

TA2.5 Draft Peat Management Plan



**Glenshero Wind Farm
Draft Peat Management Plan**

Technical Appendix 2.5

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1. INTRODUCTION

MacArthur Green has been commissioned by RES Ltd on behalf of Simec Wind One Ltd to produce a Draft Peat Management Plan (DPMP) for the proposed Glenshero Wind Farm (hereafter referred to as the 'proposed development'). This DPMP should be read conjunction with the Temporary Mineral Working Management Plan (Environmental Impact Assessment Report (EIAR) Volume 4: Technical Appendix 2.3).

This report has been produced by MacArthur Green in accordance with SEPA and SNH guidelines. All staff contributing to this technical appendix have undergraduate and/or postgraduate degrees in relevant subjects, have deep professional engineering experience, and hold professional membership of either the Chartered Institute of Ecology and Environmental Management (CIEEM) or Institution of Civil Engineers (ICE). The report has been reviewed and approved by David MacArthur of MacArthur Green and a copy of his CV is included in EIAR Volume 4: Technical Appendix 1.2.

The proposed development is located on the Glenshero Estate in an area of treeless upland and montane habitat in the southern Monadhliath Mountains of the Scottish Highlands.

Peat depth surveys at the proposed development were undertaken by MacArthur Green (Phase 1 and Phase 2 peat surveys) and the results of these surveys are presented within EIAR Volume 4: Technical Appendices 2.8 and 2.9 respectively. Furthermore, peat depth sampling locations and interpolated Peat Depths are shown on Figures 2.8.2, 2.8.3, 2.9.1 and 2.9.2 (in EIAR Volume 4: Technical Appendices 2.8 and 2.9 respectively).

The DPMP is completed in accordance with the guidance: 'Developments on Peatlands, Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste' (Scottish Renewables (SR) & SEPA, January 2012) from herein referred to as SR & SEPA (2012). In accordance with this guidance (Page 10, SR & SEPA, 2012), a Final Peat Management Plan (PMP) will be prepared post consent and in advance of construction commencing, when the infrastructure contractor has been appointed. The Final PMP will be informed by further site investigation and detailed construction plans.

2. STRUCTURE OF THE PEAT MANAGEMENT PLAN

While there are no defined requirements for the layout or content of a PMP, SR & SEPA (2012) provides a guide to what should be considered when preparing such a plan. This has been used to inform the structure within this DPMP as noted below:

Section 3 Aims and Objectives

Section 4 Details to inform the DPMP:

- Section 4.1: Peat conditions at the proposed development
- Section 4.2: Excavation and reuse volume estimates and reuse requirements for peat
- Section 4.3: Classification of excavated peat
- Section 4.4: Use of peat in temporary mineral workings restoration
- Section 4.5: Handling excavated peat
- Section 4.6: Temporary peat storage
- Section 4.7: Is there a requirement for a Waste Management Plan for the Site?

3. AIMS AND OBJECTIVES

The key aim is to demonstrate, “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 excavated” (SR & SEPA(2012), Page 6). The iterative design process that has been followed to achieve this aim is detailed within EIAR Volume 2: Chapters 2 and 3. The key elements of the design that reduce excavation of peat are, where possible, locating infrastructure in areas of shallower peat, floating of access tracks in areas where the peat is greater than 1.0 metre deep, and locating temporary mineral workings in areas of shallower peat where possible.

This DPMP deals with the peat that is expected to be excavated during the construction of the proposed development, which has been specifically designed to minimise the excavation of peat.

The aim of this DPMP is to:

Establish how peat excavated during the construction of the proposed development would be managed to allow valid re-use of peat and to avoid, or minimise, the generation of waste peat.

This aim is achieved through the following objectives:

- Objective 1: Detail the peat conditions at the proposed development.
- Objective 2: Detail expected volumes of peat to be excavated and re-used.
- Objective 3: Consider the likely physical nature of the material and confirm it will be suitable for the re-uses proposed.
- Objective 4: Consider the validity of the use of peat in temporary mineral workings restoration.
- Objective 5: Describe how excavated peat will be handled to ensure suitability for re-use.
- Objective 6: Describe if temporary storage of peat will be required during construction and how this will be done to ensure suitability for re-use.
- Objective 7: Consider whether any peat will not be suitable for re-use and whether there is a requirement for a Waste Management Plan for the proposed development.

