Limekiln Wind Farm
Section 36C Variation Application

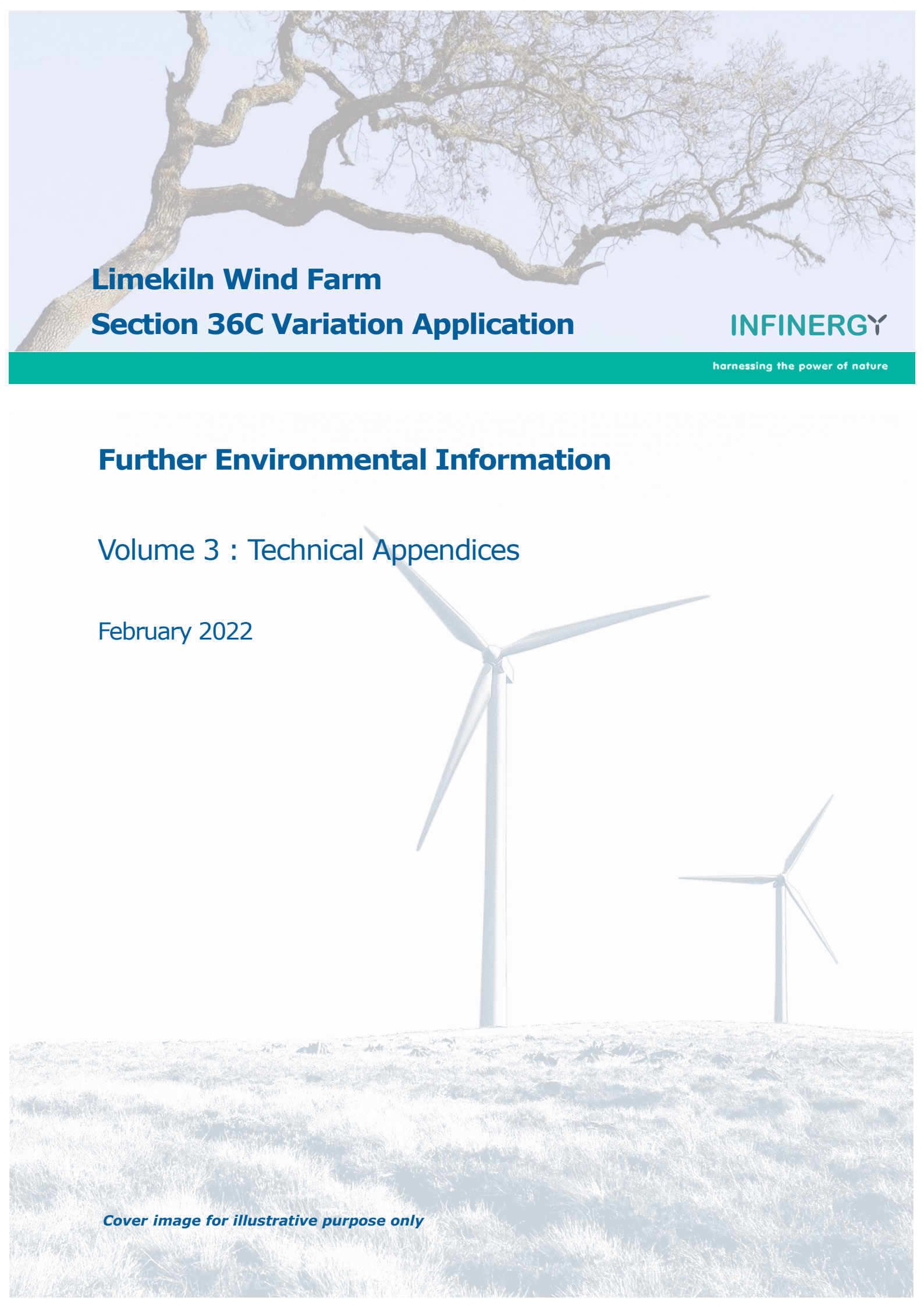
INFINERGY

harnessing the power of nature

Further Environmental Information

Volume 3 : Technical Appendices

February 2022



Cover image for illustrative purpose only

Appendix 2.1

05 November 2021
Ref – 42129-WOOD-XX-XX-CO-R-0001_S0_P01.1

Wood Group UK Limited
Partnership House
Regent Farm Road
Gosforth
Newcastle upon Tyne NE3 3AF
United Kingdom
Tel +44 (0) 191 272 6100
www.woodplc.com

Debbie Flaherty
Energy Consents Unit
Directorate for Energy and Climate Change
Scottish Government
4th Floor
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

For the attention of Debbie Flaherty

Dear Debbie,

Limekiln Wind Farm Section 36C Variation
Peat Landslide Hazard Risk Assessment

With regards to your Stage 1 Checking report (dated 06/10/21), we have considered your recommendations in Section 4.3 and provide the following further information against each bullet point.

- *In accordance with the ECUBPG please provide experience and competency of the team carrying out the assessment and associated field surveys.*

The assessment has been carried out and reviewed by consultants and engineers with significant experience of undertaking peat slide risk assessments on sites across Scotland. Details of their experience is provided below:

Richard Bagnall (BEng (Hons))

Richard is a qualified Civil Engineer with over 13 years postgraduate experience as a Geotechnical Engineer. He has been involved in a number of high-profile jobs from conception through to construction. His routine work includes the design and management of strategic geotechnical infrastructure including at numerous wind farm sites throughout the United Kingdom. Richard regularly manages Phase 1 and 2 peatland surveys and undertakes peat slide risk assessments for planning applications in accordance with Scottish Government Best Practice including the geomorphological mapping of sites to identify evidence of any relic peat slide features. Additionally, Richard provides design advice on wind farm layouts and micro-siting of turbines to alleviate site constraints prior to design freeze.

Ben Amaira BSc (Hons)

Ben has over 12 years' experience in the environmental consultancy sector specialising in contaminated land assessment and peat stability. Ben has significant experience of supporting and advising clients in the renewable sector on the peat slide risks associated with their developments. This includes significant experience in the planning and undertaking of Phase 1 and 2 peat surveys for a range of small and large scale wind farms as well as advising clients on their wind farm layouts.

Ben's skills also include the identification and mapping of upland geomorphology including a wide range of incipient and relic peat slide features. In addition, Ben's skills include conducting peatslide risk assessments in support of wind farm Environmental Impact Assessments.

Ouarda Boumendjel-Game

Ouarda is a Fellow of the Institution of Civil Engineers and has over 35 years of solid international experience from inception to completion in all aspects of geotechnical engineering relating to residential and commercial buildings, roads and motorway widening schemes, waterworks, reclamation and marine works, underground excavations, slope works and site formations, which she gained working in major infrastructure projects in the UK, Hong Kong, the Middle East, Asia and Africa. She is particularly very experienced in the preparation and reviews of geotechnical reports including feasibility studies, preliminary and detailed design reports, desk studies, interpretative reports, tender assessment and evaluation reports.

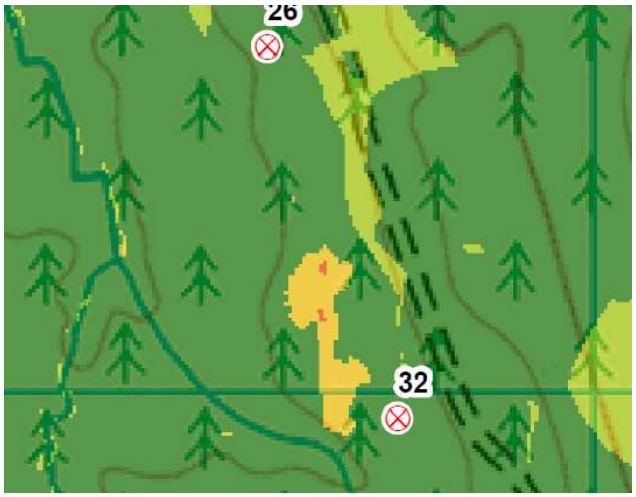
- *Please clarify why probing was not completed at the new construction compound location and on the access track to T35.*

Following the completion of the supplementary survey, based on an approved layout using the original 50m micro-siting allowance, turbine 35 was moved back to its consented position and as a result the track alignment was altered accordingly. The area of the track that has not been surveyed has predominantly been elevated to a low risk as opposed to the surrounding negligible risk to account for any local variations in peat depth, the exception being further to the east where lower peat depths were recorded.

The construction compound is located in an area of relatively flat ground absent of peat or at depths where this will be excavated and stored as part of construction. The resulting risk of peat instability is considered likely to be negligible. This area was not probed due to an oversight by Infinergy's appointed peat surveyors.

- *Clarity is sought on the presence of high-risk areas on the access track between T26 and T32 which is suggested on the risk mapping, but not discussed in the PLHRA.*

The proposed track between T26 and T32 passes between two small areas (≈20m x 15m and 15m x 15m) recorded as high risk, based on the elevated likelihood associated with low factor of safety scores under loaded conditions. The alignment of the track itself actually passes over an area of moderate risk. We appreciate this isn't clear on Figure 15 and therefore we attach an illustration below of the area in question without the access tracks overlain.



It is appreciated that this area is a sensitive part of the Proposed Development with regards to peat instability and therefore should be targeted during any ground investigation works. Given the relatively small size of the affected areas it is likely that the appropriate mitigation measures in this area would ensure stability. However, there is also the potential for micro-siting the track further away from the high-risk areas.

- *The developer should provide further information on the nature of the high/ moderate risk areas relative to proposed infrastructure, and should include specific mitigation where development will intersect with these locations. This includes the opportunity to microsite infrastructure off these areas. Table 5.4 of the ECUBPG suggests that project development should avoid high risk locations.*

As detailed above, the only high-risk area that has the potential to impact on the Proposed Development is adjacent to the proposed track between T26 and T32. Further information obtained from intrusive ground investigation works can allow for a refinement of the assessment in this area. A 50m micro-siting allowance also provides the opportunity to realign the track further away from the high-risk areas. The track is currently aligned over an area of moderate risk and therefore mitigation measures will be used to ensure peat stability remains where the track can't be micro-sited to an area of low or negligible risk. The mitigation measures required for moderate risk areas underlying proposed cut and floating tracks is provided in Section 7.3 of the risk assessment report.

Yours faithfully

Rich Bagnall
Senior Geotechnical Engineer

E-mail – richard.bagnall@woodplc.com

Appendix 2.2

93 Constitution St
Edinburgh
EH6 7AE
United Kingdom
k.clouston@infinergy.co.uk

Debbie Flaherty
Consents Manager
Energy Consents Unit
The Scottish Government
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

4th October 2021

Dear Ms Flaherty,

Limekiln Section 36C application - ScotWays – CA11.03 Core path separation distance clarification

Thank you for issuing the ScotWays response to the Limekiln Wind Farm Section 36C application.

I can confirm that five of the turbine placements in the application are within 149.9m of the core path. Specifically, as shown on the attached figure, these are turbines T26, T32, T35, T44 and T51.

In response, although we appreciate Wales offers advisory guidance, at present there are no legal requirements in Scotland specifically regarding separation distances between wind turbines and core paths.

Wind farm access tracks at operational projects across Scotland have become well known for drawing in members of the public to use for recreational purposes, including organised running, biking as well as horse-riding events. This includes locally Baillie Wind Farm, located approximately 4km north-east of the Limekiln s36C application, which is used by North Highland Harriers in their run series (https://www.northhighlandharriers.co.uk/nhh-events/virtualtrails/). In addition, and more prominent for the people in the central belt, Whitelee Wind Farm continues to offer an ideal setting for exploring for walkers, runners, cycling and horse-riding (https://www.whiteleewindfarm.co.uk/outdoor-pursuits). Finally, in 2015, thanks to outdoor activity app Strava, it was also acknowledged that within four years cyclists had impressively clocked up more than 13,000 miles of cycling around 23 Scottish wind farm access tracks (https://renews.biz/44700/scotland-on-right-re-track/).

The proposed revised Limekiln Wind Farm access track would itself become a natural extension of core path CA11.03 offering users additional route options around the Limekiln Wind Farm site. Each route will inevitably lead cyclists, walkers, runners etc directly past and beneath each turbine.

