ScottishPower Renewables

Hare Hill Windfarm Repowering and Extension

Environmental Impact Assessment Report

Volume 3

Technical Appendix 9.4: Outline Peat Management Plan

November 2025

ScottishPower Renewables

Index

Abbreviations

Abbreviation	Description
BGS	British Geological Survey
BP	Borrow Pit
EIA	Environmental Impact Assessment
LDP	Local Development Plan
NPF4	National Planning Framework 4
PMP	Peat Management Plan
SEPA	Scottish Environmental Protection Agency
SNH	Scottish Natural Heritage (now NatureScot)

1. Introduction

1. This Outline Peat Management Plan (PMP) provides information and guidance on the environmentally compliant re-use and management of excavated peat at Hare Hill Windfarm Repowering and Extension (the proposed Development). This information is required to support the assessment of potential environmental impacts assessed in **Volume 1 Chapter 9: Hydrology, Hydrogeology, and Geology** of the Environmental Impact Assessment (EIA) Report.

2. The information presented in this Outline PMP should be used to inform the wider assessments carried out for the proposed Development. The study has drawn on information collected as part of a peat study, including a desk-based study followed by a phase one and phase two peat depth surveying exercise, as well as a peatland condition assessment. The Outline PMP, as outlined in this document, estimates the total volume of excavated peat likely to be produced by the proposed Development and outlines reuse methods in line with regulatory requirements and industry good practice methods across the application area (the Site).

3. This strategy should be adopted to allow peat to be managed in a sustainable manner, minimising excavation via the adoption of appropriate construction methods. Targeted re-use of peat as part of the reinstatement works would also be a primary consideration.

1.1. Regulatory Context

4. This document addresses the following requirements in line with the Scottish Environment Protection Agency (SEPA) Regulatory Position Statement – Developments on Peatland and Off-Site Uses of Waste Peat (2017):

   - Prevention – The best management option for waste peat is to prevent its production; and
   - Re-use – Developers should attempt to re-use as much of the peat produced on Site as possible.

5. In general, the following guidance has fed into the design assumptions and subsequent selection of appropriate construction methods based on the distribution of peat depths across the Site:

   - Developments on Peatland: Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (A joint publication by Scottish Renewables, NatureScot, SEPA, Forestry Commission Scotland, 2012);
   - Peatland Survey: Guidance (2017). Scottish Government, NatureScot, SEPA;
   - Good Practice During Wind Farm Construction (A joint publication by Scottish Renewables, NatureScot, SEPA, Forestry Commission Scotland, 2024);
   - Floating Roads on Peat (Forestry Civil Engineering & SNH, 2010); and
   - Guidance on Design Principles for Renewable Energy Development on Peatland on the National Forests and Land (Forestry and Land Scotland, 2024), Version 1.

6. The document also considers the National Planning Framework 4 (NPF4), published in February 2023 (updated 2024), and the approach to soils in Policy 5 detailed below:

"a) Development proposals will only be supported if they are designed and constructed:

I. *In accordance with the mitigation hierarchy by first avoiding and then minimising the amount of disturbance to soils on undeveloped land; and*

II. *IIn a manner that protects soil from damage including from compaction and erosion, and that minimises soil sealing.*

b) Development proposals on prime agricultural land, or land of lesser quality that is culturally or locally important for primary use, as identified by the LDP, will only be supported where it is for:

III. *The generation of energy from renewable sources or the extraction of minerals and there is secure provision for restoration; and*

in all of the above exceptions, the layout and design of the proposal minimises the amount of protected land that is required.

c) Development proposals on peatland, carbon rich soils and priority peatland habitat will only be supported for:

I. *Essential infrastructure and there is a specific locational need and no other suitable site;*

II. *The generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets;*

III. *Small-scale development directly linked to a rural business, farm or croft;*

IV. *Supporting a fragile community in a rural or island area; or*

V. *Restoration of peatland habitats.*

d) Where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify:

I. *the baseline depth, habitat condition, quality and stability of carbon rich soils;*

II. *the likely effects of the development on peatland, including on soil disturbance; and*

III. *the likely net effects of the development on climate emissions and loss of carbon."*

1.2. Scope and Purpose

7. This Outline PMP provides a strategy to allow peat to be managed in a sustainable manner, minimising excavation via the adoption of appropriate construction methods as well as detailing targeted and appropriate re-use of peat as part of the reinstatement works. Central to this strategy is both minimising impacts on peatlands through avoidance and design, as well as striving to ensure the peatland system is capable of carbon sequestration.

8. This Outline PMP addresses the regulatory principles set out in **Section 1.1** by establishing the following objectives:

- providing information on the geology and pedological setting of the Site using published data including previous assessment documents;

- information on the peat conditions based on the additional field surveys and ground investigations undertaken at the Site and assess its suitability for re-use;
- information on the measures taken to avoid peat;
- information on the elements of the proposed Development that are likely to require peat extraction;
- an estimation of the peat volumes likely to be extracted at each element of the proposed Development;
- an estimate of the peat volumes that are anticipated to be suitable for re-use in reinstatements and landscape tie-ins; and
- information on control measures and appropriate management of the peat during handling and storage.

