Appendix 8.3: Peat Management Plan

EAST POINT GEO
An ABL Group Company

Consulting Report

Appendix 8.3 - Peat Management Plan Dunside Wind Farm

Scottish Borders
EDF Energy Renewables Ltd

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1. INTRODUCTION

1.1. Background

EDF Energy Renewables Limited (the Applicant) are seeking consent under Section 36 of the Electricity Act 1989 for construction of the Dunside Wind Farm, Scottish Borders (hereafter the 'Proposed Development'). The site for the Proposed Development lies approximately 6 km north of Westruther and 7 km west of Longformacus and is approximately 20 km^2 (c. 2,000 ha) in area (Plate 1.1). The site is bordered to the west by the operational Fallago Rig Wind Farm (also operated by EDF), to the north and south by open fells within the Lammermuir Hills and to the east by rolling hills which drain to Watch Water Reservoir.

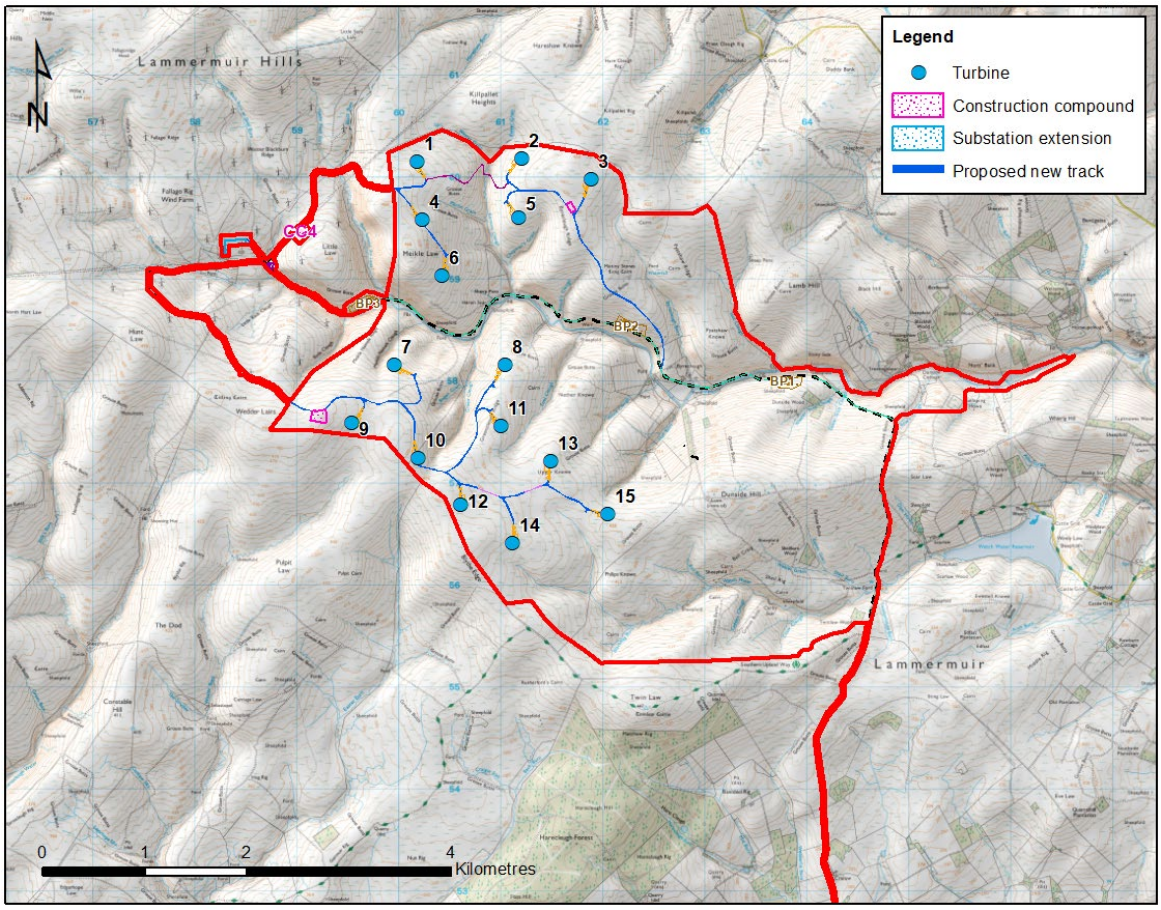

Plate 1.1 Proposed location of the Proposed Development

The Proposed Development will comprise:

- Up to 15 wind turbines, each with a maximum tip height of 220 m (with an external transformer kiosk);
- Crane hardstandings adjacent to each turbine position;
- Four new watercourse crossings and associated infrastructure;
- Approximately 15 km of proposed wind farm tracks and approximately 1.1 km of proposed light vehicle track;
- Approximately 17.5 km of existing access tracks (including areas of widening/upgrading);
- Onsite underground electrical cables and cable trenches;

- Control building and extension to Fallago Rig existing substation;
- A 20 MW battery storage area;
- Four temporary construction compounds (two existing compounds which will remain in situ following completion of the Proposed Development, and two proposed which will be restored following construction), including laydown areas and car parking; and
- Up to three temporary borrow pits which will be closed and reinstated following completion of construction.

The infrastructure will be subject to a proposed micro-siting allowance of 100 m.

This Peat Management Plan (PMP) follows guidance (Scottish Renewables & SEPA, 2012) on the assessment of peat excavation and reuse for wind farms in Scotland. The PMP was prepared in parallel with a Peat Landslide Hazard and Risk Assessment (PLHRA, EIA Report Appendix 8.4) and is informed by peat depth probing undertaken by Kaya Consulting and documented in EIA Report Appendix 8.2.

