Section 10
HYDROLOGY, GEOLOGY AND HYDROGEOLOGY

Contents

Section 10: HYDROLOGY, GEOLOGY AND HYDROGEOLOGY

10.1 Introduction

10.1.1 Natural Power Consultants Ltd (Natural Power) have undertaken a revised assessment of the potential impacts on geological, hydrological and hydrogeological receptors as a result of the construction and operation of the proposed Scoop Hill Community Wind Farm, located in Dumfries & Galloway, on behalf of Community Windpower Limited (CWL).

10.1.2 The initial works supporting the S36 application for the proposed Development are detailed within Section 10 – Hydrology, Geology and Hydrogeology, of the original Scoop Hill Community Wind Farm Environmental Impact Assessment Report (EIAR) submitted in November 2020. This revised assessment incorporates:

- The removal of seventeen turbines (T1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 35, 37, 38, 54, 56, 61 and 62);
- Removal of two Borrow Pit Search Areas (N1 and N4) due to reduced construction aggregate requirements;
- Relocation of borrow pits N6, N7 and N8;
- Access track design refinements resulting in a reduction in the length of new access track required in order to reduce development impact and site won aggregate requirements;
- Micrositing of T63;
- Removal of one Temporary Construction Compound; and
- The addition of two new turbines within the forestry to the west of the site (T76 and 77).

10.1.3 This Section presents the revised findings of the assessment due to the changes in site design and refers back to Section 10 – Hydrology, Geology and Hydrogeology, of the original EIAR where appropriate. The revised assessment accords with the legislation and guidance presented within the original EIAR, unless otherwise stated.

10.1.4 This Section is supported by the following appendices which are also submitted as part of the Additional Information (AI):

- AI Technical Appendix 10.1: Watercourse Crossing Assessment; and
- AI Technical Appendix 10.2: Peat Slide Risk Assessment.

10.1.5 All other information contained within Section 10 – Hydrology, Geology and Hydrogeology of the EIAR and associated appendices (Technical Appendix 10.3: Peat Management Plan and Technical Appendix 10.4: Private Water Supply Risk Assessment) remains valid. The revised site layout used for this assessment has been provided by CWL and is presented in AI Figure 2.1.

10.2 Consultation

10.2.1 The results of the consultation undertaken as part of the pre-submission assessment process is contained in Section 10 of the original EIAR.

10.2.2 Following submission of the EIAR, statutory consultation has taken place with consultees regarding hydrology and peat related matters, with clarification and AI supplied as required.

10.2.3 CWL addressed the points raised in the SEPA response to the EIAR (Ref: PCS/173889, dated 22nd December 2020) in a letter submitted in March 2021 (Ref: 374-210308-1192). A follow up response from SEPA was provided in June 2021 (Ref: 1634, dated 25th June 2021). In their follow up response, SEPA removed their objection to Scoop Hill Community Wind Farm on the basis that the commitments made in CWL's response (outlined below in Table 10.1) are implemented. CWL remain committed to complying with these requirements.

10.2.4 Full details on the consultation matters relating to peat slide risk are provided within Technical Appendix 10.2 which accompanies this AI submission.

10.2.5 Table 10.1 details the comments received from SEPA, and the actions and commitments taken by CWL.

Table 10.1 Consultee responses

Consultee	Consultee Comment and requests	Action taken
The Scottish Environment Protection Agency (SEPA) (Response to EIAR: PCS/173889 – dated 22nd December 2020 and SEPA response to CWL letter Ref 1634 – dated 25th June 2021).	Disturbance and re-use of excavated peat	In response to paragraphs 1.1 and 1.2 of the SEPA response, CWL are committed to micrositing of turbines 59 and 60 to further reduce excavation of peat. The micrositing would be carried out in agreement of the ECoW, secured by a planning condition (condition wording to be found in AI Section 15) as detailed in their letter to SEPA (374-210308-1192, dated 8th March 2021). Turbines 61 and 62 have been removed from the proposed Development and are therefore no longer considered in this revised assessment. As provided in the existing peat management plan (PMP) included as part of the initial EIAR, all tracks where peat is of a depth greater than 0.5 m will be floated thereby avoiding excavation of peat.
	Peat Management Plan	In response to paragraphs 2.1 – 2.6 of the SEPA response: • Paragraph 2.1: CWL are committed to providing an updated PMP prior to construction, prepared in consultation with SEPA. • Paragraph 2.2: It is confirmed that the appointed Principal Contractor will prepare a detailed method statement identifying where and how peat will be used in reinstatement or landscaping works. The method statement will include details on how peat will be excavated, handled and stored and will consider impacts on downstream receptors and potential instability issues. • Paragraph 2.3: It is confirmed no waste material will be brought onto site. • Paragraph 2.4: Peat would not be placed on existing vegetation and as outlined in point 2.1, reinstatement proposals would be included in the updated PMP and agreed with SEPA. • Paragraph 2.5: Further details on reinstatement, based on site investigations undertaken prior to construction, will be included in the updated PMP. • Paragraph 2.6: It is confirmed within Section 4.3.6 of the existing PMP included as part of the initial EIAR that only material excavated as overburden from borrow pits would be returned.
	Groundwater Dependent Terrestrial Ecosystems (GWDTE)	GWDTE data was provided to address paragraphs 3.1 and 3.2. SEPA subsequently confirmed to CWL, by letter dated 25th June 2021, that the mitigation provided in Section 8.13.6 are appropriate and should be included within the CEMP to be provided by planning condition.
	Forest Waste Management	It is confirmed, in response to paragraphs 4.1 – 4.3 of the SEPA response that all timber and brash material will be removed from site and used appropriately.

	Construction Environmental Management Plan	It is confirmed, in response to paragraphs 5.1 and 5.2 of the SEPA response, that a site-specific CEMP will be submitted to the determining authority, in consultation with SEPA, at least two months prior to the construction.
	Existing groundwater abstractions including private water supplies	It is confirmed that no groundwater abstractions are located within 250m of the wind farm infrastructure. No further action required.
	Micrositing	CWL agree to a planning condition requiring that, unless otherwise confirmed by the determining authority in consultation with SEPA, any proposed micro-siting would be subject to specific requirements. A 100m micrositing allowance is proposed with the appointed ECoW responsible for managing the micrositing process. SEPA will be consulted should the micrositing be greater than 50m. Further details are provided in Section 10.11 of this AI section.
	Outline habitat management plan	CWL are committed to refining the Habitat Management and Enhancement Plan (HMEP) to include more information on proposed future monitoring (e.g. for bog areas etc).
	Detailed advice for the applicant – Watercourse crossings	Existing crossings WX11, WX15, WX27 and WX28 remain as part of the revised layout. CWL are committed to upgrading these, and other non-compliant crossings, with compliant structures that offer environmental betterment. Further details are provided in Technical Appendix 10.1 which accompanies this AI section.
	Detailed advice for the applicant – Construction Environmental Management	A site-specific CEMP will be prepared prior to construction. An outline CEMP was submitted with the original EIAR

10.3 Legislation, Policy & Guidelines

10.3.1 Section 10 of the original EIAR provides reference and discussion in respect of relevant legislation, planning policy and guidance for which the proposed Development will comply with. This information has not been repeated here.

10.3.2 It is noted however, that since submission of the original EIAR that the following guidance has been updated:

- SEPA, (2022), *The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 9,2.*
- Scottish Government (2022), National Planning Framework 4.

10.3.3 CWL will comply with all regulatory regimes required including, but not limited to, the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). This will include the authorisation of engineering activities in or near the water environment, abstractions, and discharges as well as the application for a Construction Runoff Permit.

10.4 Assessment Methodology & Significance Criteria

10.4.1 The assessment, prediction methodology and determination of significance follows the same process as detailed within Section 10 of the original EIAR.

10.5 Additional Assessment

10.5.1 Two of the Technical Appendices have been revised, based on the changes to the infrastructure, with a summary provided below:

- Completion of a revised peat slide risk assessment (PSRA) based on the updated infrastructure layout, additional site work and the consultation comments received from Ironside Farrar on behalf of the ECU, and;
- Another site visit for the watercourse crossings assessment, including the survey of seven new watercourse crossings based on the updated infrastructure layout.

10.5.2 The Technical Appendices that have been prepared to accompany this AI should also be read in conjunction with Section 10 of the EIAR and its associated Technical Appendices.

10.6 Peat

10.6.1 A Peat Management Plan (PMP) was prepared to accompany the original EIAR (Technical Appendix 10.3). The assessment concluded that the proposed Development has the capacity to accommodate all excavated peat as part of the reinstatement of infrastructure.

10.6.2 Since the EIAR submission, the Scottish Parliament have voted to approve National Planning Policy Framework 4 (NPF4), and this was formally adopted and published on 13 February 2023. The adoption of NPF4 ultimately supersedes the existing NPF3 and Scottish Planning Policy (SPP) including polices related to peat and carbon rich soils. It is understood that the Scottish Government and key regulatory stakeholders are currently forming a working group to facilitate the prescription of specific policies and guidance drawn from NPF4. Of particular relevance to this application is Policy 5(c) and Policy 5(d);

- *5(c) Development proposals on peatland, carbon-rich soils and priority peatland habitat will only be supported for:*
  - *i. Essential infrastructure and there is a specific locational need and no other suitable site;*
  - *ii. The generation of energy from renewable sources that optimise the contribution of the area to greenhouse gas emissions reduction targets;*
  - *iii. Small-scale development directly linked to a rural business, farm or croft;*
  - *iv. Supporting a fragile community in a rural or island area; or*
  - *v. Restoration of peatland habitats*
- *5(d) Where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify:*
  - *i. the baseline depth, habitat condition, quality and stability of carbon rich soils;*
  - *ii. the likely effects of the development on peatland, including on soil disturbance; and*
  - *iii. the likely net effects of the development on climate emissions and loss of carbon.*

  This assessment should inform careful project design and ensure, in accordance with relevant guidance and the mitigation hierarchy, that adverse impacts are first avoided and then minimised through best practice. A peat management plan will be required to show that this approach has been followed, alongside other appropriate plans required for restoring and/ or enhancing the site into a functioning peatland system capable of achieving carbon sequestration.

10.6.3 The PMP is aligned with current planning policy requirements and associated good practice guidance.

10.6.4 The comments below are as previously stated within the existing PMP and only relate to the changes onsite:

- Turbines 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 35, 37, 38, 54 and 56 (which have been removed) were located in areas with recorded peat depths less than 0.5 m;
- Turbines 61 and 62 (which have been removed) were located in areas where peat depths were greater than 0.5 m;
- Turbine 63 (slight movement) was and remains in an area with a recorded peat depth less than 0.5 m;
- All borrow pits were and remain located in areas with a recorded peat depth less than 0.5 m;
- Construction compounds were excluded from the volumetric calculations as the excavated material would be fully reinstated upon completion of construction; and
- All access tracks located on peat/organic soils with depths greater than 0.5 m would be floated and were therefore excluded from the volumetric calculations.

10.6.5 Additionally, Turbines 76 and 77 (new additions) are positioned in areas with a recorded peat depth less than 0.5 m. The PMP has not been updated and is still considered appropriate for the layout. The removal of turbines 61 and 62 will likely result in less peat to be excavated and a reduced volume.

10.6.6 AI Figure 10.2.1 of the PSRA (AI Technical Appendix 10.2) presents the interpolated peat depths overlain by the revised site layout. No infrastructure has been relocated into an area of greater depth of peat/organic soil compared to what was submitted as part of the EIAR. As such, and also considering the design assumptions included within the existing PMP, there is no change to the PMP included within the EIAR.

10.6.7 As detailed earlier in Table 10.1, the PMP is a live document and CWL remain committed to updating the information presented based on removal of turbines, micro-siting of infrastructure, detailed design consideration and refinement of the reinstatement methods.

10.6.8 An updated PSRA (AI Technical Appendix 10.2) has been prepared and accompanies this section of the AI. The following key points are reiterated for the project site and reported in the PSRA:

- Over 6,000 soil depth probes have been collected as part of a targeted multi-phase field survey.
- Recorded soil depths indicate predominantly shallow or absent peat across the project site (site wide mean of 0.3m soil probe depth). These shallow records correspond to a low or negligible risk of peat slide determined for the majority (over 90%) of infrastructure locations.
- Deeper soil probes determined as peat (>0.5m) are recorded only in discrete areas.
- The wind farm layout design has been an iterative process. A multitude of environmental factors have been reviewed as part of the EIA process including the distribution of peat.
- Thus, the wind farm layout has sought to minimise its impact on peat either through siting and location of infrastructure in areas of low slide risk, shallow or absent peat, and through targeted use of low volume construction techniques including floating type access tracks / hardstanding infrastructure;
- Active mitigation measures have further been specified for limited elements of the scheme where peat slide risk is elevated.
- Through the application of these targeted mitigation measures: the risk of peat slide from the proposed wind farm and its infrastructure is currently assessed to be negligible.

10.7 Water Quality

10.7.1 Details on water quality are presented within Section 10 of the original EIAR and remains relevant for this revised assessment. As presented within Table 10.11 of the EIAR and Table 10.2 (distance to watercourses for the additional two turbines (76 and 77) and moved turbine (63)) below, all 60 turbines are located over 50 m from the mapped watercourses.

10.7.2 Seventeen turbines have been removed from the proposed Development and Turbine 63 has moved slightly. The remaining 57 turbines have not changed positions, the distances to watercourses presented in Table 10.11 of the EIAR remain valid.

Table 10.2 Distance from turbine to nearest watercourse

Turbine ID	Turbine distance from watercourse (m) *
63 (relocated)	270
76 (new)	213
77 (new)	285
*Distance includes 50 m watercourse buffer	

10.7.3 The relocation of borrow pits N6, N7 and N8 (as shown in AI Figure 2.1) does not reduce the distance between these infrastructure elements to mapped hydrological features. The removal of borrow pit N1 from the proposed Development reduces the risk of a pollution incident occurring from these activities in the catchment of the Caldwell Burn and wider Dryfe Water catchment. The removal of borrow pit N4 from the proposed Development reduces the risk of a pollution incident occurring from these activities in the catchment of the Leithenhall Burn and wider Wamphray Water catchment.

10.7.4 All temporary construction compounds were already located away from sensitive hydrological features, and this remains valid with the adjusted layout. The removal of the temporary construction compound from the Wamphray Burn catchment further reduces the risk of works potentially impacting upon water quality.

10.7.5 As presented within AI Technical Appendix 10.1, 11 of the previously assessed watercourse crossing points are no longer required, with an additional seven locations required to facilitate the adjusted track layout. The watercourse crossing assessment presents the proposed crossing details for these seven new locations, including required levels of authorisation under the Water Environment (Controlled Activities) (Scotland) Regulations 2011.

10.7.6 With reference to consultation with SEPA, as outlined above in Table 10.1, existing crossings WX11, WX15, WX27 and WX28 remain as part of the revised layout. CWL are committed to upgrading these, and other non-compliant crossings, with compliant structures that offer environmental betterment. Further details are provided in AI Technical Appendix 10.1 which accompanies this section.

10.7.7 As requested by SEPA, detailed plans for water quality monitoring prior to, during and post construction will be included within the CEMP that will be prepared prior to construction, and this will be secured by a suitably worded planning condition (see AI Section 15 for further information).

10.8 Flood Risk

10.8.1 Drainage plans for inclusion within the Construction Environmental Management Plan (CEMP), as requested by SEPA (see Table 10.1) will be prepared prior to construction. The CEMP will include design details for the construction of all new and existing watercourse crossings.

10.9 Private Water Supplies

10.9.1 Private Water Supplies (PWS) were assessed as part of the original EIAR (Technical Appendix 10.4), with SEPA confirming in their response (PCS/173889) that they were satisfied that no groundwater abstractions or groundwater fed private water supplies were located within 250 m of proposed infrastructure.

10.9.2 An existing track between Braefield Cottage (Property ID:1, this property is derelict and under the control of the applicant) and the abstraction location has been removed as part of the revised infrastructure layout. A new stretch of track is now proposed located on the opposite side of the Wamphray Water, greater than 250m from the abstraction. The infrastructure is not hydrologically connected to the abstraction.

10.10 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

10.10.1 A review and assessment of Groundwater Dependent Terrestrial Ecosystems (GWDTE) of the proposed Development has been undertaken by the appointed ecological consultants (Starling Learning), with relevant details provided in Section 8 – Ecology of the original EIAR and relevant updates provided in Section 8 of this AI.

10.11 Mitigation by Design

10.11.1 Full details of the hydrological influences on the design of the proposed Development are provided in Section 3 and Section 10 of the original EIAR. This includes:

- Reducing placement of infrastructure on peat/organic soils, with commitments to microsite where possible;
- Ensuring that turbines and other infrastructure (with the exception of watercourse crossings) remain outside of the 50 m buffers of the hydrological features; and
- Reducing the number of watercourse crossings required.

10.11.2 The updated PSRA (AI Technical Appendix 10.2) was completed following the adjustment to the infrastructure layout to demonstrate that the risk of peat slide was mitigated.

10.11.3 The updated watercourse crossing assessment (AI Technical Appendix 10.1) demonstrates that the flows within the channels can be maintained or improved. It also confirms that despite the additional seven new watercourse crossings following the refinement of the access track design, overall the total number of crossings required has reduced by four.

10.11.4 An Environmental Clerk of Works (ECoW) will be appointed and will manage the micro-siting of infrastructure to further reduce the risk to environmentally sensitive locations. This includes:

- Overall responsibility for managing the micrositing of infrastructure within the proposed 100 m allowance. The ECoW will consult with SEPA should the adjustment to infrastructure be greater than 50 m;
- No micro-siting shall take place to within a 50m buffer distance of a watercourse;
- No micro-siting shall take place to areas of peat of greater depth than the original location except for infrastructure which is to be floated in areas of peat;
- No micro-siting shall take place to within areas hosting GWDTE; and
- No micro-siting shall take place to within the buffers identified for private water supplies (as detailed in Technical Appendix 10.4 of the EIAR).

10.12 Mitigation

10.12.1 As detailed above in Table 10.1, the mitigation strategy set out in Section 10 of the original EIAR, and outline CEMP was considered satisfactory to SEPA. The environmental management requirements and mitigation strategy will be refined upon confirmation of final construction techniques.

10.12.2 As outlined in Table 10.1, it is accepted that the PMP is a live document and will be updated once final construction techniques are confirmed at the post-consent and pre-construction stage following detailed site investigation. This will include an update to the volume calculations as well as reinstatement techniques.

10.13 Summary

10.13.1 As a result of the additional survey works, information and consultation, the significance of effects of the Proposed Development with revised design on the geological, hydrological and hydrogeological environment remains as **not significant** under the terms of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, as stated in Section 10 of the EIAR.

Additional Information Appendix 10.1
WATERCOURSE CROSSING ASSESSMENT (UPDATED MARCH 2023)

Contents

Tables

Abbreviations

Abbreviation	Description
AI	Additional Information
CAR	Controlled Activities (Scotland) Regulations
CEMP	Construction Environmental Management Plan
CWL	Community Wind Limited
EIAR	Environmental Impact Assessment Report
GBR	General Binding Rules
SEPA	Scottish Environment Protection Agency

Additional Information Appendix 10.1: Watercourse Crossing Assessment

10.1 Introduction

10.1.1 Natural Power Consultants Ltd (Natural Power) have undertaken an assessment of the watercourse crossings required as part of the proposed Scoop Hill Community Wind Farm (the proposed Development), located in Dumfries and Galloway. This report forms a Technical Appendix to Section 10: Hydrology, Geology and Hydrogeology, of the Scoop Hill Community Wind Farm Additional Information (AI), which should be read in conjunction to this report.

10.1.2 This revised assessment incorporates:

- The removal of seventeen turbines (T1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 35, 37, 38, 54, 56, 61 and 62);
- Removal of two Borrow Pit Search Areas (N1 and N4) due to reduced construction aggregate requirements;
- Relocation of borrow pits N6, N7 and N8;
- Micrositing of T63;
- Access track design refinements resulting in a reduction in the amount of new access track required. This consequently reduces the development impact and site won aggregate requirements;
- Removal of one Temporary Construction Compound; and
- The addition of two new turbines within the forestry to the west of the site (T76 and 77).

10.1.3 This Section presents the revised findings of the assessment due to the changes in site design and refers back to Section 10 – Geology, Hydrology and Hydrogeology, and Technical Appendix 10.1, of the original Environmental Impact Assessment Report (EIAR) where appropriate. The revised assessment accords with the legislation and guidance presented within the original EIAR.

10.1.4 The removal of turbines and associated changes to the access track design, has resulted in the removal of 11 watercourse crossings that were previously assessed as part of the original EIAR but has also resulted in the need for additional crossings. The purpose of this report is to provide all the relevant information associated with these additional watercourse crossings required as part of the Proposed Development.

10.1.5 All other information contained within Section 10 – Geology, Hydrology and Hydrogeology of the EIAR and Technical Appendix 10.1 remains valid, unless stated otherwise.

10.2 Report update

10.2.1 Following the changes in the track layout there is a change in the location and number of watercourse crossings that are required. The track layout included as part of the original EIAR assessed 48 crossings, however the following 11 crossings are no longer required:

- WC4;
- WC5;
- WC6;
- WC7;
- WC8;
- WC19;
- WC40;
- WC41;
- WC44;
- WC47; and
- WC48.

10.2.2 The existing crossings that were assessed during the preparation of the EIAR will retain their existing ID's and will not be renumbered to maintain consistency across documents and figures already produced. The crossing ID's for the new crossings (WC49 to WC55 (seven in total)) required as part of the adjusted track design have been chosen to continue from the original assessment to reflect the requirement of this AI and to avoid confusion with what was presented as part of the original EIAR. Table 10.1 below provides a summary of these new watercourse crossings.

10.2.3 The change to the layout has resulted in the Proposed Development now requiring 44 watercourse crossings in total. This is an overall reduction of four watercourse crossings in comparison to the original EIAR.

10.3 Consultation

10.3.1 Consultation letter reference PCS/173889 dated 22 December 2020 from the Scottish Environment Protection Agency (SEPA) provided comments regarding the original watercourse crossings. As part of this response, it was confirmed that all watercourse crossings were consentable under the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011. The application for authorisation should take due regard to the determination period for licensable activities. SEPA also provided comment on the upgrade of existing crossings for environmental betterment.

10.3.2 CWL responded (Reference 374-210308-1192) in March 2021 with commitments to comply with the detailed advice as part of the finalisation of the site-specific Construction Environmental Management Plan (CEMP).

10.3.3 Following submission of the CWL letter, SEPA responded (Reference 1634 dated 25 June 2021) removing their objection to the Proposed Development on the grounds that planning conditions are attached to the consent.

10.4 Legislation

10.4.1 Since submission of the original EIAR and Technical Appendix 10.1 the following guidance has been updated:

- SEPA, (2022), The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 9.2.

10.4.2 This update included a new table outlining the regulatory approach for maintenance, repair, removal and replacement works, changes to clarify authorisation levels and amendments to GBR5, GBR6, GBR8, GBR9, GBR14, GBR15 and GBR18.

10.4.3 The remaining information presented within the original EIAR and Technical Appendix 10.1 remains valid.

10.5 Methodology

10.5.1 The information presented within the original EIAR remains valid.

10.5.2 Following the desk study to identify the new crossing locations, a site survey was undertaken to obtain information specific to each watercourse. Photographs and detailed field notes were taken, reporting the dimensions of the watercourse channel and flood channel (where apparent), the type of substrate and the crossing type. The first additional survey was carried out by Natural Power in November 2021, and during this time weather conditions varied with periods of dry weather interspersed with periods of showers. A further site visit was then undertaken by Natural Power in November 2022, and during this time weather conditions were cloudy with showers. An additional site visit was undertaken by the applicant in March 2023, during which time the weather was cloudy with heavy showers.

10.6 Watercourse crossing assessment

10.6.1 A number of watercourse crossings will be required for the access tracks to be constructed as part of the Proposed Development. Several of the watercourse crossings were identified on the OS 1:50,000 scale digital mapping and therefore require authorisation under Controlled Activities Regulations (CAR) (known as regulated crossings). However, some of the water course crossing were not shown on the OS 1:50,000 scale digital mapping and were only visible on the OS 1:25,000 scale digital mapping, which was used as the background base map for the project and illustrated in this report. These crossings, whilst listed in table 10.1, and detailed in tables 10.2-10.8, are noted as not requiring authorisation under CAR. It is also expected that a range of other small natural ephemeral channels, artificial drainage channels and flushes will be encountered during the detailed design stage prior to construction. Again these crossings will not require authorisation under CAR.

10.6.2 Table 10.1 provides a summary of the surveyed seven additional watercourses, including crossing type and CAR authorisation. At this stage, for a number of the identified crossings, the design of the crossing is not known which may impact on the level of authorisation required. Therefore, the likely lowest level of authorisation is detailed.

10.6.3 More detailed information on the seven additional watercourse crossings is provided below (Table 10.2 to Table 10.8), and considers the preceding information, as well as photographs and hydromorphological information associated with each crossing.

Table 10.1 Summary of new watercourse crossings

ID	Easting	Northing	Type	Proposed Crossing Type	CAR level of authorisation
WC49	313421	599645	New	Circular pipe	General Binding Rules (GBR)
WC50	313900	599215	New	Pipe or Box Culvert	Simple Licence
WC51	313945	599402	New	Pipe or Box Culvert	Simple Licence
WC52	313891	600611	New	Circular pipe	GBR
WC53	314820	598596	New	Circular pipe	GBR
WC54	317146	596699	Existing	Circular pipe	Registration
WC55	317042	599913	Existing	Single span bridge (Upgrade/Repair)	Simple License

Table 10.2: Watercourse crossing WC49

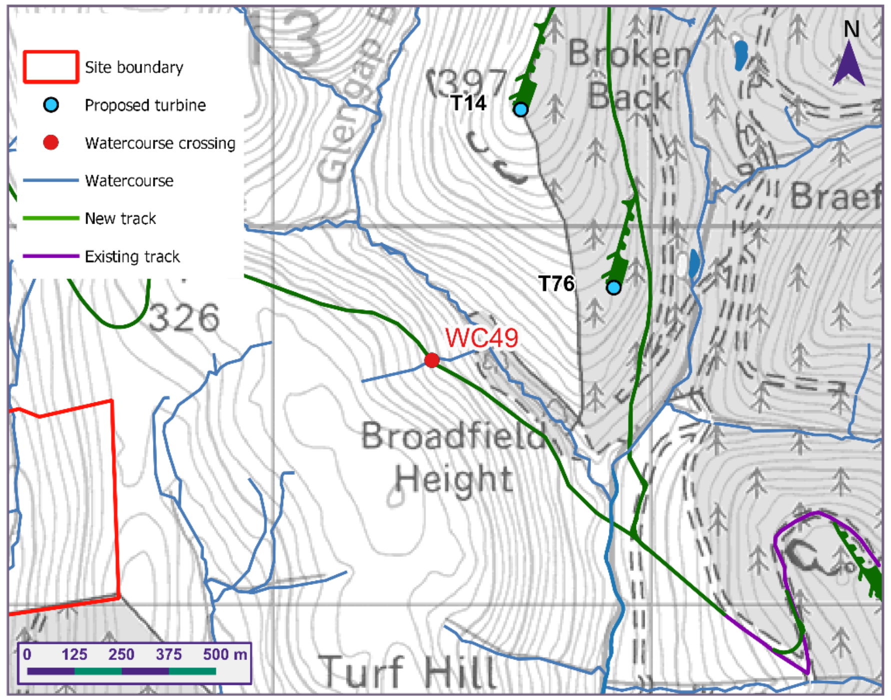
WC49 (313421, 599645)		
Crossing location	**Crossing description**	
 © Crown Copyright 2023. All rights reserved. Ordnance Survey Licence	**Existing Crossing:** No **Channel Type:** Slightly Incised **Gradient:** Steep **Valley form:** No obvious valley sides **Bank condition:** Undercut (no evidence of recent collapse) **Bed material:** Boulders, Coarse gravel, Fine sand/silt **Riparian corridor:** Moorland, Agricultural Grazing **Flow condition:** Dry	**Water width (m):** 0.05 **Water depth (m):** 0.01 **Bankfull width (m):** 0.20 **Bankfull height (m):** 0.20-0.30 **Flooded Bankfull width (m):** 2.00 **Flooded Bankfull height (m):** 0.80 **Notes:** Watercourse is not shown on OS 1:50,000 scale digital mapping. It is only shown on the OS 1:25,000 and therefore no authorisation under the CAR is required. GBR will apply **CAR Auth Level:** GBR **Proposed Crossing Type:** Circular pipe
Crossing Photographs		
Upstream	**Across**	**Downstream**
		

Table 10.3: Watercourse crossing WC50

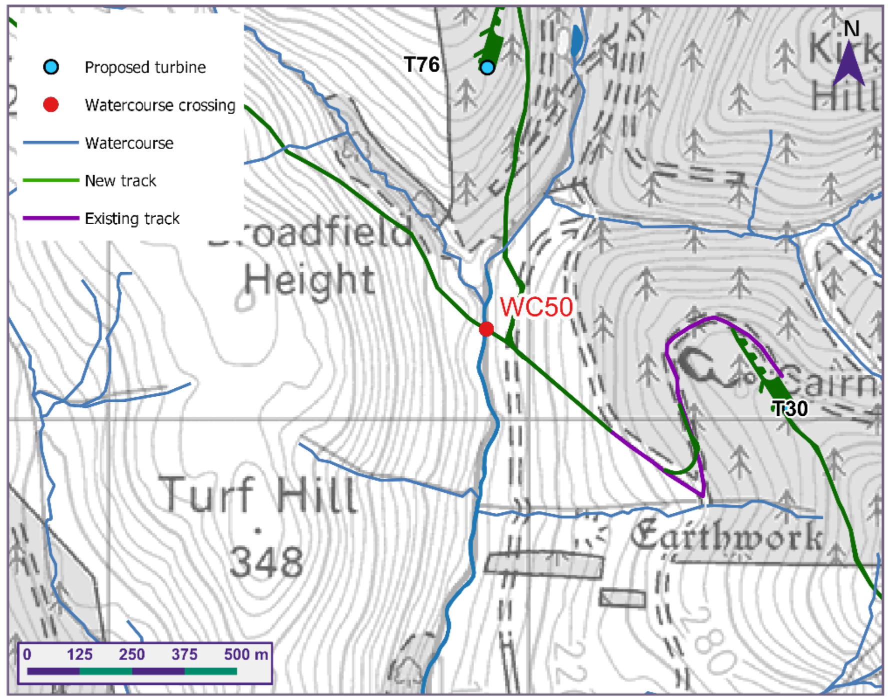
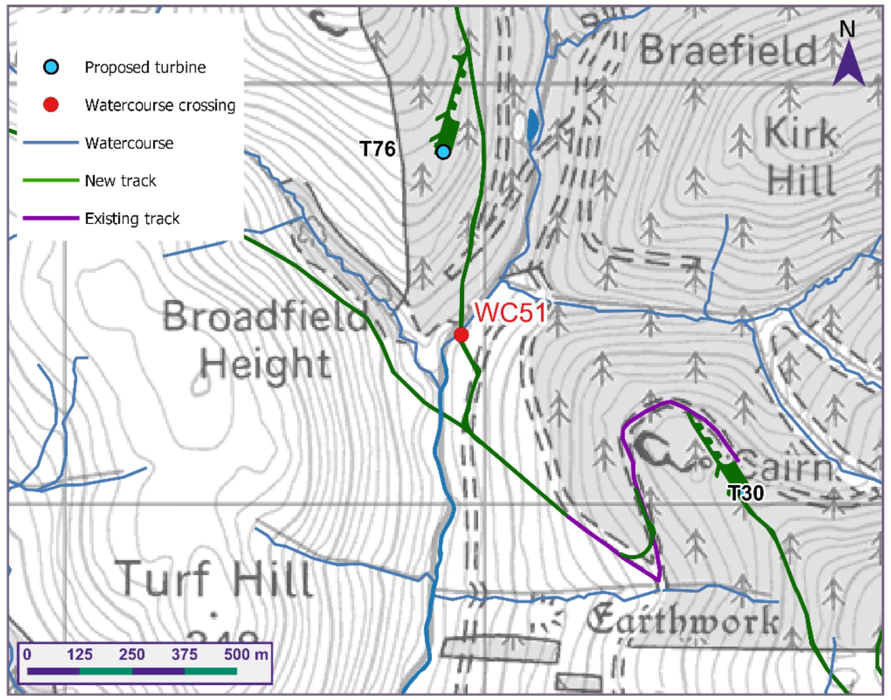
WC50 (313900, 599215)		
Crossing location	**Crossing description**	
 © Crown Copyright 2023. All rights reserved. Ordnance Survey Licence	**Existing Crossing:** No **Channel Type:** Meandering (channel straight at point of crossing) **Gradient:** Gentle **Valley form:** Vee **Bank condition:** Slight undercut (no evidence of recent collapse), Stable **Bed material:** Sand/silt, Rounded pebbles, Boulders, Bedrock **Riparian corridor:** Agricultural Grazing, Heavily Vegetated (e.g. gorse, bramble), Natural Woodland, Commercial Forestry **Flow condition:** Moderate	**Water width (m):** 3.00 **Water depth (m):** 0.30-0.40 **Bankfull width (m):** 4.50 **Bankfull height (m):** 0.90 **Banktop height (m):** 1.2 (left bank looking upstream) **Flooded Bankfull width (m):** 5.00 **Flooded Bankfull height (m):** 1.20 **Note:** Small trees/bushes and ferns along bank. **CAR Auth Level:** Simple Licence **Proposed Crossing Type:** Pipe or Box Culvert
Crossing Photographs		
Upstream	**Across**	**Downstream**
		

Table 10.4: Watercourse crossing WC51

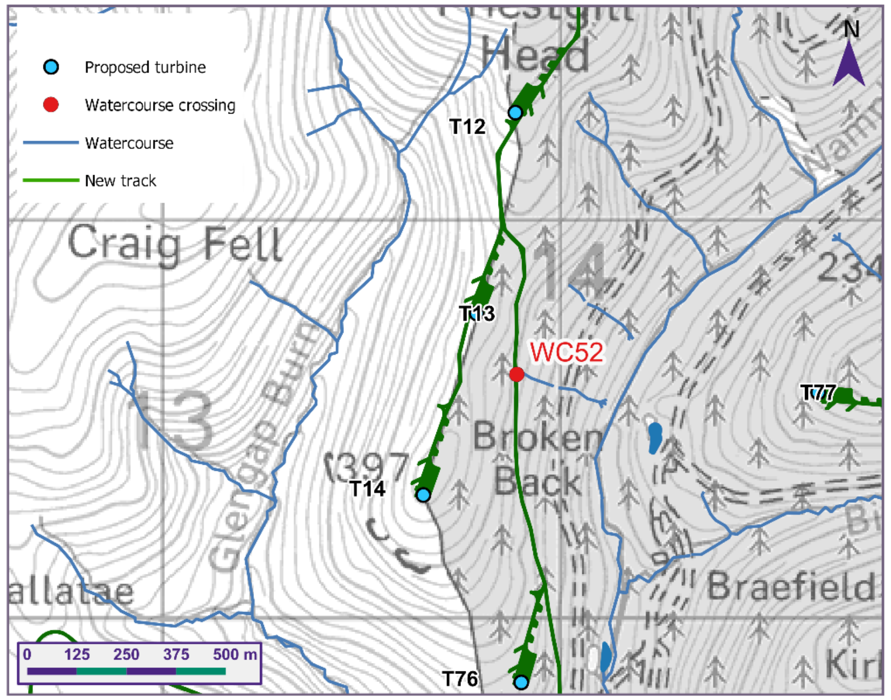
<table>
<tr><td colspan="3">WC51 (313945, 599402)</td></tr>
<tr><th>Crossing location</th><th colspan="2">Crossing description</th></tr>
<tr>
<td>

</td>
<td>Existing Crossing: No
Channel Type: Meandering (channel quite straight at point of crossing)
Gradient: Gentle
Valley form: Very shallow vee
Bank condition: Undercut (no evidence of recent collapse)
Bed material: Boulders, sand/silt, Rounded pebbles
Riparian corridor: Natural Woodland, Commercial Forestry, Agricultural Grazing
Flow condition: Moderate</td>
<td>Water width (m): 4.00
Water depth (m): 0.30-0.50
Bankfull width (m): 4.00
Bankfull height (m): 0.50
Banktop height (m): 0.50 bank on left looking upstream is higher.
Flooded Bankfull width (m): 5.00
Flooded Bankfull height (m): 0.90

Note: Small bushes and trees along bank

CAR Auth Level: Simple Licence
Proposed Crossing Type: Pipe or Box Culvert</td>
</tr>
<tr><th colspan="3">Crossing Photographs</th></tr>
<tr><th>Upstream</th><th>Across</th><th>Downstream</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Table 10.5: Watercourse crossing WC52

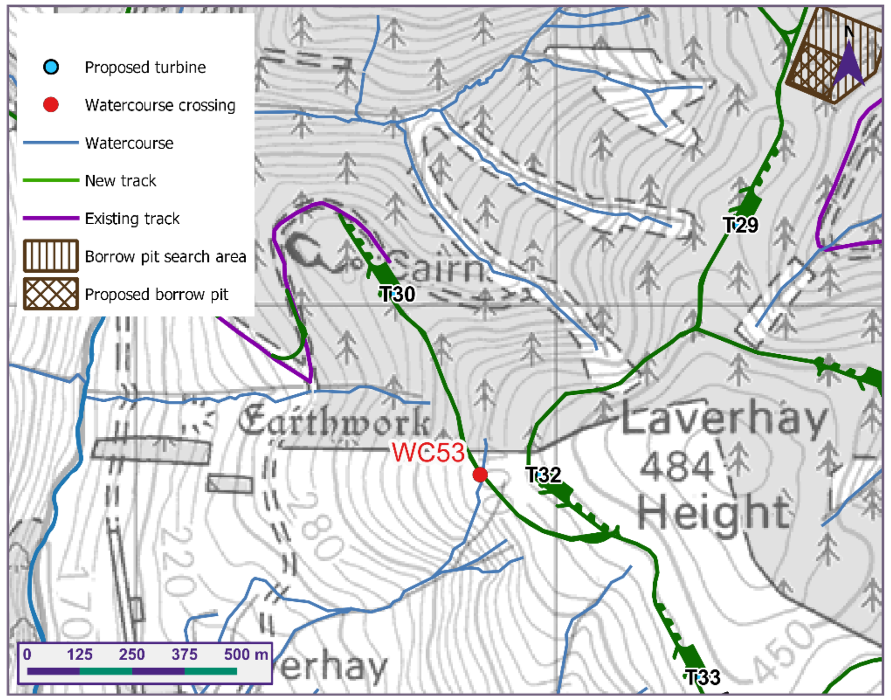
<table>
<tr><td colspan="3">WC52 (313891, 600611)</td></tr>
<tr><td>Crossing location</td><td colspan="2">Crossing description</td></tr>
<tr><td>

</td>
<td>Existing Crossing: No
Channel Type: Poorly defined
Gradient: Steep
Valley form: Vee
Bank condition: Stable
Bed material: Soil, Vegetation
Riparian corridor: Commercial Forestry
Flow condition: Dry</td>
<td>Water width (m): -
Water depth (m): -
Bankfull width (m): 0.90
Bankfull height (m): 0.30
Banktop height (m): -
Flooded Bankfull width (m): Not apparent
Flooded Bankfull height (m): Not apparent

Note: Grid reference for crossing based on mapped watercourse in woods. Undefined channel with no obvious flow. Wide sloped area leading into main channel. Channel becomes more defined at NT 13914 00624. Still grassy with no water running. Watercourse is not shown on OS 1:50,000 scale digital mapping. It is only shown on the OS 1:25,000 and therefore no authorisation under the CAR is required. GBR will apply.

CAR Auth Level: GBR
Proposed Crossing Type: Circular pipe</td></tr>
<tr><td colspan="3">Crossing Photographs</td></tr>
<tr><td>Upstream</td><td>Across</td><td>Downstream</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Table 10.6 Watercourse crossing WC53

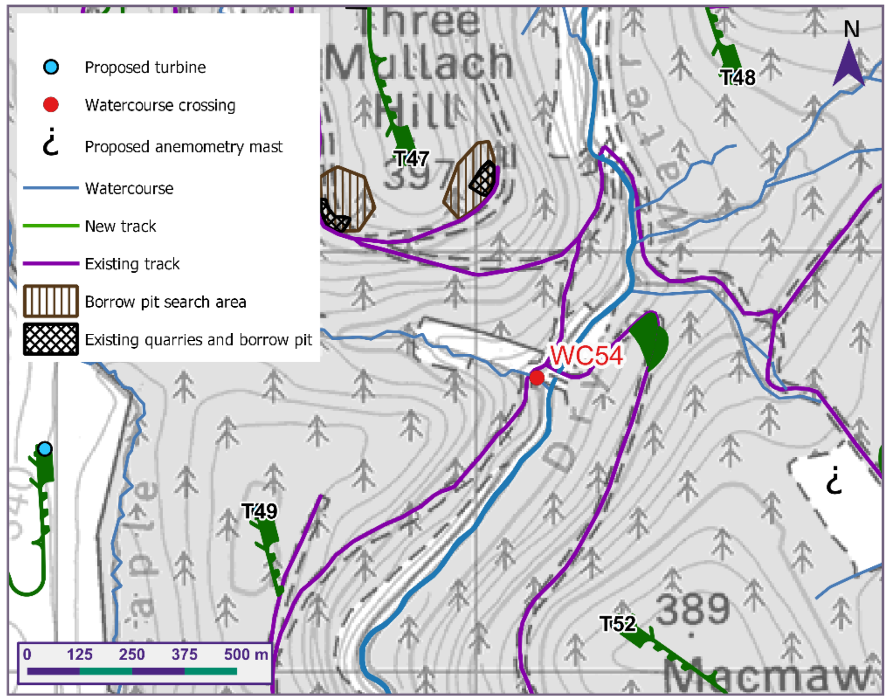
<table>
<tr><td colspan="3">WC53 (314820, 598596)</td></tr>
<tr><td>Crossing location</td><td colspan="2">Crossing description</td></tr>
<tr><td>

</td>
<td>Existing Crossing: No
Channel Type: Poorly defined
Gradient: Gentle
Valley form: No obvious valley sides
Bank condition: Stable
Bed material: Vegetation, Soil, Peat
Riparian corridor: Agricultural Grazing, Commercial Forestry
Flow condition: Very slow</td>
<td>Water width (m): 0.40-0.90, non-defined as marshy.
Water depth (m): 0.05-0.10
Bankfull width (m): Marshy area about 6m wide.
Bankfull height (m): 0.01
Banktop height (m): -
Flooded Bankfull width (m): - Not apparent.
Flooded Bankfull height (m): - Not apparent.

Note: Grid reference for crossing based on mapped watercourse in woods. Undefined channel with no obvious flow. Watercourse is not shown on OS 1:50,000 scale digital mapping. It is only shown on the OS 1:25,000 and therefore no authorisation under the CAR is required. GBR will apply.

CAR Auth Level: GBR
Proposed Crossing Type: Circular pipe</td></tr>
<tr><td colspan="3">Crossing Photographs</td></tr>
<tr><td>Upstream</td><td>Across</td><td>Downstream</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Table 10.7 Watercourse crossing WC54

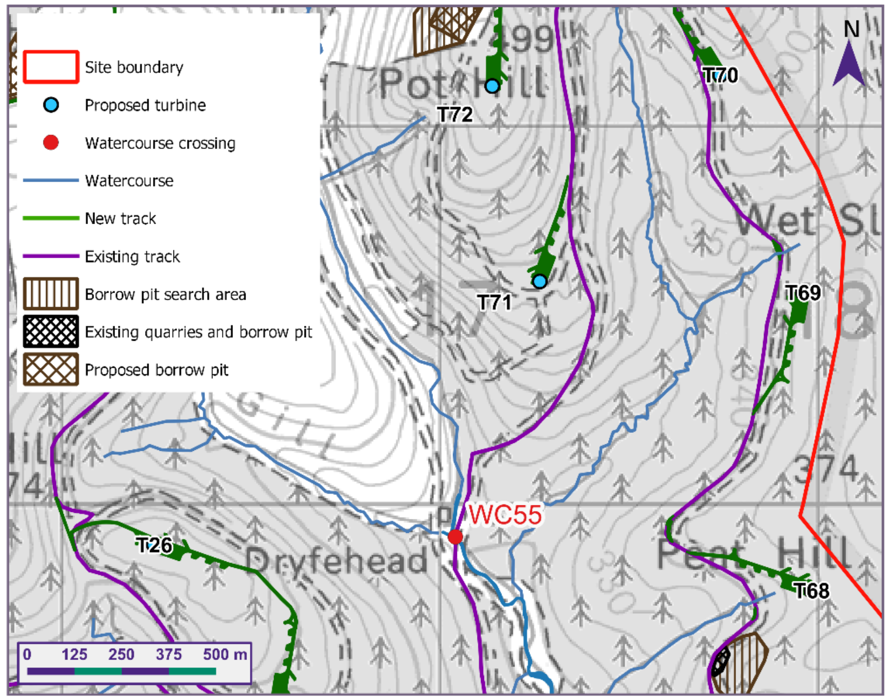
<table>
<tr><th colspan="3">WC54 (317146, 596699)</th></tr>
<tr><th>Crossing location</th><th colspan="2">Crossing description</th></tr>
<tr><td>

</td>
<td>Existing Crossing: Yes
Crossing Type (existing): Circular Culvert
Crossing Material (existing): Plastic
Crossing Condition (existing): Good
Channel Type: Meandering
Gradient: Moderate
Valley form: Vee
Bank condition: Stable
Bed material: Rounded pebbles, sand/silt, Coarse gravel, Boulders
Riparian corridor: Commercial Forestry
Flow condition: Fast</td>
<td>Culvert Dimensions (m): 1.40 diameter
Water width (m): 0.80 - at culvert inlet
Water depth (m): 0.10 - at culvert inlet
Bankfull width (m): 2.40
Bankfull height (m): 0.40
Flooded Bankfull width (m): 5.00
Flooded Bankfull height (m): 11.80

Note: Water width 0.8 m at culvert inlet, but up to 2.4m wide in areas 1-5m upstream due to boulders and varied bank width. Drop at culvert outlet of 1.5m (0.4m water depth there). Opens into a wider pool 0.6m deep and 4.0m wide, then narrows back to channel width of 2m Bankfull width, depth similar upstream. Grass and ferns along riverbank.

CAR Auth Level: Registration
Proposed Crossing Type: Existing Circular Culvert (No upgrade necessary)</td></tr>
<tr><th colspan="3">Crossing Photographs</th></tr>
<tr><th>Upstream</th><th>Across</th><th>Downstream</th></tr>
<tr><td></td><td></td><td></td></tr>
</table>

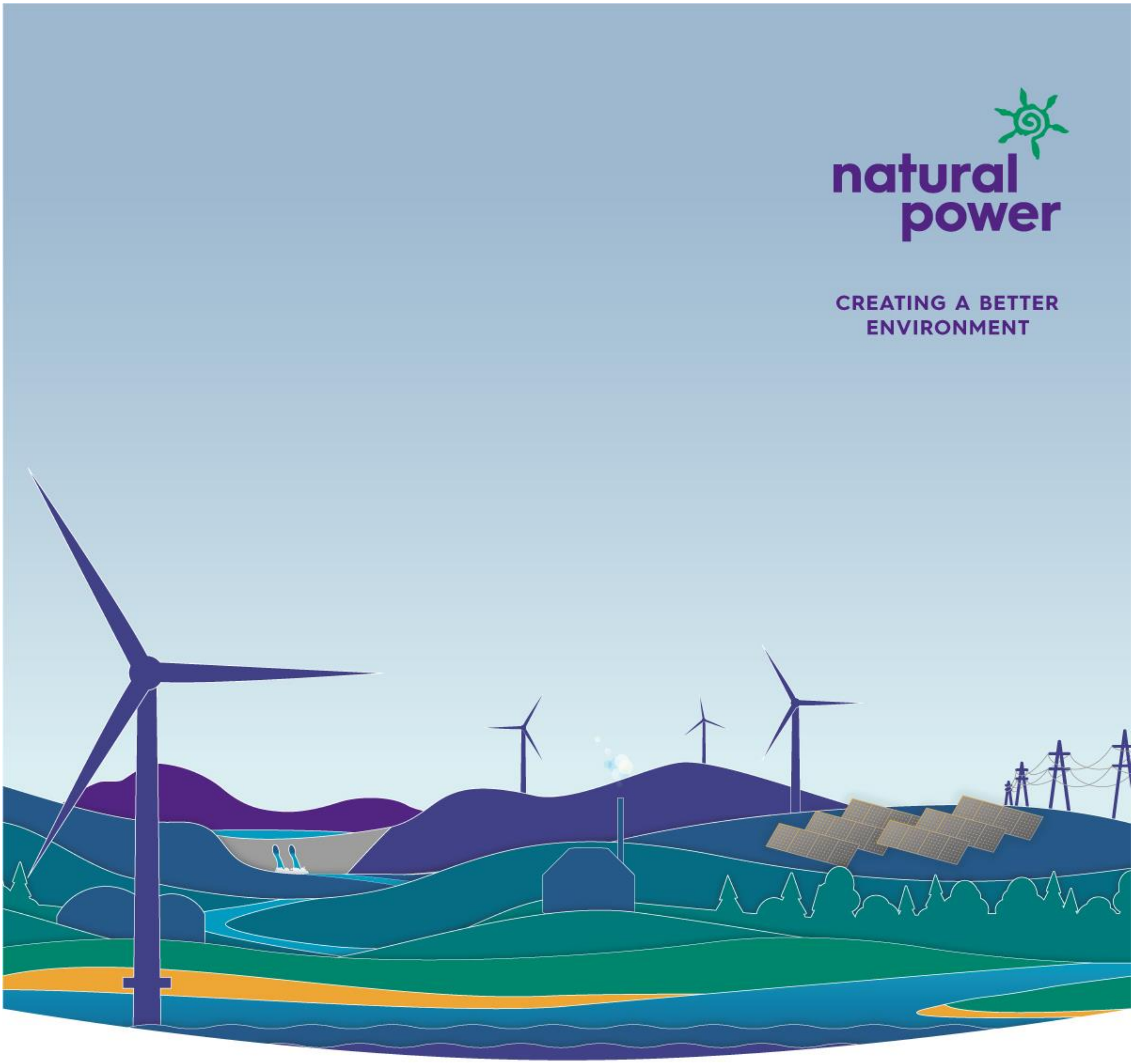
Table 10.8 Watercourse crossing WC55

<table>
<tr><td colspan="3">WC55 (317042, 599913)</td></tr>
<tr><td>Crossing location</td><td colspan="2">Crossing description</td></tr>
<tr><td>

</td>
<td>Existing Crossing: Yes
Crossing Type (existing): Bridge (in channel support)
Crossing Material (existing): Concrete
Crossing Condition (existing): Good
Channel Type: Meandering
Gradient: Gentle
Valley form: Shallow vee
Bank condition: Stable
Bed material: Rounded pebbles, Coarse gravel, sand/silt, Boulders
Riparian corridor: Moorland, Agricultural Grazing, Commercial Forestry
Flow condition: Fast</td>
<td>Culvert Dimensions (m): 5.00m bridge, 5x .0.50m diameter pipes that water flows through
Water width (m): 4.00m on upstream side, 8.00m on downstream side
Water depth (m): 0.30-0.50
Bankfull width (m): 4.00
Bankfull height (m): 0.90
Flooded Bankfull width (m): 8.00
Flooded Bankfull height (m): 1.20 (measured on downstream side of bridge due to drop)

Note: A tributary enters main channel about 3m upstream of bridge.

CAR Auth Level: Simple License
Proposed Crossing Type: Existing Bridge (Repair)</td></tr>
<tr><td colspan="3">Crossing Photographs</td></tr>
<tr><td>Upstream</td><td>Across</td><td>Downstream</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>



Scoop Hill Wind Farm

Peat Slide Risk Assessment – AI 2022

Community Windpower

December 2022

1225356

Document history

Author	Chris McCulla, Geotechnical Engineer	17/03/2020
	Original Reporting	
Approved	Gavin Germaine, Principal Geotechnical Engineer	05/12/2022
	Updated with AI Layout & Additional Surveys	

Client Details	
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Issue	**Date**	**Revision Details**
A	17/04/2020	First Issue - CM
B	23/07/2020	Second Issue following client comments - CM
B	03/08/2020	Table 5.1 Presentation Update - CM
C	10/09/2020	Updated Borrow Pit Layout - GG
D	10/11/2021	Updated for 'AI' layout - GG
D1	30/11/2021	Updated with ECU Checking Information – GG
D2	09/12/2021	Final clean version
D3	06/01/2022	Borrow Pit Numbering Reverted & BP N8 Amendment
D4	05/12/2022	Updated for Layout Revisions 'AI 2022' Submission
D5	17/02/2023	Updated following client comments
D6	23/03/2023	Updated following client comments

For full details on our ISO and other certifications, please visit: naturalpower.com/company

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Contents

1. Executive Summary

The peat slide risk assessment for Scoop Hill Community Wind Farm has examined: soil depths, geomorphology, superficial geology, and other key peat slide indicators. The development spans a wide and varied environment and the risk assessment has focussed on areas of greatest potential impact. The principal aim of the assessment has been to ensure the wind farm layout design has minimised the risk of peat slide and any wider impact on peatland.

From Stage 1 probing surveys, digital terrain analysis and past experience across surrounding ground conditions; Stage 2 probing surveys were designed. This follows the general principles of the Peatland Survey Guidance, SNH, SEPA (2017). Detailed soil depth surveys have thus been targeted across areas of greatest potential impact and in a final phase of survey work in November 2022, survey teams covered the final changes to the infrastructure layout and to gather information across several areas that were previously inaccessible due to forestry.

Surveys have provided salient and detailed intrusive peat information whilst accepting the practicalities for safe access across steep terrain and occasional areas of remaining forestry.

The following key points of this peat slide assessment are highlighted below:

- A total of **6,238 peat depth probes** have been taken across the development site as part of a targeted multi-phase field survey.
- Recorded soil depths indicate dominantly shallow or absent peat across the project site (**site wide mean of 0.3m soil probe depth**). These shallow records correspond to a **low or negligible risk of peat slide determined for the majority (over 90%) of infrastructure locations**.
- Deeper soil probes determined as peat (>0.5m) are recorded only in discrete areas.
- The wind farm layout design has been an iterative process. A multitude of environmental factors have been reviewed as part of the EIA process including the distribution of peat.
- Thus, the wind farm layout has sought to minimise its impact on peat either through siting and location of infrastructure in areas of low slide risk, shallow or absent peat, and through targeted use of low volume construction techniques including floating type access tracks / hardstanding infrastructure. Active mitigation measures have further been specified for limited elements of the scheme where peat slide risk is elevated.
- **Through the application of these targeted mitigation measures: the risk of peat slide from the proposed wind farm and its infrastructure is currently assessed to be negligible**.

Additional Information – Revised Scoop Hill Community Wind Farm proposal:

Natural Power have revised the peat slide risk assessment for the proposed Scoop Hill Community Wind Farm, located in Dumfries & Galloway on behalf of Community Windpower Limited (CWL). The revision incorporates the **removal of x17 turbines** (T01:T10, 35, 37, 38, 54, 56, 61 & 62) from the layout assessed as part of the original planning submission. Plus, the **addition of turbines T76 & T77** in the forestry which have been surveyed as part of the latest phase of work. T63 has also been micro sited northeast, this updated location has also been surveyed as part of the latest phase of work.

Additionally, the following infrastructure updates have been assessed:

- Borrow Pit Search Areas optimised in order to reduce felling requirements;
- Removal of x2 Borrow Pit Search Areas and location optimised for a further x2 locations due to reduced construction aggregate requirements;
- Access track design is refined resulting in a reduction of new access track in order to reduce development impact and site won aggregate requirements;

- Increase in size of the substation construction compound/battery storage facility and removal of the satellite battery storage facilities; and
- Removal of x1 Temporary Construction Compound in order to reduce felling requirements.

2. Reporting & ECU Checking

The following section details the reporting history for Scoop Hill Community Wind Farm Peat Slide Risk Assessment:

As part of the Section 36 Application, The Energy Consents Unit (ECU) commissioned Ironside Farrar Ltd. (IFL) to provide a checking report for the initial peat slide risk reporting. This checking process has passed through two stages.

Detailed responses provided by the authors of this report have been submitted to the ECU. Furthermore, the information provided in this revised risk assessment, which has been submitted as part of the Additional Information to the ECU, contains relevant information now fully addressing each IFL response received to date.

This Section highlights recommendations and responses for the ECU checking reports and signposts where this updated report information is now provided. The following checking reports were reviewed as part of the latest Peat Slide Risk Assessment:

- Scoop Hill Wind Farm, Stage 1 Checking Report (Ref:50737) issued by Ironside Farrar and dated March 2021 (Stage 1 response submitted to ECU April 2021 (Document Ref: 1248930).
- Scoop Hill Wind Farm, Stage 2 Checking Report (Ref: 50737) issued by Ironside Farrar and dated June 2021. (Stage 2 response Appended to this report, see Appendix C).

Natural Power consider that the layout changes represented by the 'Additional Information 2023' planning submission ultimately comprise a significant reduction in scale of development. Overall, it is concluded that these changes do not result in increased potential for peat slide risk.

All previous responses provided by Natural Power to the ECU as part of the review process are considered valid and applicable to the updated submission. This last revision report is considered a final address to the outstanding recommendations opened in the Stage 2 Checking report.

Table 2.1 below provides a summary of the Stage 1 and Stage 2 checking responses, outcomes, with detailed Stage 2 responses provided at Appendix C of this report.

