Craiginmoddie Wind Farm

Stage 1 Peat Management Plan

EnergieKontor

30 August 2022

1239594

Document history

Author	Kelly Wyness	30/08/2022
Checked	Sam Wainwright	30/08/2022
Approved	Katherine Arthur	30/08/2022

Client Details	
Contact	Michael Briggs
Client Name	EnergieKontor
Address	4330 Park Approach Thorpe Park Leeds, LS15 8GB

Issue	Date	Revision Details
A	07/12/2020	First draft submission
B	14/12/2022	Second submission following client review
C	30/08/2022	Third submission following collection of additional peat data

Local Office:

Ochil House
Springkerse Business Park
Stirling
FK7 7XE
SCOTLAND
UK
Tel: +44 (0) 1786 542

Registered Office:

The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry
Castle Douglas, Kirkcudbrightshire
DG7 3XS

Reg No: SC177881

VAT No: GB 243 6926 48

Contents

1. Introduction

This document details the requirements for a Stage 1 Peat Management Plan (PMP) at Craiginmoddie Wind Farm (the Proposed Development). This document has been prepared to support Chapter 12: Hydrology, Hydrogeology and Geology of the Craiginmoddie Wind Farm Environmental Impact Assessment (EIA) Report[1] and Technical Appendix 12.3: Peat Stability Risk Assessment[2]. Preliminary habitat management commitments have been outlined in Chapter 9: Ecology of the EIA Report[3].

The information presented should be used to inform the wider assessments carried out for the Proposed Development. The document has drawn on information collected as part of a peat study including desk study followed by a phase one and phase two peat probing exercise over three peat survey campaigns. The PMP as outlined in this document estimates the total volumes of excavated peat likely to be produced by the Proposed Development and outlines suitable reuse methods in line with regulatory requirements and industry good practice methods.

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 shall also be a primary consideration.

1.1. Revision History

The peat volume information presented in Section 5 of this report has been updated following the collection of further peat depth data collected in August 2022. The third survey campaign was carried out in response to Ironside Farrar's Stage 3 Checking Report carried out on behalf of the Scottish Government[4]. To support the update to the Peat Stability Risk Assessment[2], an additional 753 (no.) peat depths were recorded. This Stage 1 PMP has been updated utilising the additional data collected.

1.2. Regulatory Requirements

This document addresses the following requirements in line with the Scottish Environment Protection Agency (SEPA) Regulatory Position Statement – Developments on Peatland (2010):

- 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 but in doing so, they must maintain the structure and hydrological function of peat as part of any landscaping works. Consideration of re-using peat for ecological benefits will also be considered.

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, SEPA, 2012);
- Guidance on Developments on Peatland – Peatland Survey 2017. Scottish Government, SNH, SEPA;

---

[1] Natural Power on behalf of EnergieKontor (2020) Craiginmoddie Windfarm, Chapter 12 Hydrology, Hydrogeology and Geology, Document Reference 1238506

[2] Natural Power on behalf of EnergieKontor (2020) Craiginmoddie Windfarm, Technical Appendix 12.3: Peat Slide Risk Assessment, Document Reference 1238941

[3] Gavia Environmental Ltd. on behalf of EnergieKontor (2020) Craiginmoddie Windfarm, Chapter 9 Ecology

[4] Ironside Farrar (March 2022), Peat Landslide Hazard Risk Assessment, Stage 3 Checking Report (Ref: 50787)

- Floating Roads on Peat (Forestry Civil Engineering & SNH, 2010);
- Good Practice During Wind Farm Construction (A joint publication by Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, 2019), Version 4; and
- Scottish Government, SNH, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only.

Consideration should be given to the requirement of environmental licenses that may be required for any installations or processes including but not limited to:

- Any proposed engineering works within the water environment will require authorisation under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as Amended) (CAR);
- Any proposed crushing or screening will require a permit under The Pollution Prevention and Control (Scotland) Regulations 2012; and
- Management of surplus peat or soils may require an exemption under The Waste Management Licensing (Scotland) Regulations 2011.

1.3. **Document Limitations**

This document has been prepared by Natural Power with all reasonable skill, care and diligence for the purposes of assessing the peat extraction and reuse volumes at Craiginmoddie Wind Farm.

This document shall only be used in connection with the above Development. Natural Power accepts no responsibility whatsoever to third parties to whom this document, or any part thereof, is made known, unless formally agreed by Natural Power beforehand. Any such party relies upon the document at their own risk. Natural Power disclaims any responsibility to EnergieKontor (the Client) and others in respect of any matter outside the agreed scope of the services.

In order to present a conservative assessment, all excavated material in areas with depths >0.5 m is considered peat. Peat probing determines the depth of soils through which a probing rod will travel, and it is not possible to confirm the nature of these soils other than by intrusive investigation such as coring or trial pitting.

The PMP should be considered as a live document throughout any future planning and pre-construction phases of works. As such, additional information can be incorporated following the results of detailed site investigations carried out prior to construction as well as from any discussions with SEPA or other engaged stakeholders throughout the development process.

2. Site Context

The Proposed Development will be located approximately 4 km north-east of Barr, 4 km south of Dailly in South Ayrshire, Scotland. The Proposed Development will be in an upland area consisting of open moorland and extensive areas of plantation forestry. A topographic high is reached in the north east of the Proposed Development at Craiginmoddie summit of 382 m Above Ordnance Datum (AOD). All areas of the infrastructure for the Proposed Development are noted to be above 250 m AOD.

The Site has been defined as all land within the red-line planning boundary. Appendix A provides location context for the Site.

2.1. The Development

The Proposed Development includes the following elements:

- Fourteen turbines up to 200 m to blade tip;
- Associated turbine transformers;
- Associated turbine foundations;
- Hardstanding areas for erecting cranes at each turbine location;
- On-site tracks connecting each turbine;
- Underground cables linking the turbines to the substation;
- New watercourse crossings;
- 2 borrow pit search areas for the extraction of stone onsite;
- A temporary construction compound;
- On-site substation;
- A battery storage facility;
- Localised 'keyhole' forestry felling and replanting; and
- Off-site access works.

2.2. Hydrology

The Site lies within the catchments of the River Stinchar and Water of Girvan. There are several burns which supply these networks situated in and around the Site. The majority of the Site is dominated by commercial forestry, with lower reaches of the main catchments dominated by open moorland, and some recent afforestation. As such, there is evidence of multiple artificial drainage channels associated with the commercial forestry and agriculture.

The standard average annual rainfall (SAAR) for the Site has been derived from the FEH Web Service[5] as ranging from 1411 - 1656 mm based on the Site catchments.

Areas identified at risk of fluvial flooding are limited to the watercourses forming the south eastern boundary of the Site. Flood information available on the SEPA Flood Risk Management Map[6] indicates that the Auchengairn Burn and Dalquhairn Burn are at a medium (1 in 200) to high – 10% (1 in 10) likelihood of fluvial (watercourse) flooding in any given year. On the Auchengairn Burn the at risk aeras are generally contained in the river channel extent. The risk areas on the Dalquhairn Burn occupy the wider u-shaped valley near Dalquhairn and Dalwayne, which lies

[5] FEH Web Service, https://fehweb.ceh.ac.uk/, accessed 10/11/2020

[6] Scottish Environment Protection Agency (2020), Flood Risk Management Map, https://map.sepa.org.uk/floodmap/map.htm, accessed 20/11/2020

outside the Site approaching the confluence with River Stinchar. The SEPA Flood Map does not indicate any risk of fluvial flooding on watercourses situated within the Site.

