PEAT LANDSLIDE HAZARD RISK ASSESSMENT

Kirkan Windfarm

STAGE 1 CHECKING REPORT

Scottish Government
Riaghaltas na h-Alba
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ENERGY CONSENTS UNIT

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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	27.06.19	Checking Report for Developers PLHRA	Nick Matheson, BSc, CGeol, FGS, 18 years	Mark Chapman, BSc, MSc, CEng, 26 years

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.

1.3 Documents Reviews

The documents reviewed as part of this audit were:

Stage 1 Audit:

- Kirkan Wind Farm, Technical Appendix 9.1, Peat Slide Risk Assessment. RSK, March 2019, FINAL.
- Kirkan Wind Farm, Technical Appendix 9.3, Borrow Pit Assessment. RSK, March 2019.
- Kirkan Wind Farm, EIA, Volumes 1 & 2, RSK, March 2019.

2.0 REVIEW OF DATA SUPPORTING PLHRA

2.1 Background on the proposed development at Gordonbush Extension

The development site is located on the Strathvaich Estate in the Garve district of the Ross and Cromaty region of the Highlands. The site lies on an upland area south of the A835, north west of Garve.

The proposed development comprises the following elements:

- 17 No. wind turbines, up to 4.8 MW each and a maximum tip height of 175m.
- Turbine foundations and hardstanding areas around the base of each turbine. The maximum total area of hardstanding is 1,850m^2.
- 10,835m of new access track with associated water crossings. 9,975m will be new track, and 860m upgraded track. Track construction will by via cut design/ method.
- 2 No. met masts.
- 2 No. borrow pits. Extraction will include blasting.
- Operations control building with parking and temporary welfare facilities.
- Substation and compound.
- Up to 3 No. temporary construction compounds.

2.2 Is a PLHRA Necessary?

The initial assessment of baseline data available for the site confirms that the need for a PLHRA. The proposed infrastructure intersects with peat with a potential depth of greater than 0.5m and the site has slopes in excess of 2 degrees.

The reporting states that the PLHRA aims to review relevant project area information, including peat depth and peat condition in order to provide an assessment of peat stability within the project area. Recommendations are made for mitigation measures and specific construction methods that should be implemented in order to minimise the risk of inducing instability in the peat during construction works.

2.3 Team Competencies and spatial scope of the study.

Team members including their qualifications/ competency is given within the EIA.

The study area fully encompasses the proposed development area (red line boundary) and ground beyond the boundary. It includes all tracks, turbine positions and infrastructure.

2.4 Review of Desk Study

The desk study review provides background information on the ground conditions of the site including site history and published ground condition mapping (BGS 1:50,000 scale solid and drift editions and Soil Maps of Scotland).

There is also good discussion on topography, vegetation and climate and this is supported by review of aerial photography. There is also mention of discussion with land-owners on any historical instability, and also reference is made to review of previous peat studies on the site.

Although the desk study is generally reasonable, there is are no supporting figures showing published ground conditions or base mapping. It is useful to show the baseline data graphically relative to the proposed infrastructure as this is considered important in ensuring all features/ elements are considered during reconnaissance (i.e. ground truthing).

It is noted that the review of slopes over the site is via a DTM and topography is discussed. However, the scale/ resolution of the DTM is not stated and there is not any supporting figures showing the range of slopes across the site. Confirmation of DTM scale/ resolution is required to confirm that it is of a suitable scale to pick up smaller scale variations.

2.5 Review of Field Surveys – Peat Probing

Site reconnaissance has also been undertaken with good description in Section 3 which includes geomorphological features on the site, landform, drainage characteristics, soil/ peat erosion and observations on any evidence of peat instability. This is backed up by photographs. During the walkover, no significant peat instability features were recorded within the red line boundary, although the presence of collapsed peat pipes was noted west of the study area (outside the red line boundary).

The assessment has included peat probing at 1,546 locations, carried out over three phases. The initial phase was at 100m centres over the whole site with subsequent probing targeting access roads and infrastructure.

The approach, scope and frequency of probing adopted is considered robust and it has appropriate coverage of all infrastructure. The intervals adopted along access tracks was at c50m centres. Grids were adopted over infrastructure including turbines, borrow pits and hardstanding areas, which appear to be at approximately 30m centres.

Peat depth was recorded at each location and tied-in with GPS. Peat depths at each peat probe location are presented on FIGURE 9.1.2.

It is noted that there was no coring of peat or consideration of substrate. These elements are typically considered important aspects in building up a robust characterisation of the peat and any potential pre-conditions.

It is noted that as part of the walkover, a peat condition survey was carried out noting peat condition according to SNH classification, although this is assumed to have been surface observations as opposed to looking at the peat layer/ succession itself.