Table 2.1: ECU Checking Report Summary

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
1	"The PLHRA does not contain a review of the site's current use and proposed felling, nor comment from landowners which can indicate preparatory factors or evidence of pre-failure indicators respectively and should be noted."	Natural Power consider that this element is adequately addressed under the following sections of the existing PLHRA report: Section 1.3: Highlights the sites proposed forestry felling and re-stocking. Section 2.2: Land Use: "Following review of the National Library of Scotland georeferenced data set, it is concluded that the area hasn't undergone any major change that will impact the construction on the wind farm." Section 5.2: page 137 – Final Paragraph: *"The presence of commercial forestry stands across areas of the site is highlighted. Through conducting the stability assessment there has been no evidence to suggest the previous or existing forestry practices across the development have previously caused or contribute to peat instability. As part of the pre-construction phase and post felling across these infrastructure areas a detailed reconnaissance should be undertaken to identify any evidence for instability which may have been obscured by the vegetation/tree cover. All felling practices should further be subject to the same mitigation control measures as identified in this report for the relevant infrastructure elements."* It is therefore considered by Natural Power that the land use/ land management factors are adequately used as part of the qualitative risk assessment process and these issues are given relevant prominence and noting within the reporting.	<u>**No Further Action Required**</u>	Section 3.5 Section 4.7 Section 5.2 Section 7.1

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
		Landowners were not able to provide any salient or suitable evidence of failures for inclusion within the risk assessment.		
2	"The geomorphological mapping contains limited information and review of aerial photography suggests not all pertinent features are mapped. This should be reviewed in order to provide a suitably robust background to the assessment relative to peat landslide risks."	As detailed in the original EIAR Section 1.2, Table 1.1: Aerial photography information was reviewed as part of the PLHRA and provided a robust background to the assessment relative to peat landslide risks. Accepting the widespread commercial forestry plantation which obscures much of the site, the focus of the risk assessment was on identification of salient features: watercourses and topography (included on the existing base mapping) to inform the risk assessment. The EIAR PHLRA report adequately addresses the relative scarcity of terrain information through a recommendation to undertake the following actions, as detailed in Section 6.2: ● Detailed reconnaissance of instability post felling. ● Detailed ground investigation to characterise peatland across the site. Therefore, Natural Power considers at this stage, the current level of mapping and survey information is sufficient to inform the peat stability assessment.	Confirm whether major slope breaks are included / can be included. Confirm whether instability features noted within PLHRA are included.	Section 3.2 Section 4.3 Section 4.7 Section 6.1 Section 7.1
3	"Probing on a 100m grid should be undertaken across the wider area as per ECUBPG or a detailed justification provided why it was not, with specific reference to potential areas of receptors. Probing has been omitted in some locations which lie between uphill development works areas and a downhill receptor, with the potential for unknown peat between the two which could be destabilized by works."	The peat surveys follow the principles of the Peatland Survey Guidance, SNH, SEPA (2017). The central guidance being to target the peat surveys across areas of greatest potential impact. Detailed peat survey further targets proposed infrastructure including turbine foundations and adjacent hardstands. In line with the PHLRA Guidance: "Mapping of peat geomorphology (including landslides and erosion), hydrology (natural drainage features), land-use (forestry, artificial drainage) and any other pertinent factors can be undertaken in GIS in order to inform subsequent site visits and the scope of detailed peat probing work." Every effort was therefore made to predefine the peat probing survey to account for safe access provision and presence of peat soils. The PHLRA report is thus based on the current level of peat survey information where peat deposits are present or otherwise, if omitted, where access was not possible due to dense forestry or unsafe steep slopes. Examples of steep and inaccessible character of the terrain are provided in the extract Chapter 10 EIA. The report incorporates several key receptors into the assessment which directly correspond to each key infrastructure location. The risk of impacting these receptors has been assessed in part based on the proximity of downstream watercourses. This is inherent to the risk assessment. The interceding peat depth (between source and receptor) is not a primary factor. The peat depth at the infrastructure location is given priority in the risk assessment scoring. This methodology provides a robust risk classification for the proposed infrastructure locations and examines risks to downstream receptors. The risk zonation mapping of the site provides relevant further information. In this case, Natural Power does not agree that expanding the 100m grid probing would improve the confidence in the risk assessment at this pre-planning stage. The report highlights future requirement for survey and investigation which should be conducted and used to refine the risk assessment part of the pre-construction phase of development.	Phase 1 probing focused in the vicinity of infrastructure can be justified, however in instances when sensitive receptors are located upslope/ downslope of infrastructure it is expected that assessment is conducted to ensure that upslope works would not destabilise downslope peat which could then impact on receptors, with risk to human life / health most important. It is noted that the peat depth is <0.5m in the vicinity of a number of receptors highlighted in the Stage 1 Checking Report but 5 receptors have the closest peat probes reporting values >0.5m. It is recognised that forest cover may prevent access in these locations, therefore it is recommended at detailed design further investigation, assessment, and mitigation (if required) is proposed to ensure no risk. Confirm whether additional 100m grid Phase 1 probing is possible in the vicinity of Finniegill.	Section 3.3 Section 4.2 Section 7.2 **Appendix B** (Site Photos)

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
4	"The Guidance notes the Phase 1 grid should be supplemented with significant additional probing at infrastructure and along tracks. This was confirmed to the Developer in the comments requested on the proposed Phase 2 probing. Recommendations were not taken into account and additional probing has only been carried out at targeted turbine and access track locations. Probing as per Best Practice guideline documents should be undertaken at infrastructure locations or, if not possible for any reason, detailed clarification provided together with implications for the risk assessment and proposals to obtain the information."	A multi-phased approach has been presented for the detailed peat probing. This incorporated two additional stages of probing in addition to the Stage 1 (100m targeted grid probing). As per the previous response (ID 3) targeting probing where peat deposits are present and at locations of key infrastructure has been prioritised. The described nature of the peat deposits in the PHLRA report (Section 3.5.2) is such that deep peat conditions are proven not to be widespread. Just 30% of 75No. turbines record a peat depth at or above 0.5m, with the majority of proposed infrastructure locations not located upon peat. This is in line with ECUBPG guidance as the peat survey has been carried out using appropriate methods for the site environs and the type of data required. The geotechnical engineering judgement is that sufficient peat depth data has been collected to enable characterisation of peat depth across the site and in detail at salient infrastructure locations. The central requirement of the current PHLRA guidance has thus been fulfilled, and additional probing at this stage is not required. The development has a full commitment to ensuring further survey and site investigation is undertaken in future pre-construction phases of the development. This would be required as highlighted within the report, where current physical constraints (dense forestry) prevent detailed probing coverage. The risk assignments within the PHLRA report should be viewed as robust and carrying sufficient conservatism to inform the site-specific control measures. The PHLRA successfully provides site wide characterisation and in particular highlights infrastructure locations at higher risk with relevant location specific mitigation.	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020 and the position has not changed.	Section 4.2.1 Section 7 **Appendix C**
5	"Confirmation is required that a 10m grid was used for probing beneath infrastructure as part of the Phase 2 survey as it is not clear due to the scale of the mapping."	Detailed Probing (targeted) has been undertaken to the following specification: ● 50 m intervals along the centre line of the access tracks with 10 m offsets to either side. ● Probes have been taken at 10 m spacing at the turbine centre locations and at 20 m grid intervals on the hardstands and ancillary infrastructure. This is compliant with the ECUBPG which states that 'Targeted sampling regime tailored to potential development areas. Sampling should focus on areas of greatest potential impact.' However, in reference to the Peat Stability Assessment: it is the view of Natural Power that the Peat Slide Risk Assessment Government Guidance takes precedence over the ECUBPG in specific reference to the assessment of geotechnical risk associated with peat. This clearly allows for the scope of detailed peat probing work to be determined by GIS and site reconnaissance analysis such that the targeting of peat probing can be such that it focuses on pertinent aspects of the site.	If the geotechnical engineering judgement is that sufficient peat depth data has been collected to enable characterisation of peat depth along with 20 m grid intervals on the hardstands and ancillary infrastructure, then this is accepted but future probing should consider a 10m grid in line with guidance. - **<u>Accepted</u>**	Section 3.3 Section 4.2.1
6	"Further information is requested on the methodology for Phase 2 probing of construction compound, substation and borrow pit areas to confirm it is in line with guidance."	The noted ancillary infrastructure are not included in the detailed peat probing as they were deemed to be located on topsoil/nonorganic mineral soil/shallow peat and at low potential impact. Provision of additional peat depth information at these locations would almost certainly not affect the risk assessment at this stage. All locations (including the noted ancillary infrastructure); will be subject to detailed site investigation during the pre-construction phase.	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020.	Section 3.3 Section 4.2.1 **Appendix C**
7	"An assessment of likely peat depth with regards to slope angle appears to have been used to justify reduced probing. Table 3.3 shows that for slopes of 9 degrees or less (and 19 degrees) this is not an acceptable estimate, however most infrastructure targets low gradient areas and therefore the estimate would not be valid. It appears this has only been used on the track assessment, but clarification is requested."	This parametric study was undertaken to review the correlation of slope angle and recorded peat depth and not justification for reduced probing or for the final risk assessment along tracks. This exercise and resultant information were not applied directly to the risk assessment but informs wider geomorphological, terrain and reconnaissance for the project. As is correctly highlighted, the correlation of shallower terrain angles was discounted in this standalone assessment and in general the data was viewed in parallel to provide background on	**<u>No further action required</u>**	Section 5.6.1

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
		the prevalence of shallow soils across the steep slope systems of the terrain units. For the PHLRA report the direct correlation of slope angle and peat depth should be currently viewed as not integral to the assessment. The track risk assessment can be derived from the risk zonation mapping which is applied development wide. The discussion on residual risk assignment is based on qualitative review of the specific track sections.		
8	"Clarification is required on the presence of features / ability to record potential features relating to the Cracking, Groundwater, Previous Instability and Land Management factors feeding into likelihood assessment as all are scored 1."	The noted features were either not recorded or were assessed to have negligible contributory effect to instability during the field surveys, hence there is not detailed information on this. In reference to Land Management and forestry, Section 5.2 details the following: "The presence of commercial forestry stands across areas of the site is highlighted. Through conducting the stability assessment there has been no evidence to suggest the previous or existing forestry practices across the development have previously caused or contribute to peat instability." Further investigation and re-assessment will be required post felling and pre-construction as the PHLRA already confirms.	<u>**No further action required**</u> other than adherence to report recommendations.	Section 5.2
9	"Clarification on the reasoning behind infrastructure scoring is not provided and should be, particularly in relation to the reservoir. It is also queried whether the assessment of T60 should consider both receptors and compound scoring."	The assessment has considered both environmental and infrastructure impact receptors. Within the report the consideration of either factor is dealt with firstly at: Section 3.4: The impact on watercourses has been considered as the primary sensitive receptor for the PHLRA. As identified at T60, 'infrastructure receptors' are triggered where there is a deviation from this norm due to proximity to the catchment of the adjacent reservoir infrastructure. The impact assignment is qualitative for infrastructure and in the case of T60, Natural Power considers the current unmitigated risk category (Medium) to be representative. The nearby watercourse is a potential pathway for peat to travel offsite and affect the Reservoir to the east. This is clearly captured and highlighted by the risk assessment. Examining the scenario where the risk assessment compounds both environmental and infrastructure factors to overall unmitigated risk score, would be (20) High. Natural Power would not elevate to this risk category due to the very shallow slope angle determined for this location (<2deg). The risk assessment process takes the highest determined impact factor to ensure a realistic and representative assessment. The emphasis being on qualitative engineering judgement being applied in location specific cases to ensure risk assignments are not disproportionately high. Natural Power has thus assessed the risk in line with guidance. In the stated case, assigned impact scales are considered appropriate to the site environs. Natural Power does not consider the reviewer's proposed compound scoring in this scenario to appropriately represent the risk for encountered conditions at T60. Natural Power stands by the existing risk assignment and are confident it accurately accounts for the nature of the sensitive receptors and pathway to the offsite reservoir at this location.	<u>**No further action required**</u>	Section 5.5
10	"Confirmation is required on whether all potential receptors have been considered e.g. dwellings, PWS, GWDTEs, SSSI, paths, roads, archaeological features."	Natural Power has considered the noted list of potential receptors plus others, their location and the proximity of these features to the elevated risk zones within the proposed development. The qualitative judgement being that proposed infrastructure and proximity to watercourses is the prime factor to consider on Scoop Hill Wind Farm. This is driven by the complex topography and characteristic narrow and steep valley forms which would channel any peat entrained into said watercourses.	<u>**No further action required**</u>	Section 4.8

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
		The scheme has been designed to minimise impact to the environment and in particular remove impact to PWS's and GWDTE's. The hydrology chapter of the EIA should be referred to for more information. However, in terms of peat slide risk assessment, these receptors are encapsulated by the environment impact scoring within the current assessment. A brief summary is provided below: The Dryfe Water SSSI located adjacent and within the south east site boundary is noted in Chapter 10 of the EIA. As this has been captured as part of the environmental impact zonation, Natural Power considers the risk mapping has suitably accounted for the location of this feature. The River Tweed SSSI and SAC are located 1.6km north of the site boundary and are not hydrological connected to the proposed development. For this reason and negligible probability of peat being entrained offsite to this location it has been scoped out of the assessment. For the same reasoning, the Lochwood SSSI located ~5km west of the site boundary has been scoped out. Archaeological points of interest have been examined based on: ● Historical Environment Records (HER) from Dumfries & Galloway Council ● Areas of archaeological sensitivity ● Inventory of Gardens and Designated Landscapes Scotland ● Paths & Roads (As previously highlighted the environmental impact of watercourses being the primary pathway and receptor for peat material have been fully assessed for this site). GIS analysis of the risk mapping has been undertaken and it is confirmed that for the elevated risk zones, there would be no cause to increase risk assignments based on the location of these points of interest.		
11	"Explanation is requested on why the track assessment is different to the assessment of the other infrastructure and how receptors have been factored into this."	The PHLRA for track elements has been undertaken using two central modes of assessment. The geospatial risk analysis utilising side wide data as represented on the Peat Stability Risk Zones mapping (Figure 10.2.8) of the report. This assessment factors watercourses as the primary sensitive receptor. This risk maps are coupled with the assessment of discrete track sections at Table 5.3, focuses in on the higher risk track sections and discusses the relevant contributary factors to instability risk. The PHLRA examines the recorded peat depths, interpolation, and terrain data for each discrete elevated risk track sections. Assessment ultimately is determined to be at the lowest negligible risk level based on the qualitative assessment and in general prevalence of shallow peat and facility to apply best practice construction measures. The risk assessment of the track (unmitigated) is depicted on the risk zonation mapping and has been determined using the same methodology as the wider assessments. It is the residual risk which is considered within the report (Table 5.3) and which applies qualitative judgement based on the recorded site environs.	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020.	Section 7.1.1 **Appendix C**
12	"Clarification is required that floating tracks have been appropriately assessed and justification why the entrance track west of site does not require assessment."	The application of floating infrastructure has not been directly processed by the PLHRA. As stipulated in Section 4.3 of the PLHRA, it is Natural Power's view that, if during the design phase structures are proposed (i.e., floating tracks), then additional numerical stability assessment should be carried out by the appointed designer at the pre-construction phase. This would be based on detailed site investigation data. In addition, Section 6.3.1 of the PHLRA provides a detailed construction methodology for floating tracks including control and monitoring protocols.	**No further action required** other than adherence to report recommendations.	Section 6.3 Section 8.3.1

ID	Stage 1 Checking Report Recommendation (Ironside Farrar Ltd)	Natural Power Response	Stage 2 Checking Recommendation (Ironside Farrar Ltd)	Updated AI Report Section
		The entrance site track in the west of the proposed development does not traverse peat deposits. As the site track ascends Brock Hill peat survey data is introduced and included in the risk mapping. Therefore, Natural Power are satisfied that no further assessment is required until the post-consent/pre-construction phases.		
13	"Confirmation on whether alternative locations have been considered for T68 to avoid the High-risk area."	Movement of the turbine location can take place within a suitable allowable micro-siting area, which is generally set up to a 100 m radius of the current proposed turbine location. Within this limit, it is advised that contributory factors can be mitigated, and the risk category reduced to low, principally by increasing proximity to the nearby watercourse. Natural Power has further provided direction as to physical mitigation which could alternatively be used at this location (without further movement of the turbine) to reduce the risk. These include: ● Design and construct suitable retaining structure down slope of works to provide watercourse protection measures. ● No storage of peat or earthwork soil bunds downslope from the proposed infrastructure. To avoid surcharging the peat deposits near the watercourse. Therefore, Natural Power considers that the assessment for T68 and the mitigation proposed for this turbine location are sufficient and adequate.	**No further action required** other than adherence to report recommendations.	Table 7.1 Section 7.1

Source: Energy Consents Unit / Natural Power

This final peat slide risk assessment has sought to provide information to close out all items. A detailed final submission on the open items at the ECU Stage 2 checking response is provided within Appendix C of this report and provides a full response for the remaining open items: Response IDs: 2, 3, 4, 6 & 11. This information has been separated from the main body of the report to ensure clarity.

3. Introduction

This report details the revised Peat Slide Risk Assessment undertaken at the proposed Scoop Hill Community Wind Farm located in Dumfries & Galloway. The proposed development comprises x60 wind turbine generators (WTG's), ancillary infrastructure, borrow pits and access tracks. The indicative wind farm layout and relevant mapping assessments are appended to this report (Appendix A):

- Map 10.2.1: Peat Depth Survey;
- Map 10.2.2: Slope Angle;
- Map 10.2.3: Geomorphological Features Map;
- Map 10.2.4: Environmental Impact Zones;
- Map 10.2.5: Solid Geology;
- Map 10.2.6: Superficial Geology;
- Map 10.2.7: Slope Stability Factor of Safety; and
- Map 10.2.8: Peat Stability Risk Zones.

Reporting Team

Original Report Author: - Chris McCulla is a geotechnical engineer and geologist (BA Geology) with over 6 years of relevant geotechnical experience. Chris has completed multiple peat slide risk assessments for wind energy projects in the UK and Ireland. Carrying out on site assessments, terrain analysis and risk assessment reporting.

Report Checker & Updating Author: – Gavin Germaine is a principal geotechnical engineer at Natural Power and engineering geologist (MSc Engineering Geology) with greater than 15 years of relevant geotechnical experience. Gavin is a chartered Geologist (CGeol) and a Fellow of the Geological Society of London. Over the last decade Gavin has directed Natural Powers' Peat Slide Risk Assessment and procedures, completing and overseeing multiple peat slide risk assessments for wind energy projects across the UK and Ireland. Gavin has further provided expert technical advice and expert witness services as part of planning inquiries and joined an international team examining new geotechnical investigation techniques for in-situ testing and sampling of peat.

The peat slide risk assessment for Scoop Hill Community Wind Farm was supported by a multidisciplinary team comprising hydrologists (x2), engineering geologist (x1) and geotechnical engineer (x1) who contributed to desk study elements, and several phases of field work. The delivery team was led by a competent person (Chartered Geologist) with extensive experience in managing geotechnical risk in upland environments. Therefore, the delivery team make-up complies with Section 1.6 of the national guidance.

3.1. Objectives

This Peat Slide Risk Assessment considers the presence and distribution of peat deposits across Scoop Hill Community Wind Farm and provides a semi-quantitative risk assessment. The primary objectives are:

- Presentation of desk study information pertinent to the subject of peat stability assessment;
- Report on site survey and geomorphological mapping to inform the assessment;
- Identify any areas of existing peat slope instability or areas which may pose high risk of peat instability;
- Provide robust and targeted recommendations for any future construction.

This report has been undertaken in general accordance with the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Development, second edition, published by the Scottish Government in April 2017.

Peat surveys have been carried out acknowledging Scottish Government guidance: Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey, Guidance on Developments on Peatland.

3.2. Data Sources

The assessment utilises data and visual assessment collected during three phases of site survey. This data and information are combined with desk-based study and review of all salient published materials. The following data sources are highlighted (Table 3.1).

Table 3.1: Data Sources

Data Source	Location	Date
British Geological Survey – Onshore Geological Map Data: Linear Features, Mass movement deposits, Artificial ground, superficial deposits, bedrock geology, faulting,1:50,000 scale	http://mapapps2.bgs.ac.uk/geoindex/home.html	2021
British Geological Survey – Engineering Geology Viewer: 1:1M Superficial Engineering Geology; 1:1M Bedrock Engineering Geology	http://mapapps.bgs.ac.uk/engineeringgeology/home.html	2021
British Geological Survey – Hydrogeological Map of Scotland: 1:625,000 Scale	http://www.largeimages.bgs.ac.uk/iip/hydromaps.html?id=scotland.jp2	1988
National Soil Map of Scotland – main soil types originally mapped at 1:250,000 scale	http://soils.environment.gov.scot/maps/	1947-1981
National Library of Scotland, Historical mapping	https://maps.nls.uk/	Various
Historical Aerial Photograph Data **ESRI Satellite World Imagery**	https://server.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer/tile/{z}/{y}/{x}	2021
Online news archival search	Various	2021
SEPA rainfall data	www.sepa.org.uk/rainfall/	2021

3.3. Scope of Work

The following work programme has been followed:

- **Stage 1** probing survey (100m grid) to ascertain the depth and distribution of peat deposits across the development targeted across peatland and proposed infrastructure;
- **Site Reconnaissance** surveys conducted by a geotechnical engineer and hydrologist, covering all salient aspects and locations across the proposed development during 2019 & 2020;
- **Stage 2** probing survey, focusing detailed probing in-situ strength testing, peat coring and sampling at targeted deep peat locations across the proposed development; and
- **Stage 3** probing survey, focusing additional detailed probing following preliminary stability assessment.

3.4. Location

Scoop Hill Community Wind Farm is located in Dumfries & Galloway, approximately 5km southeast of Moffat and 11km northeast of Lockerbie. The centre of the development is approximated to National Grid Reference (NGR) 315629, 598652. The proposed site access tracks join the public road network to the south at NGR 319504, 593307 and 316020, 592488 and to the west at 310866, 598743. There are two access options to the south and a third access option to the west. Figure 3.1 below depicts the regional context.

Source: CWP, Openstreet Map

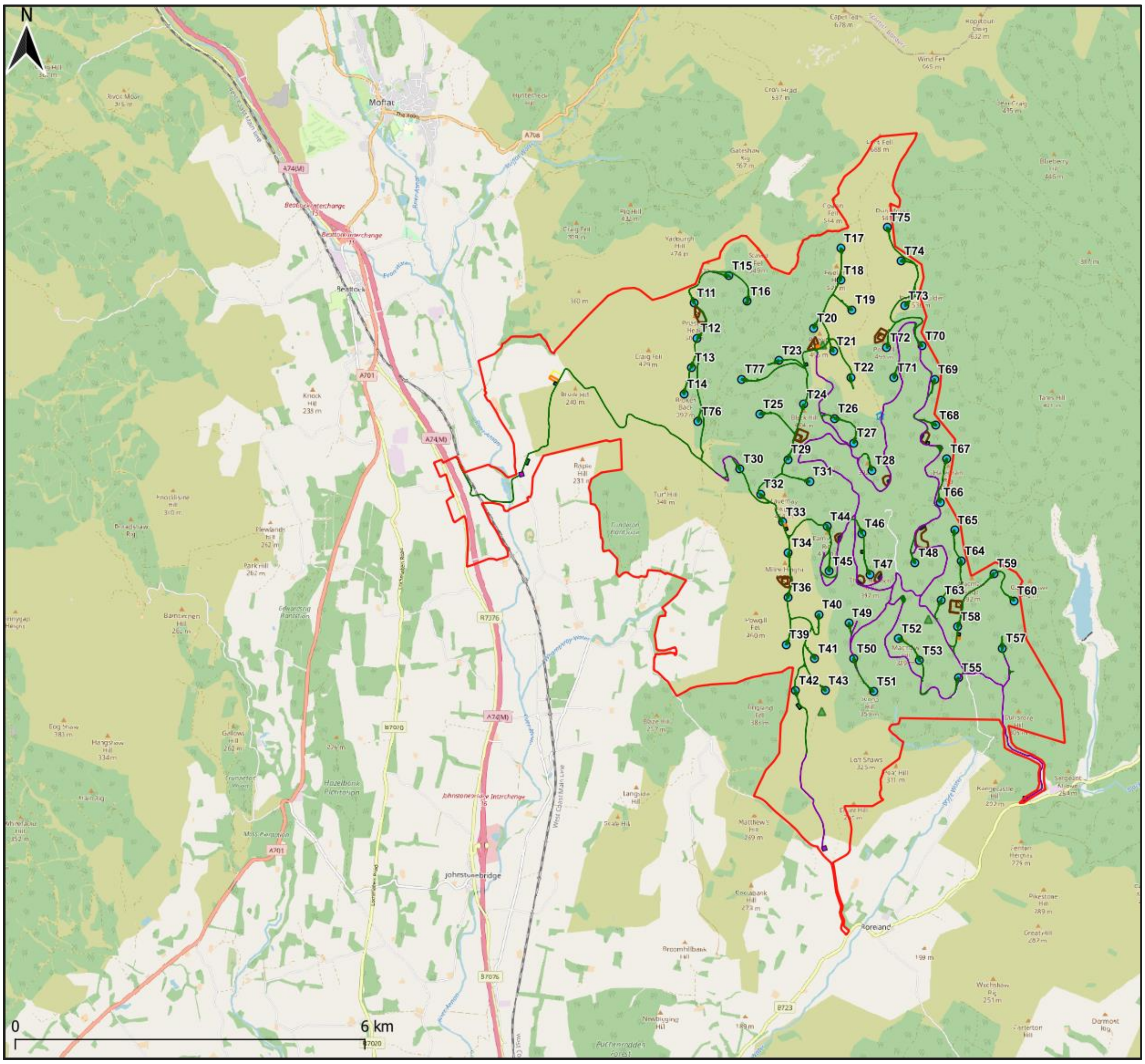

Figure 3.1: Scoop Hill Wind Farm – Regional Context

3.5. Description of Development

The proposed development will comprise of x60 wind turbine generators (WTG's). Additionally: External wind turbine transformer housings, crane hardstand areas, up to 4x substations, control centre, one main battery storage facility located near the main substation to the northwest of the site, underground electricity cables between the turbines, associated access tracks, anemometry masts, temporary borrow pits, watercourse crossings and drainage attenuation measures are also necessary, along with keyhole felling of forestry and associated re-stocking, and temporary construction and storage compounds. Figures 3.2 and 3.3 indicate the wind turbine layout with associated infrastructure. Full layout figures and legend are provided in Appendix A.

Source: CWP, Bing Maps

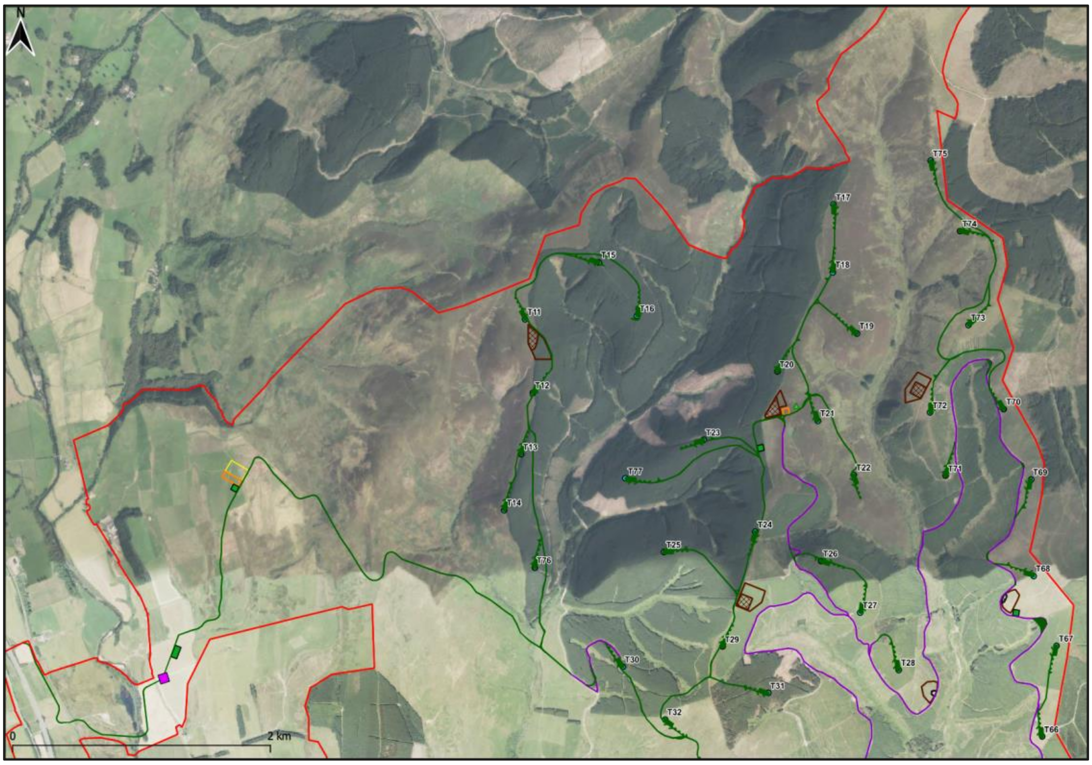

Figure 3.2: Wind Farm layout (North)

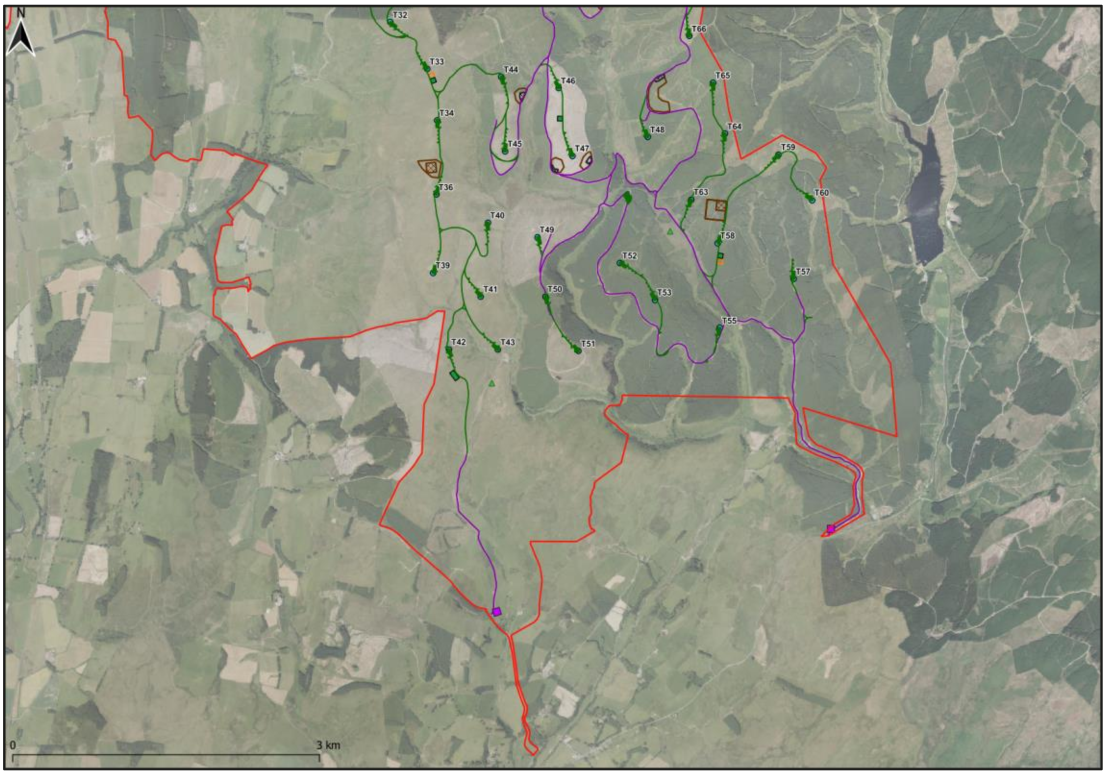

Figure 3.3: Wind Farm layout (South)

3.5.1. Borrow Pit Locations

Assessment of suitable borrow pit locations and methods of rock extraction is outside the scope of the peat stability risk assessment. Appraisal of suitable extraction methods and any effect on ground stability would be carried out following detailed intrusive investigation and design of the final borrow pit locations. Where blasting is deemed appropriate this would be assessed by a specialist blasting contractor and peak ground accelerations advised.

Borrow pit search areas are included on the peat slide risk mapping however the final location and design of borrow pit locations will be subject to detailed intrusive geotechnical investigations. It should be highlighted that all proposed borrow pit locations are sited on shallow soils (≤0.5m) and have been assigned a negligible or low peat slide risk. On this basis, further assessment is not deemed appropriate at this stage.

3.6. Terrain Description

The upland site comprises relatively narrow graduated ridgelines rising to approximately 500m Above Ordinance Datum (AOD), with deeply incised valleys trending northeast to southwest. Slopes reach high angles, of up to 30 degrees in places. The topography has been fully represented in the slope angle map, Figure 10.2.2, Appendix A. This has been derived from Ordnance Survey 'OS Terrain 5' digital terrain model (DTM) data. Ground surface elevations have been obtained across a 5m grid. Turbines have been typically sited on lower angle terrain. Figure 3.4 depicts characteristic terrain of the development.

Source: Natural Power

Figure 3.4: Photo: Typical terrain of proposed development.

Site reconnaissance including digital terrain analysis has mapped small-scale landslips in conjunction with incised watercourses across the site. These can be found on the geomorphological map, Figure 10.2.3. These features are not associated with peat instability, rather they are active features driven by the action of waterflow erosion within incised watercourse systems that affect glaciogenic soil deposits.

4. Survey Methodology

4.1. Data Review

An initial desk-based assessment has been undertaken to allow subsequent surveys to be targeted across the peatland. Table 3.1 highlights the key sources of information for this study. Following review of the National Library of Scotland georeferenced dataset it is concluded that the area has not undergone any major land change that will impact the construction on the wind farm.

Online searches for local peat or major landslides returned several instances within the region. None however had similar ground conditions or were in close proximity to the proposed development. Publicly accessible aerial imagery records dating to 2006 does not show any major changes occurring through to the present day.

Natural Power's project directory and online sources were searched for reports of peat slide incidents on regional wind farm developments. These searches did not provide any pertinent information.

4.2. Survey Details

Field investigation was carried out in accordance with current up to date guidance: Peat Landslide Hazard & Risk Assessment Guidance (PHLRAG, (2017). The surveys were further informed by the Scottish Government, Scottish Natural Heritage, SEPA (2017) Peatland Survey, Guidance on Development on Peatland.

The geotechnical reconnaissance survey included a visual assessment of the superficial ground conditions across the proposed development. This was supplemented with soil probing and in-situ hand shear vane testing.

This follows a targeted and phased approach to the survey to ensure safe, efficient, and accurate collection of data. The guidance advises targeted peat sampling around areas of greatest potential impact. PHLRAG, (2017) also provides guidance for targeted peat probe sampling to be considered.

The Peat Stability Assessment has thus been focussed on areas where peatland is present and where a risk of generating peat slide is predicted. Due to the size and scale of the development and in line with the current guidance (PHLRAG, 2017 Section 4.3) surveys were carefully planned in accordance with safe access requirements and to maximise efficacy of the surveys.

Disturbed peat samples were acquired for visual inspection using a Russian peat corer. Samples were classified using the Von Post scale as outlined in Hobbs, (1986). The testing, sampling and probing methodology is summarised as follows:

- **Stage 1**
  - Soil probing at 100m intervals of 500m buffers surrounding turbine locations.
- **Stage 2**
  - Soil probing at 50 m intervals; three probe locations aligned perpendicular to the track alignment, one at the centre of the track with two further probes spaced 10 m from the centre on either side of the track. Carried out at targeted sections of track where peat deposits predicted by Stage 1.
  - Soil probing at turbine bases and crane hardstands, 10m spacing under turbine footprint, 25m under crane hardstand. Probing taken place at locations not covered by the stage 1 survey or found to have significant peat depths during the stage 1 survey.
  - Soil probing at the construction compound, substation and borrow pit areas, in areas where deep peat is predicted by Stage 1.
  - Peat coring was carried out at x10 targeted locations throughout, where the peat deposits were of sufficient depth. Peat coring included Von Post humification classifications with depth and geotechnical description (Table 5.11). Substrate descriptions were made where possible. Of the samples, x8 were sent for carbon content measurement.

- Hand shear vane (HSV) testing at every peat core location. x31No. HSV readings were taken at 0.5m depth intervals across representative deep peat locations.

Probe, core and hand shear vane testing locations can be found on (Figure 10.2.1 Peat Depth Survey) within Appendix A.

- **Stage 3**
  - Detailed soil probing focusing on key areas following preliminary stability assessment. Final visit in November 2022.

4.2.1. Survey Guidance

Natural Power has applied current and up to date national guidance[1,2] in the case of this proposed development. The key direction stipulated in Table 2 of the guidance[2] 'Sampling (peat probing) should focus on areas of greatest potential impact from development.' There is further guidance provided in the peat landslide hazard risk assessment guidance[1]:

- Section 4.4.2 of Guidance: – Sampling locations should be optimised using the findings of the site reconnaissance and geomorphological mapping and should reflect the nature and extent of the proposed construction works.

In line with this guidance, the survey has conducted site wide 100m grid across areas of peatland and significant additional probing at infrastructure where peat accumulations were determined from desk study and site reconnaissance.

- Section 4.4.2.1 of Guidance – A competent person should be responsible for identifying and justifying the numbers, locations and types of samples collected, and this will depend upon the size and variability of the development site.

Experience of the authors is set out in the introduction of the document (Section 3). Natural Power has followed the current guidance as set out above. This makes provision for the appointed geotechnical engineer to determine the areas of greatest potential impact and within those areas, design the peat survey to suite ground conditions across the development site. The risk assessment approach has also followed this rationale. In addition, practical, economic and safety factors (all cited within Section 4.4 of the National Guidance[1]) have been used to design the scope for the detailed survey.

Natural Power highlight the following wind farm developments where this peat slide risk assessment survey approach has been accepted by the ECU: Crystal Rig III/IV Wind Farm and Rothes III Wind Farm.

Areas of peatland and deep peat (areas predominantly with a probe depth of >0.5m) have thus been the focus of detailed peat probing. Where the initial Stage 1 surveys did not identify peatland following the guidance, these areas were not advanced for additional Stage 2 survey.

From the evidence available:

- Field reconnaissance (set out in photo logs appended to this document);
- Peat depth survey Mapping (Ref:GB202142_M_015);
- Aerial photographic Mapping (Digital Terrain Analysis – Online Sources);
- Geomorphological Mapping (Ref:GB202142_M_017); and
- Geological superficial Mapping (Ref:GB202142_M_009).

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[1] Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Second Edition, April 2017

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

The guidance as set out above has focussed the detailed probing across areas of the site where deeper peat was predicted. The practical limits to peat probing 1000's of additional points across areas of shallow or absent peat was set out in the survey rationale to the ECU prior to undertaking the work and in Section 4.2 of this assessment. The survey guidance[1] clearly anticipates the scope of peat surveys to vary across developments. There is no stipulation that developments should undergo detailed probing across all areas without due consideration as to the presence of peat. Nonetheless, a total of 6,238 peat depth probes were taken across the development site.

Peat depth mapping presented as part of this peat slide risk assessment has not differentiated shallow soil types. Peat coring was undertaken on a targeted basis to confirm areas of deep peat and indicate its presence in type locations. Each individual probe data point is therefore not absolute confirmation of the presence of peat. For depths of <0.5m it was determined that such data points were indicators of an absence of organic peat. Photographic evidence for this is provided at Appendix B of this report. Site reconnaissance and visual assessment by the survey geotechnical engineer has confirmed key turbine and infrastructure areas are not within peatland / raised bog and therefore carry low and negligible risks. There should be no requirement to pursue additional probing and peat depth information at this stage and would be of no benefit to the outcome of the peat slide risk assessment. Geotechnical investigations (pre-construction) would be conducted to further investigate geotechnical risks associated with the post glaciated terrain and deeper-seated ground conditions.

4.3. Geomorphological Mapping

During Stage 2 surveys there was opportunities for geotechnical engineers to visualise the terrain, access geological and soil exposures, examine slope systems, vegetation cover and record any hydrological features impacting peat stability. The culmination of this survey exercise and digital terrain analysis is the Geomorphology Map, Figure 10.2.3, Appendix A.

There are assessed to be no major breaks in slope features consistent with peatland. Nor were there any major slope breaks which were assessed to be current contributory factors to instability for the proposed wind farm infrastructure.

This conclusion was reached through the following methods advocated by the British Society for Geomorphology[3]:

- Digital terrain analysis and landform recognition performed using software geospatial analysis tools at the desk study stage. Including: 'QGIS' for compilation and viewing of geospatial data sets and 'Surfer' for 3D surface modelling of the terrain using the 'OS Terrain 5' digital terrain model.
- Digital terrain analysis and landform recognition performed through analysis of contemporary aerial photographic records available through multiple online providers.
- Geomorphological field survey undertaken in conjunction with the multi-phase peat probing and geotechnical site reconnaissance visits.

Given the information above Natural Power can confirm, that at this stage, major slope breaks cannot be included in a way which would enhance the current risk assessment model. Slope morphology, however, has informed the risk assessment and in particular slope angle, slope aspect and visual morphologies detectable in the field and on aerial imagery were assessed qualitatively. These factors have been carefully integrated and contribute to the overall risk conclusions of the report.

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[3] Cook, S.J., Clarke, L.E. & Nield, J.M. (Eds.) Geomorphological Techniques (Online Edition). British Society for Geomorphology, London. ISSN: 2047-0371

4.4. Geology & Environment

4.4.1. Superficial Deposits

The BGS mapping shows no superficial deposits across the higher terrain elevations. Glacial till mantles valley sides and is deposited at the base of each valley with fluvial deposits associated with river systems. Glaciofluvial deposits also mantle the valley sides. Peat is mapped in discrete locations only, generally associated with larger plateau areas. The superficial geology map (Figure 10.2.6) is shown at Appendix A.

Peat: Forms a shallow disconnected blanket accumulation across higher plateau areas of the development. The blanket peat has formed deeper deposits in discrete areas only and often in topographic depressions and near water courses. The main control on peat depth is concluded to be slope angle. Smith (2006) describes peat as a form of organic soil and is typically almost entirely comprised of lightly to fully decomposed vegetation. Peat can exist in one of three forms:

- Fibrous – Non plastic with a firm structure and only slightly altered by decomposition;
- Pseudo-fibrous – Peat in this form still has a fibrous appearance but is much softer and more plastic than fibrous peat. The change is due to more prolonged sub-mergence in airless water than to decomposition;
- Amorphous – With this type of peat, decomposition has destroyed the original fibrous vegetation structure so that it has virtually become organic clay.

> The peat recorded across the development varied significantly; generally soft to very soft, dark brown, pseudo-fibrous to plastic. Von Post classes are predominantly H4-H6, with occasional deeper areas, H8 and H9 exhibiting higher degrees of humification. (Table 5.11)

Glacial till: Devensian Till – Described as a Diamicton, an ‘unsorted to poorly sorted sediment containing particles ranging from clay to boulders, suspended in a matrix of fines. Tills may contain erratic blocks of apparently un-weathered rock, which in a site investigation may be sufficiently large to be mistaken for bedrock. The glacial till will most likely form a substrate and sub-soil to the peat deposits. The heterogenous nature of this material will give rise to a wide range of geotechnical behaviours. Where soft cohesive clays are present this may create conditions for sliding and mass movement.

Peat cores conducted during the stage 2 survey found evidence of CLAY and sandy CLAY at the base of 2 cores. (Table 5.11)

In this assessment, peat slide has been assessed based on sliding within or at the base of the peat layer; and not within the underlying soil substrate. Loose poorly consolidated granular soil deposits can also create marginally stable terrain. These issues would be investigated in detail by a future phase of intrusive geotechnical investigation.

A small-scale mass movement has been identified on site within glaciogenic material (not peat), at NGR 316524, 600875. This is 250m north of T22 and situated within 50m of a proposed track, it is not thought that this will affect either the turbine or the track at this stage. There are also articles from local newspapers covering small landslides along the A7, and elsewhere in Dumfriesshire.

With reference to the existing small-scale landslip; these features are determined to be unrelated to peat movement and therefore not considered further by the peat slide risk assessment.

The soil mass movement determined in the field and from aerial photographic interpretation is related to fluvial erosional centred on steep watercourses and affecting superficial soils / subsoils only. No peat was identified to have been entrained in the debris fan, nor was there any unstable peat deposits at the site of erosion to these features. They are postulated to be natural features of erosion perhaps accelerating in activity with increasing intense rainfall events. The loss of tree/vegetation cover through overgrazing may also be a factor in the creation and continued activity of these features.

The location provided on the geomorphological map, Figure 10.2.3, Appendix A is for information only as an example type location. This location was the most prominent and contemporary in its appearance (See Figure 4.1 below for a detailed depiction).

Source: Natural Power / Bing

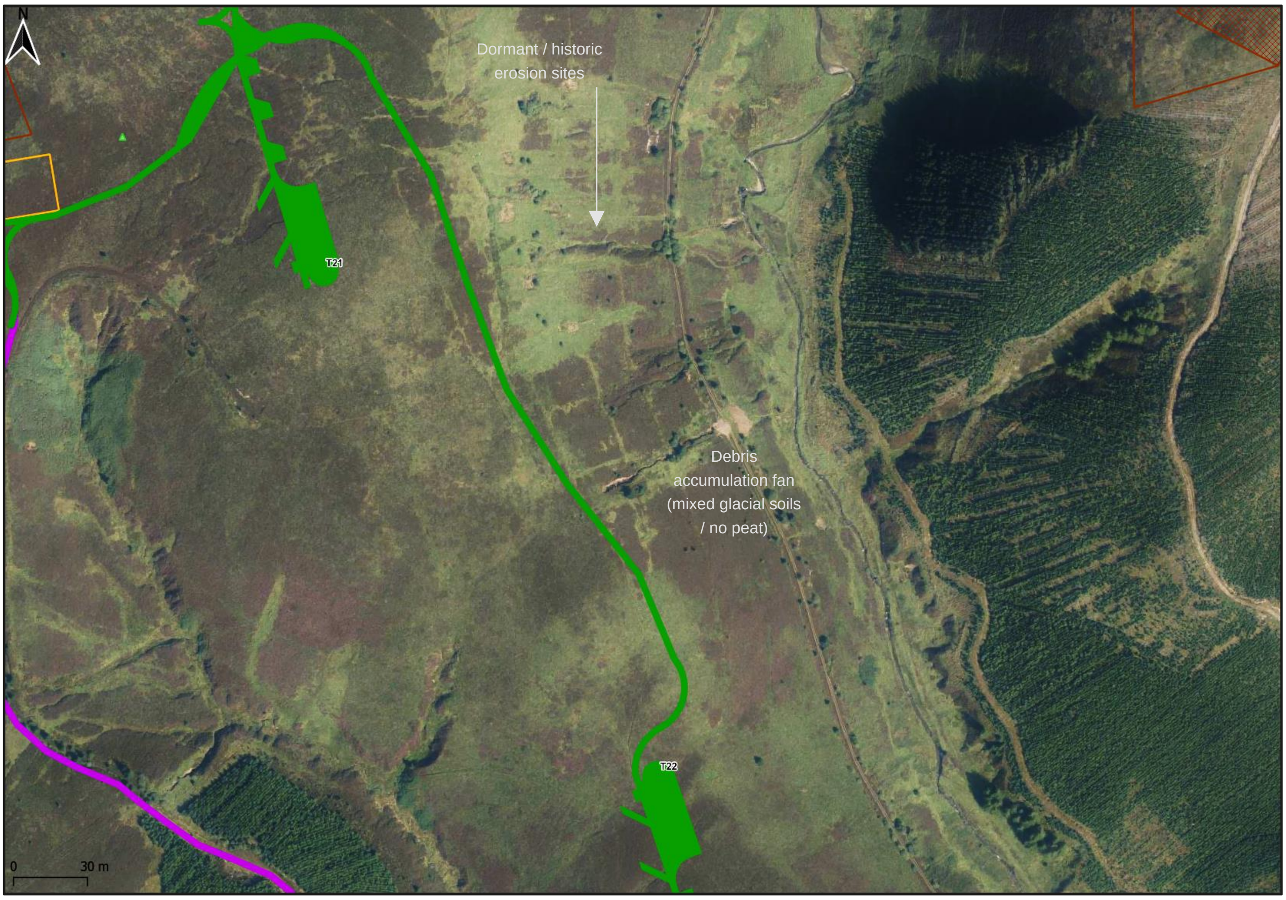

Figure 4.1: Extract from Geomorphological Mapping mass movement (superficial soils) type location

Further investigation and assessment of the superficial soil slope stability will form part of the pre-construction detailed intrusive geotechnical investigation and subsequent design. Deeper modes of investigation would be required to investigate the geotechnical make-up of the slope system and groundwater regime. These methods of detailed ground investigation do not form the scope of the peat slide risk assessment. This intrusive investigation would require techniques such as trial excavation or borehole sampling to gather undisturbed soil samples for relevant geotechnical laboratory testing and likely focussed on the proposed access track which traverses the upper reaches of this slope system.

Applicable mitigation options would need to be informed by the geotechnical investigation however may focus on:

- Drainage design which directs outfalls away from the slope system;
- Soil stabilisation techniques down slope from the proposed access track including geogrid and vegetation-based reinforcement;
- Discrete micro-siting of track alignment where geotechnical sub-soils are found to be of low bearing capacity performance.

Glaciofluvial Deposits: Glaciofluvial deposits are generally course grained deposits, sands, and gravels; with lenses of finer material, clays and silts. These will have been deposited by glacial meltwater systems.

4.4.2. Solid Geology

The 1:50,000 scale BGS Geoindex Interactive Viewer indicates four geological formations located within the site boundary. Figure 10.2.5: Solid Geology, Appendix A; shows how the geology relates to the proposed site infrastructure. All formations are either sedimentary or metasedimentary derived and are outlined below.

The northern section of the site is underlain by the Glendearg Formation, these are fluvial sandstones, mudstones and siltstones. These will be composed of detrital sediments composed of course to fine grained deposits in the form of beds and lenses.

The north-western section of the site is underlain by the Hartfield formation, these are sandstones, pebbly sandstone conglomerates. These will be similar to the Glendearg formation with the addition of conglomerates.

The remaining sections of the site are underlain by the Carghidown Formation and an undifferentiated portion of the Hawick Group, it is likely that these are similar in composition, and just not mapped as such. Both are greywacke sedimentary bedrock, deposited in deep marine environments during the Silurian period. Fine sandstones and mudstones will be the main rock type, with the Carghidown formation showing evidence of low-grade metamorphism, the nature of which is outside the scope of this report.

4.5. Hydrogeology

The majority of the development is underlain by the Hawick Group, which is classified as a low productivity aquifer. Ground water is limited and located within near surface weathered zones and secondary fractures.

The Hartfield formation is classified within the Stewartry Group, which is classified as a Highly productive aquifer. The aquifer is regionally important, up to 1500m thick, composed of sandstones and breccias yielding up to 40L/s.

The hydrogeological regime within superficial deposits at the site will likely vary significantly by deposit. The glacial till is anticipated to have a wide-ranging permeability with flow focused through lenses and interbedded sand and gravel layers. The peat will exhibit very low to moderate permeability with flow through the matrix of the peat soil and higher flows anticipated where peat is less humified and comprising fibrous material.

The presence of groundwater dependent terrestrial ecosystems (GWDTE) is considered within the Hydrology and Ecology Section of the EIAR and AI. The presence of GWDTEs associated with source zones to the minor watercourses have been incorporated for consideration within the peat slide risk assessment.

4.6. Hydrology, Flooding and Draining

The site covers three catchment areas; Newbigging Burn catchment to the west, encompassing the western site access, Wamphray Water catchment running through the centre of the site, encompassing various turbines, including T13-16, T20, T23-25, T30, T32-33 and T76-77, and the Dryfe Water catchment to the east, encompassing most of the site and remaining turbines from T17-19, T21-22, T26-29, T31, T34, T36, T39, T40-53, T55, T57-60 and T63-T75. Figure 10.1: Hydrological Overview from the main Section 10 of the EIAR shows a map of these catchments.

All catchments run from North to South through the site, and flow into the River Annan, which discharges into the Solway Firth. More information can be found in Section 10.6: Baseline Conditions, of Section 10 of the original EIAR.

Average rainfall for the region is between 1,300 – 1,500mm per year.

In relation to Peat Slide, surface water elements can be both a contributing factor and key receptor to Peat slides. It is therefore important to understand the hydrological regime for the site as a whole and at key infrastructure locations.

The SEPA online flood map information shows all flood risks to be contained within the deeply in-sized valleys running throughout the site; these are unlikely to directly affect any main infrastructure locations.

Surface water flooding does occur in various flat lying locations across the site, at all elevations. These should be identified before construction begins to ensure the natural hydrological regime is maintained during construction, and these are not diverted into existing peat deposits. There are no areas of surface water that directly coincide with main infrastructure locations.

Particular attention should be made to T60 during drainage design. It is located near a deep pocket of peat, upslope of Piper Sike Burn, which drains into the Black Esk Reservoir. Black Esk Reservoir is an important off-site receptor as it is a source of drinking water for the surrounding area.

4.7. Land Use

Historical mapping for the site has been reviewed from the National Library of Scotland archive. Earliest mapping available was from Ordnance Survey 'Outline' series for the late 19th Century. Indications are that the proposed development area has largely been unchanged and dedicated to upland farming and estate agricultural practices.

Starting in the mid-20th Century there has been widespread development of commercial forestry plantations. This development has created an expansive network of site tracks and drainage infrastructure. There are numerous large quarries also developed as part of the forestry.

Limited historical aerial imagery records were available for the proposed development area; however, available records typically corroborate with the findings of the historical mapping review.

The presence of commercial forestry stands across areas of the site is highlighted. Through conducting the peat stability assessment there has been no evidence to suggest the previous or existing forestry practices across the development have previously caused or contribute to peat instability. As part of the pre-construction phase and post felling across these infrastructure areas, a detailed reconnaissance would be undertaken to identify any evidence for instability which may have been obscured by the vegetation/tree cover. All felling practices should further be subject to the same mitigation control measures as identified in this report for the relevant infrastructure elements.

It is therefore considered by Natural Power that the land use/ land management factors are adequately used as part of the qualitative risk assessment process and these issues are given relevant prominence and noting within the assessment.

There is no history of peat landslide across the Development. Landowners have not provided any salient or suitable evidence of failures for inclusion within the risk assessment. In addition, desk based searches relating to wind farm development in the region were conducted with no evidence of peat slide activity raised.

4.8. Designated Sites & Receptors

Several areas with Site of Special Scientific Interest (SSSI) designated status are located within 5km of the site.

Dryfe Water SSSI runs south through the site from the northern boundary at NRG 316943, 604237 down to the southern boundary. The designation is for biological importance of mixed ash woodland and is hydrologically connected to the site so is included in the scope of this report.

River Tweed SSSI and Special Area of Conservation (SAC), is located 1.6km north of the site. The designation is for its Atlantic salmon, brook lamprey, otter, river lamprey, sea lamprey, beetle and fly assemblages, vascular plant assemblages, rivers with floating vegetation often dominated by water-crowfoot and trophic range river/stream; and is not hydrologically connected to the site, so can be discounted from the scope of this report.

In addition, because the River Tweed SSSI and SAC is not hydrologically connected to the proposed development, there is negligible probability of peat being entrained offsite to this location and due to this reason, it has therefore been scoped out of the assessment.

Lochwood SSSI is located 4.77km west of the site boundary. It is designated for its biological importance for woodland, butterflies, and non-vascular plants; this area is not hydrologically connected to the site, so can be discounted from the scope of this report.

This revised peat slide risk assessment focusses on a geotechnical assessment of each main proposed infrastructure location as a potential site of generation for peat slide. The pathway potential with reference to surrounding terrain units has therefore formed an intrinsic part of the assessment. However, the following criteria have also been considered by the assessment:

- Where risks are determined to be low or negligible at proposed infrastructure sites, there has been no expansion of the risk assessment outside the development area adjacent to these locations.
- Proximity of receptors including designated sites from the proposed infrastructure has been factored into the assessment using qualitative geotechnical engineering judgement and digital terrain analysis tools as per Section 4.1 of the National Guidance (PHLRAG, 2017).

In this respect it should be highlighted that two-dimensional map data should be viewed with respect of the three-dimensional terrain aspects. The '3D' terrain aspect, flow pathway and coincidence with downslope receptors is specifically clarified below for certain key receptors as previously requested by Ironside Farrar Ltd on behalf of the ECU:

Black Esk Reservoir – Main risks associated with proposed turbine T60 and proposed mitigations have been captured by the assessment (Table 7.1). A medium risk score has been determined in the assessment using the risk model for the unmitigated condition. This can be reduced to low risk with the following specific mitigation measures:

- Careful planning of earthworks with no storage of peat, bunds or stockpiles east and south of the proposed location for T60;
- An entry restriction zone for plant to be marked on site which will minimise the risk of plant machinery accidentally entering the 50m watercourse buffer zone;
- Construction design to prohibit the use of peat displacement techniques at this location to reduce potential for increasing lateral pressures in the peat mass;
- Drainage design must follow best practice and ensure where practicable run-off is suitably buffered and dispersed around the turbine foundation and surrounding infrastructure such that it does not concentrate outflows onto areas of elevated peat slide risk.

Given the very low (<2deg) slope angle for this location, Natural Power determined that additional downslope probing would not increase the validity of the risk assessment. Nor would additional downslope probing be capable of improving or altering the stated mitigation measures to any significant degree.

Property at Finniegill – The proposed wind turbines at higher elevations and within the same terrain unit have been assigned a low risk by the risk assessment model. The potential mode of peat failure for the site was also considered.

Due to the topographical relief across the proposed development and prevalence of surface watercourses, peat flows are considered the dominant model of potential peat failure. A peat flow is a debris flow comprised of water and peat debris which flows down slope using pre-existing channels. A large-scale peat slide type event has therefore been ruled out. There is no evidence gathered through desk study and site survey to indicate a large-scale translational peat slide as a hazard to this property, and the following points support this conclusion:

- The Finniegill property site is on an elevated promontory above the adjacent watercourse and thus isolated from any peat flow scenario. Terrain elevation data confirms the existing main structure to be 3m higher than the adjacent watercourse feature.
- The surrounding peat depth information does not indicate any propensity for a large-scale peat slide of major peat failure.
- The property Finniegill is not directly downslope or in the potential peat failure pathway of any proposed new wind farm infrastructure sited upslope.
- Numerical slope stability modelling (Table 6.1) does not predict instability within the nearest slope system and proposed turbine infrastructure.

An existing quarry site is present up slope at the head of the valley system and the workings assessed to have no ongoing detriment to peat or ground stability. Historic construction of the widespread existing track network across the head of the Finniegill valley has had no detrimental effect on slope stability. Considering this combination of factors alongside the terrain morphology (very steep ground linked to an absence of peat) and physical access limitations, Natural Power confirm that no further/additional 100m grid stage 1 probing was warranted, practical or possible in the vicinity of Finniegill.

Photos are appended to this document (Appendix B) to further illustrate the terrain characteristics in the vicinity of Finniegill and the Dryfe Water Valley.

Garwaldshield & Old Garwaldshield – These derelict buildings are at significant proximity away and external to the development as to negate any potential impact. The buildings stand at between at between 1.3-2km east of the development and on the opposing side of the hillside to the proposed infrastructure They are isolated on separate terrain units physically disconnected from any potential peat failure pathway originating from within the development site. Natural Power does not consider expansion of the survey area and probing effort across these receptors would benefit the current stability assessment in relation to the proposed wind farm development.

Romans & Reivers Route – This is isolated and shielded on separate terrain units from the proposed infrastructure. Natural Power does not consider expansion of the survey area and probing across this receptor would enhance current stability risk assessment in relation to the wind farm development.

The overriding qualitative judgement being that proposed infrastructure and proximity to watercourses is the prime factor to consider on Scoop Hill Community Wind Farm. This is driven by the complex topography and characteristic narrow and steep valley forms, which would channel any peat entrained into said watercourses.

The scheme has been designed to minimise impact to the environment. The Hydrology Section of the EIAR and AI should be referred to for more information. However, in terms of peat slide risk assessment, these receptors are encapsulated by the environment impact scoring within the current assessment.

Archaeological points of interest have been examined based on:

- Historical Environment Records (HER) from Dumfries & Galloway Council;
- Areas of archaeological sensitivity;
- Inventory of Gardens and Designated Landscapes Scotland; and
- Paths & Roads (As previously highlighted the environmental impact of watercourses being the primary pathway and receptor for peat material have been fully assessed for this site).

GIS analysis of the risk mapping has been undertaken and it is confirmed that for the elevated risk zones, there would be no cause to increase risk assignments based on the location of these archaeological points of interest.

5. Risk Assessment Methodology

Natural Power has carried out a revised peat slide risk assessment following the principles of the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive 2017) hereafter referred to as PLHRAG, (2017). Risk assessment is an iterative process and as such these assessments should be updated throughout the development as more information becomes available, particularly as pre-construction phases are reached.

5.1. Risk assessment work programme:

- **Stage 1:** Soil Probing Survey (100m grid around each turbine – 500m buffer) (October 2019);
- **Stage 2:**
  - Detailed soil probing survey targeting key infrastructure at higher resolution (February 2020);
  - In-situ hand shear vane testing across representative turbine locations (February 2020);
  - Development-wide mapping and assessment of salient features such as active, incipient or relic instability within the peat deposits, geomorphological features, peat depth and composition (February 2020);
- **Stage 3:** Additional detailed soil probing around specific turbines and southern access track (April 2020 & November 2022);
- **Stage 4:** Risk Assessment
  - Quantitative slope stability assessment based on in-situ shear strength data and peat slide risk assessment across the turbine array;
  - Comparison of the potential risk of peat failure with the site hydrological model including proximity to watercourses and sensitivity of those features and key sensitive receptors; and
  - Recommendations for detailed design/construction control with specific examination of the need for measures to mitigate potential peat failure as part of any future wind farm development.

5.2. Processes Contributing to Peat Instability

To provide a framework for the assessment, key principles of the peat slide risk assessment are presented. Factors which contribute to peat failure have been presented below (Table 5.1).

It is highlighted that factors such as cracking, groundwater, previous/existing peat instability and land management factors were either not detected or were assessed to have negligible contributory effect to instability during the field surveys. With reference to land management and forestry activity, it is reiterated that, the presence of commercial forestry stands across areas of the site is highlighted. Through conducting the stability assessment there has been no evidence to suggest the previous or existing forestry practices across the proposed development have previously caused or contributed to peat instability.

Further investigation and re-assessment will be required post felling and pre-construction, as is repeated throughout the assessment.

Table 5.1: Contributory Factors to Peat Instability

Factor	Discussion
Groundwater Infiltration	There are two processes which may facilitate groundwater infiltration: periods of drying, resulting in cracking of the peat surface and slope creep resulting in additional tension cracks. Drying out of the upper peat, particularly in areas of thinner peat, is likely to result in the development of near-surface cracks which could facilitate ingress of water into the peat.
Surface Loading	Any mechanisms which increase the surface load on a peat deposit can increase the likelihood of failure. This can include surface water ponding and surcharge loading, for example: construction works, stockpiling and forestry operations.
Vegetation Loss	Loss of vegetation can have a negative impact, making the peat susceptible to weathering, increasing rates of infiltration and a loss of strength.
Soil Weathering/Erosion	Weathering can weaken in-situ peat materials and destabilise a slope system. This may be in the form of weathering of peat or underlying mineral soils which could reduce shear strength at the peat/ mineral soil interface. Vertical cracking and slope creep may slowly break down peat structure over long periods of time. This can develop into peat 'hagging', which is a strong indication that natural weathering processes are ongoing. Peat hags expose the peat to increased weathering rates and may provide preferential surface water flow pathways.
Precipitation	The likely failure mechanism following a period of heavy rainfall is linked to the infiltration of surface water. There is a resulting build-up of pore water pressures within the soils and therefore reduced effective shear strength. This may be focussed within the peat deposit or at the interface between the peat and underlying mineral soil. Secondary effects may include swelling of the peat deposit and increased loading due to surface water ponding. Snow and subsequent melt can have a similar effect.
Slope Morphology	There are three main effects arising from slope morphology: Firstly, the concentration of tensile stress at the apex of a convex slope predisposes the slope for failure initiation at that point. In a convex slope the material lower down supports the material above which is held in compression. A concave slope has the opposite characteristics as material at the base maintains the apex in tension. Secondly, at the point of maximum slope convexity, because of favourable down-slope drainage conditions, a body of relatively well-drained and relatively strong peat material develops. This body of peat acts as a barrier providing containment for growth of peat upslope. This relatively well drained body of peat can subsequently fail due to a build-up of lateral pressure on the upslope face. In this scenario the slope is not supported from below so eventually the lateral pressures exceed the forces resisting sliding. The apex or point of convexity is also a likely initiation point for slope failure due to the slope tension being concentrated at this point. Thirdly a failure mechanism, analogous to a piping failure underneath dams, is postulated where springs are present in locations immediately down-slope of the relatively well drained peat body. Under these circumstances high pore pressure gradients within the peat can lead to hydraulic failure and undermining of the relatively well drained peat body resulting in a breach and loss of lateral support to peat upslope. Evolving slope morphology can be significant; for example, in the case of slope undercutting by water erosion. Any mechanism by which mass is removed from a slope toe or deposited on a slope crest will contribute to instability.

Factor	Discussion
Peat Depth & Slope Angle	Peat slides correspond in appearance and mechanism to translational landslides and tend to occur in shallow peat (up to 2.0m) on slopes between (5° – 15°). A great majority of recorded peat landslides in Scotland, England & Wales are of the peat slide type. MacCulloch, (2005) highlights that a slope angle of 20° appears to be the limiting gradient for the formation of deep peat. Therefore, the risk assessment has assigned slope angles >20° to be an unlikely contributory factor to failure. Slope angle indicators and corresponding probability factors have been similarly adapted from MacCulloch, (2005). Boylan et al, (2008) indicates that most peat failures occur on slope angles between 4° and 8°. It is postulated that this may correspond to the slope angles that allow a significant amount of peat to develop that over time becomes potentially unstable. The same author also stipulates that a number of failures have been recorded on high slope angles (>20°) but, based on the authors' inspection of such failures, peat cover is generally thin and the failure tends to involve underlying mineral soils, as opposed to peat deposits. Maps showing the interpolated peat depth and slope angle across the proposed wind farm development site are appended to this report (Figures 10.2.1 & 10.2.2). Scoop Hill Community Wind Farm has a large portion of steep slopes and relatively narrow ridges. It has been concluded for this development that slope angle shows a correlation with peat depth. A statistical analysis has been conducted on the peat probing dataset to test the validity of using slope angle to estimate peat depth. To prepare the "Interpolated Peat Depths", a spatial interpolation method termed 'Ordinary Kriging' was applied. Ordinary Kriging, as opposed to other types of Kriging, assumes spatial autocorrelation but does not assume any overriding trends or directional drift. This is therefore considered a good option for contours of peat and soil depth. The output cell size was 5m, the search radius fixed at 140m with a linear semi-variogram model used. The Kriging algorithm considers if there are multiple data points close together, giving greater weight to the points most proximal. To avoid over interpolation, the raster is then clipped to a 75m radius.
Hydrology	Natural watercourses and artificial drainage measures have often been identified as a contributory factor of peat failure. Preferential drainage paths may allow the migration of water to a failure plane therefore triggering failure when groundwater pressures become elevated. Within a peat mass, sub surface peat pipes can enable flow into a failure plane and facilitate internal erosion of slopes. It is also noted that in some instances, agricultural works can lead to the disturbance of existing drainage networks and cause failures. Forestry preparations and harvesting may also impact upon surface hydrology if implemented poorly.
Existing / Relict Failures	The presence of relict failures and any indication of previous instability are often important, indicating that site conditions exist that are conducive to peat failure. Relict peat slides may be dormant over long periods and be re-activated by any number of the contributory factors discussed in this table.
Anthropogenic Effects	Human impact on peat environments can include a range of affects associated with wind farm construction. Activities such as drainage, access tracks across peat, peat cutting, and slope loading are all examples. Rapid ground acceleration is one such example where shear stress may be increased by trafficking or mechanical vibrations.

5.3. Peat Failure Definitions

Peat failure in this assessment refers to the mass movement of a body of peat that would have a significant adverse impact on the surrounding environment or sensitive receptor. This definition excludes localised movement of peat, for example movement that may occur below an access track, creep movement or erosion events and failures in underlying mineral soils.

The potential for peat failure is examined with respect to construction and operation of the proposed Scoop Hill Community Wind Farm. Hutchinson (1988) defines the two dominant failure mechanisms namely peat flows and peat slides:

- **Peat Flows & Bog Bursts**: are debris flows involving large quantities of water and peat debris. These flow down slope using pre-existing channels and are usually associated with raised bog conditions.
- **Peat Slides**: comprise intact masses of peat moving bodily down slope over comparatively short distances. A slide which intersects an existing surface water channel may evolve into a debris flow and therefore travel further down-slope. Slides are historically more common within blanket bog settings.

Due to the topographic relief across the proposed development and a prevalence of surface watercourses, peat flows are considered for a mode of potential peat failure. Due to the absence of widespread peat within the development across slope systems; peat slides are considered less probable as a mode of failure.

5.4. Geotechnical Principles

The geotechnical parameters that influence peat stability are:

- Undrained shear strength of peat;
- Peat depth;
- Groundwater pressure (PWP); and
- Surface Loading conditions.

Slope stability is defined by the relationship between resisting and destabilising forces. In the case of a simplified infinite slope model with a translational failure mode, sliding is resisted by the shear strength of the basal failure plane and the element of self-weight acting normal to the failure plane. The stability assessments within this study considers an undrained 'total stress' scenario when the internal angle of friction (φ') = zero.

An undrained peat deposit may be destabilised by; mass acting down the slope, angle of the basal failure plane and any additional loading events. The ratio between these forces is the Factor of Safety (FoS). When the FoS is equal to unity (1) the slope is in a state of 'limiting equilibrium' and is sensitive to small changes in the contributory factors leading to peat failure.

The infinite slope model as defined in Skempton et al. (1957)[4] has been adapted to determine the FoS of a peat slope. A modified approach has been used; assuming a minimum FoS (Typically 1.3 after, BS6031: 2009)[5] . Thus, establishing the likely potential for peat sliding based on the measured in-situ values for undrained shear strength, slope angles derived from digital terrain models and the recorded peat depths.

This analysis adopts total stress (undrained) conditions in the peat. This state applies to short-term conditions that occur during construction and for a time following construction until construction induced pore water pressures (PWP) dissipate. (PWP requires time to dissipate as the hydraulic conductivity can be low in peat deposits). The following assumptions were used in the analysis of peat deposits across the proposed wind farm development:

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[4] Skempton, A.W., DeLory, F.A., 1957. Stability of natural slopes in London clay. Proceedings 4th International Conference on Soil Mechanics and Foundation Engineering, vol. 2, pp. 378 – 381.

[5] British Standards Institute (2009). BS6031:2009 Code of practice for Earthworks

- Groundwater is resting at ground level;
- Minimum acceptable factor of safety required is **1.3**;
- Failure plane assumed at the basal contact of the peat layer;
- Slope angle on base of sliding assumed to be parallel to ground surface and that the depth of the failure plane is small with respect to the length of the slope;
- Thus, the slope is considered as being of infinite length with any end effect ignored;
- The peat is homogeneous.

The analysis method for a planar translational peat slide along an infinite slope was calculated using the following equation in total stress terms highlighted by MacCulloch, (2005) and originally reported by Barnes, (2000)[6]:

$$F = Cu / (\gamma * z * \sin\beta * \cos\beta)$$

Where:

F = Factor of Safety (FoS)

Cu = Undrained shear strength of the peat (kPa)

γ = Bulk unit weight of saturated peat (kN/m^3)

z = Peat depth in the direction of normal stress

β = Slope angle to the horizontal and hence assumed angle of sliding plane (degrees)

Undrained shear strength values (Cu) are used throughout this assessment. Effective strength values are not applicable for the case of rapid loading of the peat during short term construction phase of works hence the formula cited above, has been adopted throughout.

5.5. Risk Assessment Method

A semi-quantitative risk assessment has been used to determine the risk of peat failure and hence impact on the proposed wind farm development and surrounding environment. The methodology is defined in Section 5.2 PLHRAG, (2017) and has been further enhanced with geotechnical risk management concepts set out by Clayton (2001) to produce a robust risk assessment process. It is important to highlight the assessment draws upon experiential and subjectively assigned risk parameters applied by a suitably experienced geotechnical engineer.

The assessment approach uses infinite slope stability analysis and presents analysis of factor of safety (FoS) across the proposed development. The calculated FoS, is further combined with qualitative assessment of the slope angle, peat depth and key geomorphological features. A peat slide risk map has been produced using GIS computation of these factors. (Map 10.2.8, Appendix A). While this risk map is a very useful tool for screening wide areas of the site, additional engineering judgement has been applied according to discrete conditions.

In support of the peat slide risk ranking, the environmental impact zonation (Map 10.2.4) which has assessed the potential for a peat failure to detrimentally impact surface water courses. The environmental impact zones based on proximity buffer zones applied to the sensitive watercourses within the proposed development. Water courses have been determined to be a primary sensitive receptor to a peat failure event. Table 5.2 denotes the potential impact scales to the environment.

[6] Barnes, G.E., (2000), Soil Mechanics, Principles and Practice, 2nd Edition, Palgrave Macmillan.

Table 5.2: Environmental Impact Scales

Criteria / Exposure	Potential Environmental Impact (Ei)	Impact Scale
Infrastructure <50m from watercourse	High	4
Infrastructure within 50-100m of watercourse	Medium	3
Infrastructure 100-150m from watercourse	Low	2
Infrastructure >150m from watercourse	Negligible	1

Source: Natural Power

The proximity values are developed from a literature review and designed such that this particular parameter does not skew the assessment or override other key contributing factors.