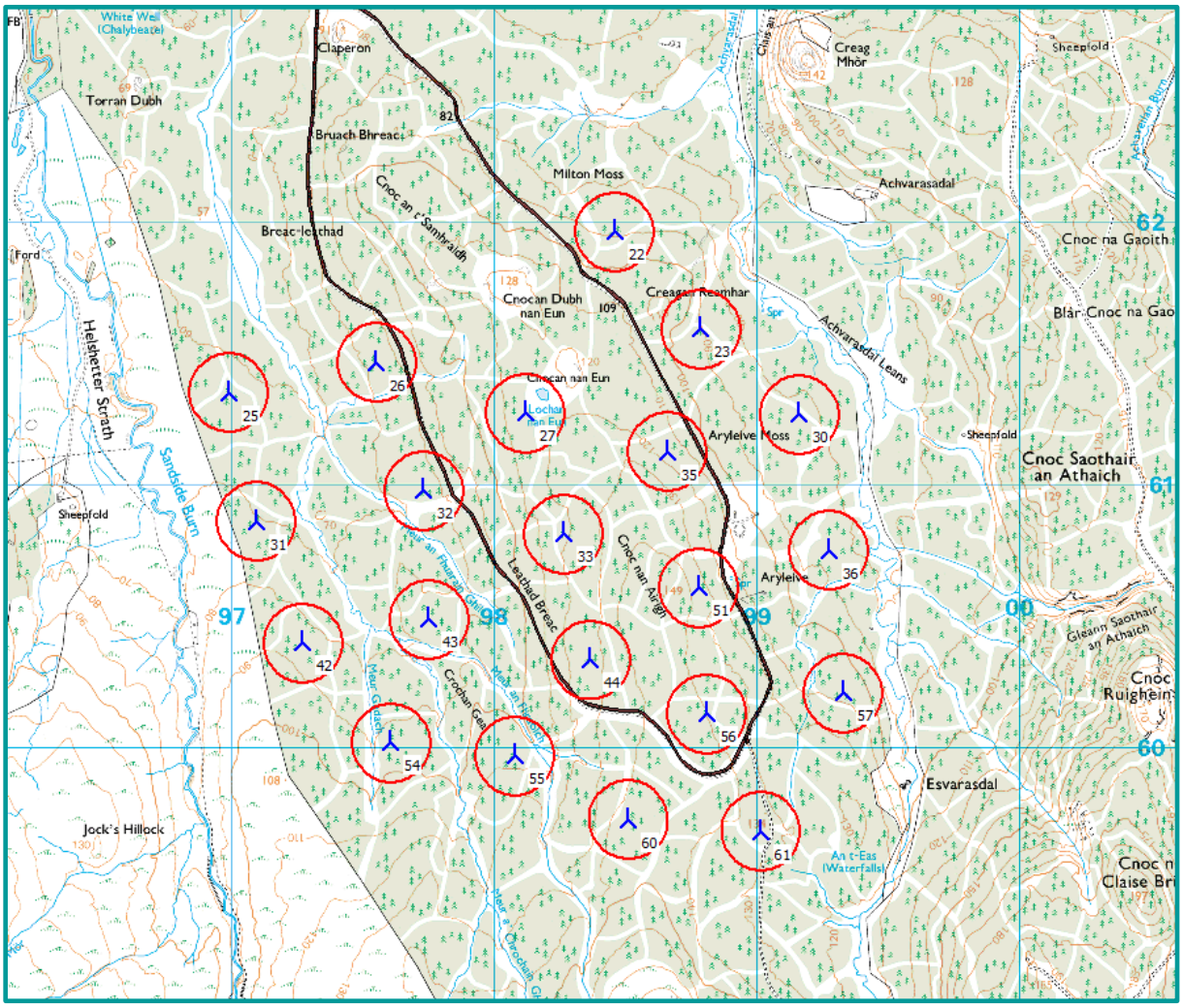
Overall, I hope ScotWays will also consider the enhancement and increased accessibility of public access on the Limekiln Estate, which appear to be aligned with the charity's objectives.

Should any further clarification be required please do not hesitate to contact me.

Yours sincerely,

Kari Clouston
Project Manager

Core path - turbine proximities



Radius 149.9m (Turbine tip height)

Appendix 2.3

Brathens Business Park
Hill of Brathens
Glassel, Banchory
Aberdeenshire
AB31 4BY

Debbie Flaherty
Energy Consents Unit
Directorate for Energy and Climate Change
Scottish Government
4th Floor
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

5 November 2021

Dear Debbie

LIMEKILN WIND FARM S36c VARIATION APPLICATION

This letter provides responses to the Royal Society for the Protection of Birds' (RSPB) concerns regarding aspects of the ornithological assessment relating to the proposed Limekiln Wind Farm S36c Variation application. RSPB's comments were conveyed in a letter (dated 6 October 2021) to the Scottish Government.

Golden eagle

We continue to be disappointed by RSPB's apparent incapacity to comprehend or register previously submitted and available material, and its apparent refusal to accept the conclusions and recommendations made by the reporters to Scottish Ministers. The representations made by the RSPB (dated 21 July 2016, 3 November 2017 and 18 July 2018) were duly considered, and scrutinised in detail, at inquiry and were summarily dismissed by the reporters to Scottish Ministers in the Limekiln Wind Farm Public Inquiry (report dated 16 October 2018).

Furthermore, it is also disappointing that RSPB appear rather selective in their reporting of the recent paper by Fielding *et al.* (2021a)[1]. Whilst RSPB are correct that Fielding *et al.* (2021a) state that collision and avoidance may not be mutually exclusive, RSPB's cherry-picking of a single sentence without

[1] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. & Whitfield, D.P. 2021a. Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* a two Scottish wind farms: Avoidance influenced by preferred habitat distribution, wind speed and blade motion status. PLoS ONE 16(8): e0254159. https://doi.org/10.1371/journal.pone.0254159

providing any context to the remainder of the paper is, at worst, misleading and, at best, shows a lack of comprehension of the information being presented.

Fielding *et al*. (2021a) show that while collision and avoidance may not be mutually exclusive, eagles still very rarely fly close to turbines and that collision mortality is not a serious threat as it is so rare. As demonstrated by Fielding *et al.* (2021a), golden eagles will fly closer to turbines when those turbines are in and have swathes of 'preferred' habitat nearby, but still not that close as to put them at risk of collision. The proposed turbines at Limekiln are not located in 'preferred' habitat even with felling and replanting. Therefore, given the lack of 'preferred' habitat within and surrounding the wind farm site coupled with the fact that wind turbines are considered as a 'threat' by golden eagles elsewhere (Fielding *et al*., 2021b)[2] there is no reasonable conclusion other than the Limekiln Wind Farm would be avoided and the risk of collision excluded.

Furthermore, as demonstrated in evidence at the Limekiln PLI, there is nothing much in terms of 'preferred' foraging habitat beyond the limits of the forest and this pair of golden eagles have a large and productive source of open ground habitat, unconstrained by neighbouring territories, away from the Limekiln Wind Farm. Therefore, there is patently no requirement to monitor golden eagle usage of the site during construction and operation of the wind farm as substantial site-based empirical evidence have shown that the eagles have absolutely no inclination to use the forest, despite there being areas of open ground, including clear-fell and restocked areas, within the forest.

Age of data

In consultation with NatureScot it was agreed that, as the number and location of turbines remains exactly the same as the consented development, new survey work was not required in this case and that revised collision risk estimates would be provided. This advice from NatureScot is entirely consistent with current NatureScot guidance on dealing with proposals for the variation of section 36 wind farm consents[3], where it states

"For birds, in the majority of cases where the number and location of turbines are not changing, all that will be needed is a re-working of the collision risk model, rather than new survey work."

Of further relevance, as shown by Fielding *et al*. (2021b), who studied eagles' reactions to numerous wind farms of varying turbine models across Scotland, their avoidance of turbines (and so the extremely low risk of collision) was largely unaffected by turbines' dimensions.

Greylag goose

We find it disappointing that the RSPB response continues its narrative on cumulative effects on greylag geese. For the benefit of RSPB, and for the avoidance of doubt, there is no possibility that the predicted collision mortality rates for greylag goose could contribute to cumulative effects for the following reasons.

1. The CRM process is inherently precautionary and the usefulness of its predictions in cumulative assessment should be treated with a high degree of caution.

[2] Fielding A. H., Anderson D., Benn S., Dennis R., Geary M., Weston E. & Whitfield, D.P. 2021b. Responses of dispersing GPS-tagged Golden Eagles *Aquila chrysaetos* to multiple wind farms across Scotland. Ibis. https://doi.org/10.1111/ibi.12996

[3] Available at https://www.nature.scot/doc/guidance-dealing-proposals-variation-section-36-wind-farm-consents

2. The predicted rate of additional mortality (0.3 collision per annum) is miniscule and beyond any practical possibility of empirical measurement.
3. As the predicted rate of additional mortality is so miniscule any additional mortality would be absorbed by, and impossible to separate from, environmental and demographic processes that are subject to stochastic variability. For context, the hunting bag information for 2019 reported 47,317 greylag geese were shot in Iceland (data from Statistics Iceland, Reykjavík[4]) and an unknown number are shot in Orkney and across the rest of Scotland. Therefore, the collision mortality estimate would constitute 0.0006 % of the greylag geese shot in Iceland alone.
4. Despite the annual harvest of c. 40,000 greylag geese annually in Iceland and an unknown number shot in other parts of the winter range, breeding success at over c.20% in each of the last ten years (Brides *et al*.,2019; Figure 6b)[5] appears to be maintaining the population.

Common scoter

As RSPB's concerns regarding common scoter are currently under consideration at the Limekiln Wind Farm Extension PLI we do not intend to repeat the Applicant's case here. Previous responses to RSPB's concerns have been submitted to the public inquiry and Scottish Government and can be accessed here https://www.dpea.scotland.gov.uk/CaseDetails.aspx?ID=121292 .

Additionally, however, we disagree with RSPB that "*research involving tagging individuals is not considered practical in the Flow Country*". It is our contention that the use of researchers with a proven track record of locating, catching and tagging breeding female common scoter in a variety of locations and habitats across Scotland, coupled with the use of highly experienced field staff in the practice of Vantage Point methods, then the practical difficulties experienced by the RSPB will be overcome.

The Applicant re-affirms their commitment to fund a common scoter tagging study in the Flow Country and considers such a tagging project a more practical and cost-effective solution to further our understanding of common scoter movements during the breeding season in the Flow Country.

Bird Protection Plan

The purpose of the Bird Protection Plan (BPP) is to prevent, or minimise, disturbance to all birds, in compliance to the Wildlife and Countryside Act 1981 (as amended), during construction of the Limekiln Windfarm. Whilst no specific measures were presented within the 2016 ES chapter, broad measures were described, including a restriction on the timing of works to prevent disturbance at nests, as the detail would be agreed with NatureScot prior to construction activities commencing. Therefore, we welcome RSPB's contribution as to what measure could be implemented to prevent construction disturbance.

I hope the above is sufficient in allaying any concerns you may have with regard to the comments made by RSPB on aspects of the ornithological assessment for the proposed Limekiln Wind Farm variation.

[4] https://statice.is/statistics/business-sectors/agriculture/hunting/

[5] Brides, K, Mitchell, C. & Auhage, S. N.V. 2019. Status and distribution of Icelandic-breeding geese: results of the 2018 international census. Wildfowl & Wetlands Trust Report, Slimbridge. 18pp

If you have any further queries or comments then please do not hesitate to contact me.

Yours sincerely,

By email

Blair Urquhart
Senior Research Ecologist
Natural Research (Projects) Ltd.

cc – Bea Ayling - RSPB Conservation Officer

Appendix 13.A

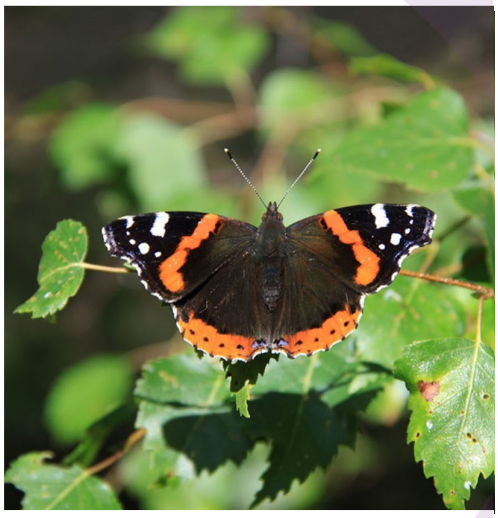
INFINERGY

wood.

Infinergy

Limekiln Wind Farm
Section 36C Variation Application

Peat Management Plan
Addendum



Wood Group UK Limited – February 2022

Report for

Kari Clouston
Senior Project Manager
Infinergy Ltd.
93 Constitution Street
Leith
Edinburgh,
EH6 7AE

Main contributors

Benjamin Amaira

Issued by

.....
Richard Bagnall

Approved by

.....
Graham Burt-Smith

Wood Group UK Limited

Partnership House
Regent Farm Road
Gosforth
Newcastle upon Tyne NE3 3AF
United Kingdom
Tel +44 (0) 191 272 6100

Doc Ref. 42129-WOOD-XX-XX-RP-R-0001_S4_P01.3

\\gos-fs14.global.amec.com\shared\gwm\data\project\42129 limekiln extension eia\deliver stage\d design_technical\peat\s36c technical appendix\pmp\appendix 13.a peat management plan_final.docx

Copyright and non-disclosure notice

Third party disclaimer

Management systems

This document has been produced by Wood Group UK Limited in full compliance with our management systems, which have been certified to ISO 9001, ISO 14001 and ISO 45001 by Lloyd's Register.

Document revisions

No.	Details	Date
P01.1	Draft for comment	10/06/21
P01.2	Final	30/06/21
P01.3	Revised Final	05/11/21
P01.3	Final	15/02/2022

Executive summary

This report has been produced with the purpose of updating the Peat Management Plan (PMP) prepared and submitted to discharge one of the planning conditions (the Tony Gee assessment) of the Consented Development. This PMP provides a comparison of the estimated peat extraction volumes for the Consented Development and the Revised Consented Development and provides an outline proposal for the re-use of extracted peat to addresses the principles set out in Scottish Renewables and SEPA guidance. This PMP also provides information on good practice for the handling and storage of peat during construction.

