grey/grey sandy clayey Silt. Shear vane strength recordings of 38, 32 & 37kPa
				1.40			Firm light grey/grey sandy clayey Silt.
				1.80			Firm grey sandy gravelly Silt/Clay with occasional cobbles
				3.00			Stiff light brown/grey sandy gravelly Silt/Clay with frequent cobbles
				3.20			End of Pit at 3.200m

1 2 3 4

Remarks: No groundwater encountered, significant flow of surface water into excavation.

Plant Used:

National Materials Testing Laboratory Ltd.

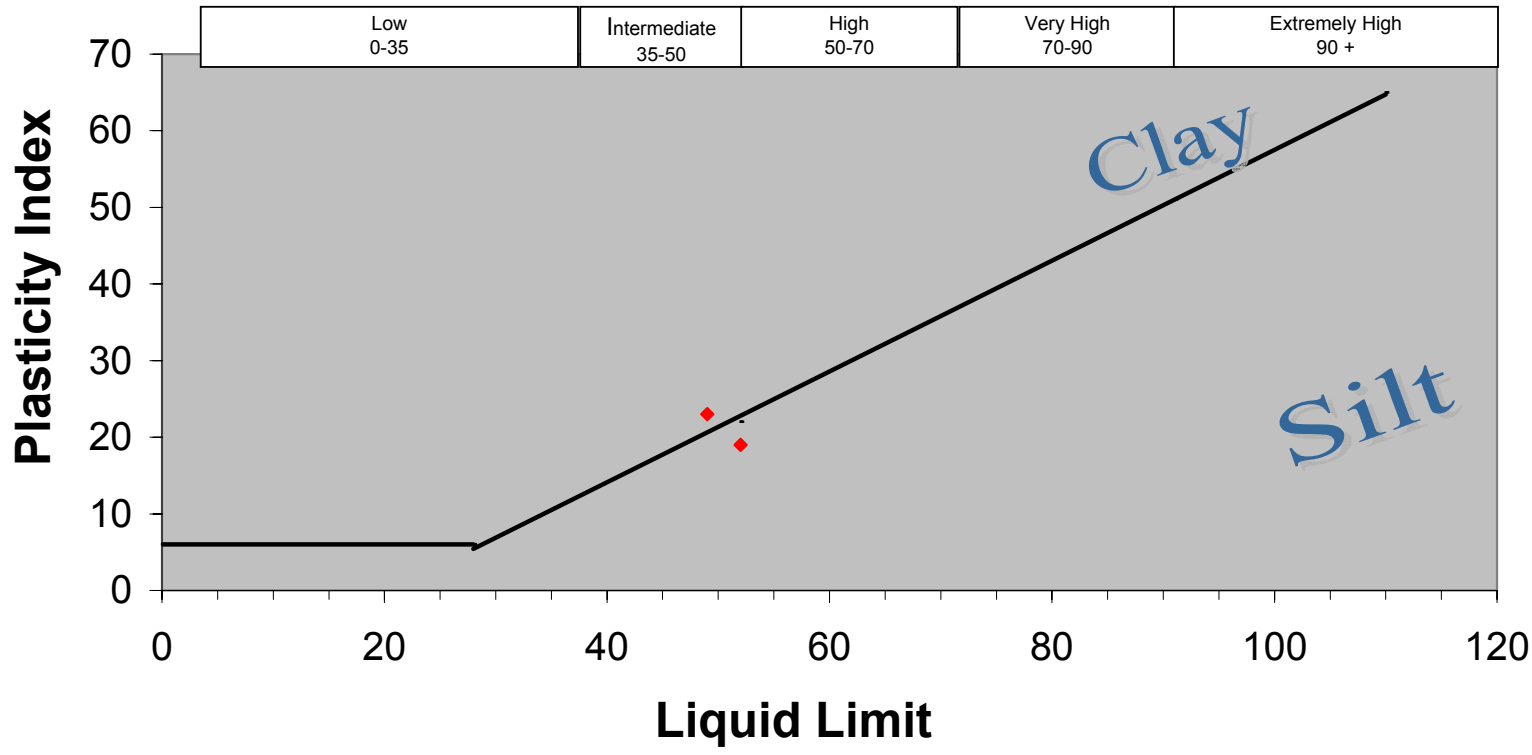
SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
TP3	N/A	B	53.3		76.4	52	33	19						
TP15	N/A	B	31.4		70.2	49	26	23						

NMTL		Notes :									Job ref No.	NMTL 2328		Table
		1. All BS tests carried out using preferred (definitive) method unless otherwise stated.									Location	Carrane Hill, Leitrim		

NMTL LTD
Unit 18c, Tullow Industrial Estate
Tullow
County Carlow
Tel: 00353 59 9180822
Mob: 00353 872575508
billachana@eircom.net

Contract:	**Carrane Hill, Leitrim**
Client:	**AGEC**
Engineer:	**N/A**
Date:	**17/11/2017**
Tested By:	**Tzr** **Checked:** **Bc**
Job ref No.	**NMTL 2328**

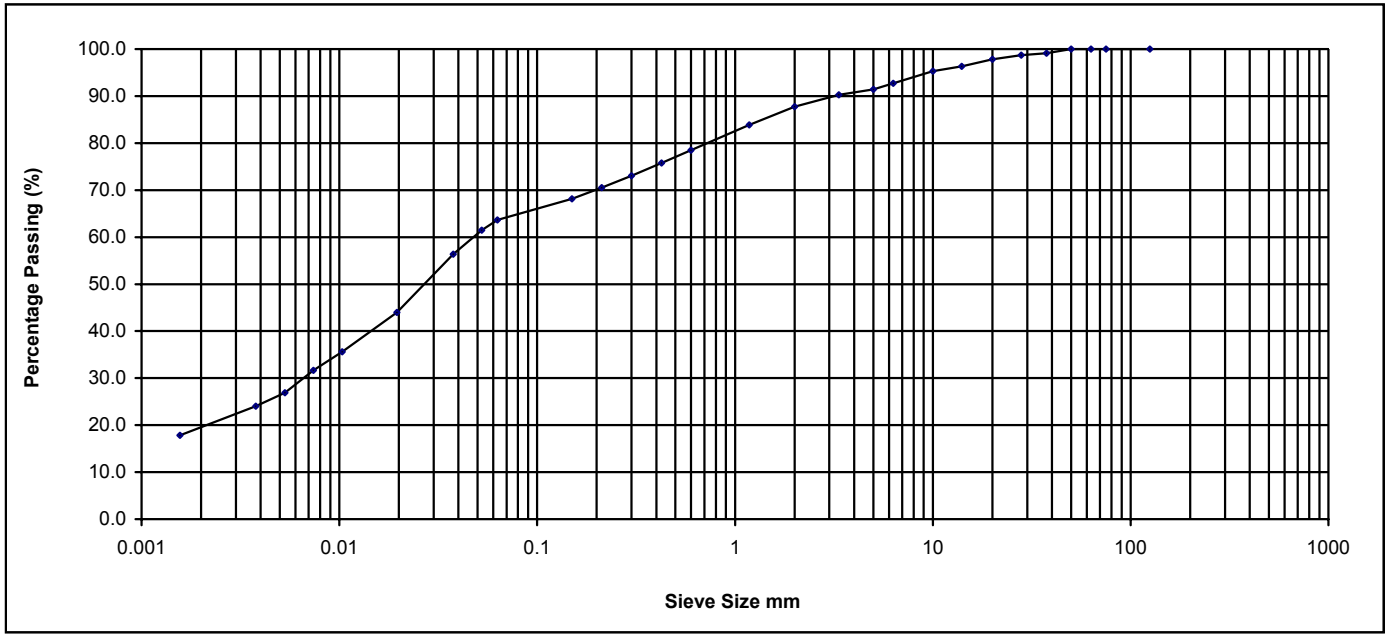


NMTL Ltd

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	99.1
28.000	98.7
20.000	97.8
14.000	96.3
10.000	95.3
6.300	92.7
5.000	91.4
3.350	90.3
2.000	87.7
1.180	83.8
0.600	78.5
0.425	75.8
0.300	73.0
0.212	70.5
0.150	68.1
0.063	63.6
0.052	61.4
0.038	56.4
0.020	44.0
0.010	35.6
0.007	31.6
0.005	26.9
0.004	24.0
0.002	17.8



Percentage Particle Size

Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
		Silt			Sand			Gravel			
17.8		45.8			24.1			12.3		0.0	0.0

Sample Description: Dark brown slightly gravelly slightly sandy clayey SILT.

Project: Carrane Hill, Leitrim

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	03/11/2017

Project No.	NMTL 2328
BH/TP No.	TP3
Sample No.	B
Depth	N/A

NMTL Ltd

Photo 1 Trial pit TP1

Photo 2 Trial pit TP2

Photo 3 Underlying soft silt/clay at trial pit TP2

Photo 4 Trial pit TP3

Photo 5 Underlying soft silt/clay at trial pit TP3

Photo 6 Arisings from trial pit TP3

Photo 7 Trial pit TP4

Photo 8 Trial pit TP5

Photo 9 Arisings from trial pit TP6


Photo 10 Trial pit TP6

Photo 11 Arisings from trial pit TP7


Photo 12 Trial pit TP7

Photo 13 Trial pit TP8

Photo 14 Trial pit TP9

Photo 15 Arisings from trial pit TP9


Photo 16 Trial pit TP10

Photo 17 Trial pit TP11

Appendix C

Ground Investigation (2019/20) – Trial Pit Logs, Laboratory Testing & Photographs




FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP1A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583251.00 823685.00 Level: 888.25	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.20		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy and plastic brown/black pseudo-fibrous and amorphous Peat
				1.10	887.15		Very soft and soft light brown/grey sandy clayey Silt
				1.40	886.85		Firm, locally soft, dark blue/grey slightly sandy gravelly Silt/ Clay with occasional cobbles. Cobbles are sub-rounded and rounded
	2.80 - 3.00	B	B14	2.60	885.65		Stiff dark blue/grey gravelly Silt/Clay with occasional cobbles. Cobbles and boulders are sub-rounded and rounded.
				3.20	885.05		End of Pit at 3.200m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP2A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583672.00 823360.00 Level: 939.75	Date 01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.40		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.70	939.05		Plastic brown/black pseudo-fibrous and amorphous Peat
				3.50	936.25		Soft, locally firm, blue/grey sandy clayey Silt with occasional cobbles. Cobbles are sub-rounded
	4.00 - 4.20	B	B12				
				4.40	935.35		End of Pit at 4.400m

1
2
3
4

Remarks: Groundwater ingress noted at 3.5m bgl. described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP3A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583836.00 823526.00 Level: 940.53	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	940.23		Spongy brown pseudo-fibrous Peat
				1.10	939.43		Spongy brown amorphous Peat
				1.30	939.23		Soft light brown/grey sandy clayey Silt
				2.10	938.43		Firm brown/grey sandy very gravelly Silt/Clay with frequent cobbles. Cobbles are rounded and angular. Localised angular fragments of shale noted in layer.
				3.80	936.73		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer. Orange mottling noted in layer.
							End of Pit at 3.800m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP4A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584234.00 823711.00 Level: 955.50	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown fibrous Peat
				0.50	955.00		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 18, 25, 23 and 31kPa
				0.80	954.70		Firm dark blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular and rounded. Localised angular fragments of shale noted in layer.
				1.90	953.60		Stiff blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded.
	3.20 - 3.50	B	B8	3.10	952.40		Very stiff, locally stiff, blue/grey sandy very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer.
				4.10	951.40		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP5A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584229.00 824031.00 Level: 832.09	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown/black pseudo-fibrous Peat
				0.90	831.19		Very soft and soft light brown/grey sandy clayey Silt
	1.90 - 2.10	B	B9	1.30	830.79		Firm, locally soft, dark blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are angular and rounded. Localised angular fragments of shale noted in layer. Orange mottling noted in layer.
				2.40	829.69		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Localised angular fragments of shale noted in layer.
				4.10	827.99		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP6A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585498.00 823282.00 Level: 1002.19	Date	29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.10		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown fibrous Peat
				0.40	1001.79		Very soft light brown /grey sandy clayey Silt
				0.50	1001.69		Firm and stiff blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are sub-angular and angular. Localised angular fragments of shale noted in layer
				2.10	1000.09		Stiff blue/grey sandy gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles are sub-rounded and angular, boulders are sub-rounded and rounded. Localised angular fragments of shale noted in layer.
				3.10	999.09		End of Pit at 3.100m

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP7A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583494.00 823756.00 Level: 893.82	Date	01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm brown/black pseudo-fibrous Peat
				0.50	893.32		Very soft and soft light brown/grey sandy clayey Silt
				0.70	893.12		Firm brown/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular and sub-rounded. Localised angular fragments of shale noted in layer. Orange mottling/staining noted in layer
				1.70	892.12		Stiff, locally very stiff, blue/grey very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Cobble and boulder content increases with depth
	2.70 - 2.90	B	B11				
				3.50	890.32		End of Pit at 3.500m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP8A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No.	Coords (E,N):	584858.00 823499.00	Date
		P1989	Level:	976.07	30/04/2019
Location:	County Leitrim/Sligo		Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan		Depth 4.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.50	975.57		Plastic brown/black amorphous Peat
				4.00	972.07		End of Pit at 4.000m

1
2
3
4

Remarks: Groundwater ingress noted at 3.2m bgl, described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP9A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585085.00 823414.00 Level: 1003.20	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.00		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseduo-fibrous and amorphous Peat
				1.70	1001.50		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 18, 19, 27 and 24kPa
				2.00	1001.20		Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				2.80	1000.40		Stiff blue/grey slightly sandy very gravelly Silt/Clay with frequent cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.80 - 4.00	B	B5	3.80	999.40		Weathered Shale with a silt/clay matrix
				4.00	999.20		End of Pit at 4.000m

1
2
3
4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP10A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584076.00 824034.00 Level: 845.53	Date 30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.00			Firm brown/black fibrous Peat
				0.40	845.13		Soft light brown/grey sandy clayey Silt
				0.60	844.93		Firm grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				1.80	843.73		Stiff, locally firm, blue/grey slightly sandy very gravelly Silt/ Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular. Localised angular fragments of shale noted in layer.
	3.20 - 3.40	B	B10	2.90	842.63		Stiff blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular. Localised angular fragments of shale noted in layer.
				4.10	841.43		End of Pit at 4.100m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP11A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585147.00 823241.00 Level: 967.92	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous and amorphous Peat
				1.30	966.62		Very soft and soft light brown/grey sandy clayey Silt
				1.50	966.42		Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Orange mottling noted in layer. Localised angular fragments of shale noted in layer.
	3.10 - 3.40	B	B4	2.50	965.42		Stiff, locally firm, blue/grey slightly sandy very gravelly Silt/ Clay with frequent cobbles. Orange mottling noted in layer. Cobbles are angular. Localised angular fragments of shale noted in layer.
				3.50	964.42		End of Pit at 3.500m

1 2 3 4

Remarks: No groundwater encountered, flow of surface water into excavation noted.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP12A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584963.00 823032.00 Level: 970.81	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.40		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.90	969.91		Plastic brown amorphous Peat
				2.50	968.31		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 14, 32, 16 and 21kPa
				2.80	968.01		Firm and stiff blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Localised angular fragments of shale noted in layer.
	4.10 - 4.30	B	B3	3.70	967.11		Stiff blue/grey slightly sandy very gravelly Silt/Clay with frequent cobbles and boulders. Cobbles and boulders are angular and sub-rounded. Localised angular fragments of shale noted in layer.
				4.40	966.41		End of Pit at 4.400m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP13A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584502.00 822527.00 Level: 1042.80	Date 29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 2.80		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.50	1042.30		Spongy brown pseudo-fibrous & amorphous Peat
				2.80	1040.00		Plastic black/brown amorphous Peat End of Pit at 2.800m

1
2
3
4

Remarks: Groundwater ingress noted 2.8m bgl, described as steady flow.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP14A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585478.00 822902.00 Level: 987.96	Date 29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous & amorphous Peat
				0.80	987.16		Plastic brown/black amorphous Peat
	2.10 - 2.40	B	B1	2.10	985.86		Very soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 12, 13, 16, 15kPa
				2.40	985.56		Firm, locally stiff, blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Orange/light brown mottling noted in layer
				3.80	984.16		End of Pit at 3.800m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP15A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 586587.00 821278.00 Level: 893.65	Date 02/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Firm and spongy black/brown fibrous Peat
				1.00	892.65		Soft, locally firm, light brown Clay/Silt with frequent cobbles and boulders. Cobbles and boulders are sub-rounded and rounded
				1.40	892.25		Firm dark blue/grey sandy gravelly Silt/Clay with occasional cobbles. Cobbles are angular.
				3.20	890.45		Stiff dark blue/grey slight sandy gravelly Silt/Clay with frequent cobbles. Cobbles are angular and sub-rounded
				3.90	889.75		End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP16A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 585793.00 822604.00 Level: 1016.21	Date	29/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.80		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseduo-fibrous and amorphous Peat
				1.30	1014.91		Firm blue/grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are sub-rounded and angular
				1.90	1014.31		Stiff, locally very stiff, very gravelly Silt/Clay with occasional cobbles and boulders. Cobbles and boulders are sub-rounded and rounded. Boulders vary in size up to 800mm in diameter. Localised angular fragments of shale noted in layer
	3.50 - 3.70	B	B2				
				3.80	1012.41		End of Pit at 3.800m

1 2 3 4

Remarks: Groundwater ingress noted at 1.3m bgl, described as minor ingress.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP17A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584623.00 823207.00 Level: 977.60	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				0.70	976.90		Spongy and plastic brown pseudo-fibrous and amorphous Peat
				2.20	975.40		Very soft light brown/grey sandy clayey Silt
				2.30	975.30		Firm blue/dark grey sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
				3.10	974.50		Stiff blue/dark grey very gravelly Silt/Clay with frequent cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.50 - 3.70	B	B6				
				3.90	973.70		End of Pit at 3.900m

1
2
3
4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP18A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584564.00 823907.00 Level: 904.18	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.20		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	903.88		Firm brown/black fibrous Peat
				0.60	903.58		Soft light brown/grey sandy clayey Silt
				2.10	902.08		Firm dark blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles. Cobbles are angular. Localised angular fragments of shale noted in layer.
	3.90 - 4.10	B	B7	4.20	899.98		Stiff, locally very stiff at depth, dark blue/grey slightly very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles are angular. Localised angular fragments of shale noted in layer.
							End of Pit at 4.200m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP21A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 586026.00 821965.00 Level: 910.98	Date	02/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 4.10		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy and plastic brown pseudo-fibrous and amorphous Peat
				2.90	908.08		Soft light brown/grey sandy clayey Silt
				3.50	907.48		Firm, locally stiff, dark blue/grey slightly sandy gravelly Silt/ Clay with occasional cobbles and boulders. Cobbles and boulders are sub-rounded and rounded
				4.10	906.88		End of Pit at 4.100m

Remarks: Groundwater ingress noted at 2.9m bgl, described as moderate flow

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP22A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 584238.00 823501.00 Level: 959.28	Date	30/04/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale	1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.50		Logged	GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown pseudo-fibrous Peat
				1.20	958.08		Plastic brown amorphous Peat
				3.20	956.08		Very soft and soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 17, 14 and 28kPa.
				3.50	955.78		End of Pit at 3.500m

Remarks: No groundwater encountered.

Plant Used:

13tN tracked excavator

FEHILY TIMONEY

Fehily Timoney & Co.
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66 Ireland

Tel: +353-59-9723800
Email: info@ftco.ie
Web:
www.fehilytimoney.ie

Trial Pit Log

TrialPit No
TP23A
Sheet 1 of 1

Project Name:	**Croagh Wind Farm**	Project No. P1989	Coords (E,N): 583922.00 823194.00 Level: 985.39	Date 01/05/2019
Location:	County Leitrim/Sligo	Dimensions (m):		Scale 1:25
Client:	McCarthy Keville O'Sullivan	Depth 3.90		Logged GK

Water Strike	Samples & In Situ Testing: Depth	Type	Results/Sample Ref	Depth (m)	Level (m)	Legend	Stratum Description
							Spongy brown/black pseudo-fibrous Peat
				1.20	984.19		Soft light brown/grey sandy clayey Silt. Shear vane strength recordings of 21, 32 and 27kPa
				1.40	983.99		Firm grey/brown sandy gravelly Silt/Clay with occasional cobbles. Cobbles are rounded. Localised angular fragments of shale noted in layer.
	3.60 - 3.80	B	B13	2.50	982.89		Stiff dark blue/grey very gravelly Silt/Clay with frequent cobbles and occasional boulders. Cobbles and boulders are angular and rounded. Orange mottling noted in layer. Angular fragments of shale noted in layer. Fragments of shale content increases with depth
				3.90	981.49		End of Pit at 3.900m

1 2 3 4

Remarks: No groundwater encountered.

Plant Used:
13tN tracked excavator

Irish Drilling Ltd

Croagh Wind Farm, Co. Leitrim **TEST SCHEDULE**

			Soil							Rock	
Trial Pit	**Sample**	**Depth**	**Moisture Content**	**Plastic**	**Liquid**	**Wet**	**Hydrometer**	**Min. Density**	**Max. Density**	**Point Load Strength Tests**	
No	**No.**	**m**		**Limit**	**Limit**	**Sieve**					
TP1A	B14	2.8 - 3.0	1	1	1	1	1				
TP2A	B12	4.0 - 4.2	1	1	1	1	1				
TP3A											
TP4A	B8	3.2 - 3.5	1	1	1	1	1				
TP5A	B9	1.9 - 2.1	1	1	1	1	1				
~~TP6A~~											
TP7A	B11	2.7 - 2.9	1	1	1	1	1				
TP8A											
TP9A	B5	3.8 - 4.0				1	1			1 no. (set of 10)	
TP10A	B10	3.2 - 3.4	1	1	1	1	1				
TP11A	B4	3.1 - 3.3	1	1	1	1	1				
TP12A	B3	4.1 - 4.3	1	1	1	1	1				
TP13A											
TP14A	B1	2.1 - 2.4	1	1	1	1	1				
TP15A											
TP16A	B2	3.5 - 3.7	1	1	1	1	1				
TP17A	B6	3.5 - 3.7	1	1	1	1	1				
TP18A	B7	3.9 - 4.1	1	1	1	1	1	1	1		
~~TP19A~~											
~~TP20A~~											
TP21A											
TP22A											
TP23A	B13	3.6 - 3.8	1	1	1	1	1	1	1		
~~TP24A~~											
TP25A											
		Total	13	13	13	14	14	2	2	1 set	

Summary of Classification Test Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample Ref	Top	Base	Type		Soil Description	Density bulk Mg/m3	Density dry Mg/m3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
TP01A	14	2.80	3.00	B		Dark grey slightly gravelly slightly sandy clayey SILT.			14.0	60	22	18	4		ML
TP02A	12	4.00	4.20	B		Dark grey slightly gravelly slightly sandy clayey SILT.			34.0	86	32	21	11		CL
TP04A	8	3.20	3.50	B		Dark grey slightly gravelly slightly sandy silty CLAY.			13.0	65	34	19	15		CL
TP05A	9	1.90	2.10	B		Dark grey slightly gravelly slightly sandy silty CLAY.			27.0	62	37	24	13		CI
TP07A	11	2.70	2.90	B		Dark grey slightly gravelly slightly sandy silty CLAY.			9.1	61	29	19	10		CL
TP10A	10	3.20	3.40	B		Dark grey slightly gravelly slightly sandy silty CLAY.			14.0	64	28	21	7		CL
TP11A	4	3.10	3.30	B		Dark grey slightly gravelly slightly sandy silty CLAY.			18.0	84	33	17	16		CL
TP12A	3	4.10	4.30	B		Dark grey slightly gravelly sandy clayey SILT.			21.0	56	25	20	5		ML
TP14A	1	2.10	2.40	B		Dark grey slightly gravelly slightly sandy clayey SILT.			72.0	96	46	29	17		MI
TP16A	2	3.50	3.70	B		Dark grey slightly gravelly slightly sandy silty CLAY.			17.0	60	26	20	6		CL
TP17A	6	3.50	3.70	B		Dark grey slightly sandy slightly gravelly silty CLAY.			28.0	56	31	24	7		ML
TP18A	7	3.90	4.10	B		Dark grey very silty very sandy GRAVEL.			11.0	38	27	18	9		CL
TP23A	13	3.60	3.80	B		Dark grey slightly sandy slightly gravelly silty CLAY.			11.0	53	29	19	10		CL

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

Key

Density test — wd - water displacement; wi - immersion in water

Linear measurement unless : 4pt cone unless : 1pt - single point test; Liquid Limit; NP - Non Plastic

Particle density; sp - small pyknometer; gj - gas jar

Date Printed: 07/02/2019 00:00

QC From No: R1

Approved By:

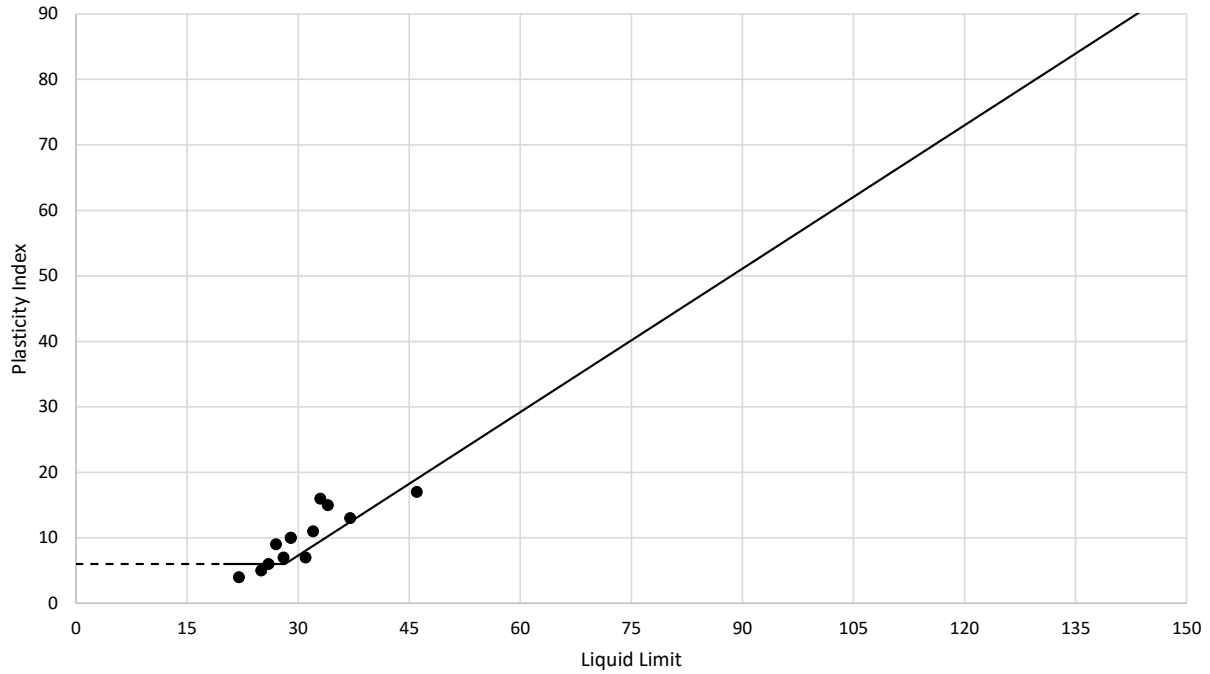
Table 1

sheet 1

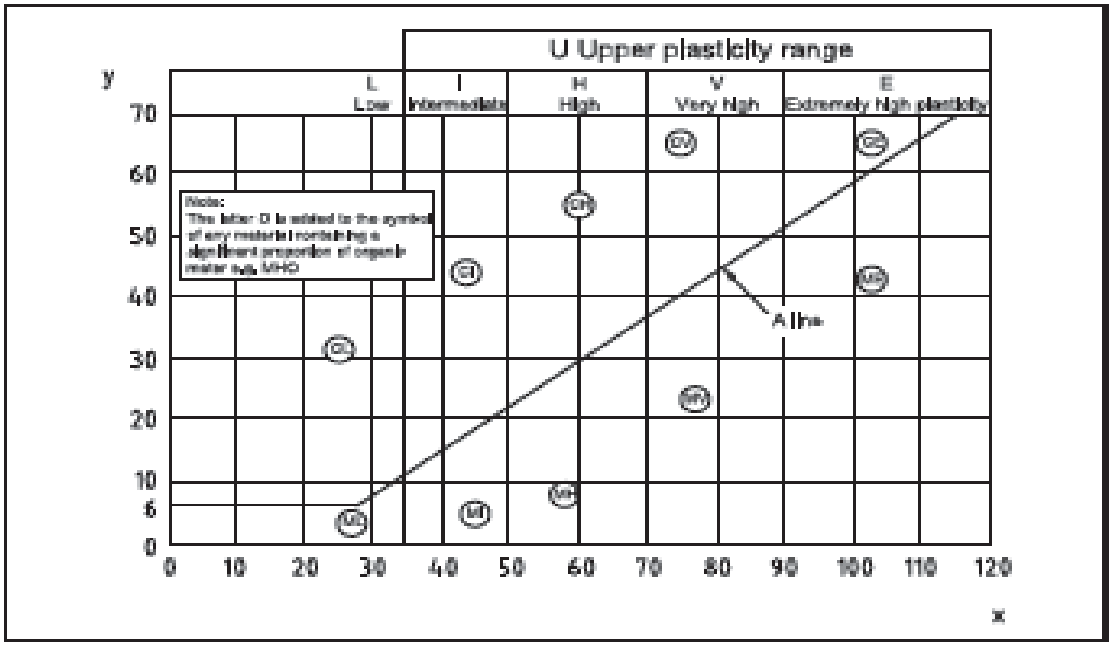
Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39