The Dobbingstone Burn / Lindsayston Burn and Dalquhairn Burn waterbodies drain into larger Water Framework Directive (WFD) classified waterbodies; the River Stinchar (Waterbody ID 10467), and Water of Girvan (Waterbody ID 10757). Old mine workings at Dailly are an existing pollution hazard on Water of Girvan and were the cause of a significant pollution event in 1979. Water quality has since considerably improved and current pressures on Water of Girvan water quality are sewage discharges[7]. By contrast, water quality is generally very good within the River Stinchar, and pollution is limited to siltation from bank erosion due to livestock[7].

2.3. Hydrogeology

According to the British Geological Survey (BGS) 1:625,000 scale Hydrogeological Map of Scotland[8], the underlying sandstone and conglomerate bedrock formations underlying the majority of the Site are considered to be a moderately productive aquifer (yields up to 12 L/s) with flow through fractures and discontinuities.

The microgabbro formation in the south west area of the Site, and the small areas of volcanic formations at the north east boundary are classified as low productivity aquifers. Groundwater is these formations will be limited to secondary fractures.

Considering the likely presence of silts and clays within till deposits, it is not expected that there exists any significant superficial aquifer. However, groundwater will be present in limited quantities within peat, till, and weathered bedrock.

The Site is primarily underlain by the Girvan groundwater body (waterbody ID 150607), which has an overall WFD classification of Good (2018). The south western tip of the Site is underlain by the Lendalfoot groundwater body (waterbody ID 150617), which also has an overall classification of Good (2018). These two groundwater bodies have classifications of Good for both quantitative status (groundwater water level), and chemical status (groundwater quality).

According to The Groundwater Vulnerability Map of Scotland[9], aquifers underlying the Site are considered vulnerable to pollutants that are not readily absorbed or transformed (Classes 4a & 4b). The most vulnerable aquifer will be the moderately productive sandstone and conglomerate formations, particularly on higher elevations and summits, where no superficial till is mapped. Where bedrock aquifers are overlain by thick till and peat deposits, groundwater vulnerability will be reduced owing to increased potential for contaminant attenuation.

It is expected that groundwater within the Site flows from high to low elevation, with the water table predominantly below ground level, and reflecting the shape of the topography. Where topography is relatively flat and overlain by peat deposits, piping may be present where water flows through eroded conduits at the interface between peat and weathered bedrock.

2.4. Soils

The distribution of soils across the Site depends on the land use, geology, topography and the hydrological regime of the catchments. Information, provided by the James Hutton Institute through the Soils Survey of Scotland[10] indicate that mineral Gleys are present in waterlogged areas on the south eastern slopes of Doughty Hill, and the south eastern slopes of Craiginmoddie. Peaty gleys are the result of particularly frequent waterlogging and are

---

[7] South Ayrshire Council (2018), State of the Environment Report 2018 – 2020, https://www.south-ayrshire.gov.uk/sustainable-development/publications.aspx, accessed 19/11/2020

[8] British Geological Society (BGS), Geology of Britain Viewer, http://mapapps2.bgs.ac.uk/geoindex/home.html, accessed 20/11/2020

[9] BGS (2015). Groundwater Vulnerability (Scotland) GIS dataset, Version 2. OR/15/002.

[10] Scotland's Soils Interactive Map, http://map.environment.gov.scot/Soil_maps/?layer=1 [Accessed 21/11/2020]

mapped on the south western slopes of Green Larg. Blanket peat is expected to be found across the more poorly drained plateau areas around the summits of Doughty Hill, Craiginmoddie, and Green Larg.

On steeper areas, particularly on the northern slopes of Doughty Hill and southern slopes of Delamford Hill, peaty podzols and brown soils are expected to be present. Podzol soils often have a thin iron-pan which restricts the flow of water deeper into the soil.

3. **Peat depth Surveys**

Surveys have been carried out to investigate peat depth and extent across the Site. The off-site abnormal load track was scoped out from the peat depth survey as it is located on Class 0 – mineral soils. Peat depth information has been collated to support the design considerations for the infrastructure and any subsequent volumetric calculations provided in this document and has subsequently been used to consider and minimise any potential impact on the peatland environment through the preparation of this document.

Investigations were undertaken to allow a high resolution and focussed assessment that maximises the understanding of the impacts of the Proposed Development on the local peatland environment by improving the efficacy of the volumetric calculations provided in this document. The completion of a focussed assessment also provides opportunity to microsite infrastructure away from areas of deeper peat.

Peat deposits can exist in one of three forms:

- Fibrous – non-plastic with a firm structure and is only slightly altered by decomposition;
- Pseudo-fibrous – peat in this form still has a fibrous appearance but is much softer and more plastic than fibrous peat. The change is due to more prolonged submergence in airless water rather than to decomposition; and
- Amorphous – decomposition has destroyed the original fibrous vegetation structure such that it has virtually become organic clay.

Peat deposits can also be characterised into two layers:

- The 'acrotelm' is the upper layer and has a relatively high hydraulic conductivity and therefore has variable water content. This layer comprises of a thin surface layer of active vegetation; and
- The 'catotelm' is the lower layer, permanently below the water table, which has a small hydraulic conductivity and is often at a higher state of humification and lower tensile capacity.

In total, 1,986 locations were identified with twenty-six of these locations unable to be surveyed due to wind blow, resulting in a total of 1,960 locations surveyed. Table 3.1 provides a summary of the recorded depths. Peat depth surveys were undertaken in July 2020, November 2020 and again in August 2022 and involved surveys being completed on a grid pattern of approximately 100 m intervals across the Site and higher resolution surveys at areas proposed infrastructure. Detailed surveys comprised of 10 m spacing at the majority of proposed turbines, crane pads, compounds and borrow pits. Along tracks, depth survey points were collected 50 m intervals, with two offset poinst surveyed 25 m from the centreline. The interpolated peat depth map is provided in Appendix A and shows the distribution of peat depths in relation to infrastructure elements.

Table 3.1: Peat Depth Summary

Peat depth range (m)	Results	% of points
<= 0.5	1015	51
>0.5 – 1.0	674	34
>1 – 1.5	153	8
>1.5 – 2.0	58	3
>2 – 2.5	15	1
>2.5 – 3	10	1
>3.0	35	2
TOTAL	1960	100

Source: Natural Power

The highest proportion (51%) of recorded peat depths were shallow (≤0.5 m). Areas of deepest peat (greater than 3 m deep) were located on the gently sloping plateau extending north west of the summit of Doughty Hill (380 m

AOD). Other areas of particularly deep peat are located on the south west slope of Doughty Hill, and at the north eastern tip of the Site.

Generally, areas indicated to be Class 5 unexpectedly coincide with peat depth measurements greater than 3 m. However, areas mapped as Class 3 do not strongly coincide with peat depths deeper than 0.5 m.

The degree of humification has been recorded at locations where deep peat was core sampled (T9, T11, T14, & T7). The peat has been characterised according to the Von Post Classification (Von Post & Granland, 1926). The peat encountered across the Site is typically soft to very soft and fibrous in the acrotelmic surface layer. In the deeper deposits, characteristically humification increases with depth at the catotelmic layer and there is a reduction in shear strength. This is most evident at the T9 sample location, which following the peat depth surveys was subsequently moved to take account of deep peat. Further details are provided in Technical Appendix 12.3: Peat Stability Risk Assessment.