1.2. Scope of Work

The scope of the PMP is as follows:

- Summarise the design principles adopted for design of the Proposed Development with respect to peat soils, including the approach to peat characterisation and the identification of opportunities taken to minimise impacts on peatlands within the Site.
- Calculate the potential volumes of peat that may be excavated in association with the construction of the Proposed Development, both acrotelmic and catotelmic peat.
- Identify and justify reuse of acrotelmic and catotelmic peat where it cannot be reinstated at source.
- Identify good practice measures to ensure excavated peat is stored safely and with minimal loss of function prior to its reinstatement.

The PMP follows the advice issued in SEPA's Scoping Opinion response of 11/04/2022. Phase 1 probing data, while not issued pre-scoping, was supplied to SEPA post-survey in August 2022, and subsequent advice received 17/08/2022 was taken into account in later design iterations.

1.3. Report Structure

This report is structured as follows:

- Section 2 provides an outline of relevant guidance relating to the excavation, storage and reuse of peat.
- Section 3 provides an overview of the Site and the Proposed Development infrastructure based on the scheme described in the main EIA chapters and on desk study review of site information.
- Section 4 describes the approach to and results of peat excavation calculations, and summarises opportunities for reuse of excavated peat soils within the Site.
- Section 5 provides general good practice measures and measures specific to the conditions at the proposed site.

Where relevant information is available elsewhere in the Environmental Impact Assessment (EIA) Report, this is referenced in the text rather than repeated in this report.

2. CONTEXT TO PEAT MANAGEMENT

2.1. Peat as a Carbon Store

Priority peatland habitats comprise blanket bog, lowland raised bog, lowland fens, and part of the upland flushes, fens and swamps, as listed in the UK Biodiversity Action Plan (UK BAP). Blanket bog is the most widespread of these habitat types in Scotland, and therefore it is blanket bog that is usually of relevance for proposed developments/wind farms in upland areas.

Blanket bogs in the UK started forming in the early Holocene, with most UK bogs initiating prior to 6,000 years ago under cooler and wetter conditions than at present. Where bogs remain waterlogged and peat forming plant species persist, blanket bog is still considered to be actively forming and accumulating organic matter, and therefore can be considered a carbon sink. A bog that is not losing carbon/peat but is no longer accumulating organic matter can be considered a carbon store, and a degrading bog can be considered a carbon source (Mills et al, 2021).

A peatland may change state between sink, store and source through natural processes or as a result of human activity. The purpose of the PMP is to avoid impacts on the peat carbon stores at wind farm sites by avoiding peat, where possible, or by minimising impacts where peat cannot be avoided. Where there are opportunities to improve peat condition, e.g. through restoration, and in so doing, help convert carbon sources into stores or sinks, this may also be facilitated by the PMP (usually in conjunction with habitat management measures as detailed in the Outline Restoration and Enhancement Plan (OREP)).

2.2. Good Practice Guidance

Where peat is to be excavated in association with built infrastructure, it may be considered to be a waste product under the following legislation:

- Environmental Protection Act 1990 (as amended).
- Landfill (Scotland) Regulations 2003 (as amended).
- The Waste Management Licensing (Scotland) Regulations 2011.

In order to address this legislation, a number of guidance documents have been issued to assist applicants in responsibly planning, installing and operating infrastructure in peatland settings. This PMP has been informed by this collective good practice, which includes the following documents:

- Good Practice during Wind Farm Construction, Version 4 (Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, 2019).
- Developments on Peat and Off-Site Uses of Waste Peat, WST-G-052 (SEPA, 2017).
- Peatland Survey. Guidance on Developments on Peatland (Scottish Government, Scottish Natural Heritage and SEPA, 2017a).
- Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments (Second Edition) (Scottish Government, 2017).
- Carbon and Peatland 2016 Map (GIS) (Scottish Natural Heritage, 2016a).
- Carbon-rich Soils, Deep Peat and Priority Peatland Habitat Mapping, Consultation Analysis Report (Scottish Natural Heritage, 2016b).
- Scotland's National Peatland Plan - Working for our future (Scottish Natural Heritage, 2015a).

- Constructed Tracks in the Scottish Uplands, 2nd Edition (Scottish Natural Heritage, 2015b).
- Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (Scottish Renewables and SEPA, 2012).
- Floating Roads on Peat - A Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments in Scotland (Scottish Natural Heritage and Forestry Commission Scotland, 2010).

In general terms, the guidance considers appropriate activities to be undertaken at the planning (Environmental Impact Assessment), post-consent/pre-construction and construction stages. The overarching principles are generally the same across the different guidance documents and are set out below.

During planning (EIA):

i. Determine at a sufficient level of detail the distribution of peat within a site in order to assess the likely level of impact of proposed works.

ii. Calculate the volumes of peat likely to be excavated during construction.

iii. Demonstrate how excavated peat will be managed (ii and iii together comprising an assessment of the "peat and soil balance").

These activities are normally considered within a PMP, delivered as part of the EIA at the planning stage.

Given consent, during the pre-construction period:

i. A refined peat and soil mass balance should be calculated through further site investigation works (including intrusive works such as detailed probing across final infrastructure footprints and/or trial pits to verify the nature of probed materials).

ii. Further detailed topographic survey and design level excavation, storage and reuse plans should be drafted to enable contractors to bid for and implement the works.

iii. Key good practice measures should be identified within the PMP that integrate with other related plans or control documents for construction, including, where applicable, the Construction and Decommissioning Environmental Management Plan, Site Waste Management Plan, Habitat Management Plan (where relevant) and Geotechnical Risk Register.