1.3. Peat Definitions

9. Peat is an organic material formed by the accumulation of plant matter at various stages of decomposition, formed over potentially many thousands of years. The characteristics of peat vary widely depending on factors such as the nature of plant material that peat is derived from, the degree of decomposition, the type of peat bog and the quality of water sustaining the bog. In Scotland, the Scottish Government et al. (2014), Joint Nature Conservation Committee (2011), the James Hutton Institute (2019) and Bruneau and Jonson (2014) defines peat and deep peat as follows:

   - Organo-soils (or peaty soils): soils with an organic horizon less than< 0.5 m thick;
   - Peat: soils with an organic horizon greater than 0.5 m in thickness and an organic matter content exceeding 60%; and
   - Deep peat: a peat as defined above, with a depth greater than 1.0 m.

10. There are two distinct types of peat, termed acrotelmic and catotelmic peat. The interface between the two layers is controlled by the position of the water table. The upper layer of peat, the acrotelm, is typically fibrous and comprises the living and partially decomposed peat forming plant matter (vegetation). The thickness of the acrotelm is typically controlled by seasonal variations in the water table that creates cycles of aerobic and anaerobic conditions. The catotelm is situated below the minimum average depth of the water table resulting in permanent anaerobic decomposition of the plant matter and the formation of less fibrous, sometimes amorphous peat.

11. A key aim of the Outline PMP is to encourage the functionality of the peatland system following reinstatement. Peat should only be re-used to create a suitable tie-in with surrounding vegetation and to reinstate adjacent ground which has been disturbed during construction. Peat must retain hydrological connectivity to remain functional.

2. Site Context

12. Information concerning the hydrology and hydrogeology of the Site, including a summary of the distribution of mapped soil types are presented **in Chapter 9: Hydrology, Hydrogeology and Geology** of the EIA Report, which this technical appendix supports.

13. The following figures presented in **Volume 2** of EIA Report should be viewed in conjunction with this Outline PMP:

- Figure 9.2: Carbon and Peatland Map (2016);
- Figure 9.3: Peatland Condition Assessment;
- Figure 9.4: Interpolated Peat Depths; and
- Figure 9.5: Predominant Soils.
- Figure 9.6: Superficial Geology
- It is also recommended this Outline PMP be read in conjunction with **Technical Appendix 9.6 Peat Slide Risk Assessment Stage 2**.

2.1. Baseline Condition

2.1.1. Published Geology and Soils

14. The Carbon and Peatland Map (2016) presented in **Figure 9.2**, shows that the peat deposits found within the Site are primarily Class 1 (Nationally important), Class 3 (Occasional peatland habitat) and Class 5 (No peatland vegetation) soils with pockets of Class 0 (Mineral Soil), Class 2 (Nationally important) and 4 (Unlikely peatland habitat) soils are also present.

15. Review of the National soil of map of Scotland (Scotland's Soils, 2024) indicates the proposed Development features dystrophic blanket peat, peaty gleys, peaty gleyed podzols, and humus-iron podzols (**see Figure 9.5**). The predominant soil type is dystrophic blanket peat and peaty gleyed podzols. The BGS Superficial Geology map (BGS, 2023) indicates that the majority of the proposed Development is underlain by peat deposits as shown in **Figure 9.6**.

16. NatureScot notes that site-specific surveys will always be required to confirm the quality and distribution of peatlands across a site (NatureScot, 2015). The consideration of the carbon and peatland, soil and superficial geology maps is therefore superseded by site-specific surveys, for example a peatland condition assessment and peat depth surveys to determine the true baseline condition.

2.1.2. Peatland Condition

17. A peatland condition assessment was conducted in February 2025 using the NatureScot Peatland Condition Assessment Guidance (Peatland ACTION, 2016). The results (presented in **Figure 9.3** and **Chapter 9, Table 9.11.)**, indicate that the vast majority of peatland areas were identified as modified (61.9 %) and drained (37.5%). Near natural

condition was identified for 0.2 % of the surveyed area, located in three discrete land parcels.

18. **Plate 2.1 to 2.6** show evidence of modified and drained peatland condition within the Site. Further details relating to the condition of peat and the approach to management and enhancement can be found in **Chapter 9** and **Technical Appendix 9.6.**

Source: Natural Power

Plate 2.1: **Peat hagging on northern facing slope of Dun Rig, facing south from NS 66396, 08610**

Plate 2.2: **Extensive drainage system facing north west from NS 65558 05709 towards Blackcraig Hill**

Plate 2.3:Peat hagging on northern facing slope. Facing east from NS 66105 08479

Plate 2.4:Actively eroding peat hags at NS 65507 08795

Plate 2.5: Peat hagging on southern ridge at NS 67267 06255

Plate 2.6: Artificial drainage on Mahago Rig, facing east from NS 67412 07106

2.1.3. Peat Depth Survey Results

19. Peat depth surveys were undertaken between May 2024 and March 2025 to carry out Phase 1 and Phase 2 investigations, in accordance with Scottish Government guidance (Scottish Government, Scottish Natural Heritage, SEPA, 2017). This was supplemented with peat depth data collected in 2013 as part of the Hare Hill Windfarm planning application.