Table 3.2: Von Post Classifications of Peat Cores

Turbine ID	Peat Depth	Von Post Class	Description
T8	-	-	0.0-0.1m – Brown TOPSOIL 0.1 – 0.3m – Light brown, slightly clayey SAND
T7	1.6	H6 / B2	0.0 – 1.0m: Soft, brown, pseudo fibrous to plastic PEAT (H6/B2) 1.0 – 1.6m – No recovery in corer due to high water content
Raised bog NE of T9	3.6	B3/H3 B2/H5	0.0 – 1.0m: Soft, brown, fibrous PEAT (B3/H3) 1.0-2.0m: No recovery in corer due to high water content; 2.0 – 3.6m: Very soft, brown pseudo fibrous to plastic PEAT (B2/H5) 3.6 – 3.7m: Soft, light grey CLAY
T11	1.0	H4/B2 H6/B2	0.0-0.5m: Soft, brown fibrous PEAT (H4/B2) 0.5 – 0.95m: Firm, brown pseudo fibrous to plastic PEAT (H6/B2) 0.95-1.0m: Firm, brown, sandy CLAY.
T14	-	-	0.0-1.0m – Light brown slightly clayey SAND

Source: Natural Power

4. Minimising Excavated Volumes

4.1. Introduction

Standard industry good practice recommendations on minimising excavation volumes will be considered for areas of infrastructure where peat has been recorded. Details on minimising excavation volumes are presented in the following paragraphs.

4.2. Micrositing

Optimisation of the wind farm design utilising the peat information presented in this document prevents the unnecessary excavation or excessive disturbance of peat/peaty soil. Infrastructure may be moved within a 100 m micro-siting buffer allowance (whilst still taking account other constraints) to avoid identified areas of deeper peat. There are complex ground conditions to consider. This include; areas of deep peat, slope stability risk and other potential geo-environmental factors. Thus, no final micro-siting decisions will be proposed until the pre-construction phase following the outcome of detailed ground investigations.

4.3. Reducing & Controlling Excavation

The most effective means of reducing the volumes of excavated peat is positioning infrastructure away from areas of deeper peat during the design process and where this unavoidable, to utilise alternative methods of construction such as “floating”.

In areas where peat excavation is required, standard industry good practice must be followed to both minimise the volume of material that is removed, and to maintain its structural integrity and resource value as far as possible through exemplary handling and storage methods.

4.3.1. Peat-Handling Prior to Construction

The principles of appropriate handling of acrotelmic and catotelmic peat so that is suitable for reuse are presented in the points below. Fundamentally the intention is to minimise excavation volumes:

- Through the utilisation of all the data collected to date and ongoing throughout the construction process, the Principal Contractor will implement methods to minimise the volumes of excavated peat. Appropriate handling and storage of excavated materials will be undertaken such that their integrity and subsequent reuse is maintained;
- An Environmental Clerk of Works (ECoW) will be employed and prior to works commencing in each area, a walkover with engineers will be carried out to identify any areas of sensitive habitat or deep peat;
- The Principal Contractor will be required to ensure that excavated peat is reused on site in landscaping and re-profiling works, to minimise visual impacts and facilitate habitat and ecological restoration, improvement and enhancement;
- The results of the ground investigation, including groundwater level information, should be assessed with respect to refining the peat stability assessment at infrastructure at highest risk. All pertinent control measures and mitigation measures should be revised, and their implementation supervised following the results of the ground investigation and construction design phase of works; and
- A programme of geotechnical inspections will be implemented during excavation works.

4.3.2. Excavation

Prior to any excavation, the Principal Contractor will produce a detailed method statement identifying where and how excavated peat will be used in reinstatement or landscaping works. Specific requirements for the excavation, handling, storage and reinstatement of peat will be outlined in the above method statement. The method statements will consider peat layering and the potential impacts on downstream hydrological receptors and also the potential for instability issues with the excavated material.

The principal requirements are outlined below;

- All excavations where required should be monitored and measures taken to prevent collapse and the destabilising of peat deposits adjacent to excavations;
- A system of daily reporting of excavations will be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This would be implemented and undertaken by a suitable, experienced and trained member of the site team;
- Where possible, areas of peat within the footprint of excavation will have the top layer of vegetation stripped off as turf prior to construction. When excavating areas of peat, excavated turves should remain as intact as possible. Peat turves will be stored to promote the retention of structure prior to use in reinstatement;
- Underlying catotelmic peat will then be removed and stored separately and kept damp;
- Excavated peat turves and catotelmic peat will be handled through careful excavation to reduce the risk for cross contamination between distinct horizons and to maximise the potential for reuse;
- Care will be taken when stripping and removing topsoil and peat turves and appropriate storage methods will be used on site, i.e. excavated material will be stored in separate horizons and turves will be placed on top of excavated peat to minimise desiccation and oxidation. They would be placed in a manner to maximise coverage in a “checkerboard” pattern; and
- Classification of excavated materials will depend on their identified re-use in reinstatement works. At this Site it is anticipated that the material to be excavated will comprise peat (which may be sub-divided into amorphous peat (catotelmic), fibrous peat (acrotelmic)) and turf.

4.4. **Peat Volumes**

The volumetric analysis of excavated peat volumes incorporates the mean peat depths recorded across each discrete infrastructure element. Therefore, average peat depths have been assessed based on relevant data points as opposed to anomalous site wide averages. Peat depth measurements of less than 0.5 m have been categorised as peaty soils, with deep peat deposits being >0.5 m in depth[11][12]. Therefore, where depths are less than 0.5 m, these will be excluded from final peat depth excavation calculations.

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 document are a preliminary indication only. Volumetric calculations should be re-evaluated once more detailed intrusive site investigation data becomes available at the construction stage. Design assumptions with regards to the likely infrastructure construction methods have also been taken. Natural Power does not warrant these assumptions as a final engineering design for the Proposed Development. If there is to be any further refinement of the infrastructure layout out with the areas surveyed, the design of the detailed site layout should be confirmed with a comprehensive site investigation.

[11] JNCC Report 445 (2011), Towards an assessment of the state of UK Peatlands. accessed 20/11/2020

[12] Scottish Government, SNH, SEPA (2017). Guidance on Developments on Peatland – Peatland Survey. On-line version only. accessed 20/11/2020

4.5. Design Assumptions

4.5.1. Turbines

During turbine base construction, peat is generated by excavation to the substrate to accommodate the concrete foundation and for a working area surrounding the foundation footprint. The turbine footprint is 20 x 20 m in diameter. The surface working area of the wind turbine foundation excavation has been assumed to be 24 x 24 m in diameter (total excavation areas will therefore be 576 m^2) into which a reinforced concrete gravity base will be constructed.

It should be noted that although excavation areas for crane hardstands and turbine foundations will likely overlap, to provide a conservative assessment, peat volumes are calculated for both areas separately.

4.5.2. Crane Hardstanding

All crane pad hardstands will be of cut and fill construction type. Preliminary geotechnical review has indicated that the upland, generally slightly sloping nature of the Site are likely to result in piled foundation construction types to be unsuitable. The hardstand will be 35 m in width and 55 m in length equating to a permanent land take of 1925 m^2 and is the value which is used for excavation volume calculation. Additional excavation will be required for laydown areas which are not included as part of this assessment as these areas will be reinstated following the completion of construction.

4.5.3. Access Tracks

Access tracks will be required to connect the various infrastructure elements of the Proposed Development and will comprise of existing track that will be upgraded, new access tracks that will be floated on top of the peat and also excavation and replace track construction. A plan showing the distribution of the access track typologies is shown in Appendix A.

4.5.3.1. Excavation and Replace

Excavate and replace ('cut') type construction of tracks, passing places and turning areas are proposed where peat depths are consistently shallower than 1 m. Track will also be cut adjacent to turbines and crane pads or on steeper topographic gradients. Of the 10.4 km of access track required as part of the Proposed Development, 7.3 km of new cut type track will be required.

The cut and fill construction method require the removal of soil deposits down to a suitable sub-grade layer within the superficial or bedrock geology. Excavated material is then reinstated carefully along access track landscaped verges on either side of the track or utilised in appropriate landscaping across the Proposed Development infrastructure.