During the construction stage:

i. Utilise micro-siting to optimise infrastructure locations relative to final pre-construction information gathered on site.

ii. Monitor, adjust and implement the PMP to accommodate deviations in expected peat volumes and adapt reuse measures to actual site volumes.

iii. Set-up monitoring programmes to identify the new post-construction baseline and provide a basis for monitoring the success of the PMP and identify appropriate mitigation where necessary.

Through the different stages of the project, the strategy should be to prevent disturbance to and losses of peat through appropriate reuse, wherever possible.

2.3. Approach at the Proposed Development

The strategy for peat management for the Proposed Development follows SEPA's guidance for developments on peat and uses of waste peat (SEPA, 2017). The hierarchy is as follows:

- **Prevent** the creation of waste peat by minimising overlap of infrastructure with peat, where it is possible to do, and given other site and design constraints that may influence turbine locations and associated infrastructure (such as tracks).
- **Reuse** peat on site in construction, reinstatement or in restoration (restoring off-site will require environmental authorisation).
- **Recycle** as a soil substitute or for use in other works (where on-site or off-site use in restoration is not possible).
- **Dispose**, only if all other options have been explored and discounted.

At the Proposed Development site, a combination of prevention and reuse has formed the peat management strategy. Outline details of this strategy are provided below, and full detail of excavation and reuse proposals are provided in Section 4.

2.3.1. Prevent

Prevention involves minimising the amount of peat excavated during construction by informed layout planning. The extent to which this is possible is not just a function of the amount of peat on site, but also of the presence of other constraints (e.g. landscape visual impacts, hydrology, terrestrial ecology) and the practical requirements of wind farm construction (e.g. minimum turbine spacings, acceptable gradients for tracks / hardstandings).

At the Proposed Development site, peat is relatively limited in extent, and therefore efforts have been made to minimise overlap as far as possible. This has prevented or minimised overlap with peat as follows:

- Complete avoidance of peat >1.0 m by both permanent and temporary hardstandings for all turbines – the average depth of soil under permanent hardstandings is 0.25 m.
- Where there is overlap of permanent and temporary hardstandings with peat, the average depth in overlapping areas is 0.55 m and occurs only at Turbines 1, 2, 4, 8 and 15, and where this is the case, peat is generally in isolated pockets or at the margins of wider peat deposits.
- Tracks have been routed to avoid peat where possible (noting constraints of gradient and bend radius required for safe construction and viable blade transport respectively), e.g.:
    - The southern access track is routed around peat on the approach to Turbine 9 and on the switchback to Turbine 7.
    - The track approaching Turbines 8 and 11 is (as far as possible given slope) routed around peat or at ‘necks’ (narrower areas) in the peat footprint.
    - The tracks to Turbine 14, as well as 13 and 15, are also routed between deeper peat deposits and will be of floating construction in this area (which is amongst the deepest peat on site).
    - The tracks to Turbines 1, 2 and 4 (in the north of the site) also cross peat deposits at necks or are routed around localised deeper peat, even if these deposits are relatively small in planform.

Note that more extensive use of floating track was investigated but either gradients precluded safe construction or sections of peat traversed by track were too limited in extent to justify floating track construction and the associated cut-floating-cut transition sections required.

- No borrow pits have been specified in peat areas.
- No construction compounds have been specified in peat areas.

As a result, the proposed layout has prevented peat excavation over most of its footprint and the majority of excavation (a ratio of c. 10:1) is in organic soils, which are often thin.

2.3.2. Reuse

The primary reuse strategy for peat management is to use peat to reinstate temporary construction locations and dress permanent infrastructure to help prevent degradation of exposed aggregate surfaces and provide a landscape tie-in to surrounding areas. Reinstatement approaches are derived from the Good Practice guidance detailed in Section 2.1 and from wider good practice approaches developed as part of wind farm construction over the last few years and include:

- Full reinstatement of peat within the footprint of temporary infrastructure (e.g. the site compound and hardstandings for blade laydowns).
- Landscaping of the margins of permanent infrastructure using peat shoulders.

This is considered in further detail in Section 4.

2.3.3. Restore

Peatland restoration will be delivered via drain blocking in upper summit peat areas, principally in the southern part of the site. Approximately 4.6 km of drains have been cut into peat around Upper Knowe and will be blocked using conventional techniques. Further detail is provided in the OREP (Appendix 6.6 of the EIAR).

2.3.4. Disposal

No disposal of peat is proposed.

3. DESK STUDY

3.1. Site Overview

The site is located within the Lammermuir Hills in the Scottish Borders and consists of rolling hills ranging between 300 m and 500 m AOD that drain from the north and south towards the west-to-east aligned Dye Water, which flows east out of the site boundary at c. 220 m AOD.

In the north, the main summits are Meikle Law (468 m AOD) in the west (adjacent to Turbines 1, 4 and 6) and Byrecleugh Ridge (c. 440 m AOD) around which Turbines 2, 3 and 5 are distributed. In the south, Wedder Lairs (486 m AOD) sits just outside the southwest corner of the main infrastructure area and a series of low un-named summits fall gentled to c. 460 m AOD at Blythe Edge (south of Turbines 12 and 14). A series of broad and sloping interfluves (or ridges) fall towards the valley floor, each of which is drained by a minor, and usually named, watercourse (see Plate 3.1 and Figure 8.3.1).