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

	Plasticity (A-Line) Chart	Project Number
Project Name:	Croagh Wind Farm, Co. Leitrim	
Location:		2019LM102

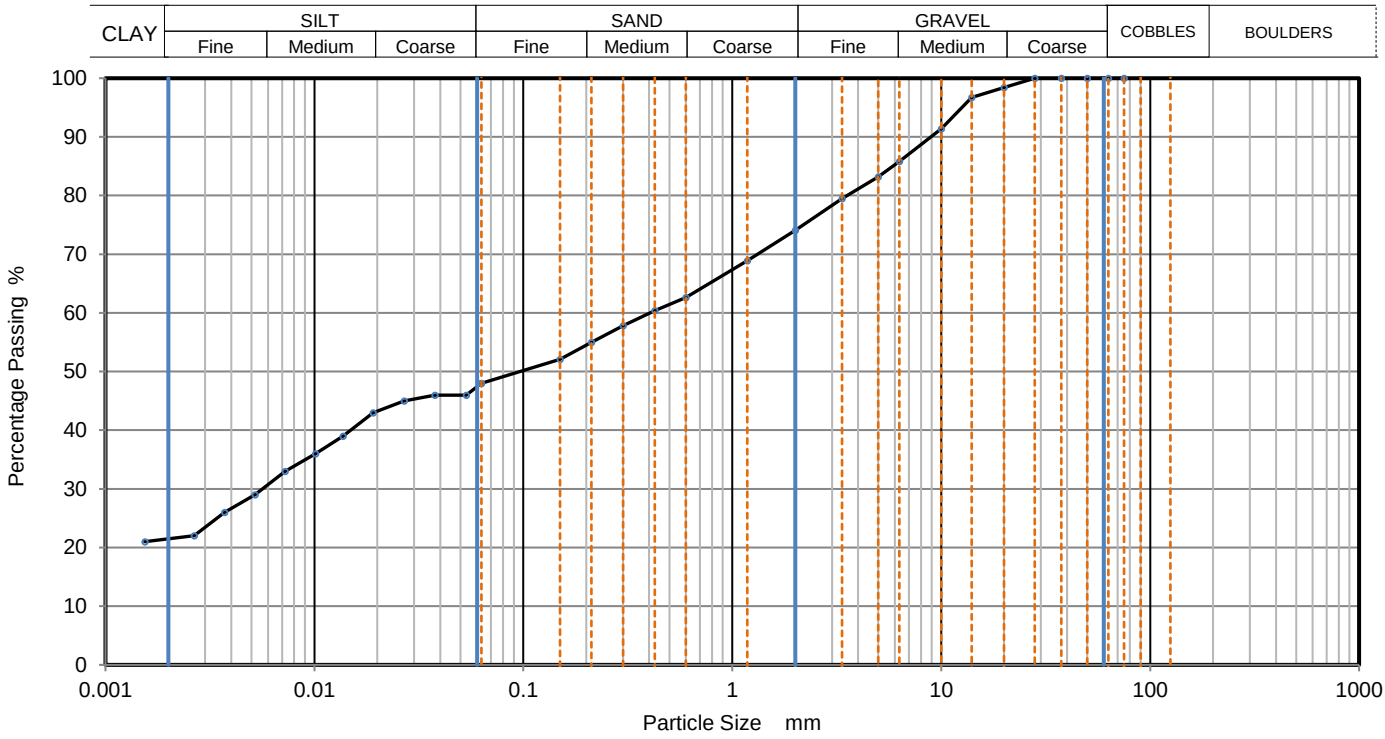


Plasticity chart



QC Form: R1

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP01A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	14
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	2.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP01A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	48
		0.0533	46
75	100	0.0377	46
63	100	0.0268	45
50	100	0.0191	43
37.5	100	0.0137	39
28	100	0.0101	36
20	98	0.0072	33
14	97	0.0052	29
10	91	0.0037	26
6.3	86	0.0027	22
5	83	0.0015	21
3.35	80		
2	74		
1.18	69		
0.6	63	Particle density (assumed)	
0.425	60	2.65 Mg/m3	
0.3	58		
0.212	55		
0.15	52		
0.063	48		

Dry Mass of sample, g	928

Sample Proportions	% dry mass
Very coarse	0
Gravel	26
Sand	26
Silt	27
Clay	21

Grading Analysis		
D100	mm	
D60	mm	0.405
D30	mm	0.00564
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

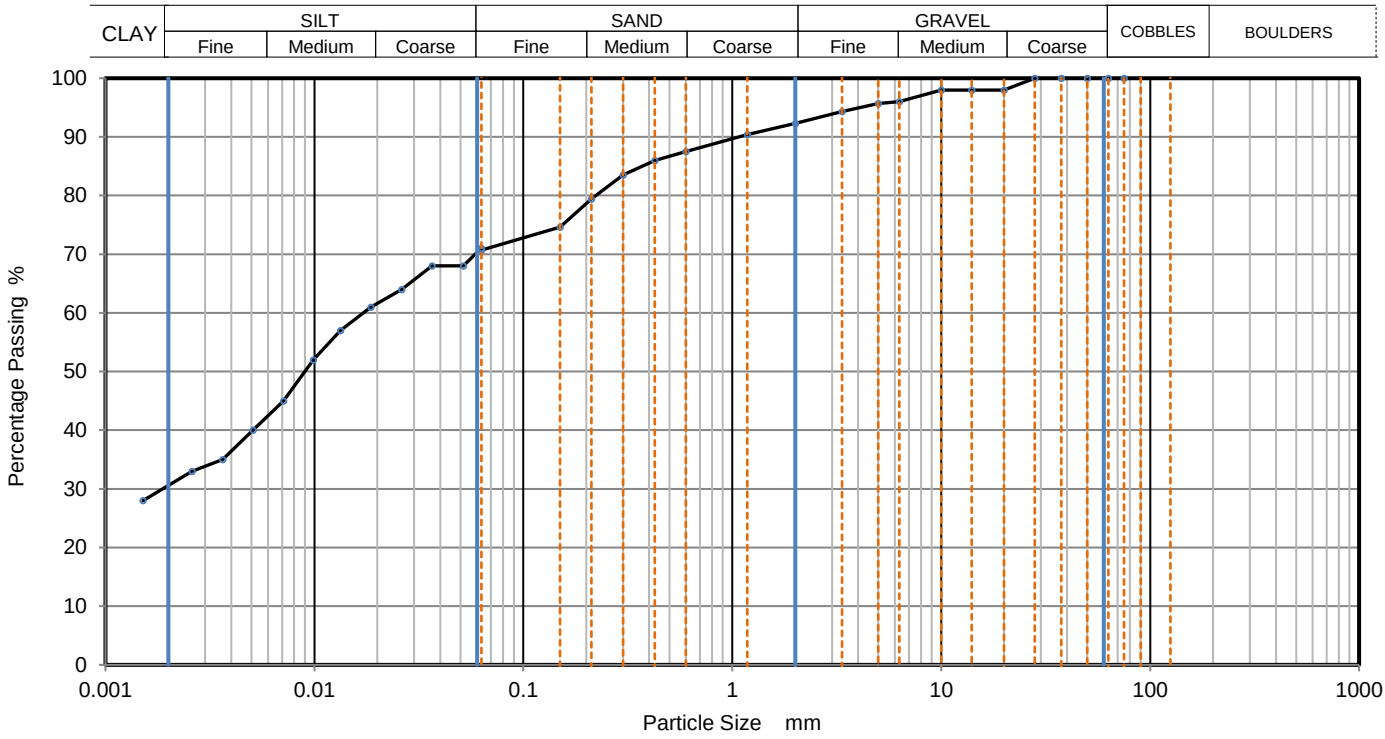
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP02A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	12
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	4.00
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP02A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	71
		0.0516	68
75	100	0.0365	68
63	100	0.0262	64
50	100	0.0186	61
37.5	100	0.0133	57
28	100	0.0099	52
20	98	0.0071	45
14	98	0.0051	40
10	98	0.0036	35
6.3	96	0.0026	33
5	96	0.0015	28
3.35	94		
2	92		
1.18	90		
0.6	88	Particle density (assumed)	
0.425	86	2.65 Mg/m3	
0.3	84		
0.212	79		
0.15	75		
0.063	71		

Dry Mass of sample, g	679

Sample Proportions	% dry mass
Very coarse	0
Gravel	8
Sand	22
Silt	40
Clay	31

Grading Analysis		
D100	mm	
D60	mm	0.017
D30	mm	0.00184
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

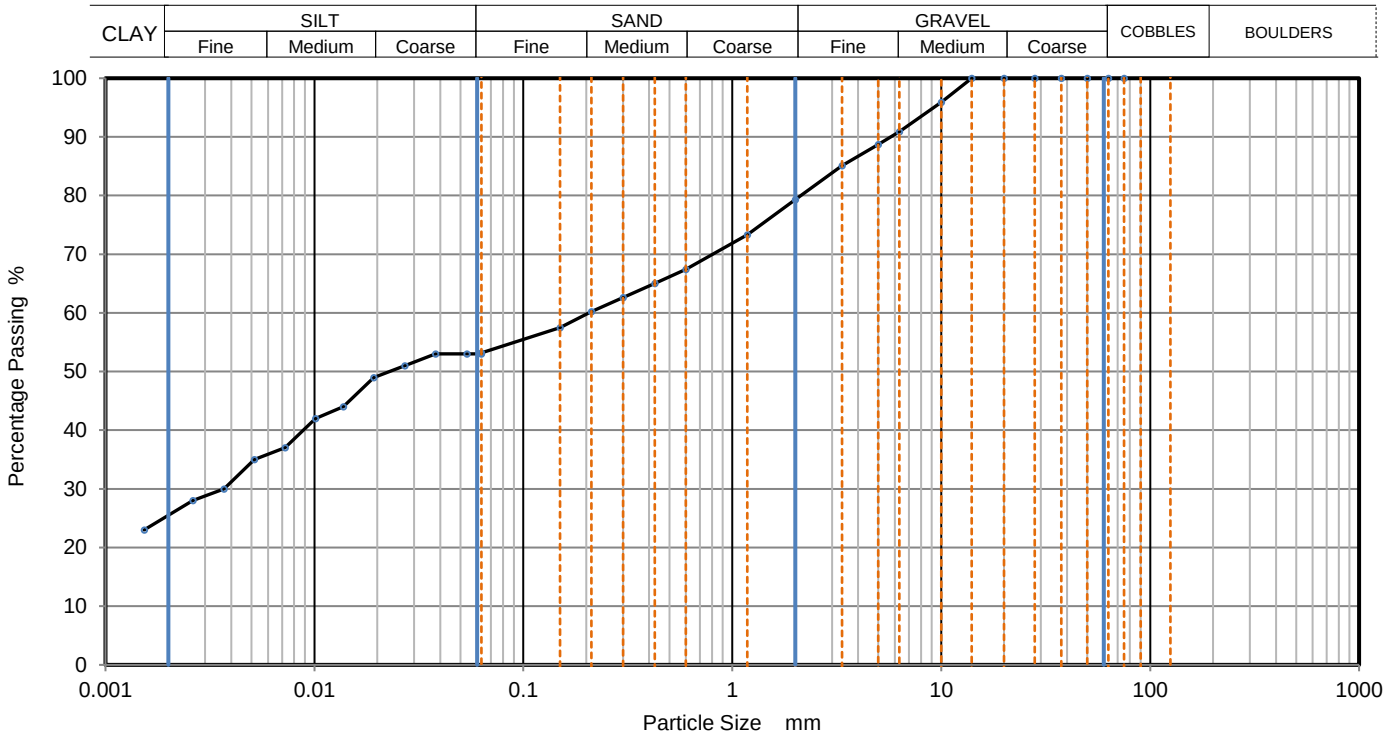
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP04A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	8
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP04A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	53
		0.0537	53
75	100	0.0380	53
63	100	0.0270	51
50	100	0.0192	49
37.5	100	0.0138	44
28	100	0.0101	42
20	100	0.0072	37
14	100	0.0052	35
10	96	0.0037	30
6.3	91	0.0026	28
5	89	0.0015	23
3.35	85		
2	79		
1.18	73		
0.6	67	Particle density (assumed)	
0.425	65	2.65 Mg/m3	
0.3	63		
0.212	60		
0.15	58		
0.063	53		

Dry Mass of sample, g	981

Sample Proportions	% dry mass
Very coarse	0
Gravel	21
Sand	26
Silt	28
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.207
D30	mm	0.00365
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

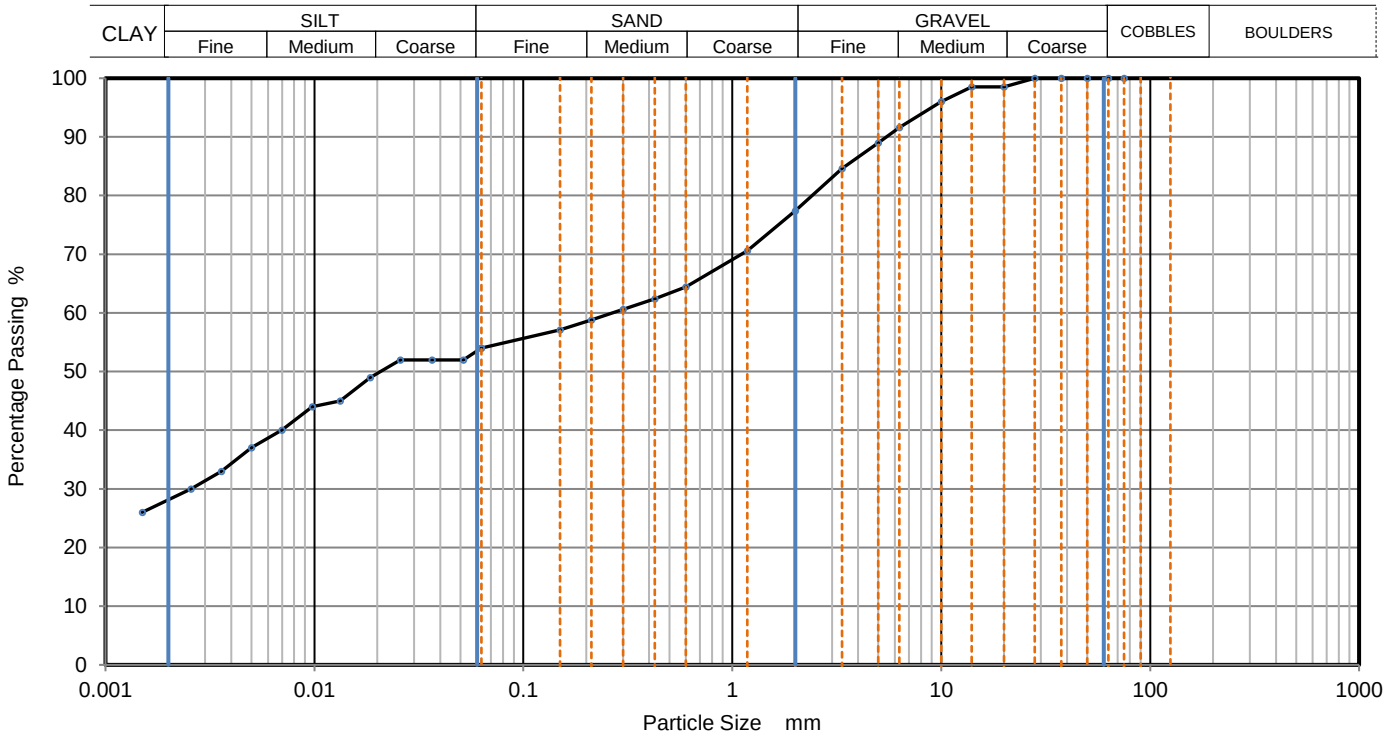
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP05A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	9
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	1.90
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP05A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	54
		0.0516	52
75	100	0.0365	52
63	100	0.0258	52
50	100	0.0185	49
37.5	100	0.0133	45
28	100	0.0098	44
20	99	0.0070	40
14	99	0.0050	37
10	96	0.0036	33
6.3	92	0.0026	30
5	89	0.0015	26
3.35	85		
2	77		
1.18	71		
0.6	64	Particle density (assumed)	
0.425	62	2.65 Mg/m3	
0.3	61		
0.212	59		
0.15	57		
0.063	54		

Dry Mass of sample, g	742

Sample Proportions	% dry mass
Very coarse	0
Gravel	23
Sand	23
Silt	26
Clay	28

Grading Analysis		
D100	mm	
D60	mm	0.267
D30	mm	0.00266
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

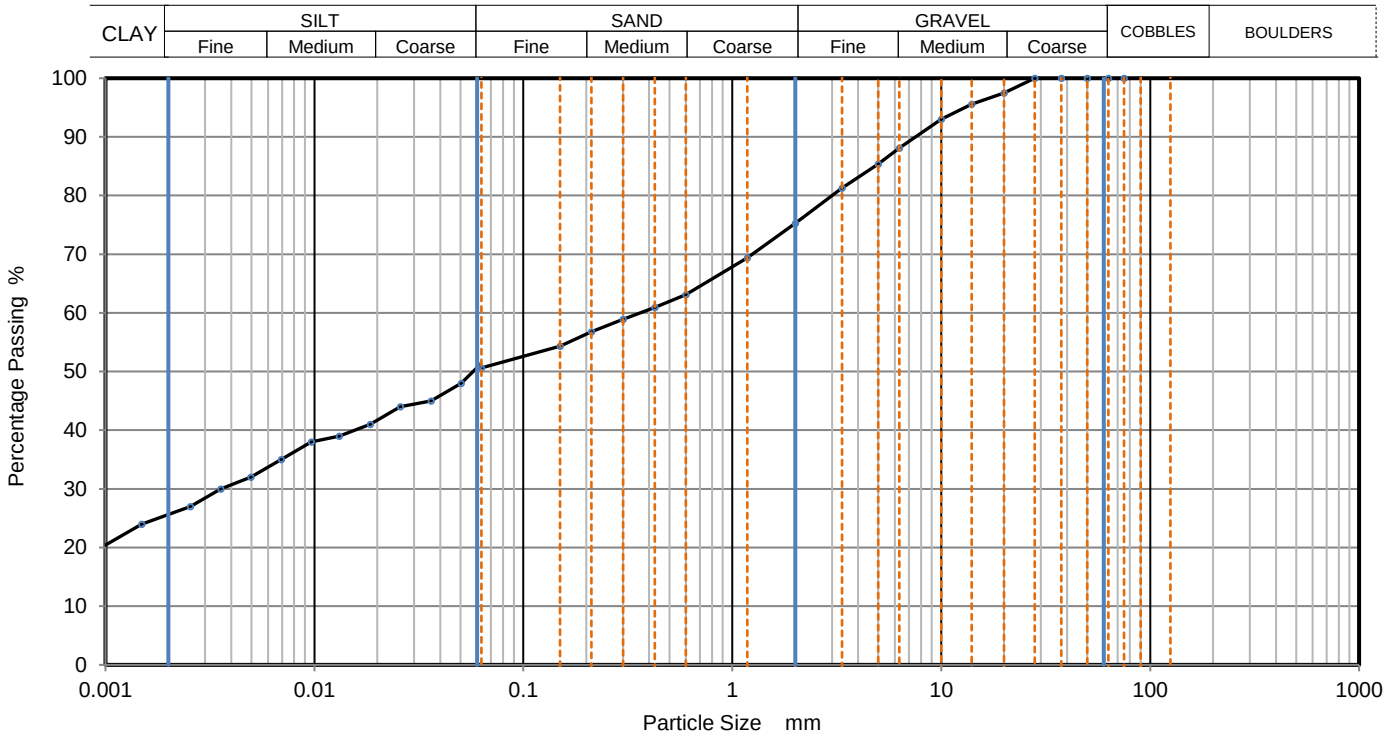
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP07A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	11
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	2.70
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP07A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0614	51
		0.0504	48
75	100	0.0362	45
63	100	0.0258	44
50	100	0.0185	41
37.5	100	0.0132	39
28	100	0.0097	38
20	98	0.0069	35
14	96	0.0050	32
10	93	0.0036	30
6.3	88	0.0025	27
5	85	0.0015	24
3.35	81	0.0008	18
2	75		
1.18	69		
0.6	63	Particle density	(assumed)
0.425	61	2.65	Mg/m3
0.3	59		
0.212	57		
0.15	54		
0.063	51		

Dry Mass of sample, g	833

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	25
Silt	25
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.364
D30	mm	0.00377
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

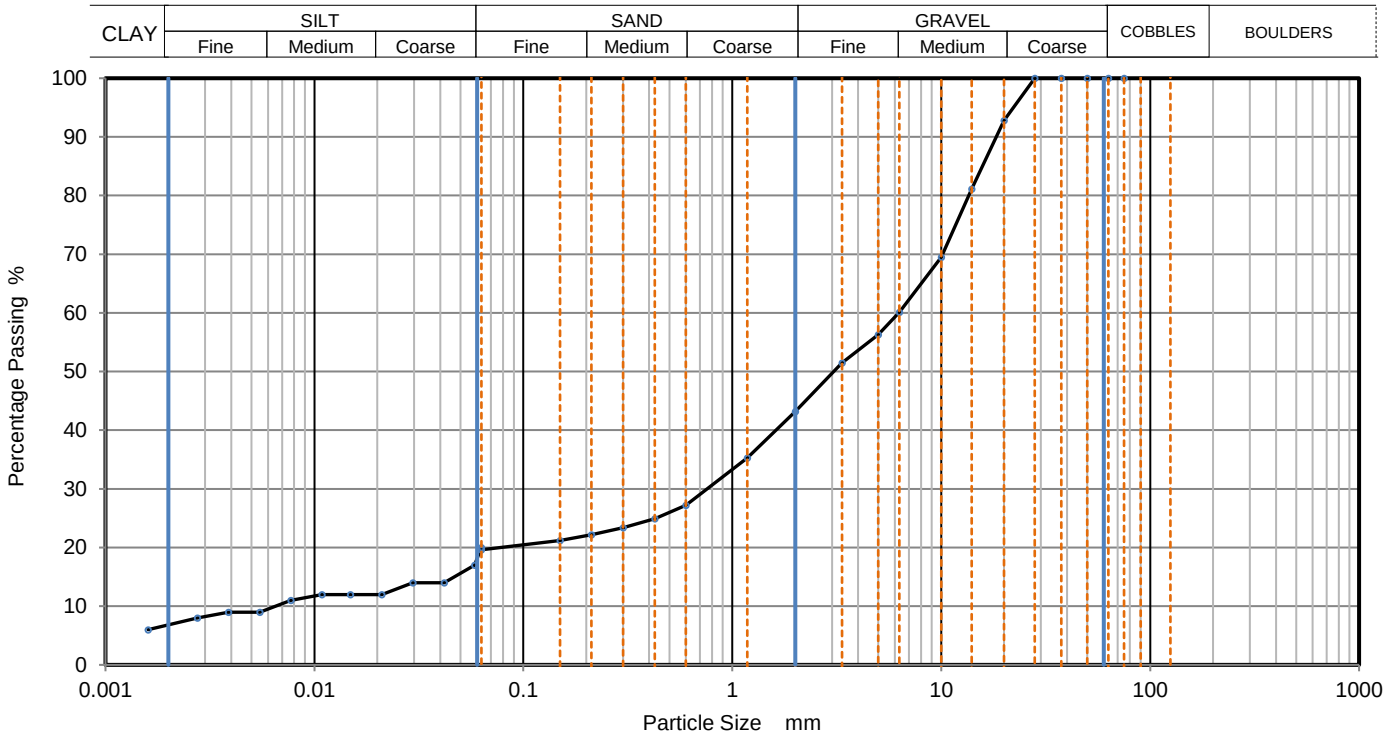
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1**
				QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP09A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	5
Soil Description	Dark grey very silty very sandy medium GRAVEL.			Depth, m	3.80
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP09A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	20
		0.0585	17
75	100	0.0418	14
63	100	0.0296	14
50	100	0.0210	12
37.5	100	0.0149	12
28	100	0.0109	12
20	93	0.0077	11
14	81	0.0055	9
10	70	0.0039	9
6.3	60	0.0028	8
5	56	0.0016	6
3.35	52		
2	43		
1.18	35		
0.6	27	Particle density (assumed)	
0.425	25	2.65	Mg/m3
0.3	23		
0.212	22		
0.15	21		
0.063	20		

Dry Mass of sample, g	827

Sample Proportions	% dry mass
Very coarse	0
Gravel	57
Sand	24
Silt	13
Clay	7

Grading Analysis		
D100	mm	
D60	mm	6.26
D30	mm	0.757
D10	mm	0.00681
Uniformity Coefficient		920
Curvature Coefficient		13

Remarks

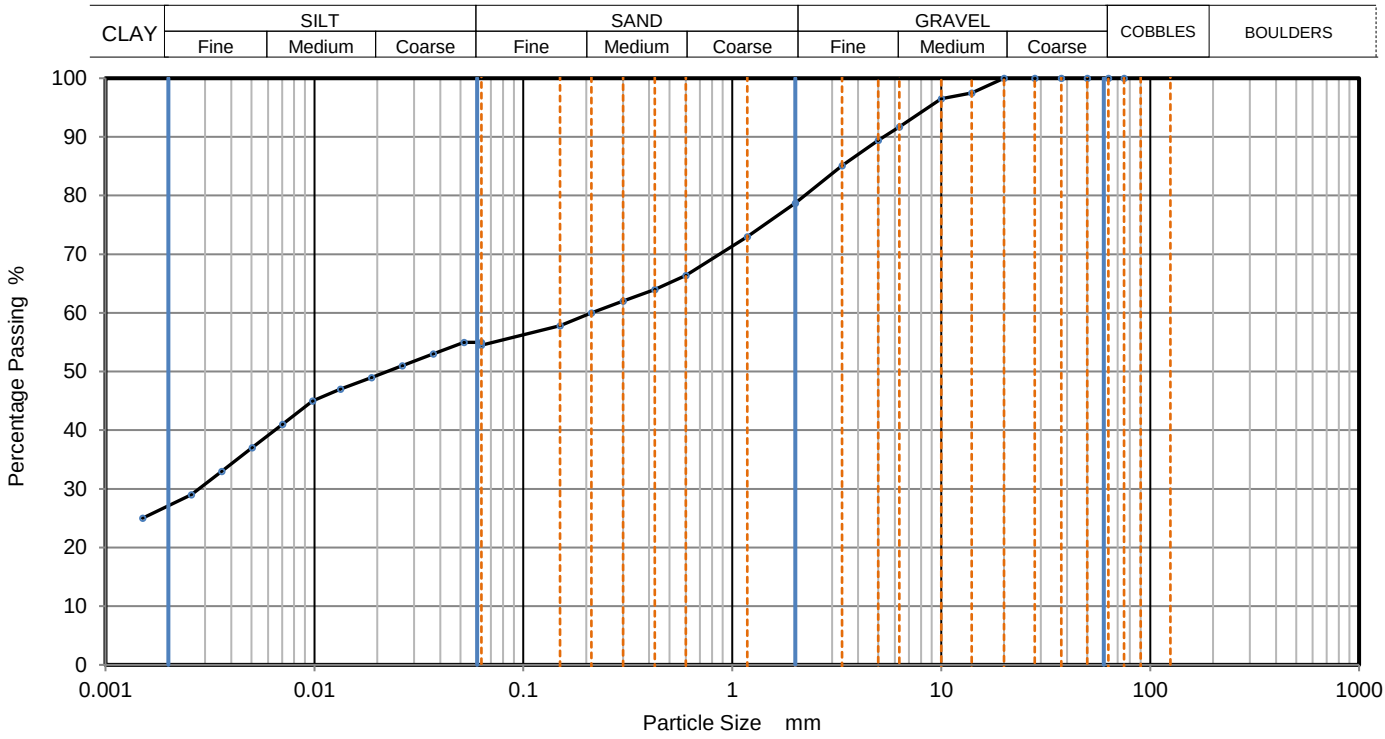
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP10A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	10
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.20
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP10A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	55
		0.0520	55
75	100	0.0370	53
63	100	0.0263	51
50	100	0.0187	49
37.5	100	0.0133	47
28	100	0.0098	45
20	100	0.0070	41
14	98	0.0050	37
10	97	0.0036	33
6.3	92	0.0026	29
5	89	0.0015	25
3.35	85		
2	79		
1.18	73		
0.6	66	Particle density (assumed)	
0.425	64	2.65 Mg/m3	
0.3	62		
0.212	60		
0.15	58		
0.063	55		