20. Peat depths were recorded on a 100 m grid spacing across the entirety of the Site, on a 10 m grid spacing over all proposed infrastructure and on a 50 m spacing between 3 points transects along all tracks. The data covered 9,888 individual peat probe points.

21. **Table 2.1.1** provides a summary of the depths of the 9,888 points surveyed and **Figure 9.4** provides an interpolated representation of this.

Table 2.1.1 Total number of locations surveyed within each category.

Soil / Peat Depth Range (m)	Results	% of Points Surveyed
≤0.5	7,410	71
>0.5 - ≤1.0	2,040	19
>1.0 - ≤2.0	802	8
>2.0	207	2
Total	**10,459**	**100**

22. As presented in **Section 1.3** above, soils of less than 0.5 m are categorised as mineral soil and/or organo-mineral soil. The peat depth survey indicates that 71% of the surveyed points consist of peaty soils (≤0.5 m depth), with 19% of the peat probe data indicates areas of shallow peat (>0.5 – 1.0 m depth), and 10% of the peat probe data indicates deep peat. The vast majority of peat probe points (90%) are less than 1 m.

3. Approach to Design

23. ScottishPower Renewables (UK) Limited (the Applicant) has sought to minimise the potential impacts on peat through an iterative design process, optimising the distribution and orientation of the proposed infrastructure following the completion of each phase of surveying. The avoidance of peat as part of the design evolution was identified as a key objective from the outset. The turbine layout was optimised, where possible and subject to engineering constraints, to avoid areas of deep peat. **Chapter 4: Site Selection and Design Evolution** outlines the design iterations.

24. In the first instance previously, disturbed areas, such as existing tracks, have been selected where possible for proposed Development infrastructure. Additionally, alternative construction methods have been implemented to reduce peatland excavation e.g. use of floating tracks.

25. Where results of detailed design indicate that micro-siting within the allocated micro-sitting distance could achieve a reduction in the requirement for peat excavation this

would be investigated by the Principal Contractor and where possible, implemented following approval with the Local Planning Authorities, SEPA and NatureScot.

4. Peat Management

4.1. Peat Management Principles

26. A hierarchy of peat management approaches is provided in NPF4 (Scottish Government, 2023, updated 2024). This recommends the following, listed in order of most preferred approach to least preferred:

- Avoid – by removing the impact at the outset. Development should first seek to avoid areas of peatland, carbon-rich soils and priority peatland habitat.
- Minimise – by reducing the impact. Direct and indirect impacts of development should be limited to the minimum.
- Restore – by repairing damaged habitats. Any habitats that are damaged by the proposal (whether direct or indirect impacts) should be restored as far as is possible.
- Offset – by compensating for residual impact that remains, with preference to on-site over off-site measures. Effective restoration and management of degraded equivalent habitat should compensate for any losses.

27. The design of the infrastructure evolved throughout the assessment of the proposed Development in response to consultations, desk studies, field surveys and technical assessments undertaken by a range of disciplines in support of the EIA Report. The NPF4 mitigation hierarchy, out outlined above, has been applied in the following ways at the proposed Development:

- Avoid: Peat depth survey results were utilised to avoid, where possible, areas of shallow and deep peat.
- Minimise: To minimise disturbance of peat existing and floating tracks have been used, where possible. Of the proposed new access tracks approximately 16% are proposed as floating access tracks, and 3% are sited on existing tracks reducing the requirement to excavate peaty soils and peat.
- Restore: Peat will be used to reinstate temporary infrastructure so it can return to a functioning peatland habitat. Peat will be used to reinstate permanent infrastructure, in a way that will allow the peat top to continue to function as a peatland (outlined in Section 4.5).
- Offset: Peatland restoration proposals are outlined in Technical Appendix 7.4: Habitat Management Plan. Peatland restoration methodology would be designed using techniques outlined in the Peatland Action Technical Compendium (NatureScot, 2024).

4.2. Construction Activities and Effects

28. The construction of the following proposed infrastructure will require the stripping of peat and peaty soils down to the underlying substrate and formation level:

- Cut access tracks;
- Wind turbine and crane pad foundations;
- Temporary construction compounds and blade laydown area;
- Borrow pits; and
- Substation.

29. Other construction activities that have the potential to disturb peat include:

- Movement of plant and machinery over areas underlain by peat and peaty soils;
- Laydown of materials such as blade laydown (including excavated peat and mineral soils) on peat or peatland vegetation and temporary areas; and
- Reinstatement of peat and peaty soils and/or other revegetation activities to reinstate or tie pre-construction peatland habitats into the proposed Development.

30. These activities have the potential to cause a range of effects during construction and operation including the loss of integrity and vegetation, drying, erosion, oxidation, interruption of peatland hydrology as well as loss of function.

4.3. Minimising Peat Excavation

4.3.1. Floating Tracks

31. The proposed Development was designed through an iterative approach informed by site surveys and constraints mapping, with peat being a significant factor being considered. The positioning of turbines and alignment of access tracks has sought to minimise the need for peat excavation in the first instance. Where tracks are required, floating infrastructure has been considered with approximately 22,953 m^2 of floating track proposed. This is 16% of all proposed new tracks.

