Appendix 12.2 Peat Management Plan

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Appendix 12.2 Peat Management Plan

Introduction

Background

This Stage 1 (Outline) Peat Management Plan (PMP) has been prepared by ITPEnergised on behalf of Nisthill Wind Farm Ltd (the Applicant) for the proposed Nisthill Wind Farm (the Proposed Development), located 5 km west of Birsay, Orkney, shown in Figure 1.

The Proposed Development will comprise 4 No. turbines and associated infrastructure, shown in Figure 2.

The PMP was led by David Nisbet, Head of Geology & Peat at ITPEnergised. David has a BSc in Earth Science and 10 years' experience in geology and environmental consultancy. David has led geology and peat assessments on many renewable energy and electrical transmission projects across the United Kingdom and Ireland, including PLHRA, Peat Management, Engineering Geological Assessment and Carbon Balance calculations.

Objectives

The aim of the Outline PMP, undertaken in accordance with generally accepted best practice guidance is to ensure that there has been systematic consideration of peat management and a quantitative assessment takes place throughout the development process. The PMP is required to show:

- How, through site investigation and iterative design, the Proposed Development has been structured and designed to minimise, so far as reasonably practicable, the quantity of peat which will be extracted;
- That volumes of peat anticipated to be excavated by the Proposed Development have been considered; and
- How excavated peat will be managed.

Ground Conditions

Definitions of Peat

Peat is defined as an organic soil comprising the partly decomposed plant remains that have accumulated in-situ, rather than being deposited by sedimentation. When peat forming plants die, they do not decay completely as their remains become waterlogged due to regular rainfall. The effect of waterlogging is to exclude air and hence limit the degree of decomposition. Consequently, instead of decaying to carbon dioxide and water, the partially decomposed material is incorporated into the underlying material and the peat 'grows' in-situ.

The Scottish Government Peat Landslide Hazard Best Practice Guide (2017) uses the following Joint Nature Conservation Committee (JNCC) report 455 'Towards an Assessment of the State of UK Peatlands' definition for classification of peat deposits:

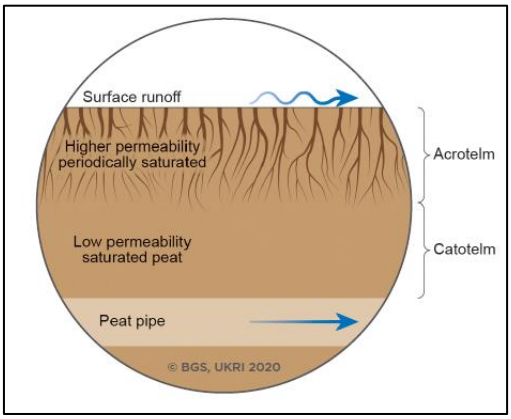
- Peaty (or organo-mineral) soil: a soil with a surface organic layer less than 0.5 m deep;

- Peat: a soil with a surface organic layer greater than 0.5 m deep which has an organic matter content of more than 60 %; and
- Deep Peat: a peat soil with a surface organic layer greater than 1.0 m deep.

There are two principal types of peat:

- The upper (acrotelm) layer in which the water table fluctuates, which is fibrous and comprises plant roots etc. The acrotelm is relatively dry and has some tensile strength and its thickness typically ranges from 0.1 m to 0.6 m deep.
- The lower (catotelm) layer, which is saturated, sitting permanently below the water table. The catotelm layer is highly decomposed, generally becoming more amorphous/liquid in nature and losing structure with increasing depth. The structure of catotelmic peat tends to disrupt completely on excavation and handling.

Plate 1.1 Typical Peat Profile



Peat Depth Assessment

A peat probing exercise was undertaken at the site in January 2022. Probing was undertaken on a 100 m grid across the full site area, in line with best practice guidance4.

A summary of the peat depths encountered during probing is detailed in Table 12.1 below and within Figure 3 of this appendix.