'Development / Infrastructure impacts' are triggered in a limited number of cases by this assessment owing to greater weighting being applied to the Environmental Impact Scale. The assessment focus has thus been shifted to watercourses as the main receptor.

The Risk Assessment across the turbine envelope is presented in Table 7.1. The assessment uses the following contributory factors to peat failure, identified from desk study and the detailed peat survey:

- **Slope angle** evaluated during field reconnaissance and (50m) OS digital elevation model (Map 10.2.2);
- **Peat depth** determined during a multi-phased soil probing survey (Map 10.2.1);
- **Factor of Safety** evaluated from numerical slope stability analysis;
- **Groundwater** flow evidence;
- **Surface water** flow evidence;
- **Existing slope instability** evidence; and
- **Land management**, qualitative based on previous site use.

Contributory risk factors are summarised in Table 5.3 along with a brief discussion of the influencing factors.

The risk assessment process takes the highest determined impact factor to ensure a realistic and representative assessment. The emphasis being on qualitative engineering judgement being applied in location specific cases to ensure risk assignments are not disproportionately high. Natural Power has thus assessed the risk in line with guidance. In the stated case, assigned impact scales are considered appropriate to the site environs. Natural Power does not consider compound scoring of impact would appropriately represent the risk for encountered conditions.

Table 5.3: Contributary Risk Factors

Factors	Comment	Criteria	Probability	Scale
Peat Depth **(A)**	Peat slides tend to occur in shallow peat (up to 2.0m) on A great majority of recorded peat landslides in Scotland, England & Wales are of the peat slide type.	0 – 0.5m >3.0m 0.5 – 1.0m 2.0 – 3.0m 1.0 – 2.0m	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Slope Angle **(B)**	It has been acknowledged that peat slide tend to occur in shallow peat (up to 2.0m) on slopes between 5° and 15°. Slopes above 20° tend to be devoid of peat or only host a thin veneer deposit.	0 – 3° >20° 4 – 9° 16 – 20° 10 – 15°	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
FoS* **(C)**	Values are from Infinite slope model using Cu derived from hand shear vane in-situ testing. Slope angle and peat depth also input to this factor.	≥ 1.3 1.29-1.20 1.10-1.19 1.00-1.09 <1.0	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Cracking **(D)**	Visual assessment undertaken in the field during detailed probing survey and covers the same extends of this survey. Field workers examined for evidence of any major crack networks which may allow surface water to penetrate the peat mass. Reticulate cracking was not investigated as this normally requires intrusive ground investigation to remove the surface fibrous layer. This may be a more important consideration for forested areas or previously forested areas of a development site. For surficial cracks, depth and cause of cracking are important to determine e.g. tension cracks appear as excess tension is released due to movement. Cracks can form during dry period and provide a water ingress pathway. Subjective requiring interpretation.	None Few Frequent Many Continuous	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Groundwater (E)	Challenging to evaluate without very detailed mapping and/or intrusive data. Look for entry / exit points. Evidence of surface hollows, collapse features at surface reflecting evidence of sub-surface peat pipe network, audible indicators including the sound of sub-surface running ground water surrounding proposed infrastructure locations	None Few Frequent Many Continuous	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Surface Hydrology **(F)**	Ranging from wet flushes to running burns to hags. Must be evaluated in conjunction with the season and weather preceding the site visit.	None Few Frequent Many Continuous	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Previous Instability **(G)**	Visual survey, scale and age are important as small to medium relict failures may be easy to detect but very large ones may require remote imaging. Recent failures should be obvious due to the scar left.	None Few Frequent Many Continuous	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5
Land Management **(H)**	Anthropogenic influences such as forestry operations, felling and removal of vegetation can be associated with de-stabilising peat deposits. This can occur as a result to surface disturbance and remoulding of peat through excavation, vehicle movements and loading. Changes in land use activities may also be associated with changes in drainage conditions. Criteria based on evidence of disturbance of peat deposit, i.e. broken surface, scarring or disrupted hydrology. At the proposed development land management factors were introduced using a subjective judgement and at the 'few' criteria based on nearby built infrastructure or moorland management practices such as drainage grips and heather/vegetation burning.	None Few Frequent Many Continuous	Negligible Unlikely Likely Probable Almost certain	1 2 3 4 5

Source: Natural Power

**The factor of safety (C) has been introduced for two essential reasons: to rapidly assess the stability condition of the terrain across the proposed infrastructure elements and allow a holistic ground model, through the use of the basal shear strength values to indicate propensity for failure along the basal peat interface.*

Adoption of the range in FoS values as indicated in Table 5.3 is derived from a ground engineering perspective. British Standard BS 6031, (2009), provides guidance on the design of both temporary and permanent earthworks. A design FoS of 1.3-1.4 is cited. The peat stability assessment has taken the upper bound value of 1.3 and a lower bound value of 1.0 to frame the FoS assessment as a contributory factor to failure. This range is considered to be in line with engineering best practice. Expanding this range beyond 1.3 would have a limited effect on highlighting any unstable slope conditions.

Additionally, the FoS approach used in the assessment ignores any passive resistance which would likely be present at the toe of a slope system. MacCulloch, (2005) to this effect states that the FoS is a conservative estimate which considering the non-linear geotechnical behaviours of peat, adds a degree of confidence to this aspect of the assessment.

A qualitative Risk Ranking is assessed from the combined probability of occurrence for the main contributory factors which are greater than (1), multiplied by the highest impact scale. Table 5.4 identifies the risk hazard ranking based on concepts of PLHRAG, (2017).

Risk Rank = ((Sum A:H) if (A:H>1)) x (Ei)

Table 5.4: Risk Ranking and Suggested Actions

Risk Ranking Zone	Control Measures
17 - >25	**High:** Avoid project development at these locations or instigate significant protection measures to reduce the risk to low or negligible.
11 - 16	**Medium:** Project should not proceed unless risk can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce risk ranking to low or negligible.
5 - 10	**Low:** Project may proceed pending further investigation to refine risk assessment and mitigate hazard through relocation or re-design at these locations.
1 - 4	**Negligible**: Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

Source: Adapted from PLHRAG (2017)

Table 5.5 below further breaks down the Risk Ranking score into a risk matrix adapted from Clayton, (2001):

Table 5.5: Risk Ranking

	Highest Probability for Contributory Factor to Peat Failure							
	Score	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Impact Scale	**4**	**4**	**8**	**12**	**16**	**17**	**24**	**28**
	3	**3**	**6**	**9**	**12**	**15**	**18**	**21**
	2	**2**	**4**	**6**	**8**	**10**	**12**	**14**
	1	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Source: Adapted from Clayton (2001)

5.6. Peat Distribution

Figures 5.1 and 5.2 show the peat coverage across the site. A peat depth interpolation map was generated and is appended to this report, Figure 10.2.1, Appendix A.

Source: Natural Power

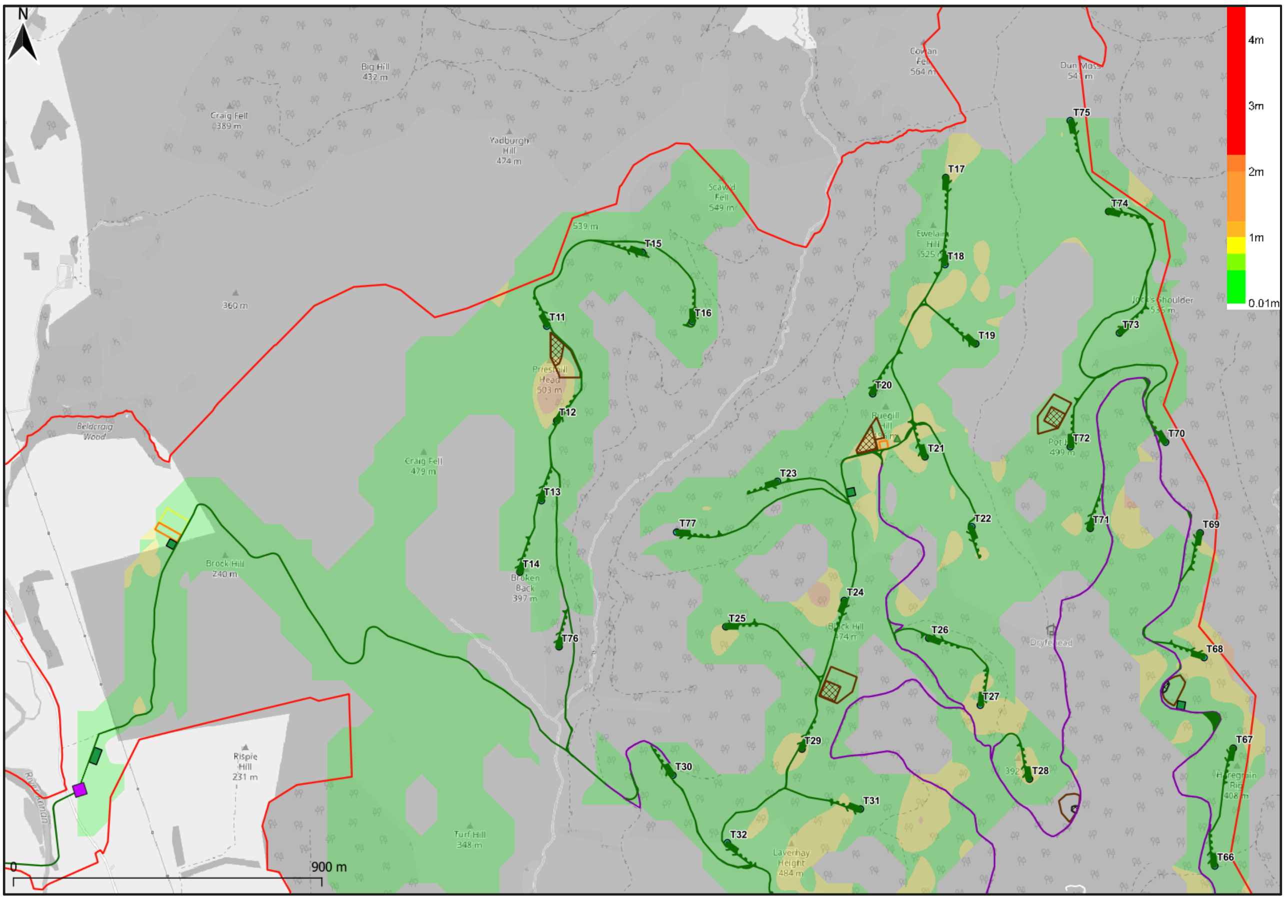


Figure 5.1: Indicated Peat Distribution (North)

> A total of 6,238 peat depth probes were acquired across the proposed Scoop Hill Community Wind Farm development.

Source: Natural Power, Ordnance Survey Crown Copyright © 2021

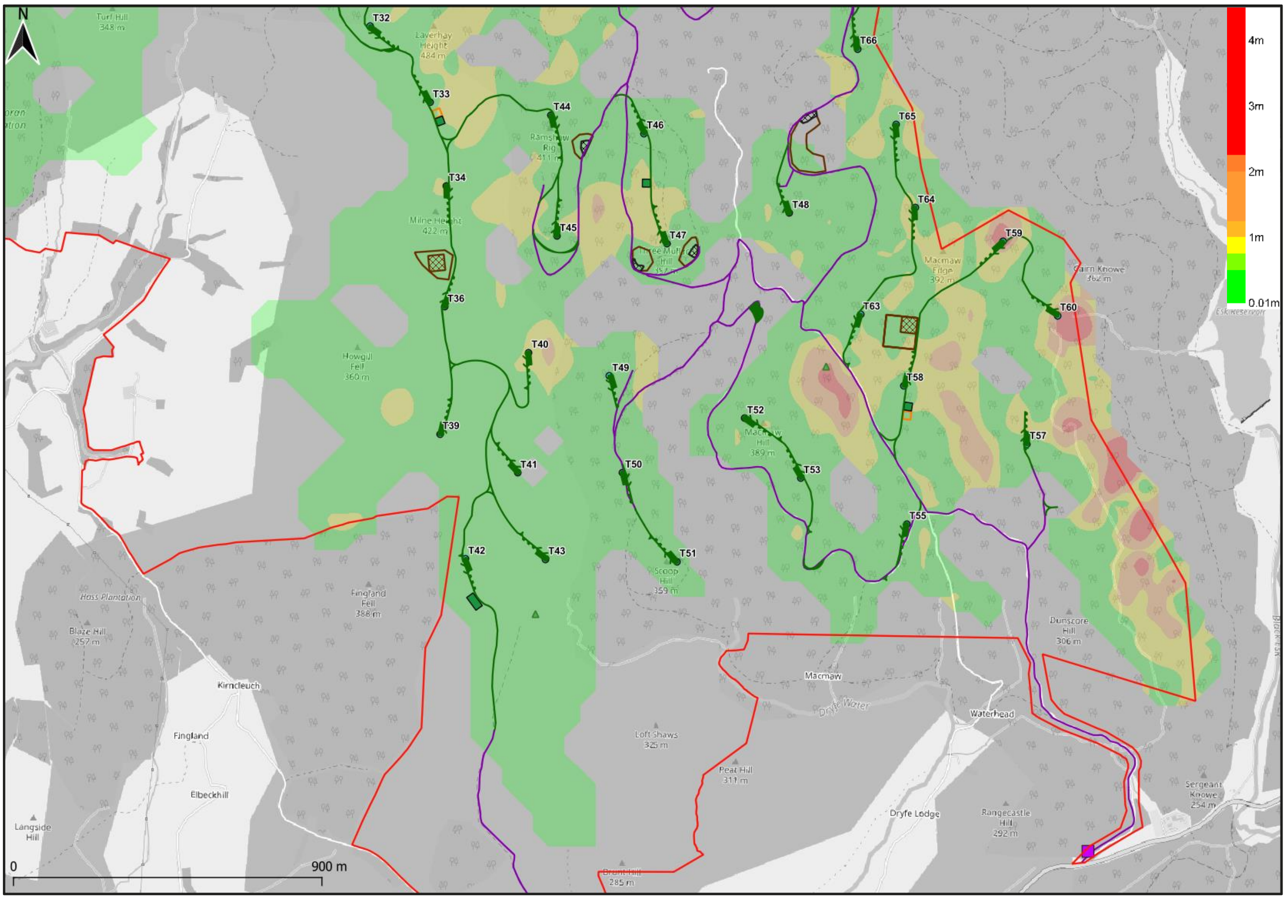


Figure 5.2: Development Peat Depth (South)

Peat deposits vary across the site, with the north western area of the site being largely devoid of peat. Deeper deposits can be found in the southeast near T60, the deepest measured point is 5.75m however this is not coincident with any proposed infrastructure. **The site wide average is 0.3m**, and Table 5.6 presents peat depth in relation to the peat slide risk factor.

Table 5.6: Peat slide risk ranks

Peat Depth	Percentage of overall values	Risk Rank
0 – 0.5m	85% (5308)	Score 1
>3.0m	0.4% (27)	Score 2
0.5 – 1.0m	12% (750)	Score 3
2.0 – 3.0m	0.4% (25)	Score 4
1.0 – 2.0m	2% (128)	Score 5

Source: Natural Power

This information shows that the majority of the soil probe depths across the site, were below 0.5m, with 12% being between 0.5m and 1.0m. Some deeper pockets of peat are present, but these are considered rare within the proposed development.

It should be noted that this data has been collected across the whole survey area, and it is not probe data only within the footprint of the proposed wind farm. Using all available information; probe data and digital terrain analysis; the infrastructure layout has aimed to minimise impact on deep peat.

5.6.1. Peat Depth Mapping

Due to the size of the development and relatively shallow nature of peat deposits, a targeted probing survey was conducted to reduce redundant soil probing. This has followed Section 4.4.2 of the National Guidance (PHLRAG, 2017). To augment the collected soil probing data, estimated peat depths have been calculated based on terrain slope angle correlation. This computation was undertaken in reference to Table 2.1 of National Guidance (PHLRAG, 2017) which demonstrates controlling parameters for peat landslide types. Estimates for peat depth from terrain slope are used in conjunction with the wider peat slide risk assessment and provide context as to peat slide potential for different terrain morphologies across the site.

All peat probe data points are compared with corresponding slope angle derived from the digital terrain model. This was discretised into degrees of terrain slope angle. All depth data found with corresponding slope values was averaged, and standard deviation calculated. A 'binning' method to assign likelihood of corresponding peat depth and slope angle has been established from the standard deviation. This method indicates the statistical reliability of peat depth for a specified slope angle.

Table 5.7 below summarises the statistical analysis.

Table 5.7: Peat Depth & Terrain Slope Angle Correlation

Slope Angle	Average Depth	Standard Deviation	Peat Depth (Likelihood)	Acceptable Estimate
0°	2.3m (n=5)	1.6m	2.0 – 3.0m (31%)	No
1°	1.2m (n=77)	1.1m	1.0 – 2.0m (45%)	No
2°	0.8m (n=150)	0.7m	0.5 – 1.0m (35%)	No
3°	0.6m (n=201)	0.6m	0.5 – 1.0m (42%)	No
4°	0.5m (n=269)	0.5m	0.5 – 1.0m (53%)	No
5°	0.4m (n=270)	0.4m	0.0 – 0.5m (63%)	No
6°	0.4m (n=238)	0.3m	0.0 – 0.5m (61%)	No
7°	0.4m (n=196)	0.3m	0.0 – 0.5m (73%)	No
8°	0.4m (n=226)	0.3m	0.0 – 0.5m (80%)	Caution
9°	0.3m (n=223)	0.2m	0.0 – 0.5m (95%)	Caution
10°	0.3m (n=163)	0.2m	0.0 – 0.5m (100%)	Yes
11°	0.3m (n=146)	0.2m	0.0 – 0.5m (100%)	Yes
12°	0.3m (n=118)	0.2m	0.0 – 0.5m (100%)	Yes
13°	0.3m (n=206)	0.2m	0.0 – 0.5m (100%)	Yes
14°	0.3m (n=95)	0.2m	0.0 – 0.5m (100%)	Yes
15°	0.3m (n=104)	0.2m	0.0 – 0.5m (100%)	Yes
16°	0.3m (n=68)	0.2m	0.0 – 0.5m (100%)	Yes
17°	0.3m (n=70)	0.1m	0.0 – 0.5m (100%)	Yes
18°	0.3m (n=70)	0.2m	0.0 – 0.5m (100%)	Yes
19°	0.3m (n=54)	0.3m	0.0 – 0.5m (93%)	Caution
20°	0.2m (n=62)	0.2m	0.0 – 0.5m (100%)	Yes
>20°	0.2m (n=345)	0.2m	0.0 – 0.5m (100%)	Yes

Source: Natural Power, using all surveyed probe depths.

Table 5.7 shows that slopes above 8° are likely to have peat depths between 0 and 0.50m and are therefore in the lowest rank of peat slide contributory factors. Areas with slope angles under 8° do not show the same reliability.

This parametric study was undertaken to review the correlation of slope angle and recorded peat depth. This analysis does not provide justification for reduced probing or for the final risk assessment along tracks. This exercise and resultant information has not been applied directly to the risk assessment but informs the wider geomorphological, terrain and reconnaissance for the project. The correlation of shallower terrain angles was discounted in this standalone assessment. In general, the data was viewed in parallel to provide background on the prevalence of shallow soils across the steep slope systems of the terrain units.

For the risk assessment, the correlation of slope angle and peat depth should be currently viewed as integral to the assessment. Risk zonation mapping is applied development wide. The discussion on residual risk assignment is based on qualitative review of the specific track sections (Section 7.1.1).

5.6.2. Peat Depth at Turbine Bases

Table 5.8 summarises average peat depths recorded across the proposed wind turbine locations, construction compounds, substations and borrow pits.

Table 5.8: Wind Turbine and Infrastructure Peat Depth

Depth Range	0 – 0.5m (Not Peat)	0.5 – 1.0m	1.0 – 2.0m	2.0 – 3.0m
Location	**Peat Depth (m)**	**Location**	**Peat Depth (m)**	
Removed from Original Layout T01 – T10, T35 T37, T38, T54, T56 T61, T62				
T11	0.20			
T12	0.40			
T13	0.30			
T14	0.20			
T15	0.30			
T16	0.40			
T17	0.90			
T18	0.40			
T19	0.40			
T20	0.30			
T21	0.70			
T22	0.45			
T23	0.50			
T24	0.50			
T25	0.20			
T26	0.50			
T27	0.30			
T28	0.50			

Depth Range	0 – 0.5m (Not Peat)	0.5 – 1.0m	1.0 – 2.0m	2.0 – 3.0m
Location	**Peat Depth (m)**	**Location**	**Peat Depth (m)**	
T29	0.60			
T30	0.30			
T31	0.40			
T32	0.30			
T33	0.30			
T34	0.40			
T36	0.30			
T39	0.30			
T40	0.30			
T41	0.20			
T42	0.20			
T43	0.40			
T44	0.25			
T45	0.30			
T46	0.30			
T47	0.60			
T48	0.40			
T49	0.40			
T50	0.10			
T51	0.15			
T52	0.40			
T53	0.20			
T55	0.40			
T57	0.50			
T58	0.40			
T59	3.30			
T60	2.00			
T63	0.40			
T64	0.60			
T65	0.30			
T66	0.45			
T67	0.10			

Depth Range	0 – 0.5m (Not Peat)	0.5 – 1.0m	1.0 – 2.0m	2.0 – 3.0m
Location	**Peat Depth (m)**	**Location**	**Peat Depth (m)**	
T68	1.10			
T69	0.50			
T70	0.40			
T71	0.40			
T72	0.10			
T73	0.30			
T74	0.20			
T75	0.10			
T76	0.00			
T77	0.00			
SS1 & SSCC	0.20			
SS2	0.30			
SS3	0.40			
SS4	0.40			
CC1	0.10			
CC2	0.55			
CC3	0.30			
CC4	0.10			
CC5	0.70			
CC6	0.40			
CC8	0.10			
CC9	0.10			
BP N2	0.30			
BP N3	0.20			
BP N5	0.30			
BP N6	0.20			
BP N7	0.30			
BP N8	0.40			

*Source: Natural Power: * peat depth values are average values across infrastructure footprint.*

Table 5.8 indicates that the majority of turbines are in areas with less than 0.50m soil probe depth indicating no peat. Only x3 locations showing peat depths over 1.00m. The maximum peat depth recorded was 3.30m at T59. The site wide average is 0.3m.

5.7. Assessment of Peat Strength

A hand shear vane (25mm 'Geonor') was used to measure the undrained shear strength of in-situ peat deposits. 31 vane tests were conducted in total across 10 turbine locations. Each strength test was comprised of two measurements: peak shear strength and remoulded shear strength.

The method of determining un-drained shear strength was carried out by inserting a steel vane vertically into the peat deposit. At increasing depth increments within the peat, the torque head is turned at the surface which rotates the shear vane within the peat deposit. The maximum shearing resistance is recorded on the torque head which is calibrated to the peak un-drained shear strength of the peat. Once the peak un-drained shear strength was determined, the shearing resistance of the free turning shear vane was recorded and is representative of the re-moulded un-drained shear strength.

It is highlighted that the shear vane has a small surface area compared to larger scale soil structure and fibres within the peat. This scale factor is highlighted as the main limitation of this in-situ test method. The scale effect can lead to an underestimation of peat strength. The hand shear vane therefore only provides a preliminary value of peak and re-moulded un-drained shear strength.

Shear vane testing was carried out at all peat coring locations, these locations are shown on the appended Figure 10.2.1, Appendix A.

Shear vane results are present in Table 5.9 below, the values highlighted in red are the lowest Peak and Remoulded values recorded across the site; these values have been used in the infinite slope analysis in Section 6.

Table 5.9: Hand Shear Vane Testing Results

Location	Depth (m)	Peak Undrained Shear Strength (kPa)	Remoulded Shear Strength (kPa)
PC01 (BNG 319862, 595178)	0.5	38.5	13
	1	19	9
	1.5	20	13
	2	23.5	25
	2.5	24.5	15.5
	3	20	20
PC02 (BNG 318062, 596305)	0.5	22.5	14.5
	0.8	27	19.5
	1	63	23
PC03 (BNG 319336, 596768)	0.5	17	9
	1	19	10.5
	1.5	17.5	12
	2	25	14.5
	2.5	17	14
PC04 (BNG 316753, 597405)	0.5	52	22
PC05 (BNG 316017, 596543)	0.5	39	23.5
	1	61	25

Location	Depth (m)	Peak Undrained Shear Strength (kPa)	Remoulded Shear Strength (kPa)
PC06 (BNG 318437, 596543)	0.5	48	30.5
	1	123	102
PC07 (BNG 318986, 597252)	0.5	13.5	14.5
	1	15.5	16
	1.5	14	14
	2	12	11
	2.5	14	12
	3	17	16
PC08 (BNG 317968, 599777)	0.5	32	9
	1	39	26.5
PC09 (BNG 316313, 601961)	0.5	20	11
	0.9	44.5	24.5
PC11 (BNG 315730, 598804)	0.5	37	16
	1	38	29

Source: Data was taken from field work carried out by Natural Power

Tests were primarily taken within 1m of peat; up to a maximum of 3.0m in some locations. Peak shear strength values range from 12kPa to >60kPa. Remoulded values range from 9kPa to 25kPa.

For the numerical slope analysis in Section 6; site wide minimum values of 12kPa and 9kPa, were used for Peak and Remoulded shear strength; in the interests of conservatism.

PC06 showed very high values in the test at 1m. Usually this would be due to testing of a clayey subsoil, but the corresponding peat core presented a small layer of stiff peat at the base. This is either a heavily decomposed peat deposit or some form of mixing has occurred to combine the organic material with silt and clay.

Humification of Peat and Peat Cores

The characteristic of the peat and specifically the degree of humification has been recorded at 10 locations around the site. Continuous cores were extracted at each location and described to Eurocode 7: BS EN 1997 standards. The peat has been characterised according to the von Post Classification (Von Post & Granland, 1926). Table 5.10 sets out the classification and Table 5.11 presents the classifications and descriptions with depth at each coring location, with photos in Table 5.12.

Table 5.10: Von Post Classification

Degree of Humification	Peat Description
H1	Completely unconverted and mud-free peat which when pressed in the hand only gives off clear water. Plant remains are easily identified.
H2	Practically unconverted and mud free peat which when pressed in the hand gives off almost clear colourless water. Plant remains are still easily identifiable.
H3	Very slightly decomposed or very slightly muddy peat which when pressed in the hand gives off marked muddy water, but no peat substance passes through the fingers. The pressed residue is thickish. Plant remains have lost some of their identifiable features.

Degree of Humification	Peat Description
H4	Slightly decomposed or slightly muddy peat which when presses in the hand gives off marked muddy water. The pressed residue is thick. Plant remains have lost more of their identifiable features.
H5	Moderately decomposed or muddy peat. Growths structure evident but slightly obliterated. Some amorphous peat substance passes through the fingers when pressed but, mostly muddy water. The pressed residue is very thick.
H6	Moderately decomposed or very muddy peat with indistinct growth structure. When pressed approximately 1/3 of the peat substance passes through the fingers. The remainder extremely thick but with more obvious growth structure than in the case of unpressed peat
H7	Fairly well decomposed or markedly muddy peat but the growth structure can just be seen. When pressed about half the peat substance passes through the fingers. If water is also released this is dark and peaty.
H8	Well decomposed or very muddy peat with very indistinct growth structure. When pressed about 2/3 of the peat substance passes through the fingers and at times a thick liquid. The remainder consists mainly of more resistant fibres and roots.
H9	Practically completely decomposed or mud-like peat in which almost no growths structure is evident. Almost all the peat substance passes through the fingers as a uniform paste when pressed.
H10	Completely decomposed or mud peat where no growth structure can be seen. The entire peat substance passes through the fingers when pressed.

Source: Von Post and Granland (1926)

Table 5.11: Von Post Classification at Turbine Locations

ID	Depth Top	Depth Bottom	Von Post Degree of Humification	Description
PC01	0	0.3	**H5**	Soft black pseudofibrous plastic slightly spongy PEAT
	0.3	1	**H5**	Soft dark brown pseudofibrous plastic slightly spongy PEAT
	1	3	**H6**	Very soft dark brown pseudofibrous plastic PEAT
	3	3.5	**H7**	Soft black amorphous spongy PEAT
	3.5	3.7	**N/A**	Soft grey slightly sandy CLAY
PC02	0	0.4	**H5**	Soft dark brown fibrous plastic PEAT
	0.4	1	**H7**	Soft dark brown amorphous plastic PEAT
PC03	0	0.5	**H4**	Soft dark brown fibrous plastic slightly spongy PEAT
	0.5	1	**H5**	Soft black pseudofibrous plastic PEAT
	1	2	**H5**	Soft black pseudofibrous plastic PEAT
	2	2.5	**H5**	Soft black pseudofibrous plastic PEAT
	2.5	2.8	**H8**	Soft black amorphous plastic PEAT
			N/A	Sandy at Base

ID	Depth Top	Depth Bottom	Von Post Degree of Humification	Description
PC04	0	0.25	**H5**	Soft dark brown pseudofibrous spongy PEAT
	0.25	0.5	**H7**	Firm dark brown amorphous plastic slightly spongy PEAT (H7/B2)
PC05	0	1	**H6**	Soft dark brown pseudofibrous plastic PEAT
	1	1.1	**N/A**	Firm grey CLAY
PC06	0	0.3	**H5**	Very soft brown pseudofibrous plastic slightly spongy PEAT
	0.3	1	**H8**	Firm dark brown amorphous plastic PEAT
	1	1.25	**H9**	Stiff dark brown amorphous plastic PEAT
PC07	0	1	**N/A**	No Sample
	1	2	**N/A**	No Sample
			N/A	Unable to push corer further, possible very fibrous peat
PC08	0	0.3	**H4**	Very soft dark brown pseudofibrous plastic PEAT
	0.3	1.3	**H7**	Soft dark brown pseudofibrous plastic PEAT
PC09	0	0.6	**H5**	Firm dark brown pseudofibrous plastic PEAT
	0.6	0.9	**H8**	Firm black amorphous plastic PEAT
			N/A	Clayey base with cobbles
PC11	0	0.4	**H5**	Soft dark brown pseudofibrous amorphous plastic PEAT
	0.4	0.8	**H7**	Firm dark brown amorphous plastic PEAT

Source: Data from field work carried out by Natural Power

Peat humification is between H4 and H9, with general trend being between H4 and H6.

Peat cores were taken at 10 locations across the site, these locations are shown on Map 10.2.1.

Table 5.12: Peat Core Photos

PC01	 **0.00-1.00m**  **1.00-2.00m**  **2.00-3.00m**  **3.00-3.70m**
PC02	 **0.00-1.00m**

PC03	 **0.00-1.00m**  **1.00-2.00m**  **2.00-2.80m**
PC04	 **0.00-0.50m**
PC05	 **0.00-1.00m**

PC06	 **0.00-1.00m**  **1.00-1.25m**
PC07	**NO SAMPLE – NO PHOTO**
PC08	 **0.00-1.00m**  **1.00-1.30m**
PC09	 **0.00-0.90m**
PC11	 **0.00-0.80m**

Source: Natural Power – Collected during Stage 2 survey

Where peat accumulations are absent, peaty topsoil is dominant. Figure 5.3 shows the typical soil profile of the open and upland moorland:

Source: Natural Power

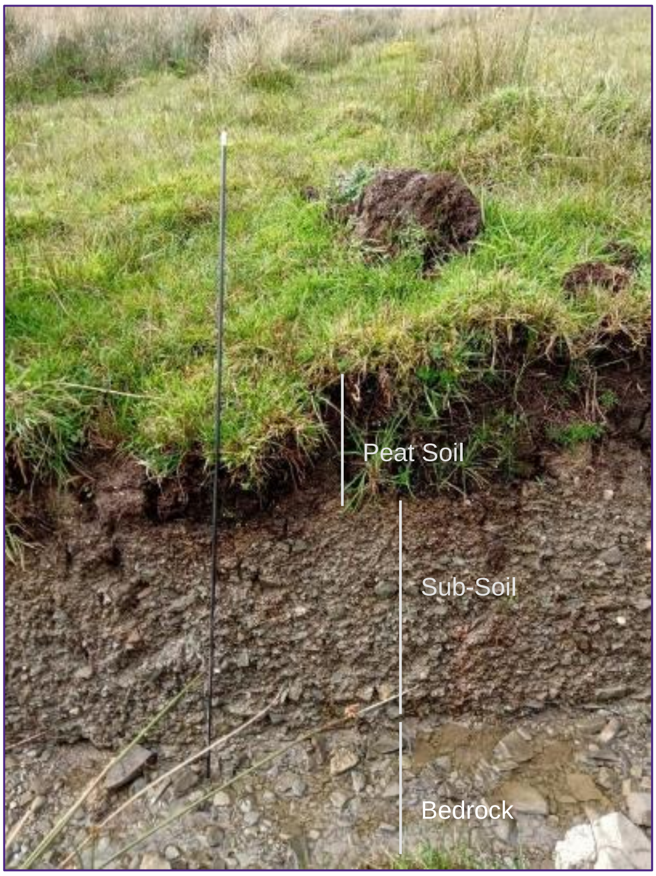


Figure 5.3: Typical shallow soil profile for Scoop Hill Wind Farm

In Figure 5.3; a thin peaty topsoil (0.1-0.3m) is overlying a mixed granular glacial sub-soil. This sequence was found to be very typical across the proposed development and revealed in artificial drainage ditches and cuttings. Such evidence has been included in the overall assessment of the peatland coverage and subsequent detailed survey design and assessment.

6. Slope Stability Analysis

6.1. Introduction

Assessing the desk study information, site layout and ground investigation data; a preliminary numerical slope analysis has been undertaken. Slope stability was assessed at each turbine location using slope angle measurements, peat depth, and minimum undrained shear strength measured using an in-situ hand shear vane. This assessment draws primarily from numeric parameters, although some qualitative interpretation will be required.

The relatively low peat depth across the site has led to assumptions being made with shear strength and slope angle. Values have been chosen to provide conservative results. For each proposed turbine location, the minimum peak undrained shear strength values have been input into the infinite slope model in order to calculate the potential factor of safety against peat slide. Section 5.4 provides an overview of principles to the stability calculation.

6.2. Undrained Slope Analysis

No peat failures have been observed across the proposed development. However, there is evidence of slope instability within sub-soils being actively eroded within watercourse valleys (not analysed by this assessment). Evidence of this can be found 250m north of T22, where a small land slide has occurred (see Map 10.2.3 Geomorphological Map, Appendix A). The assessment of deeper-seated landslide activity affecting underlying sub-soils and rock mass is beyond the scope of this report and shall require investigation through intrusive site investigation methods pre-construction.

The current baseline peat condition is assumed to be in a state of stable equilibrium. Surcharge loading has been considered to demonstrate the effect of construction works.

The factor of safety (FoS) against sliding has been calculated at the centre of proposed turbine locations. Table 6.1 below summarises the results.

Table 6.1: Infinite Slope Analysis Wind Turbines

ID	Average Peak Shear Strength (kPa)	Average Remoulded Shear Strength (kPa)	Depth, z (m)	Slope Geometry (β°)	Factor of Safety, (FoS = Cu / γ z sinβ cosβ)		
					No applied load	Surcharge 20kPa	Remoulded Surcharge
T11	12	9	0.20	8°	41.7	3.8	3.0
T12	12	9	0.40	9°	18.6	3.1	2.4
T13	12	9	0.30	2°	109.9	14.3	11.2
T14	12	9	0.20	9°	37.2	3.4	2.6
T15	12	9	0.30	5°	44.2	5.8	4.5
T16	12	9	0.40	8°	20.9	3.5	2.7
T17	12	9	0.90	4°	18.4	5.7	4.5
T18	12	9	0.40	6°	22.1	4.4	3.5
T19	12	9	0.40	9°	18.6	3.1	2.4
T20	12	9	0.30	6°	36.9	4.8	3.8
T21	12	9	0.70	4°	23.6	6.1	4.8
T22	12	9	0.45	11°	10.2	2.4	1.8
T23	12	9	0.50	3°	44.0	8.8	6.9
T24	12	9	0.50	3°	44.0	8.8	6.9
T25	12	9	0.20	7°	47.5	4.3	3.4
T26	12	9	0.50	9°	18.6	3.1	2.4
T27	12	9	0.30	7°	31.7	4.1	3.2
T28	12	9	0.50	6°	22.1	4.4	3.5
T29	12	9	0.60	4°	27.5	6.4	5.0
T30	12	9	0.30	7°	31.7	4.1	3.2
T31	12	9	0.40	12°	14.1	2.4	1.8
T32	12	9	0.30	10°	22.4	2.9	2.3
T33	12	9	0.30	8°	27.8	3.6	2.8
T34	12	9	0.40	6°	22.1	5.1	4.0
T36	12	9	0.30	6°	36.9	4.8	3.8
T39	12	9	0.30	5°	44.2	5.8	4.5
T40	12	9	0.30	9°	24.8	3.2	2.5
T41	12	9	0.20	8°	41.7	3.8	3.0

ID	Average Peak Shear Strength (kPa)	Average Remoulded Shear Strength (kPa)	Depth, z (m)	Slope Geometry (β°)	Factor of Safety, (FoS = Cu / γ z sinβ cosβ)		
					No applied load	Surcharge 20kPa	Remoulded Surcharge
T42	12	9	0.20	7°	31.7	4.1	3.2
T43	12	9	0.40	8°	20.9	3.5	2.7
T44	12	9	0.25	11°	12.3	2.5	1.9
T45	12	9	0.30	4°	41.3	6.9	5.4
T46	12	9	0.30	5°	44.2	5.8	4.5
T47	12	9	0.60	4°	27.5	6.4	5.0
T48	12	9	0.40	8°	20.9	3.5	2.7
T49	12	9	0.40	10°	16.8	2.8	2.2
T50	12	9	0.10	19°	37.4	1.8	1.4
T51	12	9	0.15	9°	49.6	3.5	2.7
T52	12	9	0.40	6°	20.1	4.3	3.4
T53	12	9	0.20	6°	55.3	5.0	3.9
T55	12	9	0.40	7°	19.0	3.8	3.0
T57	12	9	0.50	4°	33.1	6.6	5.2
T58	12	9	0.40	5°	33.1	5.5	4.3
T59	12	9	3.30	2°	10.0	6.2	4.9
T60	12	9	2.00	2°	16.5	8.2	6.5
T63	12	9	0.40	6°	18.4	4.3	3.3
T64	12	9	0.60	8°	13.9	3.2	2.5
T65	12	9	0.30	9°	24.8	3.2	2.5
T66	12	9	0.45	12°	11.3	2.3	1.8
T67	12	9	0.10	9°	14.9	3.0	2.3
T68	12	9	1.10	4°	15.0	5.3	4.2
T69	12	9	0.50	8°	16.7	3.3	2.6
T70	12	9	0.40	12°	14.1	2.4	1.8
T71	12	9	0.40	8°	20.9	3.5	2.7
T72	12	9	0.10	10°	13.4	2.7	2.1
T73	12	9	0.30	5°	44.2	5.8	4.5
T74	12	9	0.20	10°	33.6	3.1	2.4
T75	12	9	0.10	6°	110.6	5.3	4.1
T76	12	9	0	12°	No peat	No peat	No peat

ID	Average Peak Shear Strength (kPa)	Average Remoulded Shear Strength (kPa)	Depth, z (m)	Slope Geometry (β°)	Factor of Safety, (FoS = Cu / γ z sinβ cosβ)		
					No applied load	Surcharge 20kPa	Remoulded Surcharge
T77	12	9	0	8°	No peat	No peat	No peat

6.3. Discussion of Stability Analysis

The preliminary stability analysis indicates no potential for peat slide at the proposed development area under current equilibrium conditions. All locations where peat is present (≥0.5m) record FoS values greater than 1.3. Factor of safety against peat instability has been mapped across the development as depicted on Figure 10.2.7, Appendix A.

The natural peat slope condition has been calculated to be stable and was observed to be so during the field survey.

The Peat Management Plan (PMP) submitted with the 2020 EIAR provides mitigation measures for stability of peat temporary stockpiling. Slope stability assessments will be carried out during design phase for site tracks, hardstands and other relevant structures ensuring the proposed design results are safe, stable and environmentally compliant.

7. Peat Slide Risk Assessment

The potential environmental impact of a peat slide triggered by proposed wind farm infrastructure is obtained from assessing the proximity to watercourses, see Map 10.2.4, Appendix A to this report.

The peat stability assessment also includes consideration for the potential impact to the proposed development infrastructure (scored 1 – 4) from peat slide. Assessment of the proposed layout with respect to peat failure hazard zones was considered. If for example infrastructure was down-slope of a potential failure site, the development impact scale is increased. This is based on Section 4.1 of National Guidance (PHLRAG, 2017) and is a subjective engineering judgement of a resultant peat slide inundating infrastructure and rendering damage. The time and cost for the project would be increased due to the requirement for remediation.

Probability values were assessed for combined contributory factors recorded across the turbine locations and added together values >1 (See Table 5.3). The highest impact rating (either development infrastructure or environmental) is then combined with the cumulative effects of the contributory factors. This is to convey the overall risk ranking; this accounts for increased susceptibility when multiple contributory factors are identified.

> Risk ranking is provided in Table 7.2 for all main proposed infrastructure locations. Risk mapping is also provided at Appendix A. Turbine and infrastructure locations where peat is indicated to be present and (≥0.5m) are highlighted in Table 7.1 with a detailed risk analysis. Turbine locations highlighted by the IFL checking report have additionally been included in this table regardless of peat depth.
>
> The original peat slide risk assessment contains detailed breakdown of all shallow/absent peat locations if so required (Ref: 1225356 C).

Factors including peat depth, slope geometry and distance to watercourses are the main contributing factors in assessing likely areas of failure. An indicative residual risk rating is also provided assuming implementation of appropriate mitigation measures. Developmental impact assessment was limited in the assessment due to the overriding requirement to demonstrate and assess potential environmental impacts.

The risk ranking map is appended to this report, Figure 10.2.8, Appendix A. The risk map provides a superior representation of the risk zonation across the site and includes all infrastructure elements. However, the map is based on a development wide GIS analysis and should not be viewed in isolation without the narrative of this report.

The basis of the peat slide risk map is the peat/soil depth data points, interpolated terrain slope angle and proximity to major watercourse receptors. Risk modelling limitations are highlighted below:

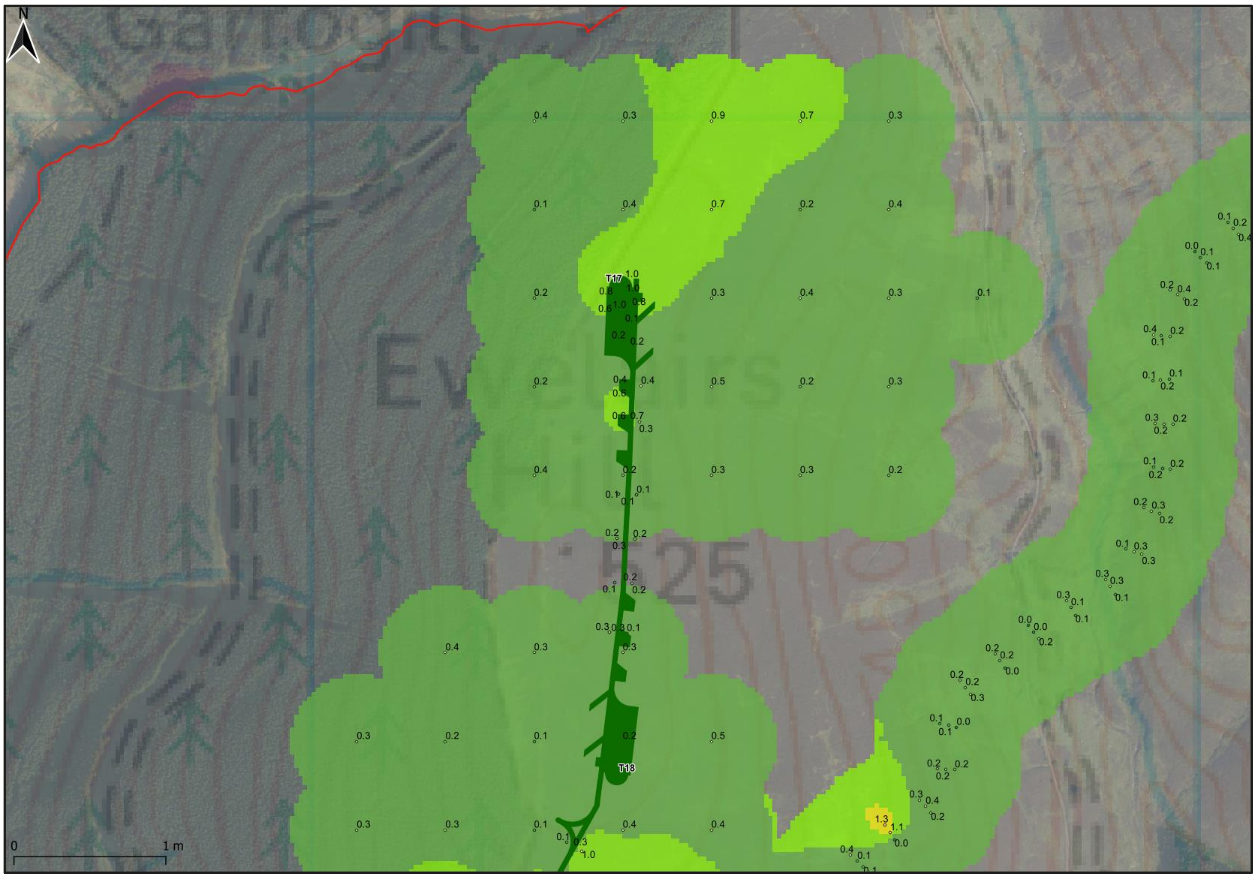
- High risk will be indicated at watercourse crossing points even for shallow peat depth locations. Further exploration of the contributing factors at these locations were considered and the final risk assignments are deployed within the main risk table of the report (Table 7.2).
- The peat depth data points are not definitive in terms of differentiation between peat and mineral soils.
- The peat slide risk zonation map will tend to produce an overestimation of risk and is therefore used as a screening tool to focus areas of the development indicated to be at highest or most widespread elevated risk.

In following the National Guidance[7] (Section 4.2.4.2.1) of (PHLRAG, 2017) expanding the scope of peat probing surveys onto areas which are not peatland or blanket bog would not increase the efficacy of the peat slide risk zonation map. Therefore no detailed probing has been undertaken across areas where:

- There is no significant potential for peat slide determined at desk study and site reconnaissance phase.
- There is no indication of peat accumulations, peatland or raised bog conditions.
- Areas are out-with the development which are disconnected by terrain unit position.

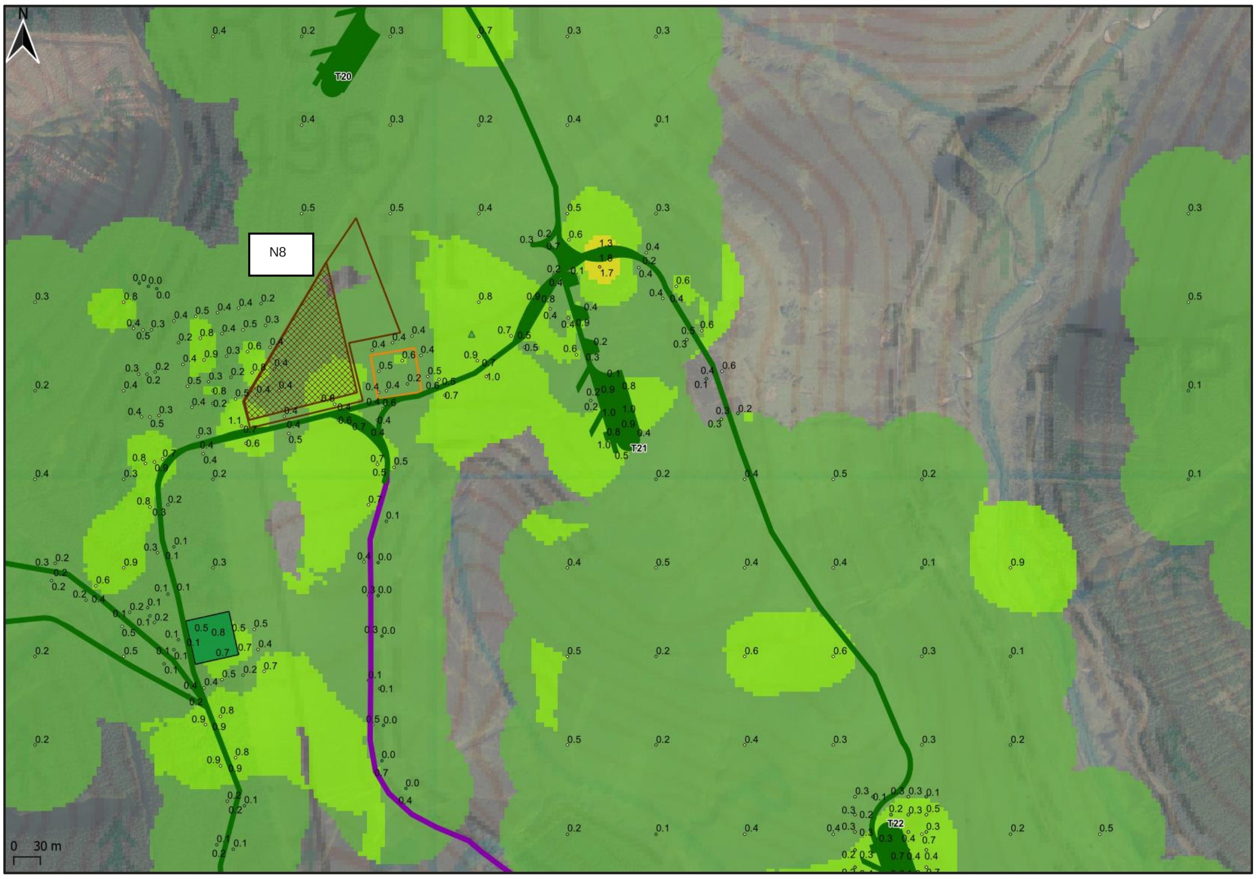
Table 7.1: Hazard Ranking Proposed Turbine Location

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T17	1	1 (305m from nearest watercourse)	Peat Depth (Mean = 0.9m)	3	6 (Low)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Recommendations		Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and design life of the foundation.		**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T21	1	1 (230m from watercourse)	Peat Depth (Mean = 0.7m)	3	6 (Low)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	

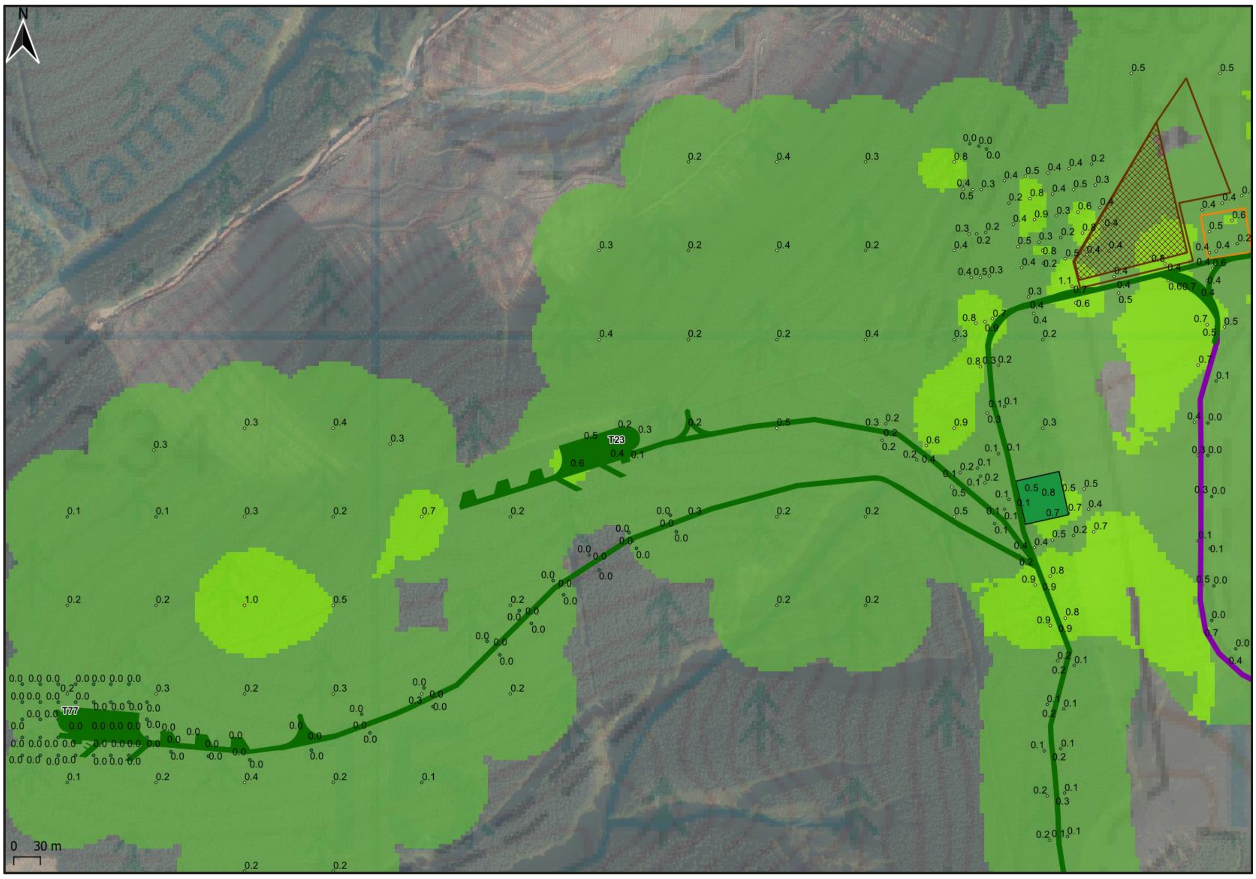


Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T22	1	1 (202m from watercourse)	Peat Depth (Mean = 0.45m)	1	5 (Low)
			Slope Angle (11°)	5	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	

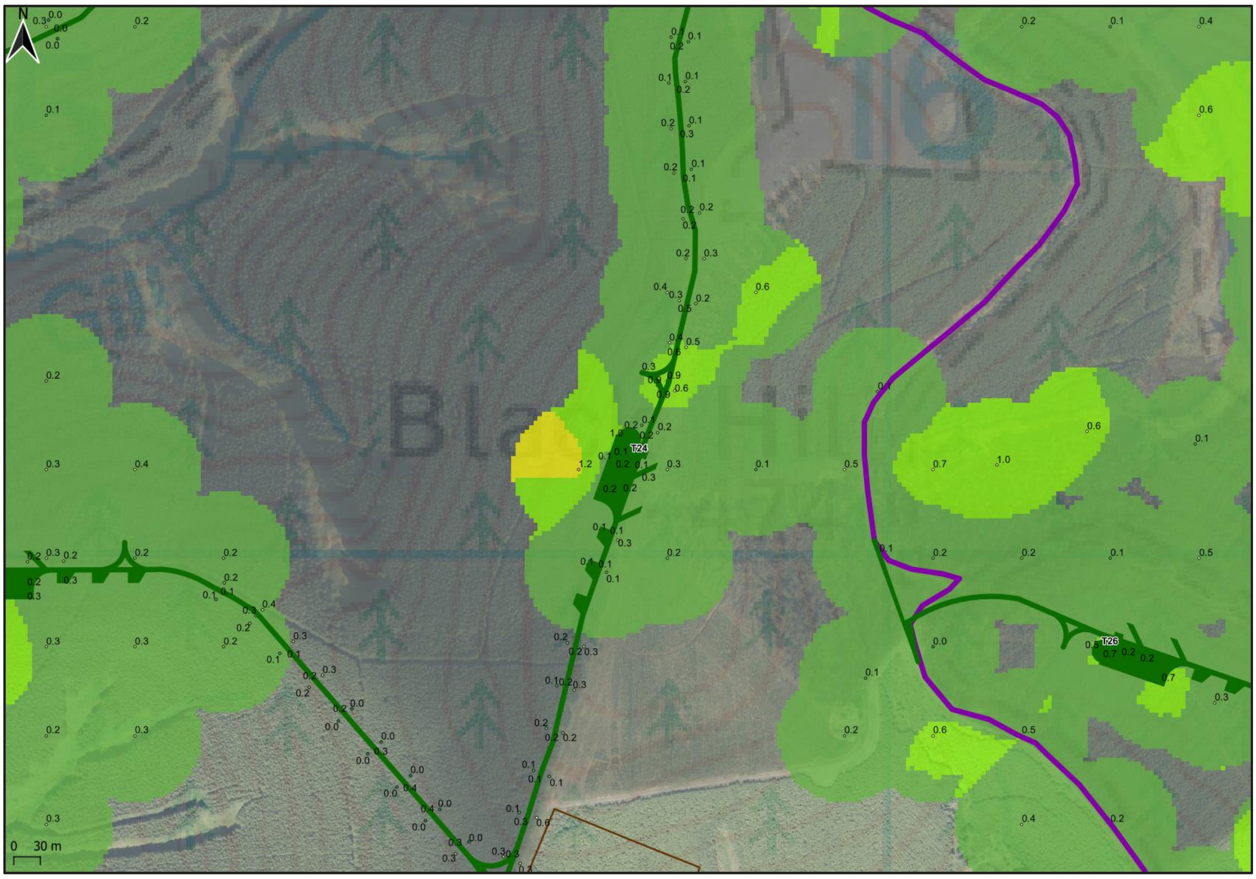
Recommendations		Residual Risk
• Reported Risk Category **Low** • Mean Peat Depth at Proposed Infrastructure - 0.45m based on detailed probing. Low angle terrain coincident with deeper peat. The controlling and steeper sloping terrain to the east recorded absent peat. With gentler slopes to the west holding peat to a depth of 0.7m. • Mean Peat Depth Surrounding Area – Absent thin soils / not peatland, mean soil depth 0.25m across the wider ridge system. • Terrain slope is low angle along the axis of the ridge line but increases to the east and west off the ridge line. • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Surrounding terrain is not peatland and contributory factors (signs of previous instability, hydrology, groundwater, and infiltration) at the proposed turbine location indicated a low peat slide risk. • The location is a significant distance from the nearest watercourse.. Peat survey information shows widespread shallow peat or absent peat in the surrounding terrain.		**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T23	1	1 (241m from watercourse)	Peat Depth (Mean = 0.5m)	3	3 (Negligible)
			Slope Angle (3°)	1	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



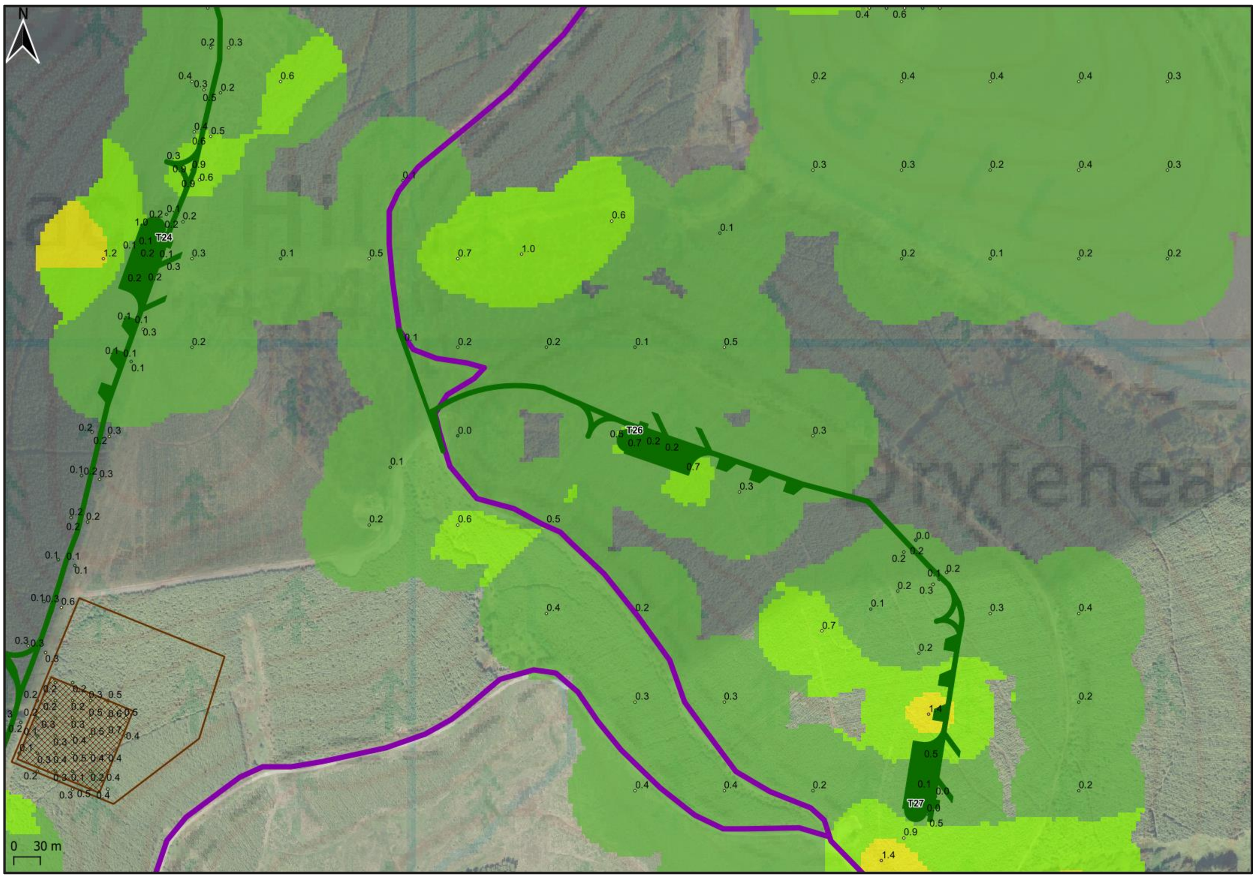
Recommendations		Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.		Negligible

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T24	1	1 (270m from watercourse)	Peat Depth (Mean = 0.5m)	3	6 (Low)
			Slope Angle (3°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



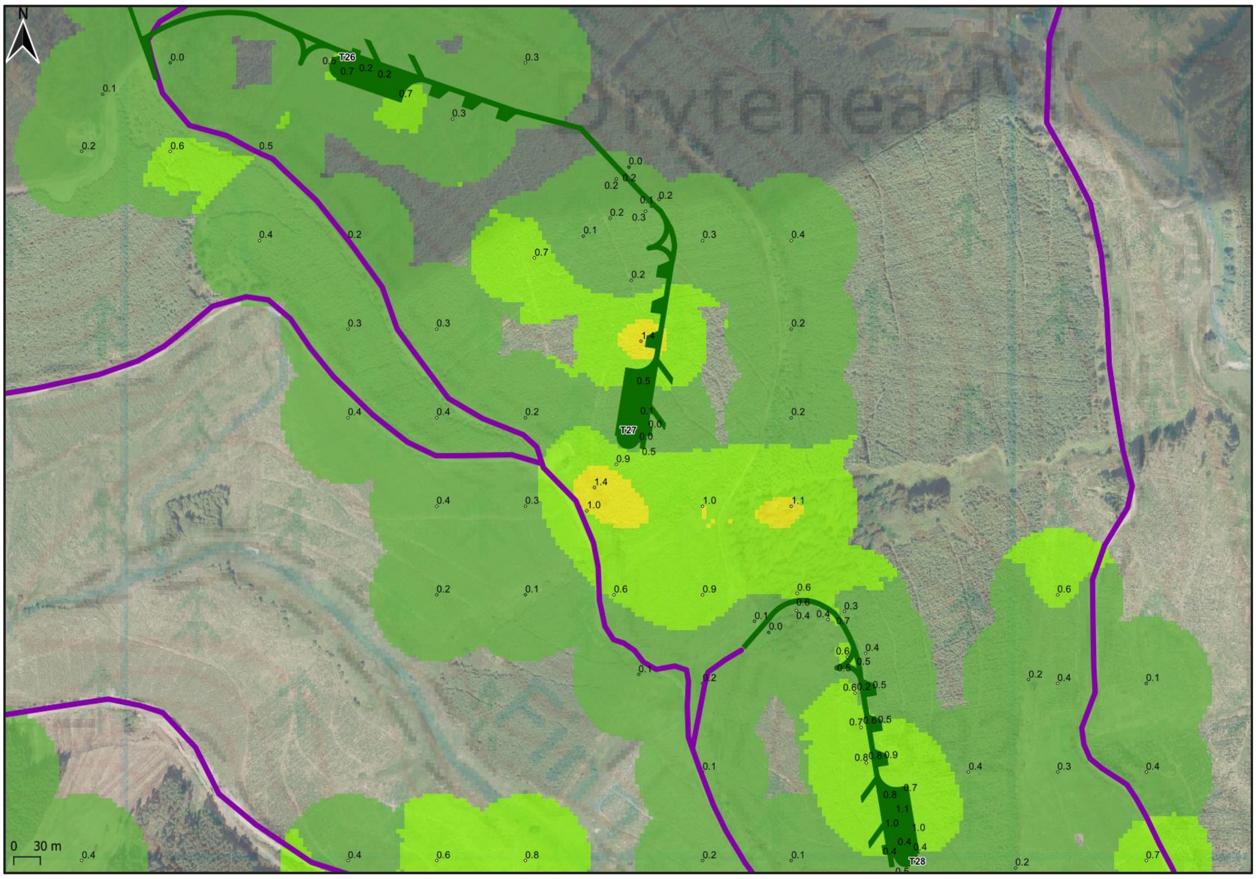
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T26	1	1 (263m from watercourse)	Peat Depth (Mean = 0.5m)	3	**6 (Low)**
			Slope Angle (9°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