4. DETAILS TO INFORM THE PEAT MANAGEMENT PLAN

The following sections detail the information available to inform the DPMP.

4.1 Peat conditions at the proposed development (Objective 1)

EIAR Volume 4: Technical Appendices 2.8 and 2.9 describe the peat conditions at the proposed development site:

- Technical Appendix 2.8: Peat Depth Survey & Information to Inform an Assessment of Blanket Mire Condition
This report includes the data from 100 m² peat probing survey throughout the proposed development and around infrastructure, carried out by MacArthur Green.
- Technical Appendix 2.9: Phase 2 Peat Depth and Coring Survey

This report presents the data from intensive 10 m and 50 m probing of key infrastructure locations and access tracks, and the peat coring surveys, carried out by MacArthur Green. Various attributes of the condition of peat are presented, which include: degree of humification, fibrous content, water content, pH.

A peat depth figure combining the intensive 10 m and 50 m probing of infrastructure locations and track from the Phase 2 peat probing with the Phase 1 depth probing data is provided in EIAR Volume 4: Technical Appendix 2.6, Technical Appendix 2.9: Figures 2.9.1 and 2.9.2. All probes informing the peat depth interpolation were taken to full depth.

4.2 Excavation and re-use volume estimates and re-use requirements for peat (Objective 2)

Table 2.5.1 details the construction activities (excluding the temporary facilities to be provided) that would generate excavated peat and the expected volumes of peat arising from these activities. These estimates are based on the peat depth information gathered by MacArthur Green and the infrastructure layout as illustrated by EIAR Volume 3: Figure 2.1. For any temporary facilities any excavated peat would be stored adjacent to the facility, and reinstated once the temporary facility has been removed.

Cabling would follow the line of access tracks, which could require excavations to be undertaken specifically for this cabling. However, cable trenches would be incorporated, as much as possible, into the restored peat verges (if these are required) along the access tracks in order to reduce the requirement to excavate undisturbed ground. Any peat arising from specific cable trench excavations would be backfilled using the same peat and reinstated in the correct order. Backfilling would be on an 'as-you-go' basis in order to minimise time between excavation of the cable trench and peat reinstatement. Peat excavation and restoration effectively cancel each other out with no net surplus of peat being generated. As a result, the peat volumes associated with the cabling are not included within the peat reuse calculations within Table 2.5.1, and cabling is not considered further in this DPMP.

The formation of the temporary construction facilities would also generate excavated peat, however, this peat would be stored adjacent to the facility and reinstated once the temporary facility has been removed. There would not be any requirement to re-use this peat elsewhere within the proposed development. Peat excavated for the temporary construction facilities would be handled and stored in line with the principles outlined within this DPMP (section 4.5). The excavation and subsequent restoration of this peat would cancel each other out, as a result the peat volumes associated with the temporary construction facilities are not included within the peat excavation calculations in Table 2.5.1.

Table 2.5.1 Peat Excavation by Construction Category – Total Peat Generated

Infrastructure	Estimated Peat Volume to be Excavated (m ³)
Turbine Foundations (Excavated)	7,470
Crane Hardstandings (Excavated)	30,412
Substation (incl. building and compound)	3,069
Control Building	160
Floating Access Tracks	0
Excavated Access Tracks	57,379
Temporary Mineral Workings Search Areas	28,600
Total	127,090
Contingency 5%	6,355
Total with contingency	133,445
*A 5% contingency has been applied to the total excavated volume in order to take into account that the excavated sides would be battered back and not vertical.	

Table 2.5.2 below provides details on the reinstatement requirements of the proposed development and, in particular, the anticipated demand for peat from the various reinstatement sources. Table 2.5.3 summarises the figures for total supply and demand for peat.