4.4. Temporary Storage Methodologies

32. Consideration for the storage of peat has been undertaken with input gathered from the Scottish Renewables guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste (NatureScot, SEPA & Forestry Commission Scotland, 2012).

33. The temporary storage of excavated peat shall seek to minimise disturbance of deposits by minimising haul distance between temporary peat storage sites and re-use areas. In general, it shall be a priority to avoid a single site dedicated temporary peat storage area. A plan showing where the material would be stored would be created by the Principal Contractor prior to the works commencing. In areas where storage of the peat turves or excavated material adjacent to the works is not possible, then the material would be taken to the nearest agreed storage areas as soon as possible. A progressive construction

method which re-cycles peat through excavation and timely re-instatement in a continuous process would be adopted for the construction of access tracks, hardstand areas and foundation elements. However, temporary infrastructure elements would require storage of peat prior to re-instatement at the end of the construction phase.

34. For the temporary construction compound, it is proposed that stripped peat and superficial deposits are temporarily stored in stockpiles / bunds adjacent and surrounding each infrastructure site. Where practical the layers would be correctly stored in their respective soil/peat horizons, i.e. in the layers that they were stripped in, so when reinstated they can be put back in the correct order. The exact areas identified for temporary storage would be defined following appointment of the Principal Contractor.

35. Surrounding these areas, the peat stability, drainage and pollution prevention mitigations would be appraised as part of the detailed construction method statement. In general, areas of peat (>0.5 m) shall be avoided for dedicated temporary storage areas.

36. Furthermore, it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas. In temporary storage areas, peat would be stored on geo-textile matting which acts as a protective barrier to the underlying soils and vegetation. The geo-textile would be designed to prevent ingress of groundwater and erosion and de-stabilisation of the base of the stored peat. Peat would be stored to a maximum depth of 1 m with the peat turfs, catotelmic and acrotelmic peat stored separately. The peat turves would be stored where possible vegetation side up. It is not considered practical to lay turfs in a single layer due to the size of area required and the resultant additional habitat damage to vegetation below the laydown layer.

37. A system of watering the stored peat and turfs / vegetation would be in place where possible to ensure that the peat remains damp and prevents drying out and desiccation. The vegetation layer and seed bank would therefore be sustained. This is an important element in the restoration of infrastructure, providing continuity with surrounding local vegetation upon reinstatement. For the duration of the temporary storage, it would be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained. This may need to be undertaken by a suitably qualified geotechnical engineer.

4.5. Reinstatement Methodologies

38. In line with NPF4 and associated good practice guidance, the primary design aim is to avoid adverse impacts on peat and therefore avoid peat excavation. Whilst the design has attempted to avoid peat where possible, due to engineering, logistical, wind analysis or other environmental constraints, the complete avoidance of peat by the proposed Development infrastructure has not been possible. Therefore, the proposed Development has minimised the effects of disturbance through design and mitigation, such that the reinstatement of peat allows it to remain part of the peatland system and for it not to become degraded and lose function as a means of carbon sequestration.

39. The principles of peat re-use and reinstatement at the Site are as follows:

- where encountered, the placement of catotelmic peat in locations that encourages catotelmic peat functionality within the peatland system (i.e. connected to the water table); and

- the placement of acrotelmic peat and turves over the top of catotelmic peat. Acrotelmic peat and turves can also be used in track verge dressing but must be prioritised to cover reinstated catotelmic peat.

40. In following these principles, the following must be considered:

    - The placement of catotelmic peat must be in a location that would encourage the retention of water and thus decrease the risk of the peat drying, oxidising and degrading;
    - The placement of catotelmic peat must not form topographic highs situated at an elevation above the likely surrounding water table;
    - The source of the catotelmic peat should be from excavations / temporary storage as local as possible in order to minimise transport distances;
    - Restoration would be carried out as soon as possible following construction to minimise the risk of turves drying out;
    - Reinstated peat should not be spread too thinly then there is a tendency for it to dry out and crack, particularly during prolonged dry periods. This subsequently means that the soil/peat material would be unstable because the root system has not had an opportunity to establish. This is very much dependent upon the time of year that the work is taking place and also the altitude;
    - The placement of peat must not result in any geotechnical instability;
    - Peat turves (which hold the seedbank) should be stripped as whole turves and set aside vegetation side up. As part of reinstatement, turves should be placed on top of acrotelmic peat over the top of catotelmic peat. Acrotelmic peat and turves can also be used in track verge dressing but must be prioritised to cover reinstated catotelmic peat. Peat turves can be reinstated in a checkerboard pattern when full coverage of turves is not possible; and
    - In areas where the spreading of seed rich turves is considered to be impractical, not plausible or ineffective, then consideration should be given to re-seeding methods. The seed type and mix would be agreed by NatureScot and the local planning authorities.

