Technical Appendix 6.2

Soil and Peat Management Plan

SCOTTISHPOWER RENEWABLES

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1 Soil and Peat Management Plan

1.1 Introduction

1. This report has been developed to provide additional information to **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** and should be read with reference to the chapter and associated figures.

2. The Proposed Development is located in Dumfries and Galloway, north of Dumfries and is described fully in **Chapter 4: Development Description**.

3. There are a number of existing access tracks within the Site due to current forestry and the Operational Harestanes Windfarm.

4. Further site descriptions and photographs are provided in Chapter 6: Hydrology, Hydrogeology, Geology and Soils and Appendix 6.1: Peat Stability Assessment.

5. During initial investigations it was established that peat was present within the Site. Further work was commissioned to establish peat characteristics, depths and extent.

6. In its regulatory position statement Developments on Peat (SEPA, 2010a), the Scottish Environment Protection Agency (SEPA) state that "*developments on peat should seek to minimise peat excavation and disturbance to prevent the unnecessary production of waste soils and peat*". This report examines the volume of soil and peat likely to be excavated during the construction process, and the potential for minimising excavation and identifying volumes for re-use. It is recognised that while re-use of any peat and soil during the construction process represents the preferred option, any such use should be carefully considered regarding risks to the environment or human health.

1.2 Scope of Work

7. During the construction phase there would be a need to excavate peat and soil for infrastructure such as access tracks and turbine bases. Where there is not a defined use for this material during the construction process, excess material would be considered as waste and would need to be disposed of in accordance with regulatory requirements.

8. This report defines the likely excavation volume based on the Proposed Development's layout and dimensions and evaluates options to minimise excavated volumes and examines potential re-use strategies for excavated material. While there may be minor amendments to the Site layout, this strategy ensures appropriate plans for excavation, storage, re-use, and (if necessary) disposal of soil and peat have been considered in advance of the construction phase.

9. Reference has been made to the following guidance documents during the development of this report:

- Promoting the sustainable re-use of greenfield soils in construction (SNH (NatureScot), 2010);
- Regulatory Position Statement – Developments on Peat (SEPA, 2010a); and
- Developments on Peatland Guidance – Waste (SEPA, 2010b).

1.3 Methodology

10. Soil mapping of the Proposed Development area consist of peaty podzols, peaty gleys, brown forest soils and alluvial soils (for further details, please refer to **Chapter 6: Hydrology, Hydrogeology, Geology and Soils**). **Chapter 6: Hydrology, Hydrogeology, Geology and Soils** also provides evidence that Importance Classes 1 and 2 ('areas of significant protection') are not identified within the Site (SNH (NatureScot), 2016).

11. Excavated soil and peat management during the construction process falls into four main categories as follows:

- excavation – at the location of all site infrastructure, including tracks, turbine bases, hardstandings and borrow pits;
- re-use – including reinstatement of borrow pits and trackside banking. There may be options for further re-use of excavated material onsite;
- storage – limited to the short-term storage of excavated material before re-use; and
- disposal – where there is an excess of excavated material following reasonable opportunities for re-use in line with good practice, there may be a need for disposal of that material to a licensed waste facility.

12. James Hutton Institute Soils Maps (1982) and Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017), both indicate a minimum depth for soil to be defined as peat of 0.50m.

13. A proportion of the sub-soils may be suitable as a base on which to lay aggregate for construction of hardstandings and access tracks, thus reducing the requirement to excavate material. The values calculated are therefore considered to be a combination of soil types, including peat. Catotelmic peat is considered separately in **Section 1.5**.

14. Peat probing is a 'blind' exercise and determines the depth of soils through which a probing rod will travel. It is not possible to confirm the nature of these soils other than by intrusive investigation, such as coring or trial pitting, which would form part of the pre-construction ground investigation.

15. Volumes are generally quoted to the nearest 100m^3, in recognition that the numbers used are in many cases estimates based on professional judgement and design data available.

1.3.1 Excavation

16. Peat depths applied to this report are based on a combination of actual probing data or estimated from the indicative peat depth map, **Figure 6.1.5 Peat Overview**, with methodology and further details provided in **Appendix 6.1 Peat Stability Assessment**.

17. The estimation of volume of excavated material includes all soil types, based on site characteristics, a substantial proportion of this material will not be peat, as discussed in the section above.

18. Site probing provided a dataset of 1,207 peat depths, 65% of which recorded depths of less than 0.50m (indicating that some areas of the Site would not be considered to be peat based on the 0.5m depth-based definition), 89% less than 1.0m and an average depth of 0.48m.

19. Within 25m of all track infrastructure (including new track and existing track requiring upgrade), there are 532 probing records, with this dataset including adjacent turbine bases and hardstandings, with the average probe depth being 0.47m, slightly shallower than the overall probing average, reflecting peat depth constraint input to infrastructure design.

20. The layout of the wind farm and dimensions of infrastructure are presented within **Chapter 4: Development Description**.

21. Initial excavation estimates for access tracks, turbine bases, hardstandings and other identified infrastructure were developed in a spreadsheet to provide a total excavated volume. A refinement exercise was then carried out to revise the initial estimates and identify good practice opportunities to minimise the excavated soil and peat volumes.