Table 2.5.2 Reinstatement Requirements and Estimated Peat Volume Requirement

Reinstatement Requirements	Total Length (m)	Cross-sectional Area (m ²)	Total Demand Estimate (m ³)	Assumptions
Turbine Foundation verges	2,388	9.75	23,283	Assumes that three edges would be available for reinstatement. Infill original excavation and backfill over turbine foundation.
Crane Hardstanding verges	2,795	0.78	2,180	Assumed that one length and one width of each hardstanding would be available for reinstatement. 1 metre width assumed.
Substation (incl. building and compound)	198	0.71	141	Assume two lengths and one width would be available for reinstatement
Floating Access Track verges	4,631	1.90	8,799	Assumes that all road verges would be available for reinstatement. 2.0 metre width per side tapered to zero is assumed.
Excavated Access Track verges	23,132	0.90	20,819	Assumes that all access track verges would be available for reinstatement 1.0 metre per side to full depth of excavation, tapered to zero.
Temporary Mineral Workings Search Areas restoration	337	193	81,250	Assumes 1.25 metre deep layer over temporary mineral workings footprint.
		Total	136,471	

Table 2.5.3 Total demand, supply and balance of peat

TOTAL PEAT DEMAND (m³) (From reinstatement)	136,471
TOTAL PEAT SUPPLY (m³) (From excavation, with contingency)	133,445
SURPLUS (+) OR DEFICIT (-) (m³) [Supply - Demand]	-3,026

With regards to peat reuse as detailed in Table 2.5.2 above, the following guiding principles and assumptions are made:

- During the excavation and reuse of peat deposits, where any layered structuring within the peat exists, namely the 'acrotelm' and underlying 'catotelm', these layers would be preserved as far as is practicable. This approach would aid in the successful re-vegetation and prevent drying and desiccation of the peat;
- Any underlying substrate material removed as part of the excavation should also be stored separately (not mixed with the peat material) and used as the base layer in restoration in temporary mineral workings (to mimic the natural stratigraphy of a peatland);
- Peat would be stored suitably close and reused as close to its source location as far as practicable;
- Where feasible, reinstatement and restoration would be carried out concurrently with construction rather than at its conclusion.

It can be concluded from Table 2.5.3 above that the demand for peat for reinstatement purposes is greater than the supply of peat arising from excavation. By adjusting the depth of peat used for restoration works within the temporary mineral workings a balance between supply and demand could be achieved, thereby ensuring there is no surplus peat generated on the proposed development.

4.3 Classification of Excavated Peat (Objective 3)

Peat was characterised for the nine peat core sub-samples from seven sample locations (as detailed in EIAR Volume 4 Technical Appendix 2.9: Figure 2.9.2). Furthermore, EIAR Volume 4: Technical Appendix 2.9 details the physical properties recorded from the nine peat core sub-samples taken at the proposed development.

The key measures of peat condition, which are important to establishing the appropriate type of reuse, are noted in Table 2.5.4 below. Overall, the sample results suggest that the acrotelm layer is variable in depth and it is recommended that the upper 0.5 m should be reused as part of the reinstatement programme, where this depth of material is available. Excavation of 0.5 m ensures that the acrotelm remains as intact as possible and captures much of the underlying seed bank material which would aid vegetation regeneration. With regards to the catotelm material within the proposed development, the results indicate that over 75% of this material is fibrous and the remaining 25% intermediate. No amorphous peat was recorded.

Table 2.5.4 Peat Condition

Acrotelm / Catotelm	Measure of Peat Condition	Consideration (Refer to EIAR Volume 4: Technical Appendix 2.9 for detail)
Acrotelm	Depth	The depth of the acrotelm was measured at 7 sample point locations, which ranged from 0 to 17 cm, with a mean depth of 7 cm. Due to the difficulties of excavating a thin layer of acrotelm, without causing significant damage to it, it is recommended that 0.5 m of surface peat is excavated (where possible) for reuse as acrotelm material.
Acrotelm/Catotelm	Degree of Humification	77.78% (n=7) of 0.5 m sub-samples were fibrous in nature. 22.2% (n=2) of 0.5, sub-samples were intermediate in nature. 0% of sub-samples were amorphous in nature.
	Fibrous Content (fine and coarse fibres)	Due to the low levels of humification recorded fine and coarse fibre content was recorded as intermediate high in all samples.
	Water Content	The 7 sub-samples ranged from 2-3 in their wetness rating (1 being dry and 5 being very wet). Most (4) samples were rated as 2. The peat on the proposed development is therefore fairly dry.
	Von Post	Von Post classification ranges from 1 (low level of humification) to 10 (highly humified and amorphous peat). The level of humification ranged from 3-5 with most samples (4) recording 3 (low levels of humification).