The probing has identified the following:

- 879 probes with peat <0.5m, considered peaty soil.
- 369 probes with peat 0.51-1.00m, considered thin peat.
- 146 probes with peat 1.01-1.50m, considered thin peat.
- 77 probes with peat 1.51-2.00m, considered thick peat.
- 39 probes with peat 2.01-2.50m, considered thick peat.
- 15 probes with peat 2.51-2.50m, considered thick peat.
- 17 probes with peat 2.51-3.00m, considered thick peat.
- 2 probes with peat 3.51-4.00m, considered thick peat.
- 2 probes with peat +4.01m, considered thick peat.

The results of the peat probing indicate that over 50% of the area can be described as having topsoil or peaty soil. Deep peat (classed as over 2m) was found on ground west of the current red line boundary during initial probing phases. As a result, this area was subsequently removed from the project development area.

Consideration of peat depth between each probe location and in a buffer around the red line boundary has been carried out through GIS using gravity interpolation, based on a 25m cell size. Interpolated peat depth is shown on FIGURE 9.2.1 in 0.5m thickness bands. This approach is reasonable and is considered to have built up a suitably robust data set on peat depth across the study area.

2.6 Integration of Desk Study and Field Surveys

A set of figures showing slope angle, peat characteristics, natural and artificial drainage would have been useful to integrate desk study and field surveys.

3.0 REVIEW OF HAZARD & RISK ASSESSMENT AND PROPOSED MITIGATION

3.1 Assessment of Likelihood

Assessment of likelihood has been carried out via the use of the infinite slope model assessing slope stability and Factor of Safety (FoS), as per the Scottish Government Guidance.

Table 9.1.3 details the various input parameters considered and gives the rationale. In general, the input values appear to be appropriate and realistic. Confirmation of the scale of the DTM to generate slope angle would be required to confirm this input element was suitable.

The FoS (f) was calculated via GIS for each probing location and also for 50m by 50m cells across the study area and also a 250m buffer. The FoS was divided into classes to determine levels of likelihood. The ranges of likelihood and the corresponding FoS selected for that particular range appears to be logical and realistic.

Table 9.1.4 details the results of the Infinite Slope Model (f) for both peat probe positions and for each cell.

All but one peat probe depth calculates either an unlikely negligible or nil likelihood. 98.5% of cells calculate an unlikely, negligible or nil likelihood, 0.8% a likely likelihood of likely, 0.4% probable likelihood and 0.2% almost certain likelihood.

3.2 Assessment of Consequence

A consequence assessment has been carried by consideration of a range of sensitive receptors and consideration of the level of adverse consequence. The range of receptors considered includes existing infrastructure (roads), proposed infrastructure (e.g. wind turbine foundations), proposed access tracks, water courses, sensitive habitats (e.g. GWDTE) and private water supplies.

Each grid cell has been assigned a level of consequence from very low consequence to very high consequence depending on the presence and type of receptor present. For water course a 50m buffer has been utilised.

The range of receptors considered for the assessment area is thought to be appropriate and the various levels of risks reasonable. However, the calculation of adverse consequence on purely a cell by cell basis means it is unclear as to whether slope and potential slide runout have been considered and whether these affect some of the consequence ratings in certain areas of the site. For instance, a water course more than 50m downslope of an area of moderate likelihood of peat landslide might be at risk of a peat landslide from further up the slope. The way the consequence has been calculated by taking the stream itself and a 50m buffer might not take this into consideration.

3.3 Calculation of Risk

Section 6.16 presents a risk assessment. Risk is calculated by multiplying likelihood score with the consequence score for each cell across the site. This has produced a level of risk from negligible to high as per the risk assessment matrix presented in the Scottish Guidance.

Table 9.1.7 provides a summary of the risk rankings in each cell and this is supported by FIGURE 9.1.5-Risk Ranking.

There are no high risk rankings. 0.7% of the cells calculate moderate risk, 8.7% calculate low risk and the remainder (90.6%) a negligible or nil (no peat) risk.

Whilst the calculation of risk is considered appropriate, the lack of run-out and slope consideration within the adverse assessment might mean some risks are miscalculated.

As a check, it is recommended that all sensitive receptors down slope of moderate likelihood areas to check that risks to these are not higher than currently presented. It is noted that down slope receptors are discussed within the proposed mitigation (area 1), but further consideration should include the area of moderate risk identified out with the red line boundary to check that any peat slide here would not affect infrastructure (the proposed development).

3.4 Proposed Mitigation

Mitigation is discussed for each area of moderate (or higher) risk highlighted within the study area, for which there are two.

Site-specific mitigation proposed includes the following:

Area 1 (west of turbine T01): no construction activity within the area highlighted at moderate risk (one area). Sediment management would also be installed to between the works and the down slope water course to control any silty run-off.