Dry Mass of sample, g	789

Sample Proportions	% dry mass
Very coarse	0
Gravel	21
Sand	24
Silt	27
Clay	27

Grading Analysis		
D100	mm	
D60	mm	
D30	mm	0.00276
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

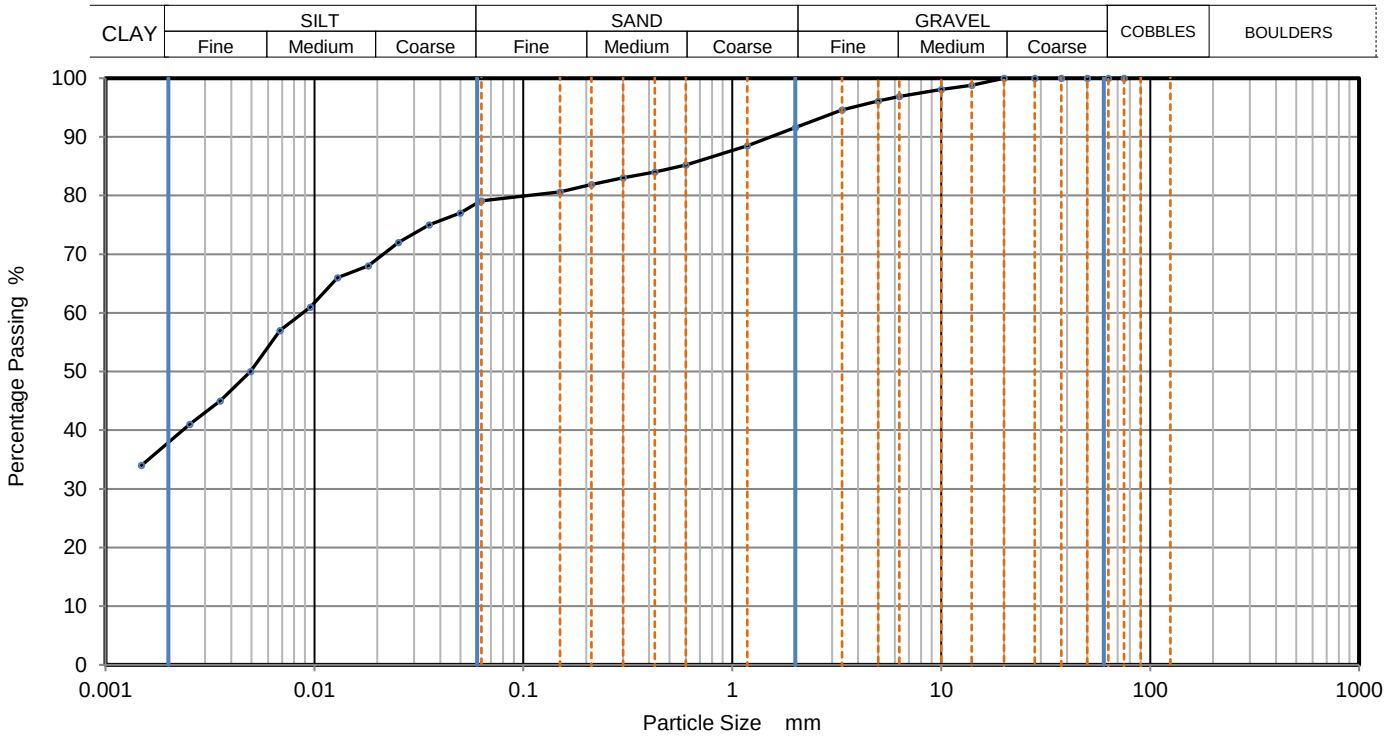
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	1
				QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP11A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	4
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP11A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0618	79
		0.0498	77
75	100	0.0355	75
63	100	0.0253	72
50	100	0.0181	68
37.5	100	0.0129	66
28	100	0.0096	61
20	100	0.0068	57
14	99	0.0049	50
10	98	0.0035	45
6.3	97	0.0025	41
5	96	0.0015	34
3.35	95		
2	92		
1.18	89		
0.6	85	Particle density (assumed)	
0.425	84	2.65 Mg/m3	
0.3	83		
0.212	82		
0.15	81		
0.063	79		

Dry Mass of sample, g	913

Sample Proportions	% dry mass
Very coarse	0
Gravel	8
Sand	13
Silt	41
Clay	38

Grading Analysis		
D100	mm	
D60	mm	0.00886
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

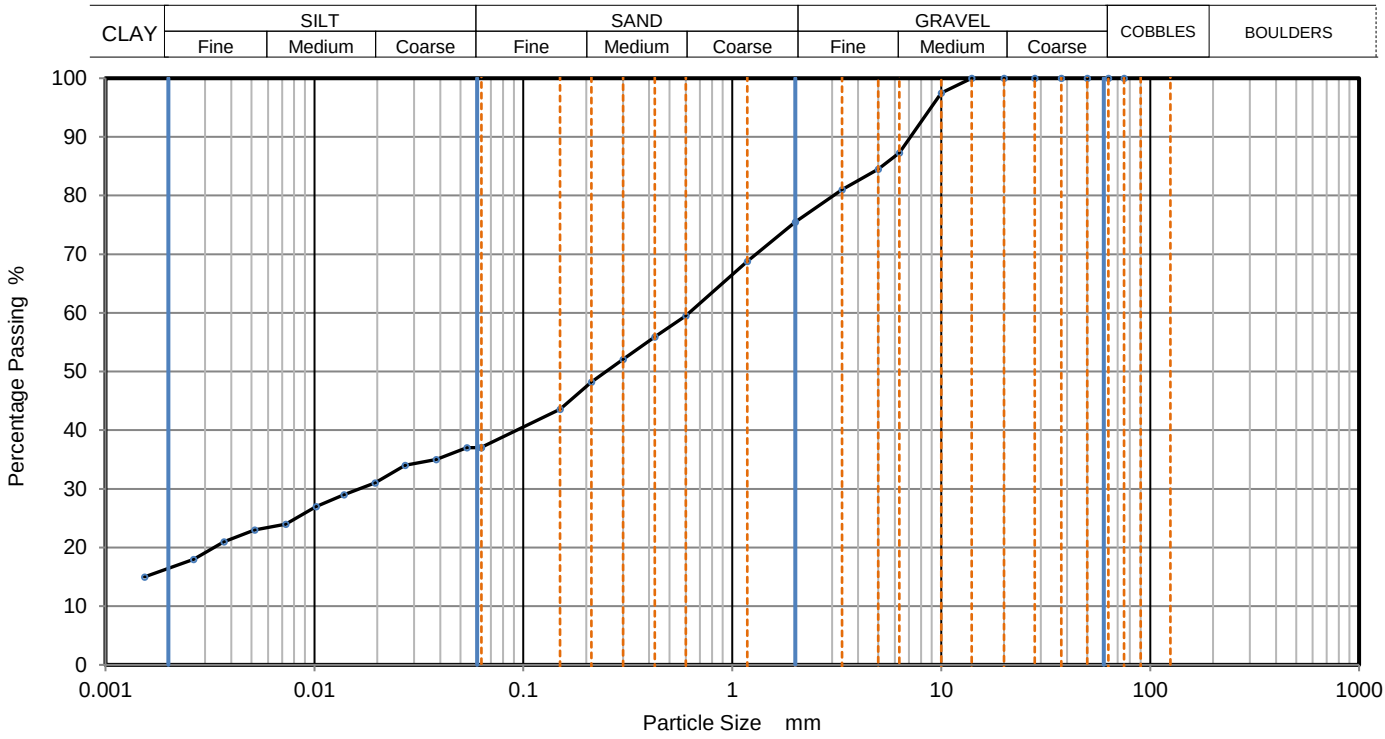
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP12A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	3
Soil Description	Dark grey slightly gravelly sandy clayey SILT.			Depth, m	4.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP12A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	37
		0.0537	37
75	100	0.0382	35
63	100	0.0272	34
50	100	0.0195	31
37.5	100	0.0139	29
28	100	0.0102	27
20	100	0.0073	24
14	100	0.0052	23
10	98	0.0037	21
6.3	87	0.0026	18
5	85	0.0015	15
3.35	81		
2	76		
1.18	69		
0.6	60	Particle density (assumed)	
0.425	56	2.65	Mg/m3
0.3	52		
0.212	48		
0.15	44		
0.063	37		

Dry Mass of sample, g	616

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	38
Silt	21
Clay	16

Grading Analysis		
D100	mm	
D60	mm	0.62
D30	mm	0.017
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

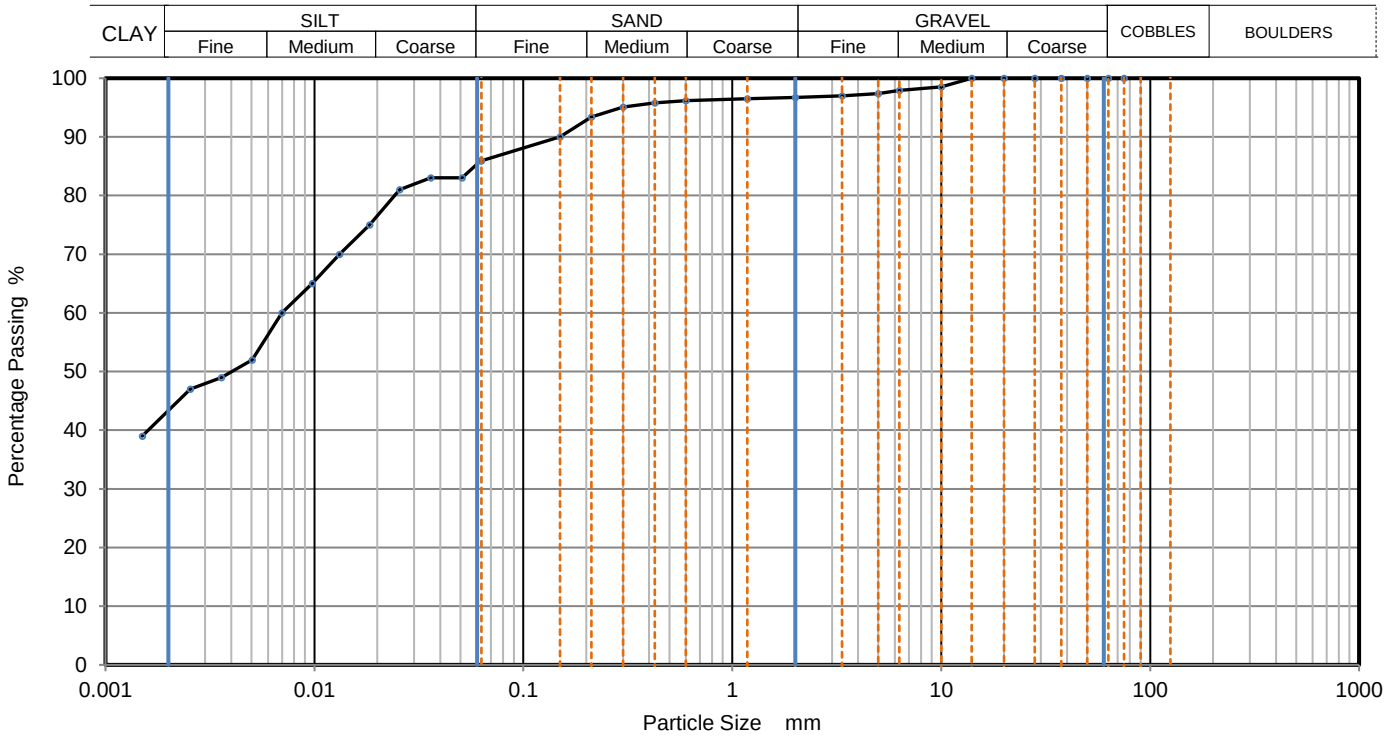
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP14A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	1
Soil Description	Dark grey slightly gravelly slightly sandy clayey SILT.			Depth, m	2.10
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP14A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0628	86
		0.0509	83
75	100	0.0360	83
63	100	0.0256	81
50	100	0.0184	75
37.5	100	0.0132	70
28	100	0.0098	65
20	100	0.0070	60
14	100	0.0050	52
10	99	0.0036	49
6.3	98	0.0025	47
5	97	0.0015	39
3.35	97		
2	97		
1.18	97		
0.6	96	Particle density	(assumed)
0.425	96	2.65	Mg/m3
0.3	95		
0.212	93		
0.15	90		
0.063	86		

Dry Mass of sample, g	328

Sample Proportions	% dry mass
Very coarse	0
Gravel	3
Sand	11
Silt	43
Clay	43

Grading Analysis		
D100	mm	
D60	mm	0.00705
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

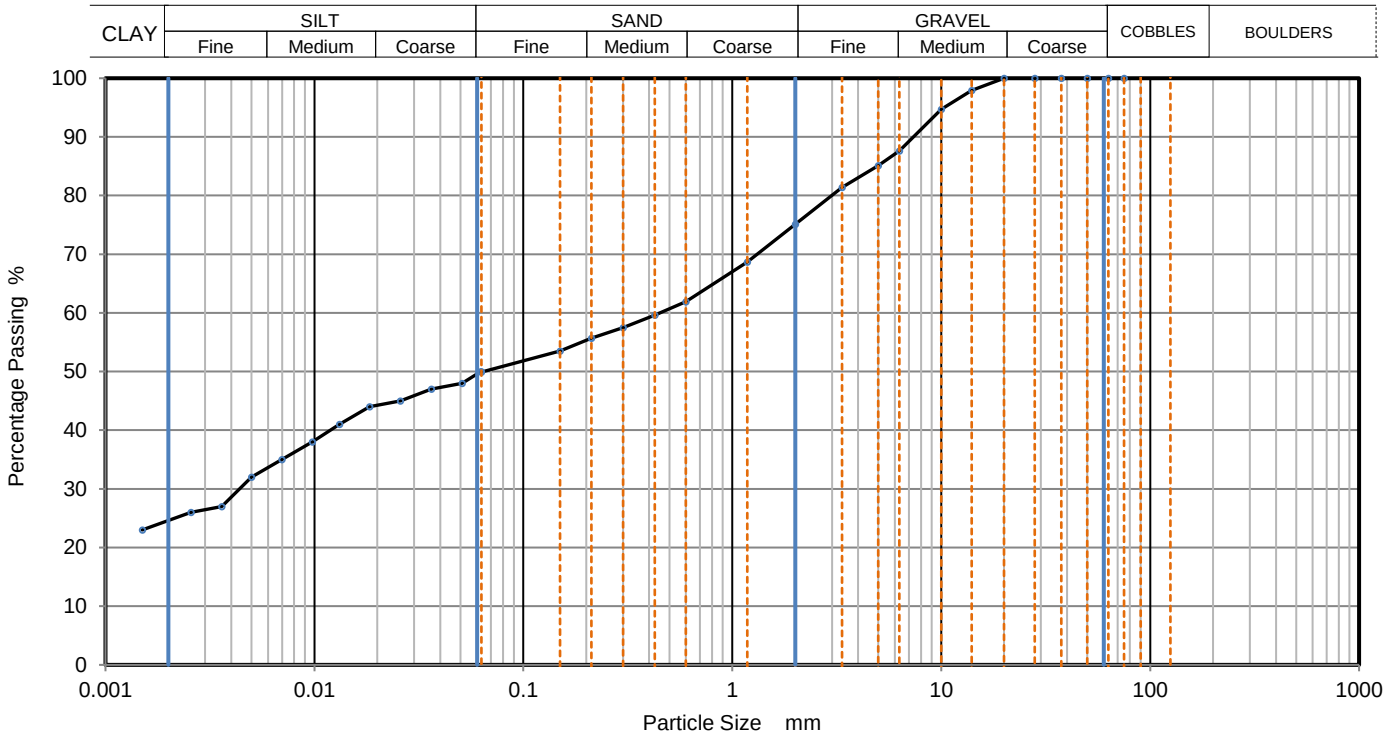
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP16A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	2
Soil Description	Dark grey slightly gravelly slightly sandy silty CLAY.			Depth, m	3.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP16A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0628	50
		0.0509	48
75	100	0.0362	47
63	100	0.0258	45
50	100	0.0184	44
37.5	100	0.0132	41
28	100	0.0098	38
20	100	0.0070	35
14	98	0.0050	32
10	95	0.0036	27
6.3	88	0.0026	26
5	85	0.0015	23
3.35	81		
2	75		
1.18	69		
0.6	62	Particle density (assumed)	
0.425	60	2.65	Mg/m3
0.3	58		
0.212	56		
0.15	54		
0.063	50		

Dry Mass of sample, g	1007

Sample Proportions	% dry mass
Very coarse	0
Gravel	25
Sand	25
Silt	26
Clay	24

Grading Analysis		
D100	mm	
D60	mm	0.453
D30	mm	0.00441
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

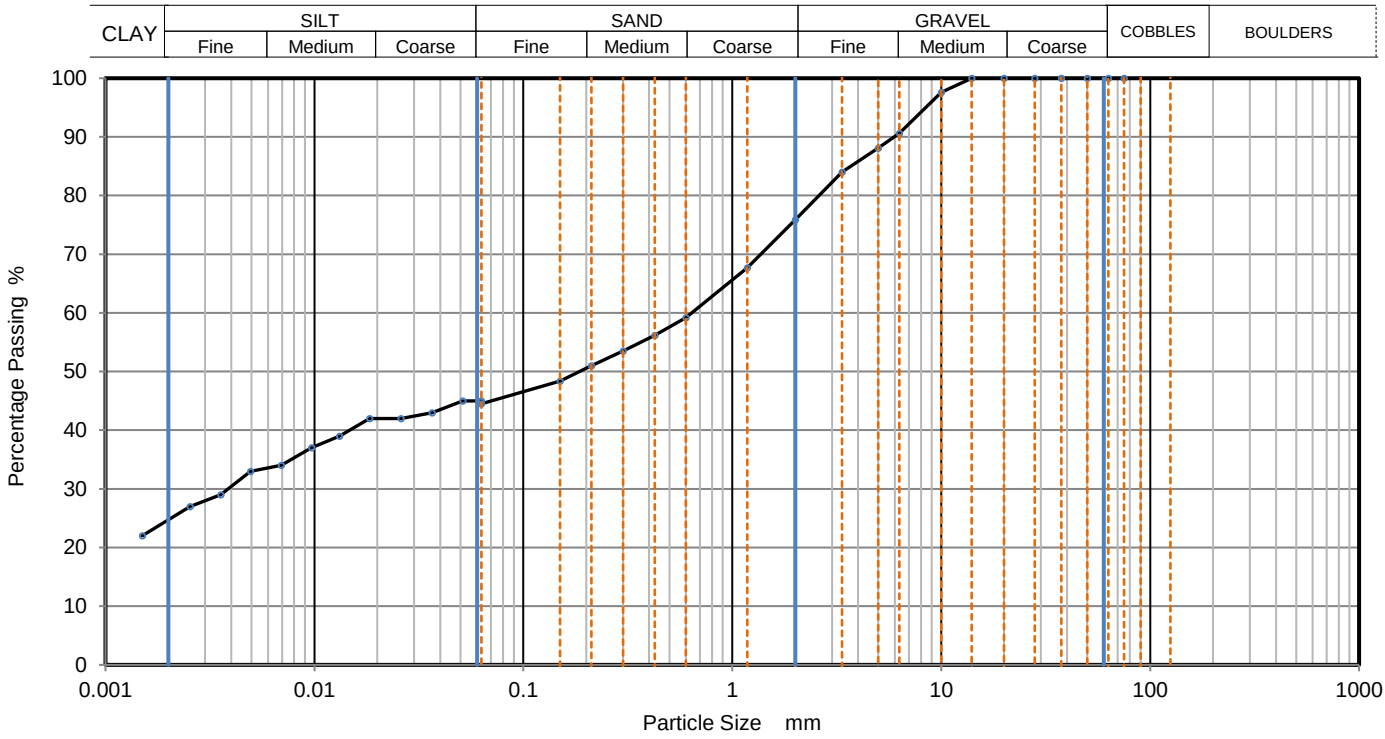
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP17A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	6
Soil Description	Dark grey slightly sandy slightly gravelly silty CLAY.			Depth, m	3.50
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP17A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	45
		0.0513	45
75	100	0.0365	43
63	100	0.0260	42
50	100	0.0184	42
37.5	100	0.0132	39
28	100	0.0097	37
20	100	0.0069	34
14	100	0.0049	33
10	98	0.0036	29
6.3	91	0.0025	27
5	88	0.0015	22
3.35	84		
2	76		
1.18	68		
0.6	59	Particle density (assumed)	
0.425	56	2.65	Mg/m3
0.3	54		
0.212	51		
0.15	48		
0.063	45		

Dry Mass of sample, g	13284

Sample Proportions	% dry mass
Very coarse	0
Gravel	24
Sand	31
Silt	20
Clay	25

Grading Analysis		
D100	mm	
D60	mm	0.641
D30	mm	0.00393
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

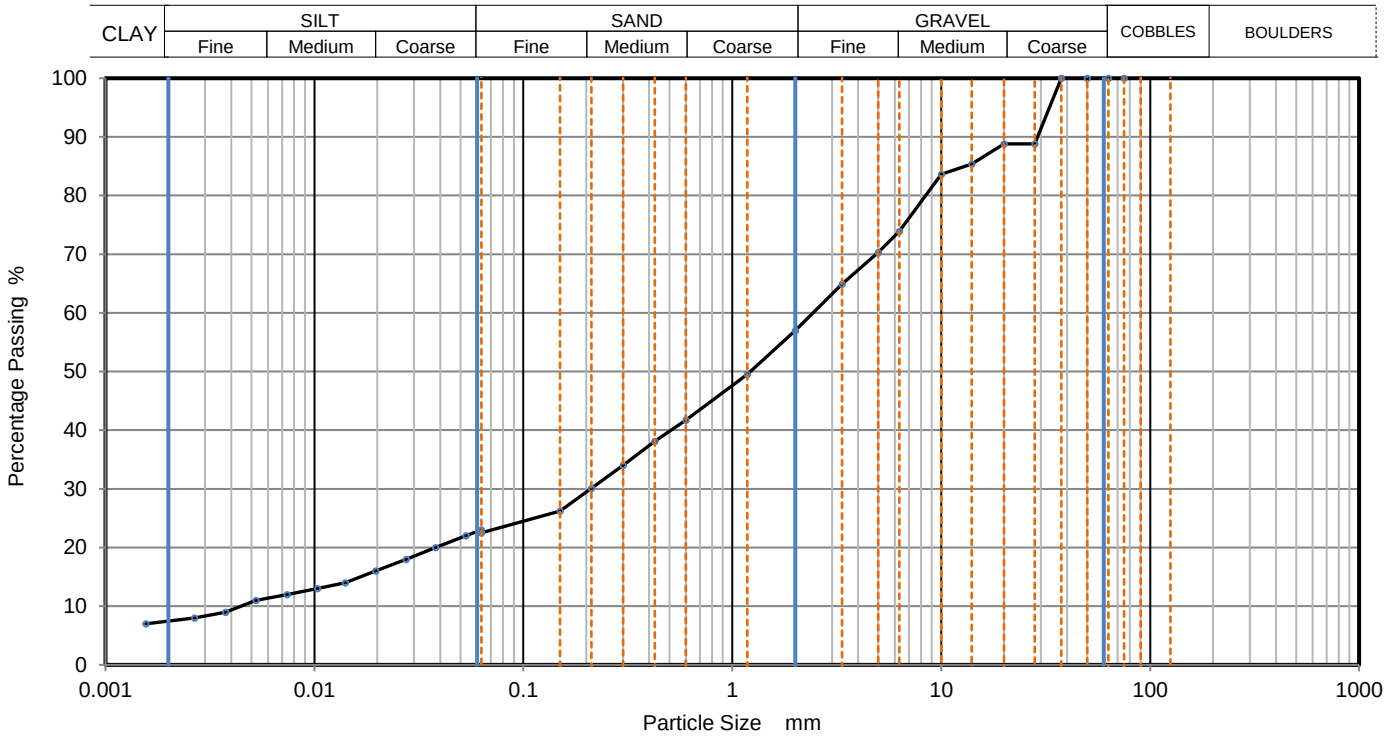
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP18A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	7
Soil Description	Dark grey very silty very sandy GRAVEL.			Depth, m	3.90
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP18A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0630	23
		0.0531	22
75	100	0.0380	20
63	100	0.0274	18
50	100	0.0196	16
37.5	100	0.0140	14
28	89	0.0103	13
20	89	0.0074	12
14	85	0.0053	11
10	84	0.0038	9
6.3	74	0.0027	8
5	70	0.0016	7
3.35	65		
2	57		
1.18	50		
0.6	42	Particle density (assumed)	
0.425	38	2.65 Mg/m3	
0.3	34		
0.212	30		
0.15	26		
0.063	23		

Dry Mass of sample, g	803

Sample Proportions	% dry mass
Very coarse	0
Gravel	43
Sand	35
Silt	15
Clay	7

Grading Analysis		
D100	mm	
D60	mm	2.43
D30	mm	0.211
D10	mm	0.00444
Uniformity Coefficient		550
Curvature Coefficient		4.1