1.3.2 Re-use

22. The initial estimation of the volume of excavated soil and peat that can be re-used during construction was very conservative and limited to backfilling the batter areas around turbine bases and hardstandings and use of small bankings either side of access tracks.

23. By using an iterative approach, values have been refined to generate volumes of material where there is clearly identified and quantified potential for additional re-use.

1.3.3 Storage

24. Storage considerations relate to short term storage and segregation of excavated material identified for re-use on site. Typically, it would be expected that such material would be re-used nearby and within six weeks of excavation. At all times the volume and duration of storage would be minimised.

25. This report does not include long term material storage, e.g. for decommissioning purposes, as none is proposed or required.

1.3.4 Disposal

26. Should there be an excess of excavated material or material unsuitable for re-use, disposal options would be explored and recommendations made as to the potential disposal routes for any such material.

1.4 Results

27. In this section, calculated values for excavation and re-use, review of the data and layout, and discussion of the re-use volumes is detailed for each infrastructure type. The results are summarised in **Tables 6.1** and **6.2**, at the end of this document.

1.4.1 Access Tracks

28. Access tracks comprise a total length of approximately 15.14km, with 3.14km tracks being new 'cut and fill' type due to the typically shallow soil depth (average depth of 0.47m within 25m of centrelines of all track types). This technique requires excavation of surface deposits and backfilling with aggregate to produce a final track level at, or close to, the existing surface level.

29. There are 12.00km of existing cut track sections requiring upgrade/widening, which would follow similar techniques to that described above, anticipated as widening to one side of the existing track.

30. No floating tracks are proposed for this Site, as there were limited locations where deeper peat deposits were identified and such locations typically coincide with existing track sections planned for widening. Therefore, it was not considered feasible to apply floating track adjacent to existing cut track sections.

31. Track types and routes are displayed overlying peat depth mapping on **Figure 6.1.5 Peat Overview**.

1.4.1.1 Cut and Fill Track

32. Typical track construction information for cut and fill tracks is provided in **Chapter 4: Development Description** and associated drawings of the EIA Report. A standard running width of 5.5m for cut and fill tracks is indicated, calculated as a width of 7.50m to include potential ditches and banks. The new track positioning has taken account of constraints mapping, avoiding areas of deeper peat, wherever practicable.

33. Where existing tracks are to be upgraded/widened, this track has been assumed to require a 1.50m excavation on average to widen the running width and include equivalent sized shoulders and ditch to the standard design, to one side and contingency for any extra works. During the site visits, the existing tracks were estimated to be approximately 4.00m running width plus adjacent banks and drainage features.

34. To provide additional depth information, specific to the new cut track locations, analysis was undertaken to identify the average peat depth within 25m of the proposed new cut track routes; from 183 records the average depth is 0.48m. The equivalent average depth for the existing track to be widened is 0.47m from 349 records.

35. Initial estimated excavation values are calculated using mean averages for the 3.14km of new excavated track and 12.00km of widened existing track. This gives a combined volume of 19,800m^3.

36. The depth of excavated material at the shallow cut track locations is likely to be less than that initially assumed because either the full depth or a proportion therein would be suitable for access track construction. It is considered that achieving a 0.10m improvement in soil depth is feasible for cut track locations, given that the average value includes all depth records within 25m of the new cut track centreline. Note that the existing track required to be widened would not have the opportunity for such improved positioning as is dictated by the present alignment. Taking account of this reduced excavation requirement for new tracks, the combined track excavated volume would be reduced by 2,400m^3 to 17,400m^3. Taking account of approximately 7.0km of existing track crossing non-peat, the peat volume within the total excavation is anticipated as 12,500m^3.

37. Assuming a narrow triangular profile bank at either side of the track of 1.75m width and 1.00m height for the cut and fill tracks, the estimated re-use of excavated material for new track and widened existing track (to one side only) is 16,000m^3.

38. The use of excavated material for reinstatement and/or landscaping will not be uniform across the Site, and experience of other similar projects has shown that substantial volumes of excavated material may be necessary for reinstatement and/or landscaping for banking downslope of cut and fill tracks where these traverse a hillside, as occurs on this Site, as shown on **Illustration 6.1**.

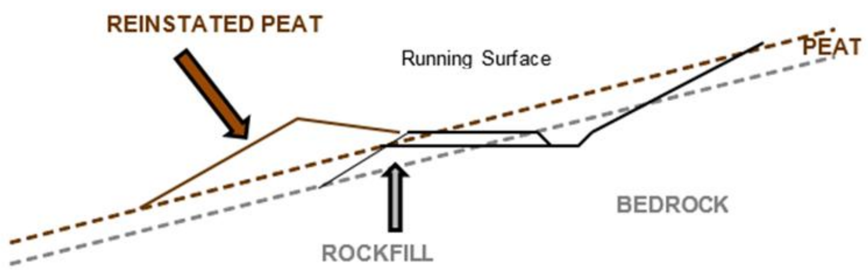

Illustration 6.1: Cross-gradient schematic of cut and fill track construction

39. For this type of construction, the quantity of excavated material required for landscaping of the downslope banking varies with the cross slope angle. The extent of downslope banking required may be substantial. The re-use of peat and soil on the disturbed ground immediately adjacent to the track corridor is considered pragmatic. Assuming a revised larger average bank at either side of the track of 3.50m width (retained at 1.00m maximum height) for the cut and fill tracks, the potential estimated re-use of excavated material is increased to 32,000m^3.

