

# **Beinn Ghlas Wind Farm Repowering EIA Report**

## **Technical Appendix 8.2**

### **Peat Survey Report**

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## **1 Depth of Penetration Surveys**

Three depth of penetration surveys, considered to be equivalent to peat depth, were completed in April 2022, between December 2022 and February 2023, and October 2023 by Fluid Environmental Consulting Ltd across the Site and Site Access. These were undertaken in accordance with the guidance in Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland.

A total of 5,032 probing locations and 25 cores were completed over the three phases.

### **Phase 1**

The first phase of peat probing was completed in April 2022 to provide information for scoping which comprised a 100 m grid across an area larger than the Site that was originally considered for development. A total of 644 peat probes and 12 cores were undertaken in this phase. These data were used as an input to the constraints map for development of the infrastructure layout.

### **Phase 2**

Once the layout was further developed, detailed probing was completed in December 2022 and February 2023 at the following specification:

- Across the footprint of all infrastructure within peat areas on a 10 m grid and probing within a 50 m buffer area on a 20 m grid, and
- At 50 m intervals with 10 m offset probes along all proposed and existing access tracks.

A total of 3,446 locations were planned, however 142 probing locations were on an existing track or altered ground and one within a watercourse and therefore accurate peat probing was not possible. There was no benefit in probing in alternative locations as there were already probes located nearby or the flattened area was too large. A total of 3,303 peat probes and seven cores were undertaken in this phase.

### **Phase 3**

Following a review of the layout and adjustment due to various constraints, additional peat probing was undertaken in October 2023 at the following specification:

- At 50 m intervals with 10 m offset probes along all proposed and existing access track; and
- Across the footprint of all infrastructure within peat areas on a 10 m grid and probing within a 50 m buffer area on a 20 m grid.

A total of 1,085 locations were planned, however nine probing locations were on an existing track and accurate peat probing was not possible. Nine alternative probes were therefore completed near the proposed locations. A total of 1,085 peat probes and six cores were undertaken in this phase.

The three surveys included completion of the following:

- Record the depth of penetration at each probe location along with an estimate of the geology at the limit of penetration;

- Collect data from five cores on total peat depth, Von Post measurements every metre, the thickness of the acrotelm, catotelm and amorphous peat (if present) and comments on water table if possible;
- Record the underlying geology at all probe locations: e.g., bedrock, clay, silt, sand;
- Record the vegetation at all probe locations: bare ground, grass, heather, cotton grass, mixed mosses or sphagnum moss;
- Record the ground firmness at all probe locations: 0 – too soft to walk on, 1 – surface just passable, 2 – surface fairly firm, and 3 – surface firm;
- Record location comments at all probe locations: (e.g, D - drain, DD - diffuse drainage, ET - existing track, EG - erosional gully, PC - peat cutting, PH - peat hag, PS - potential peat slide, W - water course, P - pool/pond, SP - sphagnum pool);
- Take a photographic record of all cores;
- Present all data in tabular form as a series of annexes; and
- Provide a peat depth contour plan across the area of probing and coring.

The data collected by Fluid are presented in detail in the attached annexes:

- A global position system (GPS) linked photographic record of peat locations and other peat features was taken and provides a detailed record across the site. Typical peat equipment and characteristics are presented in Annex I Example Photographs of Typical Ground Conditions;
- A record of the data collected at all 5,184 probe locations is presented in Annex II Peat Penetration Probing Data;
- The data collected from each of the 25 cores is presented in Annex III Peat Core Data: Peat Data and Von Post Measurements; and
- A photographic record and log of the peat for each core is presented in Annex IV Peat Coring Logs.

## 2 Methodology

### 2.1 Site Visits and Field Work

Depth of penetration probing has been completed using narrow diameter fibre glass probes of up to 10 m length that do not allow a sample to be obtained. They are pushed into the ground until there is sufficient resistance to prevent further penetration and the depth recorded as the depth of penetration. A description of the resistant substrate below is made based on the feel of the resistance (e.g. grit, bedrock, clay, sand, rock or resistance where unable to differentiate).

This probe provides the depth of penetration in soft formations and if peat is present is often representative of the actual peat depth when the formation underlying the peat is sands and gravels or bedrock. However, the depth of penetration can be an overestimate of the depth of peat where the substrate below is soft and penetrable, such as soft clay or silt. In some cases, peat may not be present and the whole of the probe penetrates through silt or clay sediments. Coring is therefore necessary to verify some of the probe results by extracting a core of the deposits for examination.

A total of 25 cores have been obtained using a gouge auger to determine the actual depth of the peat and obtain a sample of the underlying formation. Observations on the soil and peat characteristics were determined from the cores using recognised criteria (Von Post

assessment). The acrotelm, catotelm and amorphous layers (if present) within the peat have also been identified where possible. Observations on underlying geology, nearby water features, ground conditions and habitat were also noted.

Probe locations were located and recorded using a handheld GPS device, with Birdseye aerial imagery, to a six-figure grid reference (to 1 m) and georeferenced photographic records were obtained for all cores. The probes and gouge auger used at this Site are of the types shown in Annex I.