All new access tracks have been assumed to accommodate a minimum 4.5 m running width, with drainage and cabling making up an additional 2 m (1 m either side of the track width), giving a total running width of 6.5 m. A small number of turning heads are required adjacent to some of the proposed turbines and have been included in the calculations.

Excavate and replacement track construction sequences shall be designed in accordance with local ground conditions and following a detailed site investigation. A general good practice construction sequence has been provided below and has been adapted and informed by NatureScot Guidance (2015)[13].

- The route of the cut / fill access track shall be marked out on the ground well ahead of the construction activity. This will allow for advanced checks of any newly developed or unforeseen constraints;

---

[13] Scottish Government, NatureScot, SEPA (2017) Guidance on Developments on Peatland – Peatland Survey. On-line version only.

- As part of this process, the most sensitive sections of the access track route shall be defined. This will include water crossings, flush zones, slopes and steep slopes. These defined zones shall become established management zones where specific mitigation measures and construction techniques shall be implemented to minimise impacts during the construction phase;
- Where possible, the construction of the cut tracks shall avoid periods of wet weather (when soils and peat deposits are particularly susceptible to deformation and when there is an increased risk of run-off carrying unacceptable levels of sediment). Similarly, the construction of access tracks shall, where possible, avoid periods of very dry weather; when there is a high risk of excavated and exposed peat soils drying out;
- The cut access track construction shall typically proceed in an uphill direction, thus allowing drainage to be managed with a greater degree of control. The access track side and cut-off ditches shall generally be constructed first. It shall be ensured that these discharge to a suitable buffered watercourse in line with hydrological assessment and relevant drainage controls. It shall be important to ensure that surface water run-off is directed away from the track formation layer. This will act to reduce disturbance by the prevention of waterlogging and erosion;
- A progressive construction method shall typically be adopted whereby the cut track is excavated to a suitable formation and upfilled to the track running surface. Following this, the newly constructed track verges will be restored with peat and vegetation from the next advancing section of track under construction. The sequence of excavation, up-fill and restoration will be managed to minimise the time between excavation and restoration as far as is practicable; and
- Plant machinery shall work where practicable from the section of access track most recently completed. The re-use of peat turves and peat from newly excavated sections onto the verges of the most recently completed section of track will act to reduce the overall disturbance of excavated peat. Excavators with long reach arms are also beneficial in reducing vehicle manoeuvres over peat deposits. Excavation, handling, storage and reinstatement of peat will follow the principles outlined in Section 5 and 6 of this document.

4.5.3.2. **Floating Construction Type**

The design of the tracks has been made considering peat depths across the Site and floating track has been incorporated to minimise excavated peat. Where new tracks are proposed across areas of peat deeper than 1 m, floating construction techniques would be used. The total length of floating track will be 1.8 km, however further areas suitable for floating may be identified post-consent during detailed design.

Generally, the process would incorporate an approximately 7 m to 8 m wide strip of geogrid laid on the surface of the turf. A layer of approximately 700 mm to 1000 mm of crushed stone would then be laid on the geogrid to form the track, with the edges of the track forming steep batter slopes raised above the soft surface. The track would incorporate an upper layer of approximately 250 mm hard-wearing rock and the geogrid system, which would be designed for floating road construction, would aim to limit the potential for tracks to penetrate into the ground.

4.5.3.3. **Existing Track**

Where possible, the design of the Proposed Development has sought to utilise existing infrastructure, including on-site access tracks. In total, a minimum of 1.2 km of existing access track will be used as part of the design in order to reduce the need for further cut and replace or floating tracks. The off-site abnormal load track has been excluded from the calculations because it is not located on peat.

Owing to the slight increase in running width required, track upgrade works will comprise of the widening to achieve a minimum running width of 4.5 m. These tracks are generally of cut and replace construction type, with widening methods complementing the existing construction approaches. In order to provide a conservative assessment, it is assumed that excavation of peat along existing tracks will be 3.75 m, half of the total excavation area for a new cut and replace track.

It is recommended that the requirement for widening be subject to detailed design review post-consent and in order to reduce peat excavation volumes as far as possible, upgrade works progress on whichever side of the track has the shallowest peat depths.

4.5.4. **Additional and Ancillary Infrastructure**

The proposed accessible ancillary infrastructure associated with the Proposed Development consists of two potential borrow pits, one substation and one temporary construction compound. The estimations of the excavated peat volumes and any subsequent reinstatement have been calculated based on the design information available at the time of writing:

- Two potential borrow pits (15,000 m^2 & 19,000 m^2);
- Substation (2,400 m^2); and
- Temporary Construction Compound (5,000 m^2).

No calculations provided for temporary construction compound as all peat will be reinstated following completion of construction phase or used elsewhere i.e. peatland restoration.

Peat will be excavated during the construction of the temporary construction compound, with this material bunded and secured locally (as presented in Section 5.2). Following project completion, the temporary construction compound will be reinstated to its former conditions using the stored material. As such, this element is not included in the excavation volumes detailed in Section 4.6.

4.6. **Estimating Excavated Peat Volumes**

The estimate of excavated peat volume has been completed following a desk-based appraisal of the Proposed Development layout supplemented by digital terrain analysis. There has been further refined spatial analysis of the peat depth data set using QGIS software.

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 on site, depths recorded to be less than 0.5 m are peaty soils. Depths recorded to be greater than 0.5 m are peat, with the upper 0.5 m being acrotelmic peat and depths beyond 0.5 m considered to be catotelmic peat. It is acknowledged that the depth of acrotelmic peat can vary significantly depending upon specific site conditions, including topography, hydrology and climate. It is stated in SEPA guidance that acrotelmic peat can be up to 1 m in depth[14]. However, the acrotelmic layer in this assessment is classed as peat up to 0.5 m, with the catotelmic layer being the peat beyond this. This provides a conservative assessment for the purposes of differentiating between the acrotelmic and catotelmic peat layers.

The following sequence of tables provides a summary of the indicative peat extraction volume calculations for each infrastructure element (Table 4.1 to Table 4.4).

Note that the positioning of T9 and subsequent crane pad was relocated as part of the infrastructure design to avoid deeper peat.

---

[14] SEPA, 2017, Developments on Peat and Off-Site Uses of Waste Peat, available at https://www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf , accessed 21/11/2020

Table 4.1: Wind Turbine Excavation Volumes

Turbine ID	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
1	1.31	288	465	753
2	0.59	288	51	339
3	0.40	0	0	0
4	0.58	288	46	334
5	0.18	0	0	0
6	0.49	0	0	0
7	1.07	288	331	619
8	0.70	288	114	402
9	0.92	288	240	528
10	0.41	0	0	0
11	0.70	288	115	403
12	0.68	288	104	392
13	0.45	0	0	0
14	0.66	288	94	382
Total Peat Excavation (m^3)		2592	1560	4152

Table 4.2: Crane Hardstanding Excavation Volumes

Turbine ID	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
1	1.31	963	1555	2518
2	0.59	963	172	1134
3	0.40	0	0	0
4	0.58	963	153	1115
5	0.18	0	0	0
6	0.49	0	0	0
7	1.07	963	1105	2068
8	0.70	963	382	1344
9	0.92	963	803	1766
10	0.41	0	0	0
11	0.70	963	385	1348
12	0.68	963	347	1310
13	0.45	0	0	0
14	0.66	963	314	1277
Total Peat Excavation (m^3)		8667	5216	13880