1.4.1.2 Turning Heads

40. It has been determined that a number of turning heads would be required to enable safe delivery and installation of site equipment, particularly turbine components.

41. Each turning head would be located perpendicular to the access track and information provided by the civil engineering design team indicates an average surface area of approximately 450m^2. The average soil depth for the turning heads is 0.30m, with results at each location ranging from 0.10m to 0.51m.

42. With three planned turning heads, the combined volume of excavated material is estimated as being 400m^3, of which 200m^3 of peat is anticipated (solely from the turning head at Turbine 7).

43. It is not anticipated that there is potential for minimising excavation or re-use of material, as this infrastructure requires to be retained for maintenance purposes throughout the operational phase. Should there be the potential to re-use excavated material for some of the turning heads and/or reduce size, this would provide an appropriate re-use of excavated material and/or minimise excavation. This would be considered further at the pre-construction stage.

1.4.1.3 Passing Places

44. A number of new passing places will be required outwith the existing Operational Harestanes Windfarm access corridor to allow the passage of abnormal loads. They will have a typical running width of approximately 5.0m and will be placed approximately every 500m.

45. Some new passing places will be required, as per **Chapter 4: Development Description** and associated drawings of the EIA Report. It is anticipated that 23 passing places will be necessary, including 11 existing passing places to be upgraded and 12 new locations. The 11 existing locations will each require to be extended with an excavation area of 5m by 35m (175m^2), with the 12 new locations requiring an excavation of 70m by 5m (350m^2), resulting in a combined area of 6,125m^2. The exact location of the passing places has not been confirmed, applying the average peat depth along new and existing tracks of 0.47m leads to an estimated value for total excavated material of 2,900m^3. All excavation is considered as peat, as a conservative assumption, with locations to be confirmed at detailed design stage.

46. Should there be the potential to re-use excavated material for some of the passing places and/or reduce size, this would provide an appropriate re-use of excavated material and/or minimise excavation. This would be considered further at the pre-construction stage.

1.4.2 Turbine Bases and Crane Hardstandings

47. Construction of the eight turbine bases would require excavation to a suitable load-bearing layer. **Chapter 4: Development Description** and associated drawings of the EIA Report, identifies the turbine base foundation as approximately 30m diameter. As the turbine base foundations are embedded within the Crane Hardstandings foundation zone, the turbine excavation is included within the Crane Hardstandings section, below.

1.4.2.1 Crane Hardstandings

48. The eight crane hardstandings associated with the turbine bases are required for supporting lifting equipment. These would be created by excavation to suitable load-bearing layer and backfilling the excavation with aggregate to form a stable surface from which construction activities can be carried out.

49. The proposed dimensions for crane hardstandings associated with each turbine are approximately 34m x 94cm (3,196m^2), as per **Chapter 4: Development Description** and **Figure 4.4 Typical Crane Hardstanding**. It has been assumed that each hardstanding will be within an overall surface excavation of 44m x 104m (4,576m^2), with no floating type construction. The overall surface excavation includes a batter area (1,380m^2) adjacent to the hardstanding to enable construction.

50. The assumption for peat/soil excavated at hardstandings was based on peat probing data, the range of average peat depths at each hardstanding was 0.24m to 1.05m, with an overall average peat depth of 0.49m and a combined excavated volume of 15,200m^3 for the Site's eight hardstanding areas, including adjacent batter areas. The peat excavation for the hardstandings is anticipated as 14,300m^3, with Turbine 3 considered a non-peat location.

51. Although the crane hardstandings are not planned for reuse of material, the batter areas would be partially backfilled with excavated material, resulting in re-use of 2,700m^3 across the Site.

52. If micrositing allows and taking account of other constraints, relocation of hardstandings positioned in deeper peat depths can been considered. These issues would be considered further at the pre-construction stage when Ground Investigations findings are available.

53. From conceptual design inputs, it is considered likely that there will be a need for 'fill' material to 'level' each crane hardstanding to meet crane manufacturer installation requirements. It is reasonable to anticipate that some of the material excavated at each hardstanding will have suitable characteristics to be used for this purpose. Such reuse, local to each hardstanding, has not been quantified in this report but will be considered at the pre-construction stage to minimise transfer of materials around the Site.

1.4.2.2 Crane Boom Assembly

54. There are two small crane boom assembly hardstandings proposed for each turbine, on approach to the main crane hardstanding areas, with a total of 16 locations across the Site. Each has a proposed hardstanding area of 174m^2, within an overall surface excavation area of 238m^2.

55. The average peat depth for each crane boom assembly position was used to calculate the excavated material. The peat depths range from 0.30 to 0.83m, with an overall average peat depth of 0.50m and a resulting total excavated volume of 1,600m^3 for the sixteen crane boom assembly areas, including surrounding batter area. Peat excavation is estimated as 1,000m^3, with eight of the sixteen locations on non-peat soil.

56. These batter areas would be partially backfilled with excavated material, resulting in re-use of 100m^3 across the Site.