Remarks

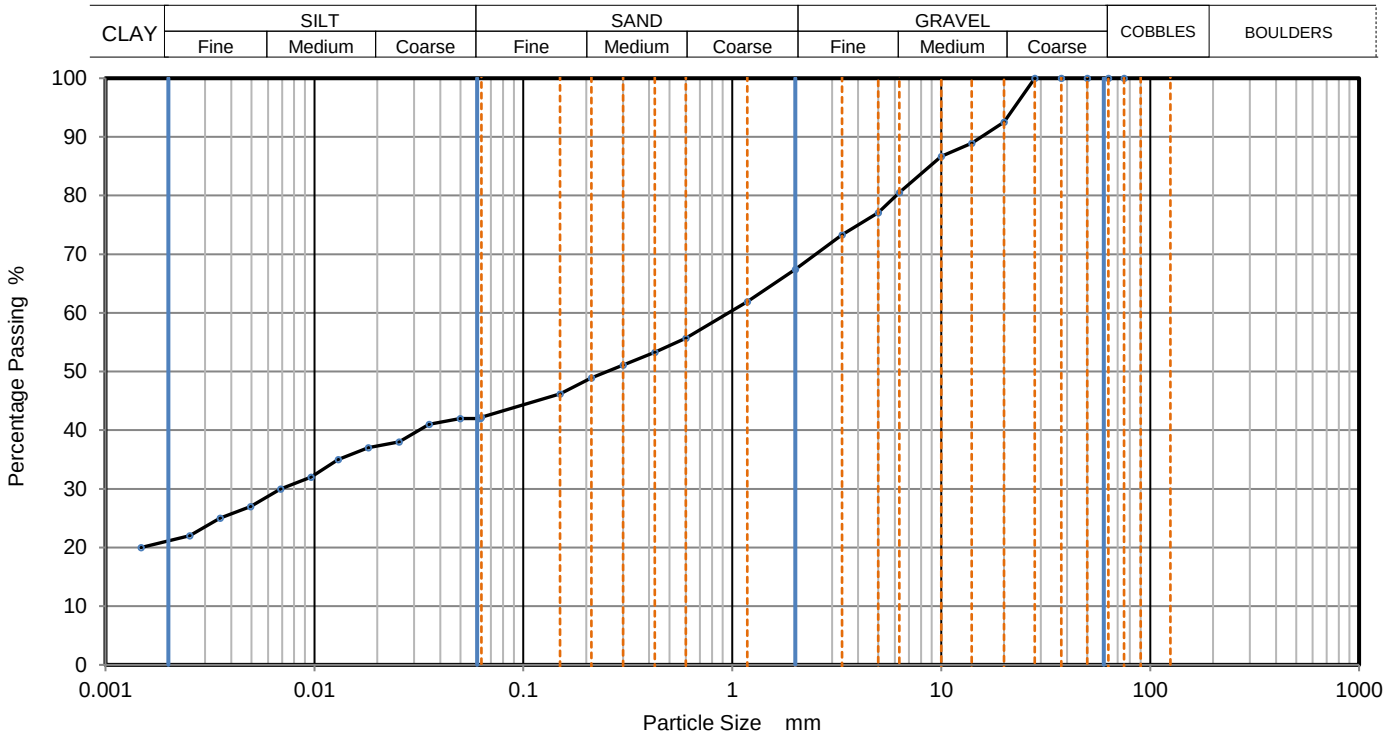
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

IRISH DRILLING LIMITED	**PARTICLE SIZE DISTRIBUTION**			Job Ref	**2019LM102**
				Borehole/Pit No.	TP23A
Site Name	Croagh Wind Farm, Co. Leitrim			Sample No.	13
Soil Description	Dark grey slightly sandy slightly gravelly silty CLAY.			Depth, m	3.60
Specimen Reference		Specimen Depth	m	Sample Type	B
Test Method	BS1377:Part 2:1990, clauses 9.2 and 9.5			KeyLAB ID	TP23A



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
		0.0623	42
		0.0498	42
75	100	0.0355	41
63	100	0.0254	38
50	100	0.0181	37
37.5	100	0.0130	35
28	100	0.0096	32
20	93	0.0069	30
14	89	0.0049	27
10	87	0.0035	25
6.3	81	0.0025	22
5	77	0.0015	20
3.35	73		
2	67		
1.18	62		
0.6	56	Particle density (assumed)	
0.425	53	2.65 Mg/m3	
0.3	51		
0.212	49		
0.15	46		
0.063	42		

Dry Mass of sample, g	871

Sample Proportions	% dry mass
Very coarse	0
Gravel	33
Sand	25
Silt	21
Clay	21

Grading Analysis		
D100	mm	
D60	mm	0.961
D30	mm	0.00709
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	
		Dympna Darcy B.Sc.	02/07/2019 15:35	**1** QC From No:R2

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

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

Summary of Results for Maximum and Minimum Dry Density Tests

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample				Soil Description	Test Method	Oversize material (as appropriate)			Dry density		Remarks
	Ref	Top	Base	Type			>37.5mm %	>6.3mm %	>2mm %	Maximum Mg/m3	Minimum Mg/m3	
TP18A	7	3.90	4.10	B	Dark grey very silty very sandy GRAVEL.	4.3, 4.5				2.02	1.35	
TP23A	13	3.60	3.80	B	Dark grey slightly sandy slightly gravelly silty CLAY.	4.3, 4.5				1.99	1.18	

Notes

Tests performed in accordance with BS 1377 : Part 4 : 1990
and clauses : 4.2, 4.4 sandy soil
4.3, 4.5 gravelly soil

Date Printed: 07/02/2019 00:00

Approved By:

Table 1

sheet 1

Photo 1 Trial pit TP1A

Photo 2 Trial pit TP2A

Photo 3 Trial pit TP3A

Photo 4 Trial Pit 4A

Photo 5 Arisings from trial pit TP4A

Photo 6 Trial pit TP5A

Photo 7 Trial pit TP6A

Photo 8 Arisings from trial pit TP6A

Photo 9 Trial pit TP7A

Photo 10 Trial pit TP9A

Photo 11 Arisings from trial pit TP9A


Photo 12 Trial pit TP10A

Photo 13 Trial pit TP11A

Photo 14 Trial pit TP12A

Photo 15 Trial pit TP13A

Photo 16 Trial pit TP14A

Photo 17 Trial pit TP15A

Photo 18 Trial pit TP16A

Photo 19 Trial pit TP17A

Photo 20 Trial pit TP18A

Photo 21 Trial pit TP17A

Photo 22 Trial pit TP18A

Photo 23 Trial pit TP22A

Photo 24 Trial pit TP23A

RECORD OF TRIAL PIT TP01_MKO

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TP01_MKO **Trial Pit Location: N E**

Date: 13 September 2019 **Logged by:** MW (MKO)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.30	Soft brown PEAT		
0.30	0.85	Grey sandy clayey Silt		
0.85	2.9	Firm blue/grey slightly sandy very gravelly Silt/Clay		
2.9	3.4	Weathered shale in a silt/clay matrix		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

TP01_MKO

RECORD OF TRIAL PIT TP03_MKO

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TP03_MKO **Trial Pit Location: N E**

Date: 13 September 2019 **Logged by:** MW (MKO)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.35	Soft brown PEAT		
0.35	0.85	Very soft to soft light brown/grey sandy clayey Silt		
0.85	2.2	Firm blue/grey slightly sandy very gravelly Silt/Clay with occasional cobbles		
2.2	3.3	Weathered shale in a silt/clay matrix		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

TP03_MKO

RECORD OF TRIAL PIT TPAR1

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR1 **Trial Pit Location: E** 587701 **N** 823093

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	1.30	Made Ground – clayey gravel (shale)		
1.30	2.20	Firm brown fibrous PEAT		
2.20	4.10	Stiff dark blue/grey SILT/CLAY		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR2

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR2 **Trial Pit Location: E** 588267 **N** 823162

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.60	Peaty topsoil		
0.60	1.50	Firm brown slightly gravelly CLAY		
1.50	3.20	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR3

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR3 **Trial Pit Location: E** 588807 **N** 822991

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.25	Topsoil		
0.25	0.80	Firm brown slightly gravelly CLAY		
0.80	4.10	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
4.1		End of trial pit		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR4

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR4 **Trial Pit Location: E** 589127 **N** 822863

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.70	Firm brown slightly gravelly CLAY		
0.70	2.50	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.50		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR5

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR5 **Trial Pit Location: E** 590217 **N** 823253

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.70	Firm brown slightly gravelly CLAY		
0.70	2.20	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.20		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

RECORD OF TRIAL PIT TPAR6

Project Number: P1989 **Project Name:** Croagh Wind Farm

Trial Pit Number: TPAR6 **Trial Pit Location: E** 589504 **N** 822084

Date: 12 March 2020 **Logged by:** CmcG (Coillte)

Depth From (m)	Depth To (m)	Soil Description	Sample No.	Sample Depth (m)
0	0.20	Topsoil		
0.20	0.80	Firm brown slightly gravelly CLAY		
0.70	2.50	Stiff dark blue/grey SILT/CLAY with occasional cobbles, becomes very stiff with depth		
2.50		End of trial pit (Boulder)		

Notes:

1. Trial pit dry upon completion.
2. Trial pit backfilled upon completion.

Appendix D

Ground Investigation (2019) – Borehole Logs, Laboratory Testing & Photographs




IRISH DRILLING LIMITED

LOUGHREA, CO. GALWAY, IRELAND

CONTRACT DRILLING
SITE INVESTIGATION

Phone: (091) 841 274
Fax: (091) 847 687

email: info@irishdrilling.ie

CROAGH WIND FARM

SITE INVESTIGATION CONTRACT FACTUAL REPORT

MKO,
Tuam Road,
Galway.

Fehily Timoney & Company,
Consulting Engineers,
Singleton's Lane,
Bagenalstown,
Carlow.

	Prepared by	Approved by	Rev. Issue Date:	Revision No.
	Ronan Killeen	Declan Joyce	16th August 2019	19 _LM_102/001
Signature				

FOREWORD

The borehole records have been compiled from an examination of the samples by a Geotechnical Engineer and from the Drillers' descriptions.

The report presents an opinion on the configuration of the strata within the site based on the borehole results. The assumptions, though reasonable, are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Contents:

1.0 Introduction.

Irish Drilling Ltd. (IDL) was instructed by Fehiliy Timoney & Partners, Consulting Engineers, on behalf of KMO, to carry out a site investigation at the site of the proposed Croagh Wind Farm Project.

This site investigation was carried out to provide detailed factual geotechnical information of the underlying ground conditions at the location of the proposed works.

The fieldwork commenced on May 29th 2019 and was completed on June 25th 2019.

2.0 Site & Geology

The site is located within lands currently owned by Coillte, close to the boundary of County Sligo and County Leitrim.

Geological Survey of Ireland Maps for the region indicate that the site is underlain by the Carboniferous Limestone and Siltstone Rock Formations.

The fieldwork was carried out predominantly on accessible existing tracks within densely forested woodlands.

A Site Plan, prepared by the client's representatives to show approximate 'as-built' locations, is included with this report.

3.0 Fieldwork.

The following plant was mobilised to site to carry out fieldwork operations:

GT1100 GoTract Rotary Core Drilling Rig.

Fieldwork carried out to date has included the following:

Four rotary core boreholes were carried out to establish overburden conditions and rockhead and to establish the nature and integrity of the underlying rock.

Wireline drilling techniques, using HQ size drill strings, were carried out to recover soil and rock core samples. The core samples recovered consisted of the following core diameters: 64mm (HQ).

The samples were stored in wooden boxes and returned to the laboratory where there were logged and photographed by a Geotechnical Engineer and presented for testing.

The rotary core boreholes were carried out to depths ranging from 30.20m to 30.30m below ground level.

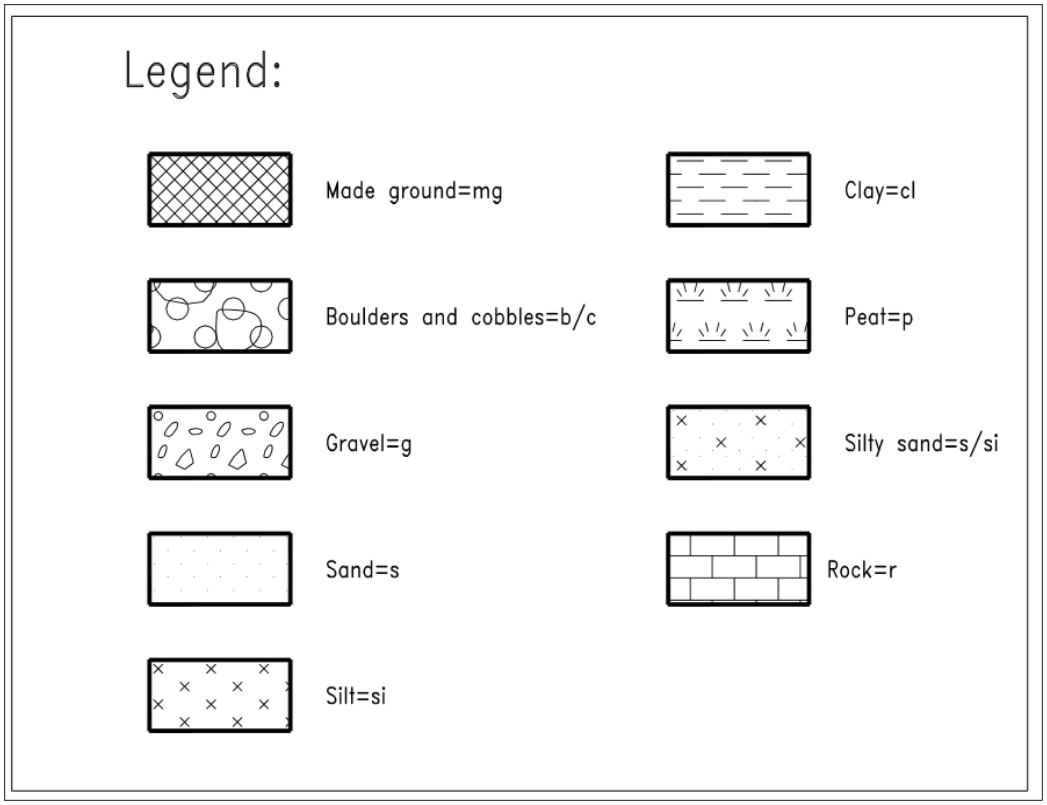
In–Situ testing consisting of Standard Penetration Tests were carried out in the overburden at regular intervals (predominantly 1.0m intervals) or as instructed by the client's representatives.

A 50mm diameter standpipe was installed in all the boreholes and as instructed by the Client's Engineer, to allow for monitoring of groundwater levels over a prolonged period of time.

In-Situ tests consisting of Rising and/or Falling Head Permeability Tests were carried out in the boreholes and the records of same are included as appendix 2 of this factual report.

Bedding planes are defined as the surface that separates one stratum, layer or bed stratified rock from another. Discontinuity is defined as the plane of physical weakness where the tensile strength perpendicular to the discontinuity or the shear strength along the discontinuity is lower than that of the surrounding soil or rock material.

The following Key Legend Table details the symbology used on the engineering logs to describe ground conditions encountered:



Ground conditions encountered during the completion of the fieldwork were typical and as expected for this region and predominantly consisted of Glacial Tills overlying bedrock.

The Glacial Tills (where recovered) in general consisted of slightly sandy gravelly silty clay with cobbles and boulders.

Dark green brown silt was also recovered in borehole BH 02 at a depth of 4.20m to 4.80m below ground level.

Possible weathered bedrock was encountered in borehole BH 03 at a depth of 10.70m to 14.90m below ground level and in borehole BH 04 at a depth of 6.20m to 9.80m below ground level.

Intact bedrock was also encountered in all of the rotary core boreholes at depths ranging from 4.80m to 17.40m below ground level.

For detailed descriptions of bedrock please refer to the engineering logs included in the appendices to this report.

The fieldwork was carried out in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations with precedence given to IS EN 1997-2 where applicable.

Where possible the borehole locations were set out on site using a Trimble CU Bluetooth GPS Surveying Unit and the co-ordinates are included on the logs presented in the appendices.

All fieldwork co-ordinates are reported to Irish Transverse Mercator (ITM) with Reduced Levels recorded relative to Malin Head Datum and with an accuracy level of + or – 0.10m. Co-ordinates for borehole BH 04 may be compromised due to the presence of dense forestation which may have affected the use of the Bluetooth GPS Surveying Unit.

4.0 Laboratory Testing

Representative samples recovered from the boreholes were scheduled for testing in the laboratory. The test schedules were prepared by the Client's Engineer and included some or all of the following tests on rock core samples:

* Point Load.
* UCS Test.
* Slake Durability.
* Magnesium Sulphate Soundness.
* LAA.

The records of these laboratory tests are included as Appendix 4 of this factual report.

The soil and rock descriptions as noted on the borehole logs are in general visual descriptions as observed and logged by our Engineers and are described in accordance with IS EN 1997-2 and BS5930, 2015 Code of Practice for Site Investigations.

Soils descriptions (cohesive or otherwise) are also initially assessed based on the texture and 'feel' of the soil materials as witnessed by our Geotechnical Engineers and in accordance with IS EN 1997-2 and BS5930.

Where laboratory classification tests have been carried out on soil or rock samples then these visual descriptions have been amended accordingly to take into account the results of these classification tests.

Representative samples recovered from trial pits that were carried out on site by others (and on behalf of the client) were also scheduled for testing in the laboratory.

The test schedules were prepared by the Client's Engineer and included some or all of the following tests on disturbed soil samples:

* Natural Moisture Content.
* Atterberg Limits.
* Particle Size Distribution.
* Sedimentation.
* Density.
* Point Load (Set of 10).

The records of these laboratory tests carried out on trial pit soil samples are included as Appendix 5 of this factual report.

The records of all fieldwork, laboratory test results and photographs are included in the appendices of this Factual Report.

Ronan Killeen
Chartered Engineer
Irish Drilling Limited
August 16th 2019

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
11-06 0.00						0.00 - 17.40 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(5) NA			(4.20)				
3.00		(30/30mm)							
4.20			292.79		4.20				
11-06 4.60	50 (-) -						Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles and boulders. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone. Core run - 4.60m to 5.10m: 1 No light brown sandstone boulder 390mm in length. Core run - 5.10m to 6.10m: 1 No light brown sandstone boulder 290mm in length.		
11-06 5.10	80 (-) -								
11-06 5.10	20 (-) -	(15/30mm)							
6.10									
11-06	29 (-) -								
7.80									
11-06 7.80	29 (-) -	(20/30mm)							
9.20									
11-06 9.60	100 (-) -								
11-06 9.60	100 (-) -	(50/0mm)							
10.80									
11-06		NA			(13.20)				

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
11-06-19	17.00	10.80	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.30	water	100

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer: Fehily Timoney & Co

Sheet 2 of 3

Rev. REV 1

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
12.20	50 (-) -							Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles and boulders. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone. *(continued)* Core run - 12.20m to 13.80m: 1 No light brown sandstone boulder 560mm in length.		
11-06 13.80	88 (-) -									
11-06 15.20	100 (-) -									
11-06 16.80	69 (-) -									
11-06 18.20	100 (39) 14	3 NI	279.59		17.40	17.40 - 30.30 Discontinuities, closely spaced, locally very closely spaced, locally medium spaced, dipping 8 to 10°, planar, smooth, with 0.5 to 3mm thick dark grey silt smear. 17.60 - 18.00 Non-intact as weathered rock. 18.80 - 19.10 Joint, subvertical dip, planar, smooth, with 0.5 to 2mm thick dark grey silt smear, open. 20.30 - 20.50 Joint, subvertical dip, planar, smooth, with 0.5 to 2mm thick dark grey silt smear and minor surficial finely disseminated pyrite, open. 21.80 - 22.10 2 No parallel joints,		Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE.		
11-06 19.60	100 (94) 35	15 18								
11-06 21.20	100 (84) 35	28								
11-06	100	20								

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH01**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	11-06-19 13-06-19	296.99	E 583,929.8 N 823,187.2

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument/ Backfill
22.80	(97) 32	25				subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear and minor finely disseminated pyrite, open.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. *(continued)*		
11-06 24.40	100 (93) 51	10			(12.90)	22.20 - 22.75 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.	22.45m to 22.47m: cubic pyrite.		
		11				23.50 - 23.65 Joint, vertical dip, undulating, rough, with 0.5mm thick dark grey silt smear and minor surficial finely disseminated pyrite, open.	24.10m to 24.15m: light grey silt.		
11-06 25.60	100 (96) 74	13				25.00 - 25.20 Joint, subvertical dip, undulating, tight.			
11-06 27.20	100 (95) 50	11				26.45 - 26.70 Joint, vertical dip, undulating, rough, with 0.5mm thick grey silt smear and minor orange brown iron stain, open.			
11-06 28.80	100 (86) 36	20 16				28.00 - 28.50 Joint, vertical dip, undulating, smooth, with 0.5 to 3mm thick grey silt smear, open to moderately wide.	27.85m to 27.90m: light grey silt.		
11-06 30.30	100 (91) 47	12 5	266.69		30.30	28.85 - 29.10 Joint, subvertical dip, stepped, smooth, with 0.5 to 2mm thick grey silt smear, open.	BH terminated at 30.30m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
12-06-19	17.00	28.80	10.50	99	63		
13-06-19	13.00	30.30	10.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

50mm standpipe installed. Response zone from 13.60m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities / Detail	Main	Geology	Instrument/ Backfill
06-06 0.00						0.00 - 4.80 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(11) NA			(4.20)				
3.00		(41)							
			300.48		4.20				
4.50				× × ×			Stiff dark greenish brown SILT.		
06-06 4.50		(30/30mm) NA	299.88	× × ×	(0.60) 4.80				
	100 (70) 0					4.80 - 9.10 Non-intact as closely and very closely spaced discontinuities. 4.81 - 30.30 Discontinuities, extremely closely and very closely spaced to 6.90m, then closely spaced, locally very closely and locally medium spaced, dipping 10 to 12°, planar, smooth, with 0.5 to 1mm thick dark grey silt smear and orange brown iron stain to 6.90m.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities.		
6.10									
06-06	100 (81) 0	NI							
7.60									
06-06	100 (49) 0						8.60m to 9.00m: weak thinly laminated grey silt as possible residual rock.		
9.10									
06-06 9.50	25 (0) 0	NR				9.10 - 9.30 CAVITY. 9.30 - 18.40 Non-intact as closely and very closely spaced discontinuities.			
06-06	100 (67) 0								
11.00									

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
06-06-19	17.00	11.00	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.30	polymer	100

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities Detail	Main	Geology	Instrument/ Backfill
06-06 12.50	100 (98) 58					11.10 - 11.35 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear and minor orange brown iron stain, open.	Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities. *(continued)*		
06-06 14.00	100 (92) 34	NI							
06-06 15.40	100 (80) 0								
06-06 17.40	100 (71) 18					15.50 - 15.80 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.			
06-06 18.40	100 (72) 15				(25.50)	16.90 - 17.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 17.50 - 18.05 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.			
06-06 19.90	93 (47) 0	NR/NI				18.40 - 19.90 Non-intact as closely and very closely spaced discontinuities. No recovery as washout of fines during drilling. No record of cavity.			
06-06 21.30	100 (86) 0					19.60 - 21.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 19.90 - 30.30 Non-intact as closely and very closely spaced discontinuities.			
06-06	100								

Drilling Progress and Water Observations								Rotary Flush			
Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing	From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH02**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	06-06-19 10-06-19	304.68	E 585,103.0 N 823,398.3

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
22.90	(83) 29							Medium strong thinly laminated dark blackish grey slightly bioclastic silty fine grained LIMESTONE. Locally weak along discontinuities. *(continued)*		
06-06 24.40	100 (96) 34					23.90 - 24.10 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear, open.				
06-06 26.00	100 (89) 43	NI				24.70 - 25.10 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick grey silt smear, open.				
06-06 27.40	100 (88) 23									
06-06 29.00	100 (95) 30					28.30 - 29.00 2 No parallel joints, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
06-06 30.30	100 (96) 24		274.38		30.30	30.00 - 30.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.		BH terminated at 30.30m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
07-06-19	17.00	29.00	4.50	99	63		
12-06-19	12.00	30.30	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 4.00m to 30.30m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology	Instrument / Backfill
31-05 0.00						0.00 - 10.70 : overburden.	Open hole drilling - no recovery.		
1.50	0 (-) -	(76/150mm) NA			(4.40)				
3.00		(50/225mm)							
4.40			279.92		4.40				
31-05 4.50	17 (-) -	(50/75mm)					Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone.		
5.60									
31-05 6.00	40 (-) -	(50/75mm)							
7.10									
31-05	100 (-) -	NA			(6.30)				
8.00									
31-05	20 (-) -								
9.00									
31-05 9.50	40 (-) -								
31-05 10.00	60 (-) -								
31-05	19 (0)		273.62		10.70	10.70 - 14.90 Non-intact as			

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
31-05-19	17.00	7.10	4.50	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	10.00	polymer	100
10	30.20	polymer	100

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV 1

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
11.60	0					weathered rock.		Weathered SILTSTONE rock. Recovered as fine to coarse gravel sized clasts of weak locally medium strong black fine grained siltstone with some black silt as probable residual rock. *(continued)*		
31-05 13.10	67 (0) 0	NI			(4.20)					
31-05 14.60	67 (0) 0									
31-05 16.10	100 (86) 41	12	269.42		14.90	14.90 - 30.20 Discontinuities, closely spaced, locally very closely spaced, locally medium spaced, dipping 8 to 10°, planar, smooth, with 0.5 to 1mm thick dark grey silt smear.		Medium strong thinly laminated dark blackish grey calcareous fine grained SILTSTONE. Locally weak along discontinuities.		
31-05 17.70	100 (96) 35	18 16				16.50 - 16.65 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 17.00 - 17.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
31-05 19.30	100 (94) 78	9				19.10 - 19.85 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open. 19.60 - 19.85 Joint, subvertical dip, 'U' shaped, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
31-05 20.90	100 (90) 38	15 28						20.60m to 20.64m: weak residual rock. 20.90m to 21.10m: weak residual rock.		
31-05	100 (51) 15	NI								

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
04-06-19	17.00	19.30	9.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH03**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	31-05-19 05-06-19	284.32	E 589,961.7 N 822,212.9

Engineer: Fehily Timoney & Co

Sheet 3 of 3

Rev. REV I

RUN DETAILS						STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology	Instrument/ Backfill
22.50								Medium strong thinly laminated dark blackish grey calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*		
31-05	100 (74) 41	28			(15.30)					
		15								
24.10										
31-05	100 (96) 89	8								
		11								
25.60								UCS @ 25.60m to 27.10m: strong.		
31-05	100 (75) 41	10								
		NI				26.80 - 27.50 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
27.10										
31-05	100 (96) 39	28								
		29				28.00 - 28.70 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
28.60										
31-05	100 (85) 20	28				29.15 - 30.20 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick dark grey silt smear, open.				
30.20		10	254.12		30.20					
								BH terminated at 30.20m bgl on REs instruction.		

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
05-06-19	17.00	30.20	9.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used.
50mm standpipe installed.
Response zone from 10.00m to 30.20m bgl.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit HQ Design	Driller PMcG	Logged By EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	1 of 3	REV 1

RUN DETAILS					STRATA				
Depth Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick- ness)	DESCRIPTION Discontinuities	Detail	Main	Geology	Instrument/ Backfill
29-05 0.00						0.00 - 6.20 : overburden.		Open hole drilling - no recovery.		
1.50	0 (-) -	(20/30mm)			(3.00)					
3.00			276.24		3.00					
29-05 3.00		(50/0mm)						Very stiff dark grey slightly sandy gravelly silty CLAY with cobbles. Sand is fine to coarse. Gravel is subangular fine to coarse of assorted grey and black siltstone and limestone and brown sandstone. Cobbles are of assorted light brown sandstone.		
4.50	80 (-) -									
29-05 4.50		(50/0mm) NA			(3.20)					
6.00	32 (0) 0	(50/30mm)	273.04		6.20					
6.40						6.20 - 9.80 Non-intact as weathered rock.		Weathered SILTSTONE rock. Recovered as weak thinly laminated black fine grained silts as probable residual rock.		
29-05 7.70	100 (10) 0									
29-05 9.30	100 (30) 0	NI			(3.60)					
29-05	100 (24) 0		269.44		9.80					
10.70						9.80 - 30.20 Discontinuities, extremely closely spaced, locally very closely spaced to 26.00m, then closely, locally medium spaced, dipping 10 to 12°, planar, smooth,		Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities.		
29-05										

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing

Rotary Flush

From (m)	To (m)	Type	Return (%)
0	30.20	polymer	100

GENERAL REMARKS

2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit Design: HQ	Driller: PMcG	Logged By: EAT

IDL AGS3 UK DH CROAGH WF RC FILE REV 1 JULY 24 2019.GPJ IDL TP TEMPLATE.GDT 14/08/19

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	2 of 3	REV I

RUN DETAILS				STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities / Detail	DESCRIPTION: Main	Geology / Instrument/ Backfill
12.30	100 (25) 0					with 0.5 to 2mm thick dark grey silt smear. 9.81 - 30.20 Non-intact as extremely closely spaced, locally very closely spaced to 26.00m, then closely spaced, locally medium spaced.	Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*	
29-05 13.80	100 (27) 0							
29-05 15.30	100 (50) 0							
29-05 16.80	100 (31) 0							
29-05 18.30	100 (35) 0	NI					18.30m to 25.70m: black thinly interlaminated grey.	
29-05 19.80	100 (35) 0							
29-05 21.20	100 (38) 0				(20.40)			
29-05	100							

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
29-05-19	17.00	17.70	3.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

GENERAL REMARKS

2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

irish drilling ltd
old galway road
loughrea

DRILLHOLE LOG

Project	Location	DRILLHOLE No
Croagh Wind Farm	Co Leitrim	**BH04**

Job No	Date	Ground Level (m OD)	Co-Ordinates ()
2019LM102	29-05-19 30-05-19	279.24	E 586,737.2 N 821,259.9

Engineer	Sheet	Rev.
Fehily Timoney & Co	3 of 3	REV 1

RUN DETAILS					STRATA				
Depth / Date	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick-ness)	DESCRIPTION: Discontinuities	Detail	Main	Geology / Instrument/ Backfill
22.80	(25) 0							Medium strong thinly laminated dark blackish grey fissile calcareous fine grained SILTSTONE. Locally weak along discontinuities. *(continued)*	
29-05 24.10	100 (87) 0								
29-05 25.70	100 (64) 0								
29-05 27.20	100 (84) 0	28						26.00m to 30.20m: dark grey thickly laminated.	
29-05 28.80	100 (84) 38	20				27.00 - 27.30 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.			
29-05 30.20	100 (85) 26	22	249.04		30.20	28.00 - 28.40 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.			
		15				29.10 - 29.50 Joint, subvertical dip, planar, smooth, clean, open as drilling induced? 29.60 - 30.00 Joint, subvertical dip, planar, smooth, with 0.5 to 1mm thick black silt smear, open.		BH terminated at 30.20m bgl on REs instruction.	