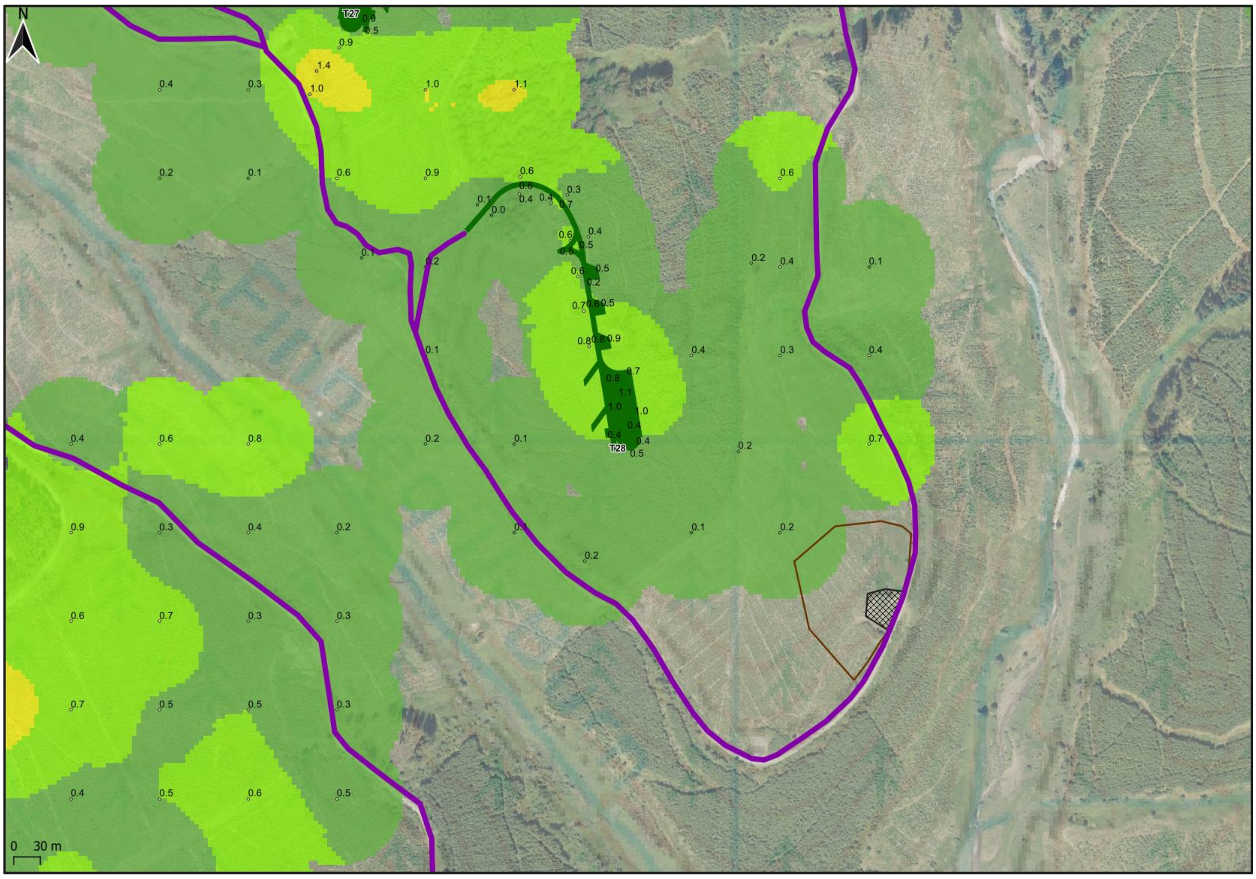
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T27	1	2 (107m from watercourse)	Peat Depth (Mean = 0.3)	1	6 (Low)
			Slope Angle (7°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



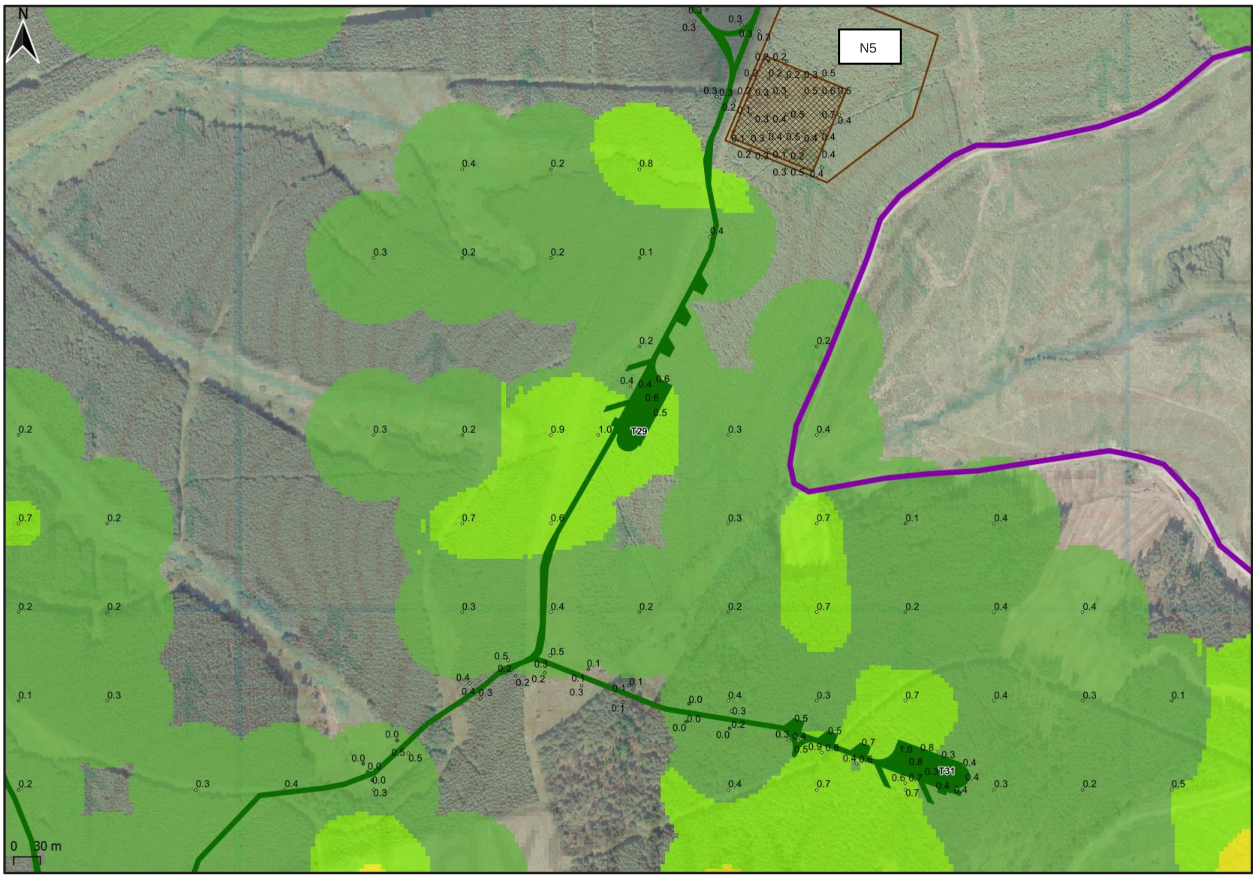
Recommendations	Residual Risk
• Risk Category – Low • Mean Peat Depth at Proposed Infrastructure - 0.3m (interpreted as thin soils / not peatland) • Terrain slope <8° • Mean Peat Depth Surrounding Area – Isolated deeper peat pockets to the north and south of the turbine, up to 1.4m. Specific peat slide mitigation methods detailed below should be followed for this turbine: • No storage of peat or earthwork bunds north & south of the proposed infrastructure location. • Avoid the use of displacement construction methods in the peat at this location which can generate lateral pressures and lead to destabilisation • Ensure hydrological regime is maintained throughout construction and life of the foundation. Best practice civil infrastructure drainage design which buffer and disperse surface waters and do not concentrate outflows from infrastructure drainage toward the south. • The nearest peat depth of >0.5m are ~80m southwards, there would thus be no direct linkage between proposed construction works at T27 and peat deposits to the south and north.	Negligible

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T28	1	1 (301m from watercourse)	Peat Depth (Mean = 0.5m)	3	6 (Low)
			Slope Angle (6°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



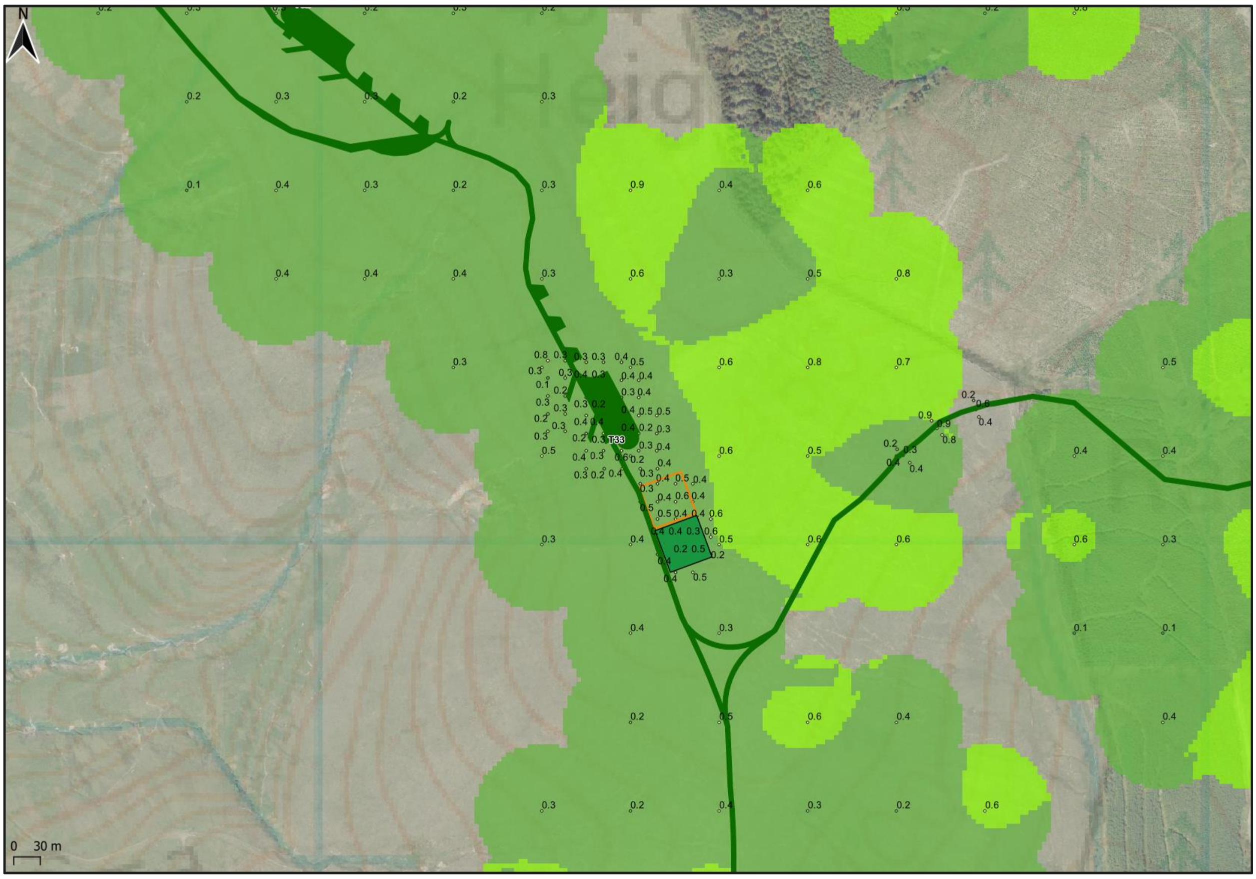
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T29	1	1 (168m from watercourse)	Peat Depth (Mean = 0.6m)	3	**6 (Low)**
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



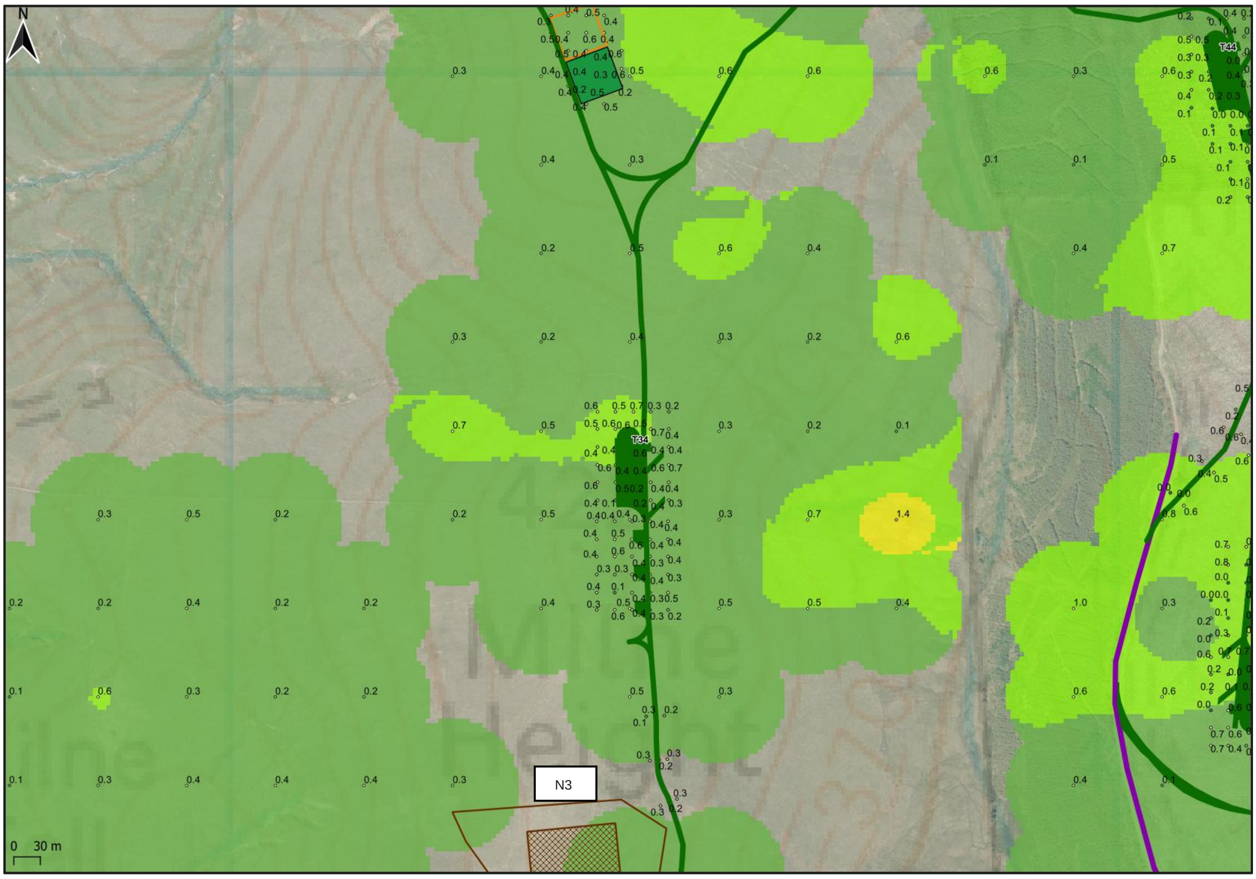
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T33	1	2 (146m from watercourse)	Peat Depth (Mean = 0.3m)	1	6 (Low)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



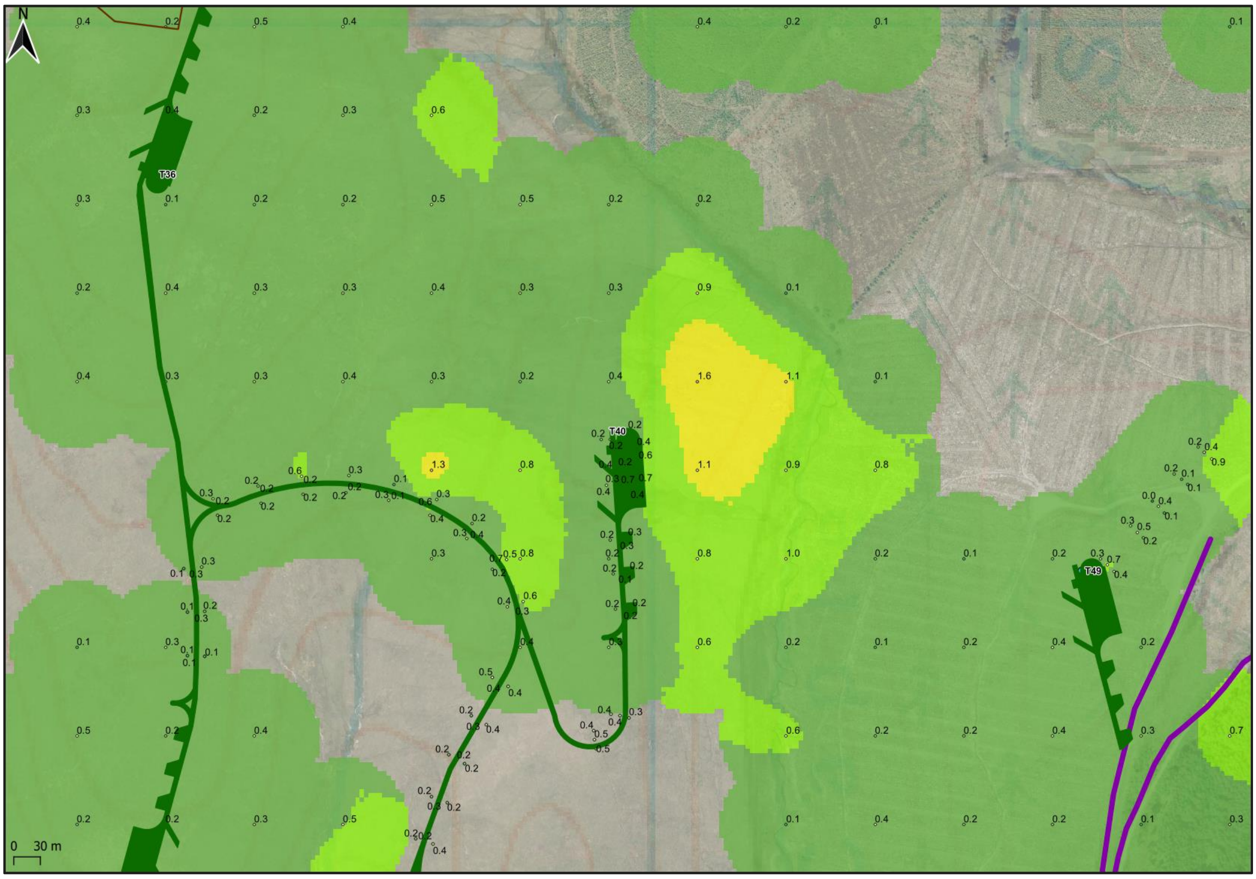
Discussion / Recommendations	Residual Risk
• Risk Category **– Low** • Mean Peat Depth at Proposed Infrastructure - 0.3m (interpreted as thin soils / not peatland) • Mean Peat Depth Surrounding Area – Absent thin soils / not peatland across the down-slope system towards the west. Directly upslope from the turbine position peat depths do not increase. • Terrain slope <9° • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. Based on the above information the location does not represent a location from where there is a significant impact potential from peat slide. At the proposed infrastructure location and across the surrounding terrain (down-slope) there is no peatland and contributory factors (signs of previous instability, hydrology, groundwater and infiltration) indicate a low-risk. The nearest peat depth of >0.5m are ~100m upslope traversing eastward and very likely disconnected from the terrain at the turbine location due to the absent peat deposits at this location. There would thus be no direct linkage between proposed construction works at T33 and peat deposits to the east.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T34	1	2 (145m from watercourse)	Peat Depth (Mean = 0.4m)	1	**6 (Low)**
			Slope Angle (6°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Discussion / Recommendations	Residual Risk
• Mean Peat Depth at Proposed Infrastructure - 0.4m. An isolated probe depth of 0.6 is recorded on the north side of the turbine location on level ground and then > 200m west and east of the turbine location. Terrain analysis and the grid probing survey data indicated a shallow / absent peat depth or thin mineral soil layer. • Mean Peat Depth Surrounding Area – Peat is majority absent with thin soils (mean – 0.3m) widespread across the down-slope system. • Terrain: <9° • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. At the proposed infrastructure location and across the surrounding terrain (down-slope) there is no deep peat on sloping ground and contributory factors at proposed turbine locations (signs of previous instability, hydrology, groundwater and infiltration) indicated a low-risk location.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T40	1	1 (196m from watercourse)	Peat Depth (Mean = 0.3m)	1	3 (Negligible)
			Slope Angle (9°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	

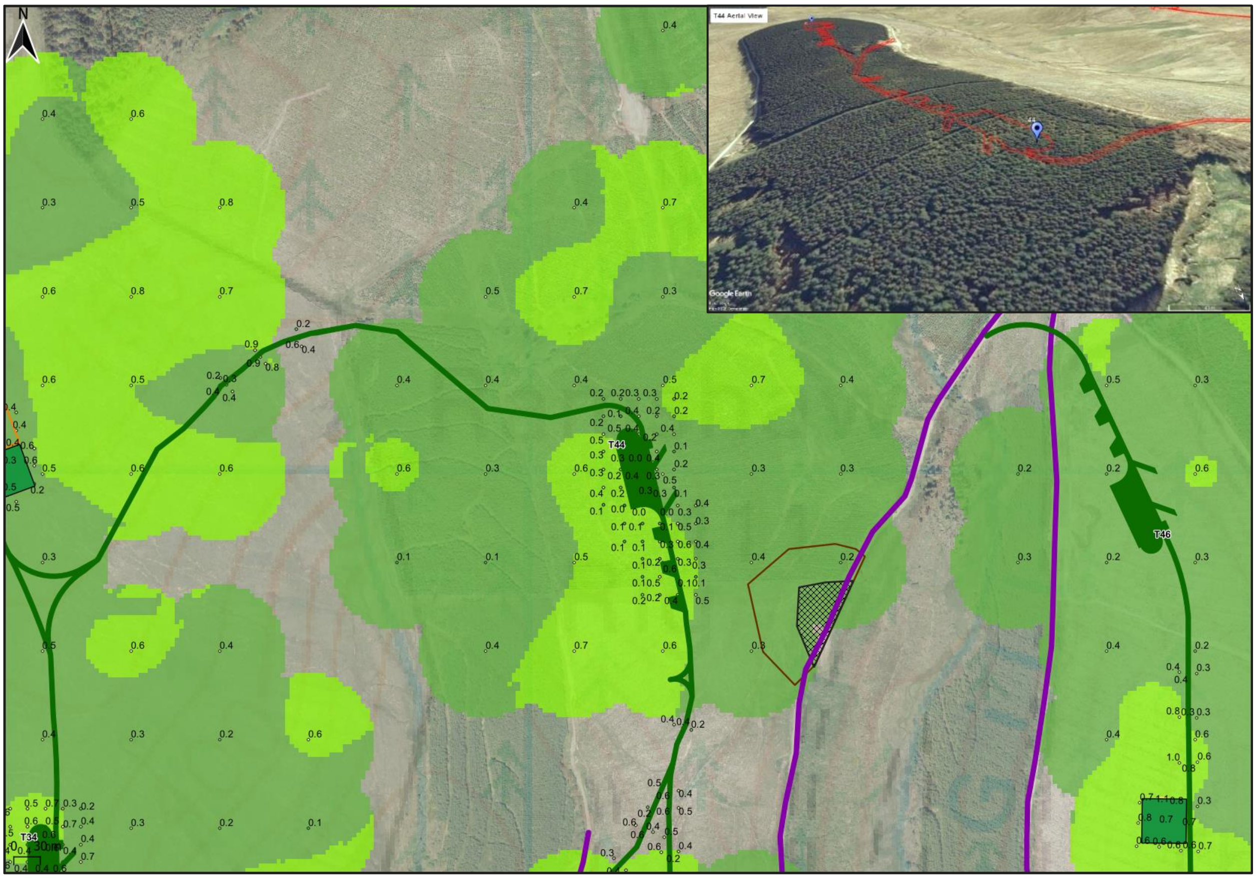


Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • No stockpiling or construction activity across area east of turbine infrastructure.	Negligible

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T43	1	1 (258m from watercourse)	Peat Depth (Mean = 0.4m)	1	3 (Negligible)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	

Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Mean Probe Depth at Proposed Infrastructure - 0.1m (Indicating thin mineral soil cover) • Mean Peat Depth Surrounding Area – Peat is absent with thin soil cover. Isolated peat pocket or possible soft soil located ~65m to the southwest associated with the alluvial depositional setting. Digital terrain analysis and site reconnaissance revealed modified grazing and no peat across this area. • Terrain <9° slope angle coupled with the absence of any peat accumulation means a large-scale peat slide event from this location is not possible. Based on this information above the location of T43 was not prioritised for detailed peat probing as it does not represent a location from where there is a significant impact potential from peat slide. Peat was assessed to be absent at the proposed infrastructure location and surrounding area. This was determined from the 100m grid probe data, digital terrain analysis and site reconnaissance. Across the surrounding terrain (down-slope) there is no continuous deep peat and contributory factors (no pre-existing signs of failure, no peatland hydrological features, shallow terrain angle) at proposed turbine locations indicated a low/negligible peat slide risk location. Further survey information at this location would not increase the precision of the risk assessment as it has been demonstrated there is no peat. This information should make it clear that such locations are not required to be the focus of detailed peat slide assessment and can be screened out of the risk assessment during the phased survey process.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T44	1	1 (Downslope stream 187m from watercourse)	Peat Depth (Mean = 0.25m)	1	5 (Low)
			Slope Angle (11°)	5	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



<table>
<tr><th>Discussion / Recommendations</th><th>Residual Risk</th></tr>
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Utilise and maintain best working practices while working on a peatland site.
Ensure hydrological regime is maintained throughout construction and life of the foundation.
Mean Peat Depth at Proposed Infrastructure - 0.5m. Marginally deeper probe depth (0.6m) recorded ~75m west of the turbine location although on the opposing side of the ridge. Depths of 0.6m were further recorded south across the access infrastructure.
Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the controlling downslope system to the east to which the proposed infrastructure occupies.
Terrain slope angle of <12°

Across the surrounding terrain (down-slope) there is no continuous deep peat and contributory factors (Factor of Safety, hydrology, and distance from nearest watercourse) at proposed turbine locations indicate a low-risk location. Detailed probing was collected at this location during the final phase of site phase following forestry felling over the intervening period since the original assessment. Post felling: there was revealed to be no signs of instability and peat has been confirmed as absent from the location with thin peat soils recorded.
</td><td>Negligible</td></tr>
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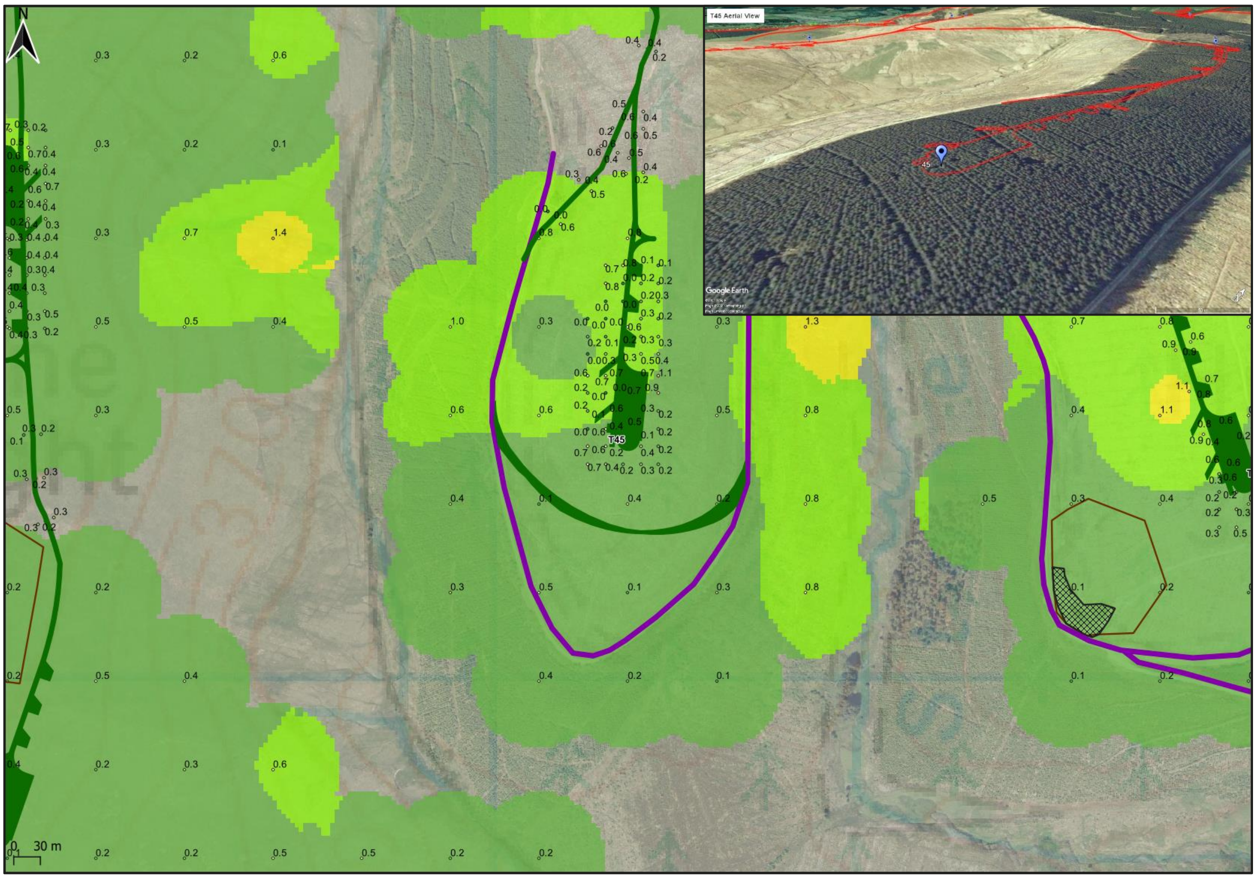
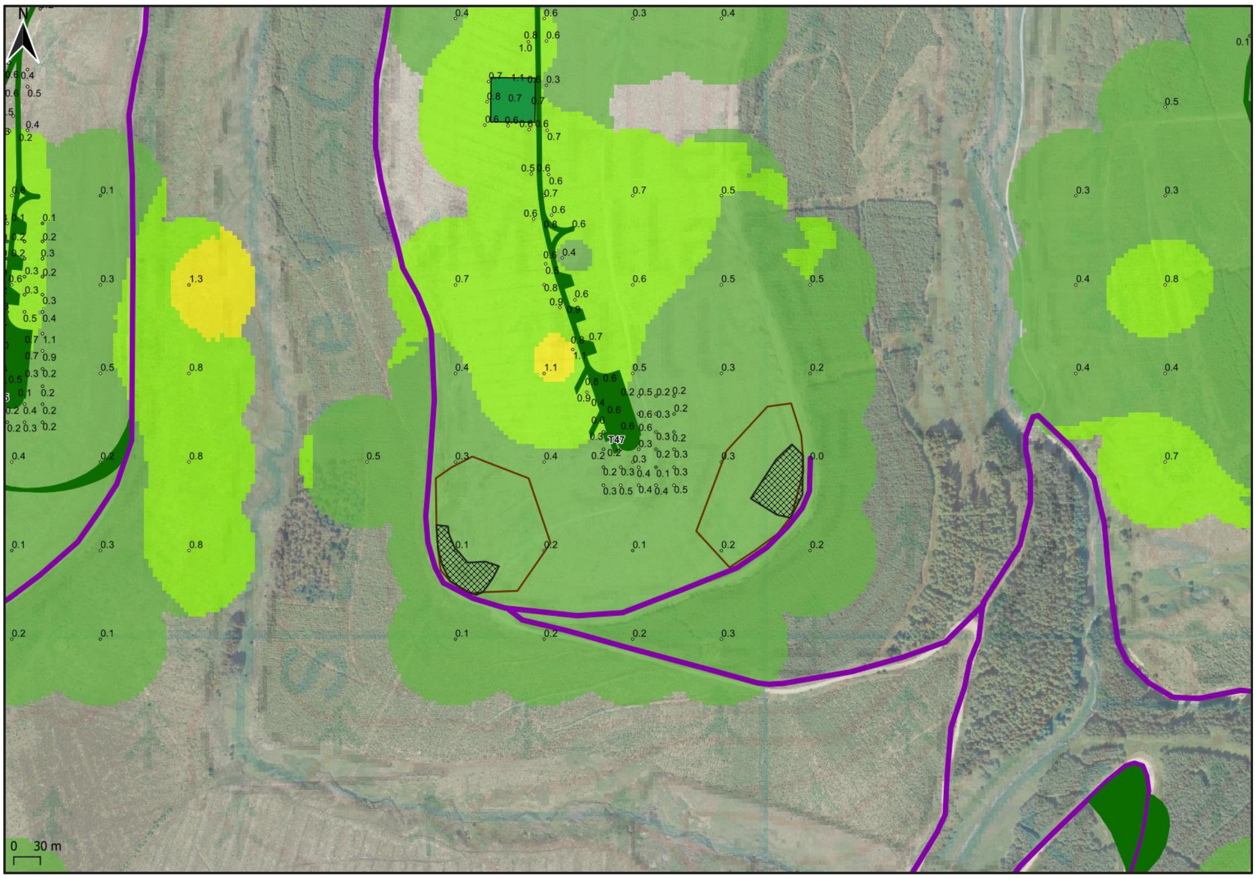
WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T45	1	1 (272m from watercourse)	Peat Depth (Mean = 0.3m)	1	**3 (Negligible)**
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



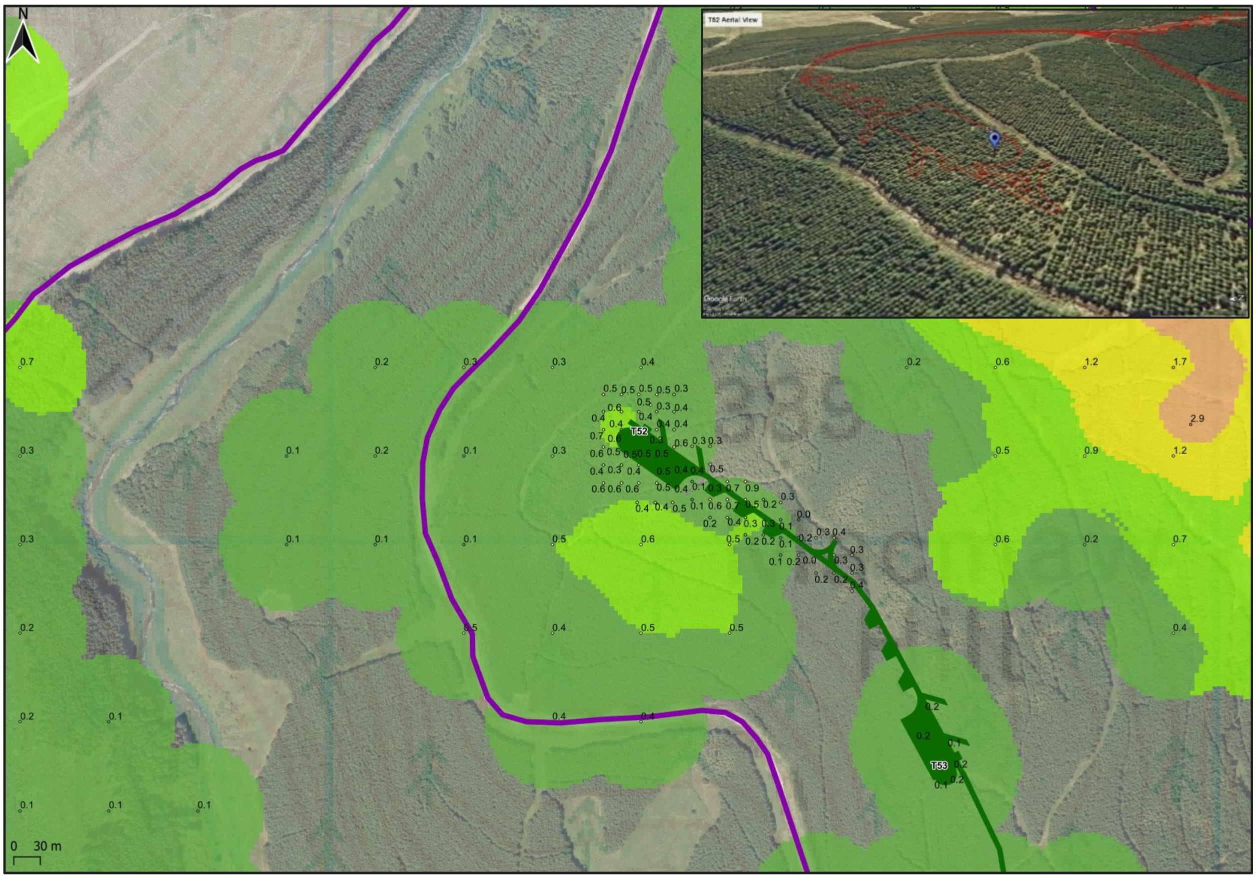
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Peat Depth at Proposed Turbine Infrastructure - 0.5m (Thin soils / Absent Peat) • Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the immediate controlling downslope system to the east and south. • Terrain <7° slope angle This location was not assessed to represent a location from where there is a significant impact potential from peat slide. Across the surrounding terrain (down-slope) there is no continuous deep peat and contributory factors (Factor of Safety, hydrology, and distance from nearest watercourse) at proposed turbine locations indicated a negligible risk location. Since conducting the initial peat survey forestry felling has occurred across this section of the site. Thus, additional terrain reconnaissance and probing has been possible in the final site survey phase in November 2022.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T47	1	1 (382m from watercourse)	Peat Depth (Mean = 0.6m)	3	6 (Low)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



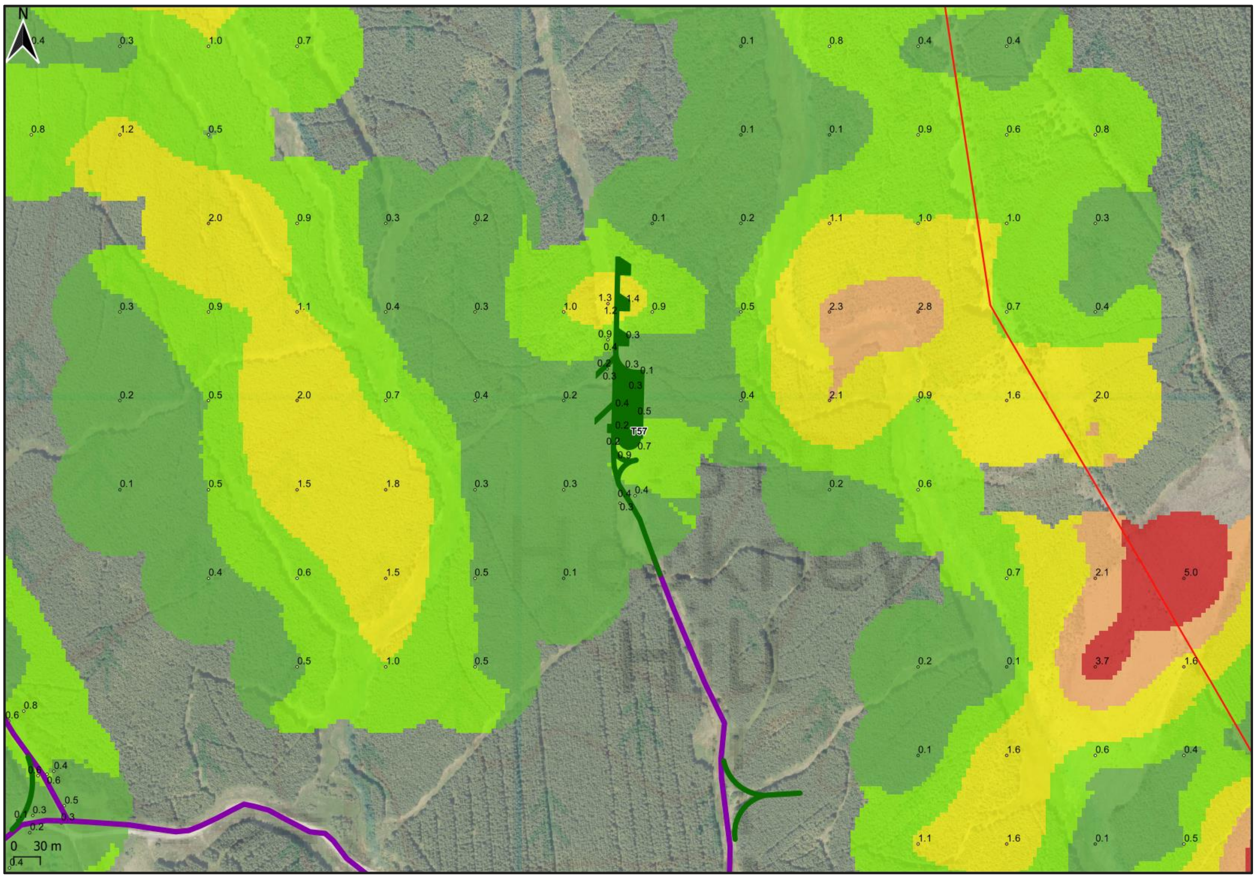
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Mean Peat Depth at Proposed Infrastructure - 0.6m • Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the immediate controlling downslope system. • Terrain <6° terrain slope angle. Detailed probing was undertaken along the approaching access infrastructure footprint where deeper peat was initially detected by the 100m grid survey. Detailed probing has confirmed peat of up to 1m depth on level or shallow sloping ground and this his was supported by a peat core sample 'PC04' described in the main peat slide risk assessment report (Table 3.7, Ref:1225356). The detailed peat probing was in the final survey phase, expanded across the turbine hardstand and foundation location. Across the surrounding terrain (down-slope) to the east, south and west; there is no indication of peat accumulation from the 100m grid probing. Contributory factors to peat slide at proposed turbine locations indicated a low-risk location. There was no evidence of previous instability, nor any hydrological indicators recorded. Due to the absence of other contributory factors (signs of previous instability, Factor of Safety, hydrology), and the significant distance for the nearest watercourse receptor (>380m) risk is low at this location.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T52	1	1 (416m from watercourse)	Peat Depth (Mean = 0.4m)	1	3 (Negligible)
			Slope Angle (6°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



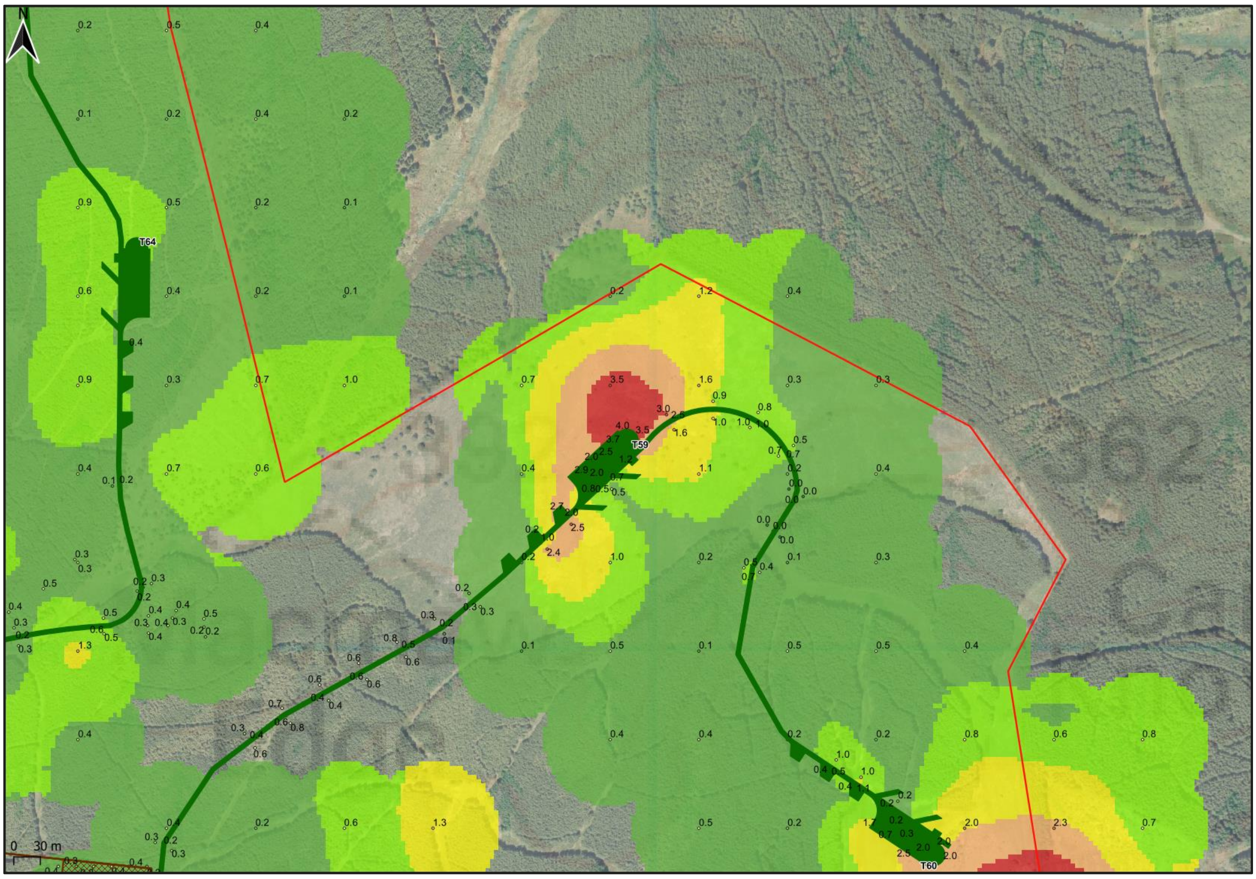
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Mean Peat Depth at Proposed Infrastructure - 0.5m • Mean Peat Depth Surrounding Area – Peat is thin and generally soil probes record <0.5m which likely represents a shallow mineral soil. • Terrain <6° The location of T52 was at the time of initial survey obscured by commercial forestry plantation. However additional detailed probing during the final survey phase was possible following removal of forestry. The wider 100m grid data surrounding the turbine and within the same terrain unit are all indicative of an absence of peat. Contributory factors to a large-scale peat slide at proposed turbine locations indicate low risk. There was no evidence of previous instability, no hydrological indicators or other key factors noted. Significant distance to the nearest watercourse receptor (>400m).	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T57	1	1 (212m from watercourse)	Peat Depth (Mean = 0.5m)	3	6 (Low)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



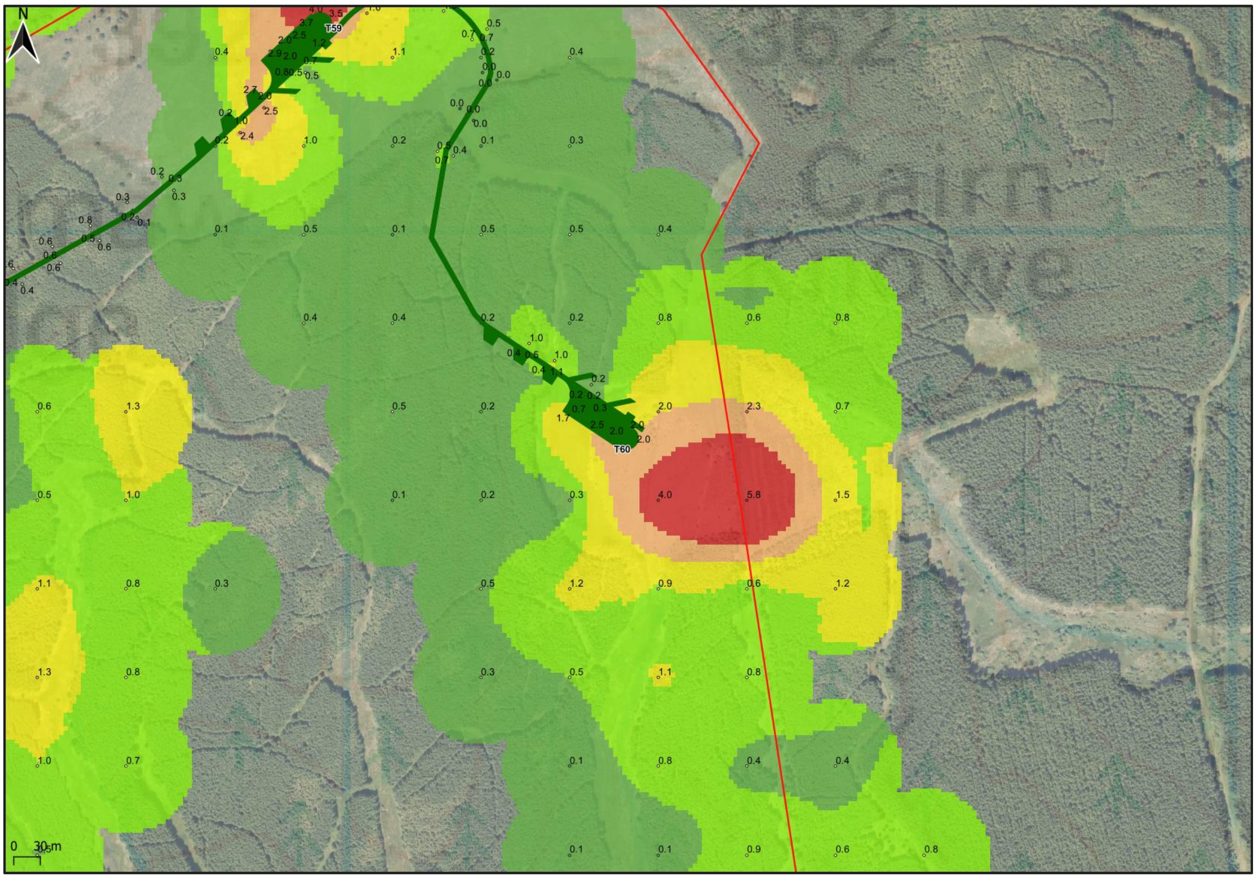
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	Negligible

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T59	1	1 (327m from watercourse)	Peat Depth (Mean = 3.3m)	2	2 (Negligible)
			Slope Angle (2°)	1	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

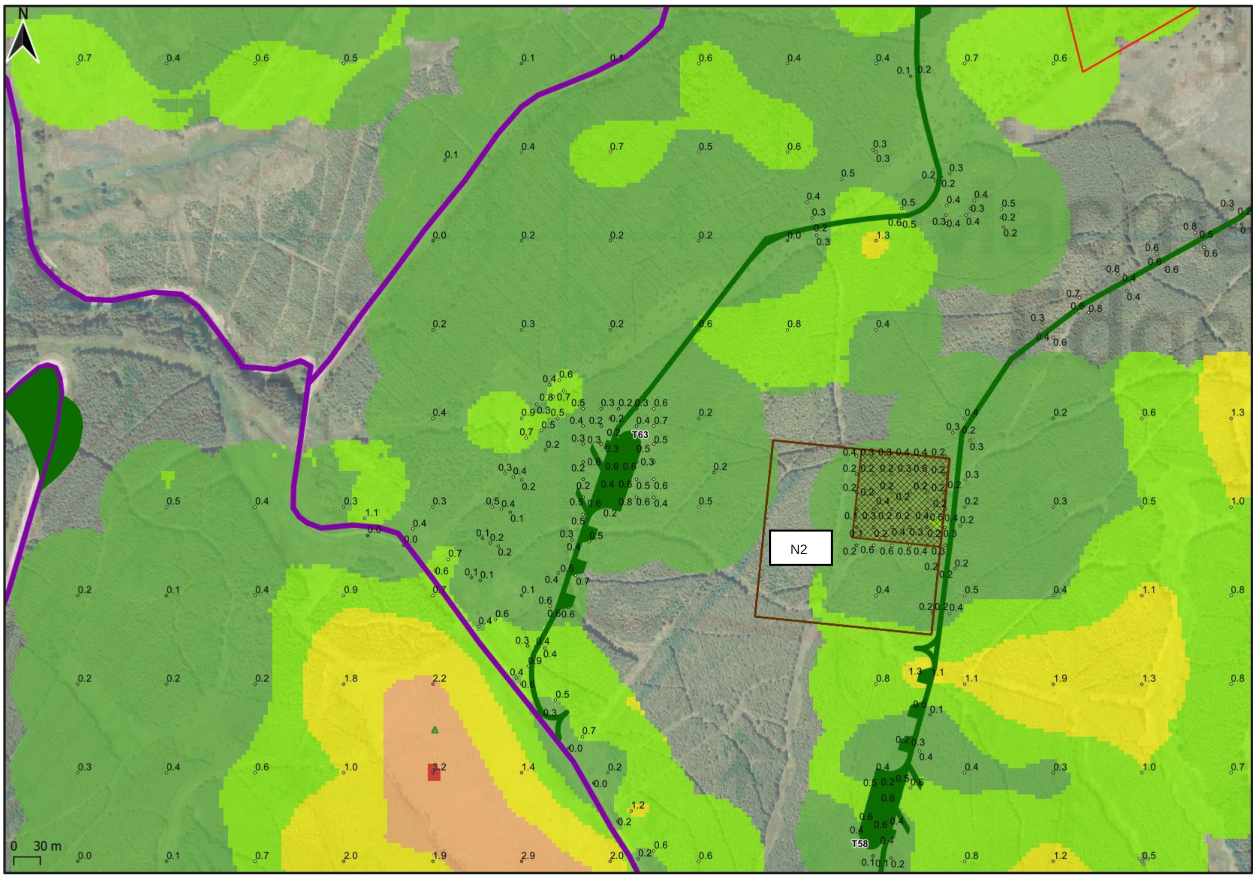
WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T60	2 (Watershed with Black Esk Reservoir located to east)	3 (93m from watercourse)	Peat Depth (Mean = 2.0m)	4	**12 (Medium)**
			Slope Angle (2°)	1	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



<table>
<tr><th>Discussion / Recommendations</th><th>Residual Risk</th></tr>
<tr><td>
Due to its proximity to catchment waters of the Black Esk Regional Reservoir the following specific mitigation measures are advised at this location:

No storage of peat or earthwork bunds east & south of the proposed infrastructure location.
Plant restriction and exclusion zone to be physically marked on site prior to and during construction to prevent access into the 50m watercourse buffer.
Avoid the use of displacement construction methods in the peat at this location which can generate lateral pressures and lead to destabilisation.
Ensure hydrological regime is maintained throughout construction and life of the foundation. Civil infrastructure drainage design to follow best practice guidance, buffering and dispersing surface waters around the turbine foundation and surrounding infrastructure. Do not concentrate outflows from infrastructure drainage toward the east/southeast.

Through application of these measures and the very low (<2°) slope angles (not conducive to peat slide) a low residual risk has been assigned.
</td><td>6
(Low)</td></tr>
</table>

<table>
<tr><th>WTG ID</th><th>Development Infrastructure</th><th>Environmental</th><th>Contributary Factors (Probability/Exposure)</th><th>Score</th><th>Risk Ranking</th></tr>
<tr><td rowspan="8">T63</td><td rowspan="8">1</td><td rowspan="8">1
(258m from watercourse)</td><td>Peat Depth (Mean = 0.4m)</td><td>1</td><td rowspan="8">3
(Negligible)</td></tr>
<tr><td>Slope Angle (6°)</td><td>3</td></tr>
<tr><td>FoS (Min = Cu_{min} >1.3)</td><td>1</td></tr>
<tr><td>Peat cracking / Infiltration</td><td>1</td></tr>
<tr><td>Groundwater Flow</td><td>1</td></tr>
<tr><td>Hydrology</td><td>1</td></tr>
<tr><td>Previous Instability</td><td>1</td></tr>
<tr><td>Land Management</td><td>1</td></tr>
<tr><td colspan="6"></td></tr>
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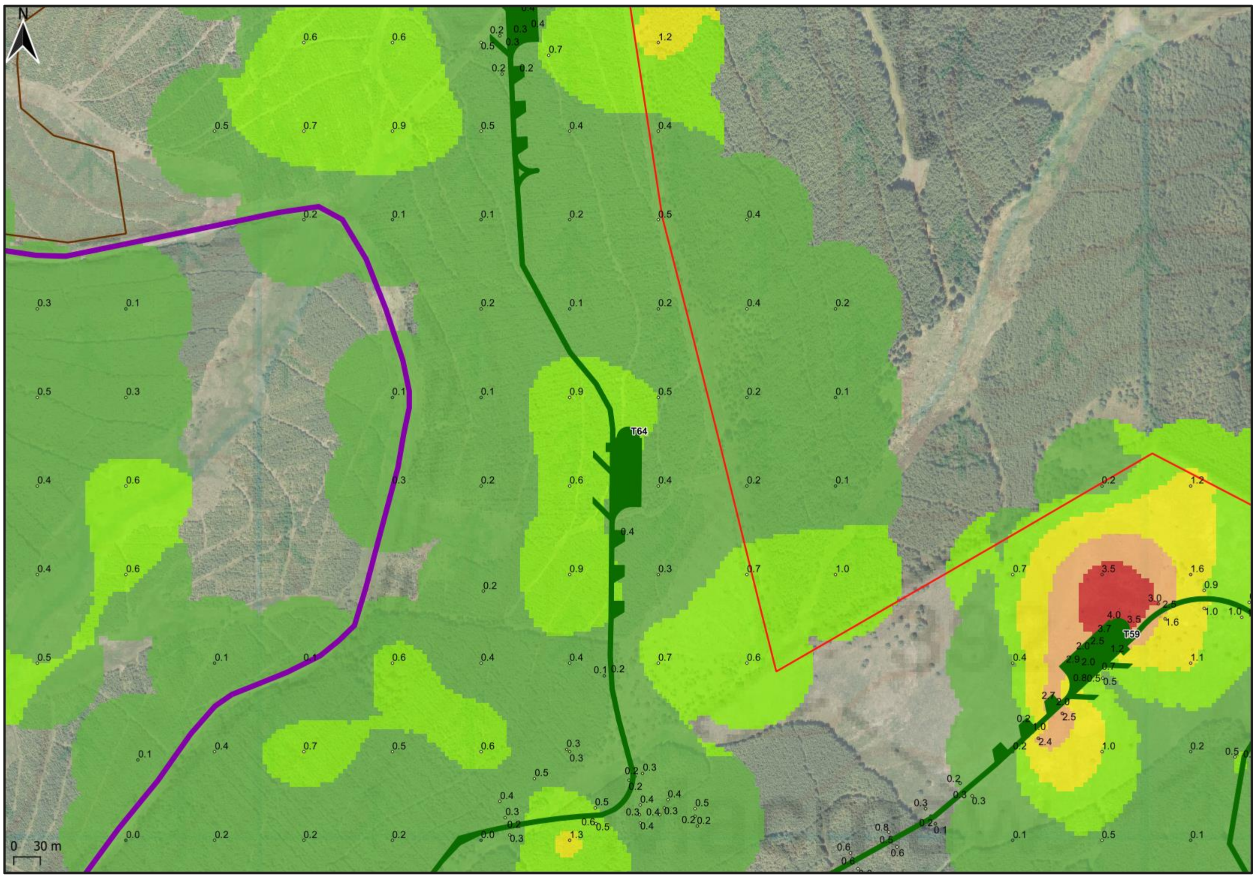
<table>
<tr><th>Recommendations</th><th>Residual Risk</th></tr>
<tr><td>• Utilise and maintain best working practices while working on a peatland site.