1.4.2.3 Blade Laydown Areas

57. Eight blade laydown areas will be required, which are planned parallel to each of the crane hardstandings. These are areas of level ground for turbine blade placement, pre-lifting onto turbine tower. Such locations do not require hardstanding. Each of the blade laydown areas are 78m by 28m (2,184m^2).

58. The average peat/soil depth for the blade laydown areas is 0.49m, with average results across the eight locations ranging from 0.00m to 2.10m. Using a conservative assumption that all such material requires to be excavated in order to achieve level ground, the combined excavation volume for blade laydown areas across the Site is estimated as 8,600m^3. Peat excavation is reduced to 7,200m^3, with blade laydown areas adjacent to Turbines 2 and 7 in non-peat locations.

59. On the basis that all such material is excavated, it is anticipated that all material will be re-used elsewhere in the blade laydown area to achieve a level profile, resulting in re-use of 8,600m^3. As a result, the balance between excavation and re-use will be zero.

60. It is reasonably likely that the construction strategy at these locations can avoid wholescale excavation and use less intrusive methods to achieve a sufficient degree of levelling, such as via bulldozer. Should local ground conditions be poor, consideration will be given to the use of a temporary geotextile surface dressing or other techniques that would enable short-term blade storage, pre-lift, and substantially reduce excavation requirements. Such techniques would be expected to minimise the volume of disturbed material, particularly at locations where deeper peat was present.

1.4.3 Meteorological (Met) Masts

61. There is one permanent met mast proposed. The proposed dimensions for the met mast hardstanding are 25m x 25m (625m^2), with a foundation of 5m x 5m (25m^2), with an overall surface area of 650m^2. Information provided by the civil engineering design team indicates an excavation area of approximately 959m^2, resulting on a batter area of 309m^2.

62. Peat probing at the met mast location is 0.94m, which equates to approximately 800m^3 of excavated material, all of which is considered peat.

63. The Met Mast is a permanent feature, so it would not be reinstated.

1.4.4 Control Building

64. There is one control building proposed. The proposed dimensions for the control building are 23m x 14m (322m^2). Information provided by the civil engineering design team indicates an excavation area of approximately 959m^2 for the control building and associated compound.

65. Peat probing within 5m of the control building location is 0.35m, which equates to approximately 300m^3 of excavated material, with no peat excavation anticipated.

66. The control building is a permanent feature, so it would not be reinstated.

1.4.5 Substation

67. The electrical power produced by the individual turbines would be fed back to the Operational Harestanes Windfarm substation, via underground cables predominantly parallel to new and existing access tracks.

68. No excavation is anticipated at the existing substation, therefore it is not considered in this assessment.

1.4.6 Cable Trenches

69. It is intended that all cable trenches will follow the route of the existing Operational Harestanes Windfarm tracks and alongside new tracks, with excavated material used to infill the cable trench. Therefore, this is effectively neutral, with the associated peat balance of zero, these are not considered further in this assessment.

1.4.7 Site Construction Compound

70. A construction compound would be required as the centre for all construction activities and to provide facilities for the day-to-day needs of the project and the workforce. There are two locations which would serve this purpose, both of which are existing hardstanding areas which were constructed for the Operational Harestanes Windfarm.

71. No excavation is anticipated at these construction compounds, therefore they are not considered in this assessment.

1.4.8 Borrow Pits

72. Three borrow pit search areas have been identified for the Proposed Development. The location of these are provided on **EIA Report Figure 4.1 Site Layout Plan** and detailed in **Appendix 6.5: Borrow Pit Assessment**.

73. The three borrow pit search areas have a combined surface area of 79,537m^2 (**Appendix 6.5: Borrow Pit Assessment**). It is proposed that the actual borrow pit footprint(s) would be within the respective search areas but considerably smaller than the surrounding search area. For the purposes of this assessment, it has been assumed the actual areas utilised as borrow pit footprints will represent approximately one third of each of the search areas. Thus, the total utilised surface area of borrow pits is estimated as 26,512m^2.

74. Based upon peat probing in the vicinity of the borrow pit search areas, the average value for soil/peat depth at the borrow pits is 0.32m (also known as overburden). Based on opening borrow pits which represent a third of the footprint of the combined search areas, the excavation volume would be 8,700m^3.

75. Restoring the borrow pit footprints with excavated material provides a re-use purpose, with BP02 and BP03 planned to be fully restored. It has been assumed that BP01 will be restored for 50% of footprint, with the remainder not restored in order to facilitate the ongoing extraction of material for track maintenance etc. On this basis, a reinstatement depth of 0.60m would equate to re-using 13,700m^3 of material.

76. Each additional 0.10m of material required for reinstatement/reprofiling of the borrow pit footprints outlined above equates to a further 2,300m^3 of re-used material.

77. Should borrow pit footprint(s) be larger than that assumed above, this would increase the capacity for re-use, without increasing the depth of material at each location. Conversely, should the borrow pit footprint required be smaller, reuse of a similar volume of material would necessitate a deeper restoration profile.

78. Any reinstatement depths greater than 2.00m would be anticipated to involve discussion of rationale and engineering techniques with SEPA and could potentially become a regulated matter under the waste management regulations.

1.5 Peat Categorisation

79. Based on peat depth surveys and site characteristics noted in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils**, site soils are mainly peaty podzols. Further peat data is provided in **Appendix 6.1: Peat Stability Assessment, Figures 6.5a-d: Peat**, **Figure 6.1.12: Geomorphology** and **Figure 6.1.6: Peat Core Locations**.