Drilling Progress and Water Observations

Date	Time	Depth	Casing Depth	Casing Dia	Core Dia mm	Water Strike	Water Standing
30-05-19	17.00	30.20	6.00	99	63		

Rotary Flush

From (m)	To (m)	Type	Return (%)

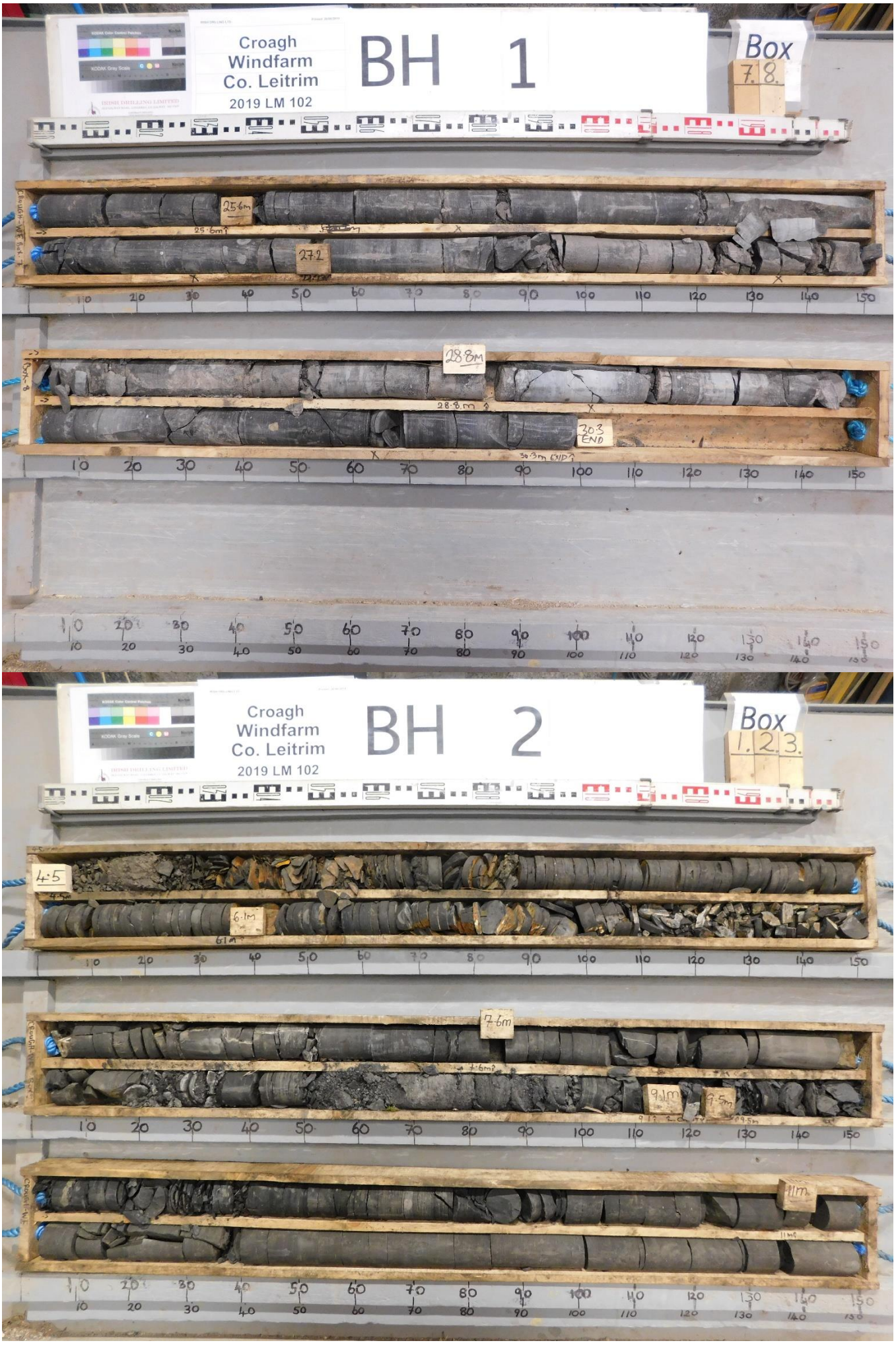
GENERAL REMARKS

2 gallons polydrill used. 50mm standpipe installed. Response zone from 3.20m to 30.20m bgl. Co-ordinates may be incorrect due to tree cover.

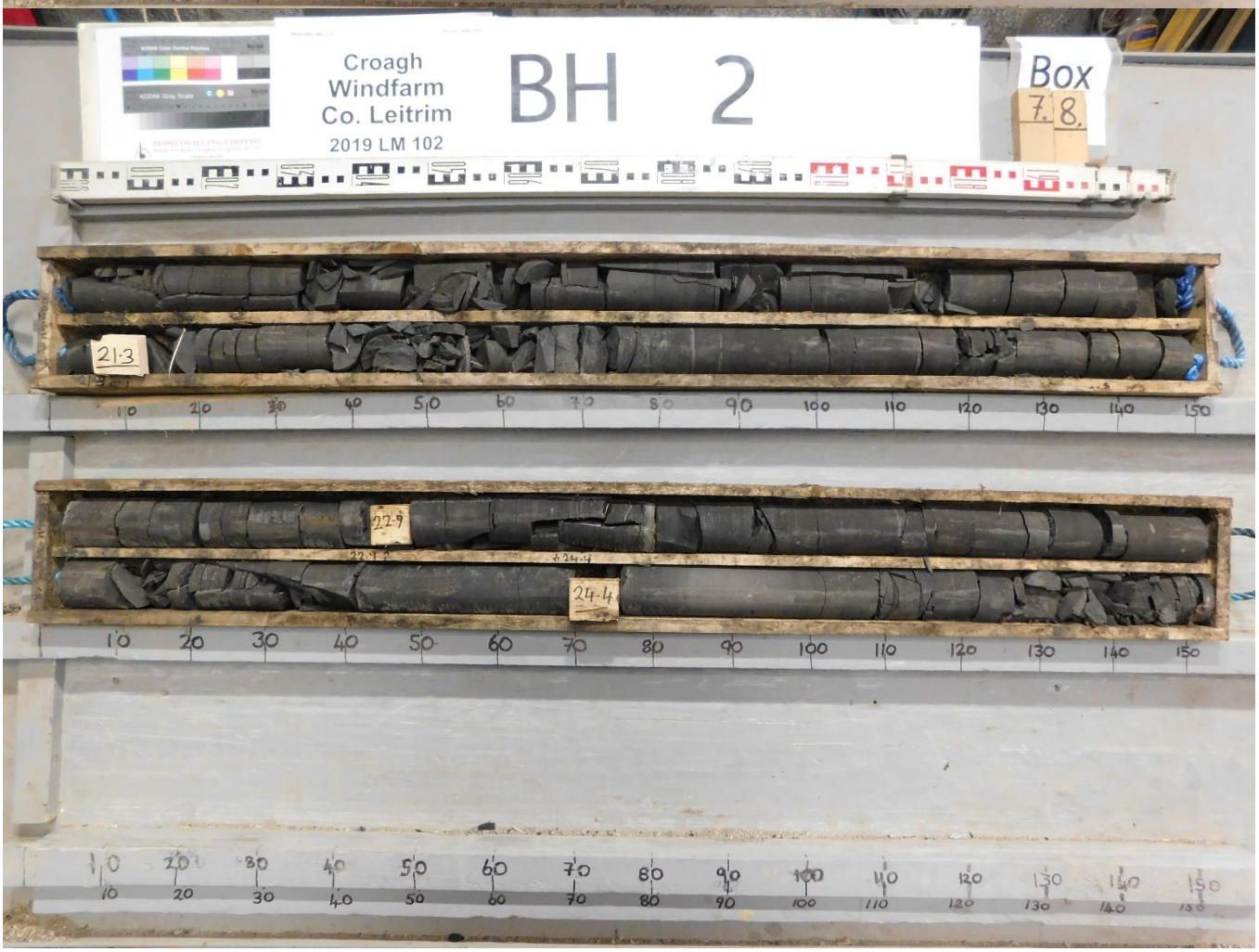
All dimensions in metres Scale 1:68.75	Client: McCarthy Keville O'Sullivan	Method/ Plant Used: Hydreq	Bit: HQ Design	Driller: PMcG	Logged By: EAT

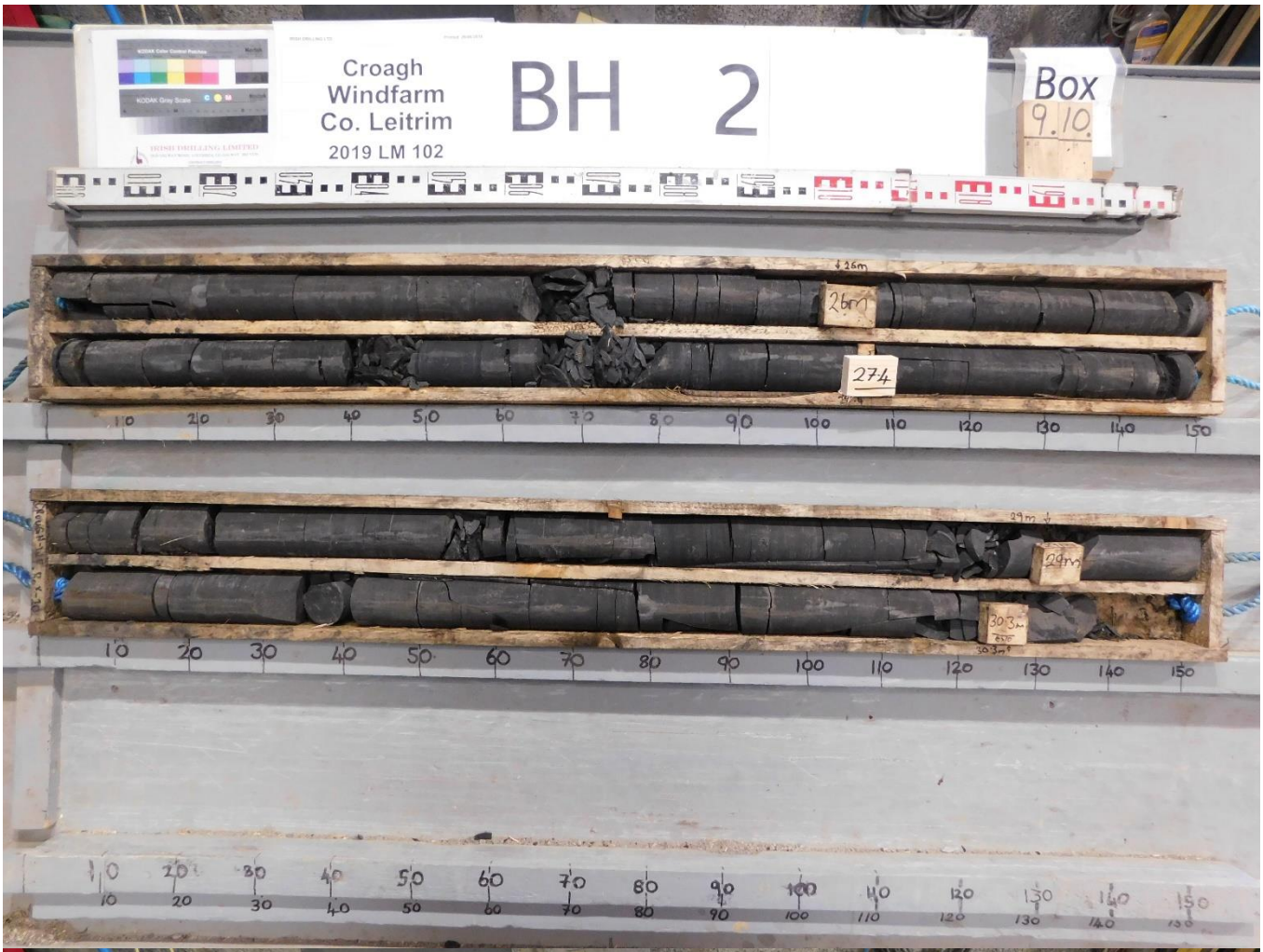

Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
1. 2. 3.


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
4. 5. 6.


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 1
Box
7.8.
25.6m
27.2
28.8m
30.3 END
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
1.2.3.
4.5
6.1m
7.6m
9.1m
9.5m
11m


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
4. 5. 6.
12·5
14M
15·4
17M
18·4
19·9


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
7. 8.
21·3
22·9
24·4


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 2
Box
9.10.
26m
274
29m
303m


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 3
Box
1.2.3.
5.6m
7.1m
8
9M
10M
11.6m
13.1m
16.1
14.6


Croagh
Windfarm
Co. Leitrim
BH 3
2019 LM 102
Box
4. 5. 6.
177
19.3
20.9
225
24.1
256
Croagh
Windfarm
Co. Leitrim
BH 3
2019 LM 102
Box
7. 8.
27.1m
28.6
30.2
END


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
1 2 3
3M START
3M
4.5
6.4
7.7M
9.3
10.7
12.3
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
4 5 6
13.8
15.3
16.8
18.3
19.8
21.2


Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
7.8
228
241
257
Croagh
Windfarm
Co. Leitrim
2019 LM 102
BH 4
Box
9.10
272
288
302
30.2m EOH

IRISH DRILLING LTD.
Loughrea Co. Galway

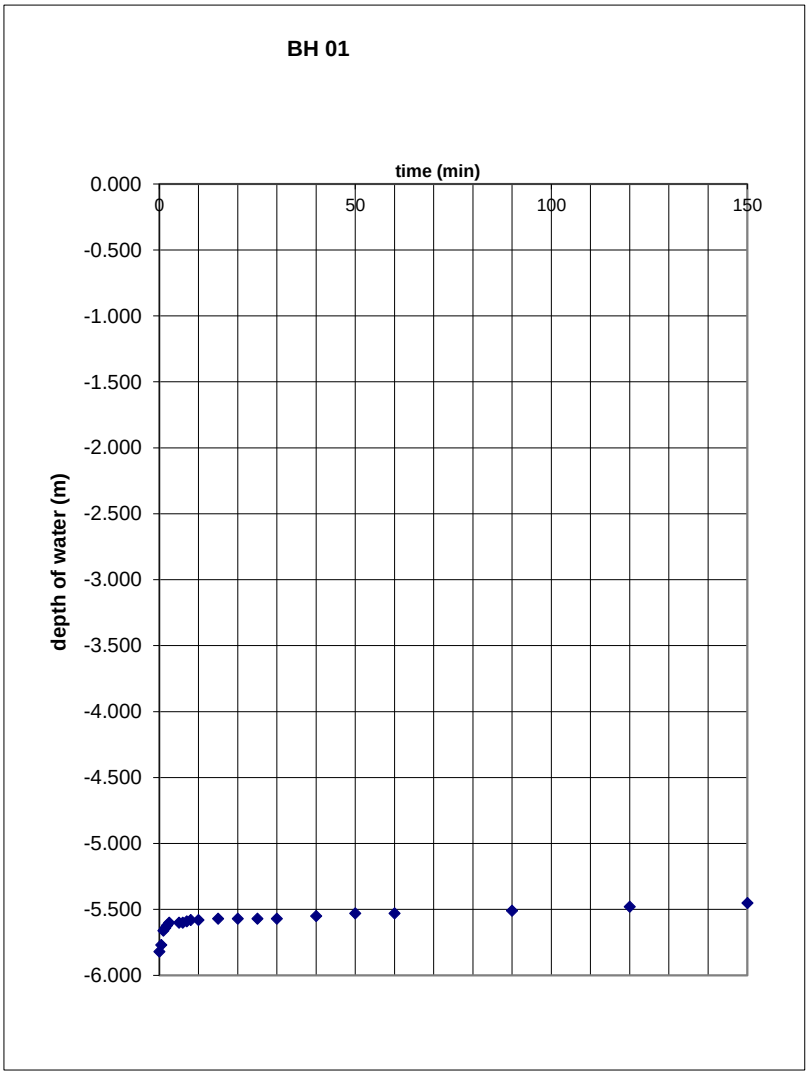
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

RISING HEAD PERMEABILITY TEST

Borehole:	**BH 01**	*Ground Level:*	296.99mOD
Bottom of Borehole:	30.30m	*Weather;*	Fair
Top of Filter Material	13.60m	*Length of Filter;*	16.70m
Response Zone:	13.60-30.30m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	5.42m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-5.820
0.5	-5.770
1	-5.660
1.5	-5.640
2	-5.620
2.5	-5.600
5	-5.600
6	-5.600
7	-5.590
8	-5.580
10	-5.580
15	-5.570
20	-5.570
25	-5.570
30	-5.570
40	-5.550
50	-5.530
60	-5.530
90	-5.510
120	-5.480
150	-5.450



Remarks:
Water pumped out of borehole at commencement of test at rate of 0.25l per second.

IRISH DRILLING LTD.
Loughrea Co. Galway

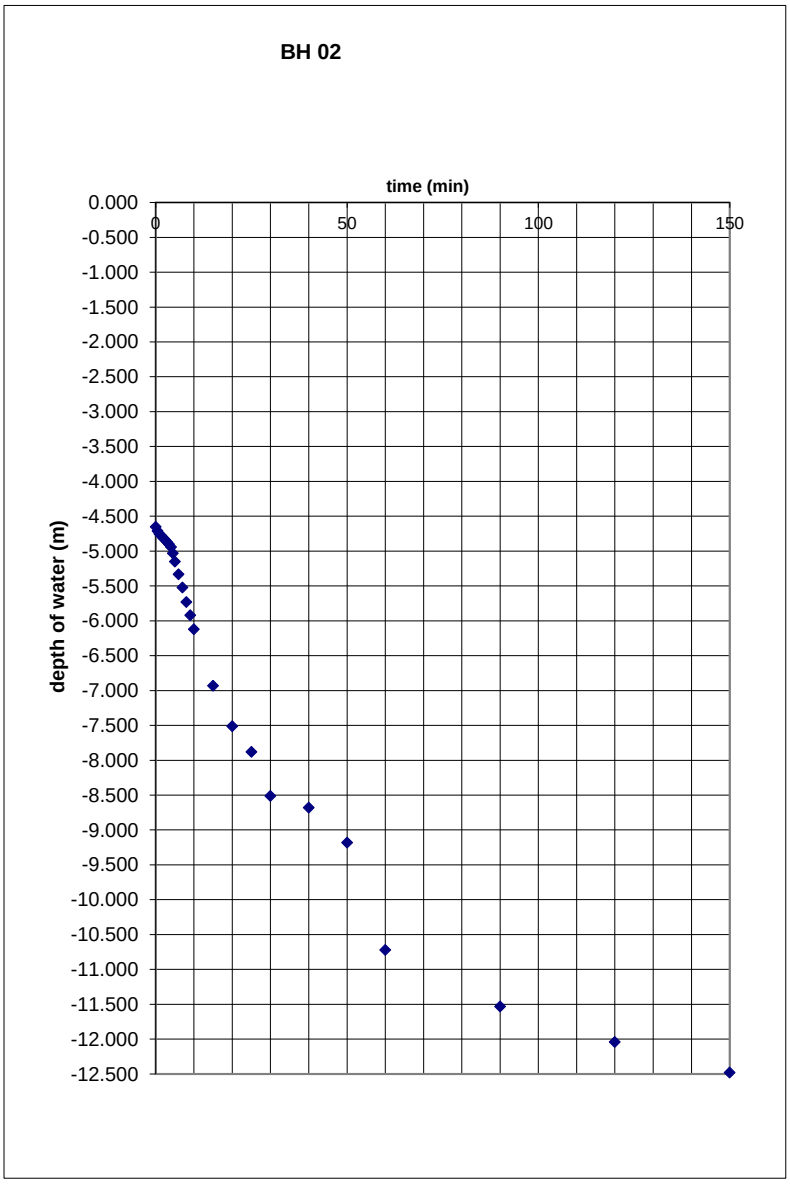
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

FALLING HEAD PERMEABILITY TEST

Borehole:	**BH 02**	*Ground Level:*	304.68mOD
Bottom of Borehole:	30.30m	*Weather;*	Fair
Top of Filter Material	4.00m	*Length of Filter;*	26.30m
Response Zone:	4.00-30.30m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	12.65m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-4.650
0.5	-4.710
1	-4.750
1.5	-4.780
2	-4.810
2.5	-4.840
3	-4.870
3.5	-4.900
4	-4.940
4.5	-5.030
5	-5.150
6	-5.330
7	-5.520
8	-5.730
9	-5.920
10	-6.120
15	-6.930
20	-7.510
25	-7.880
30	-8.510
40	-8.680
50	-9.180
60	-10.720
90	-11.530
120	-12.040
150	-12.480



Remarks:
50l of water added to borehole at commencement of test.

IRISH DRILLING LTD.
Loughrea Co. Galway

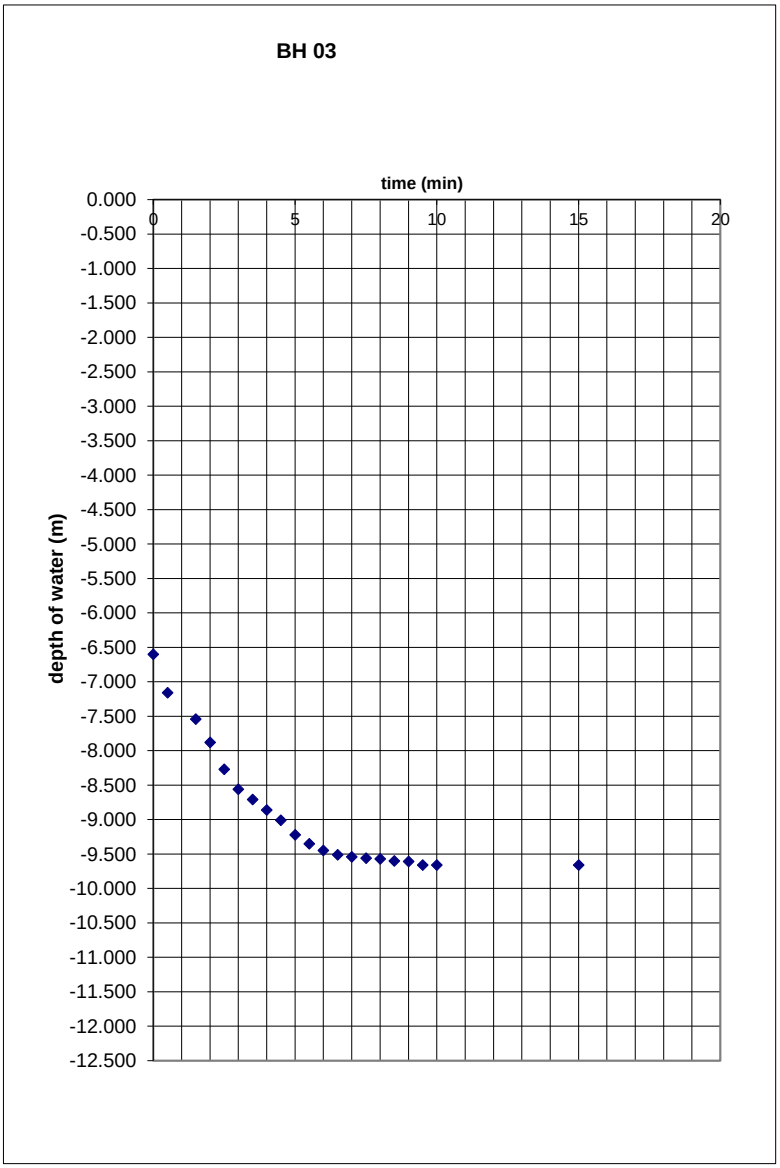
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	25/06/2019
Tested by:	DK

FALLING HEAD PERMEABILITY TEST

Borehole:	**BH 03**	*Ground Level:*	284.32mOD
Bottom of Borehole:	30.20m	*Weather;*	Fair
Top of Filter Material	10.00m	*Length of Filter;*	20.20m
Response Zone:	10.00-30.20m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	9.66m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-6.600
0.5	-7.160
1.5	-7.540
2	-7.880
2.5	-8.270
3	-8.560
3.5	-8.710
4	-8.860
4.5	-9.010
5	-9.220
5.5	-9.350
6	-9.450
6.5	-9.510
7	-9.540
7.5	-9.560
8	-9.570
8.5	-9.600
9	-9.610
9.5	-9.660
10	-9.660
15	-9.660



Remarks:
50l of water added to borehole at commencement of test.

IRISH DRILLING LTD.
Loughrea Co. Galway

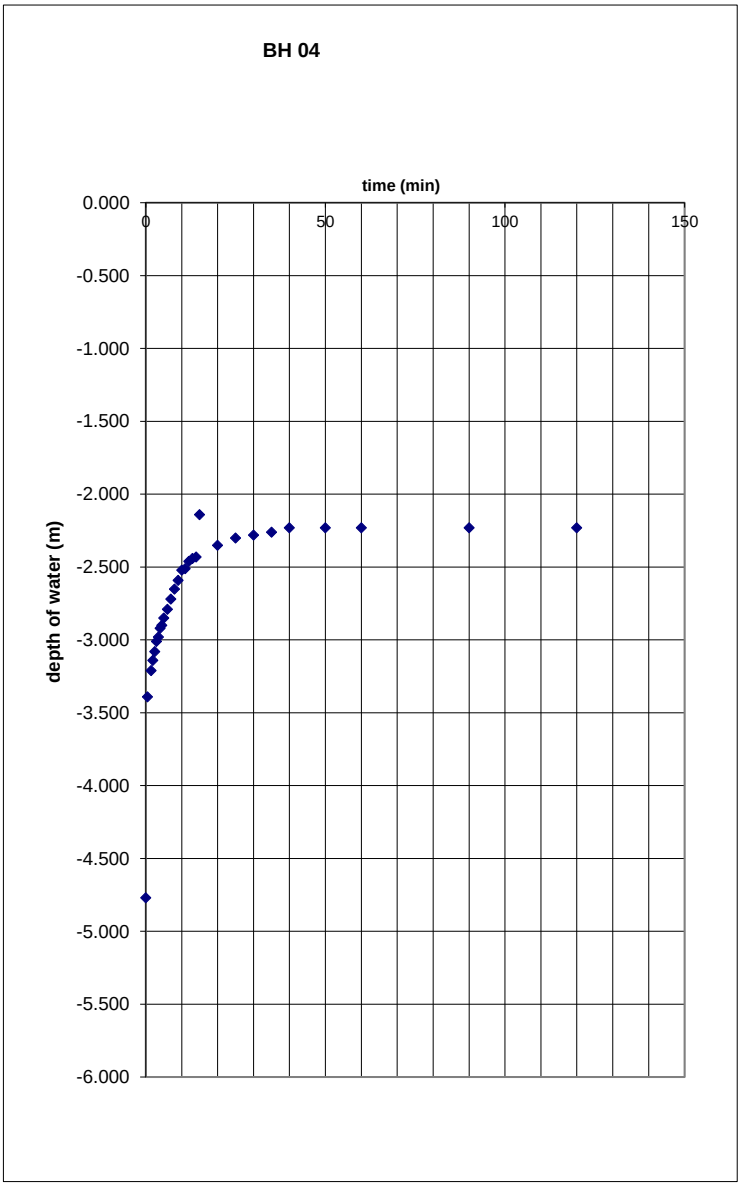
Tel: (091) 841274 Fax: (091) 880 861

Contract:	Croagh Wind Farm
Client:	MKO
Engineer:	Fehily Timoney
Date:	24/06/2019
Tested by:	DK

RISING HEAD PERMEABILITY TEST

Borehole:	**BH 04**	*Ground Level:*	279.24mOD
Bottom of Borehole:	30.20m	*Weather;*	Fair
Top of Filter Material	3.20m	*Length of Filter;*	27.00m
Response Zone:	3.20m-30.20m	*Diameter of Filter:*	0.05m
Initial Ground Water Level:	1.76m	*Installation Type:*	50mm Standpipe.

time min	WL m
0	-4.770
0.5	-3.390
1.5	-3.210
2	-3.140
2.5	-3.080
3	-3.010
3.5	-2.980
4	-2.920
4.5	-2.900
5	-2.850
6	-2.790
7	-2.720
8	-2.650
9	-2.590
10	-2.520
11	-2.510
12	-2.460
13	-2.440
14	-2.430
15	-2.140
20	-2.350
25	-2.300
30	-2.280
35	-2.260
40	-2.230
50	-2.230
60	-2.230
90	-2.230
120	-2.230



Remarks:
Water pumped out of borehole at commencement of test at rate of 0.25l per second.