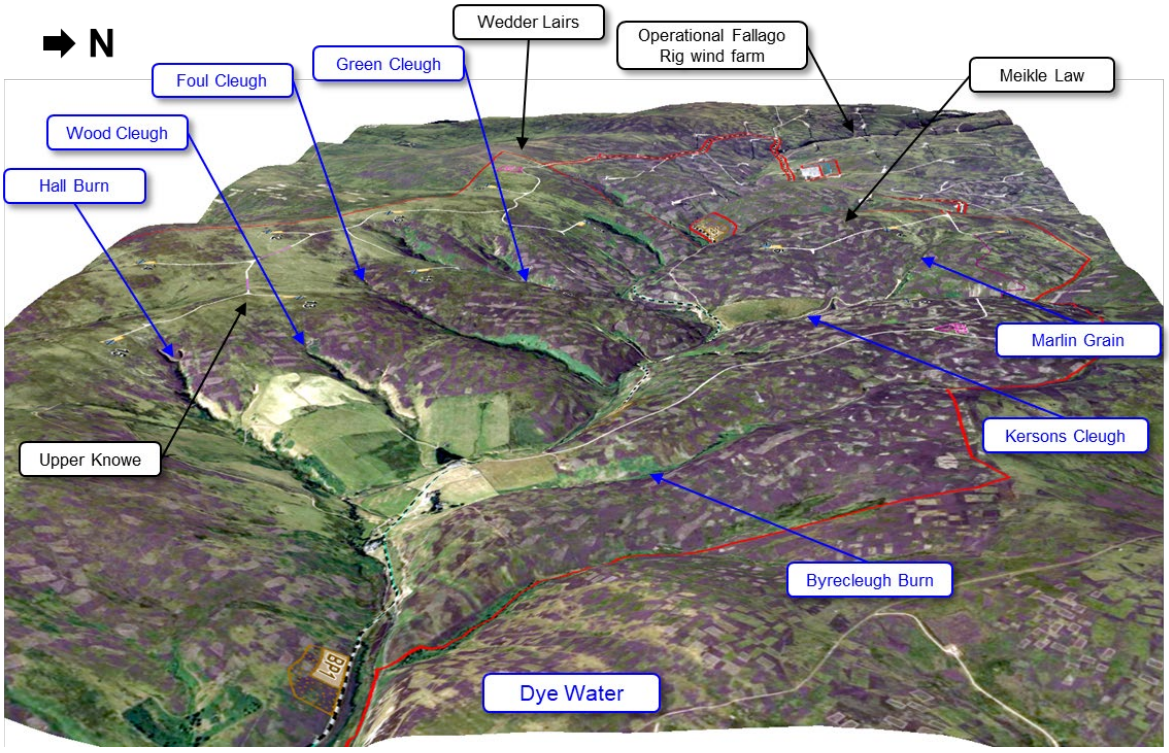

Plate 3.1 Perspective view of site (note 2x vertical exaggeration), the strong patterning associated with muirburn is clearly visible in the heather dominated (purple) upper slopes

Figure 8.3.2 shows slope angles derived from resampled publicly available LiDAR data at a raster resolution of 5 m. The broad summit bridge bordering the southern site boundary hosts gentle slopes of <2.5° which steeper relatively rapidly into the sideslopes of the interfluves that drain to the Dye Water, slope angles frequently exceeding 15° on these steep valley sides. The northern half of the site is split in two by Kersons Cleugh, again with gentle slopes on the summits to the north of Meikle Law and along Byrecleugh Ridge. Due to the severity of the sideslopes below the summits, wind farm infrastructure is concentrated on the gentle upper slopes and traversing of the sideslopes by tracks has been minimised.

3.2. Peat Depth

Peat depth probing was undertaken by Kaya Consulting in multiple phases in accordance with Scottish Government (2017) guidance:

- Phase 1 peat survey was carried out in March 2022 and September 2022.
- Phase 2 peat survey was then carried out in December 2022.
- In total, 3,088 locations were probed for peat depth across Phases 1 and 2.
- 15 cores were collected (at proposed turbine locations).

A peat survey report (EIA Report Appendix 8.2) documents the findings of these site investigations and summarises peat depth variation over the site:

- c. 38% of probed locations had depths <0.25 m and c. 43% depths between 0.25 and 0.5 m – these locations comprise organic soil and not peat.
- Of the remaining 19% of locations, c. 16% recorded depths between 0.5 and 1.0 m and the remainder > 1.0 m – the deepest peat on site was 3.8 m and was recorded along the northern boundary of the site on a saddle between Byrecleugh Ridge and Killpallet Rig.

A peat depth model was interpolated from the point data within the ArcMap GIS environment using a natural neighbour approach. This approach was selected because it preserves recorded depths at each probe location, unlike some other approaches (e.g. kriging), is computationally simple, and minimises 'bullseye' effects. The approach was selected after comparison of outputs with three other methods (inverse distance weighted, kriging and TIN).

The peat depth model is shown on Figure 8.3.3 with probing locations superimposed. Peat is generally absent below around 400 m AOD, occurring in saddles and above valley heads. The deepest areas can be found adjacent to Upper Knowe in the south of the site and at the northern site boundary north of Byrecleugh Ridge.

Comparison of the peat depth model with the layout indicates that significant efforts have been made during layout design to site infrastructure out of the deepest peat areas and to route access tracks onto shallower peat (see section 2.3.1). Much of the site optimisation occurred during interim layouts 5 to 12 (see Chapter 2 of the EIA Report).