80. Peat is a soft to very soft, highly compressible, highly porous organic material which can consist of up to 90% water by volume. Unmodified peat typically has two layers, a surface layer or acrotelm which is often considered to be 0.10-0.30m deep, highly permeable and receptive to rainfall. The acrotelm layer generally has a high proportion of fibrous material and often forms a crust under dry conditions. The second layer, or catotelm, lies beneath the acrotelm and forms a stable colloidal substance which is generally saturated and acts as an impermeable layer. As a result, the catotelm usually remains saturated with little groundwater flow. A typical threshold value of 1.00m depth for catotelmic peat has been suggested by SEPA in the published waste guidance related to peatland (SEPA, 2010b).

81. Within the catotelmic peat, there can be a sub-divide, with a more structured and fibrous upper material and underlying amorphous material with a higher water content. Amorphous catotelmic peat may not always be present within the peat-containing soil structure. Due to the inherent lack of structure in amorphous catotelmic peat, which often displays liquid rather than solid physical properties, it is more difficult to manage and successfully re-use when excavated. Thus, a good design seeks to minimise excavating such sensitive material in the first instance, but where there is a requirement to excavate deeper peat, it is important to establish the likely volumes of amorphous catotelmic peat in a pragmatic manner in order to apply practicable measures to minimise adverse effects relating to excavation, handling, transit, storage and local receptors.

82. The split between excavated acrotelmic, fibrous catotelmic and amorphous catotelmic peat is difficult to precisely quantify, especially where a variety of topographic and peatland features are present, such as at this Site. Peat core and peat depth data aid this process.

83. Peat core data is provided in **Appendix 6.1: Peat Stability Assessment**, with site data providing evidence that amorphous catotelmic peat (H6 or greater on Von Post classification) was encountered at one core, PC01a, at a depth of 1.70m, but less humified material was identified at the same core location at a depth 3.00m. This is unusual as typically deeper peat would be expected to display a greater degree of humification. This outcome suggests the threshold for this material can be expected to vary with local conditions. Given soil map evidence and local characteristics across the large Site area, it is likely that applying a 1.50m threshold value is precautionary and potentially still overestimates amorphous catotelmic peat conditions that would require excavation below infrastructure. Therefore, the applied 1.50m threshold depth may be considered conservative and further GI could lead to a potentially deeper, threshold depth across the Site.

84. Within 25m of new track, there are 532 probing records, with the average probe depth being 0.47m, 87% of depth records were less than 1.00m and 94% were less than 1.50m.

85. Estimated volumes for total peat excavation have been provided in **Table 6.3** (at the rear of this document), including peat sub-categories applying site-specific 0.30m and 1.50m threshold depths between the three categories, taking account of the SEPA guidance regarding a 1.00m expectation for overall catotelmic peat (SEPA, 2010b). These estimated excavated peat volumes are noted in **Section 1.4**.

86. Infrastructure with recorded or indicative depths of less than 0.50m (non-peat) have been excluded from **Table 6.3**, with justification as follows:

- 4.0km of the existing Operational Harestanes Access and 3.0km of the existing Forestry Track do not cross peat;
- Turning heads located adjacent to Turbines 1 and 2 are not on peat;
- Turbine 3 and associated hardstanding is not on peat;
- At Crane boom assemblies, eight of the sixteen locations are not on peat;
- Blade laydown areas for Turbines 2 and 7 are not on peat;

- Borrow pit search areas BP02 and BP03 have few depths over 0.5m, generally on on periphery, peat will be avoided by siting the borrow pits where overburden depth is reduced. The remaining borrow pit (BP01) search area has a number of peat records over 0.5m that were less likely to be avoidable, with approximately half of the BP01 footprint expected to be on this shallow peat.

1.5.1 Amorphous Catotelmic Peat

87. As the calculation within **Table 6.3** of specific peat volumes is an approximation based on threshold depths for the three peat sub-categories within overall probing results for grouped infrastructure components, this was noted to be masking specific locations where deeper peat was apparent from probing data but not reflected in the mean value across the Site. Therefore, a review was undertaken to ensure that infrastructure locations where amorphous catotelmic peat may be expected to be present were identified, based on the aforementioned threshold depth of 1.50m.

88. Applying the conservative amorphous catotelmic peat threshold depth of 1.50m, along with the considerations above, has led to an excavation estimation of 800m^3 in **Table 6.3**. Should additional GI information lead to an increase in the assumed threshold depth, the estimated volumes of such material, following same estimation principles, would be expected to reduce substantially. This demonstrates the importance of developing a strong understanding of local peat conditions at all excavation zones.

89. Where confirmed necessary to excavate such material, provisions should be made to re-use rapidly, in close proximity and for appropriate purposes. Handling via plant equipment and transportation is likely to lead to loss of structure and the material becoming more susceptible to stability failure or increasingly subject to wind or water erosive forces. Amorphous catotelmic peat should be laid under acrotelmic peat, with associated vegetation encouraged to regenerate above. Confirmation of acceptable re-use of amorphous catotelmic peat from stakeholder bodies should be sought at the pre-construction stage and built into construction phase environmental and waste management plans.