4.4 Use of Peat in Temporary Mineral Workings Restoration (Objective 4)

As detailed in EIAR Volume 2: Chapter 2: Project Description and EIAR Volume 2: Technical Appendix 2.5 (Temporary Mineral Working Management Plan), there are seven temporary mineral workings search areas within the proposed development, covering a combined working area of 65,000 m² and it is estimated that these temporary mineral workings would generate 28,600 m³ of peat.

The Scottish Renewables and SEPA (2012) guidance details examples of the valid re-use of peat within temporary mineral workings. The examples given cover two main temporary mineral workings designs, one of 'open aspect', which is cut into the side of a hill, and 'bowl shaped', where a bowl shape is created as a consequence of excavation. Both forms are suitable for receiving peat, however, a bowl shaped temporary mineral workings with an impermeable substrate is likely to be the most suitable for receiving peat, including any unconsolidated/amorphous peat. An open aspect temporary mineral workings may, however, host suitable conditions as described in the guidance (SR & SEPA, 2012).

At present, it is anticipated that the excavated profiles of the temporary mineral workings within the proposed development are likely to be either an 'open aspect' or 'bowl shaped' design. However, the final design of the temporary mineral workings would be confirmed prior to construction and further to more detailed ground investigation once the infrastructure contractor has been appointed.

Each temporary mineral working would be restored with surplus substrate material followed by peat (as detailed in section 4.2 above). Temporary mineral workings would be capped with a layer of acrotelmic material, and the total peat depth within the restored temporary mineral workings would be less than 2 m. The temporary mineral workings would be restored in line with a temporary mineral workings restoration method statement, which would be developed during construction after a further detailed site investigation, when more detailed information on the temporary mineral workings search areas, such as topography, drainage etc. becomes apparent. However, the temporary mineral workings would be restored in a manner, and with a sufficient covering of suitable material, as to create a suitable landscape and topographical tie-in to the surrounding area and be capable of regenerating to a habitat in keeping with the original habitat at that location, or in line with similar local habitat types.

It is recommended that the following principles are adopted in the final method statement for the temporary mineral workings restoration:

- All peat and soil material sourced from the temporary mineral workings should be replaced within the same temporary mineral workings where possible.
- Any unconsolidated peat arising from excavations should only be placed in temporary mineral workings that have a sufficient design to retain such peat in a wet state for use in subsequent habitat restoration.
- Additional peat would be placed in the temporary mineral workings to improve both the ecological and hydrogeological conditions within the temporary mineral workings.
- Unconsolidated peat should be placed at the bottom of any restoration profile, followed by consolidated peat and then turf material from the source temporary mineral workings should be placed on top.
- A maximum of 2 m depth of peat should be used in temporary mineral workings restoration.
- Where insufficient peat turves are available, or they have deteriorated, then consideration should be given to re-seeding the temporary mineral workings with a native seed mix (in consultation with SNH).
- Fencing to exclude deer or livestock and limit access by people should be considered if this is deemed necessary.
- Restoration activities should be overseen by an Ecological Clerk of Works to ensure methods are properly adhered to.

If these principles are followed, further material treatment or specific engineering of the temporary mineral workings would not be required to ensure suitability for use. It is recommended that post-restoration monitoring is carried out at temporary mineral workings locations to establish whether re-vegetation is occurring at a satisfactory rate.

4.5 Handling excavated peat (Objective 5)

It will be necessary for the Final PMP to detail the precise methods and timing involved in handling peat, storing it and then using it for reinstatement, all of which will be dependent on the equipment adopted for the construction activities. The final method statement for this should be based on the following principles:

- The surface layer of peat and vegetation (acrotelm) would be stripped separately from the catotelmic peat. Where possible this would involve an excavation depth of 0.5 m and the creation of turves.
- The turves should be as large as practicably possible to minimise desiccation effects during storage.