IRISH DRILLING LTD.
Loughrea Co. Galway

Tel: (091) 841274 Fax: (091) 880861

Operator DK
Checked: RK

Water Levels in Standpipe Piezometers

Boreholes	Date 24.06.2019	Date 25.06.2019	Response Zone (m bgl)	Installation Type
BH 01	5.42m		13.60m -30.30m	50mm Standpipe
BH 02	12.65m		4.00m - 30.30m	50mm Standpipe
BH 03		9.66m	10.00m - 30.20m	50mm Standpipe
BH 04		1.76m	3.20m - 30.20m	50mm Standpipe

Remarks:
All readings record depth from ground level to top of static water level (m bgl).

Project ID	2019LM102
roject Name	Croagh Wind Farm, Co. Leitrim
Schedule ID	2019LM102_2

Turnaround

Sample Details						Shear Stregth (Effective Stress)			Rock		Other							
Location	Depth (m)	Base Depth	Sample Type	Sample Ref	Date Sampled	Consolidated Drained Triaxial Test	Consolidated Undrained Triaxial Test	Consolidated Undrained Triaxial Multi	Rock Uniaxial compression	Point Load (set of 10)	LAA Test	Magnesium Sulphate Soundness	Slake Durability					
BH01	0.00	4.20	C		11/06/19													
BH01	4.20	4.60	C		11/06/19													
BH01	4.60	5.10	C		11/06/19													
BH01	5.10	6.10	C		11/06/19													
BH01	6.10	7.80	C		11/06/19													
BH01	7.80	9.20	C		11/06/19													
BH01	9.20	9.60	C		11/06/19													
BH01	9.60	10.80	C		11/06/19													
BH01	10.80	12.20	C		12/06/19													
BH01	12.20	13.80	C		12/06/19													
BH01	13.80	15.20	C		12/06/19													
BH01	15.20	16.80	C		12/06/19													
BH01	16.80	18.20	C		12/06/19													
BH01	18.20	19.60	C		12/06/19													
BH01	19.60	21.20	C		12/06/19													
BH01	21.20	22.80	C		12/06/19													
BH01	22.80	24.40	C		12/06/19													
BH01	24.40	25.60	C		12/06/19													
BH01	25.60	27.20	C		12/06/19													
BH01	27.20	28.80	C		12/06/19													
BH01	28.80	30.30	C		13/06/19													
BH02	0.00	4.50	C		06/06/19													
BH02	4.50	6.10	C		06/06/19					5							Not possible to test 10 pieces	idl
BH02	6.10	7.60	C		06/06/19				0*								*not suitable	idl
BH02	7.60	9.10	C		06/06/19						1							Celtest sent 16.7.19
BH02	9.10	9.50	C		06/06/19													
BH02	9.50	11.00	C		06/06/19							1						Celtest sent 16.7.19
BH02	9.50	11.00	C		06/06/19					5							Not possible to test 10 pieces	idl
BH02	11.00	12.50	C		07/06/19													
BH02	12.50	14.00	C		07/06/19								1					Celtest sent 16.7.19
BH02	14.00	15.40	C		07/06/19				0*								*not suitable	idl
BH02	15.40	17.40	C		07/06/19						1							Celtest sent 16.7.19
BH02	17.40	18.40	C		07/06/19													
BH02	18.40	19.90	C		07/06/19													
BH02	19.90	21.30	C		07/06/19													
BH02	21.30	22.90	C		07/06/19					5							Not possible to test 10 pieces	idl
BH02	22.90	24.40	C		07/06/19													
BH02	24.40	26.00	C		07/06/19													
BH02	26.00	27.40	C		07/06/19													
BH02	27.40	29.00	C		07/06/19													
BH02	29.00	30.30	C		10/06/19													
BH03	0.00	4.40	C		31/05/19													
BH03	4.40	5.60	C		31/05/19													
BH03	5.60	7.10	C		31/05/19													
BH03	7.10	8.00	C		04/06/19													
BH03	8.00	9.00	C		04/06/19													
BH03	9.00	9.50	C		04/06/19													
BH03	9.50	10.00	C		04/06/19													
BH03	10.00	11.60	C		04/06/19							1						Celtest sent 16.7.19
BH03	11.60	13.10	C		04/06/19					0*							*too soft to test	idl
BH03	13.10	14.60	C		04/06/19						1							Celtest sent 16.7.19
BH03	14.60	16.10	C		04/06/19				0*								*not suitable	idl
BH03	16.10	17.70	C		04/06/19					5							Not possible to test 10 pieces	idl
BH03	17.70	19.30	C		04/06/19								1					Celtest sent 16.7.19
BH03	19.30	20.90	C		05/06/19													
BH03	20.90	22.50	C		05/06/19						1							Celtest sent 16.7.19
BH03	22.50	24.10	C		05/06/19					5							Not possible to test 10 pieces	idl
BH03	24.10	25.60	C		05/06/19													
BH03	25.60	27.10	C		05/06/19				1									idl
BH03	27.10	28.60	C		05/06/19													
BH03	28.60	30.20	C		05/06/19													
BH04	0.00	3.00	C		29/05/19													
BH04	3.00	4.50	C		29/05/19													
BH04	4.50	6.40	C		29/05/19													

Project ID	2019LM102
roject Name	Croagh Wind Farm, Co. Leitrim
Schedule ID	2019LM102_2

Turnaround

Sample Details						Shear Stregth (Effective Stress)			Rock		Other						
Location	Depth (m)	Base Depth	Sample Type	Sample Ref	Date Sampled	Consolidated Drained Triaxial Test	Consolidated Undrained Triaxial Test	Consolidated Undrained Triaxial Multi	Rock Uniaxial compression	Point Load (set of 10)	LAA Test	Magnesium Sulphate Soundness	Slake Durability				
BH04	6.40	7.70	C		29/05/19					**0***							*too soft to test idl
BH04	7.70	9.30	C		29/05/19							**1**					Celtest sent 16.7.19
BH04	7.70	9.30	C		29/05/19				**0***								*not suitable idl
BH04	9.30	10.70	C		29/05/19						**1**						Celtest sent 16.7.19
BH04	10.70	12.30	C		29/05/19					**0***							*too soft to test idl
BH04	12.30	13.80	C		29/05/19								**1**				Celtest sent 16.7.19
BH04	13.80	15.30	C		29/05/19				**0***								*not suitable idl
BH04	15.30	16.80	C		29/05/19						**1**						Celtest sent 16.7.19
BH04	16.80	18.30	C		30/05/19					**0***							*too soft to test idl
BH04	18.30	19.80	C		30/05/19												
BH04	19.80	21.20	C		30/05/19												
BH04	21.20	22.80	C		30/05/19												
BH04	22.80	24.10	C		30/05/19												
BH04	24.10	25.70	C		30/05/19												
BH04	25.70	27.20	C		30/05/19												
BH04	27.20	28.80	C		30/05/19												
BH04	28.80	30.20	C		30/05/19												

Number Completed: 15.08.19 1 25 6 3 3

IDL

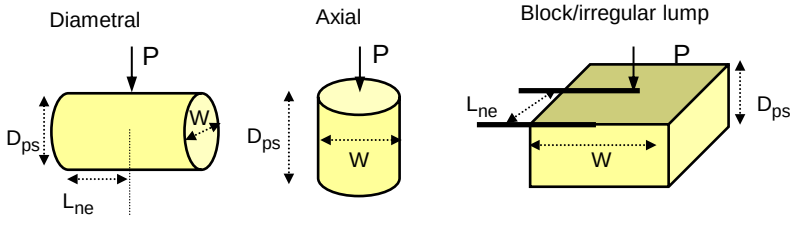
Point Load Strength Index Tests
Summary of Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Ref	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH02	4.50	6.1	C	5.12	5.15		A	P	YES		63.1		22.1	3.6	42.1	2.0	1.9	Med Strong
BH02	4.50	6.1	C	5.58	5.61		A	P	YES		63.1		27.0	4.2	46.6	2.0	1.9	Med Strong
BH02	4.50	6.1	C	5.72	5.75		A	P	YES		63.1		21.2	2.2	41.3	1.3	1.2	Med Strong
BH02	4.50	6.1	C	5.88	5.90		A	P	YES		63.1		20.4	1.9	40.5	1.1	1.0	Weak
BH02	4.50	6.1	C	6	6.03		A	P	YES		63.1		19.5	1.9	39.6	1.2	1.1	Med Strong
BH02	9.50	11	C	10.3	10.30		D	L	YES		63.1		54.2	0.3	58.5	0.1	0.1	Very Weak
BH02	9.50	11	C	10.5	10.60		A	P	YES		63.1		31.0	0.5	49.9	0.2	0.2	Weak
BH02	9.50	11	C	10.8	11.00		D	L	YES		63.1		82.0	0.2	71.9	0.0	0.0	Very Weak
BH02	9.50	11	C	9.6	9.63		A	P	YES		63.1		21.0	0.1	41.1	0.0	0.0	Very Weak
BH02	9.50	11	C	9.65	9.70		A	P	YES		63.1		23.4	0.1	43.4	0.1	0.1	Very Weak
BH02	21.30	22.9	C	21.3	21.36		D	L	YES		63.1		63.1	0.4	63.1	0.1	0.1	Very Weak
BH02	21.30	22.9	C	21.5	21.54		D	L	YES		63.1		63.1	1.1	63.1	0.3	0.3	Weak
BH02	21.30	22.9	C	22.1	22.14		A	P	YES		63.1		54.0	1.3	65.9	0.3	0.3	Weak
BH02	21.30	22.9	C	22.6	22.71		A	P	YES		63.1		42.5	1.1	58.4	0.3	0.4	Weak
BH02	21.30	22.9	C	22.7	22.80		D	L	YES		63.1		63.1	1.7	63.1	0.4	0.5	Weak
BH03	16.10	17.7	C	16.3	16.37		D	L	YES		63.1		63.1	0.2	63.1	0.0	0.0	Very Weak
BH03	16.10	17.7	C	16.7	16.74		D	L	YES		63.1		63.1	0.3	63.1	0.1	0.1	Very Weak
BH03	16.10	17.7	C	17.1	17.14		D	L	YES		63.1		63.1	2.3	63.1	0.6	0.6	Weak
BH03	16.10	17.7	C	17.2	17.30		D	L	YES		63.1		63.1	2.1	63.1	0.5	0.6	Weak
BH03	16.10	17.7	C	17.5	17.59		D	L	YES		63.1		63.1	2.3	63.1	0.6	0.6	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table: 1 sheet 1

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

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

IDL

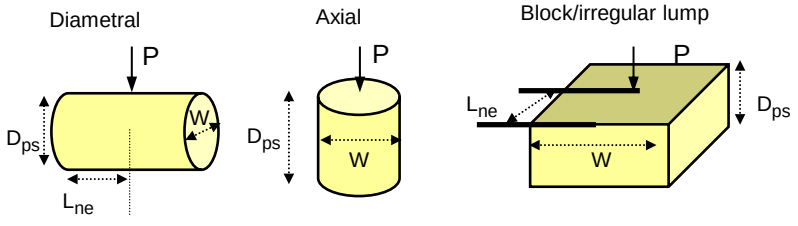
Point Load Strength Index Tests
Summary of Results

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Borehole No.	Sample			Specimen		Rock Type and Test condition	Test Type see ISRM		Failure Valid (Y/N)	Dimensions				Force P	Equivalent diameter, De	Point Load Strength Index		Remarks (including water content if measured)
	Top Depth	Base Depth	Type	Ref	Depth		Type (D, A, I, B)	Direction (L, P or U)		Lne	W	Dps	Dps'			Is	Is(50)	
	m	m		m	m					mm	mm	mm	mm	kN	mm	MPa	MPa	
BH03	22.50	24.1	C	22.5	22.54		D	L	YES		63.1		63.1	0.4	63.1	0.1	0.1	Very Weak
BH03	22.50	24.1	C	22.5	22.64		D	L	YES		63.1		63.1	3.2	63.1	0.8	0.9	Weak
BH03	22.50	24.1	C	22.8	22.86		D	L	YES		63.1		63.1	4.1	63.1	1.0	1.1	Med Strong
BH03	22.50	24.1	C	24	24.10		D	L	YES		63.1		63.1	3.1	63.1	0.8	0.9	Weak
BH03	22.50	24.1	C	232	23.54		D	L	YES		63.1		63.1	3.2	63.1	0.8	0.9	Weak

Test Type
D - Diametral, A - Axial, I - Irregular Lump, B - Block
Direction
L - parallel to planes of weakness
P - perpendicular to planes of weakness
U - unknown or random
Dimensions
Dps - Distance between platens (platen separation)
Dps' - at failure (see ISRM note 6)
Lne - Length from platens to nearest free end
W - Width of shortest dimension perpendicular to load, P



Test performed in accordance with ISRM Suggested Methods : 2007, unless noted otherwise
Detailed legend for test and dimensions, based on ISRM, is shown above.
Size factor, F = (De/50)0.45 for all tests.

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table 1 sheet 2

Tested in: Irish Drilling Ltd.(IDL), Old Galway Road, Loughrea, Co. Galway, Ireland. H62VX39
Approved Signatures: Dympna Darcy (DCD) Lab Manager, Declan Joyce (DJ) Chartered Geotechnical Engineer, Ronan Killeen (RK) Quality Manager.

IDL

UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

Project No.: 2019LM102

Project Name: Croagh Wind Farm, Co. Leitrim

Hole No.	Sample				Specimen Depth (m)	Specimen Dimensions2			Bulk Density2	Water Content 1	Uniaxial Compression3				Remarks
	Ref	Top	Base	Type		Dia. mm	Length mm	H/D	Mg/m3	%	Condition	Stress Rate MPa/s	Mode of failure	UCS MPa	
BH03		25.60	27.10	C	25.66-25.88	63.4	166.6	2.6	2.49		as received	0.3673	F	80.1	Strong

Notes

1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS

2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density

3 ISRM p153 part 1, determination of Uniaxial Compressive Strength (UCS) of Rock Materials

above notes apply unless annotated otherwise in the remarks

Mode of failure :

S - Single shear MS - multiple shear

AC - Axial cleavage F - Fragmented

Test Specification: International Society for Rock Mechanics, The complete ISRM suggested methods for Rock Characterization Testing and Monitoring, 2007

Date Printed: 16/07/2019

Approved By: APPROVED By DCD at 10:56 am, Aug 15, 2019

Table 1 sheet 1

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

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

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684237

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH02 - 12.50 - 14.00**
Date and Time of Sampling:	**07/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **83.2 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684238

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 15.40 - 17.40**
Date and Time of Sampling:	**07/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **48**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684242

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 7.60 - 9.10**
Date and Time of Sampling:	**06/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **48**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684243

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH02 - 9.50 - 11.00**
Date and Time of Sampling:	**06/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 79.8
Magnesium Sulfate Value Portion 2 (MS_2) = 94.6

Mean Magnesium Sulfate Value (MS) = 87

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 5% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684239

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 10.00 - 11.60**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 89.7
Magnesium Sulfate Value Portion 2 (MS_2) = 91.4

Mean Magnesium Sulfate Value (MS) = 91

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 20% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684240

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 13.10 - 14.60**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **46**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684241

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH03 - 17.70 - 19.30**
Date and Time of Sampling:	**04/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **98.3 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684230

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH03 - 20.90 - 22.50**
Date and Time of Sampling:	**05/06/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **44**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684234

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Slake Durability Index of an aggregate sample in accordance with **ISRM guidelines**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. :	**BH04 - 12.30 - 13.80**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	

RESULTS:

Slake Durability Index = **70.5 %**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684236

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 15.30 - 16.80**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **33**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 13 August 2019
Test Report Ref: TR 684231

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Magnesium Sulfate Value of aggregate sample within the size range 10mm to 14mm in accordance with **BS EN 1367-2 : 2009**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 7.70 - 9.30**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**30/07/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Magnesium Sulfate Value Portion 1 (MS_1) = 54.3
Magnesium Sulfate Value Portion 2 (MS_2) = 55.5

Mean Magnesium Sulfate Value (MS) = 55

Comments	Report checked and approved by:
Proportion by mass of laboratory sample used for the test portion = 5% (nearest 5%)	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Irish Drilling Limited
Loughrea
Co. Galway
Ireland
IE6399801R

Date: 14 August 2019
Test Report Ref: TR 684232

Order No: 7479

Contract: Croagh Wind Farm, Co. Leitrim

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Fragmentation of Aggregate - Los Angeles Test Method in accordance with **BS EN 1097-2: 2010**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S81941**
Client Ref. No:	**BH04 - 9.30 - 10.70**
Date and Time of Sampling:	**29/05/2019**
Date of Receipt at Lab:	**18/07/2019**
Date of Start of Test:	**15/08/2019**
Sampling Location:	**Unknown**
Name of Source:	**Croagh Wind Farm, Co. Leitrim**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Rock Core**
Target Specification:	**N/A**

RESULTS:

Size fraction from which the test portion was obtained: **14mm to 12.5mm**
12.5mm to 10.0mm

Los Angeles Coefficient (LA) = **40**

Comments:	Report checked and approved by:
None	S Parry-Didcote Sharon Parry-Didcote Aggregate Team Coordinator

Appendix E

Peat Stability Risk Register




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

Location:	**Turbine T1**

Grid Reference (Eastings, Northings):	**583322**	**823639**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 3.59 (u), 3.48 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	2	1	2	Negligible	No		2	1	2	Negligible
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Turbine T2**

Grid Reference (Eastings, Northings):	**583831**	**824112**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 4.53 (u), 4.10 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	2	1	2	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T2**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

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

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

Location:	**Turbine T3**

Grid Reference (Eastings, Northings):	**583648**	**823314**
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**1.9 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 4.53 (u), 4.10 (d)	1	3	3	Negligible	No		1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	2	3	6	Low	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	1	3	3	Negligible	No	See Below	1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	3	3	9	Low	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Relatively deep peat	2	3	6	Low	Yes		1	3	3	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T3**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

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

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

Location:	**Turbine T4**

Grid Reference (Eastings, Northings):	**584223**	**823820**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.5 to 1.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.48 (u), 1.97 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	1	3	Negligible	No	See Below	2	1	2	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Turbine T5**

Grid Reference (Eastings, Northings):	**584259**	**823347**
Distance to Watercourse (m)	**100 - 150**	
Min & Max Measured Peat Depth (m):	**0.3 to 1.3**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 7.48 (u), 8.82 (d)	1	2	2	Negligible	No		1	2	2	Negligible
2	Evidence of sub peat water flow	1	2	2	Negligible	No		1	2	2	Negligible
3	Evidence of surface water flow	1	2	2	Negligible	No		1	2	2	Negligible
4	Evidence of previous failures/slips	0	2	0	Not Applicable	No		0	2	0	Not Applicable
5	Type of vegetation	2	2	4	Negligible	No		2	2	4	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	2	2	Negligible	No	See Below	1	2	2	Negligible
7	Evidence of very soft/soft clay at base of peat	3	2	6	Low	No		1	2	2	Negligible
8	Evidence of mechanically cut peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	2	0	Not Applicable	No		0	2	0	Not Applicable
10	Evidence of bog pools	0	2	0	Not Applicable	No		0	2	0	Not Applicable
11	Other	0	2	0	Not Applicable	No		0	2	0	Not Applicable

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

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

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

Location:	**Turbine T6**

Grid Reference (Eastings, Northings):	**584841**	**823616**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.8 to 2.4**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.06 (u), 4.78 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Turbine T7**

Grid Reference (Eastings, Northings):	**584968**	**823032**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.0 to 2.8**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 8.23 (u), 7.44 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	Yes		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Relatively deep peat	2	1	2	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T7**
i	Due to relatively deep peat at this turbine location, additional construction measures such as the following may be required: - excavation side walls to be supported (eg. boulders, retaining wall units) or excavation face battered to shallow angle - temporary works designer may be required to provide excavation support design - daily detailed inspection of excavation faces - potential for greater water inflow into excavation requiring removal of water using pumping - increased exclusion zone around excavation to avoid accidental loading of crest of slope
ii	Maintain hydrology of area as far as possible;
iii	Use of experienced geotechnical staff for site investigation;
iv	Use of experienced contractors and trained operators to carry out the work;
v	Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.

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

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

Location:	**Turbine T8**

Grid Reference (Eastings, Northings):	**585523**	**822935**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**3.3 to 3.9**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.90 (u), 1.59 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	3	1	3	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Deep peat	3	1	3	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T8**
i	Due to deep peat at this turbine location, additional construction measures such as the following may be required: - access the working area possibly formed using bog mats with the addition of temporary working platform - detailed ground investigation to determine peat, mineral soil and bedrock condition and properties for design stage - detailed design of access platforms and temporary working platforms to be carried out in advance of construction works - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage - install piling/working platform required for the construction of turbine base foundation, as required - monitoring (in the form of timber stakes as sightlines) to be installed in area of turbine base and to be monitored regularly during the construction works - where piling is adopted, site trial of piling works and potential issues to be identified prior to commencing construction - where piling is adopted, testing of piles to be carried out in accordance with latest standards to ensure design assumptions are satisified
ii	Use of experienced geotechnical staff for construction supervision, monitoring works, etc.;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Maintain hydrology of area as far as possible.

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

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

Location:	**Turbine T9**

Grid Reference (Eastings, Northings):	**586144**	**822595**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**2.1 to 4.5**	
Control Required:	**Yes**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.09 (u), 1.69 (d)	1	1	1	Negligible	No	See Below	1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	3	1	3	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	3	1	3	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No		1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	3	1	3	Negligible	No		1	1	1	Negligible
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Deep peat	3	1	3	Negligible	Yes		1	1	1	Negligible

	Control Measures to be Implemented Prior to/and During Construction for **Turbine T9**
i	Due to deep peat at this turbine location, additional construction measures such as the following may be required: - access the working area possibly formed using bog mats with the addition of temporary working platform - detailed ground investigation to determine peat, mineral soil and bedrock condition and properties for design stage - detailed design of access platforms and temporary working platforms to be carried out in advance of construction works - possibly construct using piled foundation due to depth of peat and soft underlying deposits, TBC following ground investigation at detailed design stage - install piling/working platform required for the construction of turbine base foundation, as required - monitoring (in the form of timber stakes as sightlines) to be installed in area of turbine base and to be monitored regularly during the construction works - where piling is adopted, site trial of piling works and potential issues to be identified prior to commencing construction - where piling is adopted, testing of piles to be carried out in accordance with latest standards to ensure design assumptions are satisified
ii	Use of experienced geotechnical staff for construction supervision, monitoring works, etc.;
iii	Use of experienced contractors and trained operators to carry out the work;
iv	Maintain hydrology of area as far as possible.