Table 12.1 Distribution of Peat Depth Recorded at the Site

Peat Depth Interval (m)	Number of Occurrences	% of Probes
Nil	0	0
T1 Hardstanding	0.15	
0.01 to 0.49	114	88.4
0.50 to 1.00	12	9.3
1.01 to 1.50	3	2.3
Total	129	-

Although British Geological Survey (BGS) mapping indicates that much of the eastern half of the site is underlain by peat deposits, the results of the probing show that peat deposits are limited, with 88% of probes identifying thin soils (<0.5 m). Just three probe locations identified thick peat (>1 m), to a maximum depth of 1.5 m.

The proposed infrastructure generally avoids areas of thick peat.

Table 12.2 Peat Depth at Infrastructure Locations

Infrastructure Element	Average Peat Depth (m)
T1	0.18
T1 Hardstanding	0.15
T2	0.17
T2 Hardstanding	0.19
T3	0.45
T3 Hardstanding	0.58
T4	0.67
T4 Hardstanding	0.36
Construction Compound W	0.16
Construction Compound E	0.3
Substation	0.2
Borrow Pit	0.1
New Access Track	0.23
Upgraded Access Track	0.36

Outline Peat Management Plan

This Outline PMP considers the excavation of peat and organic soils across the site resulting from construction of the Proposed Development. It considers the potential for minimising excavation and disturbance to avoid or reduce any unnecessary surplus of soil and peat.

Methodology

Design Principles

The Scottish Environmental Protection Agency (SEPA) has provided the following hierarchy of design principles to minimise the impacts associated with the excavation of peat.

- Prevention: The best management option for waste peat is to prevent or limit its production. This can be done through design, positioning infrastructure in shallower peat or through consideration of alternative construction methods or engineering solutions e.g., floated roads or piling solutions;
- Reuse (on site or offsite for peatland restoration): Using excavated peat in construction or reinstatement (where suitable) e.g., restoration of temporary hardstanding areas, verge reinstatement, screening bunds, peatland restoration etc;
- Recycling/Recovery/Treatment: Where peat cannot be reused on site or off site for restoration, it may be used for agricultural benefit or treated/blended with other materials to form a soil substitute or used in other relevant works. This use would require a waste management licence or registration as an exempt activity and compliance with the legal requirements;
- Storage: Temporary storage of peat on site (for example, during short periods in the construction phase) and then re-use. Should the peat become unsuitable for reuse during storage, it would be classed as a waste material;
- Disposal (Waste): Only after all other options have been explored and discounted would this option be considered.

Three main stages within the development process are defined within the guidance and describe what data should be gathered and assessed to inform the site specific PMP:

- Stage 1: Environmental Impact Assessment (EIA);
- Stage 2: Post-consent/pre-construction; and
- Stage 3: Construction.

This report has been prepared in accordance with the requirements for Stage 1. In line with the above guidance, a detailed PMP would be prepared post-consent, in advance of construction and would be informed by detailed ground investigation.

Potential Sources of Peat During Construction

Reasonable efforts to minimise impact on peat and requirement for excavation of peat – while taking account of other constraints – have been made in the design process, informed by desk study, walkover observations and targeted peat depth survey work.

The following activities are likely to generate excavation of peat during the construction process:

- Access Tracks;

- Wind Turbine Foundations;
- Crane Hardstandings;
- Substation and Construction Compounds;
- Borrow Pits; and
- Cable Trenching;

Access Tracks

As shown in Figure 3, the majority of proposed new access tracks are not sited on areas of peat, with an average depth of 0.23 m. General guidance suggests that tracks should be floated on areas of peat greater than 1 m. No excavation is required on floated tracks and therefore there is no associated peat excavation. At the Proposed Development site, no tracks are sited across areas where peat depth greater than 1 m has been recorded, therefore no floated track sections are proposed.

Appropriate drainage will be designed to mitigate disruption to natural hydrological drainage pathways.

Excavated access tracks in peat require complete excavation to a competent substrate. This peat would require storage ahead of reuse alongside the track in appropriate locations. Good practice in association with excavated tracks is as follows:

- Trackside ditches should capture surface water (within the acrotelm) before it reaches the road;
- Any additional interceptor drains associated with the track construction should be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table); and
- Any stripped peat turves should be placed back in the invert and sides of the ditch to stabilise the banks and assist regeneration.