Table 4.3: Access Track Excavation Volumes

ID	Segment Details	Track Type	Approx. Length (m)	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
					Acrotelmic Peat	Catotelmic Peat	
1	T1 Spur	Cut	266	1.01	865	880	1745
2	Track to T4	Cut	654	0.53	2126	130	2256
3	T5 Cut Section	Cut	281	0.22	0	0	0
4	Main track by T1	Cut	779	0.63	2532	648	3180
5	T12-T13 Spur	Cut	598	0.47	0	0	0
6	T11-T14	Cut	598	0.50	0	0	0
7	Main access from Rd to T1	Cut	1246	0.43	0	0	0
8	Main track T2-T3	Existing	486	0.84	0	0	0
9	T7-T8	Floating	447	0.96	0	0	0
10	T13 Spur section 1	Cut	494	0.37	0	0	0
11	BP4 Spur	Floating	292	0.64	0	0	0
12	BP6 Spur	Floating	329	0.66	0	0	0
13	T5-T6	Existing	283	0.23	0	0	0
14	T6-T7	Cut	678	0.60	2204	429	2633
15	T3-T5	Existing	474	0.25	0	0	0
16	T3 Section	Cut	457	0.54	1485	107	1592
17	T2-T14	Cut	489	0.53	1589	106	1695
18	T9-T10	Floating	215	0.79	0	0	0
19	T10-T11	Cut	607	0.69	1973	753	2726
20	T9	Cut	108	0.93	351	304	655
21	T8-T9	Floating	592	0.74	0	0	0
22	T8	Cut	109	0.95	354	319	673
Total Peat Excavation (m^3)					13479	3676	17155

Table 4.4: Ancillary Infrastructure Excavation Volumes

Ancillary Infrastructure	Mean Peat Depth (m)	Peat Excavation Volume (m^3)		Total Peat Excavation Volume (m^3)
		Acrotelmic Peat	Catotelmic Peat	
Substation	0.84	1200	824	2024
Borrow Pit 1	0.56	5000	630	5630
Borrow Pit 2	0.64	5025	1394	6419
Total Peat Excavation (m^3)		11225	2848	14073

Table 4.5: Total Peat Extraction (Indicative) – Site Wide

Construction Element	Peat Excavation Volume (m^3) Acrotelmic Peat	Catotelmic Peat	Total Peat Excavation Volume (m^3)
Wind Turbine Foundations	2592	1560	4152
Crane Hardstands	8667	5216	13883
Access Tracks	13479	3676	17155
Ancillary Infrastructure	11225	2848	14073
Total Peat Extraction (m^3)	35963	13300	49263

The total volume of peat excavation is estimated to be in the order of 49,263 m^3.

5. Storage, Re-use and Restoration

5.1. Re-use Volumes of Excavated Peat

In order to estimate the volume of peat that could be re-used as part of construction and restoration, Natural Power has applied their experience from the construction management of wind farms across an array of upland peat sites. Table 5.1 below provides an approximate total volume of peat that could be accommodated across the site. The following additional design assumptions and management requirements salient to the re-use of excavated peat are highlighted below:

- Peat up to 0.75 m in thickness will be accommodated in the finishing and landscaping of relevant infrastructure elements;
- The reinstatement strategy will aim to encourage a tertiary / perched groundwater within the landscaped peat which would generally reflect the hydrology of the surrounding peatland. Peat will be placed in sufficient depth and volume that retention of water content is facilitated. The peat which is generally at higher degrees of humification is pseudo-fibrous to amorphous and thus is postulated to have a very low hydraulic conductivity which shall aid in this process;
- The final gradient of landscaped verges will be such that water retention is promoted / slowed and thus preventing oxidation and encouraging the re-establishment of vegetation. The reinstatement works will thus be closely monitored by the appointed ECoW to ensure the strategy achieves the desired results or otherwise where the strategy may need to be adapted;
- Where the reinstated soils are determined to be resultant in a free draining condition, it may be acceptable in these scenarios to promote development of dry heathland vegetation. The establishment of common heather vegetation would then be likely, ensuring the reinstated peat deposits established a vegetation cover offering erosion and desiccation protection;
- Batter slopes of reinstated verges of all infrastructure components must be considered in a manner that maintains slope stability, local topography and hydrology. The final design of the reinstated verges and batter angles will be form part of the detailed design, but the reinstatement values provided are indicative for the purposes of this assessment only and will vary according to the prevailing ground conditions and vegetation restoration aims:
  - For floating tracks, the reinstated landscaped verges are based on a depth of 0.75 m and width of 3.5 m. Ideally a batter slope of 1:4 would be required to maintain stability. Reinstatement methodologies are provided in Section 6.1, with the principle of reinstatement as quickly as possible;

- For turbine foundations, the peat re-use potential is within the excavation area excluding the area occupied by the concrete foundation, up to a depth of 0.75 m. As detailed in Section 6.3, the peat will be placed on top of backfill material to resemble pre-excavation conditions as far as reasonably practicable;
- For crane hardstand areas and the substation, it is assumed that peat can be used for reinstatement around the two peripheral edges to a height of 0.75 m with a batter width extending to 3.5 m (1:4 slope to maintain stability) As detailed in Section 6.4, this is based on the good practice principles that peat turf will be placed on top of the reinstatement verges; and
- For the borrow pits, a reinstatement depth of 0.6 m is proposed, with the final thickness being dependent upon the detailed design post-consent.

- The main objective of verge reinstatement is to create, a good landscape tie-in with the original ground form and habitat. To secure the best results, the previously stripped soils should be brought back over the verges as quickly as possible, as this gives the seedbank and vegetation the best chance of an early regeneration. Replacing whole turves, where available, is the ideal method of restoration;
- Verge reinstatement will be carefully managed to ensure the volume of excavated peat is distributed in a sustainable process. To achieve this, two key strategies will be enforced: Modification of the verge height whilst ensuring sufficient volume of peat for retention of rainwater to form a perched groundwater system; and ensuring the width of verge reinstatement is such that covering of existing vegetated areas is avoided;
- The formulation of a detailed construction method statement shall incorporate detailed construction design and sequencing for the reinstatement purposes that will allow refinement of the excavation volumes presented in this document;
- Careful consideration should be given as to how to manage pollution prevention in areas such as watercourse crossings and proximity bog pools and wetlands will be an important element of the site-specific construction environmental management plan;
- When reinstating the temporary compounds, the material will be removed prior to reinstatement and landscaping. The surface will be reinstated to pre-construction level;
- The ECoW will be included in decision making process around temporary storage areas, the ECoW will sign off on these (see Section 5.2);
- Training is provided to the relevant construction /site staff on the correct handling and identification of peat including excavation and separate storage requirements for vegetated peat, fibrous non-vegetated peat (acrotelm) and amorphous non-fibrous (catotelmic) peat. Include requirements for checking, monitoring and maintaining the moisture of the peat bunds;
- It is essential the condition of the stored peat is regularly monitored and should not be allowed to dry out and if appearing to be drying it should be sprayed or otherwise watered to maintain moisture levels in order to ensure the peat maintains good condition and retains the stored carbon;
- Taking into consideration the present of commercial forestry, vegetated buffer zones ensure that Groundwater Dependant Terrestrial Ecosystems (GWDTE's), protected habitats or other ecologically sensitive areas are protected from runoff arising from the construction activities and built Proposed Development layout (new track drainage); and
- The re-use volumes are based on the total combined volume of excavated peat and whilst the excavation volumes are based on a depth of acrotelmic peat up to 0.5 m, the empirical evidence collected from site indicates that peat deeper than 0.5 m may, subject to further site investigation, be suitable to be used as part of the site reinstatement.

It should be noted that this assessment has not accounted for excavation volumes of glacial sub-soils or weak bedrock material, which may be deemed unsuitable for incorporation into foundations and hardstanding elements.