The data obtained from the current site investigation was verified with the coring data and is presented in **Figures 8.9 and 8.9a to 8.9c** in Volume 3 of the EIA Report.

A shaded contour interval of 0 – 0.5 m, >0.5 m – 1.0 m, >1.0 m – 1.5 m, >1.5 – 2.0 m, >2.0 – 3.0 m, >3.0 – 4.0 m, >4.0 – 5.0 m, >5.0 – 6.0 m and >6 m has been used on the figures as the deepest probe encountered 7.15 m of peat.

The data obtained on peat occurrence and properties across the Site along with the contour plot are presented herein. The results of the probing and coring have been tabulated in Annexes I to IV along with photographs and a table of peat conditions.

## 2.2 Limitations

It should be noted that the peat depth probes were undertaken at up to 100 m spacing and there may therefore be more localised peat depth variations between some of the more separated probing points. It is also possible that some overestimation of peat depth can occur if soft silty clay is present underlying the peat that is indistinguishable from peat using just a peat probe, however this is not common on this Site and overestimate of peat depth is not anticipated.

## 3 Results

### 3.1 Depth of Penetration Probing

A total of 5,032 probes were undertaken across the Site and Site Access with each probe recording the depth of penetration (Annex II).

Of the 5,032 locations probed a total of 3,107 probes (61.7%) recorded depths of 0.5 m or less (no peat), 1,071 probes (21.3%) recorded depths of penetration between 0.5 m and 1.0 m and 854 probes (17.0%) recorded depths of penetration >1.0 m, as shown in **Table 1**.

**Table 1: Depth of Penetration Distribution**

Depth Range (m)	Number of Probes	Percentage of Probes
0 to 0.5 (no peat)	3,107	61.7%
0.5 – 1.0	1,071	21.3%
1.0 – 1.5	362	7.19%
1.5 – 2.0	225	4.47%
2.0 – 3.0	194	3.86%
3.0 – 4.0	45	0.89%
4.0 – 5.0	14	0.28%
5.0 – 6.0	9	0.18%
>6	5	0.10%
<b>Total</b>	<b>5,032</b>	<b>100%</b>

The depth of penetration at each probe location is presented on **Figures 8.9 and 8.9a to 8.9c** in **Volume 3a** of the EIA Report.

### 3.2 Coring

A total of 25 locations have been cored during the peat survey and the data collected included Von Post test results, acrotelm and catotelm thickness, observations on the peat structure and any observations on water features nearby as presented in Annex III. Comparison of the probe depth of penetration and the peat depth verified from the core is also presented in Annex III and full logs of each core including photographic record are presented in Annex IV.

A total of 23 of the 25 locations cored identified peat greater than 0.5 m depth. Comparison of the depth of peat in the cores to the depth of penetration probes validated the probing results in all locations as peat depths were recorded as the same. It is assumed that if the difference between the peat depth from coring and from probing is less than 0.1 m, then it is an acceptable variation due to the accuracy of the measurements.

The cores identified a distinctive acrotelm layer in all of the 25 coring locations ranging between 0.05 m and 0.30 m thick and averaging 0.17 m. The catotelm thickness ranged from 0.20 m to 2.55 m in the 25 cores.

The variations in the results of coring and probing typically occur when silty clay deposits are present underlying the peat. These are not usually very thick (a few 10s of cms) and although they do reduce the overall peat thickness this tends to only make a significant difference at shallower peat depths. There was no evidence of this effect at this Site.

### 3.3 Substrate

A total of 5,032 probes were undertaken across the Site with each recording the potential substrate at the limit of penetration (Annex II).

The probes recorded substrate information based on feel as the probe made contact with the formation underlying the peat as follows:

**Table 2: Substrate across all probe locations**

Substrate	Number of Probes	Percentage of Probes
Rock	3,711	73.7%
Silt	728	14.5%
Grit	439	8.72%
Gritty silt	132	2.62%
Resistance	8	0.16%
Gritty clay	3	0.06%
Gritty sand	3	0.06%
Silty clay	2	0.04%
Sand	2	0.04%
Sandy silt	2	0.04%
Clay	1	0.02%
Clayey silt	1	0.02%
<b>Total</b>	<b>5,032</b>	<b>100%</b>

### 3.4 Peat Depth Distribution

Based on the data collected, an interpreted peat depth map (**Figures 8.10 and 8.10a to 8.10c** in Volume 3 of the EIA Report) was produced to demonstrate the variation in peat across the Site and Site Access. A comparison of the peat depth across the Site and Site Access is presented in **Table 3**:

**Table 3: Peat Depth Distribution across Site and Site Access**

Depth Range (m)	Area (m <sup>2</sup> )	Area (%)
0 to 0.5 (no peat)	2,603,854	60.8%
>0.5 – 1.0	1,100,922	25.7%
>1.0 – 1.5	329,340	7.69%
>1.5 – 2.0	128,490	3.00%
>2.0 - 3.0	96,165	2.25%
>3.0 - 4.0	20,204	0.47%
>4.0 - 5.0	1,463	0.03%
>5.0 - 6.0 m	310	0.01%
>6.0 m	27	0.001%
<b>Total</b>	<b>4,280,438</b>	<b>100%</b>

These data indicate that peat >0.5 m depth is present across 39.2 % of the Site and Site Access; and no peat (0 – 0.5 m depth) is present across 60.8 % of the Site and Site Access. Peat >1.0 m depth is present at 13.5 % of the Site and Site Access.