In June 2019, Limekiln Wind Farm gained Section 36 consent from Scottish Ministers. The Applicant is now applying to the Scottish Government for consent under Section 36C of the Electricity Act 1989 for a Revised Consented Development. The revisions include the removal of two turbines, an increase in blade tip height, larger foundations and alterations to the access track layouts.

Soil mapping of the Development Site indicates that Revised Consented Development layout passes through blanket peat as well as pockets of peaty podzols and peaty gley soils. The NatureScot Carbon and Peatland 2016 map (SNH, 2016) indicates that these soils are Class 1 and 2 soils that are defined as carbon-rich and deep peat.

A series of peat depth survey campaigns and a ground investigation have been undertaken at the Development Site since November 2011. The latest survey was undertaken on the Revised Consented Development layout in April 2021. In total 5,363 peat depth measurements have been taken across the Development Site and layouts of the Consented and Revised Consented Development.

The Consented Development was designed through an iterative approach largely undertaken by site surveys and constraints mapping by a number of environmental disciplines, including peat. The findings of peat depth surveys have been considered througout the layout design process including for the Revised Consented Development, with the aim of minimising peat disturbance and the requirement for peat excavation as far as reasonably practicable. Floating roads will be constructed where possible to minimise the extraction volumes.

The total estimated volume of excavated peat for the Consented Development based on the Tony Gee assessment and the volumes calculated for the Revised Consented Development herein are presented in Section 4.3. In additon, estimations of the total re-use volumes have been re-calculated based on the proposed re-use methods in Section 3.4 and the assumptions in Section 4.2.

Based on the volume calculations approximately 90,799m^3 of peat will be excavated from the Revised Consented Development and all of this can be beneficially re-used in reinstating areas following removal of temporary site infrastructure, reinstating areas around permanent site infrastructure to achieve good tie-ins with adjacent vegetation and restoration of the borrow pit. This volume represents an anticipated marginal increase of 61m^3 compared to the Consented Development.

It should be recognised that this PMP provides an outline of the potential re-use opportunities and peat mass balance for the Revised Consented Development. It should therefore be updated at the detailed design/tender stage once the final infrastructure locations are known, and a contractor has been appointed.

Contents

1. Introduction

1.1 Background

Wood Group UK Limited (Wood) has been commissioned by Limekiln Wind Limited (the Applicant) to prepare a Peat Management Plan (PMP) in support of the Section 36C Variation Application for the proposed Limekiln Wind Farm, south of Reay, Caithness.

The 'Development Site' is located approximately 2km south of Reay at approximate central National Grid Reference (NGR) NC 98270 60620, as illustrated in **Figure 1.0** in **Appendix A**.

In June 2019, Limekiln Wind Farm gained Section 36 consent and deemed planning permission from Scottish Ministers. The 'Consented Development' comprises 21 wind turbines and associated infrastructure. The Applicant is applying to the Scottish Government for consent under Section 36C of the Electricity Act 1989 for the construction and operation of a Revised Consented Development on the site of the Consented Development. This includes revisions to the layout that will affect the volume of peat to be excavated (see section 1.3 of this PMP).

1.2 Scope and Purpose

The purpose of this PMP is to update the PMP prepared and submitted for the discharge of conditions for the Consented Development. This PMP will provide a comparison of the estimated peat extraction volumes for the Consented Development and the Revised Consented Development.

This PMP addresses the principles set out in Scottish Renewables and SEPA guidance[1,2] by providing:

- Information on the geological and pedological setting based on published data;
- Information on the peat conditions based the field surveys and ground investigations undertaken at the Consented Development and assess its suitability for re-use;
- Information on the measures taken to avoid peat;
- Information on the elements of the Revised Consented Development that are likely to require peat extraction;
- An estimation of the peat volumes likely to be extracted at each element of the Revised Consented Development;
- A comparison of the estimated peat extraction volumes from the Consented Development and the Revised Consented Development;
- An estimate of the peat volumes that are anticipated to be suitable for re-use in reinstatements and landscape tie-ins;

[1] Scottish Renewables and SEPA (2012) Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.

[2] SEPA Guidance WST-G-052 (May 2017) *Developments on Peat and Off-Site Uses of Waste Peat.*

- Information on the control measures and appropriate management of the peat during handling and storage.

1.3 Proposed Development

In June 2019, Limekiln Wind Farm (the "Consented Development") was granted consent under Section 36 of the Electricity Act 1989 and Section 57 of the Town and Country Planning (Scotland) Act 1997 by the Scottish Ministers. The consent is for a wind farm with up to 21 wind turbines with varying tip heights and associated infrastructure. The Applicant is seeking to amend the consent to:

- Remove turbines 22 and 23;
- Increase the height of all remaining turbines to 149.9m (but keep them in their consented locations);
- Reroute the access tracks;
- Remove one borrow pit;
- Increase the period of consent from 30 to 40 years;
- Relocate the construction compound and increase its size from (100m x 100m) to (150 x 100m);
- Relocate five water crossings and insert two more;
- Increase the size of the crane hardstandings from 40 m x 22 m to 40 m x 35 m; and
- Remove the permanent anemometer mast.

Following the granting of consent for the Consented Development in June 2019, the Applicant has carried out the following enabling construction work:

- forming of a temporary construction compound at site entrance;
- creation of the consented access track from the A836 to Borrow Pit Search Area B;
- construction of the substation compound platform; and,
- excavation of Borrow Pit B to meet the rock requirements of the Consented Development enabling works

As the above works have already been consented and fully or partially completed, with the exception of the borrow pit, these elements of the wind farm have not been included in the calculations within this PMP.

A summary of the variations to the Consented Development proposed in the Revised Consented Development are summarised in Table 1.1 below. Note that Table 1.1. only summarises the variations and not the entire development therefore the elements of the Proposed Development that have already been constructed (as listed above) are not included.

Table 1.1 Summary of Consented Development and Revised Consented Development

Component	Consented Description	Revised Consented Description
Wind Turbines	Number: up to 21 turbines Base diameter: 18m	Number: up to 19 Base diameter: increased to 25m
Crane Pads	Number: up to 21 Dimensions: 22m x 40m	Number: up to 19 Dimensions: increased to 35m x 40m

Component	Consented Description	Revised Consented Description
Blade Laydown Hardstanding	Not included in Consented Development but included in discharge of conditions PMP.	Number: up to 19 Dimensions: three "fingers" of hardstanding each 10m x 14.5m (435m^2 at each laydown location)
Temporary Construction Compound	Location: NC 97995 63016 Dimensions: 100 x 100m	Location: NC 98192 62103 Dimensions: increased to 150 x 100m
Access Tracks (including turning heads)	Length: 15.3km[Note 1] Width: 5.5m	Length: decreased 12.1km Width: increased to 6.0m
Borrow Pits[Note 2]	Total number: 2 Footprint (assumed): 27,165.5m^2	Total number: 1 Footprint (assumed): 21,575.3m^2
Cable Trenches	Depth: 1.0m Width: 0.5m Length: 15.3km	Depth: 1.0m Width: increased to 1.2m Length: 8.5km

Notes:
1 – Access track lengths do not include the sections already consented and constructed as detailed above. A 3.1km section of access track has already been constructed.
2 – Although quarrying activities have commenced at Borrow Pit B they have only supplied rock for the elements constructed as detailed in Section 1.3. As such, further quarrying will be necessary to obtain rock for the Revised Consented Development and therefore it has been included in the calculations.

Collectively, these proposed variations to the Consented Development are referred to as the 'Revised Consented Development', which is shown on **Figure 2.0** in **Appendix A**.

1.4 Peat Definitions

Peat is an organic material formed by the accumulation of plant matter at various stages of decomposition, formed over many thousands of years. The characteristics of peat vary widely depending on, but not limited to, the nature of plant material that the peat is derived from, the degree of decomposition, the type of peat bog and the quality of the water sustaining the bog. In Scotland, the Scottish Government defines peat and deep peat as follows (Scottish Government *et al.*, 2017):

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

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

Key aims of this PMP are to set out procedures to minimise excavated volumes of peat and protect peat resources as far as possible, thereby minimising carbon losses. A range of methods and control measures are described in this PMP which are designed to prevent these effects from occurring.

1.5 Previous Peat Management Plans

In 2012 the Environmental Statement (the 2012 ES) submitted with the first Limekiln Wind Farm Section 36 Application included a commitment to develop a peat management strategy prior to construction and following completion of detailed ground investigations. In response to the application Scottish Environmental Protection Agency (SEPA) lodged an objection due to a lack of information on the management of peat (PCS/124031, dated 14/02/2013). The objection was addressed through the preparation of a Peat Management Technical Note (ref. 33865CGOS019) which was included as Appendix C of the Further Environmental Information (2013 FEI) submitted in July 2013. The Peat Management Technical Note included calculations of the anticipated peat excavation volumes which indicated that approximately 77,000m^3 of peat would require extraction and that the proposed re-use/restoration methods had sufficient capacity to re-use all of the extracted peat. Following submission SEPA withdrew their objection (PCS/127959, dated 06/08/2013) subject to the finalised PMP being agreed with the Planning Authority in consultation with SEPA and Scottish Natural Heritage (SNH) (now NatureScot).

In January 2016 the Applicant submitted a Scoping Report for the Limekiln Wind Farm Resubmission and in January 2016 SEPA responded (PCS/144513) with a request that an updated PMP should be submitted. In May 2016 EnviroCentre Ltd produced an Outline PMP in support of the resubmission application (2016 ES) which was based on the results of a site wide and targeted peat depth survey in 2011 and 2013, respectively. The calculations in the Outline PMP indicated that approximately 73,650m^3 of peat would require extraction and that the proposed re-use/restoration methods have sufficient capacity to re-use all the extracted peat. The Outline PMP stated that it would require updating at the post planning consent, pre- construction phase, to incorporate further ground investigation data, design information and construction method statements. The Planning Application to construct the wind farm was subsequently consented in June 2019.

Following consent Tony Gee and Partners LLP (TGP) were commissioned by Infinergy on behalf of Limekiln Wind Ltd to produce an updated PMP for the Consented Development in support of discharging Planning Condition 19 (relating to the requirement for a Construction Environmental Management Plan). The PMP was based on existing peat depth data, two phases of additional high resolution peat surveys and an intrusive ground investigation undertaken at the Development Site in 2020. The TGP PMP was prepared over a number of revisions in consultation with The Highland Council (THC) and SEPA and concluded that approximately 103,809m^3 of peat would need to excavated with 103,807m^3 being reinstated. The reason for the increased volume of peat extraction was noted to have been due to the increased size of the crane pads and the inclusion of a blade storage area, turning head and a passing place at each turbine increasing the overall footprint of the Consented Development.

For the purpose of this assessment, the PMP prepared by TGP is the basis for comparing the peat extraction and reinstatement volumes anticipated for the Consented Development and the Revised Consented Development.

1.6 Sources of Information and Guidance

The following sources of information and guidance have been referenced throughout this PMP:

- Appendix C: Peat Management Technical Note, Limekiln Wind Farm Further Environmental Information, July 2013;
- Appendix 5.B: Peat Slide Hazard & Risk Assessment, Limekiln Wind Farm Resubmission, Environmental Statement, May 2016 (herein referred to as “the 2016 ES”);
- Appendix 5.C: Outline Peat Management Plan, Limekiln Wind Farm Resubmission, Environmental Statement, May 2016;

- Appendix 5.A: Preliminary Ground Investigation Factual Report, Limekiln Wind Farm Resubmission Environmental Statement, June 2016 (herein referred to as "the 2016 ES");
- Limekiln Wind Farm, Peat Management Plan, Tony Gee and Partners LLP, document reference S120004-TG-00-XX-C-2001, revision R06, November 2020.
- Limekiln Wind Farm, Phase 1 Factual Ground Investigation Factual Report, reference 1228952, Natural Power, July 2020.
- Limekiln Wind Farm, Phase 2 Factual Ground Investigation Factual Report, reference 1233164, Natural Power, August 2020.
- 2020 Peat Survey Natural Power (no accompanying report, only raw data was received).

The following guidance and best practice documents for peat management have been taken into account through the development of this PMP;

- Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commisson (2019) Good Practice During Wind Farm Construction, 4th Edition.
- Forestry Civil Engineering and Scottish Natural Heritage (2010) Floating Roads on Peat.
- Scottish Renewables and SEPA (2012) Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Version 1
- SEPA Guidance (2017); WST-G-052: Developents on Peat and Off –Site Uses of Waste Peat, Version 1.

2. Peat Conditions

2.1 Site Description

The Development Site is located 1.5km to the south of the Village of Reay and 3km south/south west of the Dounreay Nuclear Power Station, in Caithness, Highland. The site extends to approximately 1,140 hectares and largely comprises of a commercial coniferous woodland plantation. The Development Site is bound to the north by undulating moorland and semi-improved agricultural land with the Reay village and dispersed settlements beyond. To the east lies further coniferous woodland while the land to the west and south is largely open moorland. The hill known as Beinn Ratha lies approximately 1.2 km to the west of the site boundary.

2.2 Published Geology

Pedology

The 1:25,000 Soil Map of Scotland (The James Hutton Institute, 2020) indicates that Revised Consented Development layout passes through blanket peat as well as pockets of peaty podzols and peaty gley soils. The 1:25,000 Soil Map of Scotland is presented as **Figure 3.0 in Appendix A**.