Access tracks are permanent infrastructure and therefore any excavated peat would be considered a loss, unless it can be re-used elsewhere on the site.

Wind Turbine Foundations

Wind turbines in peatland would generally require full and permanent excavation of peat and soils to competent strata. Temporary excavation from a wider diameter would also likely be required to gain access to the base of the excavation.

Any peat excavated would be considered a loss, unless it can be re-used elsewhere on site.

All turbines are located on peaty soils (<0.5 m), apart from T4 where the average depth is 0.67 m.

Crane Hardstandings

Similarly, crane hardstandings require excavation to a competent stratum, with any excavated peat considered a loss if it cannot be reused on site. All hardstandings have avoided peat and are located on soils <0.5 m thick, excluding T3 where the average depth is 0.58 m.

Substation and Construction Compounds

Temporary construction compounds would be required during the construction phase for storage of construction materials, turbine components and fuel, concrete batching plant and siting of welfare and office facilities. Should peat be excavated during the construction of the compound, it would normally be stored locally and reinstated on completion of works. Both construction compounds and the proposed substation are located on soils less than 0.3 m thick.

Borrow Pit

Materials for access tracks and hardstandings are proposed to be sourced from extension of the existing borrow pit on site. The borrow pit has been selected based on its morphology and anticipated proximity of bedrock to surface. Any excavated peat would require to be reused on site, most likely in the restoration and landscaping of the borrow pit post construction. There is no peat (>0.5 m) expected at the proposed borrow pit location.

Cable Trenching

Electric cabling would typically be buried/ducted in trenches alongside the proposed track network, where practicable. Should cables be buried within existing peat, excavated peat would generally be replaced at its point of origin and therefore not considered a loss.

Proposed Mitigation During Construction

There are four main types of impact on peat which can occur during construction. These are:

- Loss of structural integrity and peat strength, due to stripping off or damaging the surface vegetation turf, excavation, handling and transporting peat (particularly wet, subsurface peat);
- Erosion and gullying, caused by exposure and desiccation of bare peat surfaces primarily caused by water erosion, due to surface runoff after rainfall;
- Contamination, caused by leaks, spillages or inappropriate laydown of materials; and
- Peat slide, caused by laying wet peat on top of wet peat, laying other heavy materials (including excavated mineral soil or other construction materials) on top of wet peat or by inappropriate stockpiling, such as attempting to create stockpiles of peat that are too high, without bunding, engineering or geotechnical support.

A range of methods and control measures are described below which are designed to prevent these impacts from occurring. This best practice guidance should be adhered to throughout the construction phase.

Peat Excavation and Handling

As described previously there are two distinct layers of peat; the acrotelm (including the vegetated turves) and the catotelm. These distinct layers should be recognised during peat excavation and reuse activities.

Excavation

If peat is to be reused or reinstated with the intention that its supported habitat continues to be viable, the following good practice applies:

- Peat should be excavated as turves, including the acrotelm (surface vegetation) and a layer of adjoining catotelm (more humified peat) or as blocks of catotelmic peat;

- The acrotelm should not be separated from its underlying peat, if possible, the full depth of acrotelm layers from the top surface of the peat deposit should be excavated together;
- Turves should be as large as possible to minimise desiccation during storage;
- Mineral soils should be transported and stored separately to reduce the risk of contamination of excavated peat;
- The timing of excavation of peat should avoid periods of very wet weather and multiple handling of peat should be avoided to reduce the risk of peat losing its structural integrity

Temporary Storage

Peat storage will only be required where reinstatement is not immediately possible, and all stored peat will be reinstated at the end of the construction phase. To ensure that the storage locations are suitable in terms of environment, construction practicality and safety, the precise location of temporary peat stockpiles should be determined at a site level following consideration and assessment of suitable areas by the Environmental Clerk of Works (ECoW), Geotechnical Engineer and contractor using the guiding principles below:

