# Harestanes South Windfarm Extension

# Environmental Impact Assessment Report Addendum

# Appendix A2 – Consultation with ECU (Ironside Farrar)

June 2022

SCOTTISHPOWER RENEWABLES

# PEAT LANDSLIDE HAZARD RISK ASSESSMENT

# Harestanes South Windfarm Extension

## STAGE 1 CHECKING REPORT

Scottish Government
Riaghaltas na h-Alba
gov.scot
ENERGY CONSENTS UNIT

IronsideFarrar
EnvironmentalConsultants
50781 | 29.04.21



## Contents

## History/ Stage

This document has been prepared to audit Peat Landslide and Hazard Risk Assessments on behalf of the Scottish Government Energy Consents Units.

**The Stage of the Checking Point and history of the document is as follows:**

| Stage | Date | Description | Author | Checked/ Approved |
|---|---|---|---|---|
| 1 | 29.04.21 | Stage 1 Checking Report | Nick Matheson BSc, CGeol, FGS | Mark Chapman BSc, MSc, CEng, MICE, Director |
| | | | | |





# 1.0 INTRODUCTION

## 1.1 Context to Report

The Scottish Government Energy Consents Unit is responsible for processing applications under sections 36 and 37 of the Electricity Act 1989 to develop electricity generation projects and overhead electric lines. In addition, under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, Scottish Ministers are required to consider the environmental impacts of the proposal. EIA Development applications are therefore required to be supported by EIA Reports, which include site-specific information and survey details in respect of the risk of peat landslide events for elements of the proposal and its infrastructure (i.e. construction of roads, access, tracks, wind turbine foundations etc).

The Energy Consents Unit commissioned Ironside Farrar Ltd to technically assess the Peat Landslide Hazard and Risk Assessment(s) (PLHRAs) submitted by developers. This checking report will consider whether or not adequate and appropriate field survey, peat sampling and analytical methods have been employed to provide a sound basis for assessing peat stability and the risk from peat landslides within the development envelope. The checking report will provide a summary of findings and recommendations and the Energy Consents Unit will issue a copy to the developer in accordance with the requirements of the Best Practice Guide (Scottish Government, 2017).

## 1.2 Audit Methodology

This audit primarily reviews the information submitted by the developer against the guidance provided in:

- Peat Landslide Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Energy Consents Unit Scottish Government, Second Edition, April 2017, (described herein as the ECUBPG).

## 1.3 Documents Reviews

The documents reviewed as part of this audit were:

**Stage 1 Audit:**

- EIAR Volume 4 - Technical Appendix 6.1 - Peat Stability Assessment, WSP, December 2020.
- EIAR Volume 4 - Technical Appendix 6.2 - Peat Management Plan, WSP, December 2020.
- EIAR Volume 4 - Technical Appendix 6.5 – Borrow Pit Assessment, WSP, December 2020.
- EIAR Chapters 1-4, WSP, December 2020.
- Various Figures supporting the EIAR, including development context, proposed development, peat depth, baseline geology and peatland and geomorphological information, hydrology, typical development details (e.g. turbine bases and tracks).

# 2.0 REVIEW OF DATA SUPPORTING PLHRA

## 2.1 Background on Proposed Development

The proposed Harestanes South Windfarm Extension Wind Farm is located approximately 13km north of Dumfries, in Dumfries and Galloway. The site covers approximately 1,036 hectares of commercial forestry in an upland setting with undulating topography that rises to a maximum of 393m AOD at Pumro Fell. There are a number of water courses in the site which fall within the Water of Ae catchment. The western extent of the site is characterised by a steep valley in which flows the Water of Ae.

The development is to comprise the following elements:

- 8 No. wind turbines with a blade tip height of up to 200m.
- Turbine infrastructure including foundations, external transformers and crane hardstanding/ set down areas.
- Control building and substation compound containing control and substation buildings, battery storage and comms mast.
- Construction of approximately 3km of new access tracks (cut tracks) and upgrading of approximately 12km of existing windfarm and forestry tracks.
- A temporary construction compound.
- Underground electricity cables.
- 3 No borrow pit areas.

## 2.2 Is a PLHRA Necessary?

The initial assessment of baseline data available for the site confirms the need for a PLHRA. Parts of the site are shown to comprise peat (BGS data) and Class 5 peat (Carbon & Peatland Map 2016). This means that there is potential for peat to be present at >0.5m depth, and the site has slopes in excess of 2 degrees. Site characteristics therefore meet the criteria contained within the ECUBPG for when a PLHRA is required.

## 2.3 Team Competencies and Spatial Scope of Study

The authors of the PLHRA are included in Section 1.10 of the PLHRA. The team appears to have good experience and expertise on PLHRA preparation with relevant qualifications.

The extent of the study includes tracks, turbines, borrow pits and other associated infrastructure included within the main development areas but not all parts of the red line boundary have been fully assessed in accordance with the ECUBPG. This is further discussed in later sections of the PLHRA checking report.



**Harestanes South Windfarm Extension**

Scottish Government
Consents Unit

## 2.4 Structure of PLHRA Reporting

The PLHRA is contained within Appendix 6.1 of the EIA Report. The PLHRA makes reference to a number of other Figures, Reports and Chapters within the wider EIA that should be read in conjunction with the reporting.

The PLHRA includes an introduction, report aims and methods, a desk study, details of fieldworks, various risk assessments and details of mitigation. There are supporting Figures and Appendices.

The report broadly follows a recognised structure that is used for PLHRA assessment.