The NatureScot Carbon and Peatland 2016 map (SNH, 2016) is presented as **Figure 4** in **Appendix A**. The map indicates that the Revised Consented Development passes through areas of Class 1 and 2 soils that are defined as carbon-rich and deep peat. The Revised Consented Development also passes through a small area of Class 5 (no peatland habitat recorded) adjacent to the borrow pit.

2.3 Field Surveys

Peat Probing

A summary of the peat depth surveys undertaken at the Development Site is provided in Table 2.1 below.

Table 2.1 Summary of Peat Surveys

Author & Date	Purpose	Scope & Detail
AMEC (now Wood) November 2011	Preliminary assessment for consenting	• The aim of the survey was to provide a preliminary indication of the likely distribution of peat across the Development Site. However, due to dense forestry a targeted survey was undertaken primarily at turbine locations and en-route along fire breaks and rides where access allowed. • A total of 124 no. peat depth measurements were taken using a peat utility probe and a Russian peat sampler where the peat depth was >1.0m. • The Russian peat core samples were subject to classification in accordance with the modified von Post classification scheme (Hobbs, 1986) • The results of the survey (including coordinates) are presented in Appendix 5.A Preliminary Ground Investigation Factual Report, Limekiln Wind Farm Resubmission, Environmental Statement.

Author & Date	Purpose	Scope & Detail
AMEC (now Wood) May 2013	Detailed assessment for consenting	• The aim of the survey was to provide detailed peat depth data across the Development Site as well as at the locations of turbines, existing and new access tracks, borrow pits, substation and construction compound. • A total of 129 no. peat depth measurements were taken using a peat utility probe and a Russian peat sampler where the peat depth was >1.0m.
Tony Gee and Partners LLP June 2020	Detailed assessment for Phase 1 of construction – access and enabling works	• A high resolution (closely spaced) peat depth survey was undertaken at the location of proposed wind farm infrastructure to inform the enabling works (the main access, borrow pit, construction compound and control building) and discharge of conditions for the Consented Development. • The survey was undertaken alongside the initial tree felling operations to clear routes for the ground investigation. • An intrusive ground investigation was also undertaken concurrently with the peat probing that targeted the wind farm infrastructure • The proposed access track route and the entire micrositing buffer zone were probed where tree felling allowed. • The scope of peat survey comprised: ▸ Access Tracks – transects every ~50m perpendicular to the track comprising a minimum of 5 no. probes every 20m from centre line. ▸ Construction compound – grid of probes spaced at 25m centres across the entire footprint. ▸ Control building – grid of probes at 20m centres across the entire footprint. ▸ Borrow Pit B – transects every 20m along existing rides or felled corridors within the borrow pit footprint where possible (the number of probes depended on the cleared area).
Tony Gee and Partners LLP July & August 2020	Detailed assessment for Phase 2 of construction – access and turbine construction	• A high resolution (closely spaced) peat depth survey was undertaken at all remaining wind farm infrastructure to inform the construction of remaining access routes and discharge of conditions for the Consented Development. • The survey was undertaken alongside the tree felling operations to clear routes for the ground investigation. • The scope of peat survey comprised: ▸ Access Tracks – transects every ~50m perpendicular to the track comprising a minimum of 5 no. probes every 20-50m from centre line. ▸ Crane pads and turbines – grid of probes spaced at approximate 25m centres across the entire footprint where possible. ▸ Borrow Pit A – transects every 20m along existing rides or felled corridors within the borrow pit footprint where possible (the number of probes depended on the cleared area).

Author & Date	Purpose	Scope & Detail
Natural Power April 2021	Update of TGP PMP to support Section 36C application.	• A scope of detailed peat depth survey was developed by Natural Power in general accordance with guidance published by the Scottish Government et al (2017)[3] • The survey targeted on the varied elements of Revised Consented Development layout including the turbine location and access tracks. The unaltered elements of the Consented Development were not probed. • The scope of the survey comprised: ▸ Access Track – the access tracks south of Borrow Pit A were surveyed at 50m intervals with a probe also placed ~15m perpendicular to either side of the access track. ▸ Turbines – a crosshair of probes orientated to grid north-south were undertaken at 10m intervals from the location of the turbine up to 100m.

Reference: partly adapted from Limekiln Wind Farm Peat Management Plan, Tony Gee and Partners LLP, reference S12004-TG-00-XX-RP-C-2001

Ground Investigation

The TGP PMP provides information on the intrusive ground investigation undertaken at the site by Natural Power under the supervision of engineers from TGP. The ground investigation is summarised is as follows:

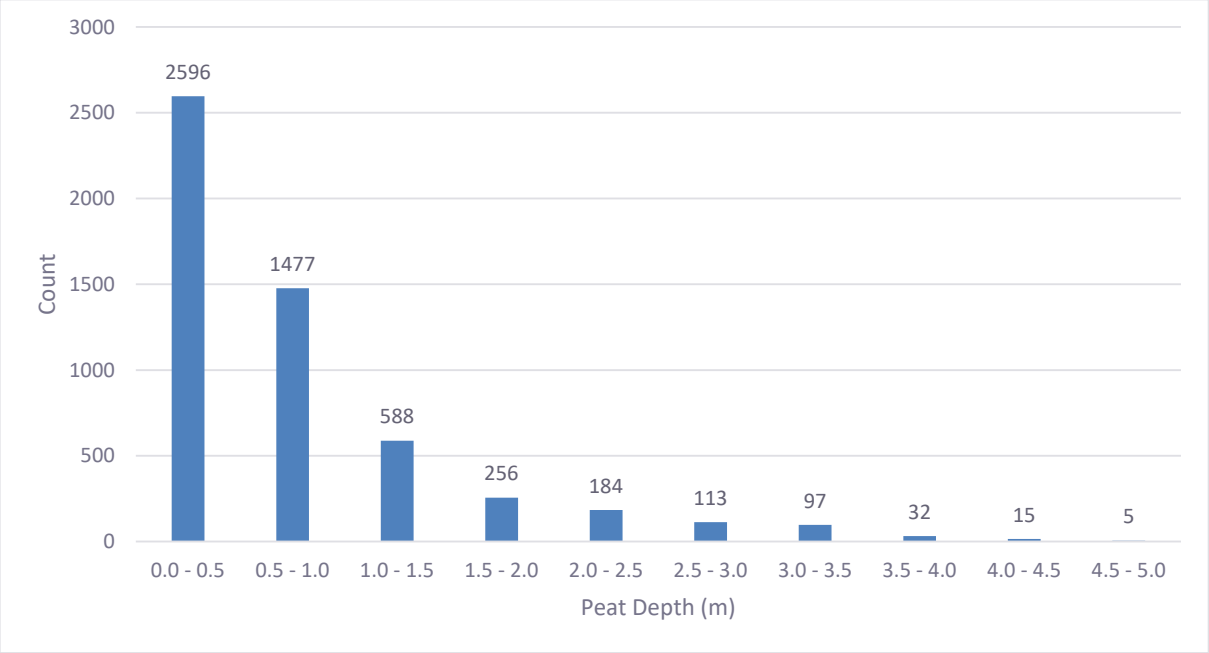
- 54 no. boreholes (29 no. rotary percussive boreholes with follow on rotary core drilling, 25 no. windowless boreholes);
- 192 no. machine excavated trial pits, 3 no. hand dug trial pits;
- 5 no. pavement cores;
- In-situ testing (dynamic cone penetrometer testing; standard penetration testing and undisturbed sampling, hand shear vane tests in peat in trial pits);
- Groundwater and ground gas monitoring; and
- Geotechnical and geochemical laboratory testing.

2.4 Peat Depth & Distribution

In total 5,363 peat depth measurements have been taken across the Development Site and layouts of the Consented Development and Revised Consented Development. The peat probing campaigns and ground investigation reveal that peat depths range between 0.00m and 4.90m. A total of 2,767 (~51%) recorded peat depths ≥0.5m and the calculated mean of all peat depths ≥0.5m is 1.17m. Figure 2.1 below summarises the distribution of peat depth measurements for the Development Site.

[3] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only

Figure 2.1 – Summary of all peat depth data



A summary of the peat depths recorded at the Consented Development and Revised Consented Development is provided in Table 2.2 below.

Table 2.2 Summary of peat depths

	Consented Development	Revised Consented Development
Number of measurements	2,620	1,780
Minimum	0.00m	0.00m
Maximum	4.00m	4.60m
Mean	0.72m	0.81m

Notes
These values relate to the probing locations along the Consented and Revised access tracks leading from BP-B only. The probing locations at turbines and crane pads are also included.

The peat depths recorded during the peat survey of the Revised Consented Development are presented as **Figures 5.0 to 5.8.** A composite of all peat depths survey results, include the ground investigation are presented in **Figures 6.0 to 6.11**

The peat depth measurements from all sources have been combined to create an interpolated peat depth map showing the extent and variation in thicknesses of peat across the Development Site. **Figure 7.0** in **Appendix A** shows the interpolated peat depths with the Consented Development and Revised Consented Development overlain.

The interpolated peat depth map indicates that approximately one third of the Development Site contains peat depths <0.5m. In the west of the site between T26 and T43 the proposed access passes through a large area of peat with thicknesses in excess of 2.0m, ranging up to approximately 4.5m. In addition, further pockets of peat with thicknesses >2.0m are identified throughout the site in or near the location T25, T54, T55, T30 and T57.

2.5 Peat Characteristics

A total of 74 peat cores were logged according to the von Post scale of humification during the peat depth surveys undertaken in 2011 and 2013. The coring revealed a typical one or two layer profile with generally low moisture content values (typically B2). The humification values were typically less than H5 with H values up to H7 rarely recorded. The investigation also attempted to estimate the thickness of the acrotelmic layer, which revealed thicknesses vary from approximately 0.3m to 0.5m. However, as noted in the Peat Management Technical Note, the commercial forestry plantation has resulted in the peat being densely planted and with trees along deeply ploughed furrows. As a consequence of the planting, the increased drainage and evapotranspiration of the surface peat has resulted in the peat being reasonably dry. It was noted that the characteristics of the surface peat have been altered to such a degree that there was no clear distinction between acrotelmic and catotelmic peat. The peat was described as exhibiting 'haplotelmic' peat conditions in which the acrotelm has been degraded through drainage, compaction and oxidative wastage.

The TGP PMP reveals that the intrusive ground investigation undertaken on the Consented Development encountered fibrous to pseudofibrous (H3-H6) peat, with localised areas of amorphous peat (H7-H9). As identified by previous surveys, the distinction between the acrotelmic and catotelmic peat was difficult to distinguish. The distinction was especially difficult in areas where trees had been felled, and brash had to be removed prior to trial pitting. However, where identifiable, the acrotelmic layer generally varied in thickness from 0.1m-0.7m.

3. Peat Management

3.1 Peat Management Principles

A hierarchy of peat management approaches is provided in Scottish Renewables and SEPA guidance documents (Scottish Renewables and SEPA, 2012; and SEPA, 2017) that recommend the following:

- **Prevention** – prevent or minimise peat excavation/disturbance through considered design that avoids or minimises wind farm infrastructure within areas of peat. Where avoidance is not possible, minimise excavation of peat using engineering solutions such as floating roads.
- **Re-Use/Reinstatement –** re-use extracted peat close to its original location in the reinstatement or restoration of temporary infrastructure, road verges and borrow pits. Peat may also be used where appropriate to improve or restore peatland habitats.
- **Recycle/Recover/Treat –** while the priority should always be to prevent and re-use peat on site there may be situations in which there may still be a surplus of excavated peat. Where demonstrated that it is suitable for use peat, may be blended, dewatered or treated to improve its properties to support re-use on site.
- **Temporary storage –** store the peat temporarily during construction prior to re-use in on site reinstatement or restoration activities.

The design of the wind farm layout evolved throughout the assessment of the Development Site in response to consultations, desk studies, field surveys and technical assessments undertaken by a range of disciplines in support of the Environmental Impact Assessment Report (EIAR) and FEI.

3.2 Construction Activities & Effects

The following construction activities will require the stripping of peat and peaty soils down to the underlying substrate and formation level of the infrastructure at the Revised Consented Development layout;

- Construction of 6.1km of cut access tracks. It should be noted that the use of floating tracks has been maximised (5.9km) to reduce excavated peat);
- Wind Turbine Generator (WTG) foundation excavations;
- Crane pads;
- Cable trenches;
- Temporary construction compound hard standings; and,
- Removal of overburden to facilitate further borrow pitting

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

- Trafficking of plant and machinery over areas underlain by peat and peaty soils;
- Laydown of materials (including excavated peat and mineral soils) on peat and peatland vegetation; and
- Reinstatement of peat and peaty soils and/or other re-vegetation activities to reinstate or tie pre-construction peatland habitats into the Revised Consented Development.

These activities have the potential to cause a range of effects during construction and operation including loss of integrity and vegetation, drying, erosion, oxidation and interruption of the peat hydrology,

3.3 Minimising Peat Excavation

The Consented Development was designed through an iterative approach largely undertaken by site surveys and constraints mapping by a number of environmental disciplines, including peat. The proposed alignment of access tracks for the Revised Consented Development has sought where possible to minimise the overall track length and avoid identified constraints.

The findings of peat depth surveys have been considered througout the layout design process for the Consented Development, with the aim of minimising peat disturbance and the requirement for peat excavation as far as reasonably practicable.