- Peat turves should be stored in wet conditions or irrigated to prevent desiccation (once dry, peat will not rewet);
- Stockpiling of peat should be in large volumes to minimise exposure to wind and sun but with due consideration for slope stability;
- Excavated peat and topsoil should be stored to a maximum of 1m thickness (unless otherwise agreed by the Geotechnical Engineer);
- Stockpiles of peat should be isolated from any surface drains and a minimum of 50 m from watercourses, and stockpiles should not be located on areas of deep peat, in order to avoid increasing peat slide risks associated with additional loading;
- Stockpiles should include appropriate bunding to minimise any pollution risks where required. Excavated topsoils would be stored on geotextile matting to a maximum of 1 m thickness;
- Stores of non-turf (catotelm) peat should be bladed off to reduce the surface area and desiccation of the stored peat; and
- Monitor areas of steep peat/storage during period of wet weather, or during snow melt, to identify early signs of peat instability.

Temporary Storage around Infrastructure

Where peat cannot be transferred immediately to an appropriate restoration area, short term storage will be required. The following good practice applies:

- Peat should be stored around the perimeter at sufficient distance from the cut face to prevent overburden induced failure;
- Local gullies, drainage lines, wet ground and steep slopes should be avoided;
- Stored upper turves (incorporating vegetation) should be organised and identified according to National Vegetation Classification (NVC) community (assisted by ECoW) for reinstatement adjacent to like communities in the intact surrounding peat blanket;

- Drying of stored peat should be avoided by irrigation (although this is unlikely to be significant for peat materials stored less than 2 months).

Where longer term storage is required (>2months) the following good practice applies:

- Peat generated should be transported directly to its allocated restoration area to minimise the volume being stockpiled, with the possibility of drying out;
- Stores of catotelmic peat should be bladed off to reduce surface area and minimise desiccation; and
- Monitoring of large areas after wet weather or snow melt.

Transport

Movement of turves should be kept to a minimum once excavated, and therefore it is preferable to transport peat planned for translocation and reinstatement to its destination at time of excavation.

If HGVs are used for transporting non-peat material and excavated peat, measures should be taken to minimise the risk of cross-contamination.

Handling

A detailed storage and handling plan will be prepared by the Principal Contractor as part of the construction phase PMP, including:

- Best estimate excavation volume at each infrastructure location (including peat volume split into acrotelm or 'turf' and catotelm);
- Volume to be stored locally and volume to be transferred directly on excavation to restoration areas elsewhere to minimise handling;
- Location and size of storage area relative to natural peat morphology and drainage features; and
- Irrigation requirements and methods to minimise desiccation of excavated peat during short term storage.

These parameters will be determined by the contractor prior to construction.

Reinstatement and Restoration of Construction Disturbed Areas

- Undertake reinstatement/relocation and revegetation works as soon as possible;
- Where required, consider exclusion of livestock from areas of site undergoing restoration;
- As far as is reasonably practicable, restoration should be carried out concurrently with construction rather than at its conclusion; and
- To ensure safe reuse, all peatland restoration works should be subject to assessment by a geotechnical specialist, ensuring that emplacement of peat will not increase the likelihood of peat instability.

Site Based Excavation and Management Assessment

This outline PMP has been undertaken as part of the Environmental Impact Assessment for the Proposed Development. The PMP aims to ensure that:

- there is a clear understanding of any peat on site;
- the total volume of peat that may be excavated is known;
- the design avoids areas of deep peat where possible; and
- the reuse of excavated materials is certain and minimised where possible, in line with industry good practice and guidance.

Estimated Peat Excavation and Reuse Volumes

Encompassing all data gathered from peat probing, aerial photography reviews and site walkovers, the total predicted volume of excavated materials has been calculated, with estimates of reuse (see Table 12.3).

The total peaty soil/peat volumes are based on a series of assumptions for the Proposed Development and peat depth data averaged across discrete areas of the development. Such parameters can still vary over small scale and therefore topographic changes in the bedrock profile, historical ground disturbance etc. may impact the total accuracy of the volume calculations.