**Figures 8.10 and 8.10a to 8.10c** in Volume 3 of the EIA Report demonstrate the presence of some substantial areas of peat, up to 7.15 m depth in between larger areas with no peat and rocky outcrops. The peat pockets are fairly well spread across the Site with perhaps a slightly higher concentration in the centre, along the northern boundary and in the south.

There is limited peat along the Site Access although some occasional pockets of peat were encountered including a short section about 500 m west of Barguilean Farm.

### 3.5 Sampling Results

Samples of peat were observed in the field as part of the peat depth probing programmes and descriptions noted with respect to its characteristics, including fibre content, decomposition and moisture content.

The Von Post test was also carried out at core locations. Von Post scores for the acrotelm ranged between H1 and H4. A score of H1 is defined by Ekono (1981) (1981) as *‘Completely undecomposed peat which, when squeezed, releases almost clear water. Plant remains easily identifiable. No amorphous material present.’*

H2 is defined as *‘Almost entirely undecomposed peat which, when squeezed, releases clear or yellowish water. Plant remains still easily identifiable. No amorphous material present.’*

H3 is defined as *‘Very slightly decomposed peat which, when squeezed, releases muddy brown water, but from which no peat passes between fingers. Plant remains still identifiable, and no amorphous material present.’*

H4 is defined as *‘Slightly decomposed peat which, when squeezed, releases very muddy brown water. No peat is passed between the fingers but plant remains are slightly pasty and have lost some of their identifiable features.’*

This means that there is no amorphous peat in category H1, H2 and H3. H scores of 5 or more begin to have amorphous material, with significant amorphous material occurring at scores of H9 and above.

For the catotelm, Von Post scores ranged between H5 and H8. A score of H5 is defined as *‘Moderately decomposed peat containing a fair amount of amorphous material. Plant structure recognisable though somewhat vague. On squeezing, some peat but mainly muddy water issues. Residue is strongly pasty.’*

H6 is defined as *‘Moderately highly decomposed peat with a very distinct plant structure. When squeezed, about one-third of the peat escapes between the fingers. The residue is very pasty but shows the plant structure more distinctly than before squeezing.’*

H7 is defined as *‘Highly decomposed peat. Contains a lot of amorphous material with very faintly recognizable plant structure. When squeezed, about one-half of the peat escapes between the fingers. The water, if any is released, is very dark and almost pasty.’*

H8 is defined as *‘Strongly decomposed peat with much amorphous material and very indistinct plant structure. On squeezing, two thirds of the peat and some water passes between the fingers. Residue consists of plant tissues capable of resisting decomposition (roots, fibres, wood, etc.).’*



No amorphous peat was identified on the Site or Site Access.

In terms of reuse, consideration has to be given to the increasingly amorphous and plastic nature of that catotelm with Von Post scores of H7 and above.

## 4 Summary

The following summarises the results of the peat survey campaign:

- Peat depth probing was completed on a 100 m grid across an area larger than the Site that was originally considered for development, on a 10 m grid and within a 50 m buffer area on a 20 m grid across the footprint of all infrastructure and at 50 m intervals with 10 m offset probes along all proposed and existing access tracks both on Site and along the Site Access;
- Peat has been determined to be present up to a depth of 7.15 m based on 5,032 depth of penetration probes and 25 cores;
- A distinct acrotelm layer was identified in all of the 25 cores and averaged 0.17 m in thickness;
- Coring for peat depth verification and assessment of peat characteristics was completed at 25 locations. The coring verified the peat probing depths in all locations where the probe depth was recorded the same;
- No amorphous peat was identified at site;
- The data collected has been used to produce an interpreted maximum depth of peat contour map using ArcGIS (**Figures 8.10 and 8.10a to 8.10c** in Volume 3 of the EIA Report).
- These data indicate that peat >0.5 m depth is present across 39.2 % of the Site and Site Access; and no peat (0 – 0.5 m depth) is present across 60.8 % of the Site and Site Access. Peat >1.0 m depth is present at 13.5 % of the Site and Site Access,
- **Figures 8.10 and 8.10a to 8.10c** in Volume 3 of the EIA Report demonstrate the presence of some substantial areas of peat, up to 7.15 m depth in between larger areas with no peat and rocky outcrops. The peat pockets are fairly well spread across the Site with perhaps a slightly higher concentration in the centre, along the northern boundary and in the south;
- There are various sections of track and other proposed infrastructure, including some turbines and crane hardstandings and the temporary construction compound within the Site that are located on peat;
- There is limited peat along the Site Access although some occasional pockets of peat were encountered including a short section about 500 m west of Barguilean Farm; These are discussed in more detail, and the volumes of peat that will be required to be extracted are quantified, within **Technical Appendix 8.3** of the EIA Report.