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

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

Location:	**Turbine T10**

Grid Reference (Eastings, Northings):	**584676**	**822493**
Distance to Watercourse (m)	**50 - 100**	
Min & Max Measured Peat Depth (m):	**0.8 to 1.0**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.89 (u), 3.85 (d)	1	3	3	Negligible	No		1	3	3	Negligible
2	Evidence of sub peat water flow	1	3	3	Negligible	No		1	3	3	Negligible
3	Evidence of surface water flow	1	3	3	Negligible	No		1	3	3	Negligible
4	Evidence of previous failures/slips	0	3	0	Not Applicable	No		0	3	0	Not Applicable
5	Type of vegetation	2	3	6	Low	No		2	3	6	Low
6	General slope characteristics upslope/downslope from infrastructure location	2	3	6	Low	No	See Below	1	3	3	Negligible
7	Evidence of very soft/soft clay at base of peat	3	3	9	Low	No		1	3	3	Negligible
8	Evidence of mechanically cut peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	3	0	Not Applicable	No		0	3	0	Not Applicable
10	Evidence of bog pools	0	3	0	Not Applicable	No		0	3	0	Not Applicable
11	Other	0	3	0	Not Applicable	No		0	3	0	Not Applicable

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

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

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

Location:	**Substation**

Grid Reference (Eastings, Northings):	**584584**	**823867**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.9 to 1.7**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 5.13 (u), 7.39 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	2	1	2	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Const. Comp. 1**

Grid Reference (Eastings, Northings):	**584170**	**823980**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**0.7 to 1.6**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.92 (u), 2.56 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	3	1	3	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Const. Comp. 2**

Grid Reference (Eastings, Northings):	**585150**	**823232**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.3 to 1.9**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 2.19 (u), 2.58 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	1	1	1	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

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

Location:	**Met. Mast**

Grid Reference (Eastings, Northings):	**584059**	**823136**
Distance to Watercourse (m)	**> 150**	
Min & Max Measured Peat Depth (m):	**1.0 to 1.2**	
Control Required:	**No**	

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating	Control Required	Control measures to be implemented during construction	Prob (Note 2)	Impact (Note 3)	Risk	Risk Rating
1	FOS = 1.98 (u), 2.42 (d)	1	1	1	Negligible	No		1	1	1	Negligible
2	Evidence of sub peat water flow	1	1	1	Negligible	No		1	1	1	Negligible
3	Evidence of surface water flow	2	1	2	Negligible	No		1	1	1	Negligible
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Negligible	No		2	1	2	Negligible
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Negligible	No	See Below	1	1	1	Negligible
7	Evidence of very soft/soft clay at base of peat	3	1	3	Negligible	No		1	1	1	Negligible
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

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

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

Appendix F

Calculated FOS For Peat Slopes

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

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
AT1	583322	823639	3	6	10	2.2	3.2	**5.22**	**3.59**
AT2	583831	824112	2	6	10	2.8	3.8	**6.14**	**4.53**
AT3	583648	823314	2	6	10	2.8	3.8	**6.14**	**4.53**
AT4	584223	823820	12	6	10	1	2.0	**2.95**	**1.48**
AT5	584259	823347	2	6	10	1.3	2.3	**13.23**	**7.48**
AT6	584841	823616	2	6	10	2.4	3.4	**7.17**	**5.06**
AT7	584968	823032	1.1	6	10	2.8	3.8	**11.16**	**8.23**
AT8	585523	822935	3.7	6	10	3.9	4.9	**2.39**	**1.90**
AT9	586144	822595	3	6	10	4.5	5.5	**2.55**	**2.09**
AT10	584676	822493	6	6	10	1	2.0	**5.77**	**2.89**
Amet	583166	823847	8	6	10	1.2	2.2	**3.63**	**1.98**
Amet - SS	584503	823160	1.2	6	10	8.2	9.2	**3.49**	**3.11**
AT1 - SS	583313	823651	4.5	6	10	1.8	2.8	**4.26**	**2.74**
AT2 - SS	583799	824070	2.5	6	10	2	3.0	**6.88**	**4.59**
AT5 - SS	584263	823319	5.6	6	10	1.3	2.3	**4.75**	**2.69**
AT9 - SS	586026	822642	3	6	10	5.6	6.6	**2.05**	**1.74**
A54	586897	821078	9.8	6	10	0.2	1.2	**17.89**	**2.98**
A56	586749	821210	6.1	6	10	0.7	1.7	**8.11**	**3.34**
A57	586660	821254	1.8	6	10	0.3	1.3	**63.70**	**14.70**
A58	586570	821298	9.8	6	10	0.4	1.4	**8.94**	**2.56**
A59	586475	821330	7	6	10	0.2	1.2	**24.80**	**4.13**
A60	586383	821369	10	6	10	0.6	1.6	**5.85**	**2.19**
A61	586305	821427	10	6	10	0.9	1.9	**3.90**	**1.85**
A62	586244	821504	4.7	6	10	1.3	2.3	**5.65**	**3.19**
A63	586216	821600	7.2	6	10	1.4	2.4	**3.45**	**2.01**
A64	586205	821699	7	6	10	0.9	1.9	**5.51**	**2.61**
A82	585214	823103	0.4	6	10	1.7	2.7	**50.56**	**31.83**
A91	584771	823851	4.2	6	10	1.3	2.3	**6.32**	**3.57**
A93	584587	823894	4.2	6	10	0.6	1.6	**13.69**	**5.13**
A94	584497	823852	10	6	10	0.2	1.2	**17.54**	**2.92**
A96	584340	823762	8.7	6	10	0.3	1.3	**13.38**	**3.09**
A98	584225	823914	7.5	6	10	0.9	1.9	**5.15**	**2.44**
A112	584991	822592	4.1	6	10	1.7	2.7	**4.95**	**3.12**
A113	584892	822597	1.9	6	10	2.6	3.6	**6.96**	**5.03**
A114	584794	822615	3.2	6	10	1.9	2.9	**5.67**	**3.71**
A118	585353	822956	3.7	6	10	2.6	3.6	**3.58**	**2.59**
A119	585450	822936	1.8	6	10	2.7	3.7	**7.08**	**5.17**
A120	585544	822904	3	6	10	2.9	3.9	**3.96**	**2.94**
A135	584296	823698	14.6	6	10	0.2	1.2	**12.30**	**2.05**
A136	584239	823617	9.6	6	10	0.9	1.9	**4.05**	**1.92**
A146	583873	823500	3	6	10	3.2	4.2	**3.59**	**2.73**
A166	584905	823362	0.2	6	10	2.7	3.7	**63.66**	**46.46**
A167	584813	823323	0.6	6	10	4.5	5.5	**12.73**	**10.42**
A168	584723	823281	2.1	6	10	5	6.0	**3.28**	**2.73**
A169	584638	823228	2.5	6	10	2.2	3.2	**6.26**	**4.30**
A170	584572	823193	1.1	6	10	2.6	3.6	**12.02**	**8.68**
WP007	587148	821010	9.1	6	10	1	2.0	**3.84**	**1.92**
WP008	587028	821024	6.8	6	10	1.1	2.1	**4.64**	**2.43**
WP010	585013	823067	2.3	6	10	2.8	3.8	**5.34**	**3.94**
WP011	585140	823251	7.6	6	10	1.9	2.9	**2.41**	**1.58**
WP012	585159	823246	7.6	6	10	1.4	2.4	**3.27**	**1.91**
WP013	585147	823265	5.2	6	10	1.8	2.8	**3.69**	**2.37**
WP014	584747	823868	5.7	6	10	0.5	1.5	**12.14**	**4.05**
WP017	584190	824022	12	6	10	0.4	1.4	**7.38**	**2.11**
WP018	584187	824047	6	6	10	0.7	1.7	**8.25**	**3.40**
WP022	583414	823650	7.1	6	10	1.8	2.8	**2.72**	**1.75**
WP023	583833	823524	5.6	6	10	1	2.0	**6.18**	**3.09**
WP024	584274	823299	4.1	6	10	2.6	3.6	**3.24**	**2.34**
WP025	584280	823343	4.6	6	10	0.8	1.8	**9.38**	**4.17**
WP027	585363	822726	4.7	6	10	2.2	3.2	**3.34**	**2.30**
mk0v1_79	584960	822641	2.1	6	10	3	4.0	**5.46**	**4.10**
mk0v1_93	584955	823020	2.9	6	10	3.8	4.8	**3.12**	**2.47**
mk0v1_112	583295	823649	4.6	6	10	2.2	3.2	**3.41**	**2.35**
mk0v1_114	583364	823610	4.6	6	10	1.9	2.9	**3.95**	**2.59**
mk0v1_115	583340	823607	5.5	6	10	2	3.0	**3.14**	**2.10**
mk0v1_116	583394	823575	7.4	6	10	1.6	2.6	**2.94**	**1.81**
mk0v1_117	583444	823588	6.7	6	10	1.6	2.6	**3.24**	**1.99**
mk0v1_129	584319	823738	12.1	6	10	1.8	2.8	**1.63**	**1.05**
mk0v1_130	584319	823672	4.2	6	10	1.8	2.8	**4.56**	**2.93**
mk0v1_133	584295	823365	3.3	6	10	0.9	1.9	**11.60**	**5.49**
mk0v1_147	584532	823182	0.1	6	10	5.7	6.7	**60.31**	**51.31**
mk0v1_156	584627	823162	5.1	6	10	1.5	2.5	**4.52**	**2.71**
mk0v1_160	585128	823069	1.5	6	10	5.7	6.7	**4.02**	**3.42**
mk0v1_172	585113	823352	5	6	10	2.7	3.7	**2.56**	**1.87**
mk0v1_173	585045	823386	5.4	6	10	1.8	2.8	**3.56**	**2.29**
mk0v1_174	584999	823448	0.8	6	10	3.1	4.1	**13.86**	**10.48**
mk0v1_178	584733	823819	6.5	6	10	1.8	2.8	**2.96**	**1.91**
mk0v1_186	585401	822975	2.1	6	10	4.1	5.1	**4.00**	**3.21**
mk0v1_190	585629	822579	7.9	6	10	0.9	1.9	**4.90**	**2.32**
mk0v1_394	584532	823182	0.1	6	10	5.7	6.7	**60.31**	**51.31**
mk0v1_397	584235	823654	9.9	6	10	1.6	2.6	**2.21**	**1.36**
mk0v1_398	584234	823562	8.2	6	10	1.2	2.2	**3.54**	**1.93**
mk0v1_399	584238	823475	6.7	6	10	2.2	3.2	**2.35**	**1.62**
mk0v1_400	584233	823375	2.4	6	10	1.6	2.6	**8.96**	**5.52**
mk0v1_401	584229	823270	1.1	6	10	5.8	6.8	**5.39**	**4.60**
mk0v1_410	584125	823985	3.4	6	10	1.7	2.7	**5.96**	**3.75**
mk0v1_411	584028	823957	7.7	6	10	1	2.0	**4.52**	**2.26**
mk0v1_427	584734	823263	1.7	6	10	5.7	6.7	**3.55**	**3.02**
nol1_312	584854	823616	2.9	6	10	3	4.0	**3.96**	**2.97**
nol1_313	584897	823542	2.4	6	10	5.5	6.5	**2.61**	**2.21**
nol1_317	583317	823657	3.1	6	10	3.6	4.6	**3.09**	**2.42**
nol1_318	583314	823684	4.8	6	10	3	4.0	**2.40**	**1.80**
nol1_320	583859	823518	1.7	6	10	2.75	3.8	**7.36**	**5.40**
nol1_322	584227	823317	3.9	6	10	2	3.0	**4.42**	**2.95**
nol1_328	584032	823997	10.9	6	10	0.3	1.3	**10.77**	**2.49**
nol1_329	584058	823959	10.6	6	10	0.9	1.9	**3.69**	**1.75**
nol1_332	584116	823992	6.5	6	10	0.9	1.9	**5.93**	**2.81**
nol1_333	584096	824006	8.4	6	10	1.2	2.2	**3.46**	**1.89**
nol1_334	584078	824021	7.6	6	10	3	4.0	**1.53**	**1.14**
nol1_335	584227	824022	4.9	6	10	0.7	1.7	**10.07**	**4.15**
nol1_338	584197	824031	5.7	6	10	1.5	2.5	**4.05**	**2.43**
nol1_340	584309	823725	10.6	6	10	0.8	1.8	**4.15**	**1.84**
nol1_343	584717	823874	4.5	6	10	5	6.0	**1.53**	**1.28**
nol1_344	584705	823845	5	6	10	1	2.0	**6.91**	**3.46**
nol2_345	585021	823396	4.8	6	10	1.5	2.5	**4.80**	**2.88**
nol2_346	585097	823436	2.7	6	10	1.8	2.8	**7.08**	**4.55**
nol2_347	585086	823403	2.3	6	10	1.8	2.8	**8.31**	**5.34**
nol2_348	585043	823356	8.1	6	10	1.5	2.5	**2.87**	**1.72**
nol2_349	585198	823317	4.2	6	10	2.2	3.2	**3.73**	**2.57**
nol2_350	585079	823242	3.4	6	10	3.3	4.3	**3.07**	**2.36**
nol2_351	585100	823222	2.7	6	10	4.5	5.5	**2.83**	**2.32**
nol2_352	585132	823182	5	6	10	3.6	4.6	**1.92**	**1.50**
nol2_353	585053	823073	3.4	6	10	3.3	4.3	**3.07**	**2.36**
nol2_356	584971	823050	0.8	6	10	3.6	4.6	**11.94**	**9.34**
nol2_357	584924	823035	3.5	6	10	3.6	4.6	**2.74**	**2.14**
nol2_358	584922	822994	3	6	10	3.6	4.6	**3.19**	**2.50**
nol2_359	585037	823019	3.1	6	10	2.5	3.5	**4.44**	**3.17**
nol2_361	585490	822885	2.6	6	10	3.6	4.6	**3.68**	**2.88**
nol2_362	585492	822960	2.9	6	10	6	7.0	**1.98**	**1.70**

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

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
nol2_363	585527	822979	2.1	6	10	4.8	5.8	**3.41**	**2.82**
nol2_364	585415	822677	3.4	6	10	1.8	2.8	**5.63**	**3.62**
nol2_366	584867	822629	1.1	6	10	3.6	4.6	**8.68**	**6.80**
nol2_236	585412	822802	4.6	6	10	2.5	3.5	**3.00**	**2.14**
nol2_239	585610	822634	6.5	6	10	2.2	3.2	**2.42**	**1.67**
nol2_240	585959	822635	4.1	6	10	4.9	5.9	**1.72**	**1.43**
nol2_241	585986	822660	3.3	6	10	4	5.0	**2.61**	**2.09**
nol2_242	586002	822633	2.9	6	10	5.5	6.5	**2.16**	**1.83**
nol2_243	586025	822621	2.6	6	10	5.5	6.5	**2.41**	**2.04**
nol2_244	586024	822646	3	6	10	3.7	4.7	**3.10**	**2.44**
nol2_245	586031	822667	3.3	6	10	3.7	4.7	**2.82**	**2.22**
nol2_246	586012	822666	4.6	6	10	3.8	4.8	**1.98**	**1.56**
nol2_250	585529	822943	2.2	6	10	4.5	5.5	**3.48**	**2.84**
nol2_251	585510	822942	1.8	6	10	5.2	6.2	**3.68**	**3.08**
nol2_252	585509	822929	3	6	10	4.1	5.1	**2.80**	**2.25**
nol2_253	585513	822912	3.6	6	10	3.4	4.4	**2.82**	**2.18**
nol2_254	585475	822930	2.9	6	10	3.6	4.6	**3.30**	**2.58**
eg2_189	583818	823444	7.6	6	10	2.1	3.1	**2.18**	**1.48**
eg2_190	583799	823431	4	6	10	4.1	5.1	**2.10**	**1.69**
eg2_201	583871	823287	2.2	6	10	2.7	3.7	**5.79**	**4.23**
eg2_204	584202	823287	1.9	6	10	5.5	6.5	**3.29**	**2.79**
eg2_205	584200	823339	3.1	6	10	1.9	2.9	**5.85**	**3.83**
eg2_206	584222	823303	2.3	6	10	2.7	3.7	**5.54**	**4.04**
eg2_207	584269	823306	4.3	6	10	2.1	3.1	**3.82**	**2.59**
eg2_208	584264	823336	8.6	6	10	2	3.0	**2.03**	**1.35**
eg2_209	584247	823325	5.7	6	10	1.9	2.9	**3.20**	**2.09**
eg2_210	584199	823318	1.2	6	10	2.5	3.5	**11.46**	**8.19**
eg2_212	584011	824106	5.4	6	10	2.1	3.1	**3.05**	**2.07**
eg2_213	583958	824105	3.4	6	10	2.5	3.5	**4.05**	**2.90**
eg2_215	583909	824085	2.3	6	10	2.9	3.9	**5.16**	**3.84**
eg2_217	583856	824075	2	6	10	3	4.0	**5.73**	**4.30**
eg2_218	583816	824066	3.3	6	10	1.9	2.9	**5.49**	**3.60**
eg2_223	583800	824066	2.5	6	10	2.9	3.9	**4.75**	**3.53**
eg2_227	583875	823957	10.8	6	10	1.1	2.1	**2.96**	**1.55**
eg2_234	584745	823816	7.6	6	10	1.2	2.2	**3.81**	**2.08**
eg2_235	584727	823829	7.4	6	10	2	3.0	**2.35**	**1.57**
T2	583789	823872	9	6	10	0.6	1.6	**6.47**	**2.43**
T4	584433	823809	2.9	6	10	2.4	3.4	**4.95**	**3.49**
T7	585063	823067	3.4	6	10	3.3	4.3	**3.07**	**2.36**
P40	584612	823926	8.3	6	10	0.3	1.3	**14.00**	**3.23**
P41	584521	823899	8.3	6	10	2.7	3.7	**1.56**	**1.14**
P42	584452	823830	6.3	6	10	2.3	3.3	**2.39**	**1.67**
P43	584374	823774	11.9	6	10	1.8	2.8	**1.65**	**1.06**
P44	584286	823815	9.8	6	10	0.6	1.6	**5.96**	**2.24**
P45	584234	823888	5.8	6	10	0.8	1.8	**7.46**	**3.32**
P47	584145	824040	11.9	6	10	1.7	2.7	**1.75**	**1.10**
P48	584052	824077	8.1	6	10	0.9	1.9	**4.78**	**2.26**
P56	583834	823908	11.7	6	10	0.3	1.3	**10.07**	**2.32**
P70	583795	823676	3.3	6	10	1.6	2.6	**6.53**	**4.02**
P71	583800	823576	6.2	6	10	0.9	1.9	**6.21**	**2.94**
P72	583832	823485	5	6	10	1.8	2.8	**3.84**	**2.47**
P83	584767	823792	4.3	6	10	1.7	2.7	**4.72**	**2.97**
P84	584785	823697	2.3	6	10	3.3	4.3	**4.53**	**3.48**
P85	584831	823608	3.2	6	10	2.3	3.3	**4.68**	**3.26**
P86	584873	823517	3.5	6	10	3.8	4.8	**2.59**	**2.05**
P87	584917	823427	2.5	6	10	2.8	3.8	**4.92**	**3.62**
P88	584987	823356	6.4	6	10	1.5	2.5	**3.61**	**2.17**
P89	585057	823285	3.1	6	10	1.6	2.6	**6.94**	**4.27**
P90	585127	823213	3.3	6	10	2.8	3.8	**3.73**	**2.75**
P91	585183	823131	0.7	6	10	3.8	4.8	**12.93**	**10.23**
P92	585237	823047	2.6	6	10	1.7	2.7	**7.79**	**4.90**
P93	585286	822960	5.3	6	10	1.5	2.5	**4.35**	**2.61**
P94	585332	822871	4.2	6	10	2	3.0	**4.11**	**2.74**
P95	585378	822782	6.8	6	10	2.2	3.2	**2.32**	**1.59**
P96	585424	822693	6.5	6	10	2.2	3.2	**2.42**	**1.67**
P97	585470	822605	9.5	6	10	0.9	1.9	**4.10**	**1.94**
P98	585517	822516	7	6	10	0.6	1.6	**8.27**	**3.10**
P99	585593	822458	11.8	6	10	0.2	1.2	**14.99**	**2.50**
P100	585636	822369	5.1	6	10	1.4	2.4	**4.84**	**2.82**
P101	585679	822278	6.7	6	10	2.3	3.3	**2.25**	**1.57**
P102	585673	822186	2.9	6	10	3.3	4.3	**3.60**	**2.76**
P103	585619	822102	1.7	6	10	2.5	3.5	**8.09**	**5.78**
P114	585936	822137	3.9	6	10	1.4	2.4	**6.32**	**3.68**
P115	585995	822057	2.9	6	10	1	2.0	**11.87**	**5.94**
P116	586050	821974	5.7	6	10	2.3	3.3	**2.64**	**1.84**
P119	586182	821732	4.9	6	10	1.4	2.4	**5.04**	**2.94**
P120	586198	821639	9.1	6	10	1.4	2.4	**2.74**	**1.60**
WP007	584205	823981	10.4	6	10	0.5	1.5	**6.76**	**2.25**
WP009	584727	823878	5.6	6	10	0.5	1.5	**12.36**	**4.12**
WP011	584874	823509	3.5	6	10	2.4	3.4	**4.10**	**2.90**
WP013	584002	823980	9.4	6	10	0.7	1.7	**5.32**	**2.19**
WP014	583940	823932	3.9	6	10	1	2.0	**8.84**	**4.42**
WP015	583814	823766	3	6	10	0.8	1.8	**14.35**	**6.38**
WP019	583741	823834	6.4	6	10	1	2.0	**5.42**	**2.71**
WP031	585821	822218	5.9	6	10	0.5	1.5	**11.74**	**3.91**
WP033	586127	821871	7	6	10	0.4	1.4	**12.40**	**3.54**
WP034	586177	821793	7.7	6	10	0.8	1.8	**5.65**	**2.51**
agec_16	585703	822331	5.4	6	10	0.6	1.6	**10.67**	**4.00**
agec_23	585678	822606	8.5	6	10	0.1	1.1	**41.04**	**3.73**
agec_24	585778	822606	3	6	10	0.3	1.3	**38.27**	**8.83**
agec_25	585878	822606	3.1	6	10	0.5	1.5	**22.22**	**7.41**
agec_26	585978	822606	8.5	6	10	0.1	1.1	**41.04**	**3.73**
agec_38	585594	822906	2.6	6	10	3.7	4.7	**3.58**	**2.82**
agec_81	586178	822615	5.7	6	10	2.1	3.1	**2.89**	**1.96**
agec_122	585365	822234	3.9	6	10	4.5	5.5	**1.96**	**1.61**
agec_130	584665	822434	6.2	6	10	2.7	3.7	**2.07**	**1.51**
agec_134	584665	822522	11	6	10	1.4	2.4	**2.29**	**1.33**
agec_365	585489	822211	0.9	6	10	3.8	4.8	**10.05**	**7.96**
agec_WP003	585180	822324	2.1	6	10	1.4	2.4	**11.70**	**6.83**
agec_WP004	585112	822350	5.7	6	10	1.9	2.9	**3.20**	**2.09**
agec_WP033	585478	822906	3.3	6	10	2.2	3.2	**4.75**	**3.26**
agec_WP042	585700	822608	4.7	6	10	0.1	1.1	**73.47**	**6.68**
agec_WP043	585773	822609	4.5	6	10	3.2	4.2	**2.40**	**1.83**
agec_WP044	585880	822621	6.1	6	10	2.9	3.9	**1.96**	**1.46**
agec_WP045	585969	822582	5.9	6	10	3.8	4.8	**1.54**	**1.22**
agec_WP046	586077	822627	3.1	6	10	2.7	3.7	**4.12**	**3.00**
agec_WP047	586066	822558	2.3	6	10	4.8	5.8	**3.12**	**2.58**
agec_WP052	583920	824106	2.9	6	10	1.9	2.9	**6.25**	**4.09**
agec_WP054a	583814	824109	3.3	6	10	1.9	2.9	**5.49**	**3.60**
agec_WP061	583995	823988	11.2	6	10	0.5	1.5	**6.30**	**2.10**
agec_WP062	583844	823909	9.4	6	10	0.9	1.9	**4.14**	**1.96**
TP14A	585478	822902	3.3	6	10	2.1	3.1	**4.97**	**3.37**
TP16A	585793	822604	3.7	6	10	1.3	2.3	**7.17**	**4.05**
TP12A	584963	823032	1.1	6	10	2.5	3.5	**12.50**	**8.93**
TP11A	585147	823241	6.9	6	10	1.3	2.3	**3.87**	**2.19**
TP9A	585085	823414	1.9	6	10	1.7	2.7	**10.65**	**6.71**
TP17A	584623	823207	3	6	10	2.2	3.2	**5.22**	**3.59**
TP8A	584858	823499	1.8	6	10	4	5.0	**4.78**	**3.82**
TP18A	584564	823907	9.6	6	10	0.3	1.3	**12.16**	**2.81**
TP22A	584238	823501	5.5	6	10	3.2	4.2	**1.97**	**1.50**

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

Turbine No./Waypoint	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition	
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)
TP10A	584076	824034	8.8	6	10	0.4	1.4	**9.92**	**2.83**
TP3A	583836	823526	6.1	6	10	1.1	2.1	**5.16**	**2.70**
TP21A	586026	821965	4.3	6	10	2.9	3.9	**2.77**	**2.06**
TP15A	586587	821278	9.9	6	10	1	2.0	**3.54**	**1.77**
WP006b	583643	823324	3.7	6	10	2.8	3.8	**3.33**	**2.45**
WP007b	583645	823315	3.7	6	10	2	3.0	**4.66**	**3.11**
WP008b	583652	823318	6.5	6	10	1.9	2.9	**2.81**	**1.84**
WP009b	583844	824110	1.7	6	10	2.8	3.8	**7.23**	**5.32**
WP010b	583853	824113	2.6	6	10	1.8	2.8	**7.36**	**4.73**
WP011b	583849	824107	1	6	10	2.7	3.7	**12.73**	**9.29**
WP012b	584866	823560	2.6	6	10	3.7	4.7	**3.58**	**2.82**
WP013b	584881	823563	2.5	6	10	3.8	4.8	**3.62**	**2.87**
WP014b	584882	823563	2.5	6	10	3.7	4.7	**3.72**	**2.93**
WP017b	584637	823196	3.1	6	10	2	3.0	**5.56**	**3.70**
WP018b	584648	823212	3.3	6	10	2.1	3.1	**4.97**	**3.37**
WP020b	586160	822535	1.2	6	10	2.1	3.1	**13.65**	**9.24**
WP021b	586161	822600	2.1	6	10	2.6	3.6	**6.30**	**4.55**
WP022b	586156	822578	1.2	6	10	3.5	4.5	**8.19**	**6.37**
WP023b	586138	822582	2.1	6	10	4.5	5.5	**3.64**	**2.98**
WP024b	583324	823640	4.6	6	10	2.1	3.1	**3.57**	**2.42**
WP025b	583331	823648	3	6	10	2.2	3.2	**5.22**	**3.59**
WP026b	583314	823652	4.5	6	10	2	3.0	**3.84**	**2.56**
WP027b	583327	823624	4.7	6	10	1.8	2.8	**4.08**	**2.62**
WP028b	583327	823624	5	6	10	2.1	3.1	**3.29**	**2.23**
WP029b	584275	823358	3.3	6	10	0.7	1.7	**14.91**	**6.14**
WP030b	584835	823638	2.5	6	10	1.7	2.7	**8.10**	**5.10**
WP031b	584699	822496	7.4	6	10	0.8	1.8	**5.87**	**2.61**
WP032b	584680	822475	6.9	6	10	0.9	1.9	**5.59**	**2.65**
WP033b	584665	822501	8.6	6	10	1	2.0	**4.06**	**2.03**
WP034b	584668	822488	11.7	6	10	0.8	1.8	**3.78**	**1.68**
WP035b	584674	822476	10.5	6	10	0.8	1.8	**4.19**	**1.86**
CM379	583829	823299	3.5	6	10	2.4	3.4	**4.10**	**2.90**
CM380	583801	823309	2	6	10	2.4	3.4	**7.17**	**5.06**
CM381	583776	823318	1.3	6	10	2.5	3.5	**10.58**	**7.56**
CM390	583640	823333	4.8	6	10	2.1	3.1	**3.43**	**2.32**
CM391	583659	823307	4.2	6	10	1.2	2.2	**6.85**	**3.73**
CM392	583674	823329	2.2	6	10	1.8	2.8	**8.69**	**5.59**
CM393	583669	823298	4.2	6	10	1	2.0	**8.21**	**4.11**
CM394	583674	823256	1.3	6	10	2	3.0	**13.23**	**8.82**
CM397	583727	823301	5.1	6	10	0.6	1.6	**11.29**	**4.24**
CM398	583747	823283	7.9	6	10	1	2.0	**4.41**	**2.20**
CM399	583755	823260	5.6	6	10	0.2	1.2	**30.89**	**5.15**
CM400	583781	823255	6.4	6	10	0.5	1.5	**10.83**	**3.61**
CM401	583807	823248	No peat recorded at location						
CM422	585955	822586	7.2	6	10	2.3	3.3	**2.10**	**1.46**
CM423	585916	822611	6.7	6	10	1.1	2.1	**4.71**	**2.47**
CM424	585872	822609	8.1	6	10	1	2.0	**4.30**	**2.15**
CM425	585828	822605	3.3	6	10	1.6	2.6	**6.53**	**4.02**
CM426	585777	822597	10.4	6	10	1.1	2.1	**3.07**	**1.61**
CM427	585731	822594	8	6	10	1.5	2.5	**2.90**	**1.74**
CM429	585647	822609	6.5	6	10	1.5	2.5	**3.56**	**2.13**
CM430	585603	822638	7.1	6	10	1.5	2.5	**3.26**	**1.96**
PP	584745	822555	7.1	6	10	2.5	3.5	**1.96**	**1.40**
PP10	583700	823628	4.9	6	10	1.6	2.6	**4.41**	**2.71**
PP11	583646	823639	5.7	6	10	1.1	2.1	**5.52**	**2.89**
PP12	583526	823648	4.2	6	10	1	2.0	**8.21**	**4.11**
PP13	583490	823639	2.6	6	10	2.2	3.2	**6.02**	**4.14**
PP14	583387	823633	3.8	6	10	2.4	3.4	**3.78**	**2.67**
PP15	583358	823622	4.6	6	10	2.7	3.7	**2.78**	**2.03**
PP4	584762	822581	12.2	6	10	1	2.0	**2.90**	**1.45**
PP5	584796	822595	4	6	10	2	3.0	**4.31**	**2.87**
PP6	584906	822595	2.7	6	10	2.85	3.9	**4.47**	**3.31**
PP7	584986	822621	4.7	6	10	2	3.0	**3.67**	**2.45**
PP9	583754	823599	4.6	6	10	1.5	2.5	**5.00**	**3.00**
T10	584676	822493	8.6	6	10	1.5	2.5	**2.71**	**1.62**
WP001c	583746	823619	5.3	6	10	1.6	2.6	**4.08**	**2.51**
WP002c	583724	823633	4.4	6	10	0.8	1.8	**9.80**	**4.36**
WP003c	583691	823605	3.3	6	10	1.4	2.4	**7.46**	**4.35**
WP004c	583660	823627	4.9	6	10	1.2	2.2	**5.88**	**3.20**
WP005c	583638	823638	6.2	6	10	0.9	1.9	**6.21**	**2.94**
WP006c	586876	821154	7.6	6	10	0.9	1.9	**5.09**	**2.41**
WP009c	586757	821108	13.1	6	10	0.9	1.9	**3.02**	**1.43**
WP010c	586733	821124	15.1	6	10	0.7	1.7	**3.41**	**1.40**
WP011c	586684	821141	10	6	10	1.4	2.4	**2.51**	**1.46**
WP013c	586609	821257	9.6	6	10	0.9	1.9	**4.05**	**1.92**
WP018c	585449	822222	3.8	6	10	2.6	3.6	**3.49**	**2.52**
WP019c	585425	822227	5.3	6	10	1.6	2.6	**4.08**	**2.51**
WP020c	585374	822269	6.9	6	10	1.8	2.8	**2.79**	**1.80**
WP021c	585326	822294	5.2	6	10	1.9	2.9	**3.50**	**2.29**
WP022c	585170	822334	5.3	6	10	1.5	2.5	**4.35**	**2.61**
WP023c	585132	822369	8	6	10	1	2.0	**4.35**	**2.18**
WP024c	585118	822404	3.8	6	10	1.3	2.3	**6.98**	**3.94**
WP025c	585115	822410	13.9	6	10	0.6	1.6	**4.29**	**1.61**
WP026c	585042	822507	8.5	6	10	0.8	1.8	**5.13**	**2.28**
WP027c	585038	822585	3.3	6	10	1.6	2.6	**6.53**	**4.02**
mk0v3_562	584102	823120	12.8	6	10	1.2	2.2	**2.31**	**1.26**
mk0v3_563	584124	823131	8.2	6	10	1	2.0	**4.25**	**2.13**
mk0v3_564	584071	823091	3.9	6	10	3.5	4.5	**2.53**	**1.96**
mk0v3_565	584043	823102	3.3	6	10	2.7	3.7	**3.87**	**2.82**
mk0v3_566	584012	823114	2.8	6	10	2.8	3.8	**4.39**	**3.24**
mk0v3_567	583984	823121	2.4	6	10	3	4.0	**4.78**	**3.59**
mk0v3_568	583944	823138	5.8	6	10	3.4	4.4	**1.76**	**1.36**
mk0v3_569	583909	823151	6.2	6	10	3.4	4.4	**1.64**	**1.27**
							Minimum =	**1.53**	**1.05**
							Maximum =	**73.47**	**51.31**
							Average =	**6.97**	**3.73**

Notes:

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

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

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

(4) A lower bound undrained shear strength, cu for the peat of 6kPa was selected for the assessment. It should be noted that a cu of 6kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. In reality the peat has a significantly higher undrained strength.