Reuse

This section of the PMP includes methods for dealing with peat which could potentially be classified as waste (only if the material cannot be reused).

Excavated peat from the construction process will be reused in the following ways:

- Reinstatement of temporary infrastructure;
- Appropriate landscaping of new infrastructure e.g., track sides, hardstanding etc.

Table 12.3 Excavation Materials Management Plan

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat and Peaty Soils (m^3)	Estimated Volume of Potential Peat and Peaty Soil Reuse (m^3)	Notes
Excavated Access Tracks Total length of the access tracks would be approximately 3.2 km, consisting of the following: - 2.5 km of new track (excavated) - 0.65 km of existing, upgraded tracks	0.23 (new track) 0.36 (upgraded track)	New Track: 3,519 m^3 (2550 m x 6 m x 0.23 m) Upgraded Track: 461.50 m^3 (650 m x 2 m x 0.36 m) **Total: 3,980.5 m^3**	Verge restoration and visual screening, particularly along access track. **6,400 m^3** (3200 m x 2m x 0.5m) x 2 of peat and peaty soils.	Requires detailed ground investigation to fully characterise peat/peaty soils.
Turbine Foundations 4 No. turbines Average excavation of up to 28m diameter	0.37	**1,152.48 m^3** (28 m x 28m x 0.37 m) x 4	At turbine foundations, topsoil would be stripped, keeping top ~200 mm of turf intact. This would be stored adjacent to the base working area and would be limited to 1 m in height. **224 m^3** could be used to dress the edges of the turbine bases. (56 m x 2m x 0.5m) x 4	Requires detailed ground investigation to fully characterise peat/peaty soils.
Hardstandings	0.32	Permanent: 1,280 m^3 (50 m x 20 m x 0.32 m) x 4	At crane hardstandings, topsoil would be stripped, keeping top ~200 mm of turf intact. This would be stored	Requires detailed ground investigation to fully characterise peat/peaty soils.

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat and Peaty Soils (m^3)	Estimated Volume of Potential Peat and Peaty Soil Reuse (m^3)	Notes
4 No. crane hardstandings. Average permanent excavation of 50 m x 20 m x 0.32 m with additional temporary laydown areas amounting to 5755 $m^{2.}$		Temporary: 7,366.40 m^3 (5,755 m^2 x 0.32 m) x 4 **Total: 8,646.40 m^3**	adjacent to the base working area and would be limited to 1 m in height. Material excavated for temporary areas would be stored and reinstated on completion of construction. **360 m^3** could be reused to dress the edges of the hardstanding area. (90 m x 2 m x 0.5 m) x 4 Material excavated from temporary hardstand locations (**7,266.40 m^2**) (blade laydown and ancillaries) would be reinstated following construction.	
Construction Compounds Two temporary constriction compounds 50 x 50 m and 25 x 50 m respectively.	0.16 (west) 0.30 (east)	West: 400 m^3 (50 m x 50 m x 0.16m) East: 375 m^3 (50 m x 25 m x 0.3 m) **Total: 775 m^3**	Due to its temporary nature, material excavated to form the construction compounds would be reinstated on completion of construction. **775 m^3**	Requires detailed ground investigation to fully characterise peat/peaty soils.

Infrastructure Location	Average Peat Depth (m)	Estimated Volume of Excavated Peat and Peaty Soils (m^3)	Estimated Volume of Potential Peat and Peaty Soil Reuse (m^3)	Notes
Substation 25 m x 50 m	0.20	**250 m^3** (25 m x 50 m x 0.2 m)	**100 m^3** could be reused to dress the edges of the substation area. (100 m x 2 m x 0.5 m)	Requires detailed ground investigation to fully characterise peat/peaty soils.
Borrow Pit Maximum dimension of search area is 130 m x 120 m (including existing excavation)	0.1	**1,560 m^3** (130 m x 120 m x 0.1 m)	Limited peaty topsoil can be stockpiled and used for reinstatement elsewhere on site or in restoration of the proposed borrow pit site. **1,560 m^3** (130 m x 120 m x 0.1 m)	Borrow pit design and dimensions to be confirmed following detailed ground investigation to assess suitability. The proposed borrow pit is an extension of an existing site, where rock has been identified close to surface with no peat or significant overburden anticipated.
TOTAL	-	**16,364.38 m^3**	**16,775.40 m^3**	-