Table 5.1: Estimate of Peat Re-Use Volumes

Construction Element	Peat Excavation Volume (m3)	Peat Re-Use Volume (m3)	Surplus (+) or Capacity (-) (m3)
Wind Turbine Foundations	4152	7441	-3289
Crane Hardstands	13883	1654	12229
Access Tracks	17155	27515	-10360
Ancillary Infrastructure	14073	12232	1841
Total (m3)	49263	48842	+421

Table 5.1 shows there will be a small surplus of 421 m^3 of peat. Following detailed design, additional opportunities for micro siting and/or floating infrastructure will be identified to reduce the volumes of peat excavated from access tracks. Peat can also be used during the dressing and reinstatement of other features including drainage as well as part of local habitat restoration proposals.

Where factors which contribute to the bulking of the peat deposits are mitigated the total volume of excavated peat may be further reduced through:

- Reduction of peat handling with re-use of peat undertaken as close as possible to the excavation site;
- Maintain the integrity of the excavated peat mass including preservation of the surface acrotelm layer as far as possible; and
- Prevent the drying and desiccation of excavated peat deposits through timely re-vegetation and preservation of the surface hydrology systems.

5.2. Temporary Peat Storage

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[15].

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. Stored peat would also be covered with the turves in a manner to maximise coverage. In general, it shall be a priority to avoid a single site dedicated temporary peat storage area. A progressive construction method which re-cycles peat through excavation and timely re-instatement shall be adopted. However, some elements may require storage of peat prior to re-instatement at the end of the construction phase.

The areas and locations identified for temporary storage shall be identified only after site investigation and a full topographic survey. Determining factors are associated with the peat stability, sensitive receptors, drainage and pollution prevention. Areas of deeper peat (>1.0 m) and sensitive areas including GWDTE shall be avoided for dedicated temporary storage areas. It would be a priority to ensure that a future detailed site investigation provides information on the suitability of these temporary peat storage areas including the topographic profile, groundwater regime, and geotechnical properties of deposits underlying the temporary storage sites. Furthermore, it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas.

Owing to the position of the site within an upland setting, with a relatively high rainfall (See Chapter 12: Hydrology, Hydrogeology and Geology) it is anticipated that watering the stored peat through natural precipitation will be sufficient for the peat to remain damp, thus preventing drying out and desiccation and allowing the vegetation layer

[15] Scottish Renewables & SEPA. 2012. Guidance on the assessment of peat volumes, reuse of excavated Peat and the minimisation of Waste. Version 1. Available at http://www.gov.scot/Resource/0045/00455955.pdf

and seed bank to 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 shall be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained, of which may need to be undertaken by a suitably qualified geotechnical engineer. During prolonged dry spells artificial wetting could be undertaken, however this will be done under the agreement and supervision of the ECoW and Principal Contractor with appropriate mitigation in place to ensure the protection of the stored peat, as well as any nearby receptors such as watercourses or GWDTE.

5.3. **Assessment Limitations & Uncertainty**

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 Proposed Development. 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.

The accuracy of these predictions may be improved though further detailed site investigation (post consent). It is therefore important that the PMP remains a live document throughout pre-construction and construction phases and is encapsulated within a wider Construction Environmental Management Plan (CEMP). The PMP and volumetric assessments can be updated as more accurate information becomes available.

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, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, 2012);
- Floating Roads on Peat (Forestry Civil Engineering & Scottish Natural Heritage, 2010); and
- Good practice during wind farm construction (A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, version 4, September 2019).

Interpolated peat depth maps (Appendix A) illustrate the peat depth across the site, thus giving an indicative assessment of the peat depths at various infrastructure locations. As this will be discussed in the following sections, the excavated peat and peaty soils across the Site can be used in a variety of scenarios including dressing side slopes on the roads; backfill over turbine bases; and infill of artificial drainage. These further details on the best practice measures to re-use the excavated peat and peaty soils at the Proposed Development are discussed in the following sections.

6. Reinstatement Methodologies

Prior to commencing the construction excavation works, consideration will be given to methods for handling and holding the excavated materials, particularly peat. Haulage distances for the excavated material will be kept to a minimum, in order to reduce the potential impact on the peat structure. Peat has the potential to lose structural integrity upon excavation particularly when double handled or moved around the site. Peat handling can also increase the bulking factor of the material which has the overall effect of increasing the volume of peat which will need to be re-used across the site. The following paragraphs discuss the reinstatement measures that can be adopted for the main infrastructure components associated with the Proposed Development.

It is important to limit peat re-use to the areas already disturbed during construction and that peat should not be spread on intact vegetated areas as this will smother vegetation.

6.1. Access Tracks

The Proposed Development will utilise the upgrade of cut and replacement, existing and floating-track design.

The reuse of peat along the verges of floating track has been considered.

The fundamental aspects of track reinstatement are summarised as follows:

- Consider haulage methods and specified storage locations in relation to areas being worked. Haulage distances to storage locations will be minimised;
- Vegetated turves and topsoil will be stripped with care and stored correctly i.e. separated into horizons and vegetation stored vegetation side up;
- For track reinstatement peat will be placed back in the correct horizon order and topsoil containing the seed bank will be on the top. If vegetated turves have been previously stripped, then these will be placed on top to maximise vegetation growth potential;
- Reinstatement of verges will be completed as soon as practical to minimise turf drying i.e. reinstatement can take place whilst track construction continues;
- Peat will not be spread too thin during verge reinstatement in order to prevent cracking/drying out and excessive amounts of peat will also not be used as this can lead to unstable surfaces, effect drainage, loss of habitat via smothering of adjacent vegetation and create sediment laden runoff. This is very much dependent upon the time of year that the work is taking place and the altitude;
- If insufficient turves are present when reinstatement takes place, then the turves available should be maximised by placing them over exposed peat in a checkerboard pattern to distribute coverage of vegetation and aid in the quick restoration. If peat is left unturved and insufficiently rewetted (through natural precipitation or manual rewetting), it will dry out, oxidise and erode. Peat will be reinstated in a manner that retains its existing structure with a strategy for creating a perched groundwater or otherwise a strategy focused towards establishment of dry heath where a higher degree of success is determined by the monitoring ECoW;
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration, however, if required, following consultations with NatureScot re-seeding using a native species mix may be considered; and
- Lateral water loss from track edge peat “cliffs” will be minimised. This can be achieved through appropriate re-profiling and reinstatement of the track verges at an angle that blends into the surrounding landscaping as well as placing vegetated turves onto the verges. Consideration will be given to the placement of turves in a checkerboard fashion should there be insufficient turves available. This will be considered in greater details as part of the detailed track design.

Reinstatement will be completed as soon as possible following construction to minimise the risk of any peat/soil/turf drying. Restoration will be carried out as track construction progresses.

In order to obtain the best results, the any stripped soils, vegetated layers or turves will be brought back over the verges of constructed tracks within as short a time period as reasonably practicable, to give the seed bank and vegetation the best chance of an early regeneration.

If storage is required, the layers will 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. This also provides the seedbank and vegetation the best chance of early regeneration. If temporary storage of excavated materials is required, then material will be stored safely, and the method of storage will be reasonably minimised in order to reduce the areas of additional disturbance. If materials are to be stored for any length of time, then these designated areas will be agreed with the ECoW prior to the storage of any material. As previously discussed, consideration will also be given to periodically wetting the vegetation layers during prolonged dry spells in order to prevent drying out. If this method is implemented, any runoff will be dealt with appropriately and will not be allowed to discharge into any adjacent watercourses unless treated.

6.2. Cable Trenches

The reinstatement and storage of any excavated materials for the cable trenches will involve replacement of previously stripped soils, vegetated layers or turves. Timing of trench reinstatement works will also consider adjacent construction activities which may disturb any reinstatement works already carried out.

The amount of time between the excavation of the trench and subsequent reinstatement following cable laying will be minimised as much as possible. The reason for this is that the longer the stripped turves are stored for, the more they will degrade and become unsuitable for successful reinstatement. Reinstatement will take place as soon as possible; trenches which are left open for a long period of time will tend to act as conduits for surface water runoff, thus potentially leading to increased sediment loading due to erosion. This could potentially affect the sites watercourses and lead to the occurrence of a pollution event.