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

(6) For load conditions see report text.

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

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	100% Water to height of Peat	Depth of In situ Peat	Friction Angle	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m^3)	γ_w (kN/m^3)	(m)	(m)	ø' (deg)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
AT1	3	4	10.0	10.0	2.2	2.2	25	3.2	**3.48**	**5.17**
AT2	2	4	10.0	10.0	2.8	2.8	25	3.8	**4.10**	**6.53**
AT3	2	4	10.0	10.0	2.8	2.8	25	3.8	**4.10**	**6.53**
AT4	12	4	10.0	10.0	1.0	1	25	2.0	**1.97**	**2.08**
AT5	2	4	10.0	10.0	1.3	1.3	25	2.3	**8.82**	**10.79**
AT6	2	4	10.0	10.0	2.4	2.4	25	3.4	**4.78**	**7.30**
AT7	1.1	4	10.0	10.0	2.8	2.8	25	3.8	**7.44**	**11.88**
AT8	3.7	4	10.0	10.0	3.9	3.9	25	4.9	**1.59**	**2.74**
AT9	3	4	10.0	10.0	4.5	4.54	25	5.5	**1.69**	**2.99**
AT10	6	4	10.0	10.0	1.0	1	25	2.0	**3.85**	**4.14**
Amet	2.3	4	10.0	10.0	0.6	0.6	25	1.6	**16.63**	**13.49**
Amet - SS	1.2	4	10.0	10.0	8.2	8.2	25	9.2	**2.33**	**4.50**
AT1 - SS	4.5	4	10.0	10.0	1.8	1.8	25	2.8	**2.84**	**3.94**
AT2 - SS	2.5	4	10.0	10.0	2.0	2	25	3.0	**4.59**	**6.62**
AT5 - SS	5.6	4	10.0	10.0	1.3	1.3	25	2.3	**3.17**	**3.86**
AT9 - SS	3	4	10.0	10.0	5.6	5.6	25	6.6	**1.37**	**2.51**
A54	9.8	4	10.0	10.0	0.2	0.2	25	1.2	**11.92**	**4.24**
A56	6.1	4	10.0	10.0	0.7	0.7	25	1.7	**5.41**	**4.79**
A57	1.8	4	10.0	10.0	0.3	0.3	25	1.3	**42.47**	**21.21**
A58	9.8	4	10.0	10.0	0.4	0.4	25	1.4	**5.96**	**3.63**
A59	7	4	10.0	10.0	0.2	0.2	25	1.2	**16.53**	**5.92**
A60	10	4	10.0	10.0	0.6	0.6	25	1.6	**3.90**	**3.11**
A61	10	4	10.0	10.0	0.9	0.9	25	1.9	**2.60**	**2.62**
A62	4.7	4	10.0	10.0	1.3	1.3	25	2.3	**3.77**	**4.60**
A63	7.2	4	10.0	10.0	1.4	1.4	25	2.4	**2.30**	**2.88**
A64	7	4	10.0	10.0	0.9	0.9	25	1.9	**3.67**	**3.74**
A82	0.4	4	10.0	10.0	1.7	1.7	25	2.7	**33.70**	**45.96**
A91	4.2	4	10.0	10.0	1.3	1.3	25	2.3	**4.21**	**5.14**
A93	4.2	4	10.0	10.0	0.6	0.6	25	1.6	**9.13**	**7.39**
A94	10	4	10.0	10.0	0.2	0.2	25	1.2	**11.70**	**4.15**
A96	8.7	4	10.0	10.0	0.3	0.3	25	1.3	**8.92**	**4.40**
A98	7.5	4	10.0	10.0	0.9	0.9	25	1.9	**3.43**	**3.49**
A112	4.1	4	10.0	10.0	1.7	1.7	25	2.7	**3.30**	**4.49**
A113	1.9	4	10.0	10.0	2.6	2.6	25	3.6	**4.64**	**7.26**
A114	3.2	4	10.0	10.0	1.9	1.9	25	2.9	**3.78**	**5.35**
A118	3.7	4	10.0	10.0	2.6	2.6	25	3.6	**2.39**	**3.73**
A119	1.8	4	10.0	10.0	2.7	2.7	25	3.7	**4.72**	**7.45**
A120	3	4	10.0	10.0	2.9	2.9	25	3.9	**2.64**	**4.24**
A135	14.6	4	10.0	10.0	0.2	0.2	25	1.2	**8.20**	**2.86**
A136	9.6	4	10.0	10.0	0.9	0.9	25	1.9	**2.70**	**2.73**
A146	3	4	10.0	10.0	3.2	3.2	25	4.2	**2.39**	**3.94**
A166	0.2	4	10.0	10.0	2.7	2.7	25	3.7	**42.44**	**67.08**
A167	0.6	4	10.0	10.0	4.5	4.5	25	5.5	**8.49**	**15.04**
A168	2.1	4	10.0	10.0	5.0	5	25	6.0	**2.18**	**3.94**
A169	2.5	4	10.0	10.0	2.2	2.2	25	3.2	**4.17**	**6.21**
A170	1.1	4	10.0	10.0	2.6	2.6	25	3.6	**8.02**	**12.53**
WP007	9.1	4	10.0	10.0	1.0	1	25	2.0	**2.56**	**2.74**
WP008	6.8	4	10.0	10.0	1.1	1.1	25	2.1	**3.09**	**3.48**
WP010	2.3	4	10.0	10.0	2.8	2.8	25	3.8	**3.56**	**5.68**
WP011	7.6	4	10.0	10.0	1.9	1.9	25	2.9	**1.61**	**2.26**
WP012	7.6	4	10.0	10.0	1.4	1.4	25	2.4	**2.18**	**2.73**
WP013	5.2	4	10.0	10.0	1.8	1.8	25	2.8	**2.46**	**3.41**
WP014	5.7	4	10.0	10.0	0.5	0.5	25	1.5	**8.09**	**5.81**
WP017	12	4	10.0	10.0	0.4	0.4	25	1.4	**4.92**	**2.97**
WP018	6	4	10.0	10.0	0.7	0.7	25	1.7	**5.50**	**4.87**
WP022	7.1	4	10.0	10.0	1.8	1.8	25	2.8	**1.81**	**2.50**
WP023	5.6	4	10.0	10.0	1.0	1	25	2.0	**4.12**	**4.44**
WP024	4.1	4	10.0	10.0	2.6	2.6	25	3.6	**2.16**	**3.37**
WP025	4.6	4	10.0	10.0	0.8	0.8	25	1.8	**6.25**	**6.00**
WP027	4.7	4	10.0	10.0	2.2	2.2	25	3.2	**2.23**	**3.30**
mk0v1_79	2.1	4	10.0	10.0	3.0	3	25	4.0	**3.64**	**5.91**
mk0v1_93	2.9	4	10.0	10.0	3.8	3.8	25	4.8	**2.08**	**3.57**
mk0v1_112	4.6	4	10.0	10.0	2.2	2.2	25	3.2	**2.27**	**3.37**
mk0v1_114	4.6	4	10.0	10.0	1.9	1.9	25	2.9	**2.63**	**3.72**
mk0v1_115	5.5	4	10.0	10.0	2.0	2	25	3.0	**2.10**	**3.01**
mk0v1_116	7.4	4	10.0	10.0	1.6	1.6	25	2.6	**1.96**	**2.59**
mk0v1_117	6.7	4	10.0	10.0	1.6	1.6	25	2.6	**2.16**	**2.85**
mk0v1_129	12.1	4	10.0	10.0	1.8	1.8	25	2.8	**1.08**	**1.47**
mk0v1_130	4.2	4	10.0	10.0	1.8	1.8	25	2.8	**3.04**	**4.22**
mk0v1_133	3.3	4	10.0	10.0	0.9	0.9	25	1.9	**7.73**	**7.92**
mk0v1_147	0.1	4	10.0	10.0	5.7	5.7	25	6.7	**40.21**	**74.08**
mk0v1_156	5.1	4	10.0	10.0	1.5	1.5	25	2.5	**3.01**	**3.90**
mk0v1_160	1.5	4	10.0	10.0	5.7	5.7	25	6.7	**2.68**	**4.94**
mk0v1_172	5	4	10.0	10.0	2.7	2.7	25	3.7	**1.71**	**2.69**
mk0v1_173	5.4	4	10.0	10.0	1.8	1.8	25	2.8	**2.37**	**3.29**
mk0v1_174	0.8	4	10.0	10.0	3.1	3.1	25	4.1	**9.24**	**15.13**
mk0v1_178	6.5	4	10.0	10.0	1.8	1.8	25	2.8	**1.98**	**2.73**
mk0v1_186	2.1	4	10.0	10.0	4.1	4.1	25	5.1	**2.66**	**4.64**
mk0v1_190	7.9	4	10.0	10.0	0.9	0.9	25	1.9	**3.26**	**3.32**
mk0v1_394	0.1	4	10.0	10.0	5.7	5.7	25	6.7	**40.21**	**74.08**
mk0v1_397	9.9	4	10.0	10.0	1.6	1.6	25	2.6	**1.48**	**1.94**
mk0v1_398	8.2	4	10.0	10.0	1.2	1.2	25	2.2	**2.36**	**2.76**
mk0v1_399	6.7	4	10.0	10.0	2.2	2.2	25	3.2	**1.57**	**2.32**
mk0v1_400	2.4	4	10.0	10.0	1.6	1.6	25	2.6	**5.98**	**7.96**
mk0v1_401	1.1	4	10.0	10.0	5.8	5.8	25	6.8	**3.59**	**6.64**
mk0v1_410	3.4	4	10.0	10.0	1.7	1.7	25	2.7	**3.97**	**5.41**
mk0v1_411	7.7	4	10.0	10.0	1.0	1	25	2.0	**3.01**	**3.23**
mk0v1_427	1.7	4	10.0	10.0	5.7	5.7	25	6.7	**2.37**	**4.36**
nol1_312	2.9	4	10.0	10.0	3.0	3	25	4.0	**2.64**	**4.28**
nol1_313	2.4	4	10.0	10.0	5.5	5.5	25	6.5	**1.74**	**3.18**
nol1_317	3.1	4	10.0	10.0	3.6	3.6	25	4.6	**2.06**	**3.48**
nol1_318	4.8	4	10.0	10.0	3.0	3	25	4.0	**1.60**	**2.59**
nol1_320	1.7	4	10.0	10.0	2.8	2.75	25	3.8	**4.91**	**7.79**
nol1_322	3.9	4	10.0	10.0	2.0	2	25	3.0	**2.95**	**4.24**
nol1_328	10.9	4	10.0	10.0	0.3	0.3	25	1.3	**7.18**	**3.52**
nol1_329	10.6	4	10.0	10.0	0.9	0.9	25	1.9	**2.46**	**2.48**
nol1_332	6.5	4	10.0	10.0	0.9	0.9	25	1.9	**3.95**	**4.03**
nol1_333	8.4	4	10.0	10.0	1.2	1.2	25	2.2	**2.31**	**2.69**
nol1_334	7.6	4	10.0	10.0	3.0	3	25	4.0	**1.02**	**1.64**
nol1_335	4.9	4	10.0	10.0	0.7	0.7	25	1.7	**6.71**	**5.96**
nol1_338	5.7	4	10.0	10.0	1.5	1.5	25	2.5	**2.70**	**3.49**
nol1_340	10.6	4	10.0	10.0	0.8	0.8	25	1.8	**2.77**	**2.61**
nol1_343	4.5	4	10.0	10.0	5.0	5	25	6.0	**1.02**	**1.84**
nol1_344	5	4	10.0	10.0	1.0	1	25	2.0	**4.61**	**4.97**
nol2_345	4.8	4	10.0	10.0	1.5	1.5	25	2.5	**3.20**	**4.14**
nol2_346	2.7	4	10.0	10.0	1.8	1.8	25	2.8	**4.72**	**6.57**
nol2_347	2.3	4	10.0	10.0	1.8	1.8	25	2.8	**5.54**	**7.71**
nol2_348	8.1	4	10.0	10.0	1.5	1.5	25	2.5	**1.91**	**2.46**
nol2_349	4.2	4	10.0	10.0	2.2	2.2	25	3.2	**2.49**	**3.70**
nol2_350	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
nol2_351	2.7	4	10.0	10.0	4.5	4.5	25	5.5	**1.89**	**3.34**
nol2_352	3.2	4	10.0	10.0	3.6	3.6	25	4.6	**1.99**	**3.37**
nol2_353	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
nol2_356	0.8	4	10.0	10.0	3.6	3.6	25	4.6	**7.96**	**13.49**
nol2_357	3.5	4	10.0	10.0	3.6	3.6	25	4.6	**1.82**	**3.08**
nol2_358	3	4	10.0	10.0	3.6	3.6	25	4.6	**2.13**	**3.60**
nol2_359	3.1	4	10.0	10.0	2.5	2.5	25	3.5	**2.96**	**4.58**
nol2_361	2.6	4	10.0	10.0	3.6	3.6	25	4.6	**2.45**	**4.15**
nol2_362	2.9	4	10.0	10.0	6.0	6	25	7.0	**1.32**	**2.45**

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

Turbine No./Waypoint	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	100% Water to height of Peat	Depth of In situ Peat	Friction Angle	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition	
	α (deg)	c' (kPa)	γ (kN/m³)	γ_w (kN/m³)	(m)	(m)	ø' (deg)	Condition (2)	Condition (1)	Condition (2)
									100% Water	100% Water
nol2_363	2.1	4	10.0	10.0	4.8	4.8	25	5.8	**2.28**	**4.08**
nol2_364	3.4	4	10.0	10.0	1.8	1.8	25	2.8	**3.75**	**5.22**
nol2_366	1.1	4	10.0	10.0	3.6	3.6	25	4.6	**5.79**	**9.81**
nol2_236	4.6	4	10.0	10.0	2.5	2.5	25	3.5	**2.00**	**3.09**
nol2_239	6.5	4	10.0	10.0	2.2	2.2	25	3.2	**1.62**	**2.39**
nol2_240	4.1	4	10.0	10.0	4.9	4.9	25	5.9	**1.14**	**2.05**
nol2_241	3.3	4	10.0	10.0	4.0	4	25	5.0	**1.74**	**3.01**
nol2_242	2.9	4	10.0	10.0	5.5	5.5	25	6.5	**1.44**	**2.63**
nol2_243	2.6	4	10.0	10.0	5.5	5.5	25	6.5	**1.60**	**2.94**
nol2_244	3	4	10.0	10.0	3.7	3.7	25	4.7	**2.07**	**3.52**
nol2_245	3.3	4	10.0	10.0	3.7	3.7	25	4.7	**1.88**	**3.20**
nol2_246	4.6	4	10.0	10.0	3.8	3.8	25	4.8	**1.32**	**2.25**
nol2_250	2.2	4	10.0	10.0	4.5	4.5	25	5.5	**2.32**	**4.10**
nol2_251	1.8	4	10.0	10.0	5.2	5.2	25	6.2	**2.45**	**4.45**
nol2_252	3	4	10.0	10.0	4.1	4.1	25	5.1	**1.87**	**3.25**
nol2_253	3.6	4	10.0	10.0	3.4	3.4	25	4.4	**1.88**	**3.14**
nol2_254	2.9	4	10.0	10.0	3.6	3.6	25	4.6	**2.20**	**3.72**
eg2_189	7.6	4	10.0	10.0	2.1	2.1	25	3.1	**1.45**	**2.11**
eg2_190	4	4	10.0	10.0	4.1	4.1	25	5.1	**1.40**	**2.43**
eg2_201	2.2	4	10.0	10.0	2.7	2.7	25	3.7	**3.86**	**6.10**
eg2_204	1.9	4	10.0	10.0	5.5	5.5	25	6.5	**2.19**	**4.02**
eg2_205	3.1	4	10.0	10.0	1.9	1.9	25	2.9	**3.90**	**5.52**
eg2_206	2.3	4	10.0	10.0	2.7	2.7	25	3.7	**3.69**	**5.83**
eg2_207	4.3	4	10.0	10.0	2.1	2.1	25	3.1	**2.55**	**3.73**
eg2_208	8.6	4	10.0	10.0	2.0	2	25	3.0	**1.35**	**1.93**
eg2_209	5.7	4	10.0	10.0	1.9	1.9	25	2.9	**2.13**	**3.01**
eg2_210	1.2	4	10.0	10.0	2.5	2.5	25	3.5	**7.64**	**11.82**
eg2_212	5.4	4	10.0	10.0	2.1	2.1	25	3.1	**2.03**	**2.97**
eg2_213	3.4	4	10.0	10.0	2.5	2.5	25	3.5	**2.70**	**4.17**
eg2_215	2.3	4	10.0	10.0	2.9	2.9	25	3.9	**3.44**	**5.53**
eg2_217	2	4	10.0	10.0	3.0	3	25	4.0	**3.82**	**6.21**
eg2_218	3.3	4	10.0	10.0	1.9	1.9	25	2.9	**3.66**	**5.19**
eg2_223	2.5	4	10.0	10.0	2.9	2.9	25	3.9	**3.17**	**5.09**
eg2_227	10.8	4	10.0	10.0	1.1	1.1	25	2.1	**1.98**	**2.20**
eg2_234	7.6	4	10.0	10.0	1.2	1.2	25	2.2	**2.54**	**2.98**
eg2_235	7.4	4	10.0	10.0	2.0	2	25	3.0	**1.57**	**2.24**
T2	9	4	10.0	10.0	0.6	0.6	25	1.6	**4.31**	**3.46**
T4	2.9	4	10.0	10.0	2.4	2.4	25	3.4	**3.30**	**5.04**
T7	3.4	4	10.0	10.0	3.3	3.3	25	4.3	**2.05**	**3.40**
P40	8.3	4	10.0	10.0	0.3	0.3	25	1.3	**9.33**	**4.61**
P41	8.3	4	10.0	10.0	2.7	2.7	25	3.7	**1.04**	**1.62**
P42	6.3	4	10.0	10.0	2.3	2.3	25	3.3	**1.59**	**2.39**
P43	11.9	4	10.0	10.0	1.8	1.8	25	2.8	**1.10**	**1.50**
P44	9.8	4	10.0	10.0	0.6	0.6	25	1.6	**3.97**	**3.18**
P45	5.8	4	10.0	10.0	0.8	0.8	25	1.8	**4.97**	**4.76**
P47	11.9	4	10.0	10.0	1.7	1.7	25	2.7	**1.17**	**1.55**
P48	8.1	4	10.0	10.0	0.9	0.9	25	1.9	**3.19**	**3.23**
P56	11.7	4	10.0	10.0	0.3	0.3	25	1.3	**6.71**	**3.28**
P70	3.3	4	10.0	10.0	1.6	1.6	25	2.6	**4.35**	**5.79**
P71	6.2	4	10.0	10.0	0.9	0.9	25	1.9	**4.14**	**4.22**
P72	5	4	10.0	10.0	1.8	1.8	25	2.8	**2.56**	**3.55**
P83	4.3	4	10.0	10.0	1.7	1.7	25	2.7	**3.15**	**4.28**
P84	2.3	4	10.0	10.0	3.3	3.3	25	4.3	**3.02**	**5.02**
P85	3.2	4	10.0	10.0	2.3	2.3	25	3.3	**3.12**	**4.70**
P86	3.5	4	10.0	10.0	3.8	3.8	25	4.8	**1.73**	**2.96**
P87	2.5	4	10.0	10.0	2.8	2.8	25	3.8	**3.28**	**5.23**
P88	6.4	4	10.0	10.0	1.5	1.5	25	2.5	**2.41**	**3.11**
P89	3.1	4	10.0	10.0	1.6	1.6	25	2.6	**4.63**	**6.16**
P90	3.3	4	10.0	10.0	2.8	2.8	25	3.8	**2.49**	**3.96**
P91	0.7	4	10.0	10.0	3.8	3.8	25	4.8	**8.62**	**14.77**
P92	2.6	4	10.0	10.0	1.7	1.7	25	2.7	**5.19**	**7.07**
P93	5.3	4	10.0	10.0	1.5	1.5	25	2.5	**2.90**	**3.75**
P94	4.2	4	10.0	10.0	2.0	2	25	3.0	**2.74**	**3.94**
P95	6.8	4	10.0	10.0	2.2	2.2	25	3.2	**1.55**	**2.29**
P96	6.5	4	10.0	10.0	2.2	2.2	25	3.2	**1.62**	**2.39**
P97	9.5	4	10.0	10.0	0.9	0.9	25	1.9	**2.73**	**2.76**
P98	7	4	10.0	10.0	0.6	0.6	25	1.6	**5.51**	**4.44**
P99	11.8	4	10.0	10.0	0.2	0.2	25	1.2	**9.99**	**3.53**
P100	5.1	4	10.0	10.0	1.4	1.4	25	2.4	**3.23**	**4.06**
P101	6.7	4	10.0	10.0	2.3	2.3	25	3.3	**1.50**	**2.25**
P102	2.9	4	10.0	10.0	3.3	3.3	25	4.3	**2.40**	**3.98**
P103	1.7	4	10.0	10.0	2.5	2.5	25	3.5	**5.40**	**8.34**
P114	3.9	4	10.0	10.0	1.4	1.4	25	2.4	**4.21**	**5.31**
P115	2.9	4	10.0	10.0	1.0	1	25	2.0	**7.92**	**8.56**
P116	5.7	4	10.0	10.0	2.3	2.3	25	3.3	**1.76**	**2.64**
P119	4.9	4	10.0	10.0	1.4	1.4	25	2.4	**3.36**	**4.22**
P120	9.1	4	10.0	10.0	1.4	1.4	25	2.4	**1.83**	**2.28**
WP007	10.4	4	10.0	10.0	0.5	0.5	25	1.5	**4.51**	**3.20**
WP009	5.6	4	10.0	10.0	0.5	0.5	25	1.5	**8.24**	**5.92**
WP011	3.5	4	10.0	10.0	2.4	2.4	25	3.4	**2.74**	**4.17**
WP013	9.4	4	10.0	10.0	0.7	0.7	25	1.7	**3.55**	**3.12**
WP014	3.9	4	10.0	10.0	1.0	1	25	2.0	**5.89**	**6.37**
WP015	3	4	10.0	10.0	0.8	0.8	25	1.8	**9.57**	**9.20**
WP019	6.4	4	10.0	10.0	1.0	1	25	2.0	**3.61**	**3.88**
WP031	5.9	4	10.0	10.0	0.5	0.5	25	1.5	**7.82**	**5.62**
WP033	7	4	10.0	10.0	0.4	0.4	25	1.4	**8.27**	**5.07**
WP034	7.7	4	10.0	10.0	0.8	0.8	25	1.8	**3.77**	**3.59**
agec_16	5.4	4	10.0	10.0	0.6	0.6	25	1.6	**7.12**	**5.75**
agec_23	8.5	4	10.0	10.0	0.1	0.1	25	1.1	**27.36**	**5.32**
agec_24	3	4	10.0	10.0	0.3	0.3	25	1.3	**25.51**	**12.73**
agec_25	3.1	4	10.0	10.0	0.5	0.5	25	1.5	**14.81**	**10.68**
agec_26	8.5	4	10.0	10.0	0.1	0.1	25	1.1	**27.36**	**5.32**
agec_38	2.6	4	10.0	10.0	3.7	3.7	25	4.7	**2.39**	**4.06**
agec_81	5.7	4	10.0	10.0	2.1	2.1	25	3.1	**1.93**	**2.81**
agec_122	3.9	4	10.0	10.0	4.5	4.5	25	5.5	**1.31**	**2.32**
agec_130	6.2	4	10.0	10.0	2.7	2.7	25	3.7	**1.38**	**2.17**
agec_134	11	4	10.0	10.0	1.4	1.4	25	2.4	**1.53**	**1.89**
agec_365	0.9	4	10.0	10.0	3.8	3.8	25	4.8	**6.70**	**11.49**
agec_WP003	2.1	4	10.0	10.0	1.4	1.4	25	2.4	**7.80**	**9.85**
agec_WP004	5.7	4	10.0	10.0	1.9	1.9	25	2.9	**2.13**	**3.01**
agec_WP033	3.3	4	10.0	10.0	2.2	2.2	25	3.2	**3.16**	**4.70**
agec_WP042	4.7	4	10.0	10.0	0.1	0.1	25	1.1	**48.98**	**9.61**
agec_WP043	4.5	4	10.0	10.0	3.2	3.2	25	4.2	**1.60**	**2.63**
agec_WP044	6.1	4	10.0	10.0	2.9	2.9	25	3.9	**1.31**	**2.09**
agec_WP045	5.9	4	10.0	10.0	3.8	3.8	25	4.8	**1.03**	**1.76**
agec_WP046	3.1	4	10.0	10.0	2.7	2.7	25	3.7	**2.74**	**4.33**
agec_WP047	2.3	4	10.0	10.0	4.8	4.8	25	5.8	**2.08**	**3.72**
agec_WP052	2.9	4	10.0	10.0	1.9	1.9	25	2.9	**4.17**	**5.90**
agec_WP054a	3.3	4	10.0	10.0	1.9	1.9	25	2.9	**3.66**	**5.19**
agec_WP061	11.2	4	10.0	10.0	0.5	0.5	25	1.5	**4.20**	**2.97**
agec_WP062	9.4	4	10.0	10.0	0.9	0.9	25	1.9	**2.76**	**2.79**
TP14A	3.3	4	10.0	10.0	2.1	2.1	25	3.1	**3.31**	**4.85**
TP16A	3.7	4	10.0	10.0	1.3	1.3	25	2.3	**4.78**	**5.84**
TP12A	1.1	4	10.0	10.0	2.5	2.5	25	3.5	**8.34**	**12.89**
TP11A	6.9	4	10.0	10.0	1.3	1.3	25	2.3	**2.58**	**3.13**
TP9A	1.9	4	10.0	10.0	1.7	1.7	25	2.7	**7.10**	**9.68**
TP17A	3	4	10.0	10.0	2.2	2.2	25	3.2	**3.48**	**5.17**
TP8A	1.8	4	10.0	10.0	4.0	4	25	5.0	**3.19**	**5.52**
TP18A	9.6	4	10.0	10.0	0.3	0.3	25	1.3	**8.11**	**3.99**
TP22A	5.5	4	10.0	10.0	3.2	3.2	25	4.2	**1.31**	**2.15**