The majority of the soils excavated on site are expected to comprise mineral and peaty soils, with some acrotelmic peat. Catotelmic peat is not expected to be excavated during construction of the Proposed Development. Based on the values indicated, there is a balance of materials with no surplus peat anticipated to be generated on site – see Annex 2. Should further ground investigation information become available, the figures would need to be re-calculated.

Monitoring and Inspection

The construction phase of the development would be supported by a Geotechnical Engineer and ECoW. There would be frequent, routine, and regular inspections of peat in all stockpiles and temporary storage areas as part of the PMP audit process. Inspections would assess in situ peat physical conditions, integrity of containment and temporary drainage conditions, and they would seek to confirm that stockpile design and management was adequate to prevent erosion and peat slide. These inspections would take place weekly (at a minimum) during stockpile creation and storage.

Should any problems be observed during regular visual inspections of peat stockpiles, this would invoke implementation of an appropriate corrective action which would be recorded and monitored for effectiveness. Types of corrective actions would include, but would not necessarily be limited to:

- modification of temporary drainage;
- additional or modified bunding;
- incorporating of sediment fencing if required; and
- light re-grading to correct any areas of surface erosion, etc.

Regular, frequent inspections of peat conditions during construction and restoration phases of work would be carried out by the Geotechnical Engineer and ECoW as follows:

- Peat surface, peat profile and peat consistency conditions would be carried out as part of ground investigations prior to the start of construction. This information would provide detailed information on the baseline conditions for each part of the infrastructure footprint.
- Restored peat conditions would be inspected immediately after restoration to ensure that the methods detailed in the PMP had been correctly implemented and to inform any corrective actions should they be required.
- The physical condition of peat would be retained as carefully as possible both at the peat storage and the peat restoration stages. This is particularly important for vegetation establishment.
- Within 3 months of completion of works in any area, the ECoW inspects the reinstatement efforts to determine satisfactory placement of sub-soil, topsoil and turves.
- The ECoW (or other qualified person) undertakes a final inspection of all reinstated areas at the end of the first growing season following completion of reinstatement.
- The ECoW should complete a daily diary of onsite activities which would be compiled within a monthly ECoW report which will include information relating to peat reinstatement, these reports will be available at the request of the Planning Authority.

Conclusion

The Outline PMP follows the guiding principles and has been created in adherence with best practice guidance.

The PMP addresses the following peat related issues:

- The depth of peaty soils/peat deposits at site;
- The volumes of peaty soils/peat that are predicted to be excavated and its suitability for reuse;
- The capacity to reuse the peat onsite; and
- Peat handling and temporary storage.

The figures detailed within this report are to be considered indicative at this stage. The total excavation volumes are based on a series of assumptions for the Proposed Development and peat depth data averaged across discrete areas of the development. Such parameters can still vary over small scale and therefore topographic changes in the bedrock profile, historical ground disturbance etc. may impact the total accuracy of the volume calculations.

A series of good practice standards detailed within this report relating to excavation, handling and storage of peat should be utilised to maintain the structural integrity of excavated peat and its suitability for reuse.

It has been concluded that all the materials to be excavated on site would fall into the non-waste classification as all of the topsoil and peaty soils would be re-used on site. Based on the probing exercise and observations on site, the excavated materials are likely to comprise predominately organic topsoils and acrotelmic peat, with limited catotelmic deposits present. Thick peat deposits are limited across the site and have been avoided by design.

All excavated material is expected to be entirely reusable, with no surplus of peat anticipated.

Post consent, the Outline PMP and Construction Environmental Management Plan (CEMP) should be updated with information gathered during detailed ground investigation.