Where peat cannot be avoided a floating design will be employed wherever possible to minimise the extraction volumes (Forestry Commission Scotland and SNH, 2010). The location for floating access tracks has been assessed using the following criteria:

- Minimum 750mm depth;
- Where tracks require large amounts of fill, this would include a makeup of bulk fill (e.g. Class 1A) and selected engineered materials (e.g. 6F2, Type 1);
- Limit for floating tracks on the longitudinal gradient: max 8%;
- Vertical profile 1 in 500 to prevent grounding; and
- Limit for floating tracks on hillsides with a cross slope gradient: max 5%.
- Floating track used on filled turning head locations;
- Infrastructure unsuitable for floating design: turbines area and hardstands;

As a result, it is considered that an additional 2.9km of floating access track can be constructed on the revised consented scheme i.e. 5.4km compared to the consented scheme (2.5km).

Table 3.1 below summarises the wind farm infrastructure elements in each peat depth definition.

Table 3.1 Summary of peat depth definitions at wind farm infrastructure

Peat Depth	Consented Development	Revised Consented Development
Peaty soils (<0.5m)	Turbines: 25, 26, 31, 35, 42, 56 Crane pads at turbines: 26, 35, 42 Blade laydown: n/a[Note 1] Temporary construction compound Cut access track: 5.5km[Note 2]	Turbines: 25, 26, 31, 35, 42, 43, 44, 54 Crane pads at turbines: 25, 26, 31, 35, 42, 44, 51 Blade laydown at turbines: 25, 35, 42, 44, 51 Temporary construction compound Cable trenches: 2.7km Cut access track: 2.7km
Peat (>0.5 and <1.0m)	Turbines: 22, 23, 32, 33, 36, 43, 44, 51, 54, 61 Crane pads at turbines: 22, 23, 25, 26, 27, 30, 31, 36, 43, 44, 56, 51, 61 Blade laydown: n/a Cut access track: 7.2km	Turbines: 32, 33, 36, 51, 56, 57, 61 Crane pads at turbines: 30, 36, 43, 54, 55, 56, 57, 61 Blade laydown at turbines: 26, 27, 30, 31, 33, 36, 55, 56, 57, 61 Borrow Pit B Cable trench: 5.7km Cut access track: 4.0km Floating access track: 1.7km

Peat Depth	Consented Development	Revised Consented Development
Deep Peat (>1.0m)	Turbines: 27, 30, 55, 57, 60 Crane pads at turbines: 32, 33, 54, 55, 57, 60 Blade laydown: n/a Cut access track: n/a Floating access track: 2.5km	Turbines: 27, 30, 55, 60 Crane pads at turbines: 27, 32, 33, 60 Blade laydown at turbines: 32, 43, 54, 60 Cable trench: n/a Cut access track: n/a Floating access track: 3.7km

Notes:
1 – Blade laydown areas were not proposed in the Consented Development but were included in the TGP PMP.
2 – Access track lengths do not include the sections already consented and constructed as detailed in Section 1.3.

3.4 Proposed Re-Use

While the guiding principle has been to avoid peat and therefore peat excavation, for engineering, logistical and due to other environmental constraints (e.g. ecological or hydrological) the placement of wind farm infrastructure in areas of peat has been unavoidable. The next best solution is to reinstate or re-use the peat at its original position wherever this is possible. Further details are provided in **Section 4**.

3.5 Suitability for Re-use

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

The von Post classification undertaken during previous investigation of the Consented Development indicate that humification values were typically less than H5 in areas of shallow peat and that the peat is fibrous to pseudofibrous. In areas of deeper peat H values ranged between H7 to H9 and localised areas of amorphous peat were identified.

The depth of the acrotelmic layer, where identifiable in previous investigations, generally varied in thickness from 0.1m-0.7m. For the purpose of this PMP it has been assumed that the top 0.5m will be acrotelmic peat consisting of fibrous peat and the surface vegetation.

The following assumptions have been made with regard the characteristics of the peat and the intended suitable reuses at the Revised Consented Development:

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

3.6 Temporary Storage

The selection of temporary peat storage locations shall consider the environmental constraints, peat landslide risk and avoid placing peat on top of sensitive peatland habitats and near watercourses. In addition, the stockpiles shall be designed to include measures that avoid instability of the stockpiles and the run-off of peat laden sediment into watercourses. As far as possible excavated peat from the access tracks and cable trenches shall be temporarily stored adjacent to the excavation or re-used immediately in the restatement of the track verges and trench.

The outline PMP submitted with the 2016 ES and the TGP PMP submitted to discharge planning conditions, identify locations for temporary storage using the criteria in Table 3.2. For the purpose of this assessment, the same criteria have been utilised to identify suitable locations for temporary storage at the Revise Consented Development layout as shown in **Figure 8** in **Appendix A**.

Table 3.2 Temporary storage criteria

Suitability	Criteria
High	• Less than 75m from proposed infrastructure (to minimise extent of construction envelope). • More than 50m from watercourses. • Located on peat that is less than 1.5m thick. • Located on slopes which are less than 5°. • Avoiding groundwater dependent terrestrial ecosystems (GWDTEs).
Moderate	• Defined in the same way as High but GWDTEs are present.
Low	• Areas which do not meet one or more of the defined criteria (excluding the presence of GWDTEs).

Although **Figure 8** in **Appendix A** identifies potentially suitable storage locations, the exact location and dimensions of the temporary storage stockpiles shall be determined on site during construction. Each storage location will be assessed by the Site Environmental Engineer, Geotechnical Engineer and the Environmental Clerk of Works (EcoW) to determine whether they are suitable. The Site Engineer will consider each location's suitability in terms of its environmental impact, safety, constructability and whether special mitigation measures will be required (e.g. orientation of the stockpile, levelling/benching, bunding to contain stored materials and site-specific drainage to ensure that runoff waters are sufficiently controlled.

The peat will be temporarily stored in the following general arrangement:

- Peat stripped to construct the new cut access tracks will be re-used as the construction progresses. The intact surface turves will be placed on roadside verges during construction and will not need to be temporarily stored elsewhere.
- At turbines, crane pads, blade laydowns and the construction compound peat will be temporarily stored in designated locations as close to its original location as possible. Surplus excavated peat will be transported for temporary storage as close as possible to the location of its proposed re-use.
- At the borrow pit, peat will be stripped and temporarily stored as close as possible to the borrow pit, within the borrow pit search area.
- At the control building and substation peat will be temporarily stored within a purpose-built peat storage area or the borrow pit search area and then re-used for reinstatement at other parts of the Revised Consented Development.

4. Peat Mass Balance

4.1 General

The peat extraction volumes for the Revised Consented Development have been estimated from data gathered during the field surveys described in Section 2.3 and the dimensions of the infrastructure components shown Table 1.1. In each case, the average peat depths for the calculations have been derived from the average of all 5m cell centres of the interpolated peat depth map (**Figure 7.0** in **Appendix A**) that fall within each element using ESRI ArcGIS.

The interpolated peat depth map has used the Spline method of interpolation. While it is recognised that this method may exaggerate the troughs and peaks where there are large distances between sample points (i.e. the peat depth measurements) it plots the modelled surface exactly through the sample point value. Other methods such as Natural Neighbour apply weightings to the values which may result in over or under estimation of the modelled surface value at the sample points. Given the density of the sample points along proposed infrastructure (except for the sections in mentioned in Section 4.2) the Spline method is considered an appropriate model of the peat depths at infrastructure locations. An interpolated peat depth map resolution of 5m is considered appropriate given the distance between sample points is between 10 and 50m with the highest resolution of sample points at the turbines and related infrastructure. This method of determining the average peat depth considers the modelled spatial variation in peat depths between sample points rather than relying on just the sample points that fall within the footprint of proposed infrastructure.

The access tracks are long linear features that pass over a large range of peat depths. The use of a single average for the access tracks would not therefore represent the peat depth variability. As such, the access tracks have been divided into chainages typically 50m long, though depending on their location some chainages may be longer or shorter (i.e. the ends of the track may be shorter or longer depending how the preceding chainages are aligned).

The peat extraction volumes have been estimated for the Revised Consented Development and compared against the estimated volumes for the Consented Development for the site as a whole as presented in Table 15 of the TGP PMP. The layouts of the Consented Development and Revised Consented Development to which the calculations relate are presented in **Figure 2.0** in **Appendix A**.

4.2 Key Assumptions and Limitations

Key assumptions are as follows:

- The extraction volumes in Table 15 of the Limekiln Wind Farm, Peat Management Plan (Tony Gee and Partners LLP, document reference S120004-TG-00-XX-C-2001, revision R06, November 2020) include the entirety of the main access track from the A836 to Borrow Pit B which has already been constructed. The peat extraction volume for this section of access track is given in Table 7 of the TGP PMP as 2,267m^3 which has been subtracted from the value presented in Table 15 of the TGP PMP. The values presented for the Revised Consented Development tracks therefore relate to the tracks leading away from Borrow Pit B to the turbines.
- The calculations presented herein do not include the elements of the Proposed Development that have already been constructed, as detailed in Section 1.3. It is assumed that the peat excavated for these elements has already been/is being managed appropriately.
- The excavated peat volumes have been divided into acrotelmic and catotelmic peat. It is assumed that all peat of thickness up to 0.5m are acrotelmic, and anything >0.5m in thickness is catotelmic.

- The estimated extraction volumes at the turbines have been calculated slightly differently to the method adopted in the TGP PMP. In addition to wider base diameters (25m) the top diameter of the excavation has been calculated based on the average peat depth at each turbine location and a batter angle of 27° (1:2). However, it assumed that excavations in peat depths less than 0.5m will not require the peat to be battered back. This has been adopted for the purpose of these calculations but in practice would need to be assessed by the Principal Contractor based on the characteristics of the peat at each turbine.
- The calculations for access tracks include the turning heads and junction arcs.
- Where the access tracks pass turbines, crane pads and blade laydown areas the estimated values have been adjusted accordingly to avoid double counting.
- No allowance has been made for the assist pad and turning head footprint included in the TGP PMP. It is assumed that these will not be required in the Revised Consented Development layout.
- Excavation and reinstatement volumes associated with drainage ditches and areas of cut and fill for the access tracks have not yet been calculated as the dimensions will depend on the final alignment of the track and dimensions of the drainage ditches.
- The peat balance calculations are in the context of the Revised Consented Development layout, guidance, and literature sources available at the time of writing. New information, improved practices and changes in guidance or significant alterations to the Revised Consented Development layout post-consent may necessitate a re-interpretation of the assessment in whole or in part after its original submission.
- It should be recognised that the surveys and interpolations based on those surveys provide information characterising the variation of peat depths and that different conditions may be present between survey locations.
- The calculations are based on peat depth data obtained by third parties and provided to Wood. Wood has assumed that the data are true and correct at the time of use and cannot provide any warranty or accept any liability for their accuracy. Wood has not verified any of the peat depth measurements obtained by third parties.

4.3 Peat Extraction Volumes

Table 4.1 below summarises the estimated excavations volumes of peat that will be extracted across the Consented Development compared to the Revised Consented Development (excluding the main access from the north).

Table 4.1 Assessment of peat extraction volumes

Infrastructure	Total Extraction Volume (m^3)	
	Consented Development	Revised Consented Development
Turbine bases	56,395	8,465
Crane pads		24,405
Blade laydown		8,586
Turning head and assist pad		Not required

Infrastructure	Total Extraction Volume (m^3)	
	Consented Development	Revised Consented Development
New cut access tracks	11,231 Note 1	27,014
Upgraded access tracks	4,880	0
Floating access track	0	0
Cable trenches	2,570	5,567
Construction compound	2,500	3,600
Borrow pit	13,162	13,162 Note 2
Total Volume	**90,738**	**90,799**

Notes
1 – The estimated volume of cut tracks in the TGP PMP has been reduced by 3,900m^3 to account for the approximate volume of extraction along the main access track from the B836.
2 – The location of borrow pit search area BP-B has not been revised. The value presented here is the same as that calculated by TGP in Table 11.

The volume estimations indicate that an additional **61m^3** of peat will be excavated overall by the Revised Consented Development as compared to the Consented Development. This is broken down as follows:

- An estimated 15,000m^3 of additional excavated peat will be generated due to:
  - 10,903m3 from the construction of additional new cut access tracks and the removal of upgraded tracks;
  - 2,997m3 from wider cable trenches; and
  - 1,100m3 from the increased size of the Temporary Construction Compound.
- An estimated reduction of 14,949m^3 in excavated peat will be achieved by:
  - Removal of turbines T22 and T23;
  - Reduction of each blade laydown area from 797.5m^2 to 435m^2 by the use of three "fingers" of hardstanding rather full hardstanding; and
  - Replacement of 2.9km of cut access track with floating access track compared to the consented scheme (i.e. 5.4km compared to 2.5km).

A summary of the peat extraction volumes for the Revised Consented Development split by acrotelmic and catotelmic peat is presented in Table 4.2 below.