• Ensure hydrological regime is maintained throughout construction and life of the foundation.</td><td>Negligible</td></tr>
</table>

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T64	1	1 (207m from watercourse)	Peat Depth (Mean = 0.6m)	3	6 (Low)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

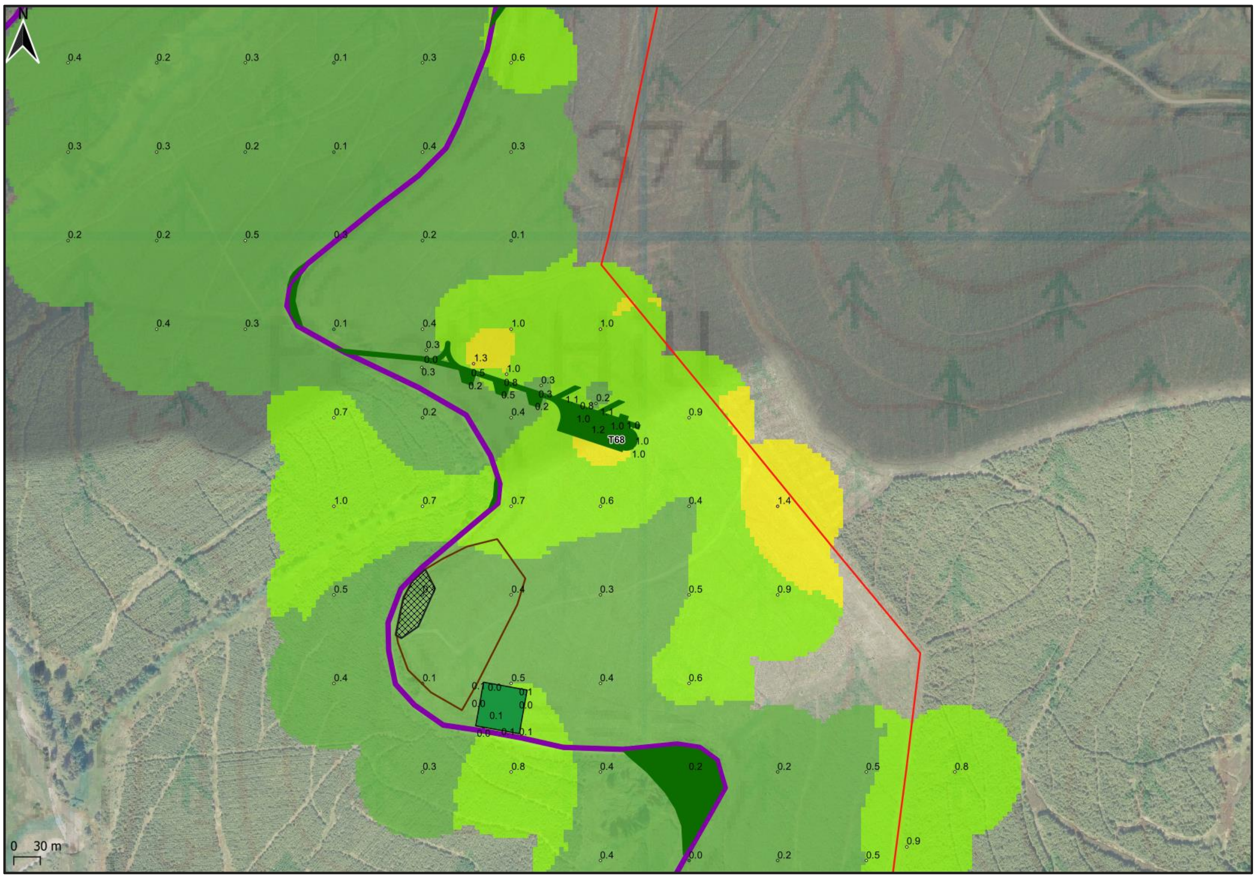
WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T67	1	1 (215m from watercourse)	Peat Depth (Mean = 0.1m)	1	**3** **(Negligible)**
			Slope Angle (9°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	

<table>
<tr><th>Discussion / Recommendations</th><th>Residual Risk</th></tr>
<tr><td>

Utilise and maintain best working practices while working on a peatland site.
Ensure hydrological regime is maintained throughout construction and life of the foundation.
Peat Depth at Proposed Turbine Foundation Infrastructure - 0.1m (Peat Absent) recorded by 100m grid survey.
Mean Peat Depth Surrounding Area – Peat soil thickness: mean depth 0.4m and likely represents a shallow mineral soil with isolated peat pockets
Terrain <12° terrain slope angle

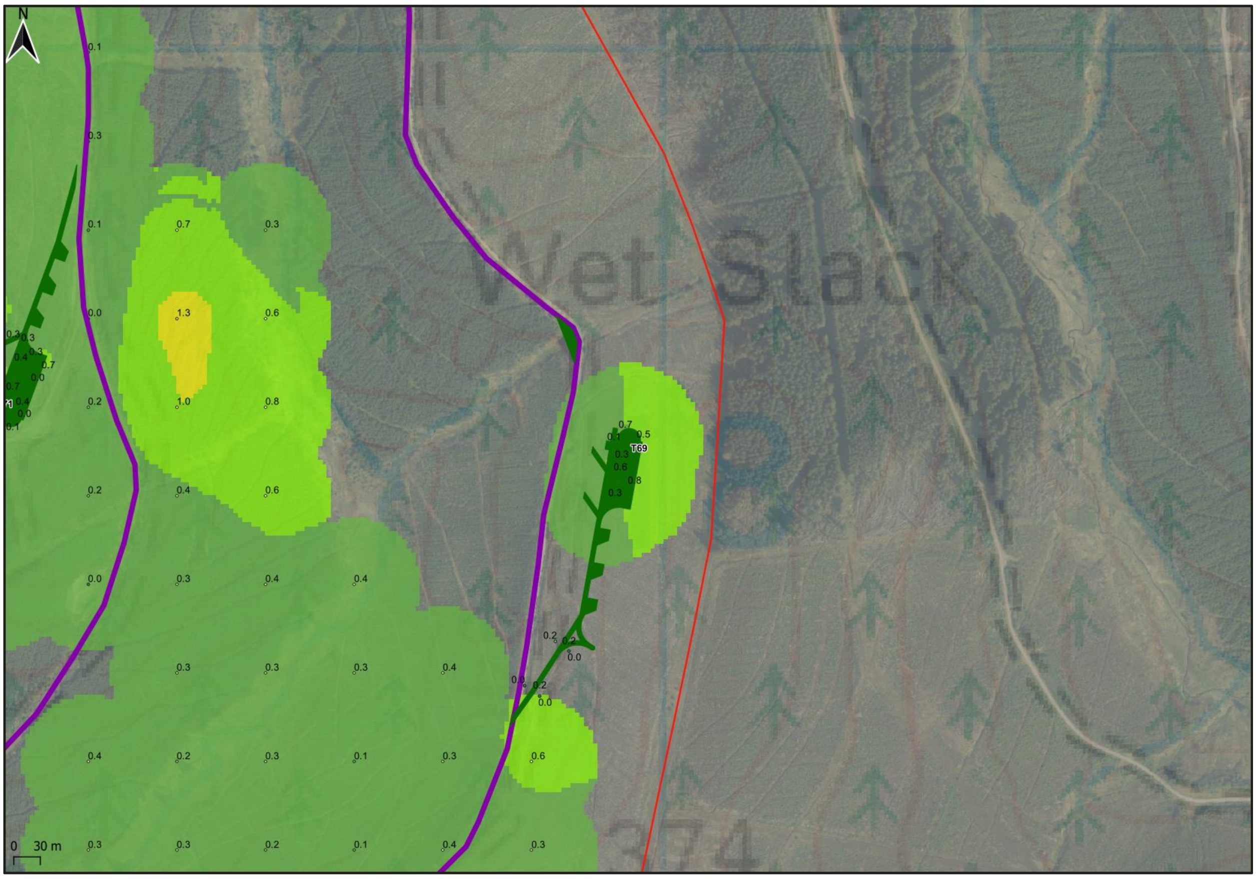
Across the surrounding terrain and in particular on the same slope system there is no continuous deep peat and contributory factors at proposed turbine locations indicated low risk from peat slide.
Recent felling activity has had no detectable impact on stability based on the aerial image assessment and final phase of survey. At time of the Stage 1 Survey Q1 2020; there was dense forestry recorded at the turbine location which hindered detailed probing since removed.
Significant distance for the nearest watercourse receptor (>200m).
</td><td>Negligible</td></tr>
</table>

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
T68	1	3 (82m from watercourse)	Peat Depth (Mean = 1.1m)	5	24 (High)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



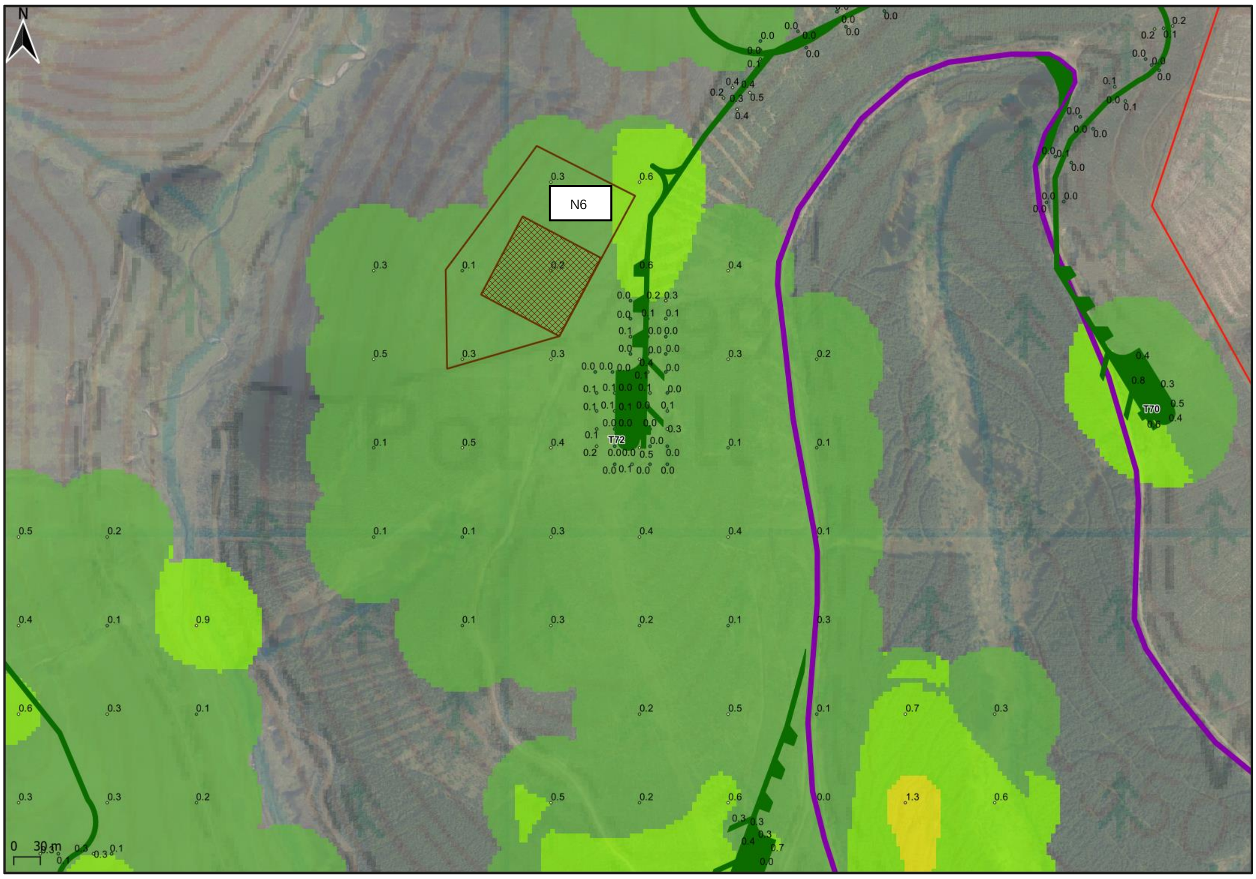
Discussion / Recommendations	Impact	Residual Risk
The high risk at this location requires specific mitigation measures to be applied in order permit development at this location: ● Ensure hydrological regime is maintained throughout construction and life of the foundation. Civil infrastructure drainage design to follow best practice guidance, buffering and dispersing surface waters around the turbine foundation and surrounding infrastructure. Do not concentrate outflows from infrastructure onto deep peat to prevent a build-up of pore pressure. ● No storage of peat or earthwork soil bunds downslope from the proposed infrastructure. To avoid surcharging the peat deposits in close proximity to the watercourse.	**Environmental Impact reduced to 1**	**8** **(Low)**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T69	1	2 (117m from watercourse)	Peat Depth (Mean = 0.5m)	1	6 (Low)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



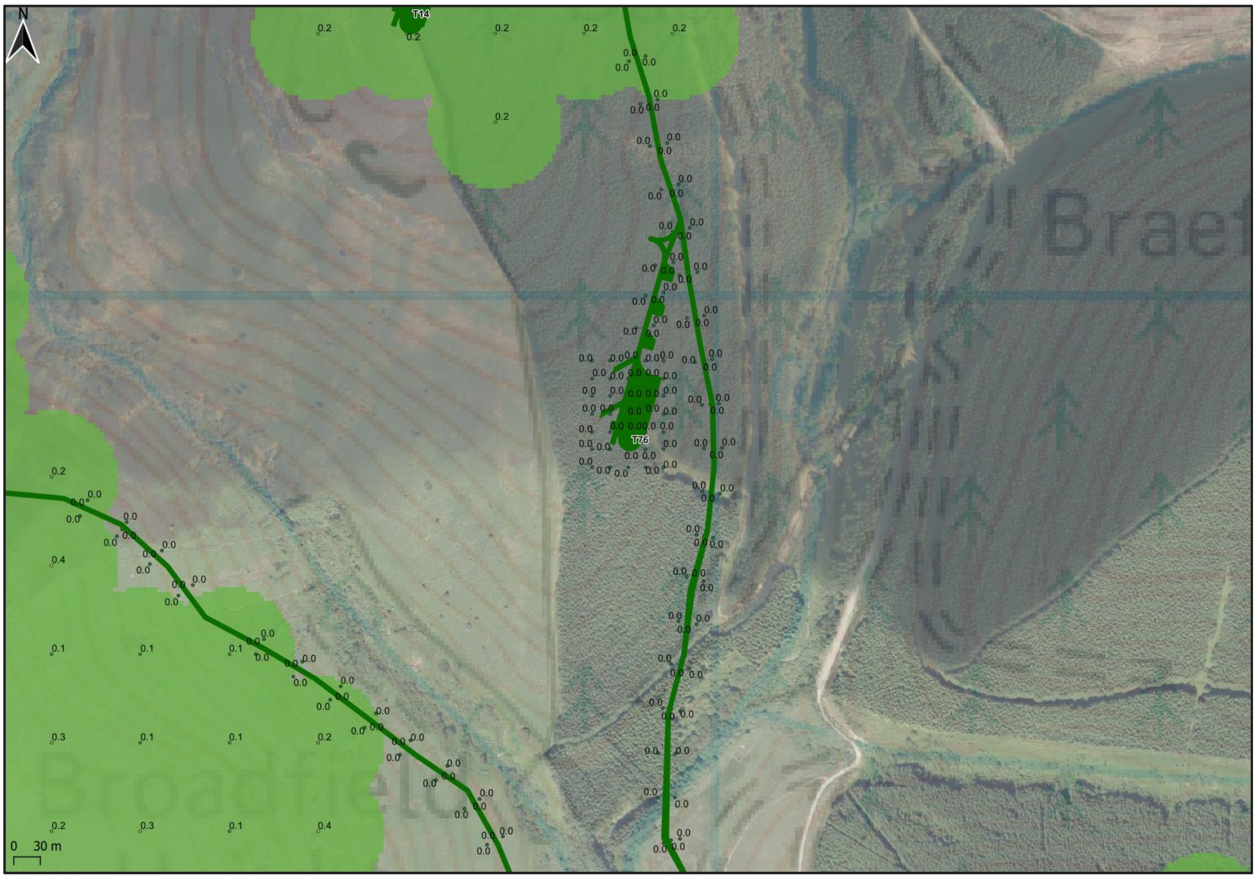
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	Negligible

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
T72	1	1 (203m from watercourse)	Peat Depth (Mean = 0.1m)	1	**5** **(Low)**
			Slope Angle (10°)	5	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



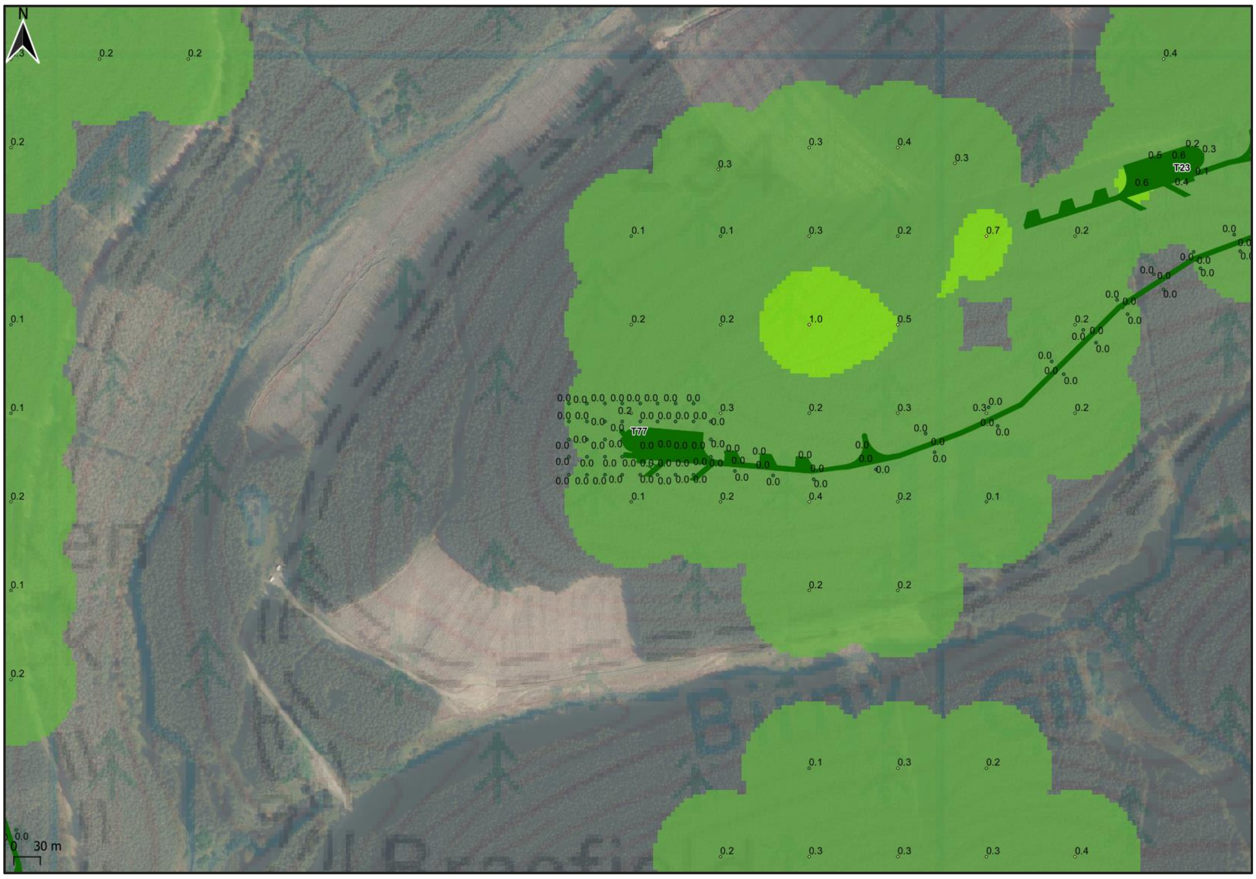
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Mean Probe depth at Proposed Infrastructure - 0.1m (Peat Absent with this probe depth indicative of shallow mineral soil) • Mean Peat Depth Surrounding Area – Peat / soil is thin mean 0.25m and likely represents a shallow mineral soil with isolated peat pocket or soft soil to the west and north. • Terrain <10° The 100m grid probing indicated no peat accumulation at the proposed wind turbine infrastructure location or across the controlling steeper slope system to the east. Across the surrounding terrain there is no continuous deep peat and contributory factors (Factor of Safety, hydrology and signs of previous instability) at the proposed turbine location indicate a low risk from peat slide.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
T76	1	1	Peat Depth (Mean = 0.0m)	1	5 (Low)
			Slope Angle (12°)	5	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



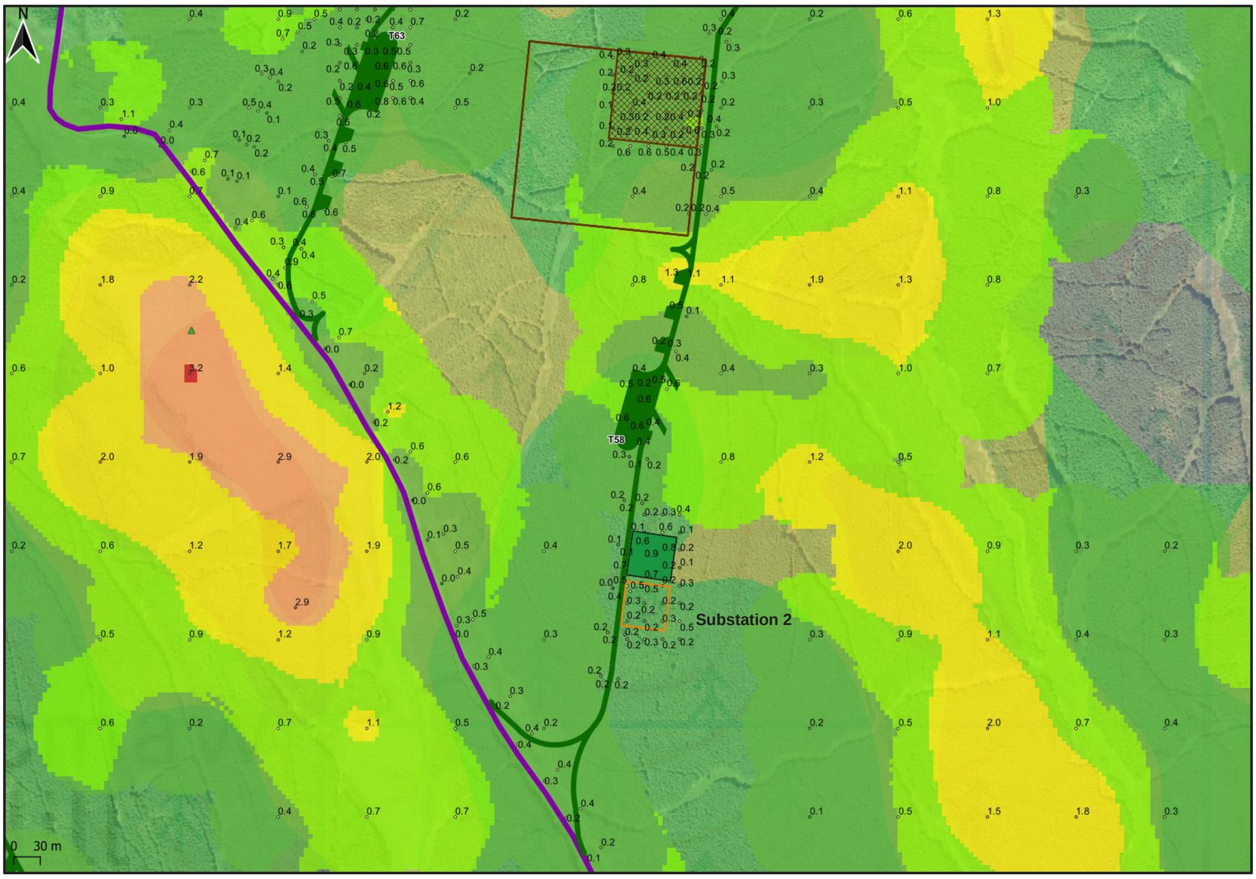
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. • Utilise and maintain best working practices while working on a peatland site. i.e., no transfer or reinstatement of excavated peat across areas not originally peatland. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
T77	1	1	Peat Depth (Mean 0.0m)	1	3 (Negligible)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



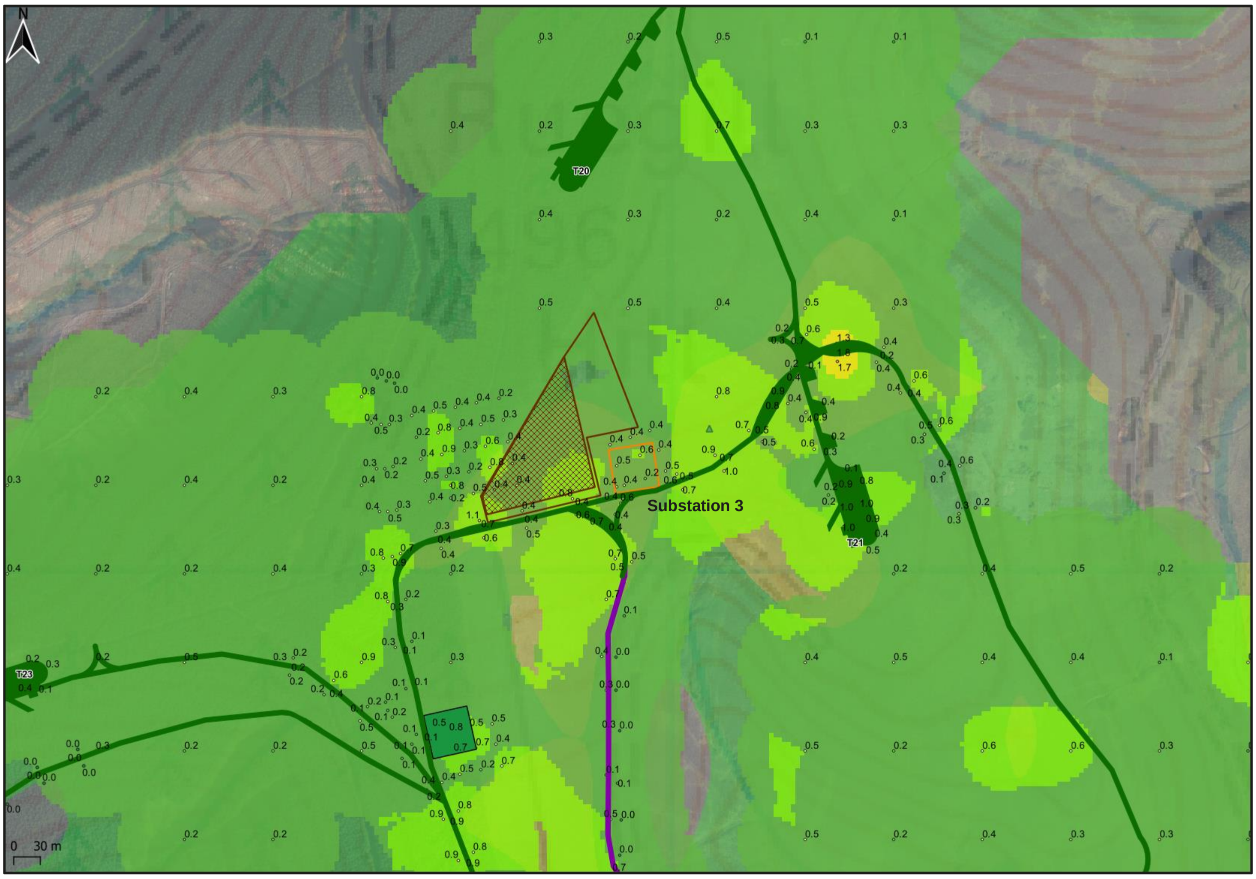
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. • Utilise and maintain best working practices while working on a peatland site. i.e., no transfer or reinstatement of excavated peat across areas not originally peatland. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	Negligible

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
Substation 2	1	1 (278m from watercourse)	Peat Depth (Mean = 0.3m)	1	1 (Negligible)
			Slope Angle (3°)	1	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



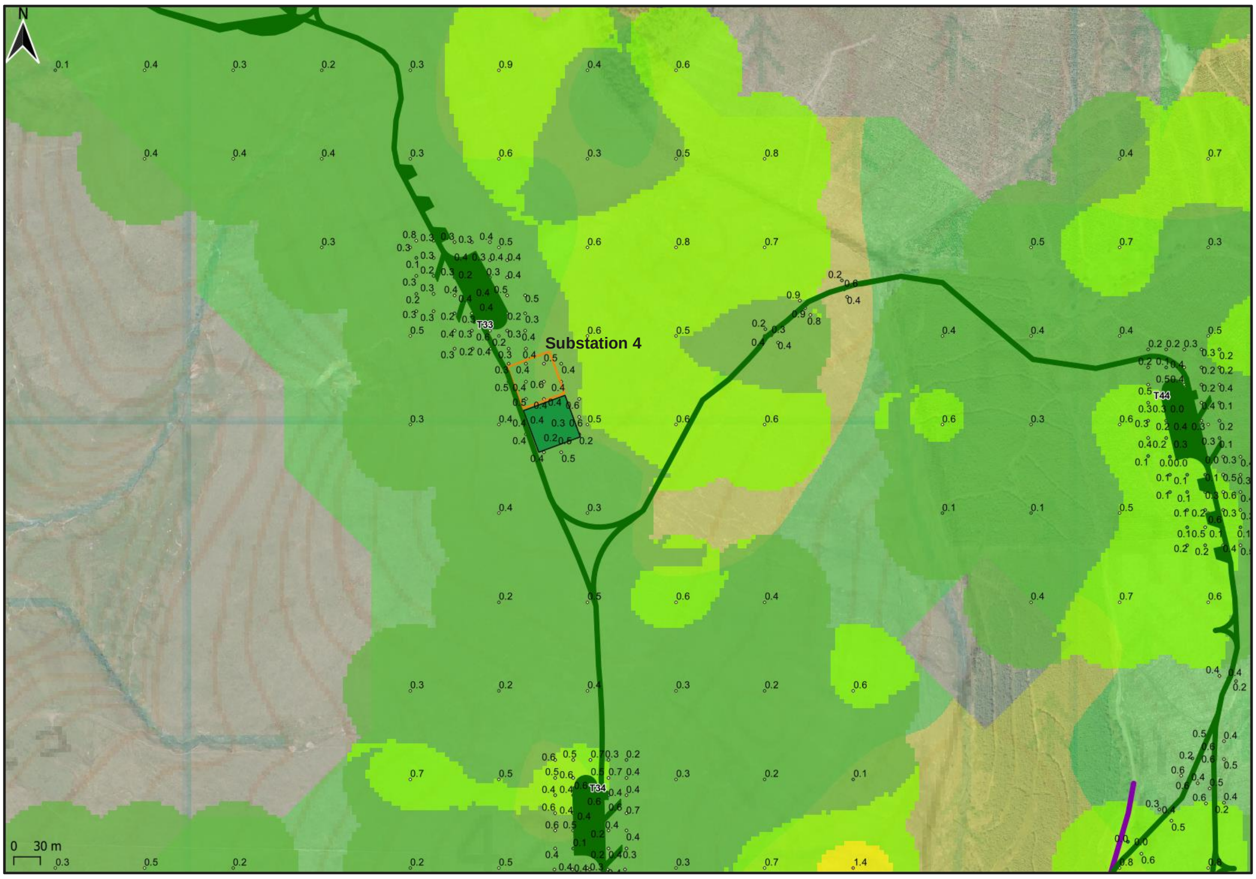
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. • Utilise and maintain best working practices while working on a peatland site. i.e., no transfer or reinstatement of excavated peat across areas not originally peatland. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Substation 3	1	1 (175m from watercourse)	Peat Depth (Mean = 0.4m)	1	3 (Negligible)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



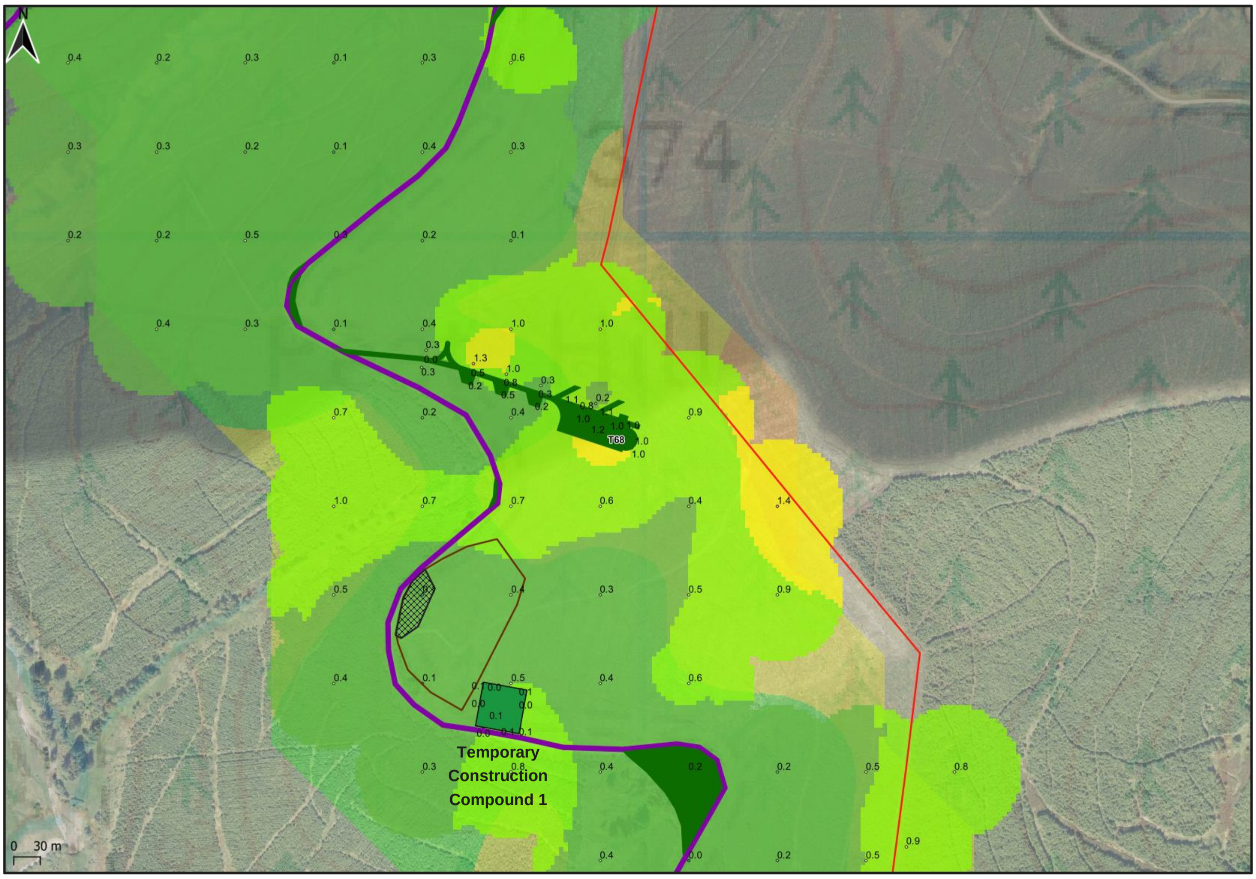
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
Substation 4	1	1 (185m from watercourse)	Peat Depth (Mean = 0.4m)	1	3 (Negligible)
			Slope Angle (5°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



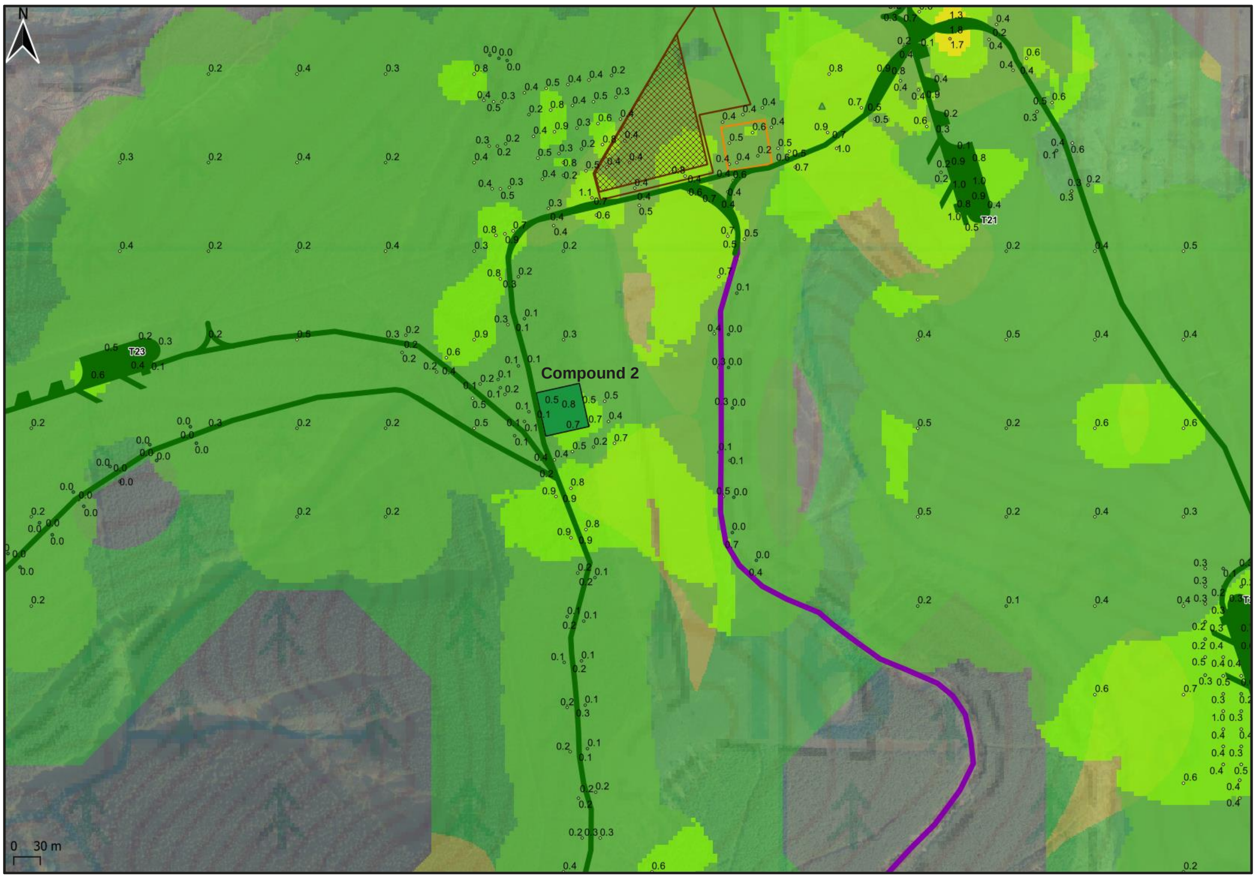
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. • Utilise and maintain best working practices while working on a peatland site. i.e., no transfer or reinstatement of excavated peat across areas not originally peatland. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Compound 1	1	1 (Watercourse buffer cross slope, nearest downslope is 233m)	Peat Depth (Mean = 0.1m)	1	**3 (Negligible)**
			Slope Angle (7°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



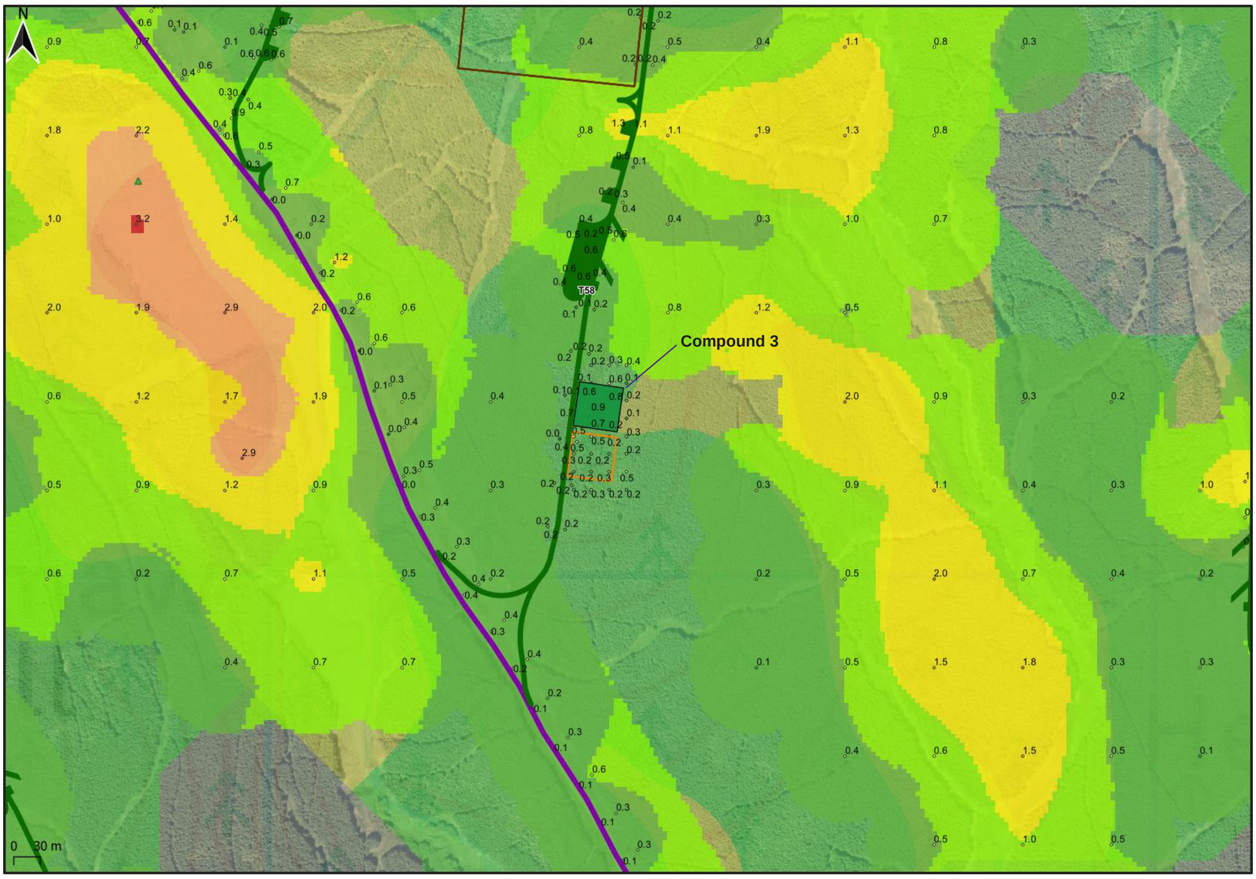
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. Soil probe depths 0.0-0.1m. Visual survey has futher confirmed the absence of peat at this location. • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
Compound 2	1	1 (211m from watercourse)	Peat Depth (Mean = 0.55 m)	3	6 (Low)
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



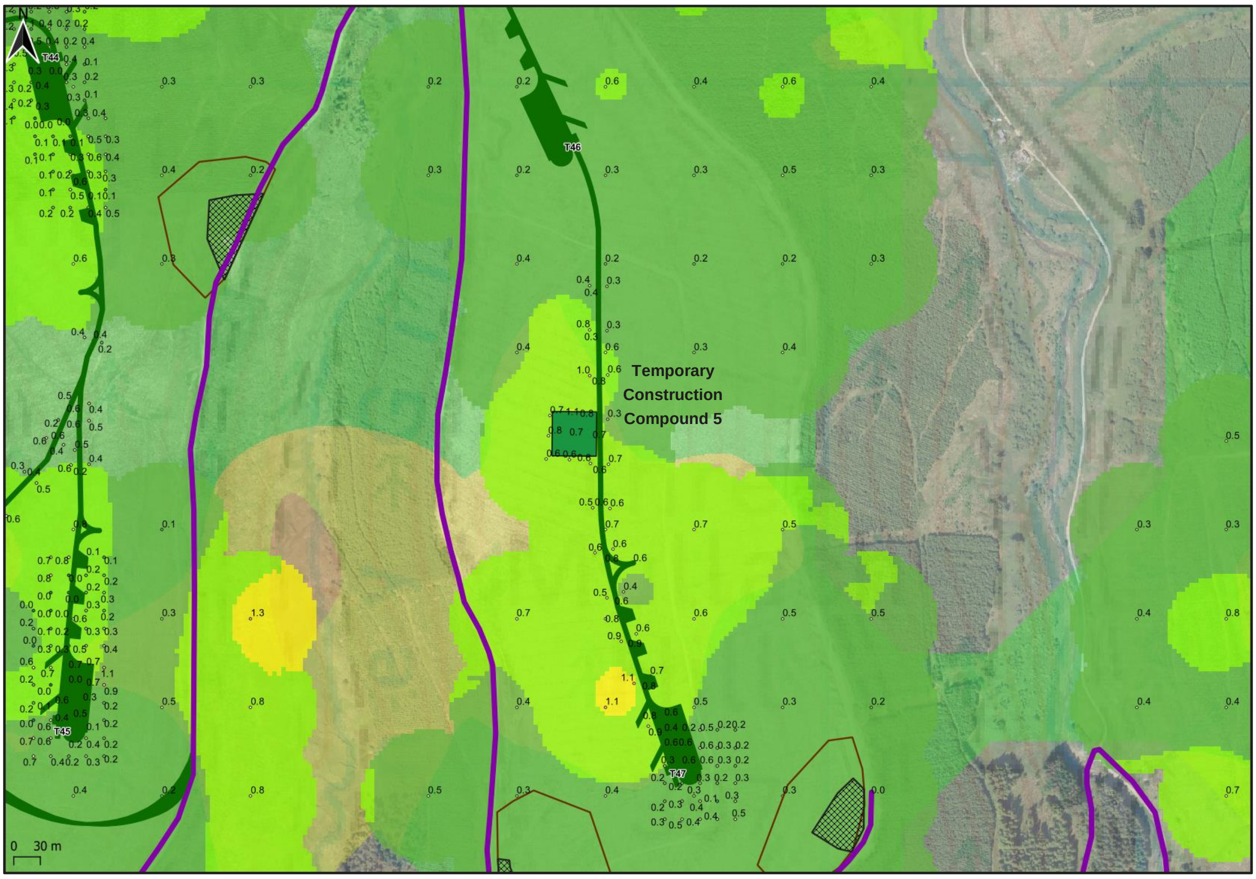
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Compound 3	1	1 (312m from watercourse)	Peat Depth (Mean = 0.3m)	1	1 (Negligible
			Slope Angle (3°)	1	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



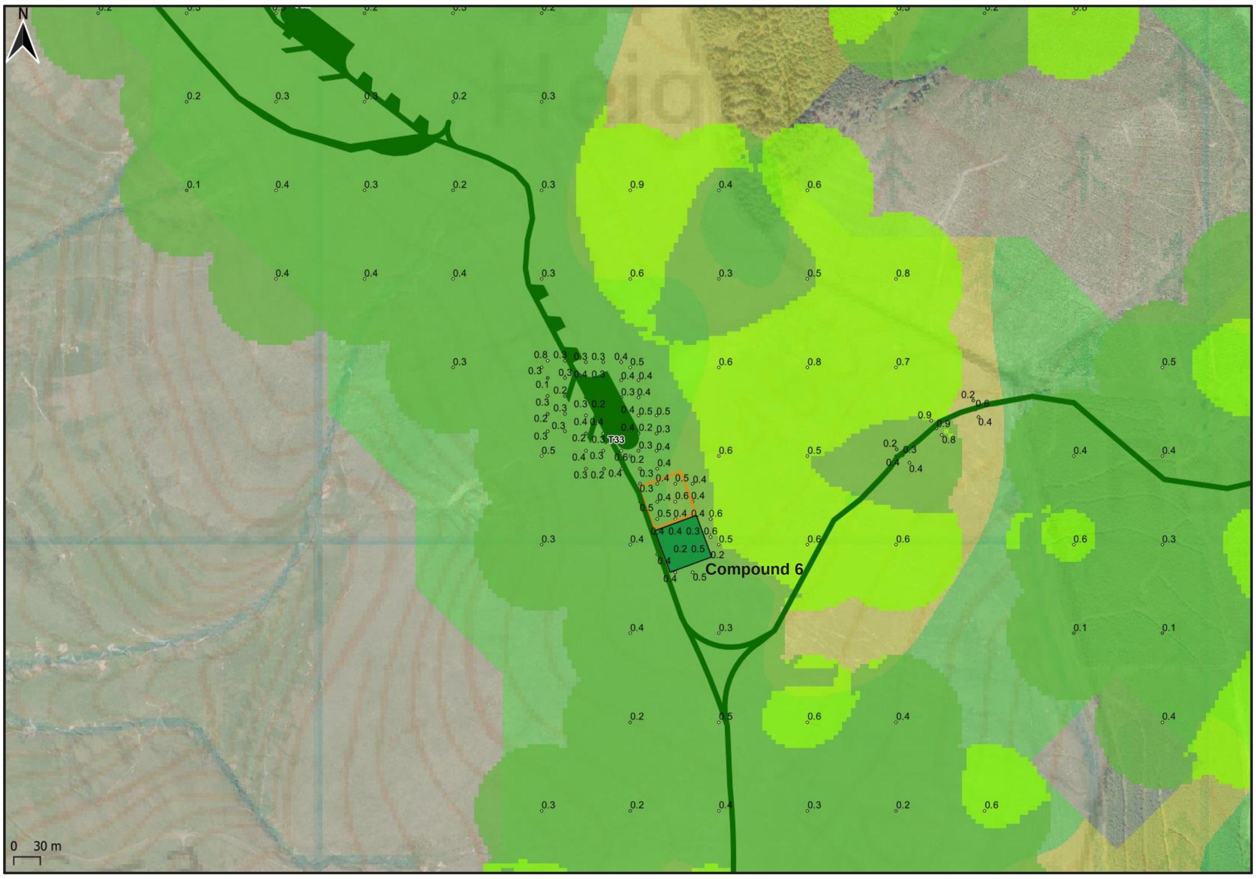
Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. Average soil probe depth is 0.3m and represented a shallow mineral soil • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Compound 5	1	1 (306m from watercourse)	Peat Depth (Mean = 0.7m)	3	6 (Low)
			Slope Angle (4°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



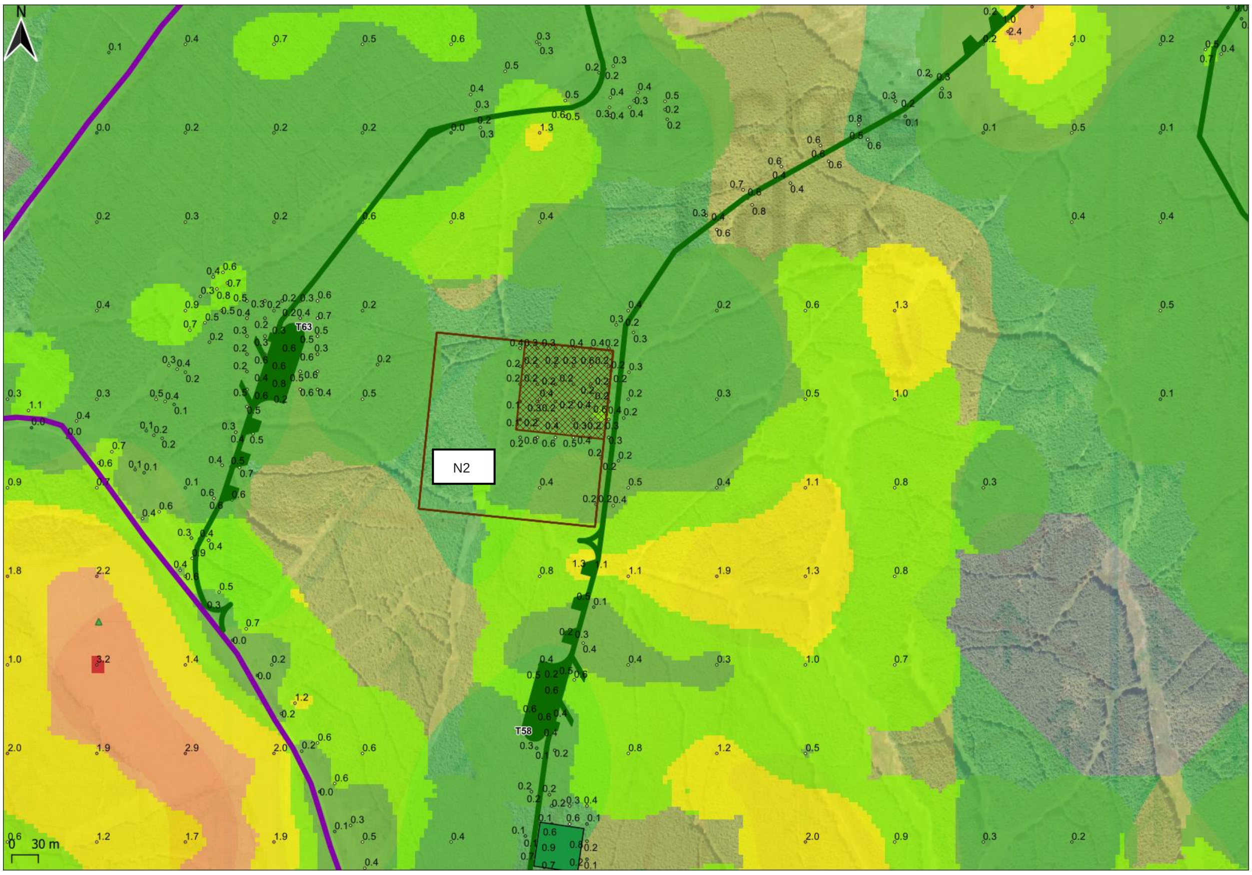
Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
Compound 6	1	1 (264m from watercourse)	Peat Depth (Mean = 0.4m)	1	**3** **(Negligible)**
			Slope Angle (8°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



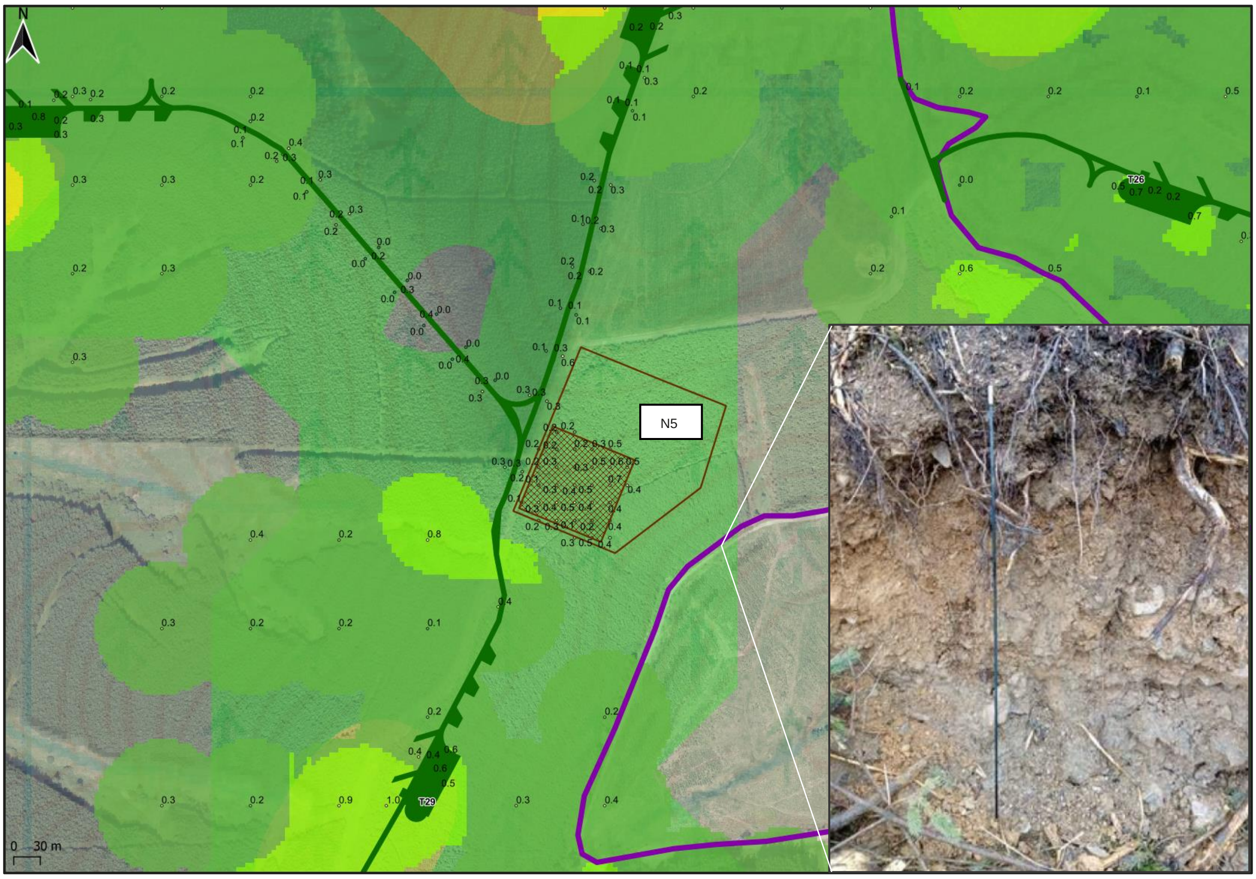
Discussion / Recommendations	Residual Risk
• Determined to be not on peatland or blanket bog. Average soil probe depths of 0.4m visual surveys have determined this location not to be peatland. • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Proposed Borrow Pit N2	1	1 (295m from watercourse)	Peat Depth (Mean = 0.3m)	1	**3 (Negligible)**
			Slope Angle (5°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



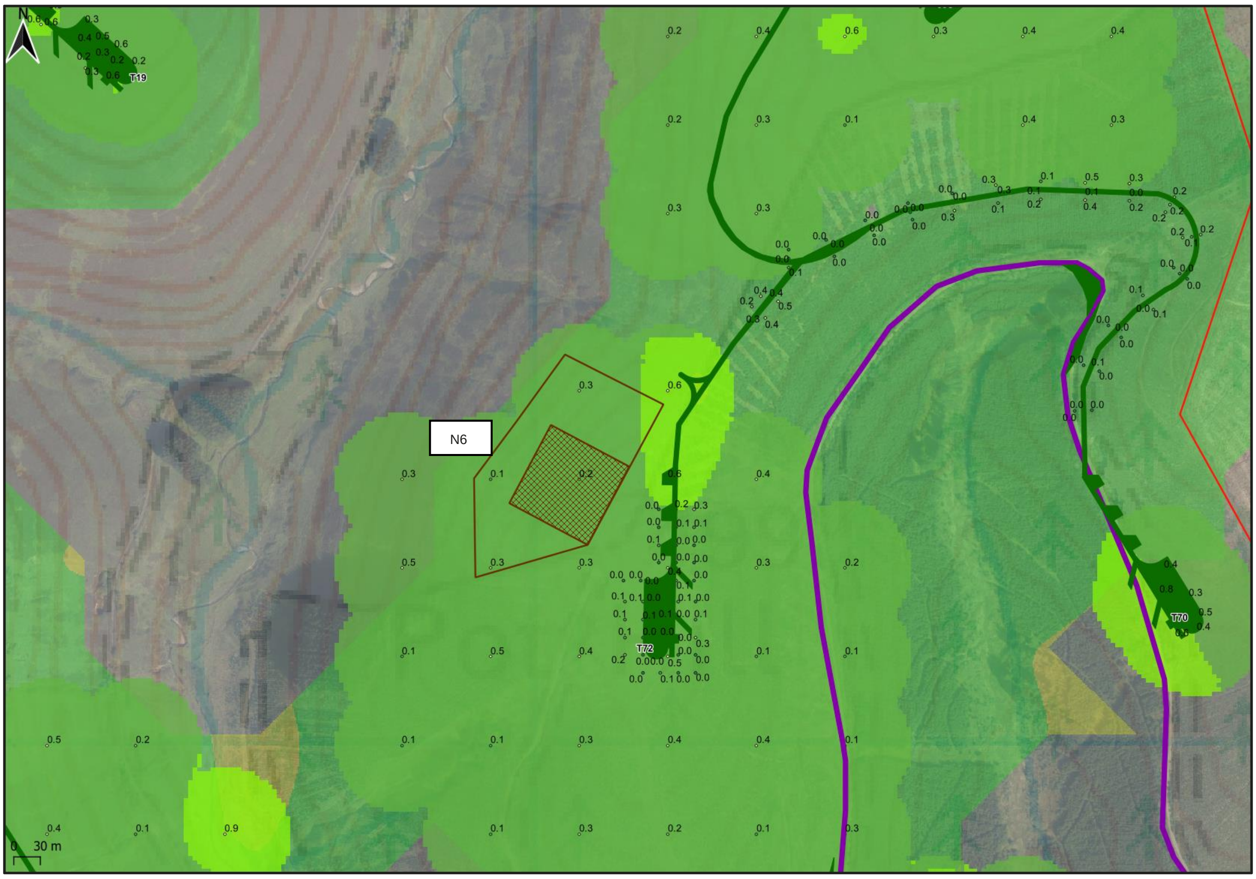
Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Determined in the Stage 1 survey to be not located on peatland with average depths of 0.2-0.3m indicating thin soil coverage and no peat accumulation. Thus, these locations were screened out of any further detailed stability assessment in line with guidance.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure	Score	Risk Ranking
Proposed Borrow Pit N5	1	1 (270m from watercourse)	Peat Depth (Mean = 0.3m)	1	**3 (Negligible)**
			Slope Angle (5°)	3	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



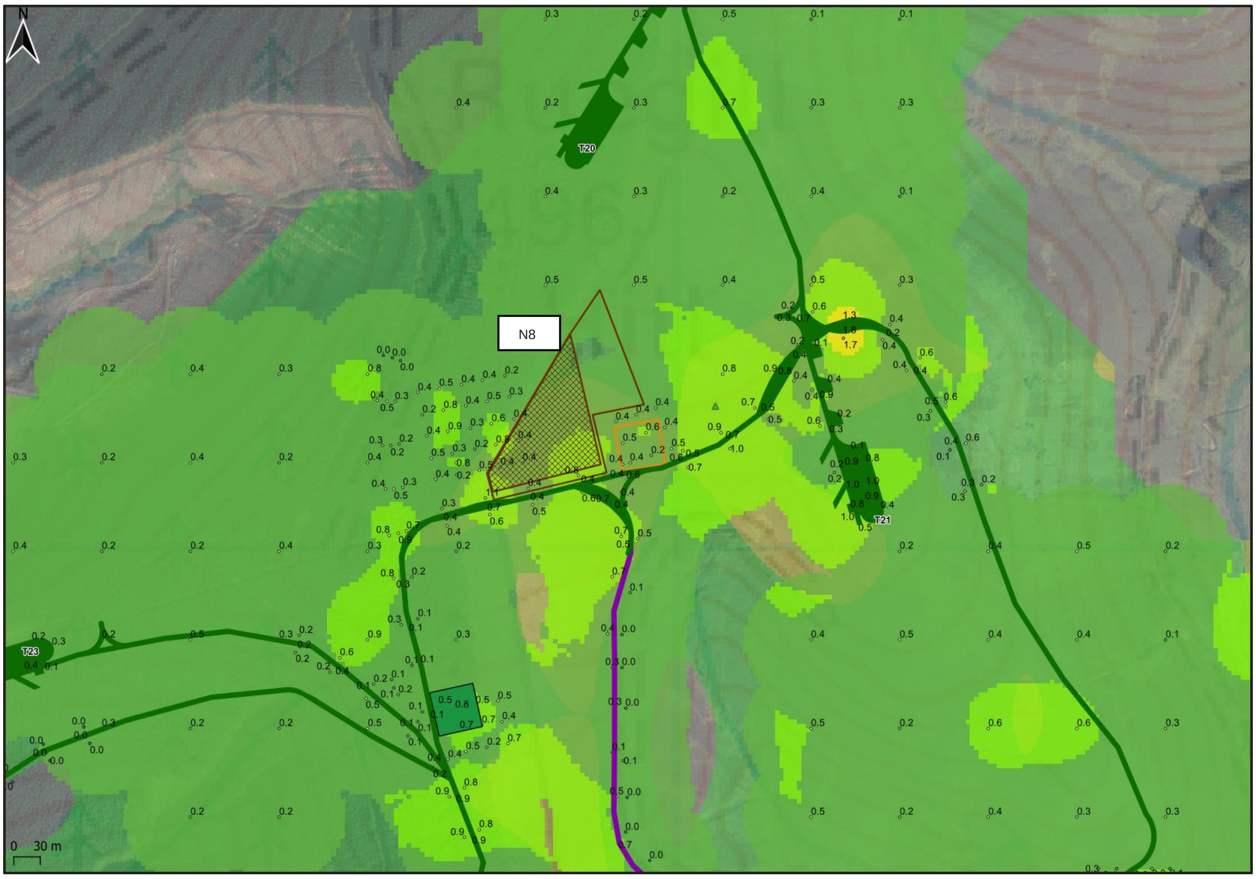
Discussion / Recommendations	Residual Risk
• Borrow Pit N5 was not accessible due to steep slopes and dense forestry during initial survey, final phase of survey allowed access following tree felling. • Probing indicated 0.3m soil depth. and visual reconnaissance evidence of thin soil coverage only. • In addition, reconnaissance photography from the access track cutting to the southeast revealed an absence of peat. (See photo inset). • The location is a significant distance from the nearest sensitive receptor (>250m). • Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributory Factors (Probability/Exposure)	Score	Risk Ranking
Proposed Borrow Pit N6	1	1 (260m from watercourse)	Peat Depth (Mean = 0.2m)	1	**5** **(Low)**
			Slope Angle (10°)	5	
			FoS (Min = Cu_{min} >1.3)	1	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. At BP N6 (B) Stage 1 probe data did not reveal any evidence of blanket peat or raised bog conditions. The terrain across this location is steepened and with an indicative shallow soil overburden thickness. Thus, the borrow pit search area is proposed to allow for efficient extraction of bedrock materials from the steeply rising southern aspect slope. The borrow pit location was chosen specifically for its avoidance of peat deposits. Deeper intrusive geotechnical investigation is the next logical step to confirm the geotechnical ground model, including soil profile and underlying rock mass classification. This would be carried out as part of the pre-construction phase of works and post consent.	**Negligible**

WTG ID	Development Infrastructure	Environmental	Contributary Factors (Probability/Exposure)	Score	Risk Ranking
Proposed Borrow Pit N8	1	2 (85m from watercourse)	Peat Depth (Mean = 0.4m)	1	**8** **(Low)**
			Slope Angle (20°)	2	
			FoS (Min = Cu_{min} >1.3)	2	
			Peat cracking / Infiltration	1	
			Groundwater Flow	1	
			Hydrology	1	
			Previous Instability	1	
			Land Management	1	



Discussion / Recommendations	Residual Risk
• Utilise and maintain best working practices while working on a peatland site. • Ensure hydrological regime is maintained throughout construction and life of the foundation. • Terrain at Borrow Pit 'N8' is relatively steep with only thin probing depths recorded. The conclusion was hence this location was not indicative of peatland or a blanket bog location. The thin soil cover and steep slopes were primary selection criteria for this borrow pit.	**Negligible**

Source: Natural Power

7.1. Turbine Bases – Risk Summary

Table 7.2 below summarises the risk assignments for each turbine and infrastructure location. The principal contributory factors and impact scales used to derive these assignments are also stated. A risk rank is indicated after targeted mitigation and best practice construction. Details of which are provided in Section 8.3.

Table 7.2: Risk Assessment Outcome and Hazard Ranking Assignment

Turbine ID	Risk Ranking	Principal Contributory Factors in Risk Assessment	Risk Ranking with Targeted Mitigation and Best Practice Construction
T11	3 (Negligible)	Slope angle	Negligible
T12	10 (Low)	Environmental, Slope angle	Negligible
T13	3 (Negligible)	Slope angle	Negligible
T14	5 (Low)	Slope angle	Negligible
T15	6 (Low)	Environmental, Slope angle	Negligible
T16	6 (Low)	Environmental, Slope angle	Negligible
T17	6 (Low)	Peat depth, Slope angle	Negligible
T18	3 (Negligible)	Slope angle	Negligible
T19	3 (Negligible)	Slope angle	Negligible
T20	3 (Negligible)	Slope angle	Negligible
T21	6 (Low)	Peat depth, Slope angle	Negligible
T22	5 (Low)	Peat depth, Slope angle	Negligible
T23	3 (Negligible)	Peat depth	Negligible
T24	6 (Low)	Peat depth, Slope angle	Negligible
T25	6 (Low)	Environmental, Slope angle	Negligible
T26	6 (Low)	Slope angle, Peat Depth	Negligible
T27	6 (Low)	Peat Depth, Slope angle, Environmental	Negligible
T28	6 (Low)	Peat depth, Slope angle	Negligible
T29	6 (Low)	Peat depth, Slope angle	Negligible
T30	3 (Negligible)	Slope angle	Negligible

Turbine ID	Risk Ranking	Principal Contributary Factors in Risk Assessment	Risk Ranking with Targeted Mitigation and Best Practice Construction
T31	5 (Low)	Slope angle	Negligible
T32	10 (Low)	Environmental, Slope angle	Negligible
T33	6 (Low)	Environmental, Slope angle	Negligible
T34	6 (Low)	Environmental, Slope angle	Negligible
T36	3 (Negligible)	Slope angle	Negligible
T39	3 (Negligible)	Slope angle	Negligible
T40	3 (Negligible)	Slope angle	Negligible
T41	3 (Negligible)	Slope angle	Negligible
T42	3 (Negligible)	Slope angle	Negligible
T43	3 (Negligible)	Environmental, Slope angle	Negligible
T44	5 (Low)	Environmental, Slope angle, Peat depth	Negligible
T45	3 (Negligible)	Slope angle	Negligible
T46	5 (Low)	Slope angle	Negligible
T47	6 (Low)	Peat depth, Slope angle	Negligible
T48	3 (Negligible)	Slope angle	Negligible
T49	5 (Low)	Slope angle	Negligible
T50	4 (Negligible)	Slope angle	Negligible
T51	5 (Low)	Slope angle	Negligible
T52	3 (Negligible)	Peat depth, Slope angle	Negligible
T53	3 (Negligible)	Slope angle	Negligible
T55	9 (Low)	Environmental, Slope angle	Negligible
T57	6 (Low)	Peat depth, Slope angle	Negligible
T58	3 (Negligible)	Slope angle	Negligible
T59	2 (Negligible)	Peat depth	Negligible

Turbine ID	Risk Ranking	Principal Contributary Factors in Risk Assessment	Risk Ranking with Targeted Mitigation and Best Practice Construction
T60	12 (Medium)	Environmental, Peat Depth	Low
T63	3 (Negligible)	Slope angle	Negligible
T64	6 (Low)	Peat depth, Slope angle	Negligible
T65	3 (Negligible)	Slope Angle	Negligible
T66	10 (Low)	Environmental, Slope angle	Negligible
T67	3 (Negligible)	Slope angle	Negligible
T68	24 (High)	Environmental, Slope angle, Peat depth	Low
T69	6 (Low)	Environmental, Slope angle	Negligible
T70	5 (Low)	Slope angle	Negligible
T71	3 (Negligible)	Slope angle	Negligible
T72	5 (Low)	Peat depth, Slope angle	Negligible
T73	3 (Negligible)	Slope angle	Negligible
T74	6 (Low)	Environmental, Slope angle	Negligible
T75	3 (Negligible)	Slope angle	Negligible
T76	5 (Low)	Slope angle	Negligible
T77	3 (Negligible)	Slope angle	Negligible
SS1 & SSCC	1 (Negligible)	Environmental	Negligible
SS2	1 (Negligible)	Peat Depth	Negligible
SS3	3 (Negligible)	Slope Angle	Negligible
SS4	3 (Negligible)	Slope Angle	Negligible
CC1	3 (Negligible)	Slope Angle	Negligible
CC2	6 (Low)	Peat Depth, Slope Angle	Negligible
CC3	1 (Negligible)	Peat Depth	Negligible

Turbine ID	Risk Ranking	Principal Contributary Factors in Risk Assessment	Risk Ranking with Targeted Mitigation and Best Practice Construction
CC4	**3 (Negligible)**	Slope Angle	**Negligible**
CC5	**6 (Low)**	Peat Depth, Slope Angle	**Negligible**
CC6	**3 (Negligible)**	Slope Angle	**Negligible**
CC8	**3 (Negligible)**	Slope Angle	**Negligible**
CC9	**9 (Low)**	Environmental, Slope angle	**Negligible**
BP N2	**3 (Negligible)**	Environmental, Slope angle	**Negligible**
BP N3	**3 (Negligible)**	Slope Angle	**Negligible**
BP N5	**3 (Negligible)**	Slope Angle	**Negligible**
BP N6	**5 (Low)**	Peat Depth, Slope Angle	**Negligible**
BP N7	**5 (Low)**	Slope Angle	**Negligible**
BP N8	**8 (Low)**	Environmental, Slope Angle, FOS	**Negligible**

Source: Natural Power

The table above shows 76 of the 78 locations assessed to be of low or negligible risk from peat slide prior to mitigation. Through the use of an experienced civil contactor, and use of the recommendations listed in Section 8.3, the risk at these 76 locations can be viewed as negligible.