3.3. Peat Geomorphology and Condition

Gentle (< 5°) planar summits dominate the upper elevations, below which moderate to steep slopes fall towards the Dye Water, incised into a series of steep valley sides within which the various minor watercourses flow. Minor gullying and erosion is present in various locations typically on the moderate slopes above valleys. Drains occur around the heads of some of the valleys, generally in areas where vegetation indicates localised flushes / diffuse surface drainage. Many of the gully heads have evidence of small scale cracking or minor tears, though none of these features appear to be associated with large-scale instability.

A map of peat geomorphology is provided within the PLHRA (EIA Report Appendix 8.4) based on interpretation of satellite imagery and subsequent field walkover and verification. The geomorphology as relevant to peat excavation and reuse can be summarised as follows:

- Peat deposits are generally planar, with little evidence of patterned ground, an absence of deep erosion (e.g. gullies) on gentle slopes and minimal areas of bare peat. Therefore there is minimal opportunity to use excavated peat to restore eroded areas.
- While peat cuttings are present in the far north of the site (near Turbine 3) they are minimal in size and are unlikely to be suitable for restoration purposes.
- Moor drains have been cut into both peat and non-peat covered slopes, principally around Upper Knowe, however these drains are relatively small in cross-section and are not currently proposed for infill using excavated peat.

Review of the Carbon and Peatland (2016) Map (inset, Figure 8.3.3) indicates the peat covered summits to be Class 5, i.e. carbon-rich soils but with no peatland habitat. Lower slopes are Class 4, i.e. are unlikely to be associated with peatland habitats. There are no Class 1 or Class 2 priority peatland categories within the site.

Ecological impact assessment (EcIA) of the site indicates primarily dry modified bog in the upper elevations of the site with abundant heather and cotton grass but very limited *Sphagnum* (see Appendix 6.2 of the EIA Report). A peatland condition assessment (PCA, EIA Report Appendix 6.8) indicates the site to be Modified by extensive burning, grazing and localised drainage, with extensive cover of heather and rarity of *Sphagnum*.

3.4. Drainage

The site is drained by the Dye Water, which flows east to join Whiteadder Water well outside the site boundary. In the main infrastructure area, to the south of the Dye Water, Green Cleugh, Foul Cleugh, Wood Cleugh and Hall Burn drain the southern ridge line and to the north of Dye Water, Kersons Clough (fed by Marlin Grain, Wester Grain, Easter Grain and Chapman's Grain), Brock's Cleugh and Byrecleugh Burn drain the northern hills. The minor tributaries are narrow but steep.

Chapter 8 of the EIA Report describes the sensitivities of the various watercourses, noting that the Dye Water is part of the River Tweed SAC (downstream of its confluence with Kersons Cleugh). Despite this, only the Dye Water was noted to have 'Poor Ecological Potential' by SEPA in 2020.

In addition to the natural watercourses, there are a small number of moor drains, primarily on the southern ridge line, but also on the east facing slopes of Meikle Law (where peat is absent). These total around 10 km in length, with c. 4.6 km around Upper Knowe. Approximately 28 ha of peatland is within 30 m of drains on Upper Knowe, much of which would potentially benefit from drain blocking. Plate 2.2 of the PLHRA (EIA Report Appendix 8.4) provides site photographs of typical hydrological features around the site.

3.5. Land Use

Land use is predominantly agricultural with widespread grazing and extensive muirburn to support grouse shooting (lines of grouse butts are marked on the Ordnance Survey sheets for the site and are also visible on the ground). Much of the upper elevations are dominated by heather, and the strong patterning associated with muirburn is very visible in the landscape (see Plate 3.1).

Other than agricultural uses, there is a network of agricultural boundary walls, informal tracks, farm buildings and dwellings and local quarries used to support construction activities within the valley floor.

4. PEAT EXCAVATION AND STORAGE

4.1. Excavation calculations

The majority of infrastructure comprising the Proposed Development will require full excavation of the peat or soils underlying the infrastructure footprints during construction (see Chapter 2 of the EIA Report). However, some infrastructure is not required post-construction (the construction compound, blade laydowns, secondary crane hardstandings and runover areas) and the peat and soil excavated from these areas will be directly reinstated. In this section, the following terms are used to describe groundworks associated with peat / soil and wind farm infrastructure:

- **Permanently excavated:** peat will be permanently removed from the infrastructure footprint, stored locally and reused elsewhere.
- **Temporarily excavated:** peat will be temporarily removed from the infrastructure footprint, stored locally and fully reinstated at the point of excavation post-construction.
- **Landscaping:** the process of using peat to 'dress' the boundaries of infrastructure.
- **Restoration:** the use of excavated materials to improve the quality of land areas that are considered degraded through mechanisms other than associated with wind farm construction (e.g. through cutting or erosion); the term is not used to describe reinstatement activities at infrastructure.

Excavation volumes have been calculated as the product of the average peat depth under each footprint (derived from the peat model) and the indicative footprint area (detailed for each infrastructure type below). Where peat depths exceed 0.5 m and infrastructure footprints are anticipated to exceed the indicative footprint area, additional ‘take’ has been specified to accommodate a 2:1 slope working area.

For each infrastructure item, the upper 0.3 m of the peat profile is assumed to be acrotelm and any remaining depth is assumed to be catotelm. A 0.3 m thickness of turf and underlying peat is a sufficiently thick continuous layer to avoid damaging the roots of the excavated vegetation and provide a coherent ‘turf’ to re-lay in an alternative location.

Soils less than 0.5 m in depth are assumed to be organic (or other) soils other than peat and are classed as 'soil' for the purposes of this assessment.