90. There are a number of locations where amorphous catotelmic peat is most likely to be present on the Site, based on the 1.50m threshold depth applied. These locations are described below and include potential opportunities to minimise excavation where development is planned:

- Turbine 5 Area; and
- Area South of Turbine 4;
- Area North of the Control Building; and
- Area South of the Existing Construction Compound.

1.5.1.1 Turbine 5 Area

91. In this central area at Turbine 5, soil mapping suggests peaty podzols and peaty gleys are predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH (NatureScot), 2016). As shown on **Photograph 6.1**, this area is currently afforested with relatively mature conifer plantation, with associated alterations to drainage and soil structure.

92. Site observation and depth records provide evidence of deep peat within the Turbine 5 hardstanding. Multiple depth records confirmed depths of up to 2.2m. Peat core PC04 was collected in this area at a depth of 1.7m and assessed via the Von Post technique as H5 'Moderately Decomposed', with little plant material and some peat expressed through fingers. H5 is not classified as amorphous catotelmic peat but deeper peat nearby may meet this criteria (H6 or greater). More peat core details are provided in **Appendix 6.1 Peat Stability Assessment**.

93. Turbine 5 has been relocated to south to an improved location (from 0.70m depth to 0.60m depth at centre-point. Levelling of ground, rather than excavation of the blade laydown area, would substantially reduce local peat disturbance and potential handling of amorphous catotelmic peat. There is also good potential for micrositing of the associated crane hardstanding and this blade laydown area at Turbine 5, with shallower peat recorded to the east of the current positions.

Photograph 6.1: Looking north from within Turbine 5 hardstanding, taken at 302348, 592706

1.5.1.2 Area South of Turbine 4

94. In this central area, soil mapping suggests peaty podzols and peaty gleys are predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH (NatureScot), 2016). As shown on **Photograph 6.2**, this area was previously afforested as conifer plantation and subject to recent forestry clearance, with associated alterations to drainage and soil structure.

95. Site observation and depth records provide evidence of deep peat basins to the south of Turbine 4, where peat was generally deeper than 2.00m, with a maximum depth of 2.80m.

96. The application of peat survey data led to the infrastructure largely avoiding the deeper areas, such as Turbine 4 being relocated north to avoid this deeper peat area.

Photograph 6.2: Looking west towards the Glenkiln Burn valley, from south of Turbine 4, taken at 301815, 593082

1.5.1.3 Area North of Control Building

97. In this central area of the Site, soil mapping suggests peaty podzols and peaty gleys are predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH (NatureScot), 2016). As shown on **Photograph 6.3**, this area was previously afforested as conifer plantation and subject to recent forestry clearance, with associated alterations to drainage and soil structure.

98. Site observation and depth records provide evidence of deep peat pockets adjacent to the junction north of Whitefauld Hill, located 500m north of Turbine 4. Multiple depth records confirmed depths of up to 3.00m. Peat core PC03 was collected in this area at a depth of 3.00m and assessed via the Von Post technique as H4 'Weakly Decomposed', with very distinct plant structure and some peat expressed through fingers. H4 is not classified as amorphous catotelmic peat but peat nearby may meet this criteria (H6 or greater). This location, which included PC03, was also assessed in **Appendix 6.1 Peat Stability Assessment** as Peat Stability Area (PSA) Area B.

99. The application of peat survey data led to the infrastructure largely avoiding this deeper area, with the exception of some track upgrades where there is a necessity to widen the existing Operational Harestanes Windfarm track that connects the eastern and western areas of the Site.

Photograph 6.3. Looking north from the Control Building toward Glenkiln Burn, taken at 302172, 593616

1.5.1.4 Area South of the Existing Construction Compound

100. In this northern area, soil mapping suggests peaty podzols and peaty gleys are predominant. In terms of priority peatland and carbon-rich soil mapping, this area is mostly considered of Importance Category 5; 'vegetation cover does not indicate peatland habitat, although soils within Category 5 are considered carbon-rich soil and deep peat' (SNH(NatureScot), 2016). As shown on **Photograph 6.4**, this area is currently afforested with relatively mature conifer plantation, with associated alterations to drainage and soil structure.

101. Site observation and depth records provide evidence of deep peat along the Operational Harestanes Windfarm track connecting the eastern and western areas of the Site, where peat was generally deeper than 0.80m with a maximum depth of 3.00m. Two areas of confirmed deep peat were identified adjacent to the existing track; between Auchencaigroch Burn and Ox Cleuch, and within the Auchendowel Rig, with four peat records between 1.80m and 2.75m. Peat cores PC01a and PC01b were collected in this area at depths of 1.70m and 3.00m. PC01a was assessed via the Von Post technique as H6 'Moderate/Highly Decomposed', about one third of peat expressed through fingers – identified as representing amorphous catotelmic peat. PC01b was assessed as H5 'Moderately Decomposed', with distinct root fibres and a small amount of peat expressed (see **Appendix 6.1 Peat Stability Assessment** for further details). Therefore, unusually, a shallower peat core exhibited amorphous characteristics, which were not evident for the deeper core at this location.

102. The application of peat survey data led to the infrastructure largely avoiding the deeper peat areas, with the exception of the widening of the aforementioned existing Operational Harestanes Windfarm track sections.