41. For verge reinstatement, peat will only be used for reinstatement in areas that have underlying peat accumulations which allows the reinstated peat to retain hydrological connectivity with surrounding peat bodies. The principal aim is to place peat in sufficient quantity to ensure retention of pore waters and prevent drying and in the longer term to promote interconnectivity with surrounding hydrological regime. Reinstating peat in narrow and shallow strips reduces resilience of the peat accelerating drying and desiccation.

42. Where the access tracks are required to traverse cross slope or complex terrain: the final restoration volumes shall be refined during detailed design to ensure maximum stability and connection with the surrounding hydrology. This shall be based on a detailed three-dimensional infrastructure design which is currently beyond the scope of the PMP. In such

circumstances sloping terrain may reduce availability of restoration potential on the upslope side of the track.

43. Ensuring the peat soils are replaced in sufficient thickness and volume would increase resilience of the soil mass, by reducing risk of drying and provide a more robust substrate for supporting the preserved surface vegetation layer. The shallow angle of repose and wider verge reinstatement would reduce the velocity of surface run-off; further reducing the likelihood for erosion and loss of the peat mass over time.

44. Having a wider verge contact area with the existing peatland will promote re-establishment of hydrological connectivity. Where groundwater levels are already artificially lowered in the surrounding peatland, encouraging the re-establishment of a dry heath vegetation system is also considered a viable alternative and from experience an approach recommended by SEPA in similar wind farm environments.

45. Table 4.5.1 presents the proposed strategy for successful peat re-use / reinstatement at different infrastructure elements and provides assumptions for the Peat Balance Assessment in Section 4.

Table 4.5.1 Reinstatement Methodology

Infrastructure Element	Reinstatement Methodology
Turbines & Crane Pads	Turbine and crane pad foundations would be overlain by a suitable ballast material. Peat would be re-used on the surrounding batter slopes (reinstatement length ~550 m, width ~4 m, height ~1 m) to ensure suitable tie-in with the surrounding vegetation and habitat. To facilitate hydrological connectivity of the catotelmic peat, verge reinstatement is calculated as 0.5 m^2 of catotelmic peat overlain with 1.5 m^2 of acrotelmic peat and turves. Catotelmic peat would only be placed where it would be connected to the water table (lower sections of the slope) and would still require to be covered with acrotelmic peat / turves. The only turbines considered suitable for reinstatement are those in which peat volumes are being generated through excavation. Therefore, the turbines omitted from reinstatement are T7, T12, and T15.
New Cut Access Tracks	The verges of new cut access tracks will be reinstated to ensure visible tie-in with surrounding vegetation and habitat but also to ensure stability and functionality of the re-used peat. The reinstatement area would be ~4 m wide along either side of the track and ~1 m high. To facilitate hydrological connectivity of the catotelmic peat, verge reinstatement is calculated as 0.5 m^2 of catotelmic peat overlain with 1.5 m^2 of acrotelmic peat and

Infrastructure Element	Reinstatement Methodology
	turves. Peat will only be used in reinstatement in areas of existing peatland (>0.5 m). As the depth varies along sections of track, a soil to peat ratio has been calculated to inform volume of peat to be used in reinstatement of track sections.
New Floating Access Tracks	The verges of the floating access tracks would be reinstated to ensure visible tie-in with surrounding vegetation and habitat but also to ensure stability and functionality of the re-used peat. The reinstatement area would be ~4 m wide along either side of the track and ~1 m high. To facilitate hydrological connectivity of the catotelmic peat, verge reinstatement is calculated as 0.5 m^2 of catotelmic peat overlain with 1.5 m^2 of acrotelmic peat and turves. Floating tracks are located in areas of deep peat, therefore it is assumed that the whole length of the new floating tracks can be reinstated with peat.
Existing Cut Access Tracks	No reinstatement is assumed to be required for the existing cut access tracks as only limited and localised upgrading works are required.
Borrow Pits	Replacement of catotelmic peat should include a capping layer of acrotelmic peat / turves in order to minimise erosion and consequential damage to the peat. For Borrow Pit (BP)-1, BP-3 and BP-4 it is assumed that the same volume of peat that is extracted from borrow pits will be reinstated in the same areas. For BP-2, it is assumed that a reinstatement depth of up to 1 m could be used, due to locally encountered peat depths within BP-2 of up to 1.37 m. This would allow hydrological tie in of the reinstated peat with the local peat body.
Cable Trenches	All peat excavated for cable trenches would be reinstated in the excavation after cable installation has been completed. Any catotelmic peat would be reinstated from the point of origin after the cables have been placed and would be beneath the water table.
Temporary Infrastructure (Construction	Temporary construction areas would be completely reinstated after construction.

Infrastructure Element	Reinstatement Methodology
Compounds & Blade Laydown Areas)	Temporary areas would be reinstated by removing the previously placed engineering fill and then placing catotelmic peat from temporary peat stores to a thickness similar to the pre-existing depth (as determined by pre-construction peat depth data) that also ties into the local topography without creating topographic highs. It is assumed that the same volume of peat that is extracted from temporary areas will be reinstated in the same areas.

4.6. Suitability for Re-Use

46. The characteristics of the excavated peat (e.g. fibrosity and water content) determines its suitability for re-use with the wettest most amorphous peat generally being the least suitable for use in infrastructure reinstatement.