4.1.1. Turbines, hardstandings, secondary crane pads and blade lay downs

Each turbine location will comprise a circular turbine foundation (c. 25 m diameter), approximately half of which will overlap a main hardstanding (up to 50 m x 20 m), with temporary hardstandings for a secondary crane (19 m x 11 m) and for blade laydowns. Only the foundation and main hardstanding will be permanently excavated as they must remain in place for routine maintenance and decommissioning.

Plate 2 shows the layout for these infrastructure components.

The permanently excavated volumes for turbines and main hardstandings are based on each infrastructure footprint multiplied by the average peat depth determined from detailed infrastructure probing (see Figure 8.3.3). Temporarily excavated volumes for the secondary crane pads and blade laydowns are calculated in the same way.

*** Column total differs by 2 m^3 due to sub 1 m^3 values not shown in simplified table**

Table 4-1 shows excavation volumes.

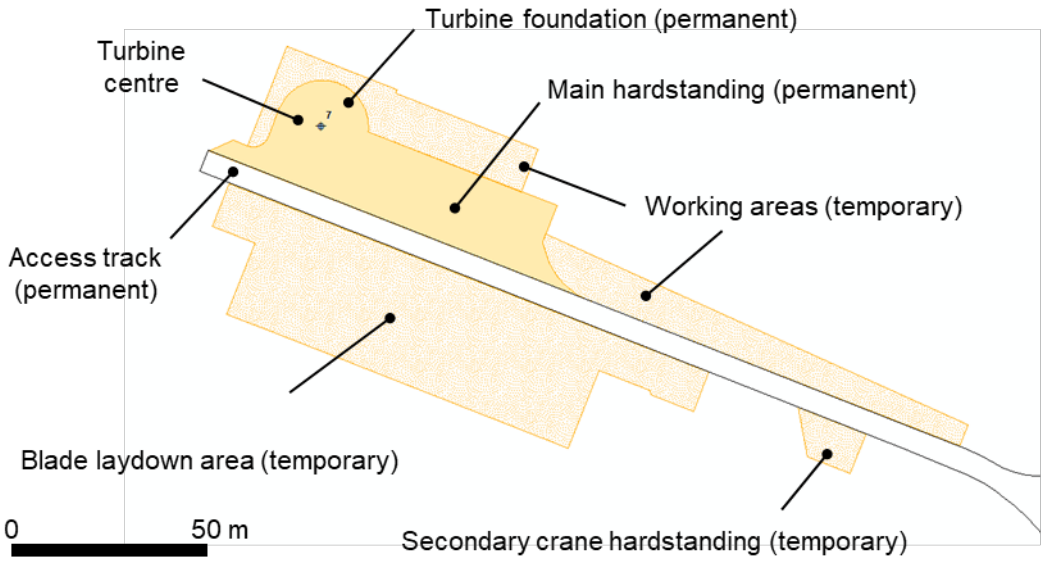

Plate 2 Indicative layout for turbines, hardstandings and track

4.1.2. Access tracks

Access tracks will comprise a 6 m wide running surface and will be constructed as floating track on peat in two main areas centred on Upper Knowe and as cut and fill tracks elsewhere. Floating tracks involve no excavation, and therefore no peat is generated from this element of site infrastructure. Cut tracks are specified for non-peat soils (<0.5 m) and where gradients do not allow floating tracks or where floating sections would be too short (typically <100 m) to justify transition pieces from cut to floating to cut forms of construction.

4.1.3. Cable trenches

Cable trenches are to be excavated alongside access tracks and all peat and soil excavated prior to cable placement will be directly reinstated after installation. Reinstatement is likely to be undertaken immediately after installation with very short-term sidecasting of materials, and therefore peat disturbed in this activity is not considered in the overall peat mass balance calculations.

4.1.4. Construction compound(s)

Four temporary construction compounds will provide storage for site plant and materials and will be reinstated post-construction. All excavated peat and soil will be stored locally and reinstated.

4.1.5. Substation

The substation will require an extension to the existing Fallago Rig substation (on the north and west side) and will be permanently excavated to substrate. Excavated organic soil (there is no peat) will be utilised in tying in infrastructure.

4.1.6. Borrow pits

Borrow pit search areas are on steep sided lower valley sides and limited probing in these areas shows minimal soil overlying the locations.

4.1.7. Excavation summary

Figures are quoted to 1 m^3 to avoid rounding errors leading to inaccurate totals in later tables rather than to imply accuracy of calculations to 1 m^3.

Infrastructure	Type of Excavation	Excavation Volume (m^3)			
		Acrotelm	Catotelm	Total	Soil
Access tracks	Cut & Fill	2,002	2,210	4,222	23,074
Turbine foundations and main hardstandings	Permanently excavated	226	178	4,04	6,804
Secondary crane and blade laydown hardstandings	Temporarily excavated	885	847	1,732	20,547
Substation	Permanently excavated	0	0	0	2,613
Construction Compounds	Temporarily excavated	0	0	0	7,439
Borrow pits	Permanently excavated	0	0	0	15
	Totals	**3,113**	**3,235**	**6,348**	**60,494***

*** Column total differs by 2 m^3 due to sub 1 m^3 values not shown in simplified table**

Table 4-1 Peat excavation volumes for all infrastructure

4.2. Reuse

Excavated peat will be re-used in three ways:

1. Reinstatement of temporary excavations for infrastructure.
2. Landscaping of permanent infrastructure to minimise visual impacts of infrastructure.
3. Extension of existing deep peat areas enclosed by constructed infrastructure.