## 2.5 Review of Desk Study

A standalone literature review and desk study is included in the PLHRA, with supporting Figures that include geological mapping (solid and drift) hydrological review and aerial mapping.

Section 1.2.1 presents a literature review and presents background information on peat morphology and instability. This includes discussion on mass movements of peat, triggers and types of slide. The literature review references the ECUBPG and also other literature.

The scope of the review is generally appropriate and also includes typical academic (literature) engineering values for peat and details on other methods of classifying peat. Limitations in the use of site derived shear strength values is also discussed here.

Sections 1.2.2 to 1.2.4.5 present a desk study. This includes a description of the site (context), baseline conditions, peatland data (Carbon & Peatland mapping and soil maps), aerial photography, historical data, BGS Geosure datasets, historical information and details on forestry. There is also a discussion on the adjacent windfarm site in respect to any instability that may have been experienced during its construction and operation where none has been reported. The desk study is supported by a series of Figures such as geological and hydrological mapping and aerial photographs.

The desk study is considered to be relatively robust and has considered to have accessed a suitable range of datasets, each of which is discussed within the PLHRA reporting. The use of Geosure BGS data strengthens desk study and is well discussed within Section 1.2.4.4. This has identified areas of Class C and Class D landslide susceptibility mainly on steep incised slopes. There are supporting figures and illustrations showing areas of potential instability highlighted by the Geosure dataset and from the study of aerial photos/ reconnaissance which are both contained within the text, as part of the geomorphological map.

## 2.6 Review of Field Surveys

Both site reconnaissance via walkover survey and peat probing surveys have been completed between March and September 2020.

Site reconnaissance is discussed in Section 1.3.1 and is supported by a series of photographs. There is good description on each photograph discussing the topographical and morphological characteristics and why certain areas have been assessed. There was evidence of peat instability/ slide at three locations adjacent to the Glenkiln burn which are highlighted on illustration 6.1, but do not appear to have been included in the geomorphological map in the Appendix.
Other areas of possible peat instability in the form of peaty debris slides on the slopes above the Glenkiln Burn are also discussed.

Generally, the geomorphological interpretation and reconnaissance is suitably robust and conveys a good understanding of the site conditions. The photograph description may have benefited from a plan showing where the photos and features discussed were located within the site, which would give an understanding how this these features relate to the proposed infrastructure and areas of proposed construction. The stability issues identified by site inspection and desk study should be added to the geomorphological mapping.

Peat probing was carried out over a number of phases and focuses on where infrastructure is proposed. In total 1207 probes have been undertaken. The description on the probing methodology is discussed in section 1.3.2.1. Whilst this appears to be a standard methodology, it is noted that the probing does not make any assessment of substrate from probe feel or how refusal is met. This is commonly applied to PLHRA to determine likely substrate lithology/ type, and is useful in building up a picture of ground conditions and also landslide susceptibility. This factor/ input can also be used to inform the likelihood assessment, or in the case of the FoS assessment used as a sensitivity check.

The ECU guidance suggests that the scope of probing to inform PLHRA should be both a Phase I probing survey, utilising a site-wide density of approximately one probe per 100m (one probe per hectare), which is then supplemented with significant additional probing at infrastructure and along tracks. It is noted for this site that a site wide survey (Phase 1 probing) has not been undertaken which is a significant deviation from the guidance.

Detailed probing has been undertaken at infrastructure locations, the positions of which are presented on Figures 6.1.5: Peat overview, and Figure 6.1.5a and 6.1.5b: Peat Detail. The Figures present the peat probing locations and depths recorded. Section 1.3.2.1 states that the strategy for probing was to achieve depth readings every 50m along tracks. However, there is no detail as to what probing layouts were adopted for the other infrastructure including turbines. Whilst the figures suggest that a number of probes have been carried out at most/ all infrastructure, it is not possible to determine exact layouts, spacing or frequencies due to the scale of the plans.

In support of the probing, coring was carried out at 4 locations with a Russian corer, targeted to areas where peat was >1.0m and close to infrastructure. Sections 1.3.3 discusses the testing carried out which includes bulk & dry density, shear strength, pH, OMC. There is good description on the results which are presented in Table 6.4. Photos of peat cores are presented in the Appendix.

The shear strength measurements gathered (6 - 27kN/m$^2$) were considered to be similar to literature values. There is discussion on the limitations of using field derived values and for the lower literature value of 4kN/m$^2$ is considered a more appropriate and suitably conservative value.

The results of the probing are discussed in Section 1.3.2.1 and 1.3.2.2 of the PLHRA. The results according to peat depth are presented on Table 6.1. The survey recorded peat depths <0.5m at 779 probe locations (64.5%). Approximately 294 (24.4%) record peat depths 0.5-1.0m. Peat >1.0m was recorded at 134 locations (11.1%).

The field surveys that have been undertaken are appropriate, generally well scoped and provide a good range of information on the peat. Whilst the infrastructure probing looks to be reasonably detailed from the plans presented, the probing frequencies on turbines and borrow pits and other infrastructure are not defined. This information is required to establish its scope and how this aligns against guidance/ best practise requirements.

The lack of a Phase I peat probing survey (site wide), is a significant short coming and clarification is required as to whether the lack of this has affected the robustness of the assessment. Particular issues include whether all areas that might be influenced by windfarm construction have been sufficiently assessed for peat depth and hence represent





correctly the depth of peat on the site, e.g. upslope and down slope locations of tracks, turbines etc.