Table 4.2 Summary of peat extraction volumes by peat characteristics

Infrastructure	Total Extraction Volume (m^3)	
	Acrotelmic Peat	Catotelmic Peat
Turbine bases	4,847	3,618
Crane pads	13,679	10,726
Blade laydown	4,702	3,884

Infrastructure	Total Extraction Volume (m^3)	
	Acrotelmic Peat	Catotelmic Peat
New cut access tracks	21,354	5,660
Floating access track	0	0
Cable trenches	4,484	1,083
Construction compound	3,600	0
Borrow pit [Note 1]	9,170	3,992
Total Volume	**61,836**	**28,963**

Notes
1 – The location of borrow pit search area BP-B has not been revised. The value presented here has been calculated by TGP.

The spreadsheet calculations for the estimated extraction volumes are presented in Appendix B.

4.4 Peat Reinstatement Volumes

Proposals for peat re-use are set out in Table 4.3.

Table 4.3 Proposed Re-Use

Infrastructure Element	Proposed Re-Use
Turbines	Reinstatement of peat over the portion of the turbine excavation not connected to the crane pad and/or blade laydown area (i.e. approximately half of the excavated area of the circular excavation). Reinstatement will extend an additional 2m around this area to ensure a suitable tie with the surrounding habitats. All reinstatement will be carried out to a maximum depth of 0.5m.
Crane Pads	In accordance with best practice guidance (Scottish Renewables *et al*, 2019), the crane pad will not be reinstated or reduced in size following construction but will be retained for future turbine maintenance. The crane pad batters are to be reinstated at the edges of the pad to create a suitable tie-in with the surrounding vegetation on two sides (i.e. those not connected to the track and turbine). All reinstatement will be carried out to a maximum depth of 0.5m.
Blade Laydown Hard standings	It has been assumed that the blade laydowns (comprising three "fingers" of hardstanding on to which the blade will be laid) are temporary and will be completely reinstated following construction of the turbine.
New Cut Assess Tracks	The verges will be reinstated to ensure that a suitable visual tie-in with the surrounding vegetation and habitats is created. The reinstatement area will be 0.5m deep and 3m wide along either side of the track. The turning heads and arcs will be reinstated to a width 2.5m along the outer edge of the arc.
New Floating Access Tracks	Verges can be reinstated to ensure that a suitable visual tie-in with the surrounding vegetation is created. Any verge reinstatement will be up to 0.5m deep (to avoid any over-depositing of peat which would create high verges that could prevent water draining off the road) and up to 2m wide on either side of track. For the purposes of this PMP it is assumed that half of the floated track would be reinstated in this way.
Cable Trenches	It has been assumed that the cable trenches will be fully reinstated with the peat that was extracted. Where the access track will be floated it is assumed that cabling will be laid directly onto the undisturbed peat and buried within the verge reinstatement.

Infrastructure Element	Proposed Re-Use
Temporary Construction Compound	The temporary construction compound will be fully reinstated to its current peat depth.
Borrow Pit	It is anticipated that the borrow pit will be restored with peat to an average depth of approximately 1.22m with the potential for localised deeper areas subject to a borrow pit assessment plan to include detailed restoration proposals. The borrow pit design may evolve during construction subject to the quality of material being excavated and thereby the quantity of useful material won and extracted. Restoration proposals will be developed at that stage.

Table 4.4 summarises the volumes of peat that will be re-used across the Revised Consented Development (excluding the main access) as per the methods outlined in Table 4.3 and the assumptions in Section 4.2.

Table 4.4 Summary of reinstatements/re-use volumes

Infrastructure	Total Re-Use Volume (m^3)		
	Acrotelmic Peat	**Catotelmic Peat**	**Total**
Turbine bases	2,933	0	2,933
Crane pads	3,026	0	3,026
Blade laydown	4,702	3,884	8,586
New cut access tracks	21,354	5,660	27,014
Floating access track	11,800	0	11,800
Cable trenches	4,484	1,083	5,567
Construction compound	3,600	0	3,600
Borrow pit	9,937	18,336	28,273
Total Volume	**61,836**	**28,963**	**90,799**

Table 4.5 summarises the peat mass balance for the Revised Consented Development. Note that this excludes the main access track from the north.

Table 4.5 Summary of peat mass balance

Infrastructure	Total Re-Use Volume (m^3)		
	Acrotelmic Peat	**Catotelmic Peat**	**Total Balance**
Turbine bases	1,914	3,618	5,532
Crane pads	10,653	10,726	21,379
Blade laydown	0	0	0
New cut access tracks	0	0	0
Floating access track	-11,800	0	-11,800

Infrastructure	Total Re-Use Volume (m^3)		
	Acrotelmic Peat	Catotelmic Peat	Total Balance
Cable trenches	-0	0	0
Construction compound	0	0	0
Borrow pit	-767	-14,344	-15,110
Totals	**0**	**0**	**0**

Notes
Positive values denote locations where there is a surplus of excavated peat that will need to be moved elsewhere.
Negative values denote locations to which excavated peat can be transferred for reinstatement/ restoration purposes.

The spreadsheet calculations for the re-use volumes are presented in Appendix B.

Table 4.1 indicates that the total volume of peat that will be stripped and excavated from the Revised Consented Development during construction will be approximately **90,799m^3**. Using the proposals for re-use set out in Table 4.3 and considering the assumptions in Section 4.2, Table 4.4 indicates that all of this excavated peat can be beneficially re-used within the site.

It should be recognised that this PMP provides an outline of the potential re-use opportunities and peat mass balance for the Revised Consented Development. It should therefore be updated at the detailed design/tender stage once the final infrastructure locations are known, and a Principal Contractor has been appointed. The final PMP should be updated in accordance with Stage 3 of the development process and should form the basis against which the site will be monitored by the ECoW and Site Construction Manager.

5. Control Measures

5.1 General

The purpose of this section of the PMP is to describe how the management of peat will be controlled and to specify how peat will be protected and peat integrity conserved throughout all stages of the construction works.

Where possible during detailed design the excavated peat volumes will be minimised by micro-siting wind farm infrastructure to avoid areas of deeper peat.

Where peat excavation is unavoidable care must be taken when handling, transporting and stockpiling peat to protect the peat structure and strength as far as possible. Where possible the movement of peat over long distances will be minimised and peat will be stored locally for re-use as soon as possible. Furthermore, double handling will be avoided as much as possible and a robust planning and monitoring programme will be developed to ensure that peat and mineral soils are not mixed.

5.2 Minimising Disturbance of In Situ Peat

The acrotelmic layer of the peat contains the living plant matter that protects the underlying catotelmic peat from drying and erosion. Therefore, it is important that measures are taken to avoid ripping up or rutting of the surface peat. In addition, unnecessary trafficking and appropriate scale plant will be used, such as 360^0 diggers rather than bulldozers to minimise any unnecessary compaction.

An Access Plan following the consented access track routes will be developed and physically demarcated by temporary fencing. The Access Plan and demarcated route will provide a designated controlled route and a permissible corridor within which service vehicles and plant can operate prior to peat and topsoil stripping. The purpose of this is to protect *in situ* peat in areas that will not be affected by the Revised Consented Development layout and prevent unnecessary damage.

Access routes and working areas will be clearly delimited throughout the construction phase to ensure that peat compaction and damage in areas not directly involved in the works will be avoided. The construction works will be phased to ensure that peat is stripped in each part of the Development Site ahead of the mineral substrate.

5.3 Methods for Stripping and Excavation of Peat

Peat stripping and excavation will generally follow the methodologies recommended for mineral soil by Ministry of Agriculture Fisheries and Food (MAFF) (2000) and the Department for Environment Food and Rural Affairs (DEFRA) (2009). However, it is recognised peat is a very different material compared to mineral soils, particularly wet amorphous peat. As a result, the stripping and excavation method(s) to be used in each part of the Development Site will be agreed in advance. Wherever possible, a 360^o excavator will be used to strip the widest peat turves possible, with their vegetation intact. Ideally the turves should be a minimum of 0.5m deep and with an area up to a maximum of $1m^2$. However, the depth and scale will depend on the depth, consistency and condition of the peat at each location and the plant used for stripping.

For the laying of electrical cables, it is anticipated that the cable trench will be excavated by stripping surface peat and laying the turves separately to catotelmic peat temporarily on a geotextile to protect the underlying vegetation. Where required, the mineral soils should be segregated from the peat and also placed on a barrier material prior to reinstatement.

5.4 Temporary Storage and Stockpiles

The temporary storage of peat for long durations should be avoided where possible to minimise drying, weathering and erosion of the peat. Where possible the peat should be transported from the point of extraction to its re-use or reinstatement location. However. there are likely to be instances during construction where the peat will need to be temporarily stored prior to re-use or reinstatement (e.g. near the turbine for later reinstatement of the turbine base). The following general principles will be applied for temporary peat storage areas and peat stockpile stability:

- Peat turves will be temporarily stored in designated locations as close as possible to the area from which they have been cut;
- The number and locations of temporary peat storage areas will be chosen to minimise the distance that stripped and excavated peat will have to be transported;
- Peat will be excavated and reinstated as quickly as possible in a progressive manner in order to minimise the area required for temporary storage at any one time;
- Storage and stockpiles will avoid sensitive peat vegetation, areas of existing peat erosion and locations with moderate or high risk of peat landslide;
- The selection of temporary peat storage areas will be cognisant of other environmental constraints and shall be more than 50m from watercourses and functioning drainage ditches;
- Peat turves will be transferred intact to their temporary storage location where they will be stored, with vegetation upright, in a single layer on geotextile material (to protect underlying vegetation as much as possible). Peat turves may be stored in double layers (separated by geotextile) provided that such storage does not extend beyond two months;
- The Site Construction Manager, with advice as necessary from the ECoW and/or Site Engineer, will determine whether special mitigation measures are required, such as orientation of the stockpile, levelling/benching to level the surface, bunding to contain stored materials and site-specific drainage to ensure that runoff waters are sufficiently controlled;
- Catotelmic peat that is not overly wet can be locally stored in stockpiles up to a maximum height of 2m. Catotelmic peat that is very wet and/or amorphous would need to be stored in purpose-built, bunded locations with a final peat depth no greater than 1m;
- Any bunded storage area would need to be designed with a sedimentation/settling pond to de-water wet peat and aid sediment containment. Each settling pond must be designed with appropriate filtration treatment facilities prior to connection into the construction-phase surface water drainage scheme and Sustainable Drainage System (SuDS) for the Development Site;
- Peat turves and stockpiles will be regularly managed and inspected throughout their lifetime to ensure maintenance of stockpile stability and integrity. Depending on the length of storage and weather conditions, regular watering may be required to protect the peat;
- Measures to manage and treat run-off, and prevent erosion during peat stripping and storage will be developed through a series of specific control measures relating to surface water management (e.g. SuDS as noted earlier) which will be described in a Drainage Management Strategy and the Construction Environmental Management Plan.
- Temporary drainage of peat stockpiles will be inspected regularly to ensure that it is fit for purpose, that runoff from stockpiles is being appropriately managed and mitigated and that it is not draining directly into any watercourse; and

- Should any problems be observed during regular visual inspections of peat stockpiles, this would invoke implementation of an appropriate corrective action (see Section 5.6) which would be recorded and monitored for effectiveness.

Although, a number of potential temporary storage sites have been identified in **Figure 8.0** in **Appendix A** the final locations and design of each temporary storage area will be determined by the Site Construction Manager with advice as necessary from the ECoW and/or Site Engineer.

5.5 Peat Reinstatement / Restoration

Dressing back site infrastructure and the creation of verges along access tracks will involve the laying of peat turves in a single layer up to 0.5m deep.

Reinstatement of blanket peat will be achieved by replacing the stripped peat. Firstly, the catotelmic peat will be laid followed by the replacement of peat turves at the surface to create conditions that promote the regrowth of peatland vegetation. Where possible the aim should be to achieve approximately the same peat profile depths as prior to construction. It is anticipated that, if peat turf has been correctly stored, no further re-seeding will be required. However, re-seeding will be carried out if judged to be necessary by the ECoW and Site Construction Manager.

Where there is a shortage of peat turves excess turves should be brought from elsewhere on the Revised Consented Development and placed on areas of bare peat. If this is not possible the EcoW and Site Construction Manager shall determine the measures necessary to promote re-vegetation and minimise erosion by rainfall, frost and wind.

In order to ensure that the minimum amount of peat compaction occurs during re-use/reinstatement, the appointed contractor will develop a method for peat tipping and spreading at each location. Where possible this will include working back from the furthest location to avoid or minimise tracking over reinstated peat. In addition, spreading and very light tamping down of placed peat is likely to be, for example, by use of the bucket on a long reach excavator.

Peat handling and placement during reinstatement activities should be carried out while the peat and weather is as dry as possible. Replaced turves may therefore need to be regularly watered.

5.6 Monitoring and Inspection

During construction the ECoW and Site Construction Manager will perform routine inspections of all temporary peat storage areas. These inspections will assess the peat conditions to determine whether any significant deleterious change has occurred during storage. The integrity of containment, temporary drainage conditions and the stockpile design and management will also be assessed to determine whether it is adequate to prevent erosion and peat landslide.

The ECoW shall also regularly inspect reinstatements as they progress and immediately after completion to monitor the success of reinstatement and vegetation re-establishment. If the ECoW determines that there is a need for further reinstatement or corrective actions, the ECoW and Site Construction Manager shall develop a method for correcting any defects that encourages the regeneration of the vegetation cover. Methods for enhancement and restoration should be carried out in accordance with NatureScot guidance (SNH, 2015) and will be further monitored for effectiveness.