4.2.1. Reinstatement

Direct reinstatement will take place of temporary working areas and temporary hardstandings around turbines and at the four construction compounds. Volumes to be directly reinstated are shown in Table 4-2.

4.2.2. Landscaping

In areas where track infrastructure is cut or floated on peat (>0.5 m on Figure 8.3.3), a standardised wedge-shaped shoulder size of 2.0 m x 0.5 m in cross-section has been specified. This is considered to be the minimum height required for effective tie-in purposes while being of sufficiently low gradient to be stable under its own weight. All batters will comprise acrotelmic peat with a vegetated turf top surface. The acrotelmic requirement is based on the plan area of turves required for the total length of track over peat soils, both floating and cut and fill. No catotelmic peat will be used for shoulders. Given the degree of drying already in evidence across the site (even in the slightly deeper peat areas), minimal degradation of the turved peat is expected.

Environmental benefits from peat batters include provision of a buffer effect on runoff from running surfaces on tracks and stabilisation of hardstanding verges (Lantschner et al, 2011). Track margins

in areas of organic soil will be tied in using excavated organic soils and overlying turves, but with a shoulder width of c. 4 m.

For permanent hardstandings, a batter of the same dimensions has been specified for the outer perimeter only (i.e. not adjacent to the turbine foundation / substation or track), in all cases being comprised of organic soils rather peat. No batter has been specified for the temporary compound and blade laydown hardstandings since these are temporary structures.

4.2.3. Extension of deep peat areas

In order to make best use of the peat excavated during construction, catotelmic peat and the remaining unused acrotelmic peat after tracks have been tied in will be used to increase the area of contiguous deep peat on the summits adjacent to proposed infrastructure, the latter providing buttressing to the emplaced deposits. Peat at the highest elevations is more likely to remain wet for longer, and the larger the area of contiguous peat, the more resilient the peat mass is likely to be as a whole. The locations of these proposed extended deep peat 'shoulders' are shown on Figure 8.3.3 and each location can be seen to be contiguous deep peat already in setting.

The average depth of emplaced peat will be 0.3m and will comprise a checkerboard of catotelmic peat and acrotelmic peat, the former overlain with turves from areas of organic soil, where surplus are available, or seeded with locally appropriate species (e.g. heather and cotton grass). Given the already limited *Sphagnum* present on site, it is not proposed to harvest and mulch *Sphagnum* in these areas, as wet modified bog (or even blanket bog) is not characteristic of the current setting.

4.2.4. Reuse summary

Table 4-2 shows reuse volumes based on the descriptions above.

Infrastructure	Type of reuse	Re-use Volume (m^3)			
		Acrotelm	Catotelm	Total	Soil
Secondary crane and blade laydown hardstandings	Direct reinstatement	885	847	1,732	20,547
Construction compounds	Direct reinstatement	0	0	0	7,439
Peat shoulders	Tie-in of track margins in peat areas only	1,490	0	1,490	0
Soil shoulders	Tie-in of track margins and hardstandings in soil areas only	0	0	0	32,508
Extended deep peat shoulders	Extension of existing deep areas on summits	738	2,388	3,126	0
	Totals	**3,113**	**3,235**	**6,348**	**60,494**

Table 4-2 Peat reuse volumes for all infrastructure

4.3. Restoration

Restoration activities will focus on use of standard methodologies for drain blocking in the vicinity of Upper Knowe, reduction in the intensity of the muirburn regime / replacing burning with cutting within

the OREP area and reduced grazing. Further details are provided in the OREP (see EIAR Appendix 6.6).

4.4. Peat Balance

The peat and soil balance for the Proposed Development is shown in Table 4-3 below. The table indicates that there is sufficient peat to fully reinstate temporary infrastructure, provide dressing of permanent infrastructure and enable extension of deep peat areas on the hill summits.

In summary, based on the calculations undertaken for this report:

- Approximately 6,348 m^3 of peat are due to be excavated during construction.
- Of this, c. 1,732 m^3 will be directly reinstated at temporary hardstanding locations.
- Of the remaining c. 4,616 m^3, c. 1,490 m^3 of acrotelmic peat will be used as shoulders to tie infrastructure in with the surrounding landscape.
- The remaining c. 738 m^3 of acrotelmic peat and c. 2,388 m^3 of catotelmic peat will be used to extend the deep peat areas on the southern hill summit.

Due to careful site design, the vast majority of excavated material will be organic soil (c. 60,494 $m^{3)}$ rather than peat (i.e. at a ratio of around 10:1 for soil to peat).

Activity	Peat Balance (m^3)		
	Acrotelm	Catotelm	Total
Total excavation during construction (Exc. Vol.)	3,113	3,235	6,348
Total re-use by either direct reinstatement or in landscaping (Re-use Vol.)	(2,375) 885 + 1,490	847	3,222
Total used in restoration of cuttings (Rest. Vol.)	738	2,388	3,126
Peat mass balance (Exc. Vol. - (Re-use Vol. + Rest. Vol.))	**(Deficit) 0**	**(Surplus) 0**	**(Surplus) 0**

Table 4-3 Peat mass balance

The next section summarises good practice for excavation, handling, storage re-use and monitoring associated with peat excavations at the Proposed Development.

4.5. Recommended storage locations

Where possible, in order to avoid multiple handling of peat, excavated materials will be transported directly to their point of reuse. Where this is not possible, for example due to construction phasing e.g. a requirement to temporarily store adjacent to foundation working areas prior to reinstatement, storage will be required locally. In these cases, it is important to ensure peat is stored safely with minimal risk of instability of stored materials while they are kept in good condition prior to reinstatement. Section 5 provides good practice advice on peat storage.