The mapping provided on peat depth is considered reasonable with peat depth banding generally appropriate. However, the individual peat probe locations presented on the map are hard to read and it is not possible to interpret the probing layout at key infrastructure locations.

## 2.7 Integration of Desk Study and Field Surveys

The reporting integrates the desk study and field surveys and there are a number of plans/ figures that show aspects such as geomorphological features and peat depth. Section 1.3.2.2 discusses how the peat depth mapping plus its interpolation has been generated though the GIS software. Peat depth has been generated for a series of 50m by 50m grid squares across the whole site. Where a number of peat depths have been generated within a particular square, the greatest peat depth result has been adopted to provide a level of conservatism.

The peat depth mapping and illustration 6.2 in the PLHRA text are noted to present peat depths over the whole site. The wider areas are widely coloured to show peat to be 0.5-1.0m in depth and to a lesser extent <0.5m. However there is a question as to how this depth is calculated in the absence of any nearby specific peat depth information gathered by the probing. This requires further explanation and whether the depths presented on the mapping are accurate/ representative.

# 3.0 REVIEW OF HAZARD & RISK ASSESSMENT AND PROPOSED MITIGATION

## 3.1 Assessment of Likelihood

Section 1.4 of the PLHRA report presents a likelihood assessment. This is assessed via a slope stability analysis utilising the factors of safety. The general methodology follows the approach adopted in the ECUBPG.

There is discussion on the application for the various inputs to the FoS equation. Much of these appears to be reasonable, justified and adequately conservative. The issues in using site derived values for shear strength have been recognised and discussed, and to generate effective cohesion c', a back calculation have been carried out. From this, values of 2.15 and 3.6kN/m$^2$ have been used. These are considered to be suitably conservative and align with literature values.

The FoS calculation was undertaken for all peat probing points and also for each of the 50m by 50m grid cells across the site. For slope inputs, the mean slope value has been used for each cell via interrogation of the 5m DTM. This appears to be a reasonable approach.

A discussion of the FoS results are summarised in section 1.4.2 with supporting table 6.5 and a series of Figures. The vast majority (approximately 96%) of the peat probing locations have a FoS >1.4 indicating a stable slope. Review of the supporting mapping suggests that an unsatisfactory FoS (<1.4) is generally clustered into areas of deeper peat and moderate to steep slopes. These areas are coincident with sections along the Glenkiln Burn Valley and its tributaries on the slopes below turbine T4 and associated track sections to turbines T01 and T02.

Likelihood has been based on the FoS calculations and is presented as initial likelihood which is presented on Figure 6.1.8 and Table 6.6 of the reporting. Each FoS class has been assigned a likelihood from almost certain to negligible. Peat depths <0.5m have been considered not applicable. The risk bands and the assigning of the FoS to each of the bands appears to be reasoned and logical and in general accordance with the ECUBPG.

The FoS results show that for the vast majority of the site, initial likelihood is classed as negligible and unlikely for 95% of positions. Probable and likely likelihoods are confined to areas of stepper slopes and deeper peat along the valley sides of the Glenkiln Burn water course with another area close to the southern boundary but away from proposed infrastructure locations.

## 3.2 Assessment of Consequence

An assessment of the consequence of peat slide has been considered as part of the initial risk assessment.

Section 1.5.2 discusses the approach to the consequence assessment. This considers a number of receptors on the site that includes terrestrial ecology, public and private infrastructure, aquatic ecology and water quality, archaeology and the proposed wind farm infrastructure. Discussion is also made on the magnitude of cost or losses that may be experienced/ attributed from peat landslide.

Table 6.8 presents a range of consequences which are rated from extremely high to very low. Each consequence banding has a description of the damage to various receptors as a consequence of being affected by a peat landslide.





Each 50m by 50m grid cell has been assigned a consequence rating using mapping software and professional judgment. The assessed area was also extended to 250m beyond the red line boundary to account for receptors beyond the site boundary.

The outcome of the consequence assessment is presented on Figure 6.1.9. This shows that the majority of the site has been assessed as moderate risk.

The scoring of consequence appears to be generally logical with dwellings and environmentally sensitive areas given the highest consequence rating. Table 6.9 does not appear to consider receptors over 100m from each cell where consequence is calculated. It is known that peat slides can travel over distances greater than this, and it is therefore unclear how this has been taken into consideration in calculating consequence.

A figure showing all the receptors that are present within the site and within influence beyond the site would have been useful for the reader and would add to the assessment.

## 3.3 Calculation of Risk

A calculation of risk has been made by combining likelihood with consequence to provide an 'initial risk value', and Table 6.10 details the levels of initial risk that would be generated. The combining of likelihood and the consequence and the bands of risk presented are considered to be in-line with the ECUBPG.

Table 6.11 presents a summary of the initial risk for each of the cells across the assessment area. This identifies that the approximately 31% of the site lies within a classification of no risk due to peat depths being <0.5m (peaty soil). Low and negligible initial risk was attributed to 68% The remainder was classed as a moderate risk and to a lesser extent high risk and thought to be attributed to deeper peat area on steeper slopes and also areas in close proximity to Wallace's House and a scheduled monument.

The table includes a suggested 'Guideline' Actions for each band of initial risk. This is generally in line with the ECUBPG.

The initial risk with the infrastructure layout overlain is presented on Figure 6.1.10. This shows that there are areas of high or moderate risk along the valley sides of the Glenkiln Burn below turbine T04 and associated access track.