The type of vegetation used for reinstatement will not differ significantly from the adjacent area. The fundamental aspects of cable trench reinstatement are summarised as follows:

- Cable trenches will be constructed to the relevant detailed design specifications;
- Majority of cable trenches will be constructed adjacent to access tracks, i.e. reducing construction impacts on virgin ground;
- As a general principle, reinstated areas will not be re-disturbed where practical, though not always possible due to construction sequencing;
- Stripping, storage and reinstatement of excavated materials will be as per good practice;
- Time between trench excavations and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose.

6.3. Wind Turbine Foundations

Where practical the peat turves and topsoil will be stored around the perimeter of the foundation excavation, excluding areas of untouched peatland habitat. A plan showing where the material is to be stored will also be created 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 will be taken to the nearest agreed storage areas as soon as possible.

The turbine foundation will be backfilled with the excavated underlying material, with the peat placed on top to replicate pre-works ground conditions. The previously stripped and stored soils, and vegetated layers or turves will then be spread over the disturbed area caused by turbine foundation construction. Reinstatement will be carried out as soon as practically possible following completion of foundation construction to minimise the risk of turves/vegetated layers drying out.

For turbines utilising the low volume construction technique, the concrete foundation will remain above ground. To successfully reinstate the foundation working area, excavated material or stripped turves will need to be placed onto and around the foundation in a manner that allows it to blend in with the surrounding landscape. Reinstatement will be carried out as soon as practically possible following completion of foundation construction to minimise the risk of turves/vegetated layers drying out.

The fundamental aspects of turbine foundation reinstatement, regardless of the construction techniques used, are summarised as follows:

- Construction works will be carried out to the detailed specification of the turbine foundation design and to permit adequate temporary works. Excessive peat excavation will be minimised.
- Stripping, storage and reinstatement of excavated materials will be as per best practice;
- A detailed plan of where excavated material will be stored will be created;
- Subsoil/peat will be spread over the backfilled area during reinstatement. Peat turves will then be placed on top to encourage natural re-growth of the vegetation;
- Time between turbine foundation excavation and reinstatement will be planned to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

6.4. Crane Hardstanding

Reinstatement of the crane pads will not occur:

- The likelihood of re-use of crane pads following construction is higher than previously estimated;
- In the past crane pads have been reinstated using a layer of peat following construction. On many sites this layer has been stripped back within 2-3 years of operation to allow maintenance works to take place; and
- When the peat is stripped back, it mixes with the stone from the hardstanding, thus contaminating the peat/peaty soil layer and making it unsuitable for re-use for reinstatement.

Due to the requirement for hardstanding to remain in place, and use of crane pad areas during maintenance activities, levels of vegetation re-growth are liable to be low if crane hardstandings are covered.

The area around the crane pad and any exposed batters will be reinstated with previously stripped soils, vegetated layers and turves, using the same methods to those described for track reinstatement (Figure 6.1). It is important to re-emphasise a strategy for tertiary peat with perched groundwater or otherwise a strategy focused towards establishment of dry heath where a higher degree of success is determined by the monitoring ECoW.

Source: Natural Power

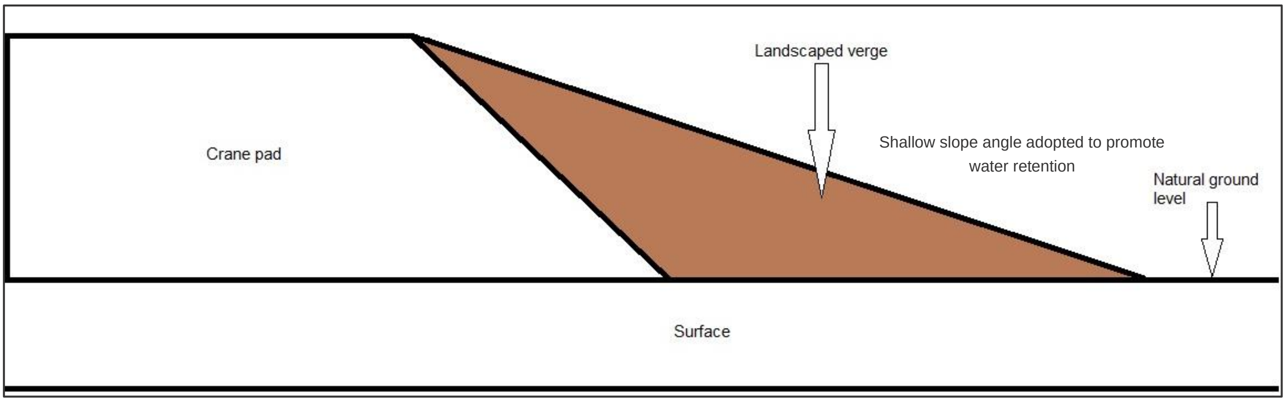


Figure 6.1: Reinstatement of peat on verges of crane pads (not to scale)

6.5. Ancillary Infrastructure

All temporary constructed areas will be removed and reinstated following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas will then be reinstated. The hardstand surface will be lifted or scarified or loosened prior to re-soiling to aid with drainage and re-generation.

The reinstatement will involve reprofiling/landscaping to allow the reinstated area to blend in with the surrounding area. Suitable materials i.e. topsoil and/or peat will then be placed over the area in appropriate horizons i.e. in the correct order. The material used for the reinstatement works (often that which was excavated for the temporary construction area), will be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors.

The fundamental aspects of temporary construction reinstatement are summarised as follows:

- Areas will be re-profiled/landscaped to ensure they blend in with the surrounding area;
- Topsoil/peat will then be spread over the area in its appropriate horizons;
- Material used for the reinstatement will be stored appropriately where practical adjacent to the temporary construction area;
- Stripped turves may dry out due to the length of time they are stored (compound required for duration of construction period) therefore they may not be suitable for reinstatement; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration.

6.5.1. Borrow Pits

Borrow pit reinstatement will be undertaken as soon as possible following the completion of material extraction and will comprise of the replacement of superficial deposits in a manner to mimic the surrounding superficial geological sequence. Reinstatement of borrow pits will ensure that drainage and material management techniques will follow those prescribed within this Peat Management Plan.

The fundamental aspects of borrow pit reinstatement are summarised as follows:

- Stored peat will be placed in suitable locations as determined by a geotechnical engineer and agreed with the ECoW. The engineer and ECoW will be responsible for monitoring the stability and quality of the peat throughout storage;
- A perimeter cut off drain shall be excavated ~10 m away from the proposed working face prior to overburden stripping. This shall reduce the surface water accumulation within the borrow pit excavation and safeguard against sediment loaded run-off;