- Acrotelmic peat / peat soils – when stripped with the vegetation, intact turves of acrotelmic peat or peaty soils would be suitable for surface reinstatement, dressing back and tying in infrastructure to the surrounding vegetation and habitats.
- Fibrous catotelmic peat – most suitable for reinstatement beneath the replaced acrotelm. It may also be used as a surface layer with careful site selection and management to control erosion and encourage vegetation recovery (e.g. seeding, translocation of vegetation and fencing to deter deer grazing).
- Amorphous peat – peat of this type would only be suitable for reinstatement of excavations beneath a surface vegetation layer. The peat may also be used in the restoration of the borrow pit beneath an acrotelmic layer to create conditions which would support development of a mire habitat.

5. Peat Mass Balance

47. To quantify the volume of peat that may be excavated and re-used across the Site, the layout has been analysed using a comprehensive peat depth dataset. The proposed 23 wind turbine layout has been appraised to obtain a preliminary estimate of the size and extent of the infrastructure footprint.

48. The peat depth data has been processed into an updated interpolated peat depth map (see Figure 9.4). Peat extraction volumes were calculated using geo-processing tools supplied in Quantum Geographic Information System 3.34. Different peat categorisations (peaty soil, acrotelmic or catotelmic) were extracted from the interpolated peat depth raster using the 'Raster calculator'. The 'Field Calculator' tool was used to calculate the area of each piece of infrastructure. The 'Zonal Statistics' tool was used for each

infrastructure/peat combination to extract values and used to calculate the average cell depth, which was then used to calculate the total volume for each categorisation.

49. According to latest statutory guidance, peat soil is an organic soil which contains more than 60% of organic matter and exceeds 0.5 m in thickness. Therefore, for the purposes of these calculations, and as a result of the information collected within the Site, depths recorded to be less than 0.5 m are considered to be peaty soils, rather than peat. Depths recorded to be greater than 0.5 m are considered to be peat, with the upper 0.5 m being acrotelmic peat and depths beyond 0.5 m considered to be catotelmic peat.

50. It should be noted that this assessment does not include excavation volumes of glacial sub-soils or weak bedrock material.

51. The estimation of peat extraction and re-use volumes relies on a series of design assumptions that may vary on a small scale according to discrete changes in ground conditions. Therefore, it should be highlighted that the peat volume estimates stated in this Outline PMP are subject to further detailed design following the ground investigation and once the Principal Contractor has been appointed. The assumed measurements are derived from proposed infrastructure dimensions alongside professional judgement and industry experience; however, Natural Power (author) does not warrant these assumptions as a final engineering design for the proposed Development. The design of the detailed proposed Development layout should be confirmed following appointment of the Principal Contractor.

5.1. Peat Extraction Values

5.1.1. Turbines and Crane Pads

52. The permanent turbine and crane pad foundation area is taken from the site layout shapefiles and ranges from 9,268 m^2 and 10,043 m^2 for the purpose of these calculations. It is assumed the full depth of peat would be extracted below the footprint. The extraction values for the turbines are presented in Table 5.1.1.

Table 5.1.1 Turbine and Crane Pad Extraction Volumes

		Extraction Volume (m^3)			
Turbine ID	Average Depth (m)	Soil	Acrotelmic	Catotelmic	Total Peat
T1	0.72	615	3,916	2,173	6,089
T2	0.34	2,536	725	194	919
T3	0.46	1,820	1,836	624	2,460
T4	0.34	3,085	92	7	99
T5	0.81	645	3,921	3,002	6,923
T6	0.43	3,181	736	95	831
T7	0.14	1,359	0	0	0

		Extraction Volume (m³)			
Turbine ID	Average Depth (m)	Soil	Acrotelmic	Catotelmic	Total Peat
T8	0.36	2,216	944	210	1,154
T9	0.72	436	4,226	2,070	6,296
T10	0.43	3,370	564	64	628
T11	0.36	2,717	561	78	638
T12	0.22	2,099	0	0	0
T13	0.25	2,231	99	6	105
T14	0.41	2,434	1,253	170	1,423
T15	0.34	3,147	0	0	0
T16	0.31	2,531	254	78	332
T17	0.22	1,893	127	10	137
T18	0.64	1,205	2,928	1,908	4,835
T19	0.39	2,684	877	99	976
T20	0.36	2,310	747	263	1,010
T21	0.54	1,435	2,923	745	3,668
T22	0.62	1,048	3,035	1,907	4,942
T23	0.39	2,201	1,093	351	1,444
Total		**47,198**	**30,857**	**14,054**	**44,911**

5.1.2. Tracks

53. The track areas and perimeters are calculated from the proposed track polygon shapefiles and therefore includes elements such as turning circles and laybys. It is assumed the full depth of peat would be extracted below the footprint. Although there are multiple sections of floating tracks these have been presented as one row in Table 5.1.2. The extraction values for the tracks are presented in Table 5.1.2.