Two locations, T60 and T68, are rated as medium and high, prior to any mitigation being implemented. This is due to proximity to nearby watercourse receptors. Where micro siting is not possible, targeted mitigation measures, such as engineered barriers to stop or divert a potential peat slide will be required to negate the watercourse proximity, and therefore the risk from peat slide. Mitigation measures and design will require information from the site investigation, which will be carried out post consent.

The risk assessment reflects the probability of peat material entering the surface water course and being entrained to an offsite receptor without any mitigation. Although, the wider geomorphological assessment and evidence from recorded peat depths would indicate that a large-scale translational mass movement of peat deposits is unlikely.

The presence of commercial forestry stands across areas of the site is highlighted. Through conducting the stability assessment there has been no evidence to suggest the previous or existing forestry practices across the development have previously caused or contributed to peat instability.

7.1.1. Access Tracks - Peat Depth & Risk Slide Risk

The assessment for track elements has been undertaken using two central modes of assessment. The geospatial risk analysis utilising site wide data as represented on the Peat Stability Risk Zones mapping, Figure 10.2.8, Appendix A. This assessment factors watercourses as the primary sensitive receptor. This risk mapping is coupled with the assessment of discrete track sections at Table 7.3, focussing in on the higher risk track sections and discusses the relevant contributary factors to instability risk.

The assessment examines the recorded peat depths, interpolation, and terrain data for each discrete elevated risk track section. Assessment ultimately is determined to be at the lowest negligible risk level based on the qualitative assessment and in general prevalence of shallow peat and facility to apply best practice construction measures.

The risk assessment of the track (un-mitigated) is depicted on the risk zonation mapping and has been determined using the same methodology as the wider assessments. It is the residual risk which is considered within the report (Table 7.3), and which applies qualitative judgement based on the recorded site environs.

The soil depths recorded along the proposed access tracks are generally shallow. This section highlights specific areas of elevated peat depth along tracks and assesses them for peat slide risk. It also discusses the track sections where risk has been assessed using conservative estimates from comparisons of peat depth using slope angle. Locations are summarised on Figure 7.1 & 7.2 below.

Source: Natural Power, Openstreet Map

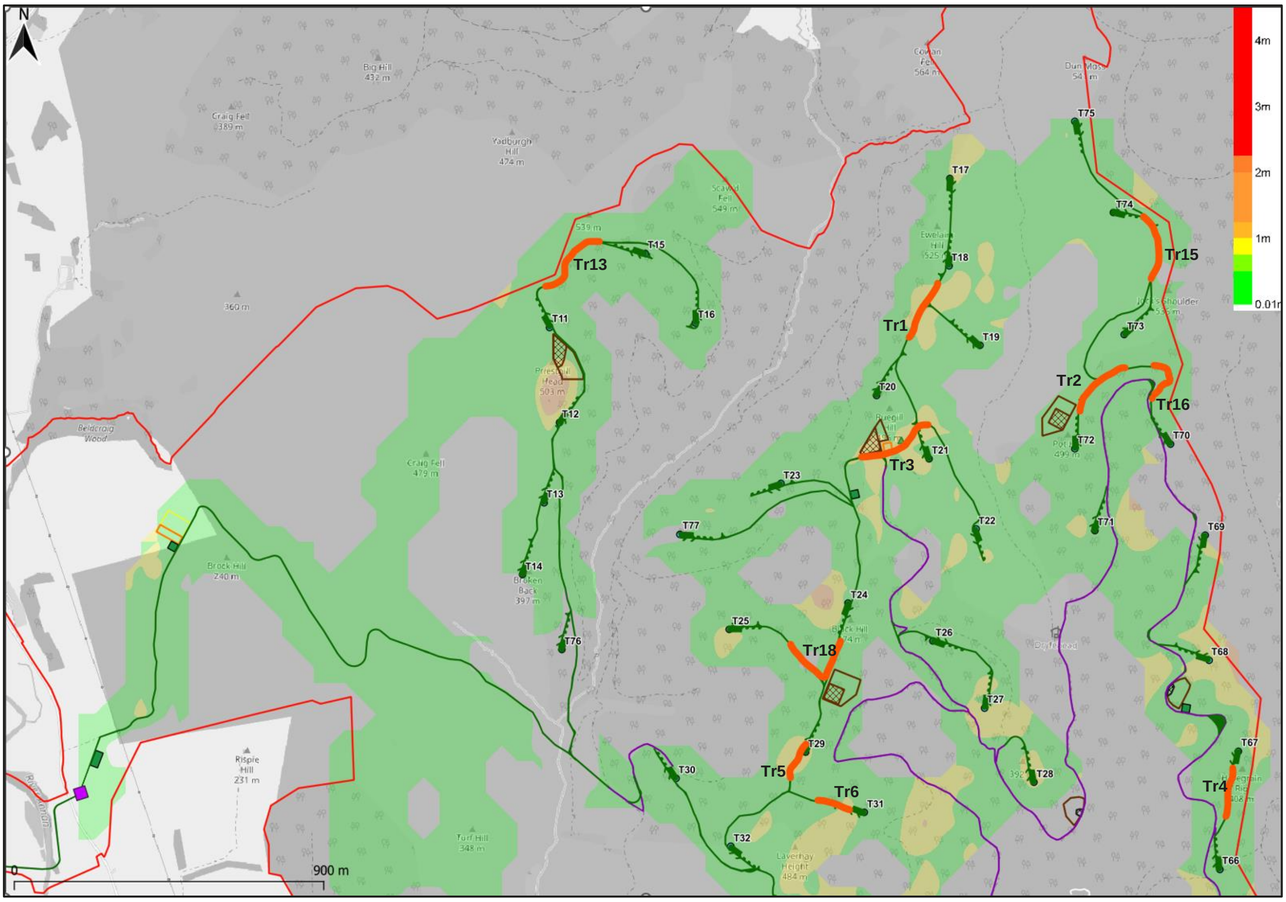


Figure 7.1: Highlighted Access Track Locations North

Source: Natural Power

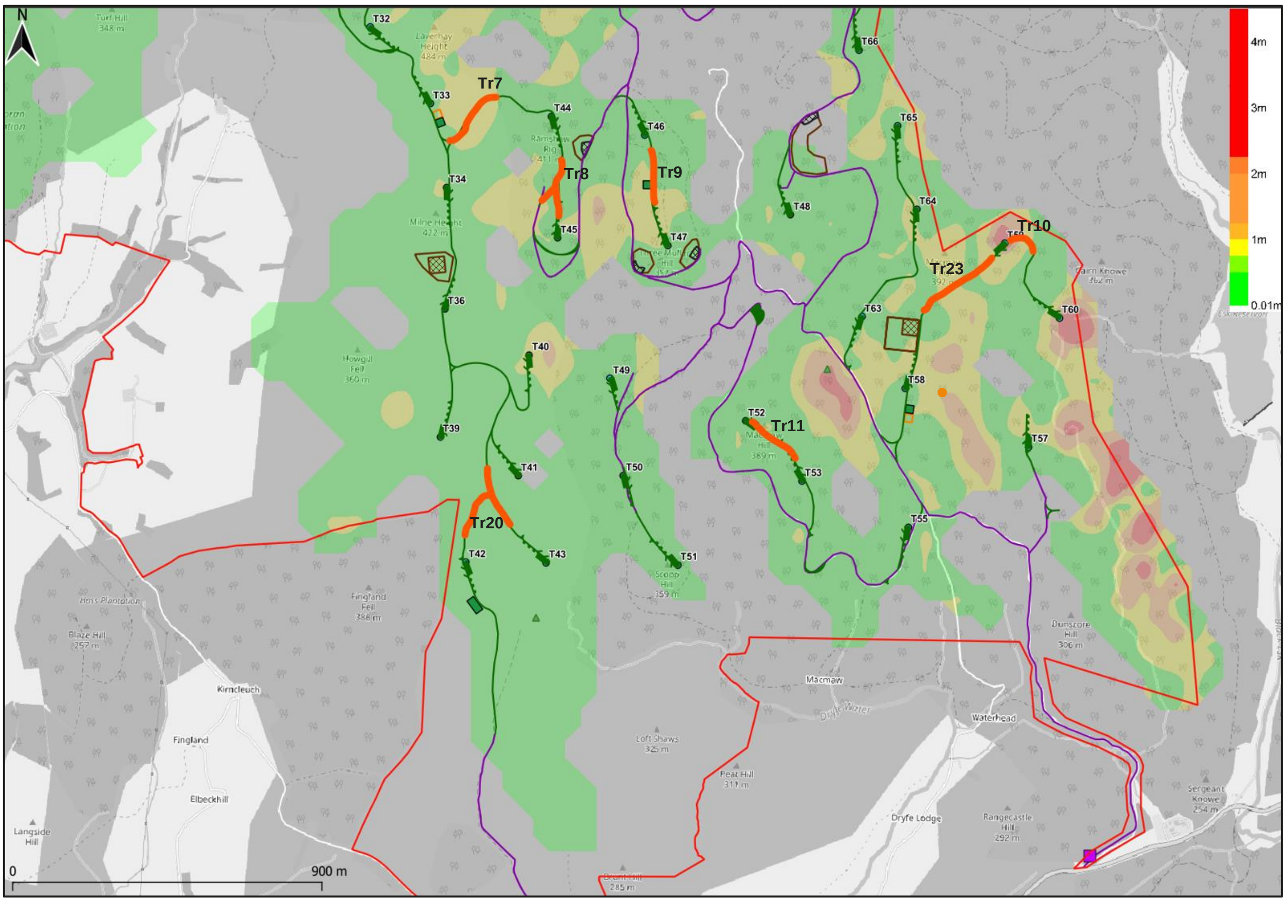


Figure 7.2: Highlighted Access Track (Shown in Bright Thick Orange Line) Locations South

Tracks with elevated peat depth generally correspond to the flatter areas where peat has accumulated. Areas with a higher slope angle are included below as they were not deemed likely to have deep deposits of peat.

Mean peat depth and slope angle have been used to represent the full length of the track section. Mean peat depth and slope angle are calculated by sampling the interpolated peat depth model at 10m intervals along the track.

Table 7.3: Overview of Peat Depths at Medium to High Risk Proposed Access Tracks

Peat Depth Slope Angle	0 – 0.5m (Score: 1) 0° – 3° (Score: 1)	> 3.0m (Score: 2) >20° (Score: 2)	0.5 – 1.0m (Score: 3) 3° – 10° (Score: 3)	2.0 – 3.0m (Score: 4) 15° – 20° (Score: 4)	1.0 – 2.0m (Score: 5) 10° – 15° (Score: 5)
Location & Length	**Mean Peat Depth (m)**	**Mean Slope Angle °**	**Comments**		
Track 1 (220m) Near to T18 and T19	0.8	8°	Peat depth and slope angle present a Low risk of peat slide in this area. Area is surrounded with peat depths <0.3m, and deeper peat areas don't correspond with higher risk slopes. Watercourse located >150m down slope. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 2 (190m) Near T72	0.6	14°	Peat depth and slope angle present a Low risk of peat slide in this area. Area is surrounded by peat depths <0.4m. Limited deep peat areas correspond to steep slopes, but they have limited lateral extent. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 3 (560m) Near T21 and T23	0.6	6°	Peat depth and slope angle present a Low risk of peat slide in this area. Deeper peat is present in smaller pockets, surrounded by peat depth of <0.5m. Watercourse is present >150m to the south. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 4 (140m) Near T67	0.7	6°	Peat depth and slope angle present a Low risk of peat slide in this area. Area is surrounded by peat depths of <0.4m. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 5 (200m) Near T29	0.7	6°	Peat depth and slope angle present a Low risk of peat slide in this area. Peat depth outside the area is <0.4m. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 6 (150m) Near T31	0.7	8°	Peat depth and slope angle present a Low risk of peat slide in this area. Peat depth outside this area is <0.4m. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 7 (130m) Near T33	0.6	9°	Peat depth and slope angle present a Low risk of peat slide in this area. Peat depth is <0.5m outside of this area. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 8 (610m) Near T44 and T45	0.6	5°	Peat depth and slope angle present a Low risk of peat slide in this area. This track length follows a broad ridgeline, the slope angle is likely increased by small scale artefacts in the model and small changes in slope. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 9 (440m) Near T47	0.7	2°	Peat depth and slope angle present a **Negligible** Peat Slide risk at this location. Best practice construction techniques and maintaining of hydrological regime should still be implemented.		
Track 10			Track Section Removed in AI 2022 Layout		
Track 11 (120m) Near T52	0.5	11°	Peat depth and slope angle present a Low risk of peat slide in this area. Peat depth outside of this area is <0.5m. Given best practice construction techniques and maintaining of the natural hydrological regime, this will represent a **Negligible** Peat Slide Risk		
Track 12			Track Section Removed in AI 2022 Layout		
Track 13 (270m) Near T11 and T15	0.1	13°	Due to the steep nature of the slope at this location and comparison to peat data collected across the site, it is unlikely to have significant peat depths at this location. Peat slide risk is therefore rated as **Negligible**. Best practice		

Peat Depth Slope Angle	0 – 0.5m (Score: 1) 0° – 3° (Score: 1)	> 3.0m (Score: 2) >20° (Score: 2)	0.5 – 1.0m (Score: 3) 3° – 10° (Score: 3)	2.0 – 3.0m (Score: 4) 15° – 20° (Score: 4)	1.0 – 2.0m (Score: 5) 10° – 15° (Score: 5)
Location & Length	**Mean Peat Depth (m)**	**Mean Slope Angle °**	**Comments**		
			construction techniques and maintaining of hydrological regime should still be implemented.		
Track 14 (720m)	-	-	Removed from updated infrastructure layout		
Track 15 (540m) Near T74 and T73	0.1	21°	Due to the steep nature of the slope at this location and comparison to peat data collected across the site, it is unlikely to have significant peat depths at this location. Interpolated probe data shows peat depths less <0.3m. Peat slide risk is therefore rated as **Negligible**. Best practice construction techniques and maintaining of hydrological regime should still be implemented.		
Track 16 (930m) Near T70	0.1	19°	Due to the steep nature of the slope at this location and comparison to peat data collected across the site, it is unlikely to have significant peat depths at this location. Nearby probe data shows peat <0.4m. Peat slide risk is therefore rated as **Negligible**. Best practice construction techniques and maintaining of hydrological regime should still be implemented.		
Track 17 (1760m)	-	-	Removed from updated infrastructure layout		
Track 18 (1060m) Near T29 and T24	0.2	10°	Due to the steep nature of the slope at this location and comparison to peat data collected across the site, it is unlikely to have significant peat depths at this location. Nearby probe data shows peat depths <0.3m. Peat slide risk is therefore rated as **Negligible**. Best practice construction techniques and maintaining of hydrological regime should still be implemented.		
Track 19			Track Section Removed in AI 2022 Layout		
Track 20 (850m) Near T42	0.1	10°	Due to the steep nature of the slope at this location and comparison to peat data collected across the site, it is unlikely to have significant peat depths at this location. Interpolated probe data shows peat depths <0.3m. This track section crosses a watercourse. Peat slide risk is therefore rated as **Negligible**. Best practice construction techniques including watercourse protection measures and maintaining of hydrological regime should still be implemented.		
Track 21			Track Section Removed in AI 2022 Layout		
Track 22			Track Section Removed in AI 2022 Layout		
Track 23 (570m) Near T59	0.6	8°	Slope angle at this location combined with peat probes <0.2m represent a peat slide risk rating of **Negligible**. Best practice construction techniques and maintaining of hydrological regime should still be implemented.		
Track 24			Track Section Removed in AI 2022 Layout		

Source: Natural Power

Table 7.3 shows few sections of track in areas of deep peat. All areas with elevated rankings had peat depths of under 1.0m.

All areas of proposed track not covered within the stage 1 probing survey and stage 2 probing survey were in areas where significant peat depth is unlikely when compared to data collected across the site and compared to slope angle. This confirming that the targeted phased peat probing has proven effective.

All sections of track present a negligible risk of peat slide, given best practice construction methods and maintaining of the natural hydrological regime, following the guidance presented in Section 8.3.

7.2. Geotechnical Risk Register

A preliminary geotechnical risk register is provided in Table 7.4. Key control measures are highlighted. A complete geotechnical risk register should be utilised on an individual turbine basis throughout the construction phase and amended accordingly as new information is received.

Table 7.4: Preliminary Geotechnical Risk Register

Hazard	Cause	Consequence
Peat Landslide / Bog Burst / Peat Flow	High rainfall, and increased surface water infiltration leading to build up of pore water pressure	• Instability of peat deposits and underlying superficial deposits around earthworks. • Contamination of natural watercourses and damage to hydrological systems. • Harm to personnel and damage to plant / equipment. • Destruction of built infrastructure
Mitigation	• Due consideration given to prevailing ground and weather condition when scheduling construction works. i.e. avoid opening new excavation during heavy precipitation and ensure sufficient drainage measures are in place to support construction activities. Ensure a contingency is in place to concentrate on more suitable construction activities during wet weather. • The drainage design should be such that its construction is in sequence with providing necessary drainage to new areas of excavation and construction in advance of works. I.e. ensure cut-off ditches are in place prior to opening new excavation. • The drainage design should as far as practicable preserve the natural hydrological regime and should not inundate areas with run-off which were previously not subjected to such affects. • Monitoring weather forecast with site specific weather station. • Monitoring (visual) regular site inspection to detect early indications of ground movement (tension cracks, groundwater issues).	
Peat Landslide / Bog Burst / Peat Flow	Concentrated loads placed at the top of slope system or on marginally stable peat deposits	• Contamination of natural watercourses and damage to hydrological systems. • Rapid ground movement and mobilisation of material down slope of construction operations; Harm to personnel, plant and equipment. • Destruction of temporary or permanent construction works.
Mitigation	• At these locations, robust and strict controls on the phasing and pace of construction must be in place. This would be most effectively managed through the CMS. Plant operatives should be briefed in detail regarding the side-casting and stockpiling of materials. Medium to high-risk areas particularly should be demarked by high visibility ticker tape or similar as a warning not to stockpile any materials in the deeper peat areas. • Ensure the peat depth contour mapping is available and has a high visibility during construction. • A programme of frequent inspections should be implemented during excavation and access track construction works. This should be carried out by suitably experienced and qualified personnel and focus on the areas of peatland at elevated peat slide risk. • Where stockpiles are placed in suitable areas, these should be closely monitored through the use of high accuracy GPS level and visual survey.	
Peat Landslide / Bog Burst / Peat Flow	Uncontrolled surface water flows	• Rapid erosion around and within temporary and permanent earthworks leading to a destabilising effect on peat slopes, loss of toe support and or increase of pore pressures through increased rates of infiltration.
Mitigation	• Detailed drainage design undertaken with sufficient capacity to buffer the effects of short periods of high intensity rainfall, perhaps though the implementation of buffer/ settlement ponds to collect surface run-off and release at a slower rate. The positioning of such elements should be at locations at low risk of peat instability. • Geotechnical supervision of major de-watering operations should be in place to ensure outflows are not being directed into terrain at higher risk of peat instability. • Due consideration should be given to prevailing ground and weather conditions when scheduling construction works.	

Hazard	Cause	Consequence
Peat Landslide / Bog Burst / Peat Flow	Inadvertent removal of toe support to slope system	• Localised instability associated with temporary and permanent earthworks; • Harm to personnel and equipment/plant through mass movement of peat and spoil; • Long term ground movements/ creep, causing deterioration and damage to temporary and permanent earthworks; • Contamination of natural watercourses and damage to hydrological systems from peat material mobilised down slope.
Mitigation	• Avoidance action during geotechnical design stage; • Routine geotechnical inspection; • Contingency plans for slope stabilisation measures. This could involve the provision of engineered toe support to affected slopes comprising gabion style retaining structures.	
Peat Landslide / Bog Burst / Peat Flow	Increased subsurface groundwater flow and 'piping' failure beneath natural peat deposits, temporary and permanent earthworks	• Localised instability associated with temporary and permanent earthworks; • Triggering of mass movement of peat material down slope causing harm to personnel, plant and equipment;
Mitigation	• Ensure geotechnical design prevents blockages of groundwater flow. This may be achieved through the use of free draining fills and ensuring temporary and permanent earthworks do not cause the build-up of groundwater pressures. • A programme of geotechnical inspections should be implemented throughout construction phase. Ensuring focus extends beyond immediate areas of construction, both up-slope and down-slope to detect any unforeseen effects on stability.	
Bearing Capacity Failure (Peat Surface)	Increased loading of low shear strength deep peat deposits	• Localised instability and settlement associated with temporary and permanent earthworks; • Triggering of mass movement of peat material down slope causing harm to personnel, plant and equipment; • Contamination of natural watercourses and damage to hydrological systems from peat material mobilised down slope.
Mitigation	• Due consideration given to the prevailing ground and weather conditions when scheduling site works; • Ensure detailed peat depth contour plan to be used in construction planning and design; • Use of appropriate plant machinery (low ground pressure and long reach to avoid over loading peat deposits). • A programme of geotechnical inspections will be implemented during excavation works; • Geotechnical monitoring post-construction.	
Peat Failure	Mass movement of temporary storage mounds and bunds	• Localised instability and settlement associated with temporary and permanent earthworks; • Triggering of mass movement of peat material down slope causing harm to personnel, plant and equipment.
Mitigation	• Storage site selection and stockpile design by a suitably qualified and experienced geotechnical engineer; • In general, the temporary storage of peat in a single dedicated are shall be avoided wherever possible; • Peat storage height shall not exceed 1m; • Routine maintenance and inspection of peat storage mounds; • Additional mitigation measures as described in standalone Peat Management Plan for proposed development.	
Creep, long term settlement of structures	Tracks or hardstand founded on peat and or poor or variable foundation soils	• Ongoing settlement and damage of infrastructure, e.g. damage to access track running surface.
Mitigation	• Contingency of routine maintenance of infrastructure and drainage elements to ensure longer term issues do not cause a build-up of effects leading to higher level consequences e.g. larger scale instability.	

8. Conclusions & Recommendations

8.1. Conclusions

The peat depths across the site are predominantly absent or shallow (recorded at <0.5m). It should be noted that where peat probes indicate shallow depths 0.1m to 0.4m that the deposits are likely to be composed of a topsoil and subsoil.

The minimum un-drained shear strength measured at 'PC07' was 12kPa at 2.0mbgl, and this is considered a conservative estimate.

Watercourses are determined to be an important off-site receptor, and when combined with steep slopes and narrow valleys, can carry entrained peat material a significant distance. Where a location cannot be micro-sited, physical intervention will be carried out to mitigate the higher risk locations. Location T68 will require development of soil retaining structures and active watercourse protection measures.

It should be highlighted that through geotechnical risk management, strict construction management and implementation of relevant control measures, the risk of peat failure across the development is predominantly negligible. Of all the infrastructure assessed within this report, only two turbine locations indicate a low risk, post mitigation.

The qualitative risk assessment should be reviewed prior to construction and further refined as part of future intrusive ground investigation. When more accurate data is available at the pre-construction stage, the analysis should be reviewed and updated accordingly. The respective risk ratings should be central to development of the Construction Method Statement (CMS), in order to ensure that extra care is taken with respect to the contributory factors at the time of the construction process and that the geotechnical risk is adequately managed.

Key points to concluded from the peat slide risk assessment are as follows:

- The large size of the proposed development, complex terrain, and variable superficial soil cover warranted a targeted peat survey approach which has been a previously accepted approach supported by the national guidance on Peat Slide Risk Assessment[7]. Detailed probing has thus not been carried out ubiquitously across all infrastructure locations but rather based on initial desk-based survey, digital terrain analysis and Stage 1, 100m grid probing survey assessment. The authors highlight the following wind farm developments where this approach has been accepted by the ECU: Crystal Rig III/IV Wind Farm and Rothes III Wind Farm.
- The site entrance track in the west of the proposed development does not traverse peat deposits. As the site track ascends Brock Hill, peat survey data is introduced and included in the risk mapping.
- There is no sector of the proposed wind farm infrastructure which is coincident with deep peat or raised bog conditions which has not undergone peat slide risk determination and without associated mitigation measures proposed. Overall, the risk assessment has provided a comprehensive breakdown of the risk assignment across all major infrastructure locations with targeted mitigation actions.
- Peat depth information, although an important factor, is not in isolation the critical means of assessing peat or ground stability risk. The peat slide risk assessment has applied a variety of desk study methodologies, field reconnaissance and geotechnical engineering assessment to ensure the risk assessment is accurate and representative of site conditions.
- Ubiquitous coverage of soil probes at detailed intervals across the whole site would not, in the opinion of Natural Power, enhance the peat slide risk assessment to a degree which would warrant the overcoming of safety, practical and economic restrictions to obtaining such a dataset. This rationale aligns with the statutory guidance[8]. Areas of the scheme where peat was identified during the initial stages was targeted

[7] Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Second Edition, April 2017

with detailed probing and this is well documented in the data and reporting presented in the original submission. Overall, however, there has been a total of 6,238 peat depth probes taken across the development site and infrastructure locations.

- The overall risk profile of the development with respect to peat stability is deemed realistic and representative for the terrain and superficial geology encountered across the development site. Natural Power consider that the next logical step to enhance understanding of the ground conditions across the site would be through intrusive ground investigation. The developer is committed to undertaking these works as part of the pre-construction detailed design phase of development.
- Movement of the turbine locations can take place within a suitable allowable micro-siting area, which is generally set up to a 100 m radius of the current proposed turbine location. Within this limit, it is advised that contributory factors can be mitigated, and the risk category reduced to low, principally by increasing proximity to the nearby watercourse.
- Given these aspects of the assessment, specified mitigation measures and commitment to further investigation, it is the opinion of Natural Power and the Developer that the issue of peat slide risk has been addressed to a comprehensive degree for this current phase of development. There exists a robust volume of work with targeted mitigation and recommendations to ensure risks continue to be addressed throughout all later stages of development.

8.1.1. Construction Risks

The following construction related factors are highlighted for consideration during the pre-construction phase of development:

- Ground movement can occur following over-loading of peat slopes, e.g. by placement of fill, stockpiling and end-tipping directly onto peat slopes;
- Suitability of drainage measures and the prevailing groundwater conditions are also key factors to consider during construction. Increasing pore water pressures within peat deposits decreases the stability of a slope;
- In extreme events, peat can act as a viscous fluid and travel over very shallow slopes. The re-working or excessive handling of peat can reduce the shear strength to residual levels and hence lead to ‘liquid’ peat behaviour;
- The rate of construction can have a major influence on the stability of peat land environments. Rapid loading and limited time for excess pore pressure dissipation can also decrease the stability state of peat slopes; and
- Excavation across a side slope, in particular a convex slope / break in slope, can induce peat failure.

The consequence of peat failure at the development may result in a number of negative impacts; external public infrastructure has been excluded due to the remote nature of the proposed development. Therefore, the most significant but unlikely impact is considered to be death or injury to site personnel. More likely is disruption to the proposed infrastructure through infrastructure damage and impact through degradation of the hydrological and peat land environment.

8.1.2. Borrow Pits

All borrow pits would be subject to individual borrow pit working methodologies which would draw upon detailed ground investigation data. As part of the working methodologies, usually submitted as part of a planning condition, would include information on the volume and type of soil overburden and management protocols, including temporary storage and stability control, along with details of the bedrock geology and extraction methods, details of relevant pollution prevention controls, and finally, full details of the contemporaneous restoration of borrow pit locations as part of the construction phase.

Within this process, the detailed ground investigation data would be analysed, including any further peat or soil depth information and peat stability risk management would be inherent within the detailed borrow pit design protocols.

8.2. Risk Management Recommendations

The following recommendations, when incorporated into the design of the project, will ensure risk from peat instability is at a low/negligible level for the proposed development:

- The use of experienced and competent construction contractors;
- Detailed monitoring programme of geomorphology and hydrology across areas at medium and high risk of peat slide as part of the construction management; this should be focussed across all infrastructure elements;
- Refine the environmentally sensitive zones across the site and integrate these areas into the detailed Construction Method Statements (CMS);
- Apply conservative design parameters across the elevated hazard zones (i.e. where undrained shear strengths are low and there is shallow groundwater interaction);
- Produce a robust drainage design which preserves the natural hydrological regime across the development. The control of silt and suspended solids should be carefully planned to avoid detrimental environmental effects. All drainage discharges should be under consent from the relevant SEPA control unit and performed in an environmentally compliant manner;
- A documented procedure should be in place and a rapid reaction strategy in place, prior to the commencement of construction on peatland. This strategy should be easily enacted should signs of peat movement be recorded across the development. This approach requires periodic and continued monitoring of the construction process by a suitably qualified geotechnical engineer;
- A detailed CMS should incorporate the conclusions of the peat stability report and continuously update the assessment and develop appropriate mitigations to respond to the peat slide risk;
- The Geotechnical Risk Register should be maintained as a 'live' document and updated and amended as required throughout the pre-construction and construction phase of the development.

The proposed turbine layout design has been arrived at through an iterative design process. The design has included consideration across a wider set of environmental constraints. As part of this process, specific consideration including steepness of terrain, peat depth and associated environmental sensitivities has been taken. The proposed layout has emerged from an iterative design process during which technical requirements; environmental and visual considerations have been identified and addressed. During this process the proposed development has sought to avoid steep terrain and areas of deep peat where practicable. If significant layout changes outwith the micrositing allowance are implemented in the future, it is recommended that the peat stability assessment is updated accordingly.

The preliminary geotechnical risk register for peat at the development, cites key control measures which are required to reduce the risk of peat slide to residual levels. These control measures apply to the infrastructure locations. However, there should be wider consideration of these measures across all areas of the proposed development which may be influenced by the proposed construction. This is critical where infrastructure may impact terrain and slope conditions beyond the proposed working areas. The following points should be considered to help mitigate against this:

- A detailed intrusive ground investigation should be carried out (post-consent) and as part of the pre-construction phase of development. The results of a detailed ground investigation should be assessed with respect to refining the peat stability assessment at all infrastructure locations. All pertinent control measures and mitigation measures should be detailed in the CEMP, and their implementation supervised following the results of the ground investigation and construction design phase of works; and
- This investigation should seek to further characterise the peat deposits with emphasis on, advanced in-situ shear strength testing and targeted undisturbed sampling and laboratory testing. All peat samples recovered should be classified in accordance with the Von Post system, (Hobbs, 1986) and current British and Eurocode standards for site investigation;
- Groundwater level information should be collated as part of any future ground investigation;

- Continued assessment and monitoring throughout the construction phase of works and at suitable intervals post construction should be implemented to ensure the control measures are suitable and are providing adequate mitigation against peat slide.

8.3. Recommended Construction Methods

Construction practices shall be managed through the CMS and within the wider context of the Construction Environmental Management Plan (CEMP). The CMS should be prepared by the appointed principal contractor and reviewed by a suitably experienced geotechnical engineer who has read and understood this report. The following general recommendations are provided in line with the 'Good practice during wind farm construction' (4th Edition 2019) guidance:

- Avoidance of peat arisings being placed as local concentrated loads on peat slopes without first establishing the stability condition of the ground and slope system. Stockpiling on areas of deep peat and in close proximity to steep slopes should be avoided;
- Avoidance of uncontrolled and concentrated surface water discharge onto peat slopes as this may act as a contributory factor to failure. All water discharged from excavations during the construction phase should be directed away from all areas identified as susceptible to peat failure and should be managed by a suitably designed site drainage management plan;
- All excavations where required should be adequately supported to prevent collapse and the destabilising of peat deposits adjacent to excavations; and
- A system of frequent reporting should be established during construction and utilised to monitor the geotechnical performance of slopes including peat, sub-soil and bedrock. This should be implemented and undertaken by a suitably experienced and qualified geotechnical engineer. Post construction, this monitoring procedure should be curtailed to allow for annual or ad-hoc inspection as required.

8.3.1. 'Floating' track construction

The application of floating infrastructure has not been directly processed by the assessment. The following salient advice has been provided; MacCulloch, (2005) advises that a 'floating' type road construction which leaves the peat deposits in situ may be advantageous with respect to preventing peat failure. This method of construction has a lower impact on the internal groundwater flow within the peat land. However, there are cases where groundwater flow within the peat can be detrimentally affected. The following control measures should be implemented as part of the design and construction of 'floating' access tracks:

- Prevent the rupture of the vegetation surface of the peat by avoiding the use of large sharp rock fill;
- Prevent the overloading and subsequent shearing of the peat throughout construction and use of the 'floating' track;
- Monitoring of the long-term settlement of the 'floating' track is necessary to predict the effects of reducing permeability within the peat and hence increasing groundwater pressures beneath the track construction. Through ongoing monitoring, additional drainage relief measures can be implemented when conditions for peat failure are predicted; and
- Do not position 'floating' access track on or adjacent to convex side slopes.

An additional control on the construction and use of 'floating' track is through the strict management of construction traffic loading. This may involve the timing between heavy traffic to be staggered to prevent the effect of cyclic loading over short time periods reducing the shear strength of the peat. In order to assess the maximum loading rate or timing between heavy construction traffic it may be necessary to monitor the vertical deformation of the 'floating' track sections following loading and recording the time taken for recovery of vertical deformation. The use of simple settlement plates and survey pegs can be used to achieve this. The frequency of trafficking for heavy loads must then be timed to allow deformation of the 'floating' road to recover its deformation.

MacCulloch (2005) generally advises that in order to prevent injury or an environmental incident, it is important that there is a robust procedure in place, should it become apparent that a peat failure is imminent.

8.3.2. ‘Cut’ track construction

The construction of proposed access tracks at Scoop Hill Community Wind Farm is likely to be by excavation and replacement method, MacCulloch, (2005). Excavated peat is carefully placed along bunds at either side of the access track. Imported aggregate would be used to form the subgrade and running surface of the track.

For ‘Cut’ track construction, the risk of peat failure is therefore focussed on the peat deposits adjacent to the access track, and the placement of peat arisings. In these areas, the following control measures are listed by MacCulloch, (2005):

- Careful excavation of peat deposits by appropriate machine excavator to limit localised peat failures which can occur on the edge of the track excavation. This is in order to prevent a minor failure triggering retrogressive peat failure affecting a larger area of peat adjacent to the track;
- Temporary drainage systems followed by establishment of a permanent drainage network. Silt traps and small retaining structures may be required especially in proximity to water crossings to prevent siltation and blockage of watercourses;
- Ongoing monitoring and on demand maintenance when silt traps require emptying and temporary drainage reinstated if blocking occurs. This will assist in maintaining hydrology baseline conditions; and
- The permanent drainage system must direct surface water flow away from the ‘cut’ track to prevent peat failure within the track bunds.

8.3.3. Existing Track Upgrade

The upgrading of existing tracks has been identified as a possibility in some sections. This method of construction will require the existing track to be widened and surface upgrades of the existing track, to ensure it is laid to the required engineering specification. The widening of the track will be performed similarly to the cut track method discussed above. The locations where upgraded track is proposed are mostly in areas of shallow peat.

8.3.4. Foundation Excavation and Crane Pads

Application of the following strategies are deemed unlikely given the predominantly shallow and sporadic peat deposits recorded across the development. Such scenarios would be considered following the detailed ground investigation stage:

- Where excavation into deep areas of peat is unavoidable; the use of a rock cofferdam or rock fill ring structure around the excavation should be considered. The rock retaining wall should be designed to retain peat and groundwater from an excavation and prevent ingress or failure on the periphery of the working area. This technique may not be required due to the low peat depth and low risk ranking.
- Piling of turbine foundations can also be considered at the detailed design stage. This method of foundation construction can reduce the requirement for deep and large excavations within peat and hence reduce the associated risk of failure when excavating. Full consideration must however be given to the plant requirements and working area which may need to be formed on a ‘floated’ hard standing or working platform. However, this is highly unlikely to be required on this development.
- Rock fill displacement methods, which are sometimes employed for crane pads in deep peat, should be subject to thorough design risk assessment, particularly in the vicinity of slope crests where the lateral loading may add to slope destabilising forces.

8.3.5. Drainage Measures

Environmentally compliant drainage designs for the proposed development will form a primary control and mitigation for maintaining surface hydrology and shallow groundwater flow across the proposed development. Some of the key responses to minimising the effect on the hydrology of the proposed development are reiterated below:

- Check dams, silt traps, settlement ponds and buffer strips will be incorporated into the drainage system as necessary and will serve the dual purpose of attenuating peak flows, by slowing the flow of runoff through the drainage system, and allowing sediment to settle before water is discharged from the drainage system;
- The constructed drainage system shall not discharge directly to any natural watercourse but will instead discharge to buffer strips. These buffers will act as filters and minimise sediment transport, attenuate flows prior to discharge and maximise infiltration back into the soils and peat. Erosion protection shall be installed at discharge points;
- To reduce the impact of the proposed development on the natural hydrological regime, the site design will aim to mimic the greenfield runoff response at source, using sustainable drainage practices;
- Ponds and basins that can store water at the ground surface, can be designed to control flow rates by storing floodwater and releasing it slowly once the risk of flooding has passed;
- All watercourse crossing structures will be designed and constructed using best practice techniques and will be of sufficient capacity to accommodate storm flows for a 1 in 200-year storm event, with an allowance for increased flows that may occur as a result of climate change. By ensuring that structures have sufficient capacity the risk of upstream flooding and increased erosion and sedimentation will be reduced; and
- All drainage management plans including any proposed drainage blocking should be agreed with SEPA and the relevant statutory bodies prior to starting construction.

8.3.6. Earthworks

It has been identified that there is a likely requirement for temporary storage of volumes of peat and superficial deposits during construction of the wind farm. Initially the vegetated peat layer and any topsoil should be stripped and temporarily stockpiled away from areas of deep peat and steep slopes. The design of this stockpile must be agreed by a suitably qualified geotechnical engineer. When working in areas of deep peat (i.e. >1.0m), no peat or overburden should be stored on such deposits as this may lead to instability. The following options for peat storage may be considered:

- Dedicated peat storage area designed under the advisement of a suitable qualified geotechnical engineer and conform to up to date SEPA regulations and waste directives;
- Re-use of peat in batters on access tracks, finishing of cable trenching works, and the landscaping of turbine bases;
- Excavated glacial till and weathered rock may be used as backfill to turbine bases, should material be deemed geotechnically suitable; and
- All related works must be carried out in accordance with an agreed CEMP and conform to site restoration plans.

For in-situ and undisturbed peat; site vehicle movements must be minimised across such areas, throughout construction and post construction. Observation and monitoring for settlement, deformation or signs of failure along access tracks and critical working areas must be implemented. This may be achieved with a network of settlement plates and survey markers which can be periodically re-surveyed, and any differential movements identified. It is recommended that all earthworks are designed in accordance with current standards. Suitable guidance for temporary workings in peat is outlined in Table 8.1 below, in line with Construction Health and Safety, Earthworks, (2005) and observations suggest ‘soft non-fibrous dry peat’ is predominant on site:

Table 8.1 Temporary Slope Geometry (1-14 days)

Peat Type	'Dry' Site	'Wet'* Site
	Degrees from horizontal (min/max)	
Soft non-fibrous	10/20	5 / 10
Firm non-fibrous	15/25	10 / 15
Firm fibrous	35/40 (6)	20 / 25 (6)
Stiff fibrous	35/45 (6) (7)	25 / 35 (6) (7)

'Dry' Site: minor or no seepage from excavation faces, with minor or no surface runoff.
**'Wet' Site: submerged or widespread seepage from excavated faces*

Source: Construction Health and Safety Earthworks, (2005)

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Appendices

A. Maps

B. Site Reconnaissance Photography

The following sequence of photographs provide a selection of photographs taken during the field reconnaissance survey and peat probing phase. Photographs are aimed at representing typical terrain units reviewed as part of the digital terrain assessment. There are further examples of practical challenges for survey access with respect to entry into dense forestry stands and across steep slopes.

Source: Natural Power

Figure 9.1: Glaciofluvial valley system with steep escarpments, devoid of peat; west of Turbine 57

Source: Natural Power

Figure 9.2: Example of steep terrain of the Dryfe Water Valley

Source: Natural Power

Figure 9.3: Additional view showing steepened valley sides of Dryfe Water Valley

Source: Natural Power

Figure 9.4: Example terrain type: grazing pasture (thin mineral soil and no peat): Ridge in distance location of Turbines 63, 64, 66 & 67 with similar superficial soils

Source: Natural Power

Figure 9.5: Turbine T49 & T50 soil profile exposing thin peat soil layer 0.1 – 0.4m thickness

Source: Natural Power

Figure 9.6: Infrastructure looking south towards T49 - inaccessible for probing due to wind blow

Source: Natural Power

Figure 9.7: Example soil profile at Turbine T32 showing thin peat layer (1m probe for scale)

Source: Natural Power

Figure 9.8: Steep forested terrain south from T25 no peat recorded by 100m grid probing for this terrain type

Source: Natural Power

Figure 9.9: Further type location steep valley sides (no peat recorded) vicinity of Turbine T23

Source: Natural Power

Figure 9.10: Example terrain: bedrock exposure and no peat on approach to T30

Source: Natural power

Figure 9.11: Example terrain: steep valley form with incised watercourse in glaciogenic sediments (Rae Gill)

C. Stage 2 ECU Checking Response

This detailed response addresses comments received within the Peat Landslide Hazard Risk Assessment, Scoop Hill Community Wind Farm, Stage 2 Checking Report (Ref: 50737) issued by Ironside Farrar and dated June 2021.

The aim is to provide the necessary additional clarification and support of the peat slide risk assessment model now updated for the AI 2023 submission. The peat slide risk assessment was designed and conducted based on detail of the project site specifics: terrain, geomorphology, and superficial geology and peat slide indicators. Specifically, the risk assessment has focussed across the proposed infrastructure areas of greatest potential impact. The principal aim of the peat slide risk assessment has been to ensure the scheme layout design has minimised the risk of peat slide and impact on deep peat deposits. Updated layout considerations are included, however in general terms, these layout changes have resulted in a significant reduction in scale (See Section 1 of main report).

The following critical points are reiterated for the site as reported in the main Peat Slide Risk Assessment Report:

- A total of 6,238 soil depth probes have been collected as part of a multi-phase field survey.
- The recorded soil depths indicate dominantly shallow or absent peat across the project site (site wide mean of 0.3m probe depth). These shallow probe depths correspond to a low or negligible risk of peat slide determined for the majority (over 90%) of infrastructure locations.
- Deeper pockets of peat (>0.5m) are recorded only in discrete areas.
- The wind farm layout design has been an iterative process. A multitude of environmental factors have been reviewed as part of the EIA process including the distribution of peat across the development.
- Thus, the wind farm layout has sought to minimise its impact on peat either through siting and location of infrastructure in areas of low risk, shallow or absent peat, and through targeted use of low volume construction techniques including floating type access tracks / hardstanding infrastructure;
- Active mitigation measures have further been specified for limited elements of the scheme where peat slide risk has been assessed to be elevated. Through the application of targeted mitigation measures, the risk of peat slide from the proposed wind farm and its infrastructure is assessed to be low.

On the subject of conducting additional peat depth investigation. The approach has been clearly set out prior to submission of the peat slide risk assessment. Details provided to the ECU included the following rationale for the detailed probing surveys. This was communicated in an email from the Developer in February 2020:

"Through geomorphological analysis of the 100m peat probing survey, aerial imagery, site topography, published soil maps and experience with surrounding ground conditions; the following peat probing survey has been designed (see attached map GB202142_M_004). This follows the general principles of the Peatland Survey Guidance, SNH, SEPA (2017). The central guidance being to target the peat surveys across areas of greatest potential impact. Detailed peat survey targets proposed infrastructure including turbine foundation and adjacent hardstands. Photographs of the terrain, and peat samples will be acquired during this Phase 2 survey.

The survey design provides salient and detailed intrusive peat survey information whilst accepting the practicalities for safe access. Key details and assumptions are outlined below:

- *Tracks and infrastructure covered by the 100m survey, which recorded and/or have interpolated peat depths below 0.5m are not included within the Phase 2 detailed survey. For this development the determination is that depths of less than 0.5m constitute mineral / converted topsoil and are areas of negligible or limited potential impact.*

- *All turbine locations not covered by the initial 100m survey or showing elevated (>0.5m) peat depths will be covered by the phase 2 detailed survey.*

- *Peat coring and undrained shear strength testing will be carried out at approximately x10 discrete locations during the Phase 2 survey. Locations shall focus on deeper peat deposits which will permit the in-situ testing and shall be representative of the type locations across the development.*

This survey is considered sufficient to inform the peat management plan and peat slide risk assessment. Where detailed probing is required this will take place at 50 m intervals along the centre line of the access tracks with 10 m offsets to either side. Four probes would be taken at 10 m offsets from the turbine locations and at 20 m intervals on the hardstands. Guidance states that there should be a 10 m grid over the turbine including micro-siting allowance. However, probing at this resolution would add a significant and impractical number of probes to the current plan. It is therefore proposed that following completion of the detailed surveys a review would be conducted and should any micro-siting be required due to discrete zones of deep peat, additional probing maybe proposed to confirm the validity of any micro-site option."

However, Natural Power carefully considered the feedback and commentary within the Checking Report and carried out a diligent review of the reporting and risk assessment modelling completed to date. From this review and bearing in mind the significant changes to the proposed development, Natural Power advised that undertaking the additional peat probing would be preferential, especially if it was for areas which were previously inaccessible due to the presence of dense forestry which had now been felled. Subsequently, significant additional detailed probing has been undertaken during November 2022 as part of the final layout iterations and AI submission which is presented within this revised PSRA.

There are five points (Items: 2, 3, 4, 6, & 11) in the Stage 2 Checking Report with recommendations for further information. Responses to these items are covered in detail within this Appendix, and in the PSRA if it related to further peat probing. The remaining eight points (Items: 1, 5, 7, 8, 9, 10, 12, 13) have been clarified in Natural Power's previous response (See Section 2) and for these items, Ironside Farrar Ltd have confirmed that no further action is required, and they are not included in this Appendix.

Table B.1: Stage 2 Checking Report Responses

ID	Stage 2 Report Comment	Recommendations	Developer Response
2	Widespread commercial forestry obscuring much of the site is a valid consideration. Section 4.4.1 of ECUBPG lists features which should be represented on a geomorphological map of the site, of these it is not clear whether major slope breaks are included. Section 2.2 of the PLHRA notes "Site reconnaissance and aerial photo review has identified various small-scale landslips mapped in conjunction with various deeply incised watercourses across the site. These can be found on the geomorphological map in figure (Map 10.2.3)." but only one feature is visible on the map. As recommended, detailed reconnaissance of instability post felling would help clarify the position.	Confirm whether major slope breaks are included / can be included. Confirm whether instability features noted within PLHRA are included.	There is assessed to be no identifiable 'major break in slope' features coincident with peatland. Nor are there any major slope breaks assessed to be current contributory factors to instability for the proposed wind farm infrastructure. This conclusion reached through the following methods advocated by the British Society for Geomorphology[8]: • Digital terrain analysis and landform recognition performed using software geospatial analysis tools at the desk study stage. Including: 'QGIS' for compilation and viewing of geospatial data sets and 'Surfer' for 3D surface modelling of the terrain using the 'OS Terrain 5' digital terrain model. • Digital terrain analysis and landform recognition performed through analysis of contemporary aerial photographic records available through multiple online providers. • Geomorphological field survey undertaken in conjunction with the multi-phase peat probing and geotechnical site reconnaissance visits. Thus, Natural Power confirm that at this stage, major slope breaks cannot be included in a way which would augment the current risk assessment model. Slope morphology however has informed the risk assessment and in particular slope angle, slope aspect and visual morphologies detectable in the field and on aerial imagery were assessed qualitatively. These factors have been assessed and contributed to overall risk conclusions of the report. The Peat Slide Risk Assessment Report (Ref: 1225356) describes in detail the Site Reconnaissance Approach at Section 4. From this process and further interrogation of soils mapping data; peat depth and coverage were determined to be a function of terrain slope angle. Peat was generally identified in discrete locations, generally associated with low angle terrain (Section 2.3.1 of this Peat Slide Risk Assessment). With reference to the existing small-scale landslips highlighted in the reporting, these features are determined to be unrelated to peat and therefore not considered further by the peat slide risk assessment. This is stated within this Peat Slide Risk Assessment at Section 4.4.1 that: loose poorly consolidated granular soil deposits are involved in the small-scale landslips and not peat. The soil mass movement determined in the field and from aerial photographic interpretation is related to fluvial erosional centred on steep watercourses and affecting superficial soils / subsoils only. No peat was identified to have been entrained in the debris fan or was there any unstable peat deposits at the site of erosion to these features. They are postulated to be natural features of erosion

[8] Cook, S.J., Clarke, L.E. & Nield, J.M. (Eds.) Geomorphological Techniques (Online Edition). British Society for Geomorphology, London. ISSN: 2047-0371

ID	Stage 2 Report Comment	Recommendations	Developer Response
			perhaps accelerating in activity with increasing intense rainfall events. The loss of tree/vegetation cover through overgrazing may also be a factor in the creation and continued activity of these features. The location provided on the geomorphological mapping is for information only as an example type location. This location was the most prominent and contemporary in its appearance (See Figure below for a detailed depiction). Further investigation and assessment of the superficial soil slope stability would form part of the pre-construction detailed intrusive geotechnical investigation and subsequent design. Deeper modes of investigation would be required to investigate the geotechnical make-up of the slope system and groundwater regime. These methods of detailed ground investigation do not form the scope of the peat slide risk assessment. This intrusive investigation would require techniques such as trial excavation or borehole sampling in order to gather undisturbed soil samples for relevant geotechnical laboratory testing and likely focussed on the proposed access track which traverses the upper reaches of this slope system. . Applicable mitigation options would need to be informed by the geotechnical investigation however may focus on: • Drainage design which directs outfalls away from the slope system; • Soil stabilisation techniques down slope from the proposed access track including geogrid and vegetation-based reinforcement; • Discrete micro-siting of track alignment where geotechnical sub-soils are found to be of low bearing capacity performance. • Natural Power therefore confirms that the instability features were highlighted and noted but not as contributory factors to the peat slide risk assessment.

Figure: Extract from Geomorphological Mapping Showing previous mass movement (superficial soils) type location south-east of T21.

ID	Stage 2 Report Comment	Recommendations	Developer Response
3	The Peatland Survey Guidance Table 1 – Preliminary Assessment of Peatland Extent and Conditions notes that the peat depth survey resolution should be Low resolution - Usually 100 m X 100 m on a regular grid pattern across the whole area proposed for development. Greater intensity surveys will not be required for areas that are unlikely to be developed. Therefore, the focus of Phase 1 probing is to understand the wider context of the site. Section 4.4.2 of ECUBPG notes Scottish Government Guidance suggests a site-wide density of approximately one probe per	Phase 1 probing focused in the vicinity of infrastructure can be justified, however in instances when sensitive receptors are located upslope/ downslope of infrastructure. it is expected that assessment is conducted to ensure	The submitted peat slide risk assessment (Ref: 1225356) has focussed on a geotechnical assessment of each main proposed infrastructure location as a potential site of generation for peat slide. The pathway potential with reference to surrounding terrain units has therefore formed an intrinsic part of the assessment. However, the following criteria have also been considered by the assessment: • Where risks are determined to be low or negligible at proposed infrastructure sites there has been no expansion of the risk assessment outside the development area adjacent to these locations. • Proximity of receptors from the proposed infrastructure has been factored into the assessment using qualitative geotechnical engineering judgement and the aforementioned digital terrain analysis tools set out in the Item 2 response. In this respect is should be highlighted that two-dimensional map data should be viewed with respect of the three-dimensional terrain aspects. The ‘3D’ terrain aspect,

ID	Stage 2 Report Comment	Recommendations	Developer Response
	100m (or one probe per hectare). Section 4.4.3 of ECUBPG notes In order that the model be considered reliable, sufficient coverage of data points should be available in areas covered by the model, hence infrastructure targeted probing (with limited coverage elsewhere) may be inadequate to produce a site wide peat model. As noted in ECUBPG, unsafe/difficult access is a reasonable justification for probing to be omitted in locations, but the initial report lacked photos to illustrate this. Section 2.2 mentions safety but does not explicitly state steep/inaccessible terrain was a factor in reduced probing. Noted that the risk assessment focuses on key infrastructure locations and that this considers downslope receptors, however the interceding peat depth can be significant as upslope works could destabilise lower peat. Detailed justification with specific reference to potential receptors noted in the Phase 1 checking report has not been provided. Some of the locations referenced are not impacted by forestry cover and therefore this cannot be justification for lack of probing. It is acknowledged most locations listed have peat depths <0.5m at the closest probe and are therefore lower risk, however Finniegill, Black Esk Reservoir, Garwarldshiels, Old Garwarldshiels and the Romans and Reivers Route all have peat >0.5m recorded on the nearest probes. It is recognised the interceding ground is forested in these instances and may therefore be difficult to probe. The distance to many of these features is also reasonable, however Finniegill is centrally located with existing tracks and turbines surrounding. The risk zonation mapping does not extend beyond the footprint of the peat probing, and therefore does not cover the sensitive receptors listed above. Noted that further survey and investigation is highlighted as required in the report at detailed design stage.	that upslope works would not destabilise downslope peat which could then impact on receptors, with risk to human life / health most important. It is noted that the peat depth is <0.5m in the vicinity of a number of receptors highlighted in the Stage 1 Checking Report but 5 receptors have the closest peat probes reporting values >0.5m. It is recognised that forest cover may prevent access in these locations, therefore it is recommended at detailed design further investigation, assessment and mitigation (if required) is proposed to ensure no risk. Confirm whether additional 100m grid Phase 1 probing is possible in the vicinity of Finniegill.	flow pathway and coincidence with downslope receptors is specifically clarified below for the key receptors highlighted by the Stage 2 checking report. Black Esk Reservoir – Main risks associated and proposed mitigations have been captured by the assessment (Table 5.1, Pg. 94). A medium risk score has been determined in the assessment using the risk model for the unmitigated condition. This can be reduced to low risk with the following specific mitigation measures: • Careful planning of earthworks; • An entry restriction zone for plant to be marked on site which will minimise the risk of plant machine entering the 50m watercourse buffer zone; • Construction design to prohibit the use of peat displacement techniques to reduce potential for increasing lateral pressures in the peat mass; Given the reported very low (<2deg) slope angle for this location; Natural Power does not agree that further downslope probing would increase the validity of the risk assessment. Nor would additional downslope probing be capable of improving or altering the stated mitigation measures to any significant degree. Finniegill – The proposed wind turbines at higher elevations and within the same terrain unit have been assigned a low risk by the risk assessment model. The potential mode of peat failure for the site was also considered. The peat slide risk assessment (Ref: 1225356) states that 'due to the topographical relief across the proposed development and prevalence of surface watercourses, peat flows are considered the dominant model of potential peat failure' A peat flow is a debris flow comprised of water and peat debris which flow down slope using pre-existing channels. A large-scale peat slide type event has therefore been ruled out at this stage. There is no evidence gathered through desk study and site survey to indicate a large-scale translational peat slide is a hazard to this property, and the following points support this conclusion: • The Finniegill property sites on an elevated promontory above the adjacent watercourse and thus isolated from any peat flow scenario. Terrain elevation data confirms the existing main structure to be 3m higher than the adjacent watercourse feature. • The surrounding peat depth information does not indicate any propensity for a large-scale peat slide of major peat failure. • The property Finniegill is not directly downslope or in the potential peat failure pathway of any proposed new wind farm infrastructure sited upslope. • Numerical slope stability modelling (PSRA Report, 1225356, Table 4.1) does not predict instability within the nearest slope system and proposed turbine infrastructure. • Existing quarry site is present up slope at the head of the valley system and the workings assessed to have no ongoing detriment to peat or ground stability. Historic construction of the widespread existing track network across the head of the Finniegill valley has had no detrimental effect on peat slope stability. Considering this combination of factors alongside the terrain morphology (very steep ground linked to an absence of peat) and physical access limitations, Natural Power confirm that no further/additional 100m grid Phase 1 probing is warranted, practical or possible in the vicinity of Finniegill. Photos are provided in Appendix B to further illustrate the terrain characteristics in the vicinity of Finniegill and the Dryfe Water Valley. The designated sites and receptors are described in detail within Section 4.8 of this peat slide risk assessment.
4	The Peatland Survey Guidance Table 2 – Further Assessment of Peatland Extent and Conditions then confirms that: Targeted sampling regime tailored to potential development areas within the proposal boundary. Sampling should focus on areas of greatest potential impact from development including: full targeted probing	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland	Natural Power has applied in good faith the relevant guidance[9/10] in the case of the development. The key direction stipulated being in Table 2 of the guidance 'Sampling (peat probing) should focus on areas of greatest potential impact from development.' There is further guidance provided in the peat landslide hazard risk assessment guidance[10]:

[9] Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, Second Edition, April 2017

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

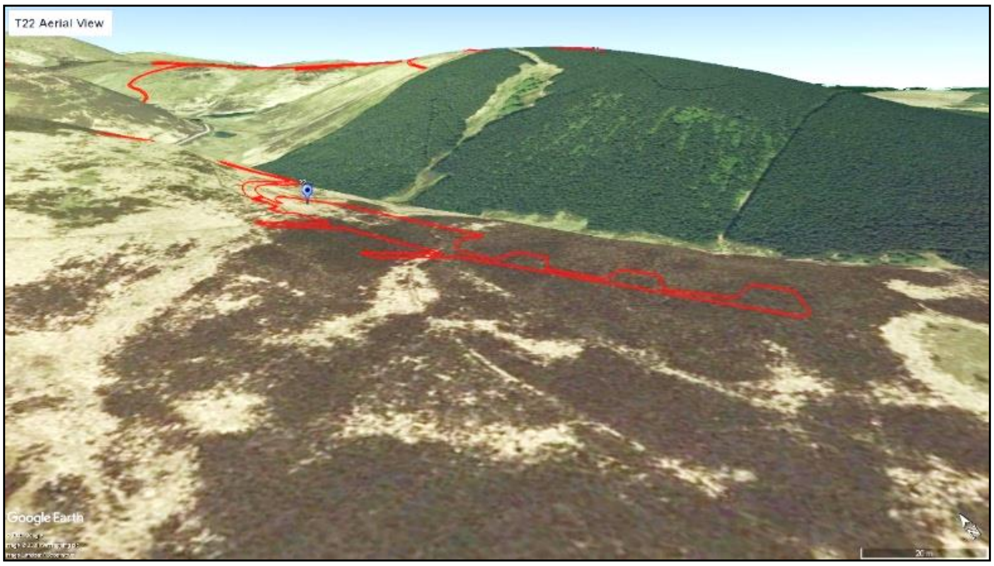
ID	Stage 2 Report Comment	Recommendations	Developer Response
	along all tracks, at all turbines/hard standings, turning points and passing places, site compounds, substation, borrow pits and met mast locations. Appropriate resolutions are then provided. ECUBPG notes The Scottish Government (Scottish Government et al., 2014) provide information on the level of detail expected for site investigations on peatlands, which suggests both a site-wide density of approximately one probe per 100m (or one probe per hectare) supplemented with significant additional probing at infrastructure and along tracks. ECUBPG notes "In general terms, sufficient sampling locations should have been investigated to produce an outline map of variability in peat depth across the development site (to inform layout iterations)." There are 12 turbines with peat >0.5m within approx. 100m, but no additional probing: T22, T33, T34, T37, T38, T43, T44, T45, T47, T52, T67, T73. Of these, T22, T33, T34, T37, T38, T43, T73 are not shown on mapping to be in forested locations and therefore it is assumed access was not an issue. It is also noted that all turbines were able to be probed for the Phase 1 survey, suggesting access is not an issue. Noted that the development has a full commitment to ensuring further survey and site investigation is undertaken in future preconstruction phases of the development, however the probing provided does not meet requirements for this stage.	Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020 and the position has not changed.	• S4.4.2 – Sampling locations should be optimised using the findings of the site reconnaissance and geomorphological mapping and should reflect the nature and extent of the proposed construction works. In line with this guidance the survey has conducted site wide 100m grid across areas of peatland and significant additional proving at infrastructure where peat accumulations were determined from desk study and site reconnaissance. • S4.4.2.1 – A competent person should be responsible for identifying and justifying the numbers, locations and types of samples collected, and this will depend upon the size and variability of the development site. A clear justification in line with this approach was set out as part of the submission to the Energy Consents Unit and set out in the introduction of the response. Natural Power considers it the responsibility of the appointed geotechnical engineer to determine the areas of greatest potential impact and within those areas focus the detailed peat survey. The risk assessment approach has followed this rationale. In addition, the practical, economic and safety factors (all cited within guidance) have been used to design the scope for the detailed survey. Areas of peatland and deep peat (areas predominantly with a probe depth of >0.5m) have thus been the focus of detailed peat probing. Where the initial phase (Phase 1) surveys did not identify peatland following the guidance, these areas were not prioritised for additional Phase 2 survey. The twelve highlighted turbine locations are all in the majority out-with areas of peatland and in areas predicted to be covered with thin peat and mineral soils. From the evidence available: • Field reconnaissance (set out in photo logs Appendix B) • Peat depth survey maps (Ref:GB202142_M_015); • Aerial photographic Mapping (Digital Terrain Analysis – Online Sources) • Geomorphological Mapping (Ref:GB202142_M_017) • Geological Superficial Mapping (Ref:GB202142_M_009) It was determined that not one of the locations identified represent an area of great potential impact. The guidance as set out above has focussed the significant detailed probing across areas of the site where deeper peat was predicted. The practical limits on peat probing the 1000's of additional points across areas of shallow or absent peat was set out in the survey rationale to the ECU. The survey guidance[10] anticipates the scope of peat surveys to vary across developments. There is no stipulation that developments should undergo detailed probing across all areas without consideration as to the presence of peat. In each case review of the contributory factors to peat failure at the twelve highlighted locations re-emphasises the low peat slide risk. It is noted that peat depth mapping presented as part of the original peat slide risk assessment has not differentiated shallow soil types. Peat coring was undertaken on a limited basis to confirm areas of deep peat and indicate its presence in type locations. However, each individual probe data point is not a confirmation of the presence of peat. In particular for depths of <0.5m it was determined for this site that such data points were indicators of an absence of organic peat. Photographic evidence for this is provided at Appendix B. Site reconnaissance and visual assessment by the survey geotechnical engineer has confirmed the highlighted turbine and infrastructure areas to be not within peatland / raised bog and therefore carry low and negligible risks. There should therefore be no requirement to pursue additional probing and peat depth information at this stage. The information provided below reviews each of the 12 turbine locations raised in the Stage 2 checking report and provides a rationale for this position. In each case Natural Power would conclude that pursuance of additional peat depth information at this stage would be of no material benefit to the outcome of the development's peat slide risk assessment. Geotechnical investigations (pre-construction) would be conducted to further investigate geotechnical risks associated with the post glaciated terrain and deeper-seated ground conditions. For each of the 12 turbines the peat depth information, 3D terrain view and risk model criteria are re-presented below. Additional peat probing has been carried out for these highlighted turbine positions and the peat slide risk is assessed within Table 7.1 of this main peat slide risk assessment report.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine T22

- Reported Risk Category **Low**
- Mean Peat Depth at Proposed Infrastructure - 0.45m based on 100m grid. Low angle terrain where deeper peat expected. The controlling and steeper sloping terrain to the east recorded absent peat. With gentler slopes to the west up to 0.7m.
- Mean Peat Depth Surrounding Area – Absent thin soils / not peatland, mean soil depth 0.25m across the wider ridge system.
- Terrain slope is low angle along the axis of the ridge line but increases to the east and west off the ridge line.

T22 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context



Detailed peat probing has now been undertaken at this location, please refer to Tables 7.1 and 7.2 of this report for the detailed assessment.