The medium and high risk area identified by the initial risk assessment have been further interrogated by adding location specific information and removal of any areas not within close proximity to planned infrastructure. This has resulted in two key areas of high and moderate risk being highlighted for the site.

Section 1.6 provides further detailed assessment on the two identified risk areas by assessment of a range of geomorphological features and base line data specific to each of the areas. This includes peat depth, Geosure data, topography, drainage, slope peat depths and potential run out distances.

A revised risk assessment has been produced for each of these areas, with Table 6.12 presenting the scales of likelihood of peat slide and the corresponding range of factor based inputs used to assess the areas in the revised risk assessment. The two areas are further discussed in detail in Annex B.

Section 1.6.1 discusses the revised risk assessment outcomes and is shown on Figure 6.1.13. Based on this, it has determined that there are no areas of high or moderate risk close to infrastructure. Table 6.13 presents the findings of the revised risk assessment for all areas. This determines 99% of locations are at low or negligible risk.

Overall the calculation of risk is considered to be detailed and suitably robust. It has been carried out as a two stage process with areas of moderate and high risk further scrutinised with location specific information including run out distances that could be generated from a peat slide at the location.

## 3.4 Proposed Mitigation

Proposed mitigation is considered in Section 1.8 of the PLHRA. The section includes a range of generic and site specific mitigation. It covers such aspects as construction methodologies and avoidance of deeper peat through design and micro-siting.

Furthermore, detailed ground investigation, post consent is discussed/ recommended to further inform mitigation design

Table 6.14 details a range of potential actions that are both applicable as best practise and as measures considered to be specific to the site. This includes details on mitigation related to blasting at borrow pits. Mitigation is also included in the specific information sheets for each risk area that are found within Appendix B.

Generally, the mitigation is considered suitably robust. Useful additions could be providing toolbox talks to site personnel on peat slide risks and associated indicators as well as best practise techniques when working in the peatland environment. Details on being careful not to disrupt or disturb the natural drainage on slopes would also be a useful addition.





# 4.0 SUMMARY AND RECOMMENDATIONS

## 4.1 Summary of Developers PLHRA

The following provides a summary of the developer's PLHRA making reference to whether or not adequate and appropriate field survey, peat sampling and analytical methods have been employed to assess peat stability and associated landslide risks including mitigation.

**Desk Study**

A literature review and standalone desk study is included in the PLHRA with supporting figures. The scope of the literature review is generally considered appropriate and suitably researched.

The desk study is considered to be robust and has considered a suitable range of baseline data sets, each of which is discussed within the report. The use of BGS Geosure data is a good addition to this.

**Field Surveys**

Both site reconnaissance via walkover survey and peat probing surveys have been completed for the site.

Generally, the geomorphological interpretation and reconnaissance is suitably robust and conveys a good understanding of the site conditions. There is good use of photographs and description, but this would have benefited from a plan showing the location of the photos and features discussed in the reporting relative to proposed infrastructure. The stability issues identified by site inspection and desk study should also be added to the geomorphological mapping.

Peat probing was carried out over a number of phases and focuses on where infrastructure is proposed. The lack of site-wide Phase 1 probing is a significant deviation from the guidance.

It is noted that the probing does not make any assessment of substrate from probe feel or how refusal is met. Consideration of substrate should be a consideration of the PLHRA, and can used to further inform the likelihood assessment, or in the case of the FoS assessment used as a sensitivity check.

The detailed probing at infrastructure location looks to be generally acceptable, however, apart from the tracks, there is no detail as to what probing layouts/ frequencies were adopted for the infrastructure including turbines locations.

In support of the probing, coring was carried out with supporting laboratory testing. This is well scoped and described in the PLHRA.

**Integration of Desk Study and Field Surveys**

The reporting appropriately integrates the desk study and field surveys and there are a number of supporting plans and figures. However, there is a question as to how peat depth has been calculated/ interpolated in the wider site areas of the site where there is an absence of any specific peat depth information.

**Hazard Assessment – Likelihood**

The likelihood assessment has utilised a slope stability analysis using factor of safety. The general methodology follows the approach adopted in the ECUBPG and the input values appear to be appropriate, justified and adequately conservative.

The FoS calculation was undertaken for all peat probing points and also on a 50m by 50m grid across the site. The outputs of the FoS have identified that the vast majority of the peat probing locations have a FoS >1.4 indicating a stable slope. Review of the supporting mapping suggests that an unsatisfactory FoS (<1.4) is generally clustered into areas of deeper peat and moderate to steep slopes along the Glenkiln Burn Valley and tributaries.

**Hazard Assessment – Consequence**

An assessment of the consequence of peat slide has been considered as part of the initial risk assessment. Overall, the consequence assessment appears to be in general accordance with ECUBPG and is suitably robust. It has identified the relevant receptors for the site and consequence has been assessed for every grid cell and probe point.

**Calculation of Risk**

A calculation of risk has been made by combining likelihood with consequence to provide an 'initial risk value'. The combining of likelihood and the consequence and the bands of risk presented are considered to be in-line with the ECUBPG.

The medium and high risk area identified by the initial risk assessment have been further interrogated by removal any areas away from planned infrastructure. This has resulted in two key areas of high and moderate risk being highlighted for the site. These two areas have then been subject to a revised risk assessment where a range of additional factors inputs such as run out distances, stability issues, slope characteristics and specific mitigation have been applied.

Outcomes of the revised risk assessment have determined that the two areas can be reassessed to low risk.

**Proposed Mitigation**

Proposed mitigation is included in the PLHRA and covers such aspects as construction methodologies and avoidance through design.