Table 5.1.2 Track Extraction Volumes

Track ID	Track Description	Mean Depth (m)	Track type	Area (m²)	Extraction Volume (m³)			
					Soil	Acro.	Cato.	Total Peat
1	C-shaped section on northern slope of Black Hill	0.70	New - Cut	2,552	217	1,028	535	1,563

Track ID	Track Description	Mean Depth (m)	Track type	Area (m^2)	Extraction Volume (m^3)			
					Soil	Acro.	Cato.	Total Peat
2	T1 to T2	0.45	New - Cut	1,728	518	144	113	257
3	T4 to Construction Compound and Blade Laydown area	0.41	New - Cut	16,030	2,562	3,120	884	4,003
4	Junction to T1 and T3	0.51	New - Cut	5,768	1,061	1,485	393	1,878
5	T4 to T5	0.37	New - Cut	4,081	1,028	353	124	477
6	Track connecting T6, T7, T8 and Substation	0.52	New - Cut	7,500	1,021	1,395	1,483	2,877
7	Track section joining existing track to junction near Substation	0.21	New - Cut	2,152	456	0	0	0
8	Turning head at T2	0.15	New - Cut	493	75	0	0	0
9	New track joining existing track to junction at T18	0.20	New - Cut	460	92	0	0	0
10	Junction to T19	0.27	New - Cut	3,665	975	12	3	14
11	Junction to T20	0.53	New - Cut	2,986	454	475	669	1,143
12	T20 to T21	0.32	New - Cut	3,154	1,003	10	1	11
13	New track joining T22, T10 and T11.	0.40	New - Cut	24,031	5,737	2,468	1,332	3,799
14	T22 to T23	0.38	New - Cut	3,750	634	517	279	795

Track ID	Track Description	Mean Depth (m)	Track type	Area (m²)	Extraction Volume (m³)			
					Soil	Acro.	Cato.	Total Peat
15	New track joining floating track to T12, T13, T14 and T15	0.40	New - Cut	26,640	6,595	3,198	823	4,021
16	Main access over Dog Hill and Whitestones Hill	0.37	New - Cut	12,451	2,290	1,335	985	2,320
17	Existing track adjacent to T08	0.14	Upgrade	3,304	0	0	0	0
18	Existing track adjacent to T16	0.40	Upgrade	1,116	0	0	0	0
19	All floating segments	N/A	New – Floated	22,953	0	0	0	0
Total					**24,718**	**15,540**	**7,624**	**23,164**

5.1.3. Borrow Pits

54. The borrow pit working areas are taken from the proposed site layout polygon. It is assumed the full depth of peat would be extracted below the footprint The extraction values for the borrow pits are presented in Table 5.1.3.

Table 5.1.3 Borrow Pit Extraction Volumes

ID	Average Depth (m)	Max. Depth (m)	Borrow Pit Working Area (m²)	Extraction Volume (m³)			
				Soil	Acrotelmic	Catotelmic	Total Peat
BP-1	0.20	0.32	22,506	4,601	0	0	0
BP-2	0.77	1.37	14,444	4,414	4,951	1,824	6775
BP-3	0.18	0.38	24,433	4,322	0	0	0
BP-4	0.33	0.78	24,382	6,743	1,129	170	1299
Total				**20,080**	**6,080**	**1,994**	**8,074**

5.1.4. Ancillary Infrastructure

55. The ancillary infrastructure excavation areas are taken from the site layout polygons. It is assumed the full depth of peat would be extracted below the footprint The extraction values are presented in **Table 5.1.1.**

Table 5.1.14 Ancillary Infrastructure Extraction Values

Infrastructure Element	Average Depth (m)	Infrastructure Working Area (m²)	Extraction Volume (m³)			
			Soil	Acrotelmic	Catotelmic	Total Peat
Temporary Construction Compounds	-	23,737	5,141	3,082	1,917	4,999
Substation	0.10	7,832	784	0	0	0
Temporary Blade Laydown	0.24	2608	543	79	5	84
Total			**6,468**	**3,161**	**1,922**	**5,083**
"-" Multiple temporary construction compounds, therefore an average depth is not representative.						

5.2. Summary of Peat Extraction Volumes

56. **Table 5.2.1** below provides a development wide indicative value of the total volume of excavated of peat required as part the construction phase of the proposed Development.

57. As outlined in **Section 4.5**, a conservative approach to peat reinstatement has been employed for the purpose of this Outline PMP. For turbines and tracks peat is only reinstated in areas of peat. It is assumed that for the borrow pits, temporary construction compounds and the temporary blade laydown area, that the same amount of peat that is excavated would be reinstated. As the substation is not located on peat, no peat will be reinstated in this area.

Table 5.2.1. Summary of Peat Extraction Volumes

Infrastructure Element	Extraction Volume (m³)			
	Soil	Acrotelmic	Catotelmic	Total Peat
Turbines & Crane Pads	47,199	30,857	14,054	44,911
Tracks	24,718	15,540	7,624	23,164
Borrow Pits	20,080	6,080	1,994	8,074

Infrastructure Element	Extraction Volume (m^3)			
	Soil	Acrotelmic	Catotelmic	Total Peat
Ancillary Infrastructure	6,469	3,161	1,922	5,083
Total	**98,466**	**55,638**	**25,594**	**81,232**

5.3. Re-Use Volumes of Excavated Peat

58. Peat re-use volume calculations have been completed exercising the reinstatement criteria presented above in Table 4.5.1.