6. Bibliography

Department of the Environment, Food and Rural Affairs (Defra) (2009) Code of Practice on Sustainable Soils on Construction Sites.

Joint Nature Conservation Committee (2011) JNCC Report Number 445: Towards an Assessment of the State of UK Peatlands.

Ministry of Agriculture, Fisheries and Food (MAFF) (2000) Good Practice Guide for Handling Soils by Machine.

Forestry Civil Engineering and Scottish Natural Heritage (2010). *Floating Roads on Peat*.

Scottish Government, Scottish Natural Heritage and SEPA (2017) Peatland Survey. *Guidance of Developments on Peatland*, on-line version only.

Scottish Natural Heritage, SNH, (2015). *Constructed Tracks in the Scottish Uplands*. 2nd Edition.

Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commisson Scotland, Historic Environment Scotland, Marine Scotland Science, AEECoW (2019). *Good Practice During Wind Farm Construction*. 4th Edition.

Scottish Renewables and SEPA (2012). Developments on Peatland - Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste. Version 1.

SEPA (2017). SEPA Guidance - Developents on Peat and Off –Site Uses of Waste Peat. WST-G-052. Version 1.

Appendix B
Volume Calculations

Introduction

This Appendix provides the raw data used to calculate peat excavation volumes for all elements of the Proposed Development's infrastructure. All calculations are based on an interpolation of the peat depths across the site. For the purposes of these calculations the average depth within the infrastructure elements have been used to calculate the extraction volumes.

Turbines

Table B.2.1 Revised Consented Development Turbines

Turbine Number	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
25	490.9	0.46	225.8	0.0	225.8
26	490.9	0.27	132.5	0.0	132.5
27	670.9	1.10	335.5	402.5	738.0
30	760.1	1.59	380.1	828.5	1208.6
31	490.9	0.34	166.9	0.0	166.9
32	622.4	0.82	311.2	199.2	510.4
33	639.5	0.92	319.8	268.6	588.3
35	490.9	0.33	162.0	0.0	162.0
36	590.5	0.63	295.3	76.8	372.0
42	490.9	0.28	137.5	0.0	137.5
43	490.9	0.34	166.9	0.0	166.9
44	490.9	0.37	181.6	0.0	181.6
51	490.9	0.50	245.5	0.0	245.5
54	490.9	0.29	142.4	0.0	142.4
55	734.0	1.45	367.0	697.3	1064.3
56	602.2	0.70	301.1	120.4	421.5
57	608.9	0.74	304.5	146.1	450.6
60	761.9	1.60	381.0	838.1	1219.0

Turbine Number	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3) Acrotelmic	Catotelmic	Total
61	580.6	0.57	290.3	40.6	330.9
		Total Volume	**4,847**	**3,618**	**8,465**

Crane Pads

Table B.2.2 Revised Consented Development Crane Pads

Turbine Number	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3) Acrotelmic	Catotelmic	Total
25	1400.0	0.47	658.0	0.0	658.0
26	1400.0	0.36	504.0	0.0	504.0
27	1638.0	1.05	819.0	900.9	1719.9
30	1601.3	0.91	800.6	656.5	1457.2
31	1400.0	0.39	546.0	0.0	546.0
32	1905.1	2.12	952.6	3086.3	4038.9
33	1839.9	1.85	920.0	2483.9	3403.9
35	1400.0	0.41	574.0	0.0	574.0
36	1540.9	0.65	770.4	231.1	1001.6
42	1400.0	0.27	378.0	0.0	378.0
43	1589.1	0.81	794.6	492.6	1287.2
44	1400.0	0.47	658.0	0.0	658.0
51	1400.0	0.40	560.0	0.0	560.0
54	1528.9	0.59	764.5	137.6	902.1
55	1589.1	0.83	794.6	524.4	1319.0
56	1564.9	0.75	782.5	391.2	1173.7
57	1601.3	0.88	800.6	608.5	1409.1
60	1638.0	1.04	819.0	884.5	1703.5
61	1564.9	0.71	782.5	328.6	1111.1
		Total Volume	**13,679**	**10,726**	**24,405**

Blade Laydowns

Table B.2.3 Revised Consented Development Blade Laydowns

Turbine Number	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
25	435.0	0.39	169.7	0.0	169.7
26	508.7	0.62	254.3	61.0	315.4
27	496.0	0.53	248.0	14.9	262.9
30	502.3	0.55	251.2	25.1	276.3
31	508.7	0.65	254.3	76.3	330.6
32	772.1	2.56	386.1	1590.6	1976.6
33	515.1	0.69	257.5	97.9	355.4
35	435.0	0.37	161.0	0.0	161.0
36	541.1	0.89	270.5	211.0	481.6
42	435.0	0.30	130.5	0.0	130.5
43	630.0	1.55	315.0	661.5	976.5
44	435.0	0.44	191.4	0.0	191.4
51	435.0	0.47	204.5	0.0	204.5
54	561.0	1.06	280.5	314.2	594.7
55	541.1	0.89	270.5	211.0	481.6
56	508.7	0.63	254.3	66.1	320.5
57	496.0	0.51	248.0	5.0	253.0
60	581.3	1.20	290.6	406.9	697.5
61	528.0	0.77	264.0	142.6	406.6
		Total Volume	**4,702**	**3,884**	**8,586**

Cut Access Tracks

Table B.2.4 Revised Consented Development Cut Access Tracks

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
ARC02	943.6	0.64	471.8	134.1	605.9

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
ARC05	950.3	0.70	475.1	193.0	668.1
ARC06	852.2	0.77	426.1	234.2	660.2
ARC07	855.3	0.51	427.6	6.8	434.4
ARC08	949.8	0.49	469.8	0.0	469.8
ARC10	2571.1	0.62	1285.6	297.5	1583.1
ARC11	506.8	0.35	176.6	0.0	176.6
ARC12	399.2	0.40	159.1	0.0	159.1
ARC15	517.8	0.84	258.9	177.6	436.5
ARC16	1119.3	0.70	559.6	225.5	785.2
ARC17	555.8	0.80	277.9	168.0	445.9
ARC18	441.7	1.14	220.8	283.6	504.5
CH-001	300.0	0.72	150.0	66.0	216.0
CH-002	268.7	0.38	102.4	0.0	102.4
CH-003	300.0	0.58	150.0	24.6	174.6
CH-004	300.0	0.16	47.1	0.0	47.1
CH-005	98.3	0.56	49.1	6.0	55.1
CH-006	300.0	0.34	101.4	0.0	101.4
CH-007	300.0	0.44	130.7	0.0	130.7
CH-008	300.0	0.52	150.0	4.6	154.6
CH-009	300.0	0.70	150.0	60.0	210.0
CH-010	300.0	0.54	150.0	11.5	161.5
CH-014	320.5	0.47	150.9	0.0	150.9
CH-017	346.4	0.53	173.2	10.2	183.4
CH-018	300.0	0.69	150.0	57.1	207.1
CH-019	57.5	0.93	28.7	24.4	53.2
CH-021	299.6	0.28	83.1	0.0	83.1
CH-024	329.0	0.64	164.5	44.5	209.1
CH-026	263.4	0.48	125.7	0.0	125.7

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-027	66.1	0.64	33.1	9.5	42.5
CH-031	300.0	0.18	53.3	0.0	53.3
CH-035	300.0	0.34	101.2	0.0	101.2
CH-038	364.4	0.71	182.2	77.9	260.1
CH-043	398.2	0.61	199.1	45.1	244.2
CH-044	300.0	0.49	146.4	0.0	146.4
CH-047	299.5	0.77	149.7	80.7	230.4
CH-048	109.3	0.84	54.6	37.3	91.9
CH-049	299.7	0.64	149.8	40.9	190.7
CH-052	151.4	0.58	75.7	12.6	88.3
CH-054	300.0	0.39	116.1	0.0	116.1
CH-055	307.1	0.58	153.6	24.1	177.7
CH-056	307.6	0.68	153.8	53.9	207.7
CH-058	310.1	0.78	155.0	86.3	241.4
CH-059	299.7	0.47	140.7	0.0	140.7
CH-060	300.0	0.76	150.0	76.8	226.8
CH-062	307.7	0.28	84.9	0.0	84.9
CH-064	300.0	0.58	150.0	23.9	173.9
CH-065	300.0	0.50	150.0	1.3	151.3
CH-068	300.0	0.38	114.8	0.0	114.8
CH-069	300.0	0.34	103.3	0.0	103.3
CH-070	300.0	0.65	150.0	44.7	194.7
CH-071	107.4	0.43	46.6	0.0	46.6
CH-072	300.0	0.68	150.0	52.7	202.7
CH-074	35.6	0.36	12.9	0.0	12.9
CH-075	300.0	0.57	150.0	19.9	169.9
CH-076	300.0	0.44	133.3	0.0	133.3
CH-077	112.2	0.82	56.1	35.8	91.8

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-079	299.9	0.58	149.9	23.5	173.5
CH-080	299.9	0.51	150.0	4.4	154.4
CH-081	300.1	0.49	147.2	0.0	147.2
CH-082	300.0	0.57	150.0	21.3	171.3
CH-083	300.0	0.31	94.0	0.0	94.0
CH-085	300.1	0.52	150.0	6.3	156.3
CH-086	300.0	0.76	150.0	78.8	228.8
CH-088	300.0	0.72	150.0	66.6	216.6
CH-089	300.1	0.51	150.0	2.2	152.2
CH-090	300.0	0.22	67.0	0.0	67.0
CH-091	300.0	0.80	150.0	88.7	238.7
CH-093	156.6	0.72	78.3	35.2	113.5
CH-094	175.0	0.86	87.5	62.9	150.4
CH-095	300.0	0.87	150.0	112.1	262.1
CH-097	72.3	0.73	36.1	16.5	52.7
CH-099	300.0	0.38	115.3	0.0	115.3
CH-102	300.0	0.89	150.0	118.0	268.0
CH-103	300.0	0.95	150.0	134.6	284.6
CH-107	300.0	0.85	150.0	105.8	255.8
CH-110	300.0	0.65	150.0	45.4	195.4
CH-112	300.0	0.92	150.0	127.4	277.4
CH-113	300.0	0.44	132.1	0.0	132.1
CH-117	210.9	1.03	105.4	112.6	218.0
CH-119	272.3	0.75	136.1	69.4	205.5
CH-120	300.0	0.96	150.0	139.0	289.0
CH-122	371.4	0.41	152.8	0.0	152.8
CH-123	299.8	0.88	149.9	114.2	264.1
CH-125	146.5	0.93	73.3	62.3	135.6

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-127	299.7	0.42	126.1	0.0	126.1
CH-129	299.2	0.36	108.8	0.0	108.8
CH-132	299.7	0.44	130.7	0.0	130.7
CH-133	332.1	0.75	166.1	82.1	248.2
CH-139	299.3	0.72	149.7	65.0	214.7
CH-140	300.2	0.62	150.1	34.9	185.0
CH-142	300.0	0.71	150.0	64.2	214.2
CH-144	300.0	0.82	150.0	95.8	245.8
CH-145	300.1	0.90	150.0	119.9	270.0
CH-151	189.7	0.45	85.8	0.0	85.8
CH-152	299.4	0.64	149.7	41.5	191.2
CH-155	300.0	0.73	150.0	68.7	218.7
CH-156	196.7	0.90	98.4	78.4	176.8
CH-158	228.9	0.75	114.5	58.2	172.6
CH-160	300.0	0.27	81.8	0.0	81.8
CH-164	300.0	0.48	144.8	0.0	144.8
CH-167	300.0	0.69	150.0	57.6	207.6
CH-168	300.0	0.29	87.2	0.0	87.2
CH-169	300.0	0.72	150.0	66.7	216.7
CH-171	299.9	0.75	150.0	74.2	224.2
CH-173	156.4	0.34	52.6	0.0	52.6
CH-174	300.1	0.82	150.0	96.5	246.6
CH-176	300.0	0.37	112.3	0.0	112.3
CH-182	99.6	0.48	47.6	0.0	47.6
CH-183	171.3	0.81	85.6	52.8	138.4
CH-184	51.8	0.66	25.9	8.2	34.1
CH-185	299.6	0.54	149.8	12.0	161.7
CH-186	299.6	0.37	111.2	0.0	111.2

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-187	299.5	0.38	114.5	0.0	114.5
CH-188	300.0	0.56	150.0	18.7	168.7
CH-191	299.6	0.46	137.8	0.0	137.8
CH-192	300.0	0.35	104.5	0.0	104.5
CH-193	300.0	0.38	114.3	0.0	114.3
CH-194	302.3	0.58	151.2	22.7	173.9
CH-196	300.0	0.52	150.0	4.7	154.7
CH-199	299.9	0.53	149.9	8.6	158.5
CH-200	300.0	0.59	150.0	25.8	175.8
CH-201	300.0	0.55	150.0	14.5	164.5
CH-202	300.0	0.54	150.0	11.5	161.5
CH-203	300.0	0.57	150.0	22.4	172.4
CH-204	300.0	0.40	121.2	0.0	121.2
CH-205	300.0	0.44	132.6	0.0	132.6
CH-206	299.9	0.17	50.6	0.0	50.6
CH-207	300.0	0.45	136.3	0.0	136.3
CH-208	300.0	0.29	87.3	0.0	87.3
CH-209	300.0	0.31	92.2	0.0	92.2
CH-210	389.1	0.46	178.0	0.0	178.0
CH-211	300.0	0.23	69.4	0.0	69.4
CH-212	300.0	0.42	125.3	0.0	125.3
CH-213	300.0	0.13	37.8	0.0	37.8
CH-221	252.3	0.65	126.1	38.3	164.4
CH-222	300.0	0.45	133.9	0.0	133.9
CH-223	299.9	0.37	111.3	0.0	111.3
CH-224	300.2	0.20	60.6	0.0	60.6
CH-228	299.9	0.20	60.7	0.0	60.7
CH-229	299.8	0.23	69.9	0.0	69.9