Generally, the mitigation is considered suitably robust. Useful additions could be providing toolbox talks to site personnel on peat slide risks and associated indicators as well as best practise techniques when working in the peatland environment. Details on being careful not to disrupt or disturb the natural drainage on slopes would also be a useful addition.

## 4.2 Summary Outcome of Checking Report

The following comprises the summary outcome of the checking report:

- The PLHRA **requires minor revisions:** although much of the PLSRA is sound, there are some key elements that are considered to be insufficiently robust to support the PLSRA conclusions and minor revisions are required. Areas of attention will be advised in the review of the findings and may be progressed by the developer through either an appendix to the original submission or by clarification letter.





## 4.3 Recommendations

Recommendations requiring clarification from the Developer:

- The stability issues identified by site inspection and desk study should be added to the geomorphological mapping to allow better incorporation into the assessment of risks at the locations identified.

- Details are required on the probing density adopted for all infrastructure including turbines and how this aligns with the SEPA/ ECUBPG.

- The lack of a Phase I site wide peat probing survey is a significant short coming in the report, and a deviation from the ECUBPG. Clarification is required as to whether the lack of site wide probing has affected the robustness of the assessment. It is not clear how the peat depths presented on large parts of the peat depth mapping have been generated without probe information. This has raised some concern as to whether the peat depths presented on the mapping are sufficiently supported by site data and in turn are sufficiently representative of the overall picture of peat on the site. This inevitably has the potential to affect the risk assessment and its outcomes. Whilst it is appreciated that some of these areas will not be in influence of the proposed infrastructure, it is ensuring that areas that are within influence, have been adequately assessed, e.g. upslope and downslope locations of wind turbines, tracks etc.

- Further explanation is required as to how peat depths have been arrived in areas of the site that do not contain any specific peat depth data and whether the depths presented on the mapping are therefore accurate and sufficiently representative to take through the risk assessment.

- Table 6.9 does not appear to consider receptors over 100m from each cell where consequence is calculated. It is known that peat slides can travel over distances greater than this, and it is therefore unclear how this has been taken into consideration in calculating consequence across the site.

Recommendations made for information only – no response required:

- The omission of Phase 1 peat probing is a significant divergence from the ECUBPG. All future PLHRAs should contain probing in accordance with ECUBPG which includes site wide probing and in many situations omission of this may mean the PLHRA is not suitably robust or will not be accepted.

- Substrate is a useful input to PLHRAs and assessing likelihood and overall risk. This should be considered in future assessments.

- A figure showing all receptors relative to infrastructure should be included as part of the PLHRA.

Ironside Farrar
5th Floor, 135 Buchanan Street
Glasgow
G1 2JA

Your ref: Harestanes South Windfarm Extension

Our ref: 70068409

1 April 2022

Dear [redacted],

**Peat Landslide Hazard Risk Assessment – Harestanes South Windfarm Extension Stage 1 Checking Report**

I am writing on behalf of ScottishPower Renewables UK (the 'Developer') in response to your Stage 1 Checking Report dated 29th April 2021 regarding the above Proposed Development.

Your letter highlights a number of issues whereby you requested clarification from the Developer.

Further information is provided below, and enclosed, structured in accordance with the content of your letter. We have reviewed the content of your response and collated the following clarifications for each Recommendation identified on page 11 of the Stage 1 Checking Report, in turn:

1. Geomorphology Figure;
2. Peat probing density;
3. Phase 1 peat probing;
4. Indicative peat depths methodology; and
5. Consequence assessment.

This report also provides clarification on other points of note included within your response, where relevant.

## 1. Geomorphology Figure

Ironside Farrar noted:

*The stability issues identified by site inspection and desk study should be added to the geomorphological mapping to allow better incorporation into the assessment of risks at the locations identified.*

A number of non-peat related slope failures were observed through aerial imagery review and confirmed on the Site, such as the collapsing watercourse channel banks caused by fluvial erosion adjacent to the incised valley of the Glenkiln Burn tributary. These locations are shown on Illustration 6.1 of the Technical Appendix 6.1 Peat Stability Assessment of the Environmental Impact Assessment (EIA) Report

110 Queen Street
Glasgow
G1 3BX
Tel: +44 141 429 3555
Fax: +44 141 429 3666
wsp.com



The results are now included in SI Figure 6.1.12 Geomorphology (appended in this document).

## 2. Peat probing surveys

Ironside Farrar requested:

*Details are required on the probing density adopted for all infrastructure including turbines and how this aligns with the SEPA/ ECUBPG.*

Peat probing was undertaken in two stages, Phase 1 and Phase 2, in line with the Guidance on Developments on Peatland (Scottish Government, Scottish Natural Heritage (now NatureScot), Scottish Environment Protection Agency (SEPA) 2017[1]).

WSP's approach does not include for the wider grid-based format that Scottish Government (2017) guidance suggests, with peat probing conducted to provide representative coverage of various landforms and then focussed peat probing on the planned development area. WSP had agreement from SEPA on the peat probing surveys methodology[2]. Additional data was collected where a higher level of initial risk, in terms of peat stability, was determined.

The first stage (Phase 1) was undertaken to establish the nature and extent of peat on Site to enable design input, as mentioned in the EIAR Chapter 6: Hydrology, Hydrogeology, Geology and Soils Section 6.4.3, Appendix 6.1: Peat Stability Assessment Section 1.3.2 and shown on Figures 6.5a-d: Peat Detail. This involves probing for uncapped peat depth data focusing peat survey efforts within the developable area of the Site, utilising open ground / forest rides to gain a good representative coverage, plus any provisional layout locations during this Phase 1 work. This resulted in peat probing at an approximate frequency of every 50 m within the developable area. This also included the production of a conjectural peat grid-based map for the Site.