Area 2 (at the location of Turbine T14): The foundation and track route have been carefully designed to avoid the area of deep peat and incursion into the deep peat pocket would be kept to a minimum. Installation of cross track drainage to provide hydraulic continuity and assist in maintaining slope stability.

There are a series of generic mitigation methods including:

- Keeping incursion to deep peat areas to a minimum
- Adoption of appropriate track drainage
- All tracks to the established via cut methods
- Additional ground investigation and micro-siting of infrastructure to avoid problematic areas
- Utilising current best practise methods, geotechnical risk register, advance inspections and regular monitoring for signs of peat instability.

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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.

Background Information

Information on the proposed development is adequate.

The document acknowledges the use of borrow pits and supporting documentation confirms that the existing borrow pits will be extended and that blasting may be used. A comment is required on whether blasting will have any influence of peat instability and landslide risk.

Team Competencies and spatial scope of the study

The competence/ experience of the team is stated, and this information is considered adequate.

Desk Study

The desk study is considered generally reasonable, although supporting figures showing published ground conditions and other baseline mapping would have been useful and are typically expected in accordance with the guidance.

The scale/ resolution of the DTM is not stated and there are not any supporting figures showing the range of slopes across the site. Confirmation of DTM scale/ resolution is required to confirm that it is of a suitable scale to pick up smaller scale variations.

Field Surveys

Suitable site reconnaissance has been undertaken which has included consideration of geomorphological features, landform, drainage characteristics, soil/ peat erosion and observations on any evidence of peat instability which is backed up by photographs.

Peat depth assessment has been carried out via peat probing, the scope and frequency of which is considered robust.

Integration of Desk Study and Field Surveys

A set of figures showing slope angle, peat characteristics, natural and artificial drainage would have been useful to integrate desk study and field surveys.

Hazard Assessment – Likelihood

Assessment of likelihood has been carried out via the use of the Infinite Slope Model assessing slope stability and Factor of Safety (FoS), as per the Scottish Government Guidance.

The input values appear to be appropriate and realistic, although confirmation of the scale of the DTM to generate slope angle would be required to confirm this input element was suitable.

The FoS (f) was calculated via GIS for each probing location and also for 50m by 50m cells across the study area and a 250m surrounding buffer. The FoS was divided into classes to

determine levels of likelihood. The ranges of likelihood and the corresponding FoS selected for that particular range appears to be logical and realistic.

Hazard Assessment – Consequence

A consequence assessment has been carried by consideration of a range of sensitive receptors and consideration of the level of adverse consequence.

The range of receptors considered for the assessment area is thought to be appropriate and the various levels of adverse consequence assigned reasonable. However, the calculation of adverse consequence on purely a cell by cell basis means it is unclear as to whether slope and potential slide runout have been considered and whether these affect some of the consequence ratings in certain areas of the site. For instance, a water course more than 50m downslope of an area of moderate likelihood of peat landslide might be at risk and the way the consequence has been calculated by taking the stream itself and a 50m buffer might not take this into consideration.

Calculation of Risk

Risk is calculated by multiplying likelihood score with the consequence score for each cell across the site. This has produced a level of risk from negligible to high as per the risk assessment matrix presented in the Scottish Guidance.

Whilst the calculation of risk is considered appropriate, the lack of run-out and slope consideration within the adverse consequence assessment may mean some risks might be miscalculated.

Proposed Mitigation

Proposed mitigation is both generic and also site-specific to where moderate or higher risk has been calculated. The range of mitigation measures presented is considered suitable in managing the risks. Micro-siting, avoiding deeper peat areas and further ground investigation is all recommended.

4.2 Summary Outcome of Checking Report

The following comprises the summary outcome of the checking report:

- The PLHRA **requires some revisions:** although much of the PLHRA is sound, some key elements are considered to be insufficiently robust to support the PLHRA conclusions and minor revisions are required; which can be either be progressed by the developer through either an appendix to the original submission or by clarification letter.

4.3 Recommendations

The following recommendations are made:

Recommendations requiring response from Developer:

- Blasting is proposed. Implications for peat instability and hence the risk of inducing landslide should be considered. Where appropriate the risk assessment and mitigation should be updated.
- The scale of the DTM should be clarified to ensure it is of appropriate scale.

- As a check, it is recommended that all sensitive receptors down slope of moderate likelihood areas to check that risks to these are not higher than currently presented. It is noted that down slope receptors are discussed within the proposed mitigation (area 1), but further consideration should include the area of moderate risk identified out with the red line boundary to check that any peat slide here would not affect infrastructure (the proposed development).

Recommendations made for information only – no response required:

- It would be useful to show the baseline data graphically, including slope relative to the proposed infrastructure as this is considered important in ensuring all features/ elements are considered during reconnaissance (i.e. ground truthing). Future PLHRA should include this.