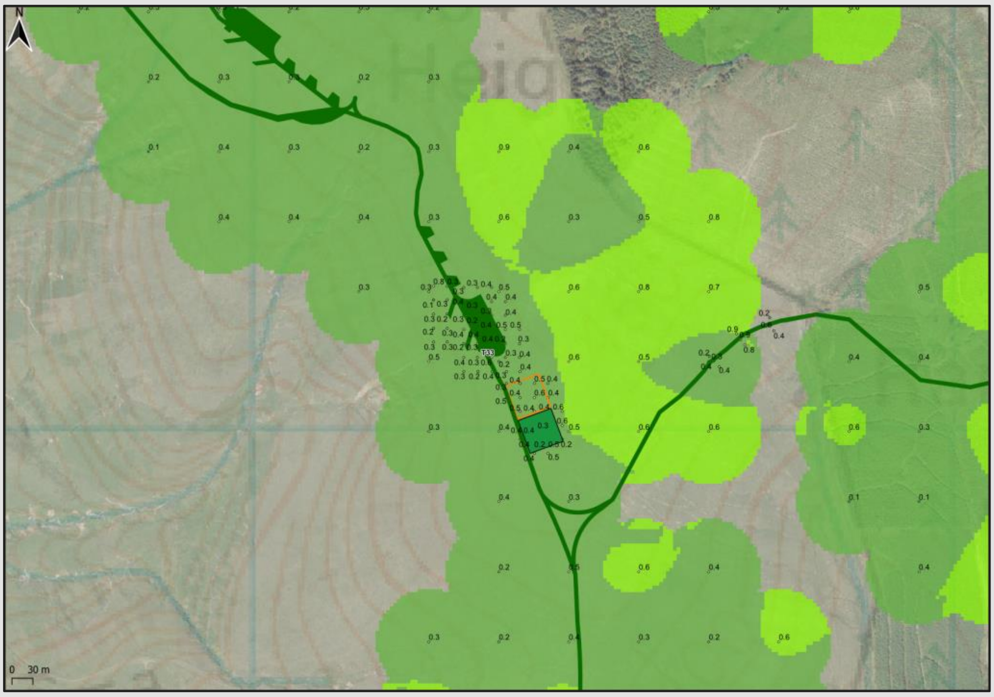
The location is a significant distance from the nearest watercourse. The current risk assignment and mitigation measures stated are deemed valid for the planning phase. Peat survey information shows widespread shallow peat or absent peat in the surrounding terrain and intrusive site investigation at the pre-construction stage is the logical time to undertake further detailed surveys.

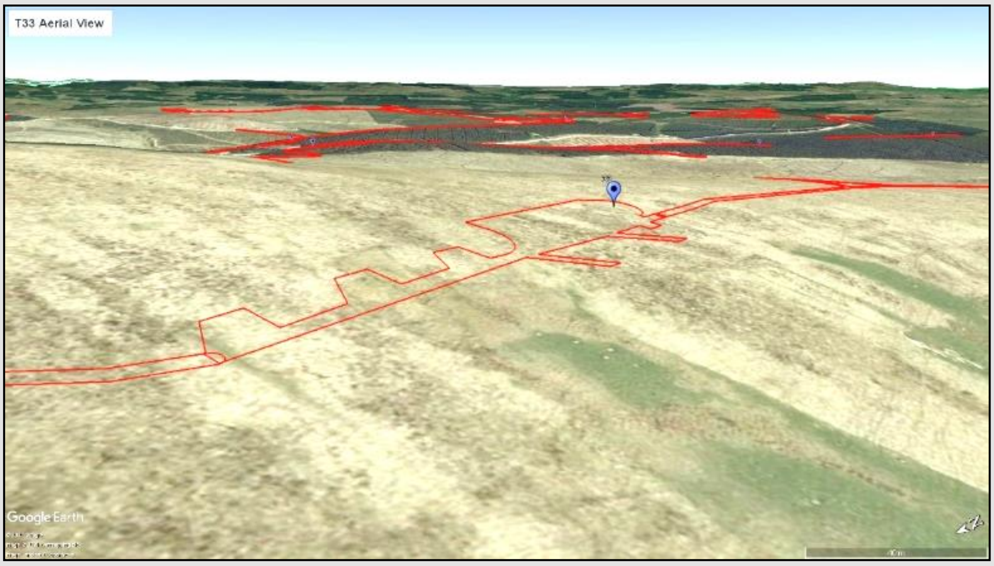
ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 33

Risk Category - **Low**

- Mean Peat Depth at Proposed Infrastructure - 0.3m (interpreted as thin soils / not peatland)
- Mean Peat Depth Surrounding Area – Absent thin soils / not peatland across the down-slope system towards the west. Directly upslope from the turbine position peat depths do not increase.
- Terrain slope 8°
- **T33 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context**



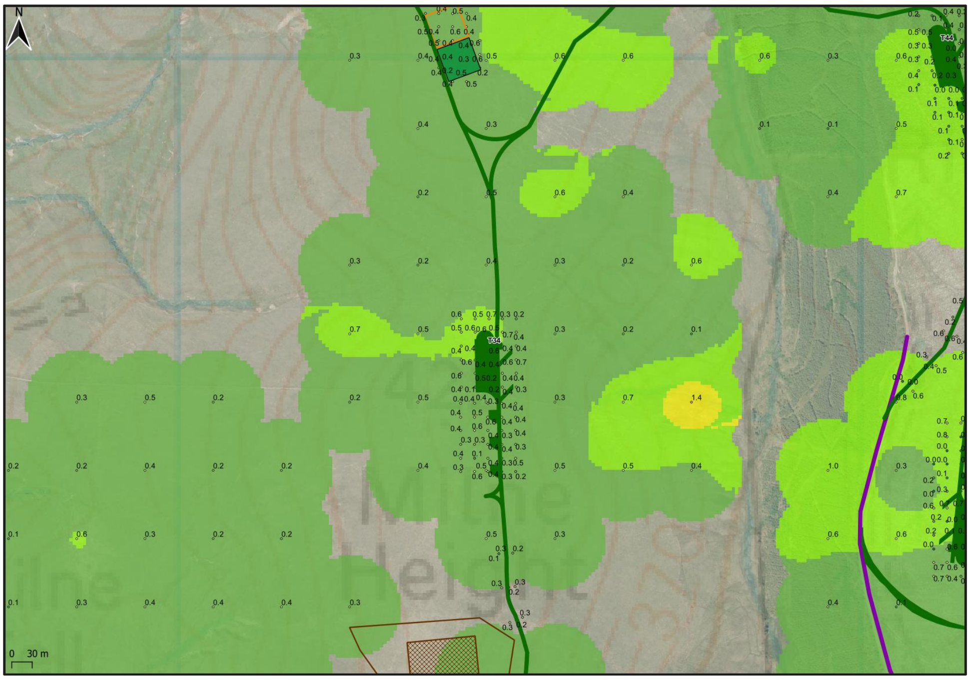


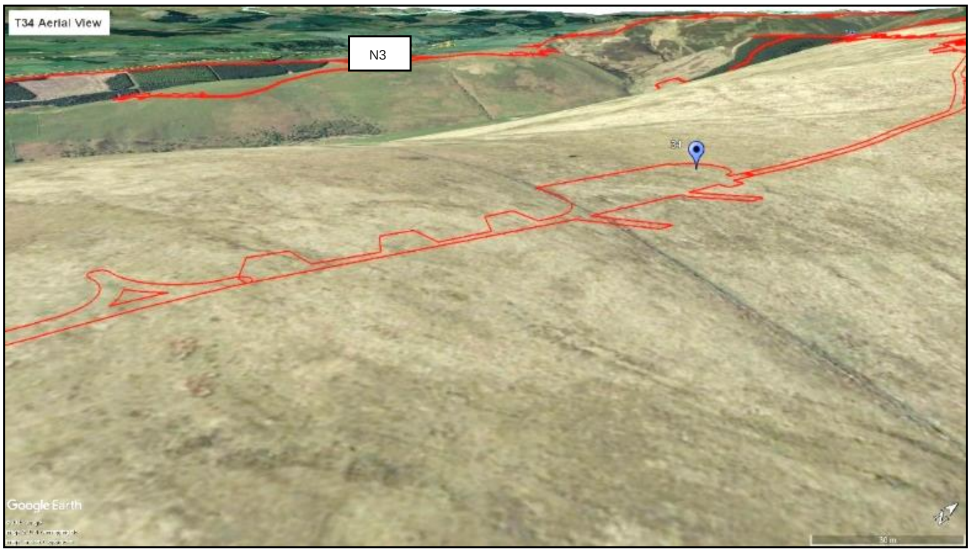
At the proposed infrastructure location and across the surrounding terrain (down-slope) there is no peatland and contributory factors (signs of previous instability, hydrology, groundwater and infiltration) indicate a low-risk. The nearest peat depth of >0.5m are ~100m upslope traversing eastward and disconnected from the terrain at the turbine location due to the absent peat deposits at this location. There would thus no direct linkage between proposed construction works at T33 and peat deposits to the east.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 34

- Risk Category - **Low**
- Mean Peat Depth at Proposed Infrastructure - 0.4m. An isolated probe depth of 0.6 is recorded on the north side of the turbine location on level ground and then > 200m west and east of the turbine location. Terrain analysis and the grid probing survey data indicated a shallow / absent peat depth or thin mineral soil layer.
- Mean Peat Depth Surrounding Area – Peat is majority absent with thin soils (mean – 0.3m) widespread across the down-slope system.
- Terrain: 6°
- **T34 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context**





At the proposed infrastructure location and across the surrounding terrain (down-slope) there is no deep peat on sloping ground and contributory factors at proposed turbine locations (signs of previous instability, hydrology, groundwater, and infiltration) indicated a low-risk location. Further survey information at this location will not in the view of Natural Power increase the precision of the risk assessment.

Turbine 37 – Now Removed from AI 2022 Submission

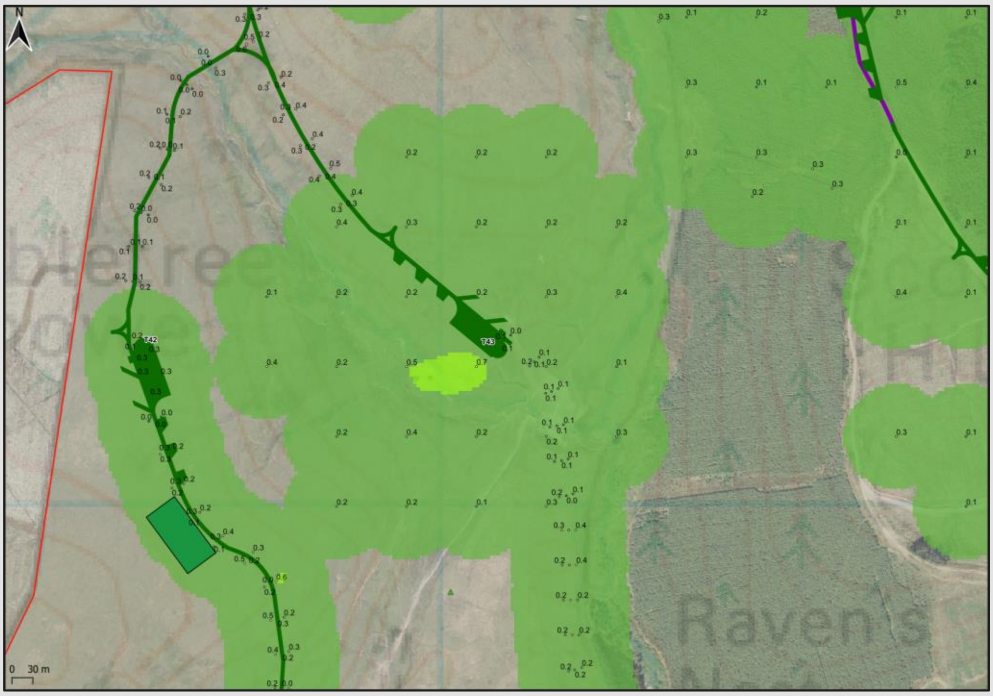
Turbine 38 – Now Removed from AI 2022 Submission

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 43

- Risk Category – **Low/Negligible**
- Mean Peat Depth at Proposed Infrastructure - 0.4 (Peat Absent)
- Mean Peat Depth Surrounding Area – Peat is absent with thin soil cover. Isolated peat pocket or possible soft soil located ~65m to the southwest associated with the alluvial depositional setting. Digital terrain analysis and site reconnaissance revealed modified grazing and no peat across this area.
- Terrain 8 degrees slope angle coupled with the absence of any peat accumulation means a large-scale peat slide event at this location is not possible.

T43 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context



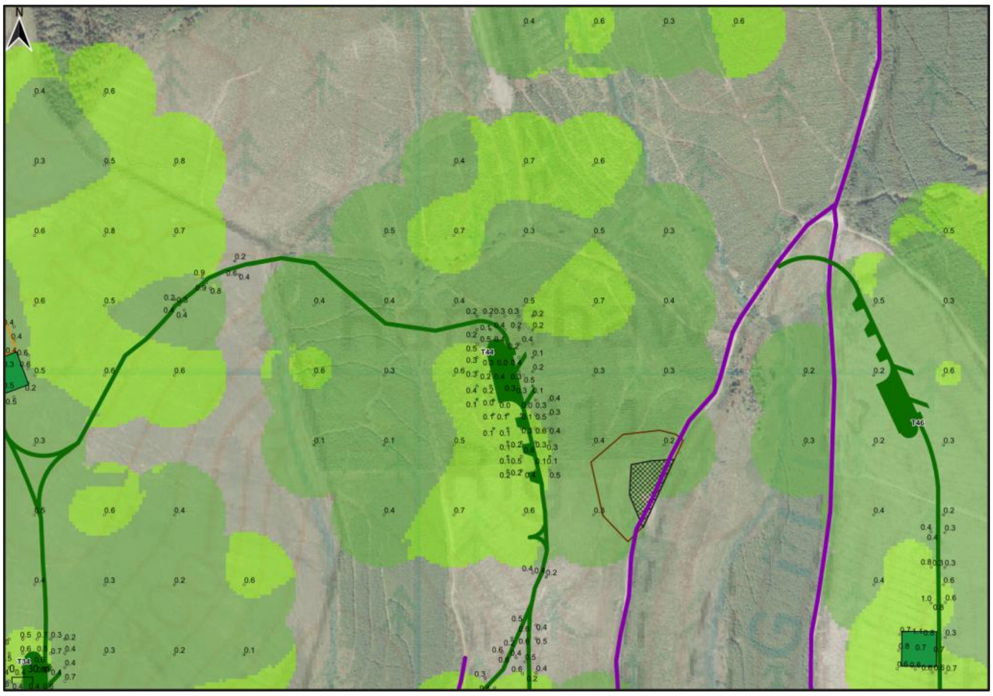
Peat was assessed to be absent at the proposed infrastructure location and surrounding area. This was determined from the 100m grid probe data, digital terrain analysis and site reconnaissance back. Across the surrounding terrain (down-slope) there is no continuous deep peat and contributory factors (no pre-existing signs of failure, no peatland hydrological features, shallow terrain angle) at proposed turbine locations indicated a low/negligible peat slide risk location. Further survey information at this location would not increase the precision of the risk assessment as it has been demonstrated there is no peat. This information should make it clear that such locations are not required to be the focus of detailed peat slide assessment and can be screened out of the risk assessment during the phased survey process.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 44

- Risk Category - **Low**
- Mean Peat Depth at Proposed Infrastructure - 0.25m. Marginally deeper probe depth (0.6m) recorded ~75m west of the turbine location although on the opposing side of the ridge. Depths of 0.6m were further recorded south across the access infrastructure.
- Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the controlling downslope system to the east to which the proposed infrastructure occupies.
- Terrain slope angle of 11°.

T44 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context



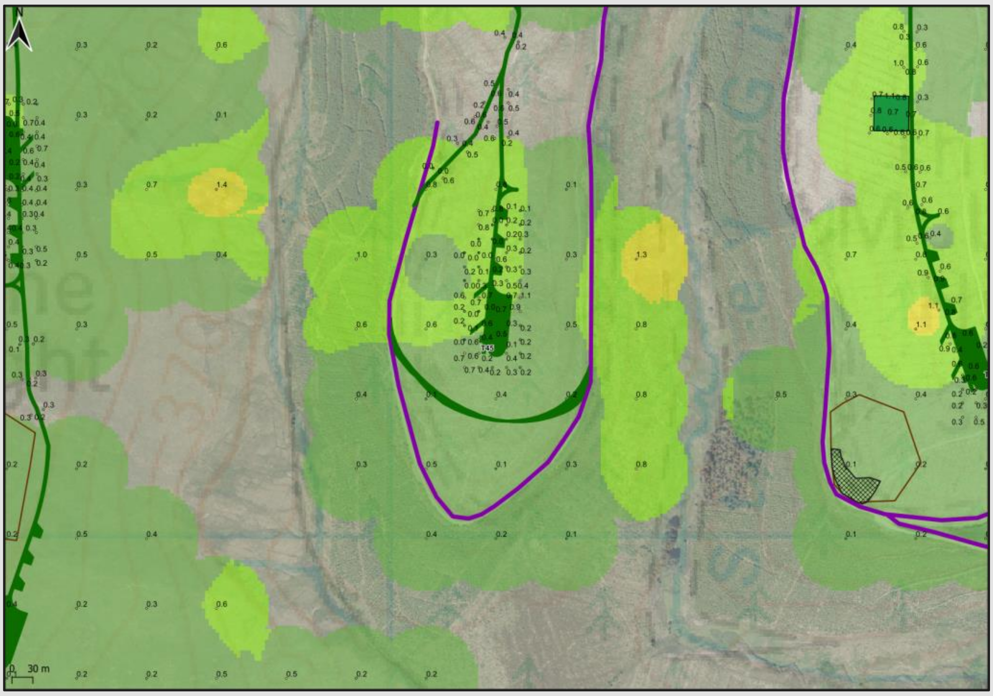
Based on this information the location of T44 was not initially prioritised for detailed assessment as it does not represent a location from where there is a significant impact potential from peat slide. Although during early phases of the survey obscured by commercial forestry plantation which negated practical access for detailed peat probing, the generally shallow peat depths across this area warrants further terrain assessment post-felling. This was completed in the final phase of survey November 2022. Across the surrounding terrain (down-slope from infrastructure) there is no continuous deep peat and contributory factors (Factor of Safety, hydrology, and distance from nearest watercourse) at proposed turbine locations indicate a low-risk location. Detailed probing has confirmed this.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 45

- Risk Category – **Negligible**
- Peat Depth at Proposed Turbine Infrastructure - 0.3m (Thin soils / Absent Peat)
- Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the immediate controlling downslope system to the east and south.
- Terrain 4° slope angle

T45 - Peat Depth and Elevation Contours (2m interval) with 3D terrain view for wider context & contemporary aerial imagery post felling



Based on this information the location of T45 was not initially prioritised for detailed peat probing. Marginally deeper peat 0.6m is recorded north across the access infrastructure and west on the opposing side of the ridge system. The proximity of the increased probing depth from the turbine infrastructure and the fact it is on a separate slope system was also considered. Given these factors; this location was not assessed to represent a location from where there is a significant impact potential from peat slide. Across the surrounding terrain (down-slope) there is no continuous deep peat and contributory factors (Factor of Safety, hydrology, and distance from nearest watercourse) at proposed turbine locations indicated a negligible risk location. Applying worst-case peat depth factor to the risk model for this location would increase the risk category to low. Thus, additional peat probe survey information was not gathered at the initial stage.

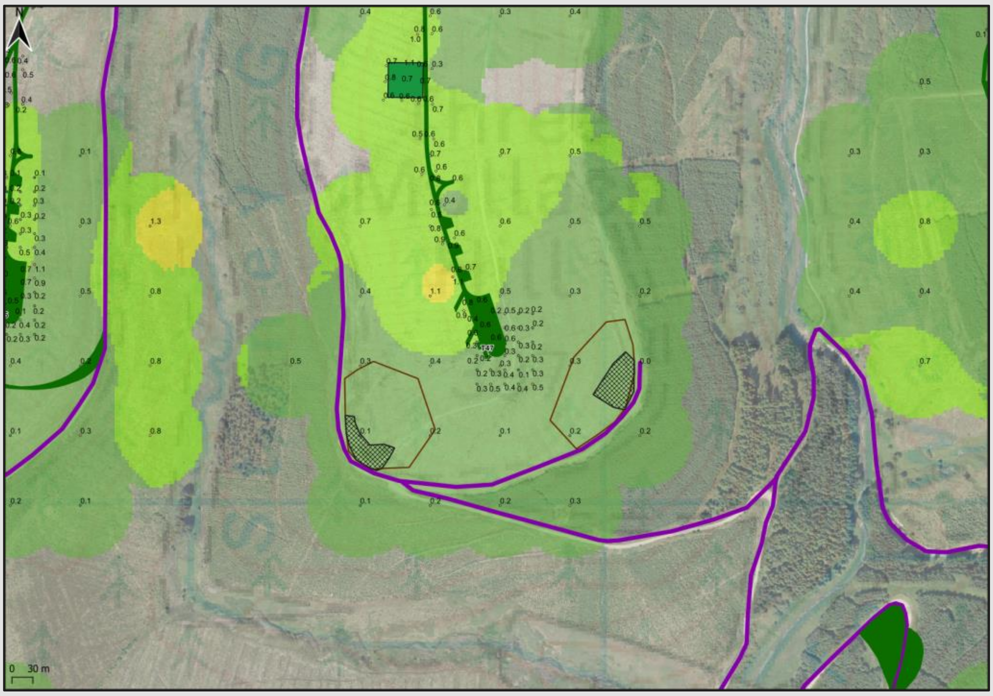
Since conducting the initial peat survey forestry felling has occurred across this section of the site. Detailed probing undertaken November 2022 and additional terrain reconnaissance has confirmed this to be a low-risk location.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 47

- Risk Category – **Low**
- Mean Peat Depth at Proposed Infrastructure - 0.6m
- Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m across the immediate controlling downslope system .
- Terrain < 6 degrees terrain slope angle.

T47 - Probe Depths and Elevation Contours (2m interval) with 3D terrain view for wider context



Based on this information, the turbine location of T47 was not initially prioritised for detailed probing. As is evident in the image extract above, detailed probing was undertaken along the approaching access infrastructure footprint where deeper peat was initially detected by the 100m grid survey. Detailed probing has confirmed peat of up to 1m depth on level or shallow sloping ground and this his was supported by a peat core sample 'PC04' described in the main peat slide risk assessment report (Table 3.15, Ref:1225356). The detailed peat probing was curtailed across the turbine hardstand and foundation location due to the indication for absent peat recorded in the 100m grid probing.

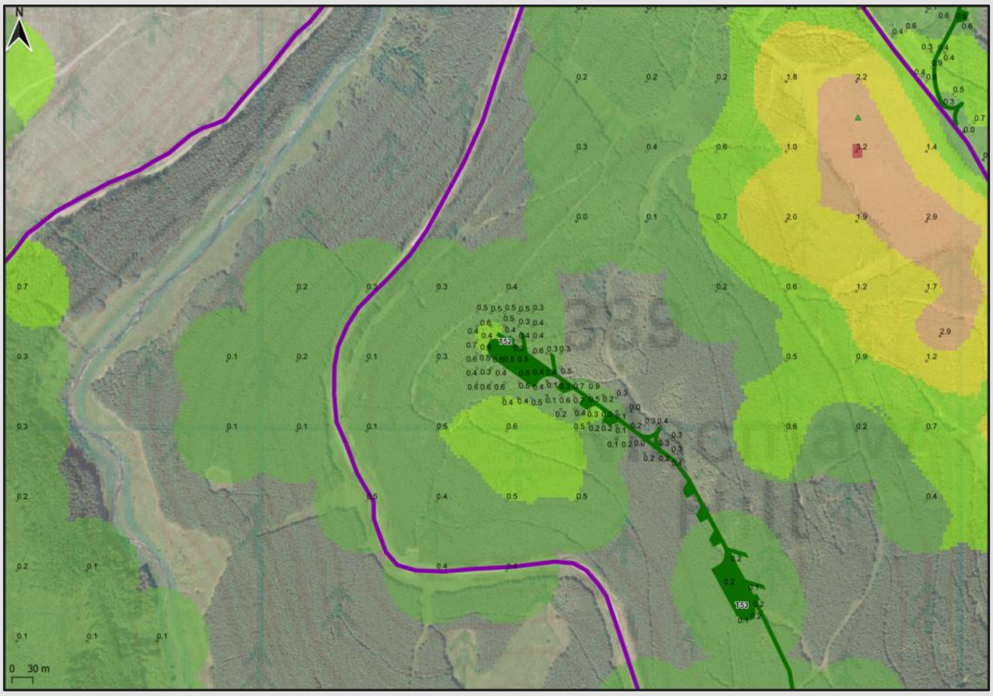
Across the surrounding terrain (down-slope) to the east, south and west; there is no indication of peat accumulation from the 100m grid probing. Final phase survey with detailed probing across this area has confirmed no peat. Contributory factors to peat slide at proposed turbine locations indicate a low-risk location. There was no evidence of previous instability, nor any hydrological indicators recorded. Further survey information at this location will not increase the outcome of the risk assessment in this case. Assuming a worst-case score for peat depth in the risk assessment model does not increase the risk category beyond low due to the absence of other contributory factors (signs of previous instability, Factor of Safety, hydrology), and the significant distance for the nearest watercourse receptor (>380m).

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 52

- Risk Category – **Low**
- Mean Peat Depth at Proposed Infrastructure - 0.4m
- Mean Peat Depth Surrounding Area – Peat is thin and generally <0.5m and likely represents a shallow mineral soil.
- Terrain 6° slope angle.

T52 - Probe Depths and Elevation Contours (2m interval) with 3D terrain view for wider context



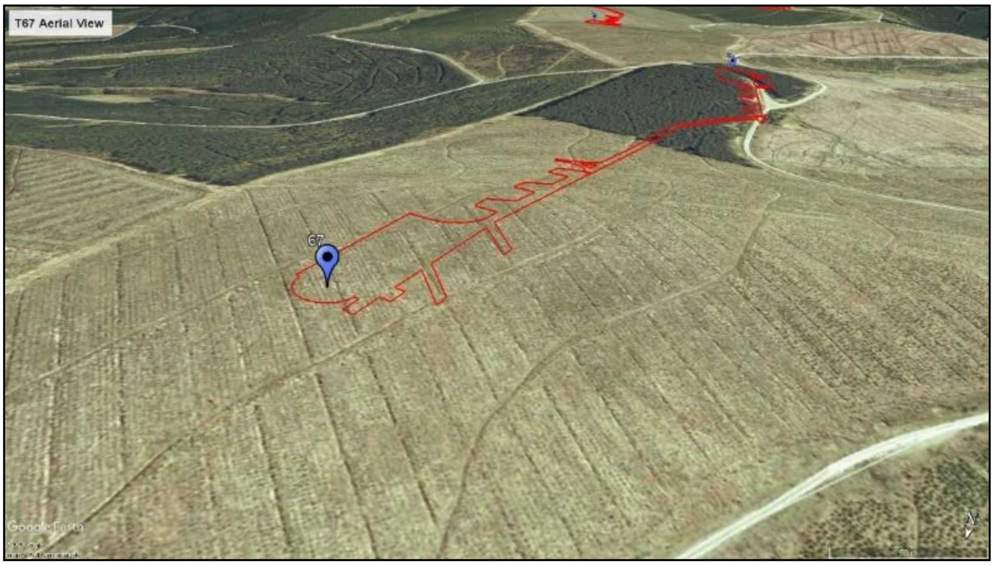
The location of T52 was at the time of survey obscured by commercial forestry plantation. However later additional detailed probing was recorded at the turbine foundation location where a maximum probe depth of 0.6m was recorded. The wider 100m grid data surrounding the turbine and within the same terrain unit are all indicative of an absence of peat. This area will require further assessment post-felling. Contributory factors to a large-scale peat slide at proposed turbine locations indicated a low risk. There was no evidence of previous instability, no hydrological indicators or other key factors noted. Further probing information at this location would not increase the precision of the risk assessment until the post felling phase is reached at which point pre-construction ground investigation would be the logical point at which to gather additional geotechnical information. Assuming a worst-case score for peat depth in the risk assessment model at this location does not increase the risk category above ‘low’ due to the absence of other contributory factors and the significant distance for the nearest watercourse receptor (>400m).

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 67

- Risk Category – Low/Negligible
- Peat Depth at Proposed Turbine Foundation Infrastructure - 0.1m (Peat Absent) recorded by 100m grid survey.
- Mean Peat Depth Surrounding Area – Peat soil thickness: mean depth 0.4m and likely represents a shallow mineral soil with isolated peat pockets
- Terrain 9° terrain slope angle

T67 - Probe Depths and Elevation Contours (2m interval) with 3D terrain view for wider context (note updated imagery shown now clear fell condition across this location, dense forestry present at time of initial survey)



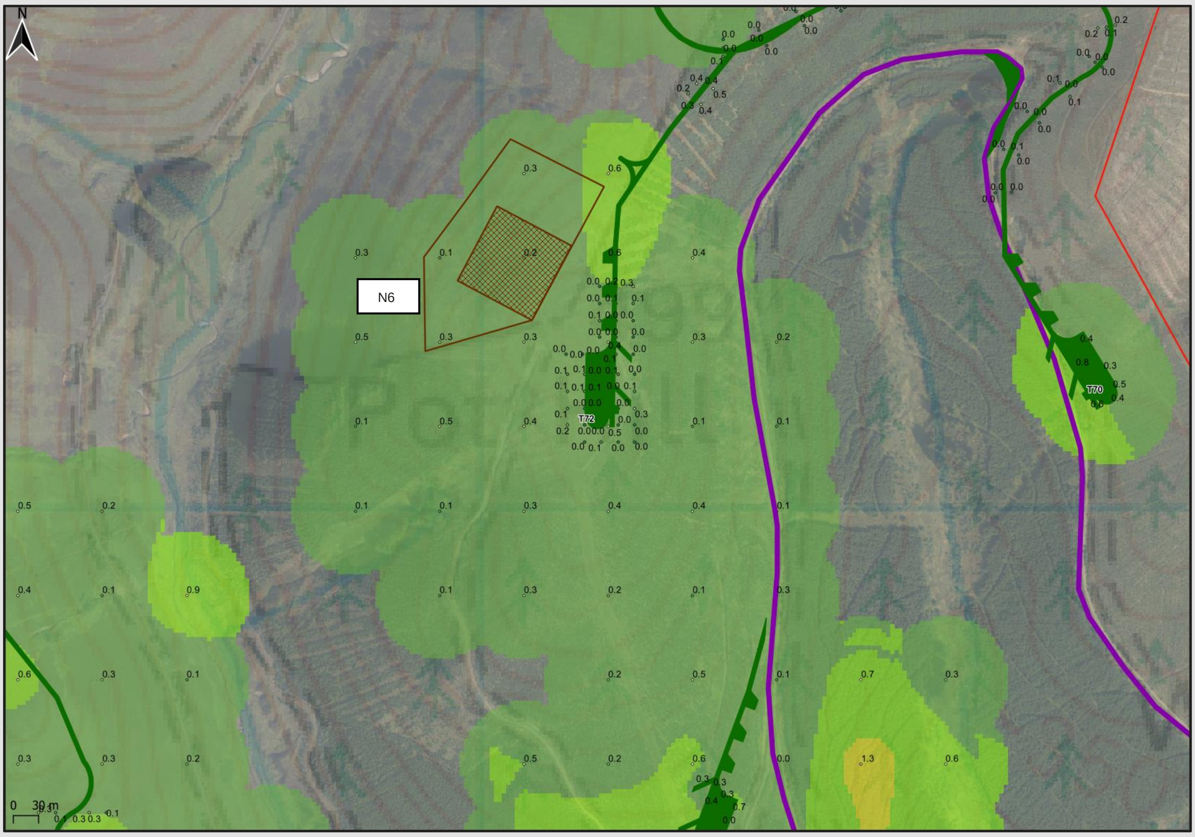
Based on this information the location of T67 was not initially prioritised for detailed peat probing as it does not represent a location from where there is a significant impact potential from peat slide. Across the surrounding terrain and in particular on the same slope system there is no continuous deep peat and contributory factors at proposed turbine locations indicated low risk from peat slide. Recent felling activity has had no detectable impact on stability based on the aerial image and last stage of detailed site assessment. At this time of the survey Q1 2020; there was dense forestry recorded at the turbine location which would have further hindered detailed probing. The additional detailed probing collected at this location confirmed the risk category as 'low' due to the absence of other contributory factors and the significant distance for the nearest watercourse receptor (>200m).

ID	Stage 2 Report Comment	Recommendations	Developer Response

Turbine 72

- Risk Category – Low/Negligible
- Mean Probe depth at Proposed Infrastructure - 0.1m (Peat Absent with this probe depth indicative of shallow mineral soil)
- Mean Peat Depth Surrounding Area – Peat / soil is thin mean 0.2m and likely represents a shallow mineral soil with isolated peat pocket or soft soil to the west and north.
- Terrain 10° slope angle.

T72 - Probe Depths and Elevation Contours (2m interval)



Based on this information the location of T72 was not initially prioritised for detailed peat probing as it does not represent a location from where there is a significant impact potential from peat slide. The 100m grid probing indicated no peat accumulation at the proposed wind turbine infrastructure location or across the controlling steeper slope system to the east. Across the surrounding terrain there is no continuous deep peat and contributory factors (Factor of Safety, hydrology and signs of previous instability) at the proposed turbine location indicate a low risk from peat slide. Further detailed probe data collected in November 2022 has confirmed these conclusions.

ID	Stage 2 Report Comment	Recommendations	Developer Response

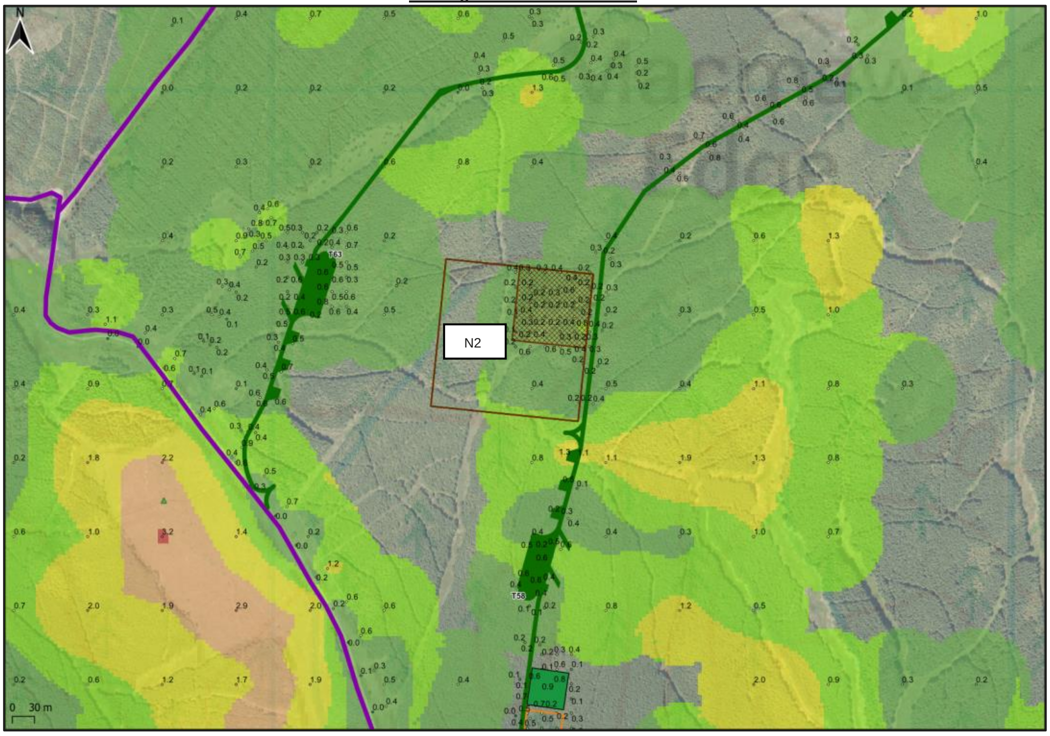
Following review of the highlighted twelve turbine & additional infrastructure locations (See item 6); Natural Power has undertaken a sensitivity analysis and reviewed the effect of peat depth on peat slide risk categories at highlighted locations. This exercise (unrealistically) assumes deep peat classification across all highlighted locations. Within the risk model; peat depth is one out of eight contributory factors which are assessed comprise the overall risk score. The table below summarises this outcome:

Turbine Infrastructure ID	Reported Peat Slide Risk Category & Score	Assuming worst case peat depth factor of '5'	Comments
T22	Low (5)	Low (10)	No change in risk category location: infrastructure is significant distance from main receptor with no further contributory factors elevated
T33	Low (6)	Medium (16)	Increased to medium risk. Elevated due to proximity to watercourse buffer. No other contributory factors are elevated.
T34	Low (6)	Medium (16)	Increased to medium risk. Elevated due to proximity to watercourse buffer. No other contributory factors are elevated.
T37			Removed from AI 2022 Layout
T38			Removed from AI 2022 Layout
T43	Negligible (3)	High (24)	Elevated due to proximity to watercourse buffer. No other contributory factors are elevated. There is very clear no peat location, determined on the digital terrain analysis, site reconnaissance and 100m probe mapping coverage.
T44	Low (5)	Low (10)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
T45	Negligible (3)	Low (8)	Elevated to low-risk category location significant distance from main receptor with no further contributory factors elevated
T47	Low (6)	Low (8)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
T52	Negligible (3)	Low (8)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
T67	Negligible (3)	Low (10)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
T72	Low (5)	Low (10)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
Temporary Compound 1	Negligible (3)	Low (10)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
Temporary Compound 3	Negligible (1)	Low (5)	Elevated to a 'Low' risk category
Temporary Compound 6	Negligible (3)	Low (8)	No change in risk category location significant distance from main receptor with no further contributory factors elevated
Substation 2	Negligible (1)	Low (8)	Slightly elevated to a 'Low' risk however development may proceed using reported mitigation measures.
Substation 4	Negligible (3)	Low (5)	Slightly elevated to a 'Low' risk however development may proceed using reported mitigation measures.

ID	Stage 2 Report Comment	Recommendations	Developer Response
			This exercise demonstrates that out of the twelve turbine locations highlighted: three are elevated to medium-high risk category when adopting the worst-case peat depth score. The scenarios for T33, T34 & T43 are considered to be highly unrealistic when considering the weight of evidence: • 100m grid probes at the infrastructure locations are on average <0.5m representing shallow or absent peat; • Digital terrain analysis indicates an absence of deep peat supported by aerial imagery and site reconnaissance; • There are no pre-existing visible signs of failure across these areas; • Numerical slope stability modelling undertaken as part of the original peat slide risk assessment (Ref: 1225356) indicates no potential for translational peat slide in these areas; Notwithstanding these points hypothetical mitigation for T33 and T34 would be straightforward and involve micro-siting on the order of 10m in order to increase proximity from the watercourse buffer for the turbine location. In the case of T43 deep peat at this location is just not represented by the terrain ground conditions or evidence gathered by the 100m grid probe survey. Peat was recorded to be absent across this location. A single soil probe depth of 0.65m located 40m southwest from the turbine centre was interpreted to be a soft mineral soil (clay or peaty soil) and not representative of any widespread blanket peat condition. This exercise questions the value in ubiquitous peat probing data when considered in the light of the full breadth of the assessment. It has been demonstrated therefore that for the turbines where further detailed probing is recommended in the Stage 2 checking report the ultimate mitigation and conclusions of the peat slide risk assessment would remain materially unchanged.
6	ECUBPG notes that Phase 1 probing should be supplemented with significant additional probing at infrastructure locations and along tracks. The Peatland Survey Guidance notes ancillary infrastructure such as these should be included. Borrow pits N2, N5, N6, N8 have peat >0.5m within approx. 100m of them based on Phase 1 survey. Temporary construction compound 1, 3, 6 have peat >0.5m within approx. 100m of them based on Phase 1 survey. Temporary compound 7 has no probing within several hundred metres. Substation control room 4 has peat >0.5m within approx. 100m based on Phase 1 survey. Substation control room 2 has no survey within 100m. On the basis of lack of information, it is not accepted that additional probing would almost certainly not affect the probing. ECUBPG is clear in the need for significant additional probing at infrastructure locations.	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020.	Natural Power disagree with Stage 2 checking recommendations for Item 6. Natural Power have re-presented the peat depth map information below and the following points for consideration: • Borrow Pits N2, N6, N8 were determined in the Phase I survey to be not located on peatland with average depths of 0.2-0.3m indicating thin soil coverage and no peat accumulation. Thus, these locations were screened out of any further detailed stability assessment in line with guidance. Current borrow pit search areas are similarly under this determination. • The following extract from the Phase 1 peat survey and reconnaissance indicates soil depths commensurate with no peat and thin mineral soil profiles. Isolated pockets of deeper probe depths were not interpreted as indicative of peatland or raised bog conditions. Please see the accompanying text and graphics below for further details.

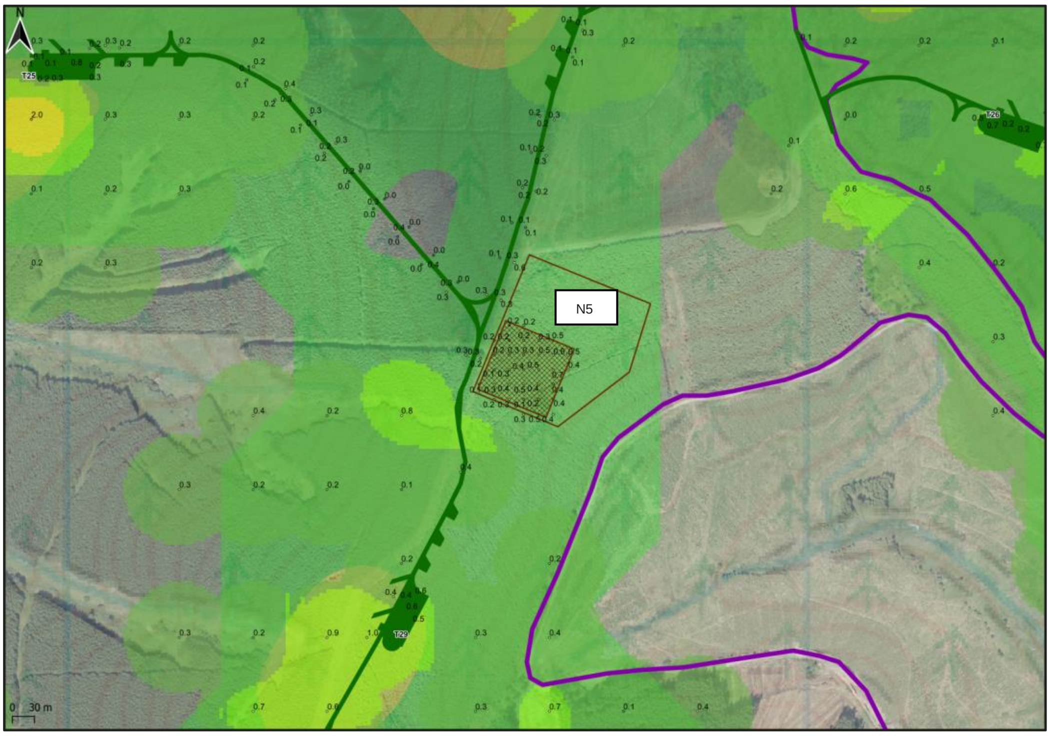
ID	Stage 2 Report Comment	Recommendations	Developer Response

Probing Data Extract – BP N2 :



Difficult access conditions were initially present at Borrow Pit N2 as shown in Appendix B (Figure 8.5). Final stage survey permitted access with probe depths confirming an absence of deep peat.

Probing Data Extract BP N5



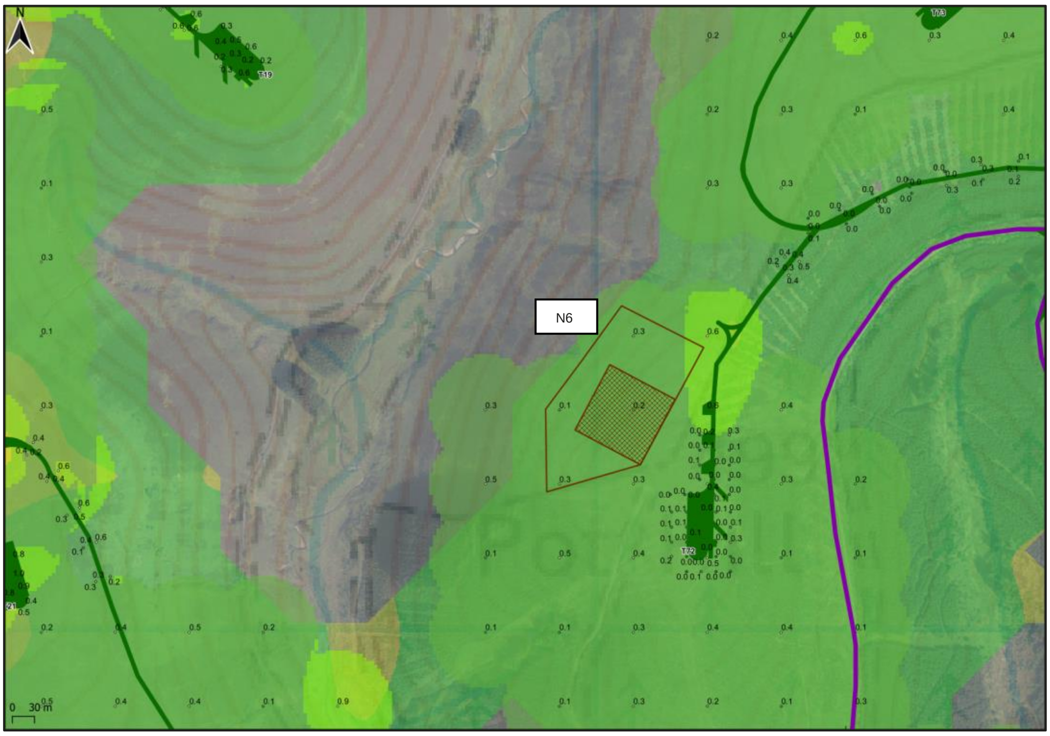
- Borrow Pit N5 was not initially accessible due to steep slopes and dense forestry.
- The nearest proximity (~100m south) probing indicated 0.4m soil depth. and again, reconnaissance evidence of thin soil coverage only.
- In addition, reconnaissance photography from the access track cutting to the southeast revealed an absence of peat. (See photo below).

ID	Stage 2 Report Comment	Recommendations	Developer Response

- Assuming a worst-case peat depth score of '5' in the risk model does not elevate the risk ranking above a 'Low' risk.
- The location is a significant distance from the nearest sensitive receptor (>250m).
- Final stage detailed survey permitted access and confirmed shallow soils.

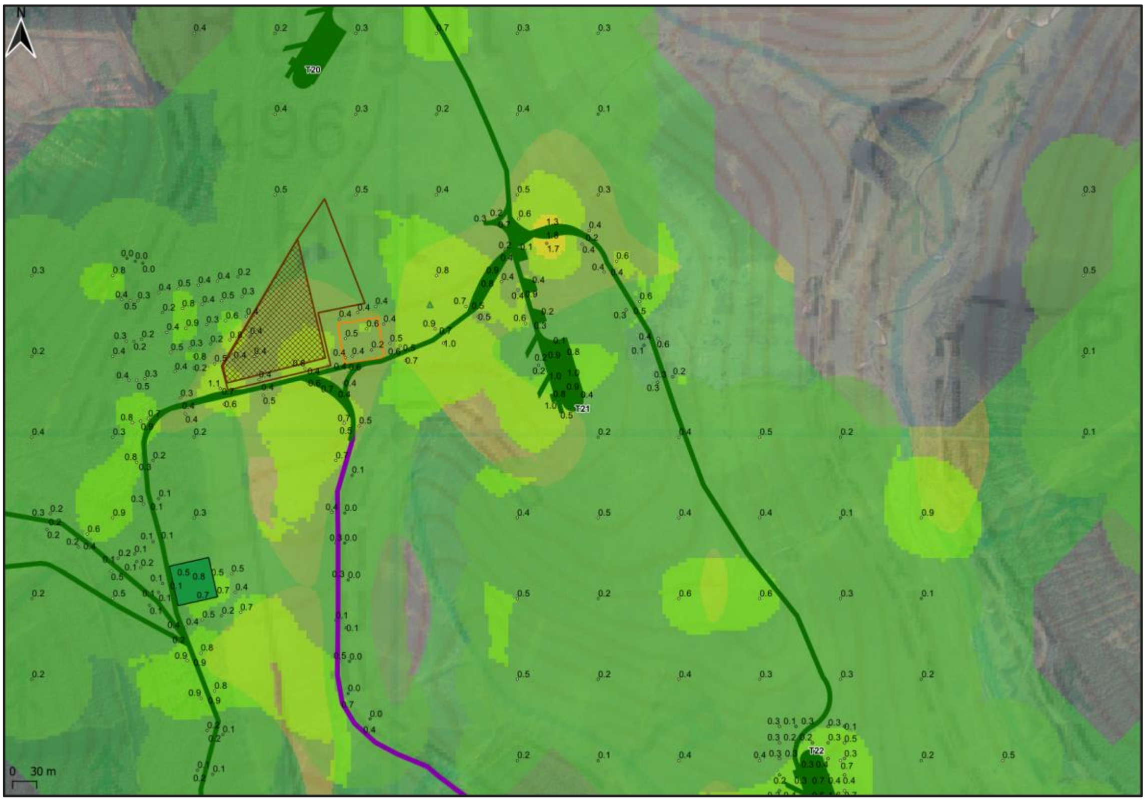
Photo at existing forestry road cutting south-east from Borrow Pit N5. No peat was visually present with mixed glacial subsoils dominant at this location.

Probing Data Extract BP N6



At BP N6; 100m grid probe data did not reveal any evidence of blanket peat or raised bog conditions. The terrain across this location is steepened and with an indicative shallow soil overburden thickness. Thus, the borrow pit search area is proposed to allow for efficient extraction of bedrock materials from the steeply rising southern aspect slope. The borrow pit location was chosen specifically for its avoidance of peat deposits. Deeper intrusive geotechnical investigation is the next logical step to confirm the geotechnical ground model, including soil profile and underlying rock mass classification. This would be carried out as part of the pre-construction phase of works and post consent.

Probing Data Extract BP N8



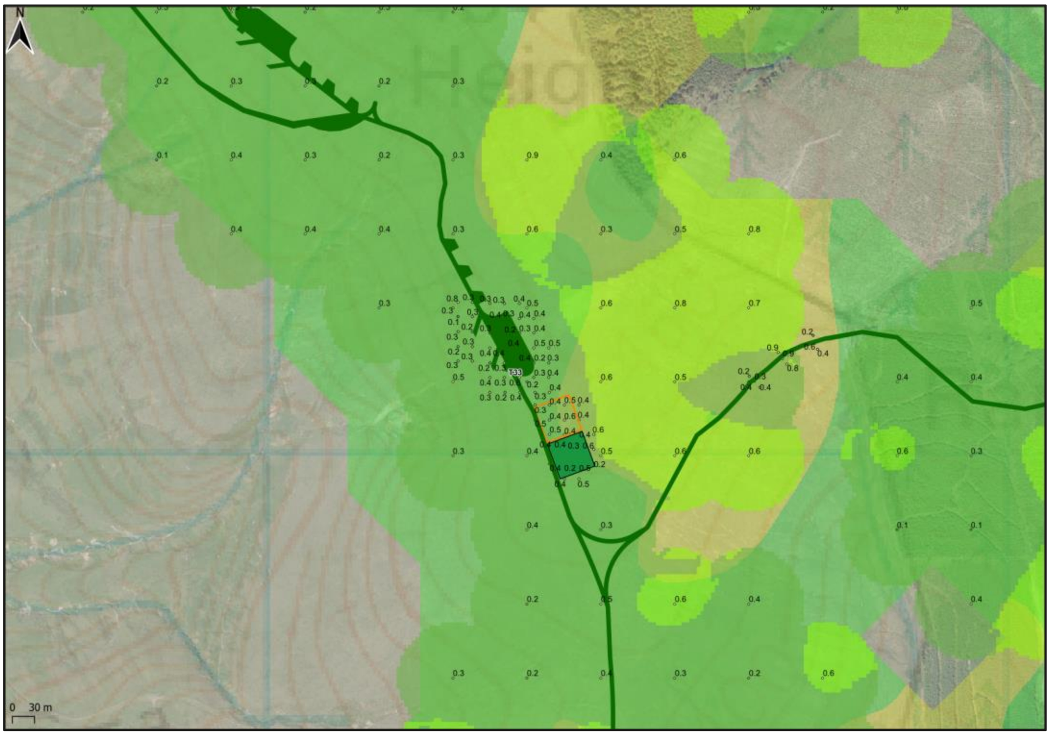
Terrain at Borrow Pit ‘N8’ has only thin probing depths recorded (≤0.5). The conclusion was hence this location was not indicative of peatland or a blanket bog location.

For all borrow pits, the search areas identified would be subject to individual borrow pit working methodologies which would draw upon detailed ground investigation data. As part of the working methodologies usually submitted as part of planning condition: volume and type of soil overburden and management protocols including temporary storage and stability control, along with details of the bedrock geology and extraction methods, details of relevant pollution prevention controls, and finally, full details of the contemporaneous restoration of borrow pit locations as part of the construction phase. Within this process, the detailed ground investigation data would be analysed including any further peat or soil depth information and peat stability risk management would be inherent within the detailed borrow pit design protocols.

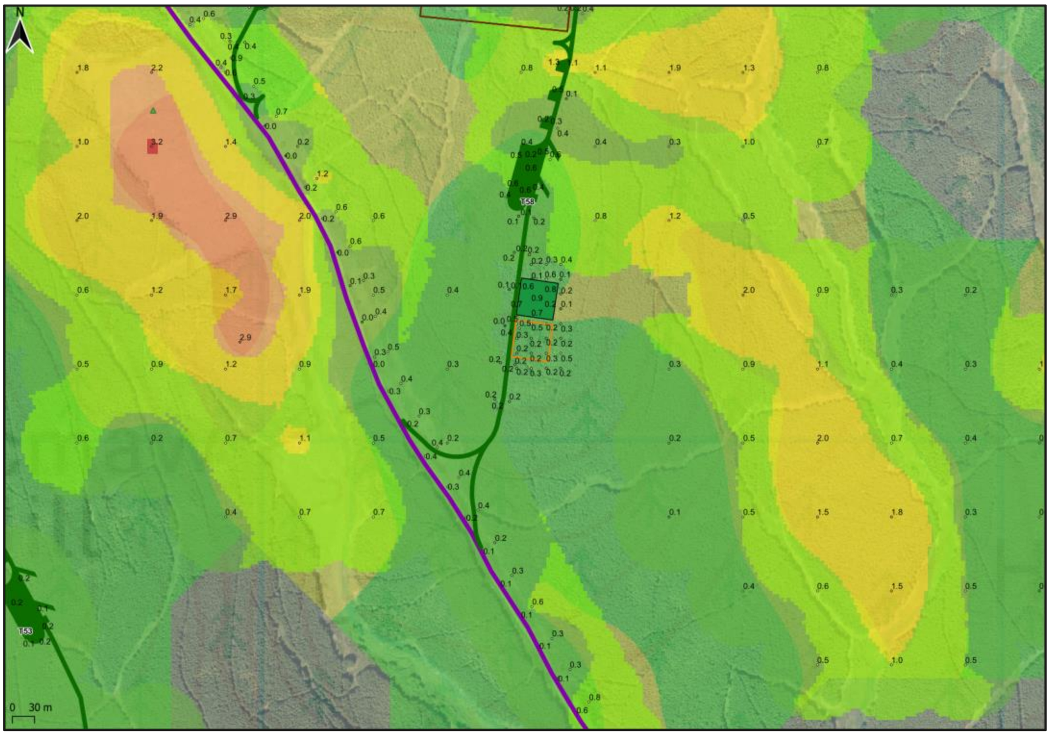
Substation Control Room 2 & 4 and Temporary Construction Compounds 1,3,6 are all determined to be not on peatland or blanket bog. Low to negligible risk ranking has been determined for these locations. Temporary Construction Compound 7 has been removed from the updated layout.

ID	Stage 2 Report Comment	Recommendations	Developer Response

Substation 4 & Compound 6 – Position Updated

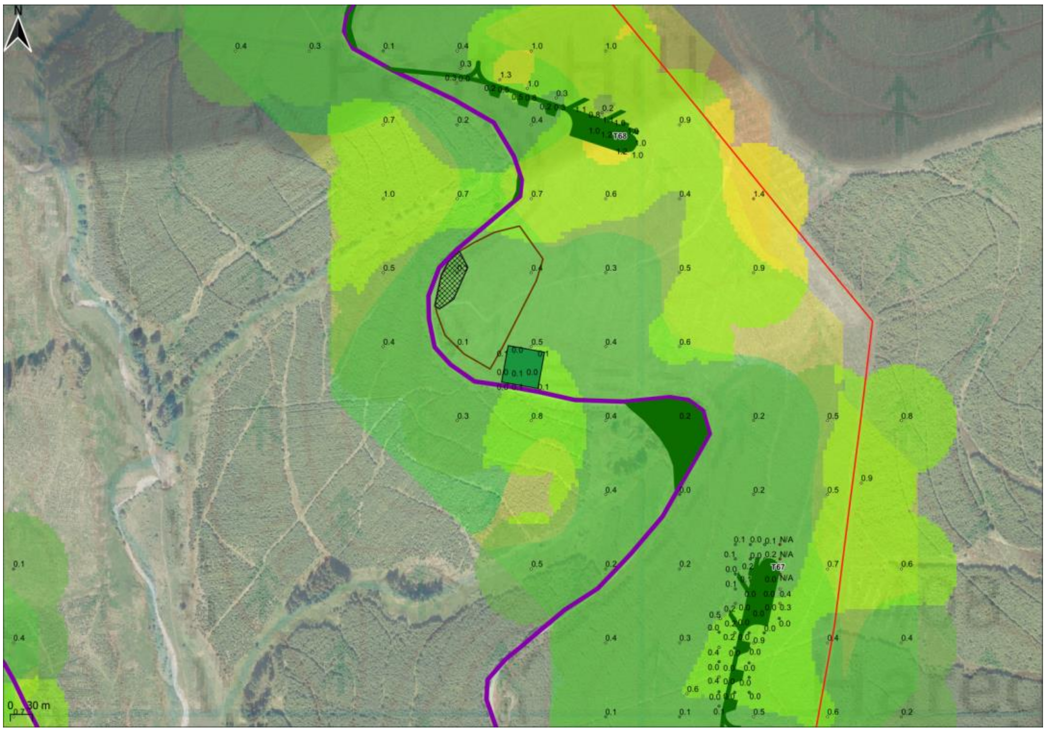


Substation 2 & Compound 3 (Position Updated Now Compound 3 & Substation)



ID	Stage 2 Report Comment	Recommendations	Developer Response

Temporary Compound 1



Overall, through re-examination of the desk study materials and field survey data there is no evidence to suggest peatland or blanket bog conditions which could give rise to peat slide conditions at the highlighted ancillary infrastructure locations. Digital terrain analysis at each location as well as compilation of soils mapping data and site reconnaissance has led to this conclusion. Returning to the highlighted principles of targeted, practical, and economic survey methods advocated by the national guidance. There was therefore no requirement under the guidance to pursue detailed survey coverage of these areas.

Nonetheless and as already stated, the developer has committed to conducting detailed ground investigation at all ancillary infrastructure locations at the appropriate pre-construction phase however there is currently deemed to be no benefit of additional peat probing at these locations to the peat slide risk assessment report as the additional peat probing results will not change the peat slide risk assessment results.

ID	Stage 2 Report Comment	Recommendations	Developer Response
11	The Peat Stability Risk Zones mapping (Figure 10.2.8) only considers slope and peat depth vs receptor according to the notes beneath the key, so it appears other factors are not considered. Use of these factors alone appears reasonable as these are most critical. However, it still not clear why some areas chosen. Reviewing Fig 10.2.8 – some of the tracks highlighted for assessment aren't covered by the Risk Zones mapping (eg north of T01, north east of T05, near Borrow Pit N5), whilst some areas of track seemly passing through medium/high risk areas according to this map aren't covered within Table 5.3 (e.g. main access route into site west of T08, track between T18 & T74). Unclear whether this is due to mitigation, explanation required. As noted above Figure 10.2.8 contains the peat stability risk zone map which appears to be based on slope angle and peat depth – however limited detailed track probing has been carried out and the Phase 1 survey has significant gaps across large sections of access track and therefore it is not thought that these is sufficient coverage with ECUBPG notes in section 4.4.3.4 that:	As per ECUBPG significant additional probing over and above the Phase 1 grid is required at infrastructure locations. Peatland Survey Guidance provides appropriate probing locations. This was detailed in the Comments on Developers Peat Probing Proposals provided in March 2020.	The risk zonation mapping presented within the Peat Slide Risk Assessment Report (Ref: 1225356) is not to be consulted in isolation but viewed in context of the accompanying risk assessment report. The basis of the map is the peat/soil depth data points, interpolated terrain slope angle and proximity to major watercourse receptors. The inherent limitations of the model are currently explained in the reporting (Section 5) where it is explained that the assessment draws upon experiential and subjectively assigned parameters. Further modelling limitation are extracted below: • High risk will be indicated at watercourse crossing points even for shallow peat depth locations. Further exploration of the contributing factors at these locations were considered and the final risk assignments are deployed within the main risk table of the report (Table 5.3). • The peat depth data points are not definitive in terms of differentiation between peat and mineral soils. • The peat slide risk zonation map will tend to produce an overestimation of risk and is therefore used as a screening tool to focus areas of the development indicated to be at highest or most widespread elevated risk. It is the view of Natural Power that expanding the scope of peat probing surveys onto areas which are not peatland or blanket bog will not increase the efficacy of the peat slide risk zonation map. The strategy of the assessment has followed the relevant

ID	Stage 2 Report Comment	Recommendations	Developer Response
	In order that the model be considered reliable, sufficient coverage of data points should be available in areas covered by the model, hence infrastructure targeted probing (with limited coverage elsewhere) may be inadequate to produce a site wide peat model.		guidance documentation11 and it is simply not the correct approach to apply detailed peat probing across areas where: • There is no significant potential for peat slide determined at desk study and site reconnaissance phase. • There is no indication of peat accumulations, peatland or raised bog conditions. • Areas are out-with the development which are disconnected by terrain unit position. For these areas therefore, the risk mapping has not been extended as it would confer a risk assignment which would not be realistic or representative. A photo extract from EIAR Chapter 10 shows the typical soil profile of the open and upland moorland:  A thin peaty topsoil (0.1-0.3m) overlying a mixed granular glacial sub-soil. This sequence was found to be very typical across the development and revealed in artificial drainage ditches and cuttings. Such evidence was included in the overall assessment of the peatland coverage and subsequent detailed survey design and assessment. This morphology is further evidenced in the main Geology/Hydrology Chapter (Section 10) of the Environmental Impact Assessment Report (EIAR).

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Conclusions

Natural Power has considered the Stage 2 Checking report for the Scoop Hill Wind Farm Peat Stability Assessment. Clarification and final justification have been stated in Table C1 of this response. The Stage 2 recommendations have arisen from a view raised that insufficient coverage of detailed peat probing had been carried out as part of the field survey on certain areas of the development. Ultimately on this point, Natural Power on behalf of the Developer has countered with the following points:

- The large size of the proposed development, complex terrain, and variable superficial soil cover warranted a targeted peat survey approach which has been a previously accepted approach supported by the national guidance on Peat Slide Risk Assessment[12]. Detailed probing has thus not been carried out ubiquitously across all infrastructure locations but rather based on initial desk-based survey, digital terrain analysis and Phase I, 100m grid probing survey assessment. Additional detailed probing has been undertaken across highlighted areas by IFL. A total of 6,238 peat probes have been obtained from across the site.
- There is no sector of the proposed wind farm infrastructure which is coincident with predicted deep peat or raised bog conditions which has not undergone peat slide risk determination and without associated mitigation measures proposed. Overall, the risk assessment has provided a comprehensive breakdown of the risk assignment across all major infrastructure locations with targeted mitigation actions.
- Peat depth information, although an important factor, is not in isolation the critical means of assessing peat or ground stability risk. The peat slide risk assessment has applied a variety of desk study methodologies, field reconnaissance and geotechnical engineering assessment to ensure risk assessment is accurate and representative of site conditions.
- Ubiquitous coverage of soil probes at detailed intervals across the site would not, in the opinion of Natural Power, enhance the peat slide risk assessment to a degree which would warrant the overcoming of safety, practical and economic restrictions to obtaining such a dataset. This rationale aligns with the statutory guidance. Areas of the scheme where peat was identified during the initial stages was targeted with detailed probing and this is well documented in the data and reporting presented in the original submission.
- The overall risk profile of the development with respect to peat stability is deemed realistic and representative for the terrain and superficial geology encountered across the development. Natural Power consider that the next logical step to enhance understanding of the ground conditions across the site would be through intrusive ground investigation. The developer is committed to undertaking these works as part of the usual pre-construction detailed design phase of development.
- Two key examples are highlighted of project scenarios where a targeted detailed peat survey approach was used as part of the peat slide risk assessment and which focused only on areas of peatland, deep peat or raised bog. In each case it is Natural Power's understanding that these have been accepted into planning by the ECU's checking process. These examples which Natural Power have been involved in include Crystal Rig IV Wind Farm, East Lothian, and Rothes III Wind Farm, Moray.

Given these aspects of the assessment, specified mitigation measures and commitment to further investigation, it is the opinion of Natural Power and the Developer that the issue of peat slide risk has been addressed to a comprehensive degree for this current phase of development. There exists a robust volume of work with targeted mitigation and recommendations to ensure risks continue to be addressed throughout all later stages of development.