The second stage (Phase 2) was used to inform detailed design iterations where further information may be required from specific locations (e.g. proposed infrastructure). Once the design layout was finalised WSP probed along the infrastructure, using the following intervals:

- Tracks (new and to be upgraded): every 50 m;
- Turbines: 10 m crosshair at every turbine;
- Hardstandings: one probe on each 50 m grid within the proposed infrastructure;
- Borrow pits: one probe on each 50 m grid within the proposed infrastructure; and
- Met Mast: one probe within the proposed location.

The conjectural peat grid map was then updated with this data following the Phase 2 analysis.

WSP probed throughout forestry, with an acceptance of the limitation of Global Positioning System (GPS) signal within such environments. Some of the previously probed forestry areas have now been felled.

---

[1] Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey. Guidance on Developments on Peatland. [online] Available at: https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2018/12/peatland-survey-guidance/documents/peatland-survey-guidance-2017/peatland-survey-guidance-2017/govscot%3Adocument/Guidance%2Bon%2Bdevelopments%2Bon%2Bpeatland%2B-%2Bpeatland%2Bsurvey%2B-%2B2017.pdf [Accessed April 2022]

[2] Meeting with SEPA on 11th May 2020 regarding Phase 1 Peat Probing at the proposed Harestanes South Extension.

As part of the WSP design input, site infrastructure was placed in open ground, where feasible, thereby reducing potential limitations caused by forestry cover in terms of peat data coverage.

As stated in Technical Appendix 6.1 of the EIA Report, further peat probing is committed post-felling in peat stability risk areas. The outcomes from this shall be reviewed against previous data and risk considerations to inform the Geotechnical Risk Register and detailed design.

The enclosed Peat Overview and Detail SI Figures 6.5 a **–** d show the probing density within the Proposed Development.

WSP recognises that gathering more information on substrate, as identified in the additional recommendation, would be a valuable addition to the data gathered at Harestanes South and recommend incorporating this pre-construction and in future projects.

### 3. Phase 1 peat probing

Ironside Farrar queried if the lack of Phase 1 peat probing has affected the robustness of the assessment:

*The lack of a Phase I site wide peat probing survey is a significant short coming in the report, and a deviation from the ECUBPG. Clarification is required as to whether the lack of site wide probing has affected the robustness of the assessment. It is not clear how the peat depths presented on large parts of the peat depth mapping have been generated without probe information. This has raised some concern as to whether the peat depths presented on the mapping are sufficiently supported by site data and in turn are sufficiently representative of the overall picture of peat on the site. This inevitably has the potential to affect the risk assessment and its outcomes. Whilst it is appreciated that some of these areas will not be in influence of the proposed infrastructure, it is ensuring that areas that are within influence, have been adequately assessed, e.g. upslope and downslope locations of wind turbines, tracks etc*.

Phase 1 was undertaken with a slight deviation from the Scottish Government Peatland Survey (2017), as mentioned in the EIAR Chapter 6: Hydrology, Hydrogeology, Geology and Soils Section 6.4.3, Appendix 6.1: Peat Stability Assessment Section 1.3.2 and shown on Figures 6.5a-d: Peat Detail.

Items addressed in the response above are also relevant to this recommendation.

Prior to the EIA stage, at the conceptual design stage, WSP had agreement from SEPA on the peat probing surveys methodology[2].

This deviation from the Scottish Government Peatland Survey (2017)[1] standard approach to peat survey is based on WSP's experience on previous windfarm EIA projects, based on an initial 100 m x 100 m grid coverage of the entire Site. WSP believe this is impractical on densely forested sites and that an appropriate level of detail can be obtained by a more targeted approach in the early stages.

We targeted peat surveys within the identified developable area on each Site, focussing particularly on open ground and forest rides, where access through forestry presents difficulty and increased safety risks; also targeting any provisional layout locations, including turbines and any associated infrastructure, where available, during the initial survey work. Though resulting in a reduced spatial density in peat depth data, we believe that sufficient and representative peat depth



data was still achieved for the developable area. This approach aligns with our standard development-focussed and risk-based approach to peat surveys for onshore windfarm EIA, conducted on recent windfarm projects such as Clash Gour, North Lowther Energy Initiative and Glendye. Each of these are 'Section 36' applications to the Scottish Government and the peat data was accepted as thorough and robust by SEPA and Scottish Government appointed Peat Stability Advisor.

### 4. Indicative peat depths methodology

Ironside Farrar requested '*further explanation is required as to how peat depths have been arrived in areas of the site that do not contain any specific peat depth data and whether the depths presented on the mapping are therefore accurate and sufficiently representative to take through the risk assessment*'.

The use of a regular grid for terrain analyses of this type is a standard recognised Geographic Information System (GIS) technique and is widely applied in a range of situations. A grid system allows the application of a systematic process across the landscape, where a set of relevant properties need to be assigned to each particular location. In this analysis, these properties include slope angle and peat depth.

The resolution of Digital Terrain Model (DTM) and base mapping must be taken into account, as using a very fine grid with a resolution identical to or finer than the DTM will return spurious results with a false indication of accuracy. For the Site, a 50 m grid was used in line with WSP's established peat stability analysis method as this is a fine enough scale to provide an appropriate level of detail for analysis but also sufficiently large to gain meaningful results from the 5 m resolution DTM and derived slope model.