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3) Acrotelmic	Catotelmic	Total
CH-230	288.6	0.27	76.9	0.0	76.9
CH-233	300.2	0.25	76.3	0.0	76.3
CH-244	300.3	0.67	150.1	51.8	201.9
CH-246	300.1	0.72	150.0	64.6	214.7
CH-248	127.0	0.39	49.8	0.0	49.8
		Total Volume	**21,354**	**5,660**	**27,014**

Temporary Construction Compound

Table B.2.5 Revised Consented Development Temporary Construction Compound

Compound	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3) Acrotelmic	Catotelmic	Total
22	15,000	0.24	3,600.0	0.0	3,600.0
		Total Volume	3,600	0.0	3,600

Borrow Pit

Table B.2.6 Revised Consented Development Cable Trenches

Borrow Pit	Total Area (m^2)	Peat depth (m)	Acrotelmic Peat (m^3)	Catotelmic Peat (m^3)	Volume m^3
B	21573.3	0.62	9,170	3,992	13,162
		TOTAL	**9,170**	**3,992**	**13,162**

Cable Trenches

Table B.2.7 Revised Consented Development Cable Trenches

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3) Acrotelmic	Catotelmic	Total
CH-001	60.0	0.72	30.0	13.2	43.2
CH-002	50.9	0.38	19.4	0.0	19.4

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-003	60.0	0.58	30.0	4.9	34.9
CH-004	60.0	0.16	9.4	0.0	9.4
CH-005	19.7	0.56	9.8	1.2	11.0
CH-006	60.0	0.34	20.3	0.0	20.3
CH-007	60.0	0.44	26.1	0.0	26.1
CH-008	60.0	0.52	30.0	0.9	30.9
CH-009	60.0	0.70	30.0	12.0	42.0
CH-010	60.0	0.54	30.0	2.3	32.3
CH-014	61.3	0.47	28.8	0.0	28.8
CH-016	60.0	0.51	30.0	0.7	30.7
CH-017	69.4	0.53	34.7	2.0	36.7
CH-018	60.0	0.69	30.0	11.4	41.4
CH-019	11.5	0.93	5.7	4.9	10.6
CH-020	60.0	0.51	30.0	0.8	30.8
CH-021	60.0	0.28	16.6	0.0	16.6
CH-022	60.0	0.55	30.0	2.9	32.9
CH-023	60.0	0.82	30.0	19.4	49.4
CH-024	63.0	0.64	31.5	8.5	40.0
CH-026	49.9	0.48	23.8	0.0	23.8
CH-027	13.2	0.64	6.6	1.9	8.5
CH-028	23.2	0.83	11.6	7.6	19.2
CH-029	60.0	0.10	6.3	0.0	6.3
CH-031	60.0	0.18	10.7	0.0	10.7
CH-032	21.5	0.72	10.7	4.8	15.5
CH-035	60.0	0.34	20.2	0.0	20.2
CH-038	72.9	0.71	36.4	15.6	52.0
CH-042	60.0	0.72	30.0	13.1	43.1
CH-043	80.1	0.61	40.1	9.1	49.1

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-044	60.0	0.49	29.3	0.0	29.3
CH-045	60.0	0.43	25.8	0.0	25.8
CH-046	60.0	0.59	30.0	5.2	35.2
CH-047	60.0	0.77	30.0	16.2	46.2
CH-048	21.9	0.84	10.9	7.5	18.4
CH-049	60.0	0.64	30.0	8.2	38.2
CH-050	60.0	0.69	30.0	11.3	41.3
CH-051	60.0	0.88	30.0	23.0	53.0
CH-052	27.5	0.58	13.7	2.3	16.0
CH-053	60.0	0.89	30.0	23.2	53.2
CH-054	60.0	0.39	23.2	0.0	23.2
CH-055	61.4	0.58	30.7	4.8	35.5
CH-056	61.5	0.68	30.8	10.8	41.5
CH-057	60.0	0.74	30.0	14.4	44.4
CH-058	62.0	0.78	31.0	17.3	48.3
CH-059	59.9	0.47	28.1	0.0	28.1
CH-060	60.0	0.76	30.0	15.4	45.4
CH-061	60.0	0.81	30.0	18.4	48.4
CH-062	61.5	0.28	17.0	0.0	17.0
CH-063	60.0	0.78	30.0	16.5	46.5
CH-064	60.0	0.58	30.0	4.8	34.8
CH-065	60.0	0.50	30.0	0.3	30.3
CH-067	60.0	0.50	30.0	0.3	30.3
CH-068	60.0	0.38	23.0	0.0	23.0
CH-069	60.0	0.34	20.7	0.0	20.7
CH-070	60.0	0.65	30.0	8.9	38.9
CH-071	21.5	0.43	9.3	0.0	9.3
CH-072	60.0	0.68	30.0	10.5	40.5

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-074	7.1	0.36	2.6	0.0	2.6
CH-075	60.0	0.57	30.0	4.0	34.0
CH-076	60.0	0.44	26.7	0.0	26.7
CH-077	22.4	0.82	11.2	7.2	18.4
CH-079	60.0	0.58	30.0	4.7	34.7
CH-080	60.0	0.51	30.0	0.9	30.9
CH-081	60.0	0.49	29.4	0.0	29.4
CH-082	60.0	0.57	30.0	4.3	34.3
CH-083	60.0	0.31	18.8	0.0	18.8
CH-085	60.0	0.52	30.0	1.3	31.3
CH-086	60.0	0.76	30.0	15.8	45.8
CH-087	60.0	0.42	25.2	0.0	25.2
CH-088	60.0	0.72	30.0	13.3	43.3
CH-089	60.0	0.51	30.0	0.4	30.4
CH-090	60.0	0.22	13.4	0.0	13.4
CH-091	60.0	0.80	30.0	17.7	47.7
CH-093	31.3	0.72	15.7	7.0	22.7
CH-094	35.0	0.86	17.5	12.6	30.1
CH-095	60.0	0.87	30.0	22.4	52.4
CH-097	14.5	0.73	7.2	3.3	10.5
CH-099	60.0	0.38	23.1	0.0	23.1
CH-100	60.0	0.31	18.9	0.0	18.9
CH-101	18.8	0.99	9.4	9.2	18.6
CH-102	60.0	0.89	30.0	23.6	53.6
CH-103	60.0	0.95	30.0	26.9	56.9
CH-104	60.0	0.59	30.0	5.5	35.5
CH-105	60.0	0.56	30.0	3.7	33.7
CH-106	60.0	0.51	30.0	0.4	30.4

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-107	60.0	0.85	30.0	21.2	51.2
CH-108	25.0	0.66	12.5	4.0	16.4
CH-110	60.0	0.65	30.0	9.1	39.1
CH-112	60.0	0.92	30.0	25.5	55.5
CH-113	60.0	0.44	26.4	0.0	26.4
CH-116	60.0	0.53	30.0	1.6	31.6
CH-117	42.2	1.03	21.1	22.5	43.6
CH-119	54.5	0.75	27.3	13.9	41.2
CH-120	60.0	0.96	30.0	27.8	57.8
CH-122	71.5	0.41	29.4	0.0	29.4
CH-123	60.0	0.88	30.0	22.8	52.8
CH-125	29.3	0.93	14.7	12.5	27.1
CH-127	60.0	0.42	25.2	0.0	25.2
CH-129	60.0	0.36	21.8	0.0	21.8
CH-131	28.2	0.95	14.1	12.8	26.9
CH-132	60.0	0.44	26.2	0.0	26.2
CH-133	66.4	0.75	33.2	16.4	49.6
CH-139	60.0	0.72	30.0	13.0	43.0
CH-140	60.0	0.62	30.0	7.0	37.0
CH-142	60.0	0.71	30.0	12.8	42.8
CH-143	15.9	0.99	8.0	7.8	15.8
CH-144	60.0	0.82	30.0	19.2	49.2
CH-145	60.0	0.90	30.0	24.0	54.0
CH-151	37.9	0.45	17.2	0.0	17.2
CH-152	60.0	0.64	30.0	8.3	38.3
CH-155	60.0	0.73	30.0	13.7	43.7
CH-156	39.3	0.90	19.7	15.7	35.4
CH-158	45.8	0.75	22.9	11.6	34.5

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-159	60.0	0.42	25.1	0.0	25.1
CH-160	60.0	0.27	16.4	0.0	16.4
CH-161	60.0	0.56	30.0	3.4	33.4
CH-162	60.0	0.52	30.0	1.4	31.4
CH-163	60.0	0.28	16.8	0.0	16.8
CH-164	60.0	0.48	29.0	0.0	29.0
CH-167	60.0	0.69	30.0	11.5	41.5
CH-168	60.0	0.29	17.4	0.0	17.4
CH-169	60.0	0.72	30.0	13.3	43.3
CH-171	60.0	0.75	30.0	14.8	44.8
CH-173	31.3	0.34	10.5	0.0	10.5
CH-174	60.0	0.82	30.0	19.3	49.3
CH-176	60.0	0.37	22.5	0.0	22.5
CH-182	20.0	0.48	9.5	0.0	9.5
CH-183	34.3	0.81	17.2	10.6	27.7
CH-184	10.4	0.66	5.2	1.6	6.8
CH-185	60.0	0.54	30.0	2.4	32.4
CH-186	60.0	0.37	22.3	0.0	22.3
CH-187	60.0	0.38	22.9	0.0	22.9
CH-188	60.0	0.56	30.0	3.7	33.7
CH-189	60.0	0.61	30.0	6.9	36.9
CH-190	60.0	0.88	30.0	23.1	53.1
CH-191	60.0	0.46	27.6	0.0	27.6
CH-192	60.0	0.35	20.9	0.0	20.9
CH-193	60.0	0.38	22.9	0.0	22.9
CH-194	60.5	0.58	30.3	4.6	34.8
CH-195	60.0	0.67	30.0	10.4	40.4
CH-196	60.0	0.52	30.0	0.9	30.9

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-197	60.0	0.55	30.0	3.3	33.3
CH-198	60.0	0.66	30.0	9.5	39.5
CH-199	60.0	0.53	30.0	1.7	31.7
CH-200	60.0	0.59	30.0	5.2	35.2
CH-201	60.0	0.55	30.0	2.9	32.9
CH-202	60.0	0.54	30.0	2.3	32.3
CH-203	60.0	0.57	30.0	4.5	34.5
CH-204	60.0	0.40	24.2	0.0	24.2
CH-205	60.0	0.44	26.5	0.0	26.5
CH-206	60.0	0.17	10.1	0.0	10.1
CH-207	60.0	0.45	27.3	0.0	27.3
CH-208	60.0	0.29	17.5	0.0	17.5
CH-209	60.0	0.31	18.4	0.0	18.4
CH-210	75.0	0.46	34.3	0.0	34.3
CH-211	60.0	0.23	13.9	0.0	13.9
CH-212	60.0	0.42	25.1	0.0	25.1
CH-213	60.0	0.13	7.6	0.0	7.6
CH-214	60.0	0.34	20.4	0.0	20.4
CH-215	60.0	0.23	13.6	0.0	13.6
CH-216	60.0	0.50	30.0	0.1	30.1
CH-217	60.0	0.72	30.0	13.3	43.3
CH-218	42.0	0.44	18.4	0.0	18.4
CH-219	60.0	0.44	26.6	0.0	26.6
CH-221	50.5	0.65	25.2	7.7	32.9
CH-222	60.0	0.45	26.8	0.0	26.8
CH-223	60.0	0.37	22.3	0.0	22.3
CH-224	60.0	0.20	12.1	0.0	12.1
CH-225	60.0	0.43	26.1	0.0	26.1

Chainage Name	Area of Extraction (m^2)	Peat Depth (m)	Volume (m^3)		
			Acrotelmic	Catotelmic	Total
CH-226	60.0	0.61	30.0	6.6	36.6
CH-227	60.0	0.43	25.7	0.0	25.7
CH-228	60.0	0.20	12.1	0.0	12.1
CH-229	60.0	0.23	14.0	0.0	14.0
CH-230	54.9	0.27	14.6	0.0	14.6
CH-231	90.0	0.61	45.0	9.6	54.6
CH-232	60.0	0.30	17.9	0.0	17.9
CH-233	60.0	0.25	15.3	0.0	15.3
CH-238	60.0	0.50	30.0	0.0	30.0
CH-241	60.0	0.26	15.6	0.0	15.6
CH-244	60.1	0.67	30.0	10.4	40.4
CH-245	60.0	0.52	30.0	1.0	31.0
CH-246	60.0	0.72	30.0	12.9	42.9
CH-248	25.4	0.39	10.0	0.0	10.0
		Total Volume	**4,484**	**1,083**	**5,567**