Photograph 6.4: Looking east towards the Operational Harestanes Windfarm track, taken at 300492, 593418

103. Opportunities for improvement have the potential to reduce the average soil/peat depth at various infrastructure locations. Detailed design and micrositing of the turbines and hardstandings in these areas will seek to minimise peat volumes excavated and reduce the likelihood of encountering amorphous catotelmic peat, as additional GI data becomes available. Existing track sections subject to upgrade have less opportunity for improvement.

104. Should amorphous catotelmic peat be confirmed or additional areas identified during pre-construction or construction activities, this material should be reported and consideration should be given to relocating infrastructure within the micrositing allowance, or use of alternative methods of construction to reduce excavation. The Geotechnical Risk Register should include for potential excavation and management of this material.

1.6 Storage and Soil Management

105. This section focuses on temporary storage of peat and soil on site during the construction phase.

1.6.1 Management of Excavated Peat and Soils

106. It is expected that prior to construction commencing, in accordance with **EIA Report Appendix 4.1 Outline Construction Environmental Management Plan (CEMP)**, the contractor would provide a plan detailing potential locations for temporary storage and an outline programme indicating the duration and quantity of stored peat and measures to mitigate and/or capture sediment runoff from stored material. At all times the primary objectives would be to minimise both the time and volume of temporary storage and to prevent sedimentation of any watercourse or waterbody. Where practical, excavated peat would immediately be used locally for reinstatement and/or landscaping.

107. Good practice methods include careful removal of vegetated turves, short timescales between lifting and replacement of turves (with a 6 week reinstatement objective) and ensuring stored turves are kept in good condition (including watering when weather conditions could lead to desiccation). Revegetation of bare soil with native vegetation would be undertaken as soon as practicable. Excavated material would be re-used as close to excavation location as practicable and as soon as possible.

- The scheme would follow standard good practice with regards to soil/peat storage (CIRIA, 2006) and provided in **Appendix 4.1 Outline CEMP**. This would include temporary storage of materials at a minimum distance of 10m from any watercourses and 50m from any watercourse identified on Ordnance Survey 50,000 scale mapping, with soil mounds and restoration depths no higher than 2.00m and with stable banking. Specific additional details on catotelmic peat management are provided separately below.
- Elements of the management and re-use of excavated material may require approval from statutory stakeholders, including SEPA, taking account of reducing erosion/compaction, protecting the soils from pollution and retaining/enhancing soil functionality as a resource.

1.6.2 Re-use for On-site Habitat Management and Landscaping

108. Locally excavated peaty podzols, peaty gleys, brown forest soils and alluvial soils could be used to aid habitat management and landscaping of the site, in particular those areas where coniferous forestry would be removed. Soil mapping suggests that these soil types dominate the Proposed Development area, as provided in **Chapter 6: Hydrology, Hydrogeology, Geology and Soils**.

109. This potential re-use option has not been quantified but would provide an additional method to retain and beneficially re-use material on site.

1.6.3 Decommissioning

110. No decommissioning phase storage has been evaluated or quantified in this report, in keeping with previous consultation with SEPA representatives for similar projects.

1.6.4 Disposal

111. It is anticipated that by considering the various discussed techniques and applying these at appropriate locations all of the excavated site material can be re-used and no disposal would be required.

112. In the event that there is an excess of excavated material, application of additional options at the detailed design and construction phases would be required, as outlined above, in order to avoid off-site disposal. Furthermore, if no site use is available, off site re-use options should be explored, with appropriate disposal as waste considered only as the final option, in line with the "waste hierarchy" (SEPA, 2010b) and discussion with SEPA.

1.7 Summary and Conclusions

113. This report identifies a number of areas of excavation, reinstatement and re-use around infrastructure to be carried out during construction. It is recognised that there is a degree of professional judgement involved in quantified assumptions, with volumes presented in **Table 6.1**.

114. There are a number of opportunities, as identified in the text above and summarised in **Table 6.2**, to reduce the extent of excavation and/or increase the extent of re-use opportunities as good practice measures. These include:

- Reducing excavation depth and footprint required for site infrastructure;
- Appropriate re-use of excavated material for reinstatement and profiling of track verges on disturbed ground; and
- Appropriate re-use of excavated material to reinstate and / or reprofile borrow pits to an average 0.6m depth.

115. Applying the reasonable assumptions discussed in sections above, summarised in **Table 6.1** and **Table 6.2**, indicates sufficient re-use opportunities as per the 'Revised Estimate Balance' column to exceed excavation values by approximately 1,200m^3. Therefore, with consideration of the above, it is considered that all excavated material could be re-used (i.e. balance) with no material needed to be brought onto site for restoration. All excavated material would be re-used nearby and in as short a timeframe as is feasible during the construction phase.

116. Specific peat values are presented in **Table 6.3**, estimating the total peat excavation as 39,900m^3. Three sub-categories of peat have been distinguished, with estimated quantities for acrotelmic, fibrous catotelmic and amorphous catotelmic peat at defined threshold depths. Due to the iterative design process using peat depth constraints as a key component for new infrastructure locations, the deeper peat locations where more sensitive amorphous catotelmic material is predicted have been avoided, where practicable. A precautionary threshold depth of 1.50m has been applied for this material, based on Site peat core data, with an anticipated excavation volume of 800m^3 recorded in **Table 6.3**. The infrastructure likely to lead to excavation of amorphous catotelmic peat, at a threshold depth of 1.50m or greater, are primarily related to the ancillary infrastructure around Turbine 5, for which opportunities to avoid or reduce excavation have been noted within this report and are summarised below.