To inform the refinement of the infrastructure layout, the results of the initial peat probing survey were used to produce an extrapolated indicative peat depth map for the Study Area. A grid of 50 m x 50 m cells was overlaid across the Site and a peat depth range assigned to each. Following final design, the peat depth grid was cropped to limit data to that within 250 m of the Application Boundary, expanded beyond this where peat probing data was available, this dataset includes all Site infrastructure and also peat survey data collated from earlier design iterations, including data gathered upslope and downslope of locations of concern.

A presentation error on the EIA Report Peat Overview and Detail Figures was noted, the peat depths surveys results were shown as an interpolated map (using Simple Krigging method) rather than a 50 m grid, as explained in Technical Appendix 6.1. This error does not alter the assessment results; however, it has been amended on the enclosed Peat Overview and Detail SI Figures 6.5 a **–** d to be consistent with the methodology explained in Technical Appendix 6.1.

### 5. Consequence assessment

Ironside Farrar noted that '*Table 6.9 does not appear to consider receptors over 100m from each cell where consequence is calculated. It is known that peat slides can travel over distances greater than this, and it is therefore unclear how this has been taken into consideration in calculating consequence across the site'*.

The assessment extends at least 250m beyond the Application Boundary, with the majority of infrastructure well within the Application Boundary.

WSP recognises the value identified of the additional recommendation to provide a supplementary figure showing all receptors considered within the Consequence assessment, this has been presented as the enclosed SI Figure 6.1.13 Receptors.

Within the Detailed Assessment datasheets, any downslope or downstream receptors that lay outwith the grid matrix but which were considered potentially influenced by peat slide have also been identified.

WSP individually evaluated potential runout distances and volumes of material on the basis of local conditions, with these estimates also recorded within the Detailed Assessment datasheets.

No evidence of peat slides from aerial imagery or during peat surveys was noted on the Site, including areas adjacent to extensive forestry access tracks, turbines and associated ancillary infrastructure for the existing Harestanes Windfarm.

Therefore, based on survey evidence, it was considered that the consequence assessment within 100 m limits is appropriate for this Site.

Ironside Farrar commented '*The photograph description may have benefited from a plan showing where the photos and features discussed were located within the site, which would give an understanding how this these features relate to the proposed infrastructure and areas of proposed construction*'. The site reconnaissance photos are now included on the enclosed SI Figure 6.1.11 Detailed Assessment Areas.

I trust that the above information provides sufficient clarification to the points raised by Ironside Farrar in your letter dated 29th April 2021.

It is our aim to satisfy Ironside Farrar that suitable proposals, commitments and mitigation can be controlled through agreed planning conditions which will ensure the Proposed Development minimises impact on the peatland and water environment.

I trust that the above information provides sufficient clarification to the points raised and enables you to withdraw your objection; however, if you would like further clarification on any final points we would be happy to arrange a call to discuss.

Yours sincerely,

[redacted]

[redacted]
Environmental Consultant

cc: SPR
Encl. Harestanes SI Figures 6.5a-d, 6.1.12, 6.1.11 and 6.1.13

300000

590000

T01
T02
T03
T04
T05
T06
T07
T08
PSA A
PSA B
6.1
6.2
6.3
6.4
6.5
6.6
6.7
6.8
6.9
6.10

N

## Legend

- Site Recconaissance photos
- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access Track
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation
- Detailed Assessment Areas



0 0.75 1.5 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 21/09/2021 | VK | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.1.11: Detailed Assessment Areas

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_201 |
| **Rev** | A |
| **Date** | 21/09/2021 |
| **Scale** | 1:30,000 @ A3 |

300000

590000

T01
T02
T03
T04
T05
T06
T07
T08

N

## Legend

- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search
- Operational Harestanes Access – To be Upgraded
- Proposed New Access
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation

### Geomorphology

- Break of Slope within Peat Stability Risk Areas
- Peat over 1.5m depth
- Potential Areas of Instability Identified on site

### Slope (Degrees)

- 0 - 8
- > 8 - 12
- >12 - 18
- >18 - 24
- > 24 - 35
- > 35 - 45
- > 45 +

### BGS Geosure Landslide Susceptibility Classifications

- Class C
- Class D

### Hydrology

- OS Watercourse (1:10,000)
- OS Water Body (1:10,000)

0 0.75 1.5 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 25/08/2021 | MIG | First Issue. |



SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.1.12: Geomorphology

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_202 |
| **Rev** | A |
| **Date** | 25/08/2021 |
| **Scale** | 1:30,000 @ A3 |

300000

590000

T01
T02
T03
T04
T05
T06
T07
T08

N

## Legend

- Application Boundary
- Existing Wind Turbines
- Scheduled Monuments
- Garden & Designed Landscapes
- National Importance Features
- Listed Buildings
- Roads
- Buildings
- Surface Water Area
- Surface Water
- Private Water Supplies Sources
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation
- Extremely High Consequence Buffer
- High Consequence Buffer
- Moderate Consequence Buffer



0 0.75 1.5 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 04/10/2021 | VK | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.1.13: Receptors

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_201 |
| **Rev** | A |
| **Date** | 04/10/2021 |
| **Scale** | 1:30,000 @ A3 |