59. Table 5.3.1 and Table 5.3.2 provide an overall peat balance calculation comparing total excavation requirements with peat re-use potential for proposed Development infrastructure, for both acrotelmic and catotelmic peat.

Table 5.3.1 Extraction and re-use volumes for acrotelmic peat

Infrastructure Element	Acrotelmic		
	Extraction Volume (m^3)	Re-Use Volume (m^3)	Surplus (+) or Capacity (-) (m^3)
Turbines & Crane Pads	30,856	16,500	14,356
Tracks	15,540	37,935	-22,401
Borrow Pits	6,080	8,351	-2,271
Ancillary Infrastructure	3,161	3,161	0
Total	**55,637**	**65,947**	**-10,310**

Table 5.3.2 Extraction and re-use volumes for catotelmic peat

Infrastructure Element	Catotelmic		
	Extraction Volume (m^3)	Re-Use Volume (m^3)	Surplus (+) or Capacity (-) (m^3)
Turbines & Crane Pads	14,054	5,500	+8,554
Tracks	7,624	12,645	-5,021
Borrow Pits	1,994	7,392	-5,398
Ancillary Infrastructure	1,922	1,922	0
Total	**25,594**	**27,459**	**-1,865**

5.4. Re-Use Volumes of Excavated Soil

60. The function of this document is to deal with the extraction and re-use of peat defined as areas with a depth >0.5 m. It is accepted that peaty soils (defined as areas with depths ≤0.5) m are still classed as carbon rich soils and will emit carbon if not handled correctly, therefore extraction values have also been presented for reference. In general, the handling principles for peat should be applied to the peaty soils. This is outlined in Section 4.

61. Soil excavation volumes for each infrastructure element are presented in detail in Table 5.1.1 to Table 5.1.1.1 and summarised below in Table 5.4.1. Table 5.4.1 also presents the reinstatement volumes for soils, applying the reinstatement methodology applied to peat (outlined in Table 4.5.1).

Table 5.4.1 Extraction and re-use volumes for soil

Infrastructure Element	Soil		
	Extraction Volume (m3)	Re-Use Volume (m3)	Surplus (+) or Capacity (-) (m^3)
Turbines & Crane Pads	47,199	19,800	+27,399
Access Tracks	24,718	44,460	-19,742
Borrow Pits	20,080	15,666	+4,414
Ancillary	6,469	6,204	+265
Total	**98,466**	**86,130**	**+12,336**

62. Table 5.4.1 indicates that there would be a surplus of 12,335 m^3 of soil, however it is considered that this surplus would be accommodated and as a result aid reinstatement on Site.

63. Due to the shallow nature of the peaty soils, the majority of the soil would be retained with the vegetation (as a turve) when excavated. The peaty soil turves can then be stored in a similar manner as the peat turves (see Section 4) and later used in the reinstatement of bare soil around infrastructure. Even highly degraded turves retain the natural and local seed bank and leads to a quicker re-establishment of vegetation following reinstatement. The turves also act as a protective layer preventing desiccation and erosion of soils. It is considered that most of the excess soil volume would be accommodated in this manner. Furthermore, the peat balance calculations in Section 5.3 indicate a capacity of 10,316 m^3 of acrotelmic peat therefore there is also more than sufficient capacity for use of peaty soil in the reinstatement of site infrastructure, if deemed appropriate.

6. Summary

64. Comparing the total capacity for peat re-use with total volume of excavated peat, Table 5.41.1 indicates that the proposed Development has capacity to accommodate 119% of the excavated acrotelmic peat, and 107% of excavated catotelmic peat within the Site.

Table 5.41.1 Peat Excavation Summary for the proposed Development

	Acrotelmic	Catotelmic	Total Peat
Excavation (m^3)	55,637	25,594	81,232
Reuse (m^3)	65,947	27,459	93,407
Surplus (+) / Capacity (-) (m^3)	**-10,310**	**-1,865**	**-12,175**
Reinstatement Capacity (%)	**119%**	**107%**	**115%**

65. In summary, the proposed Development requires the extraction of 81,232 m^3 of peat, with 93,407 m^3 available for reuse in the reinstatement of infrastructure. This means that the reinstatement process can accommodate 115% of the peat extracted during construction. Based on the peat balance calculations in Section 5, methods for recycling or disposing of excess peat would not be required.

7. Limitation of Assessment

66. The peat extraction and re-use volumes are intended as a preliminary indication. The total peat volumes are based on a series of assumptions for the proposed Development layout and peat depth data averaged across discrete areas of the Site. Such parameters can still vary over a small scale and therefore local topographic changes in the bedrock profile may impact the total accuracy of the volume calculation.

67. The accuracy of these predictions may be improved though detailed ground investigation post Consent. It is therefore important that the Outline PMP remains a live document throughout pre-construction and construction phases. The Outline PMP and volumetric assessments should be updated as more accurate information becomes available.

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