117. Appropriate methods for further consideration to reduce excavation volumes, minimise potential for amorphous catotelmic peat arisings or enhance peat re-use on this Site include:

- micrositing of crane hardstandings and blade laydown areas to avoid deeper peat, in particular at Turbine 5;
- blade laydown areas constructed with minimal excavation to achieve level ground requirement;
- restoration of existing construction compound;
- consideration of micrositing and/or restoration of turning heads and passing places;
- potential for soil re-use as fill material within the crane hardstandings areas, using locally excavated material;
- potential to increase restoration profile peat depth at borrow pits, subject to these being beneficial in terms of habitat creation; and
- potential for soil re-use at turbine bases or other hardstandings, such as a 0.50m top-dressing, where appropriate.

118. Micrositing activities, during detailed design and construction, to shallowest local locations will both reduce the overall volume of excavated material and reduce the more onerous handling and re-use issues associated with amorphous catotelmic peat.

119. Where operational concerns allow and taking account of maintenance requirements, there could be potential to avoid excavation at blade laydown areas, as well as restore some infrastructure locations with excavated material following completion of the construction phase. Restoration considerations would include the existing construction compound, turning heads and passing places, but additional opportunities should also be reviewed. As this reinstatement may occur post-construction, these would most appropriately be restored with topsoil, rather than peat, due to lengthier timeframe.

120. **Table 6.3** quantities are conservative and will include peaty soils and boulder clay that are likely to dominate the shallower soils typical on this Site, with an overall average overall depth of 0.48m. These non-peat soils may have characteristics that do not require full excavation and present better opportunities for local re-use.

121. Pre-construction it would be recommended to undertake a series of additional peat probes and trial pits following forestry clearance at excavation locations, particularly at Turbine 5, to enhance understanding of infrastructure-specific soil conditions and potentially further improve the iterative design, this study should include determination of amorphous catotelmic material and also enable sample collection for laboratory analysis.

122. Further GI data and associated detailed design amendments may enable a substantial reduction in the anticipated excavation volume of peat and particularly amorphous catotelmic peat, the Geotechnical Risk Register should include for potential excavation and management of this material.

Infrastructure Description	Initial Estimate (m^3) [1]			Revised Estimate (m^3) [1]		
	Excavation	Re-use	Balance	Excavation	Re-use	Balance
Access Tracks	19,800	16,000	3,800	17,400	32,000	-14,600
Turning Heads	400	-	400	400	-	400
Passing Places	2,900	-	2,900	2,900	-	2,900
Crane Hardstandings, including Turbines	15,200	2,700	12,500	15,200	2,700	12,500
Crane Boom Assembly	1,600	100	1,500	1,600	100	1,500
Blade Laydown	8,600	8,600	-	8,600	8,600	-
Met Mast	800	-	800	800	-	800
Control Building	300	-	300	300	-	300
Borrow Pits	8,700	8,700	-	8,700	13,700	-5,000
Total	**58,300**	**36,100**	**22,200**	**55,900**	**57,100**	**-1,200**

[1] All volumes are quoted to nearest 100m^3

Table 6.1: Volume Estimates for Excavation and Re-use of Soil / Peat

Infrastructure Description	Reduction and Re-use	Excavation Volume (m^3) [1]	Re-use Volume (m^3) [1]
Access Tracks	Micrositing to reduce peat depth by 0.1m in cut track sections	-2,400	-
	Extended width of bankings for re-use of peat on track verge for cut track sections	-	16,000
Borrow Pits	Restoring borrow pit footprints with excavated material to an average depth of 0.6m	-	5,000
Total		**-2,400**	**21,000**

[1] All volumes are quoted to nearest 100m^3

Table 6.2: Summary of Justification for Revised Volumes, as Applied to Table 6.1

Infrastructure Description	Total Peat Excavation (m^3) [1] Based on Table 6.1 Revised Estimate, Excavation	Peat Volume Sub-Categories Based on Site-Specific Threshold Depths (m^3) [1]		
		Acrotelmic Peat (<0.30m)	Fibrous Catotelmic Peat (0.30m to <1.50m)	Amorphous Catotelmic Peat (1.50m+) [2]
Access Tracks	12,500	7,800	4,600	100
Turning Heads	200	100	100	-
Passing Places	2,900	1,800	1,100	-
Crane Hardstandings, including Turbines	14,300	9,100	4,800	400
Crane Boom Assembly	1,000	500	500	
Blade Laydown	7,200	3,900	3,000	300
Met Mast	800	200	600	-
Control Building	-	-	-	-
Borrow Pits	1,000	400	600	-
Total	**39,900**	**23,800**	**15,300**	**800** [2]

[1] All volumes are quoted to nearest $100m^3$

[2] If applying a deeper threshold depth, the estimated total value for amorphous catotelmic material would reduce, with an equivalent increase for fibrous catotelmic material

Table 6.3: Volume Estimates for Excavation of Peat

1.8 References

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