- Vegetated turves (i.e. the upper most vegetated topsoil / peat layer) shall be stripped from the excavation in a progressive movement up the slope as the excavation extends. Turves will be stripped and stored separately. Turves shall not be used to form peripheral bunds. Peat will be monitored by the ECoW to determine if additional wetting is required during extended dry periods;
- All overburden, except peat, shall be stored in peripheral bunds around the working area. The stability of soil bunds will be monitored with no storage onto in-situ peat deposits deeper than 0.5 m. This will be reviewed by an experienced geotechnical engineer throughout the Proposed Development and construction of the borrow pit. The bund shall also provide screening to the area whilst the excavation is taking place;
- Any peat excavated shall be stored separately from overburden. Peat shall not be used to form peripheral bunds. Stored peat will be stockpiled with side slopes not exceeding 1:2.5 and shall not exceed 1m in height. The placement area for the material shall be on flatter ground, at a suitable location and will be assessed and confirmed as suitable for loading by a suitably experienced and qualified geotechnical engineer and agreed with the ECoW. Turves should be placed (upright) over the peat storage mounds to act as a temporary surrogate growing site for the turves while construction progresses, as well as protect the peat stores from drying out and from run-off and erosion;
- The proposed borrow pit restoration would be to generate a rough vegetated slope profile grading into the existing ground level. The quarry faces would be reinstated to blend with the existing topography as much as possible and made safe;
- Backfilling would be completed using superficial overburden placed to an adequate level and geometry onto which topsoil/ peat can be placed to achieve a final restoration profile;
- Peat from the site would then be used to form the final surface of the restored borrow pit excavation. Retained turves should be reinstated in a checkerboard pattern across all exposed areas of peat to maximise surface area to achieve quick restoration;
- Perimeter cut off drains shall also be infilled with peat to ensure natural water levels in the peat are restored;
- The restoration may not take place immediately following completion of the borrow pit. Rather this shall be completed within the construction period of the wind farm;
- The final design of the borrow pit restoration proposals will be assessed to ensure long term stability and informed by a suitably qualified geotechnical engineer and ECoW with the support of a hydrologist as may be required; and
- All restoration works shall be carried out under the supervision of the ECoW.

7. Monitoring

The success of construction and the subsequent re-use of peat across the site can be monitored to ensure that effects on the peat land environment are appropriately understood and subsequently reduced via any remedial works that can be undertaken. The details of any required monitoring would be discussed and agreed prior to commencement. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation and reinstatement measures are effective and that the site is not having a significant adverse impact upon the local and/or wider environment;
- Indicate whether further investigation is required and, where pollution is identified or unsuccessful reinstatement, the need for additional mitigation measures to prevent, reduce or remove any impacts on the environment; and
- Understand the long-term effects of the site on the natural environment.

Due to the nature of the construction activities and the possibility that such works can increase the volume of dissolved and particulate matter from entering the natural drainage network, a robust hydrological monitoring strategy will be implemented.

A reinstatement monitoring strategy can also be implemented, where surveys can be carried out to monitor the success of peat re-use and subsequent reinstatement. Complimentary to the hydrological monitoring highlighted above and best practise geotechnical monitoring, the success of vegetation reinstatement can provide an insight into the effects of the wind farm on the local environment. Full details of the environmental monitoring strategies will be finalised by way of a planning condition post-consent.

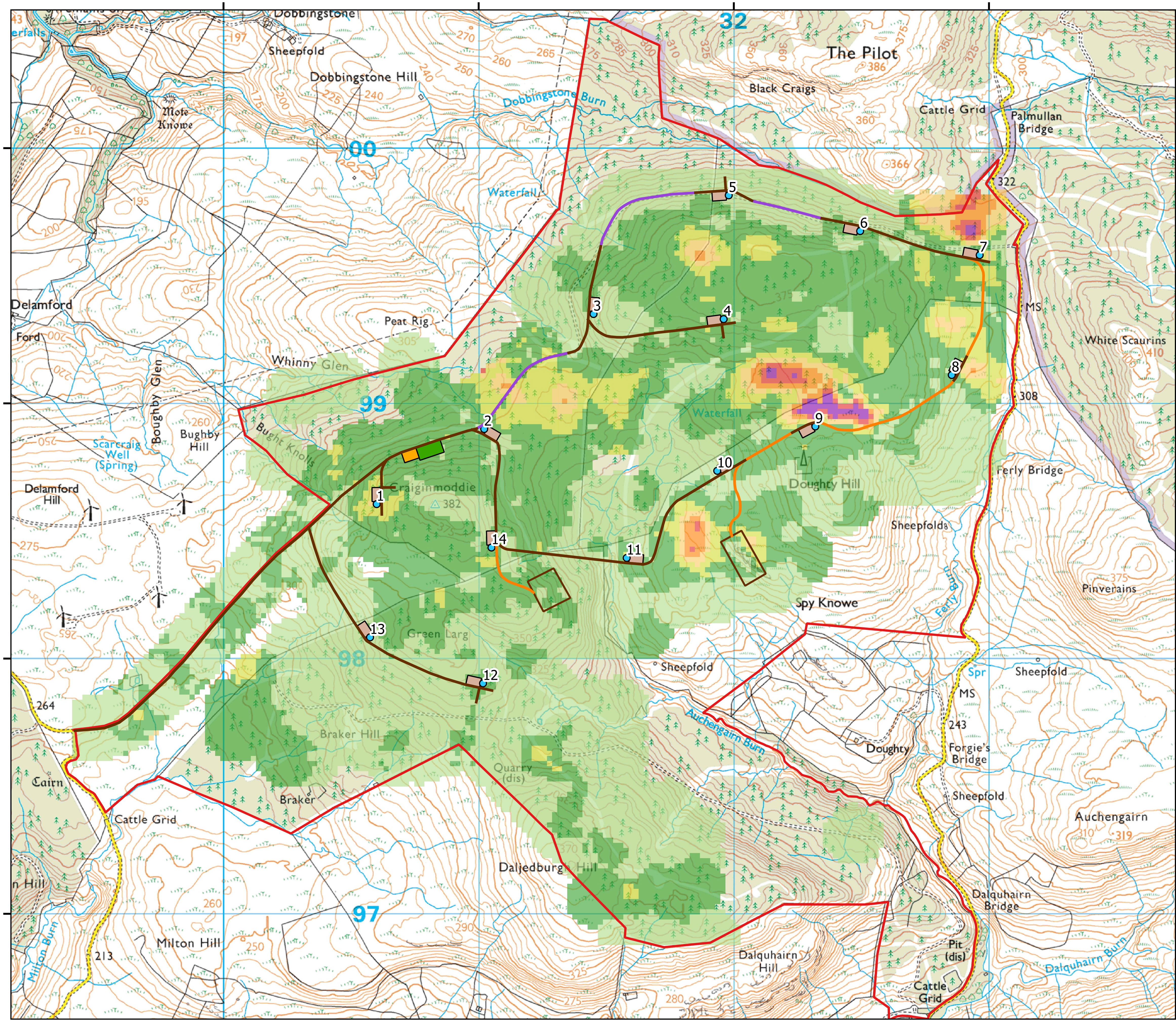
8. Conclusions

Based on available data and information, this PMP has outlined the volume of peat which is expected to be excavated and re-used within the Proposed Development. Based on the current layout and material management and handling methods outlined in this document, it is likely that peat excavation will be minimised through the balancing of excavation volumes and re-use potential at the Proposed Development.

This document will be updated post-consent, incorporating the results of further site investigations and detailed design.

Appendices

A. Figures



Project:

Craiginmoddie Wind Farm South Ayrshire

Title:

Interpolated peat depths

Key

- Site boundary
- Proposed turbine
- Proposed borrow pit
- Proposed construction compound
- Proposed substation
- Proposed crane pad

Access tracks

- Cut track
- Existing track
- Floating track

Interpolated peat depths (m)

- <= 0.5
- >0.5 - 1.0
- >1.0 - 1.5
- >1.5 - 2.0
- >2.0 - 2.5
- >2.5 - 3.0
- >3

*Peat depths interpolated using the Kriging method.

Scale @ A3: 1:15,000

Coordinate System: British National Grid

0 125 250 375 500 m

N

Date: 30-08-22	Prepared by: KW	Checked by: KA
Ref: GB202583_M_006_A	Layout: 161120_14t_A	

Drawing by:

The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry
Castle Douglas, DG7 3XS, UK
Tel: +44 (0)1644 430008
Fax: +44 (0)845 299 1236
Email: sayhello@naturalpower.com
www.naturalpower.com

natural power

Creating a better environment

naturalpower.com
sayhello@naturalpower.com

For full details on our ISO and other certifications, please visit our website.