5. GOOD PRACTICE

5.1. Background

Good practice measures in relation to peat excavation and reuse are now generally well defined following a number of years of practice (at wind farm sites) across the UK and Ireland. In Scotland in particular, there is an increasing body of experience relating to peat restoration, facilitated by Peatland Action (Scottish Natural Heritage, 2017). As a result, there are a number of specialist contractors who have experience in the planning, design and implementation of peat restoration works in the Scottish uplands. A key step in delivering the restoration proposals described above is identification of appropriate contractors to implement the restoration plans at each location.

The sections below outline good practice measures related to excavation and handling, storage, and reinstatement and restoration of peat in association with wind farm construction.

5.2. Excavation and handling

The following good practice measures are proposed for excavation and handling:

- A minimum thickness of 300 mm of acrotelmic peat or turved organic soil should be excavated where sufficient soil is present; where less than 300 mm is present, the full depth of soil and surface vegetation should be excavated.
- Excavation and transport of peat/soil shall be undertaken to avoid cross-contamination between soil horizons (e.g. organic soil and underlying mineral soil / substrate).
- Where possible, cross-tracking of plant over undisturbed vegetation should be minimised, and excavated materials transported to their storage locations along constructed track.
- If working is required away from constructed roads / tracks, the use of long reach excavators should be encouraged in order to minimise cross-tracking.
- If landscaping of road / track margins is required for temporary works, it is preferable for vegetated organic soils to be used for this purpose rather than acrotelmic peat (which should be stored).
- Wherever possible, double handling of peat should be minimised (in particular for catotelmic peat) by direct transport of materials to their point of storage.

5.3. Storage

The following good practice measures are proposed for storage:

- Eliminate storage where possibly by single handling from the point of excavation to a location of reuse.
- If storage cannot be avoided, minimise storage time by taking an holistic approach to excavation and restoration such that catotelmic peat (in particular) is used as soon as possible after excavation.
- Store excavated acrotelmic and catotelmic peat separately during excavation works, which will be undertaken by an experienced contractor specialising in peat groundworks and restoration.
- Acrotelmic peat and turved soil blocks should be stored turf side up to prevent damage to vegetation.

- Storing in areas of minimal gradient where 'runoff' or drainage away from the point of storage is minimised (these areas will also satisfy to avoid areas of lower stability)
- Fewer, larger stores will be preferable to a greater number of small stores, since the total potential area of drying surface will be less.
- Where storage is required in the medium term, preparing the peat to minimise the surface exposed to drying (e.g. through blading off of catotelmic peat and use of appropriate cover to minimise moisture loss).
- The Environmental Clerk of Works (ECoW) should work with an appointed Geotechnical Engineer (GE) to review the placement and condition of stored peat.
- Storage areas should be outside any area identified in the PLHRA as of 'Medium' risk or greater (see Appendix 8.4, note there are no such areas present on site) and should be more than 50 m away from watercourses, away from sensitive habitats and away from the edge of excavations.
- Peat and soil stores should be appropriately bunded to prevent risks from material instability and prevent runoff of sediment and water from the stockpiles
- The condition of the excavated peat, in particular its moisture content, should be regularly monitored and local water utilised to periodically 'refresh' stored peat and prevent desiccation.
- A Sustainable Drainage System (SuDS) should be implemented to control water and sediment loss during storage (this also applies to reinstated areas, see below).

5.4. Reinstatement and Restoration

The following good practice measures are proposed for reinstatement and restoration:

- Where possible, turves and underlying catotelmic peat should be reinstated at the locations from which they were removed.
- Any bare peat exposed at the surface of a reinstated area should be seeded with a seed mix or translocated vegetation appropriate to the locality.
- Where insufficient turves are available to full cover reinstated soils, a checkerboard pattern of turf blocks should be used, with turf squares no less than 1 m^2 to act as seed points interspersed amongst the bare areas.
- Reinstated ground levels should tie in with the surrounds, and any bulking up should be avoided by tamping down soils and turves.
- If appropriate, temporary fencing may be required to enable vegetation to establish following reinstatement works and prevent damage by livestock, deer or rabbits.

5.5. Monitoring

During construction, monitoring should be undertaken in any areas where peat is stored, as follows:

- Regular visual inspection of the outer peat surface of any stored peat to identify any evidence for drying or cracking.
- Regular coring of stored peat to log the moisture content of stored peat (using the von Post scale to monitor changes in moisture content for peat on the outside and within the peat mound).

- Clear specification of an action plan in response to these observations, including modifications to coverings, implementation of watering, or construction of temporary berms to retain water in the storage footprint.
- Acceleration of re-use for vulnerable stores if so identified.

Key to the success of the strategy for peat management will be careful monitoring of the post-construction works and any restoration activities. A monitoring programme should be initiated once restoration and peat reinstatement works have been completed, and should include:

- Review of % vegetation cover and vegetation composition in areas of bare peat that have been reinstated or in any areas that have been seeded (due to a lack of available turved material).
- Review of stability of deposits in their new locations.
- Fixed point photography in order to aid review over a series of monitoring intervals.

If required, mitigation recommendations should follow from the monitoring and include:

- Specification of seeding appropriate to the target vegetation or stabilisation with geotextile if revegetation is not occurring naturally (which will assist re-wetting and retention of moisture contents).
- Construction of wood dams (or equivalent) if any creep of peat soils is evident at any restored location.

Monitoring should be carried out for a minimum of five years after construction and reinstatement works have concluded.

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