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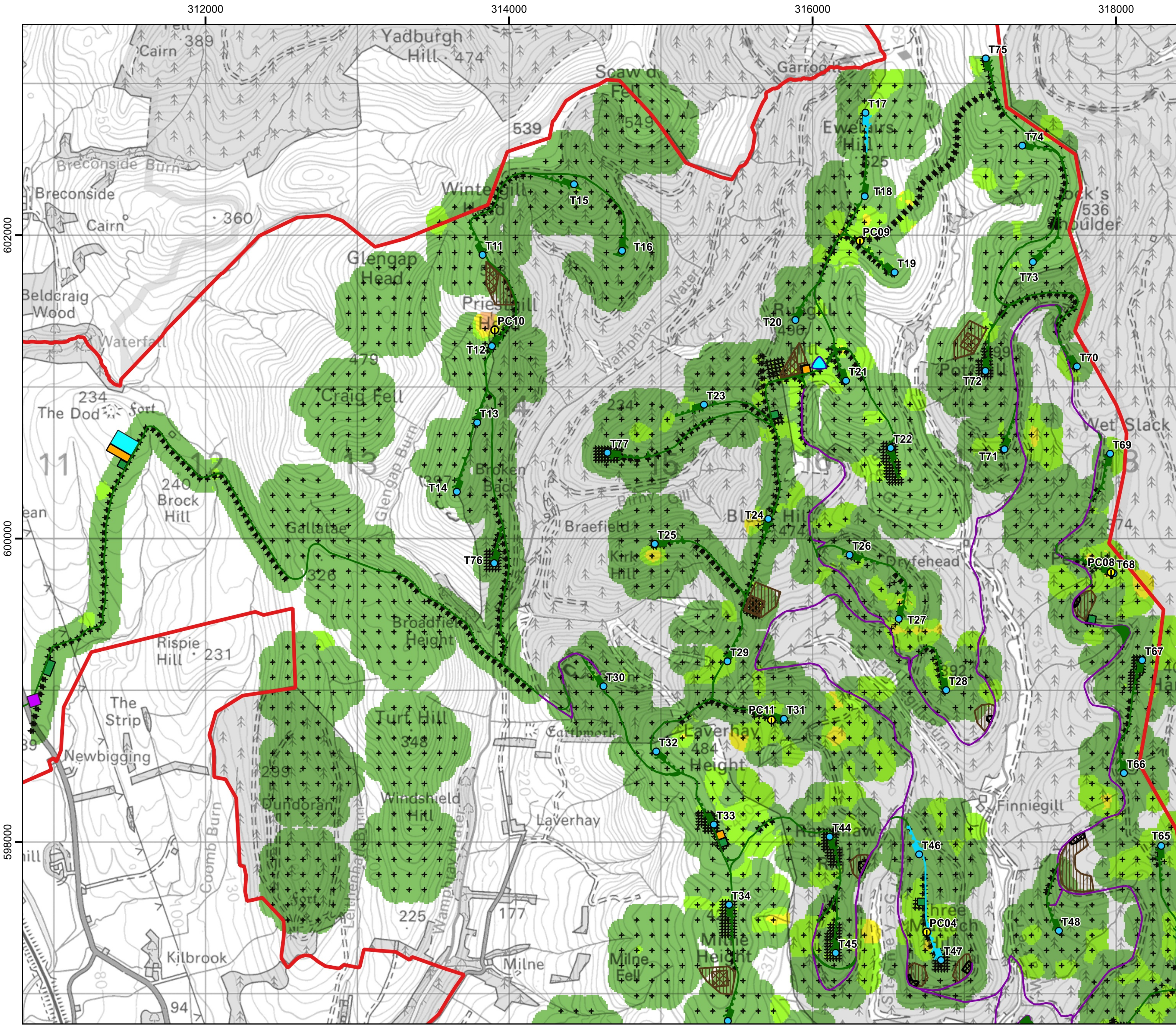

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.1: Peat Depth Survey: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance
- Peat probe
- Peat core

Peat depth (m)*

- ≤ 0.50
- 0.50 ≤ 1.00
- 1.00 ≤ 2.00
- 2.00 ≤ 3.00
- > 3.00

*Interpolation method: Kriging with a linear variogram model

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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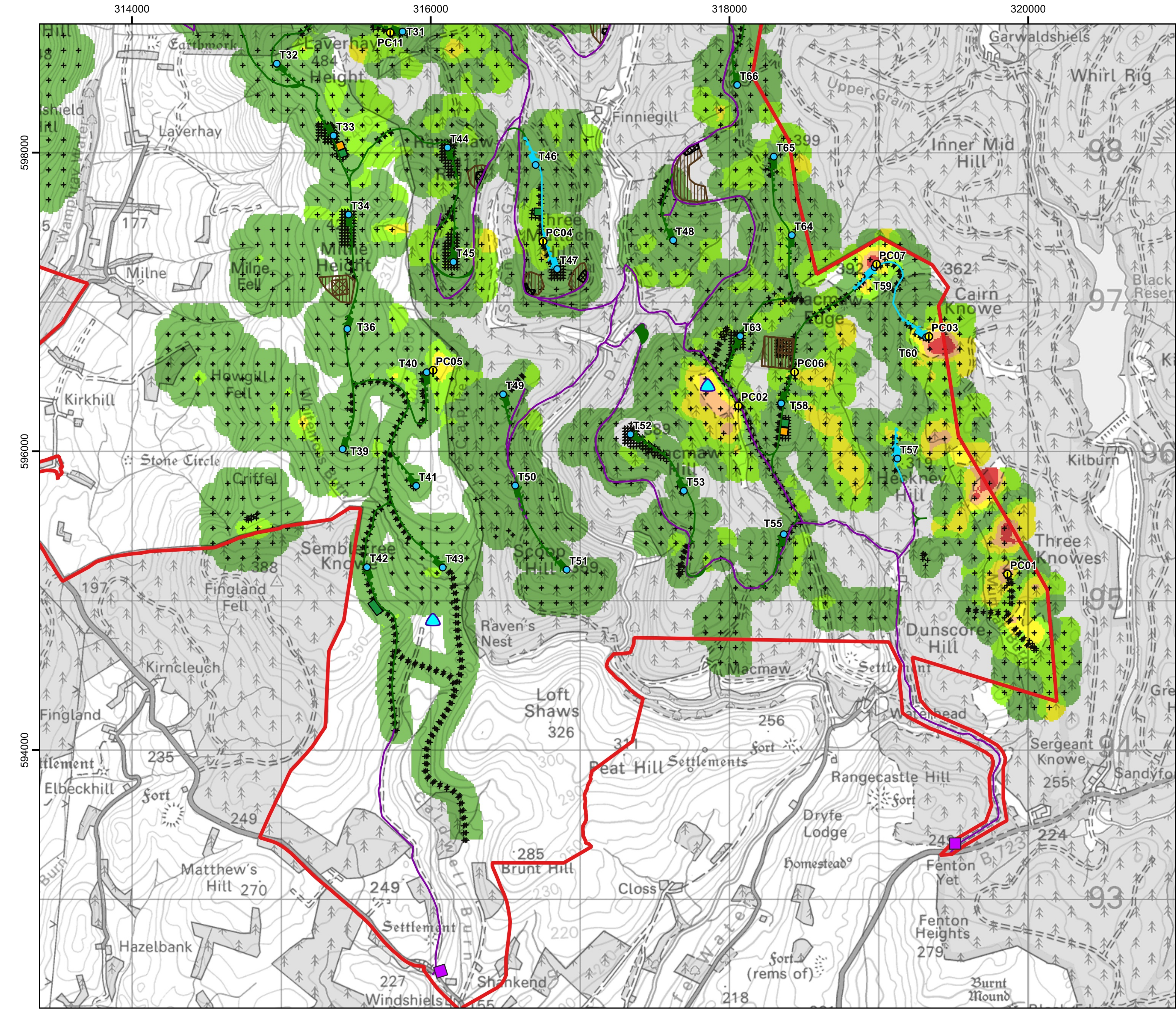

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.1: Peat Depth Survey: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance
- Peat probe
- Peat core

Peat depth (m)*

- ≤ 0.50
- 0.50 ≤ 1.00
- 1.00 ≤ 2.00
- 2.00 ≤ 3.00
- > 3.00

*Interpolation method: Kriging with a linear variogram model

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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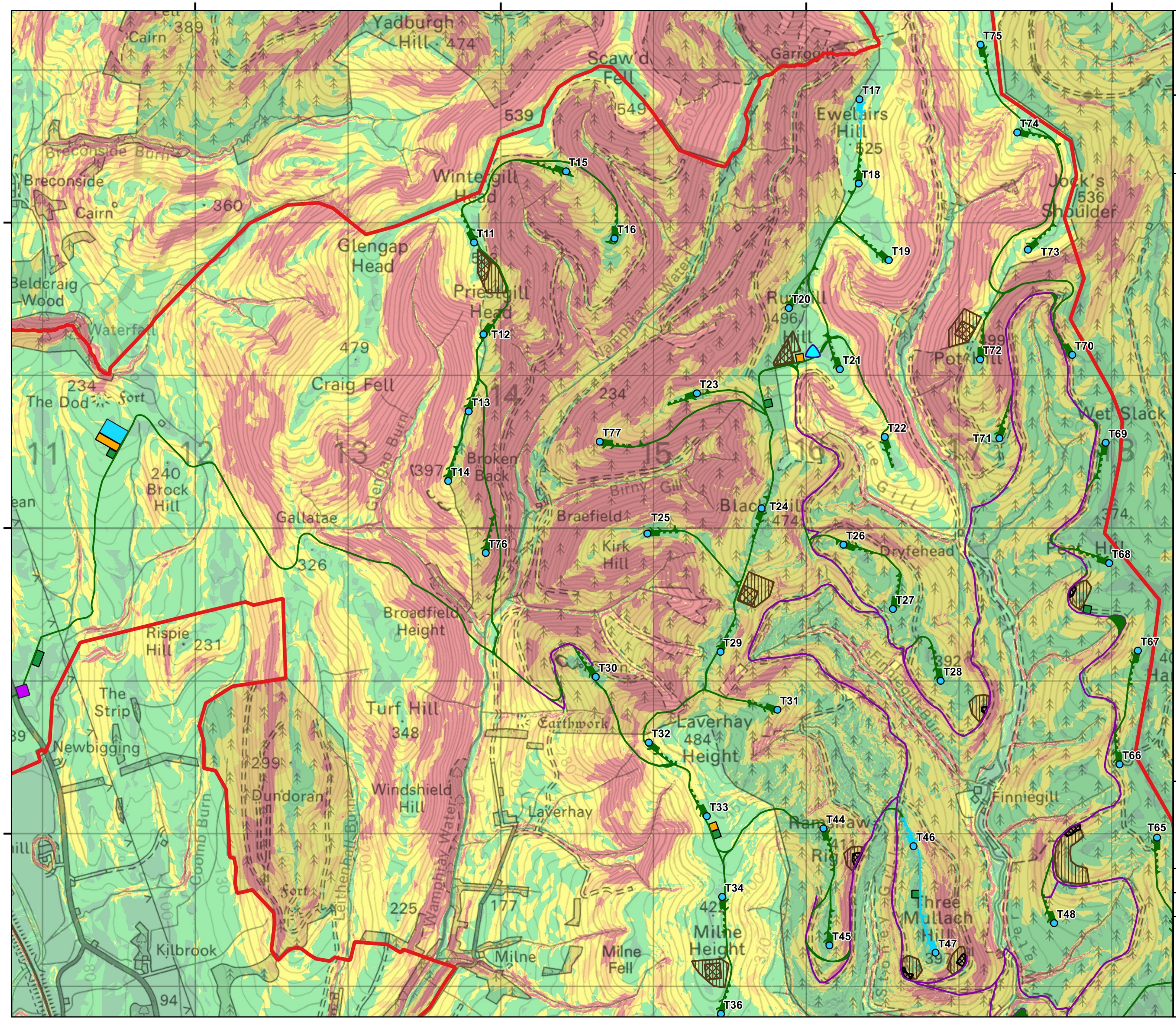

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.2: Slope Angle: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Slope (°)

- 0° ≤ 3°
- 3° ≤ 9°
- 9° ≤ 15°
- 15° ≤ 20°
- > 20°

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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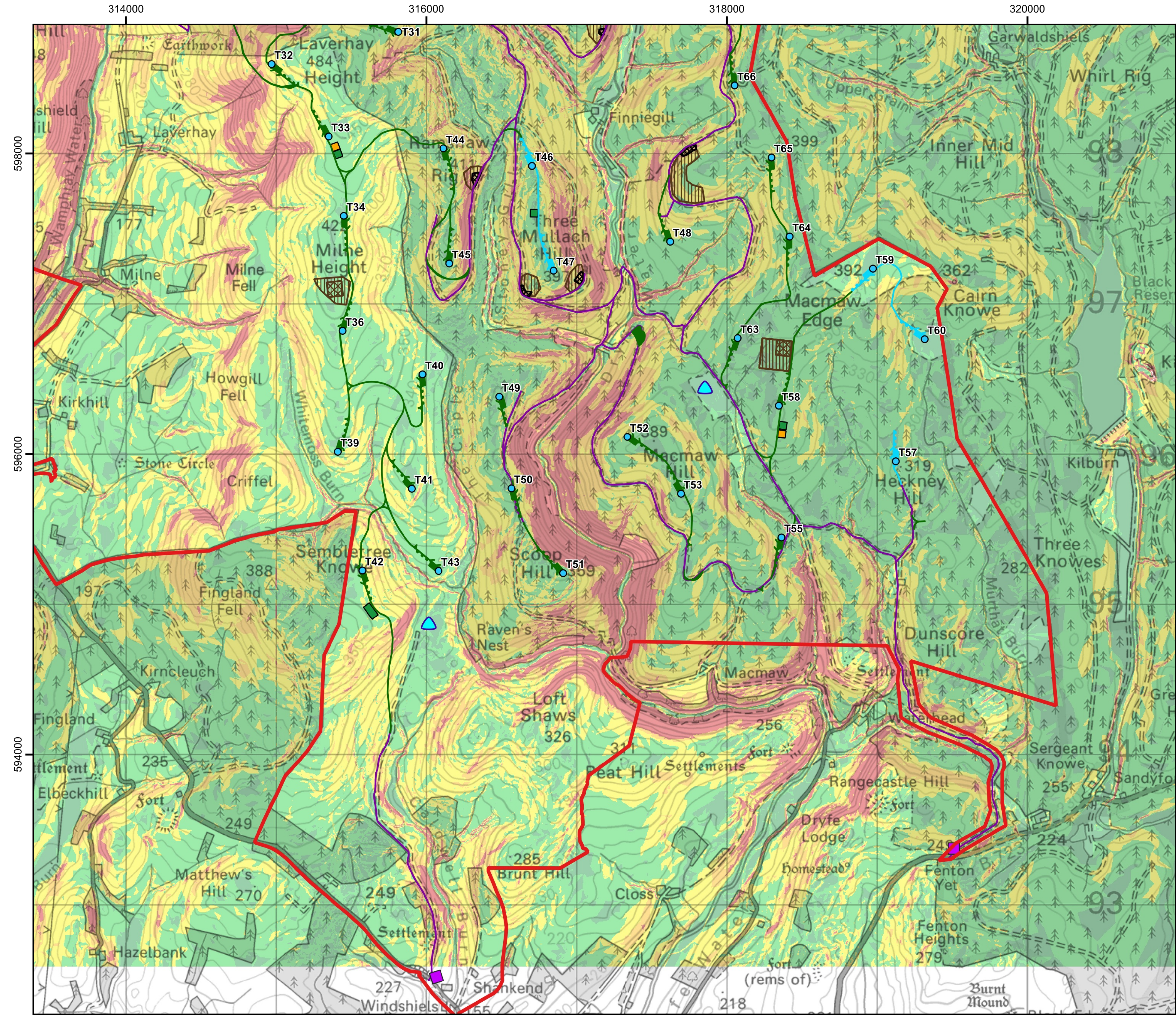

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.2: Slope Angle: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Slope (°)

- 0° ≤ 3°
- 3° ≤ 9°
- 9° ≤ 15°
- 15° ≤ 20°
- > 20°

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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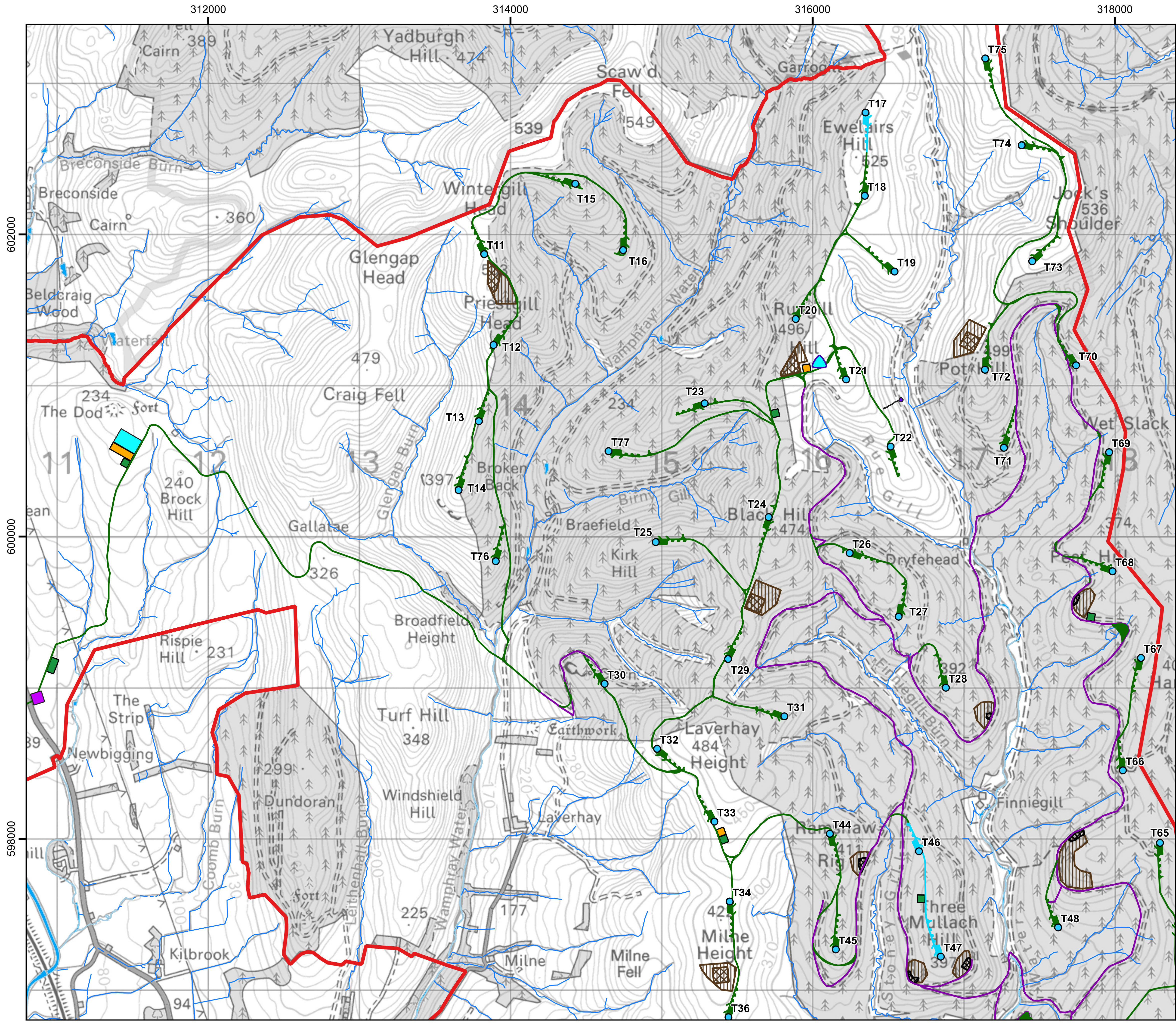

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.3: Geomorphological Features: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance
- Water body
- Watercourse
- Woodland
- Mass movement

Note: Only major geomorpholgical features shown.

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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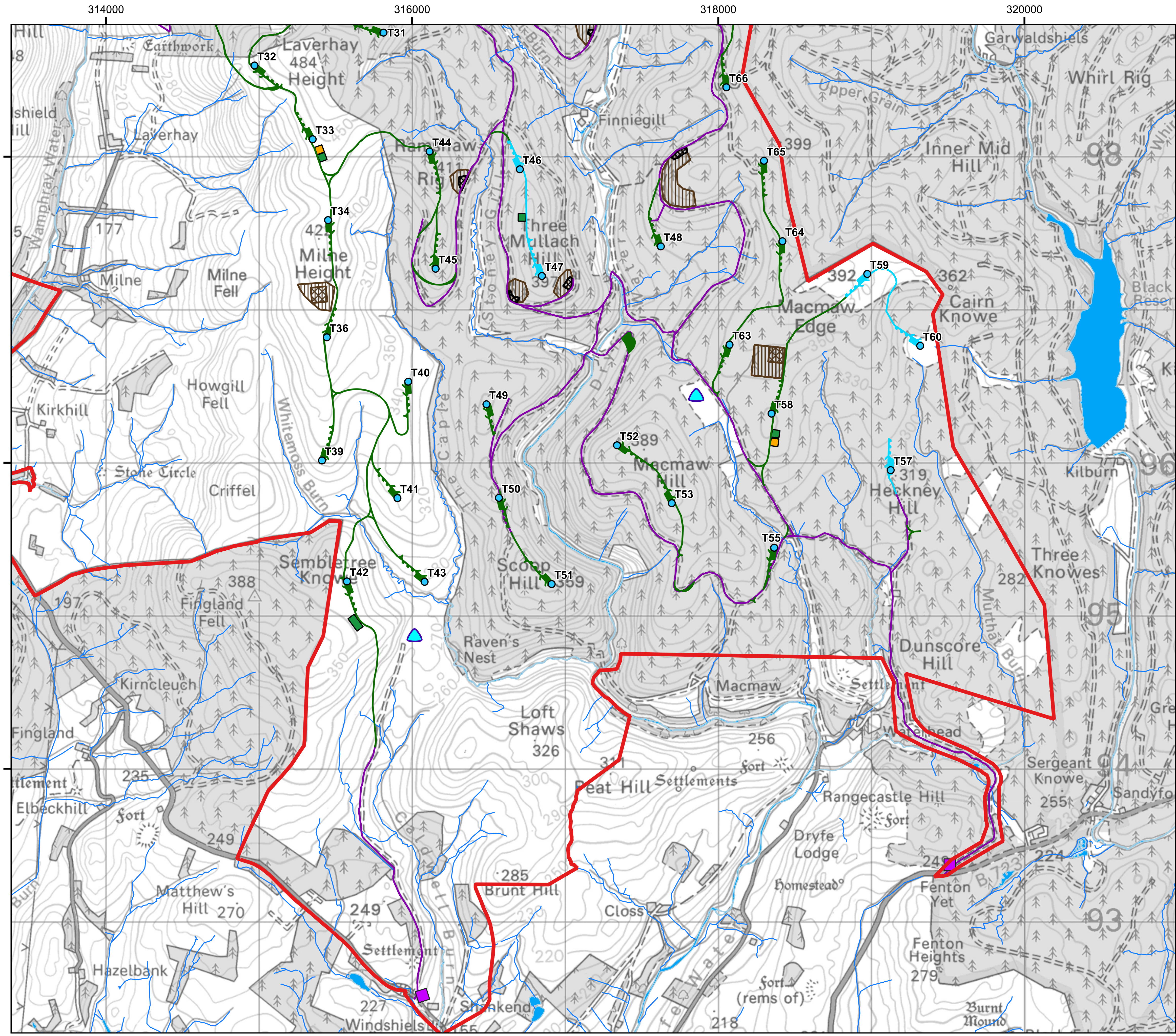

Project:

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Title:

Figure 10.2.3: Geomorphological Features: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance
- Water body
- Watercourse
- Woodland
- Mass movement

Note: Only major geomorpholgical features shown.

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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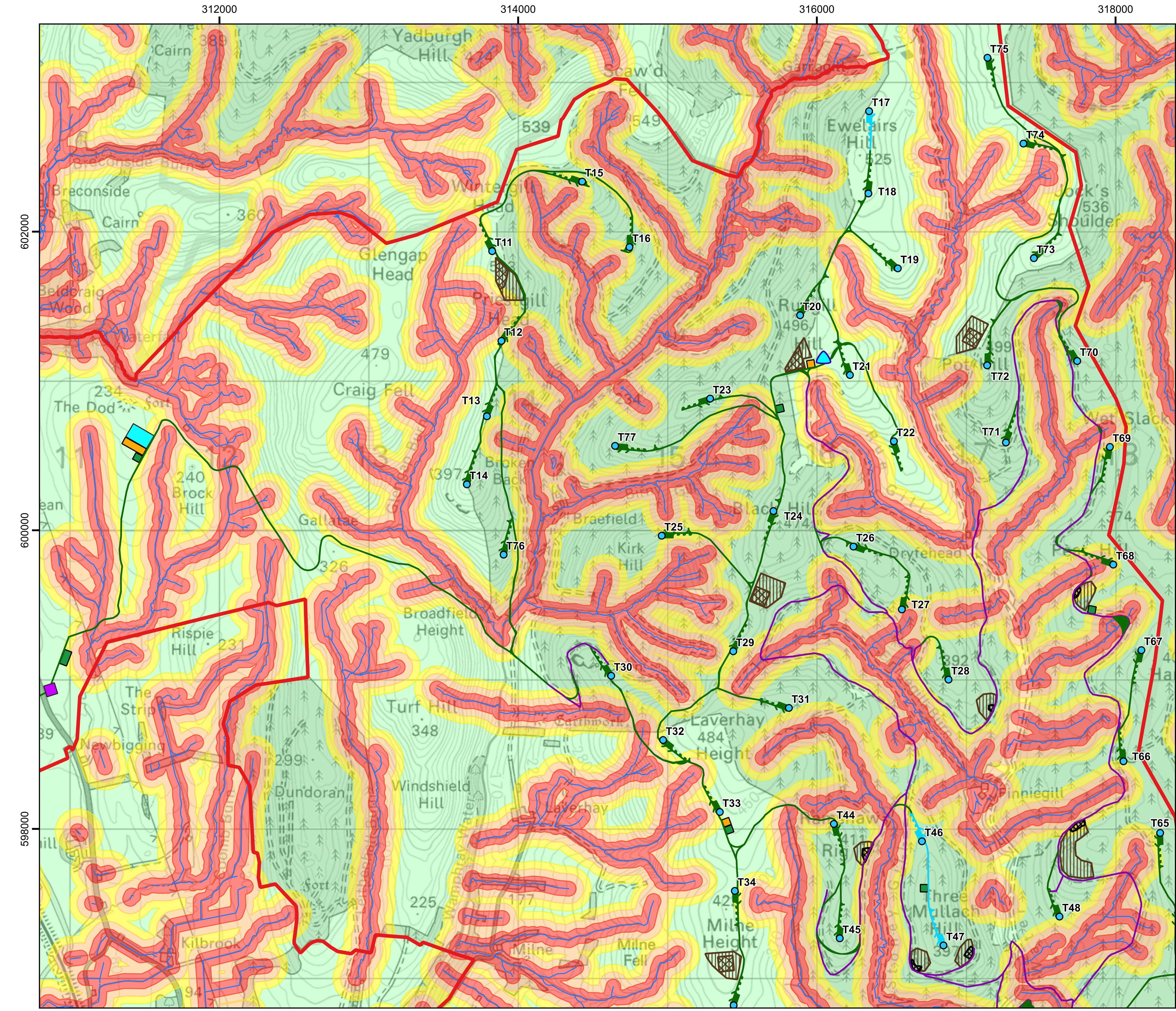

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.4: Environmental Impact Zones: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance
- Watercourse

Proximity to water course

- 0 - 50 m
- 50 - 100 m
- 100 - 150 m
- > 150 m

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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Ref: GB202142_M_018_G	Layout: A1_120922 60t_A	

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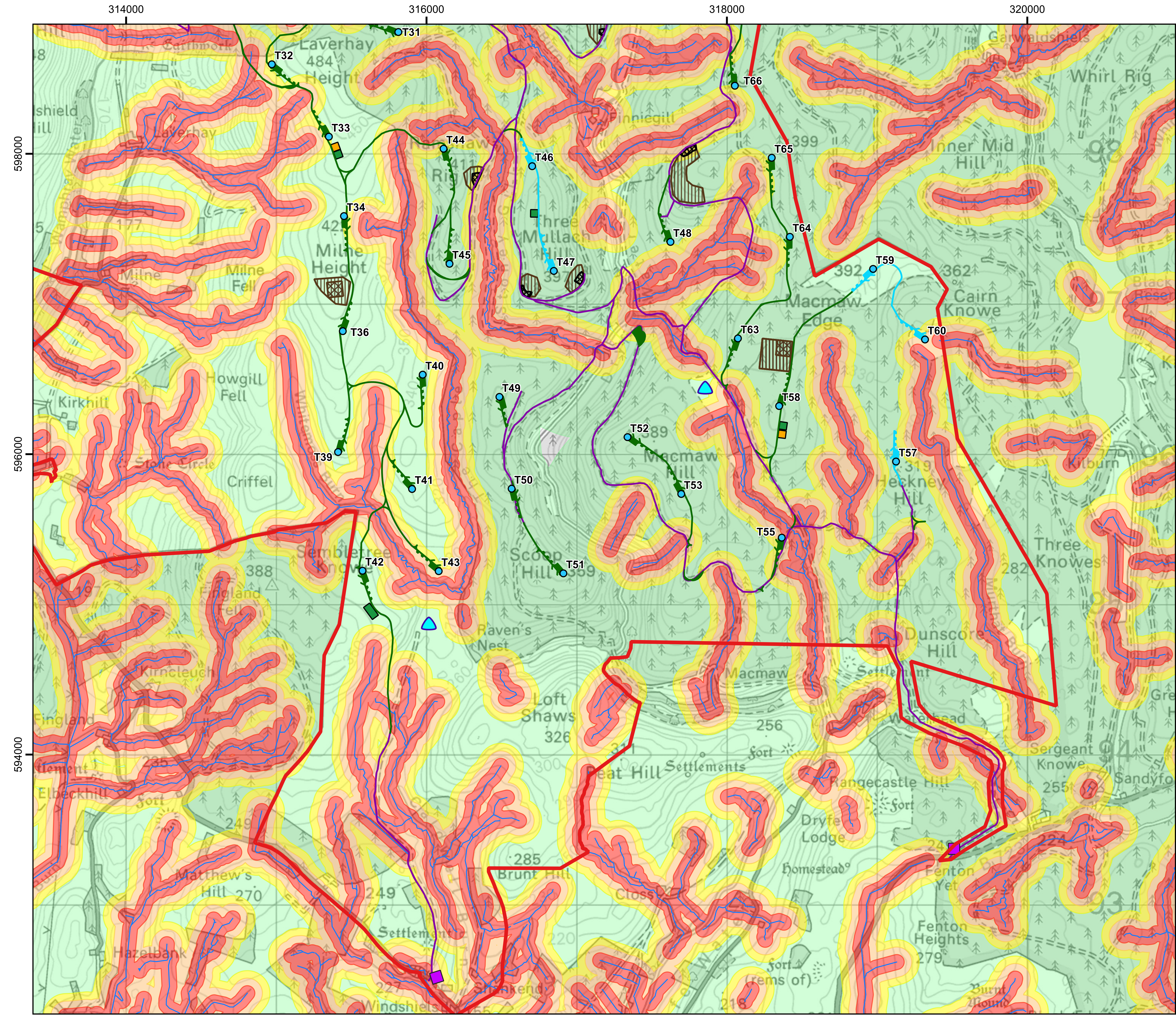

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.4: Environmental Impact Zones: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Proximity to water course

- 0 - 50 m
- 50 - 100 m
- 100 - 150 m
- > 150 m

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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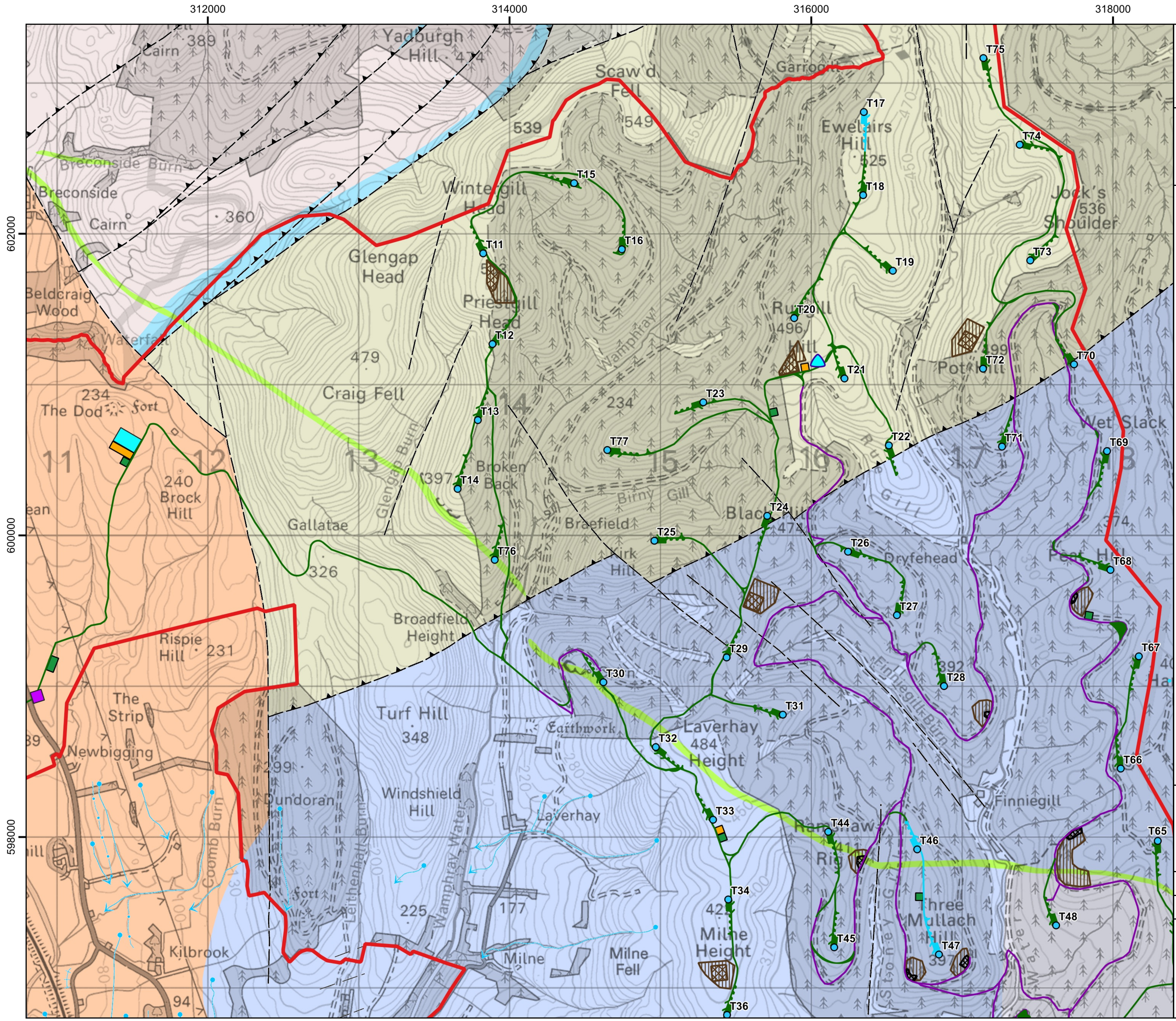

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.5: Solid Geology: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new floating track
- Proposed new access track
- Existing acess tracks
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Solid Geology

- Moffat Shale Group - Mudstone
- Carghidown Formation - Metasandstone and Metamudstone
- Glendearg Formation - Sandstone, Mudstone and Siltstone
- Selcoth Formation - Sandstone, Mudstone and Siltstonepy
- Mull Dyke-Swarm - Quartz-Microgabbro
- Hartfield Formation - Sandstone, Pebbly Sandstone and Angular Pebble-Grade Conglomerate
- Hawick Group - Wacke
- Glacial meltwater channel
- Reverse or thrust fault
- Inferred fault

Based upon GBR BGS 1:50 Bedrock Geology, with the permission of the British Geological Survey

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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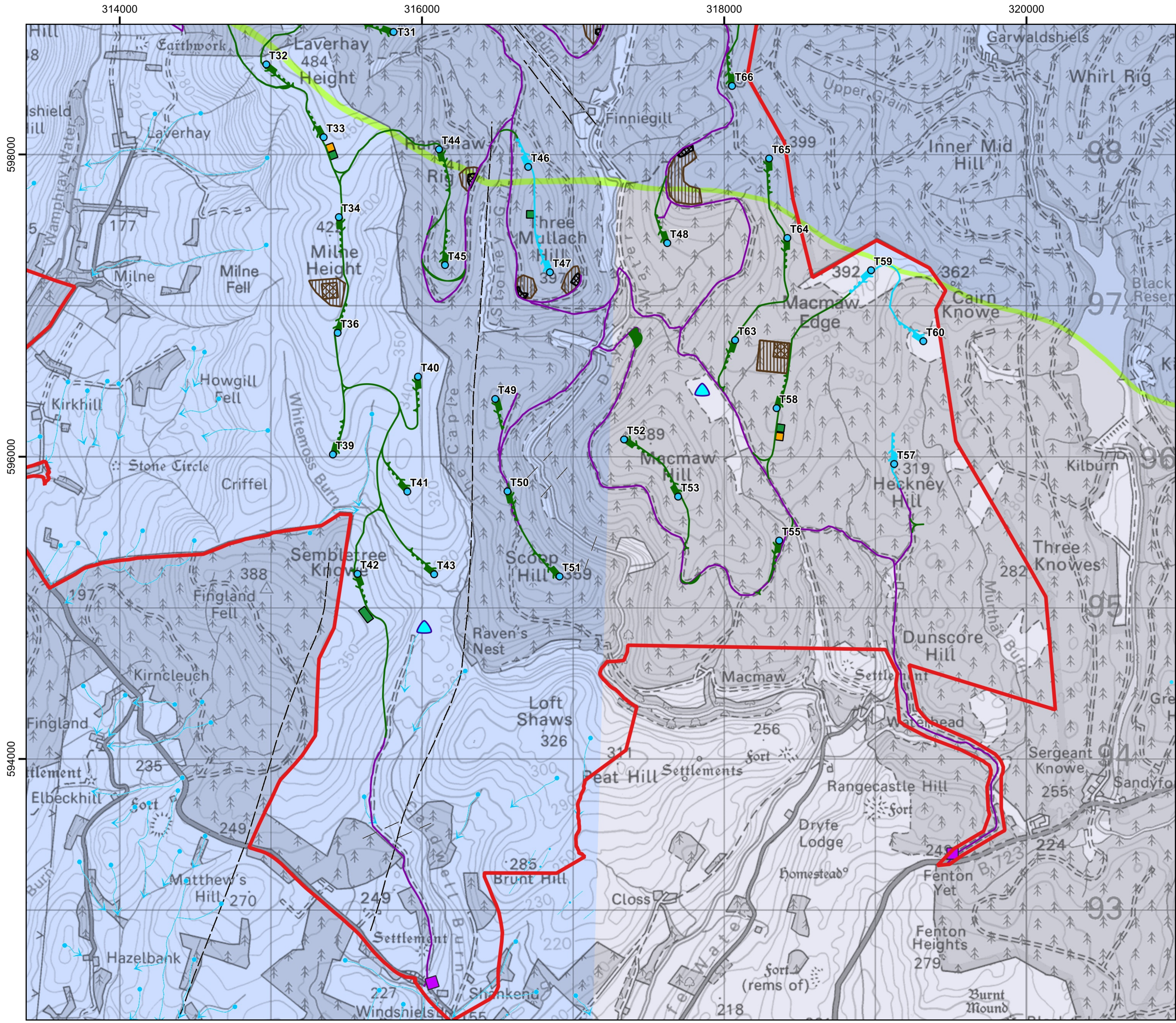

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.5: Solid Geology: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new floating track
- Proposed new access track
- Existing acess tracks
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Solid Geology

- Moffat Shale Group - Mudstone
- Carghidown Formation - Metasandstone and Metamudstone
- Glendearg Formation - Sandstone, Mudstone and Siltstone
- Selcoth Formation - Sandstone, Mudstone and Siltstonepy
- Mull Dyke-Swarm - Quartz-Microgabbro
- Hartfield Formation - Sandstone, Pebbly Sandstone and Angular Pebble-Grade Conglomerate
- Hawick Group - Wacke
- Glacial meltwater channel
- Reverse or thrust fault
- Inferred fault

Based upon GBR BGS 1:50 Bedrock Geology, with the permission of the British Geological Survey

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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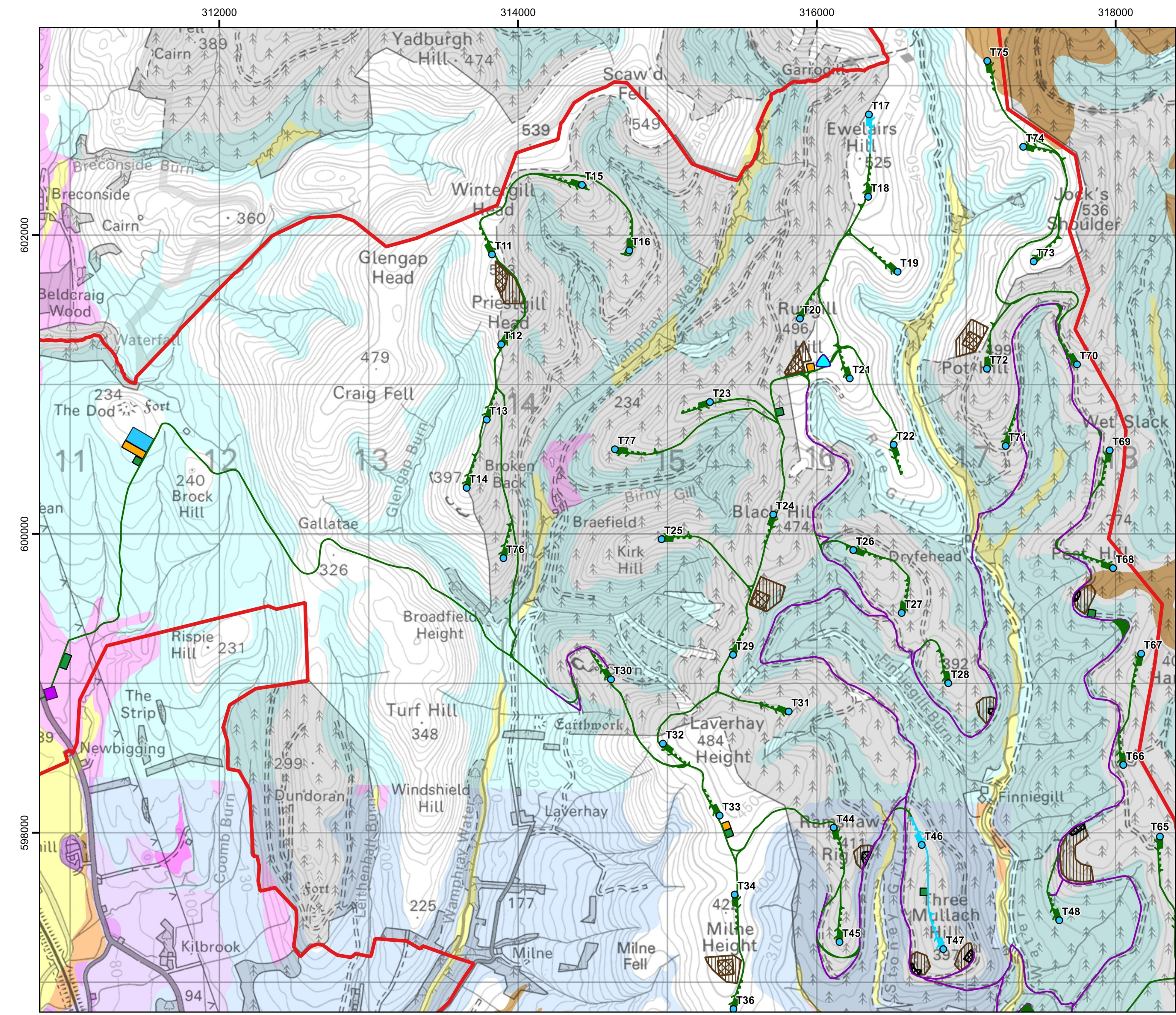

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.6: Superficial Geology: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Superficial Geology

- Alluvium - Sand and Gravel
- Kirkbean Sand and Gravel Formation - Sand, Gravelly
- Kirkbean Sand and Gravel Formation - Sand, Gravel and Boulders
- Kirkbean Sand and Gravel Formation - Silt, Sand and Gravel
- Langholm Till Formation - Diamicton
- Peat
- Till, Devensian - Diamicton

Based upon GBR BGS 1:50 Superficial Geology, with the permission of the British Geological Survey

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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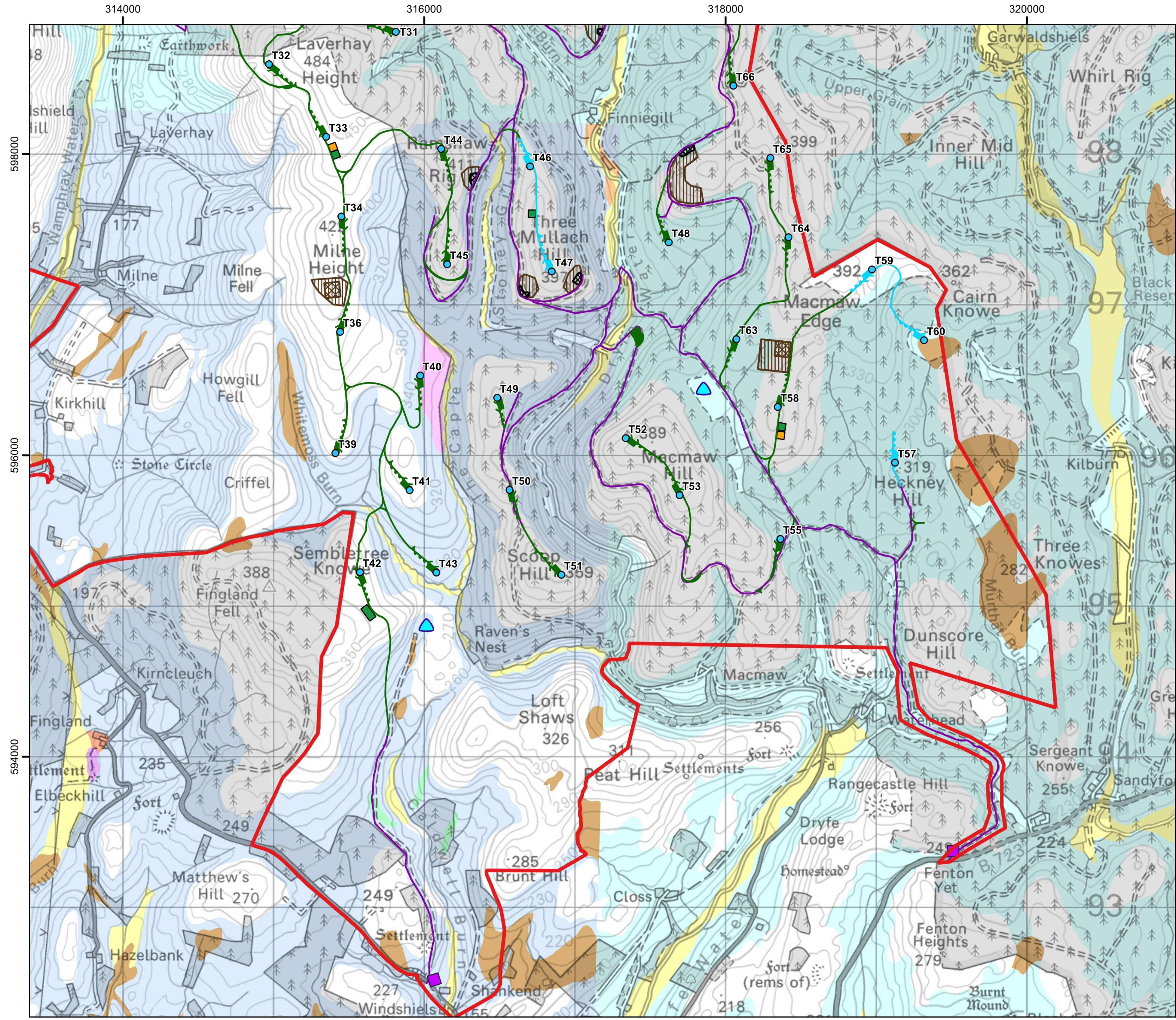

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.6: Superficial Geology: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Superficial Geology

- Alluvium - Sand and Gravel
- Kirkbean Sand and Gravel Formation - Sand, Gravelly
- Kirkbean Sand and Gravel Formation - Sand, Gravel and Boulders
- Kirkbean Sand and Gravel Formation - Silt, Sand and Gravel
- Langholm Till Formation - Diamicton
- Peat
- Till, Devensian - Diamicton

Based upon GBR BGS 1:50 Superficial Geology, with the permission of the British Geological Survey

Scale @ A3: 1:25,000

Coordinate System: British National Grid

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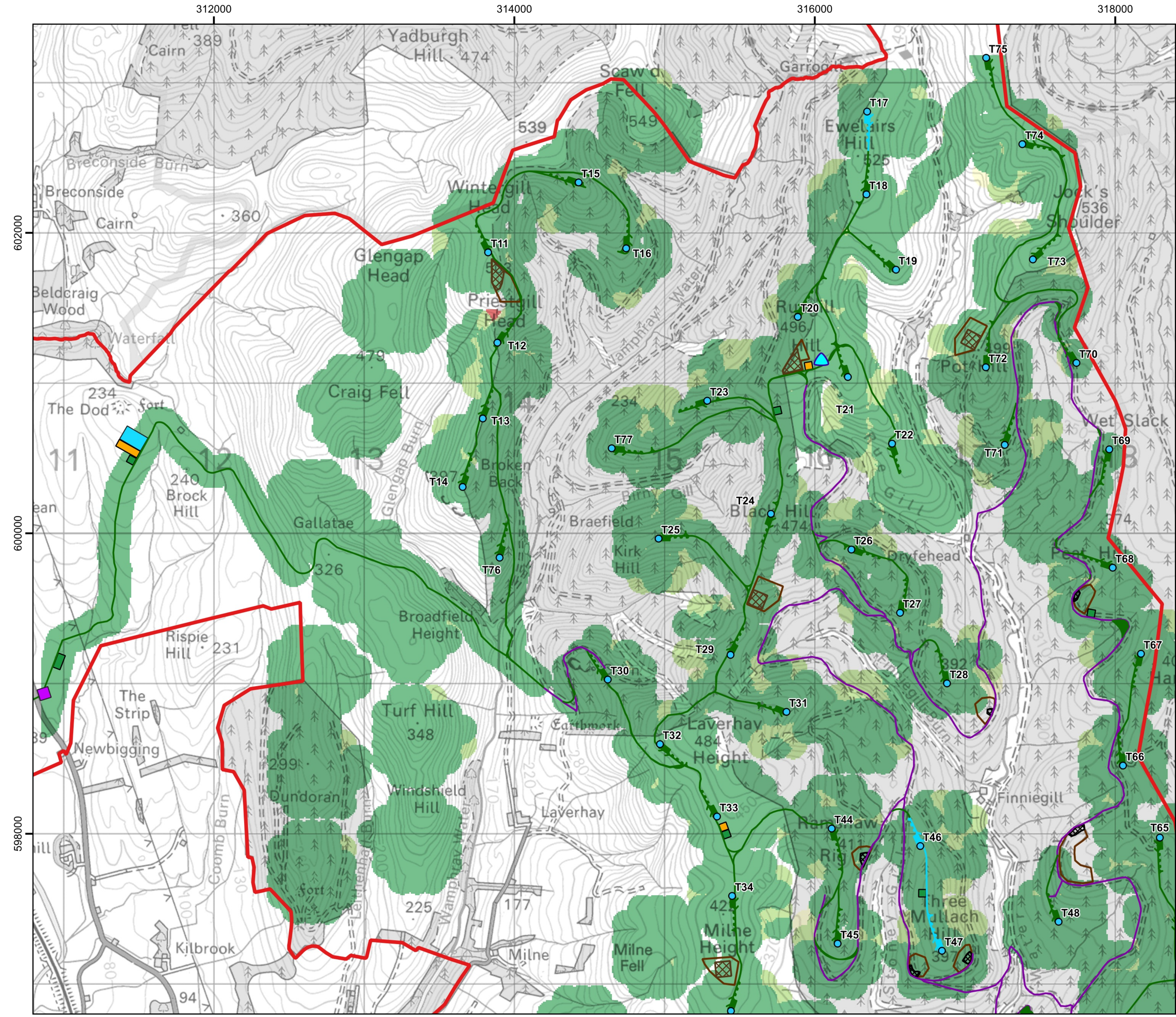

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.7: Slope Stability Factor of Safety: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Exisitng access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit

Peat Deposit Infinite Slope Analysis*

- > 1.00
- 1.00 ≤ 1.30
- 1.30 ≤ 5.00
- 5.00 ≤ 10.00
- > 10.00

*Peat Shear Strength(10kPa)' / (Peat density(10kN/m3) x Peat Depth) x Sin('Slope Angle') x Cos('Slope Angle')

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

N

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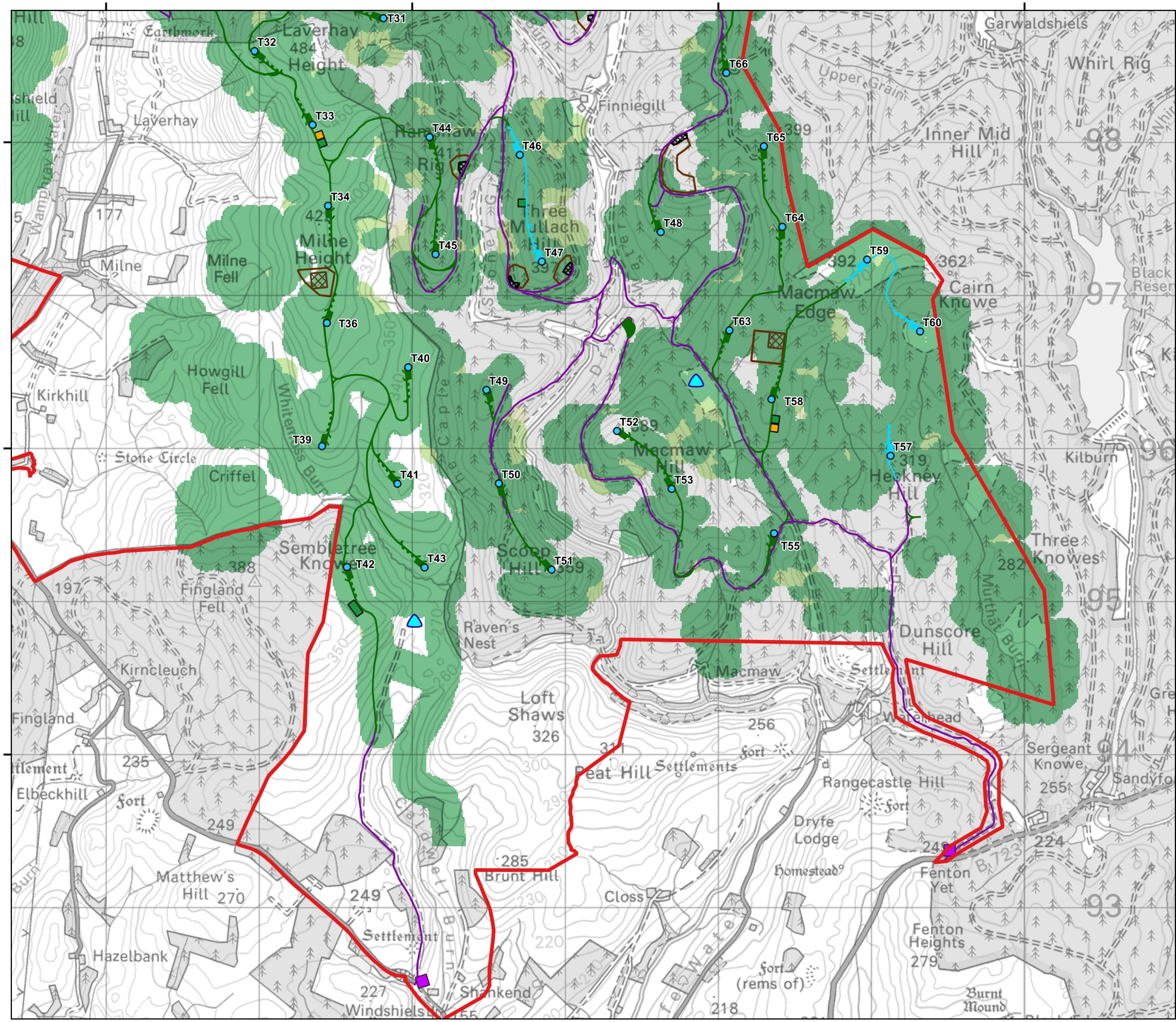

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.7: Slope Stability Factor of Safety: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Exisitng access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Peat Deposit Infinite Slope Analysis*

- > 1.00
- 1.00 ≤ 1.30
- 1.30 ≤ 5.00
- 5.00 ≤ 10.00
- > 10.00

*Peat Shear Strength(10kPa)' / (Peat density(10kN/m3) x Peat Depth) x Sin('Slope Angle') x Cos('Slope Angle')

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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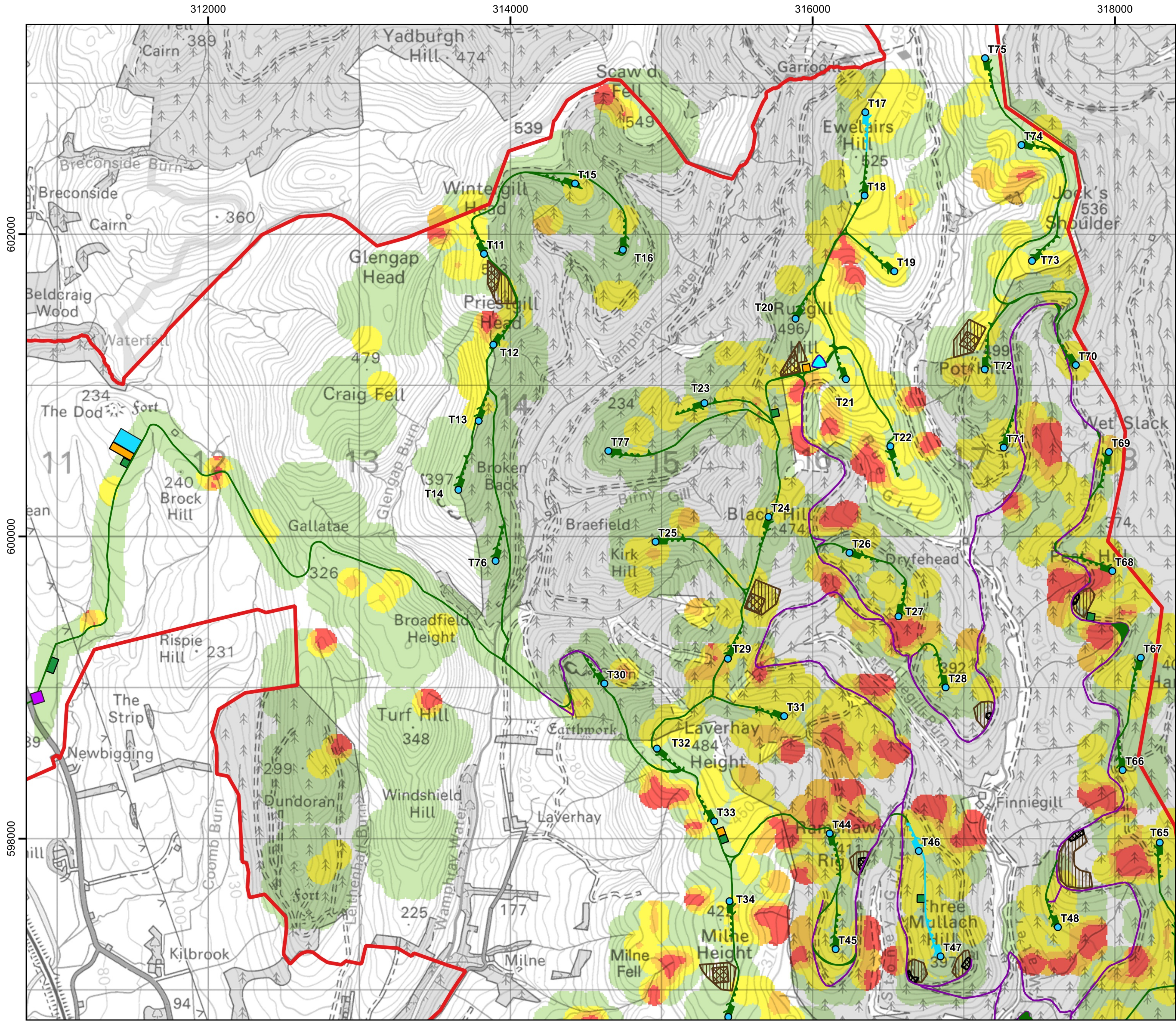

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.8: Peat Stability Risk Zones: Map 1 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Substation & control room construction compound
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Peat slide risk zones*

- 0 ≤ 4 - Negligible
- 5 ≤ 10 - Low
- 10 ≤ 16 - Medium
- > 16 - High

*Peat Slide Risk Zones = ("slopeanglerank" + "peatdepthrank") x "EIZrank"

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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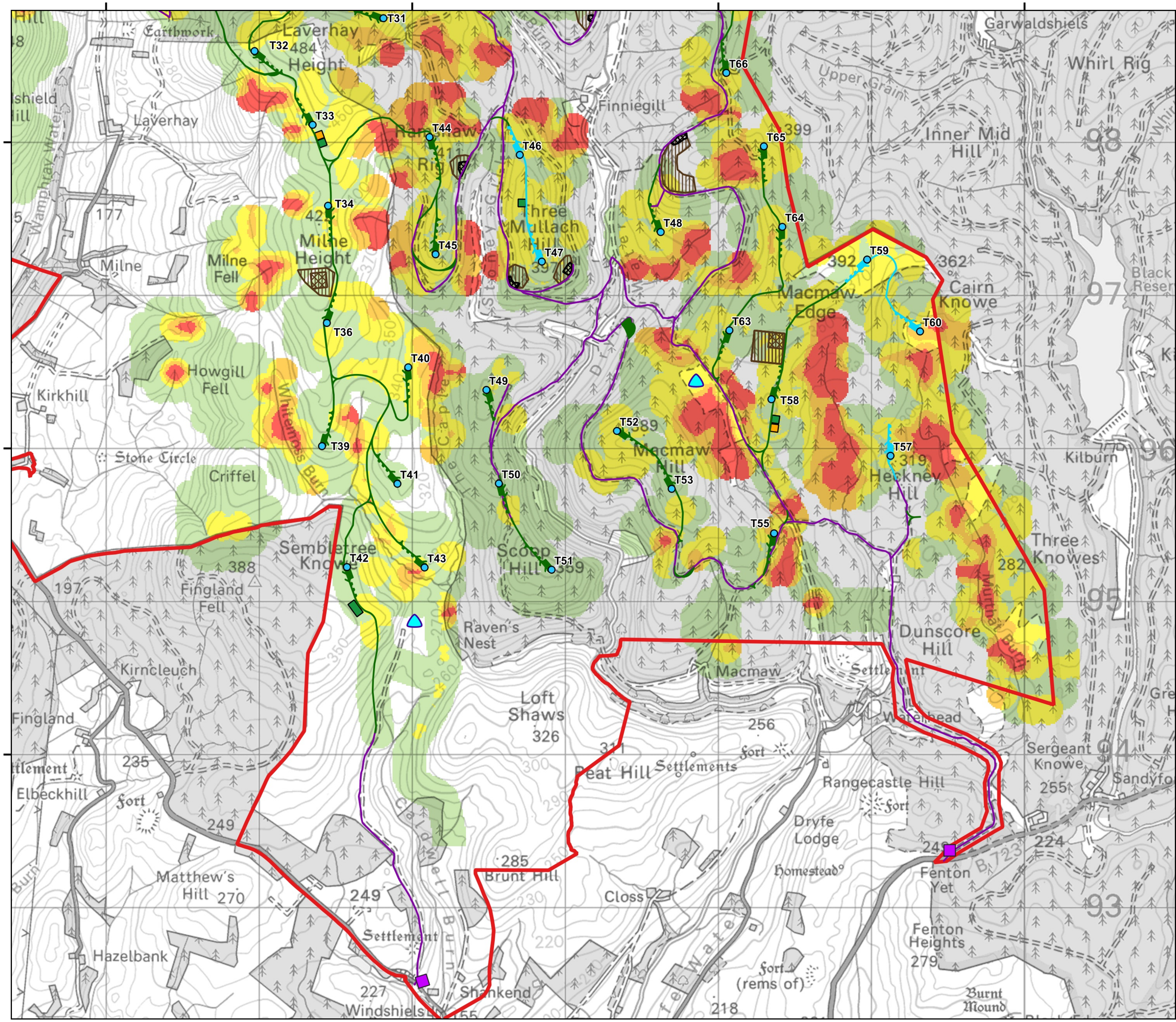

Project:

Scoop Hill Community Wind Farm, Dumfries & Galloway

Title:

Figure 10.2.8: Peat Stability Risk Zones: Map 2 of 2

Key

- Site boundary
- Proposed turbine
- Proposed anemometry mast
- Proposed new access track
- Proposed new floating track
- Existing access track
- Substation & control room
- Proposed temporary construction compound
- Existing quarries and borrow pit
- Borrow pit search area
- Proposed borrow pit
- Proposed site entrance

Peat slide risk zones*

- 0 ≤ 4 - Negligible
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- 10 ≤ 16 - Medium
- > 16 - High

*Peat Slide Risk Zones = ("slopeanglerank" + "peatdepthrank") x "EIZrank"

Scale @ A3: 1:25,000

Coordinate System: British National Grid

0 0.25 0.5 0.75 1 km

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