- Contamination of excavated peat with other substrate materials (e.g. gravels, clays or silts) should be avoided and these materials stored separately where excavated.
- Acrotelmic material would be stored separately from catotelmic material.
- Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be reused.
- Movement of excavated turves and peat should be kept to a minimum and it is preferable to transport peat intended for translocation to its final destination at the time of excavation.
- Less humified catotelmic peat (consolidated peat), which maintains its structure upon excavation, should be kept separate from highly humified amorphous peat.
- Consider the timing of excavation activities to avoid very wet weather periods in order to reduce the risk of peat becoming wet and unconsolidated, thereby reducing pollution or peat slide risk.
- Acrotelmic material would be replaced as intact as possible once construction is complete.
- To minimise handling and transportation of peat, acrotelmic and catotelmic would be replaced, as far as is reasonably practicable, in the location from which it was removed. Acrotelmic material would be placed on the surface.

4.6 Temporary Peat Storage (Objective 6)

It will be necessary for the Final PMP to detail the precise methods and timing involved in temporary storage, where this is required (the preference being that peat is placed at its end use location directly from it being excavated). It is likely that a degree of temporary peat storage would be required during construction, for instance in association with stripping areas for the turbine foundations; this material would then be used in the subsequent restoration of this temporary construction area.

The final method statement for this temporary storage should be based on the following guiding principles:

- Temporary storage of peat should be minimised. Where required it should be temporarily stored in stockpiles / bunds adjacent to and surrounding each infrastructure site.
- Acrotelm, catotelm and other substrate materials should all be stored separately and appropriately.
- Suitable storage areas should be sited in areas with lower ecological value (e.g. away from Groundwater Dependent Terrestrial Ecosystems (GWDTEs), low stability risk areas and at a minimum distance of 50 m from watercourses.
- Peat turves should be stored in wet conditions where possible (e.g. within waterlogged former excavations) or irrigated in order to prevent desiccation.
- Larger stockpiles are more preferable than numerous small stockpiles, to minimise exposure to sun and wind, which can lead to desiccation. Stockpiles should not exceed 1.5 m in height and be sited with due consideration for slope stability.
- Stores of non-turf, i.e. catotelm, should be bladed off to reduce surface area and desiccation of the stored peat.
- In dry weather periods, consideration should be given to watering stored turves and peat to prevent drying out, wastage and erosion.
- Pollution prevention measures should be installed around peat storage areas.

- Reinstatement would, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials.
- Timing the construction work, as much as possible, to avoid periods when peat materials are likely to be wetter.
- Temporary storage and replacement of peat excavated from the temporary mineral workings should occur within the 'source' pit (as set out in EIAR Volume 4: Technical Appendix 2.3).
- Transportation of peat on site from excavation to temporary storage and restoration site should be minimised.

4.7 Is there a requirement for a Waste Management Plan for the Site? (Objective 7)

There is no requirement for a Waste Management Plan on the basis that the peat excavated from the various elements of the site infrastructure would be re-used within the restoration of the site.

5. LIMITATIONS OF THE DRAFT PEAT MANAGEMENT PLAN

The peat excavation and reuse volumes included in this DPMP are intended as an initial indication. The total peat volumes are based on a series of design assumptions and estimates for the proposed development's layout and peat depth sample 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.

As explained earlier, this DPMP would be developed into a Final PMP post consent and in advance of construction commencing, when the infrastructure contractor has been appointed. The accuracy of the predictions within this DPMP may be improved though further detailed site investigation prior to and during construction. It is therefore important that the Final PMP remains a live document throughout the pre-construction and construction phases and is encapsulated within the wider Construction and Environmental Management Plan (CEMP). An Outline CEMP is included in EIAR Volume 4: Technical Appendix 2.1, which includes reference to this DPMP and sets out the principles that would be adopted and included in the final CEMP. The PMP and volumetric assessments can be updated as more information becomes available and the guiding principles within this DPMP incorporated into relevant construction method statements and plans.

6. REFERENCES

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