300000

N

T01

T02

T03

T04

T05

T06

T07

T08

Holehouse Hill

Bog Shaw

Craigshields

Brownmoor Hill

Glenkiln

Pumro Fell

Minister's Moss

Kirkland Hill

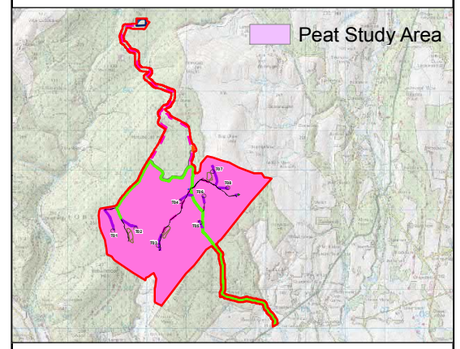
Romans and Reivers Route

300000

## Legend

- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access Track
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation

| Indicative Peat Depth Grid (m) | Peat Depth (m) |
|---|---|
| 0.0 - 0.5 | 0.0 |
| 0.5 - 1.0 | 0.0 - 0.5 |
| 1.0 - 1.5 | 0.5 - 1.0 |
| 1.5 - 2.0 | 1.0 - 1.5 |
| 2.0 - 2.5 | 1.5 - 2.0 |
| 2.5 - 4.0 | 2.0 - 2.5 |
| | 2.5 - 4.0 |






0 0.5 1 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 29/09/2021 | MIG | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.5a: Peat Detail (Western)

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_216 |
| **Rev** | A |
| **Date** | 29/09/2021 |
| **Scale** | 1:20,000 |

N

T04

T05

## Legend

- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access Track
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation

| Indicative Peat Depth Grid (m) | Peat Depth (m) |
|---|---|
| 0.0 - 0.5 | 0.0 |
| 0.5 - 1.0 | 0.0 - 0.5 |
| 1.0 - 1.5 | 0.5 - 1.0 |
| 1.5 - 2.0 | 1.0 - 1.5 |
| 2.0 - 2.5 | 1.5 - 2.0 |
| 2.5 - 4.0 | 2.0 - 2.5 |
| | 2.5 - 4.0 |

Peat Study Area



0 0.5 1 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 29/09/2021 | MIG | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.5b: Peat Detail (Eastern)

| | |
|---|---|
| Drg No | HARESTANES_WSP_I_216 |
| Rev | A |
| Date | 29/09/2021 |
| Scale | 1:20,000 @ A3 |

N

T01 T02 T03 T04 T05 T06 T07 T08

T06

T03

590000

590000

## Legend

- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access Track
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation

| Indicative Peat Depth Grid (m) | Peat Depth (m) |
|---|---|
| 0.0 - 0.5 | 0.0 |
| 0.5 - 1.0 | 0.0 - 0.5 |
| 1.0 - 1.5 | 0.5 - 1.0 |
| 1.5 - 2.0 | 1.0 - 1.5 |
| 2.0 - 2.5 | 1.5 - 2.0 |
| 2.5 - 4.0 | 2.0 - 2.5 |
| | 2.5 - 4.0 |

Peat Study Area



0 0.5 1 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 29/09/2021 | MIG | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.5c: Peat Detail (Southern)

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_216 |
| **Rev** | A |
| **Date** | 29/09/2021 |
| **Scale** | 1:20,000 |

300000

N

T07

T08

T02

T04

T05

T06

T07

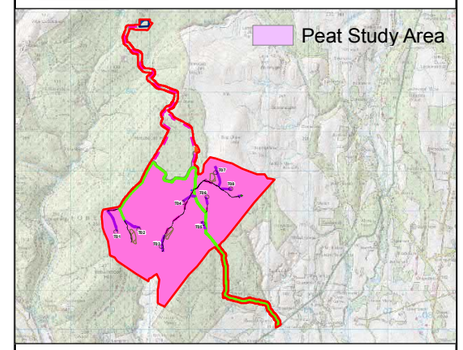
T08

300000

## Legend

- Application Boundary
- Proposed Turbine Location
- Proposed Crane Pad
- Proposed Control Building
- Proposed Met Mast
- Proposed Borrow Pit Search Area
- Operational Harestanes Access – To be Upgraded
- Proposed New Access Track
- Existing Forestry Track - To be Upgraded
- Cable Route
- Existing Construction Compound / Hardstanding
- Existing Substation

| Indicative Peat Depth Grid (m) | Peat Depth (m) |
|---|---|
| 0.0 - 0.5 | 0.0 |
| 0.5 - 1.0 | 0.0 - 0.5 |
| 1.0 - 1.5 | 0.5 - 1.0 |
| 1.5 - 2.0 | 1.0 - 1.5 |
| 2.0 - 2.5 | 1.5 - 2.0 |
| 2.5 - 4.0 | 2.0 - 2.5 |
| | 2.5 - 4.0 |






0 0.5 1 Km

| Rev | Date | By | Comment |
|---|---|---|---|
| | | | |
| | | | |
| A | 29/09/2021 | MIG | First Issue. |

SCOTTISHPOWER RENEWABLES

# Harestanes South Windfarm Extension

SI Figure 6.5d: Peat Detail (Northern)

| | |
|---|---|
| **Drg No** | HARESTANES_WSP_I_216 |
| **Rev** | A |
| **Date** | 29/09/2021 |
| **Scale** | 1:20,000 |

**Harestanes South Windfarm Extension Project Team**

ScottishPower Renewables
9th Floor ScottishPower Headquarters
320 St Vincent Street
Glasgow
G2 5AD

**HarestanesSouthWindfarm@scottishpower.com**

**www.scottishpowerrenewables.com**

SCOTTISHPOWER
RENEWABLES