

Consulting Report

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment Scout Moor II Wind Farm

Rossendale and Rochdale, England
Cubico UK Development (Wind 1) Limited

044338-D-001v04

12/06/2026

© East Point Geo Ltd 2026

Prepared for
Fluid Environmental
Consulting

Client
Cubico UK
Development (Wind 1) Limited



DOCUMENT CONTROL

Version	Description	Prepared by	Approved by	Date
01	Issued as draft for review	AM	DS	30/04/2025
02	Issued for legal review	AM	DS	28/05/2025
03	Revised layout – draft for review	AM/NT	-	11/05/2026
04	Revised boundary following 03 review – draft for review	AM/NT	-	12/06/2026

CONTENTS

1.	INTRODUCTION.....	6
1.1.	Background	6
1.2.	Scope of Work	7
1.3.	Report Structure	8
1.4.	Approaches to assessing peat instability for the Proposed Development	8
1.5.	Team competencies	Error! Bookmark not defined.
2.	BACKGROUND TO PEAT INSTABILITY	10
2.1.	Peat Instability in the UK and Ireland	10
2.2.	Types of Peat Instability	11
2.2.1.	Factors Contributing to Peat Instability	13
2.2.2.	Consequences of Peat Instability	14
3.	BASELINE CONDITIONS	15
3.1.	Topography	15
3.2.	Geology	15
3.3.	Hydrology	16
3.4.	Land Use	16
3.5.	Peat Depth and Character	17
3.6.	Peatland Geomorphology	18
4.	ASSESSMENT OF PEAT LANDSLIDE LIKELIHOOD	20
4.1.	Introduction.....	20
4.2.	Limit Equilibrium Approach	20
4.2.1.	Overview	20
4.2.2.	Data Inputs.....	21
4.2.3.	Results	23
4.3.	Landslide Susceptibility Approach	23
4.3.1.	Overview	23
4.3.2.	Slope Angle (S).....	23
4.3.3.	Peat Depth (P)	24
4.3.4.	Substrate Geology (G).....	24
4.3.5.	Peat Geomorphology (M)	25
4.3.6.	Artificial Drainage (D).....	26
4.3.7.	Slope Curvature (C).....	26
4.3.8.	Forestry (F)	27
4.3.9.	Land use (L).....	27
4.3.10.	Generation of Slope Facets	28
4.3.11.	Results	28

4.3.12.	Combined Landslide Likelihood	29
5.	ASSESSMENT OF CONSEQUENCE AND RISK.....	30
5.1.	Introduction.....	30
5.2.	Receptors	30
5.2.1.	Watercourses, reservoirs and private water supplies	30
5.2.2.	Habitats	30
5.2.3.	Public rights of way	31
5.2.4.	Infrastructure	31
5.3.	Consequences	31
5.3.1.	Overview	31
5.3.2.	Local limits on runout (Watercourses)	32
5.3.3.	Local limits on runout (slope curvature).....	32
5.3.4.	Local limits on runout (peat thickness in source zone).....	33
5.3.5.	Results of runout analysis.....	34
5.4.	Calculated Risk	34
6.	RISK MITIGATION.....	35
6.1.	Overview	35
6.2.	Good Practice Prior to Construction.....	35
6.3.	Good Practice During Construction.....	35
6.4.	Good Practice Post-Construction	37

1. INTRODUCTION

1.1. Background

Cubico UK Development Limited (“Cubico”, “the Applicant”) are seeking consent under Section 36 of the Electricity Act 1989 for construction of 12 No. wind turbine generators and associated infrastructure with an expected installed capacity of around 68.4MW on land at Rooley Moor (hereafter the “Proposed Development”), adjacent to the existing Scout Moor Wind Farm (“SMWF”) in Rossendale and Rochdale.

The Site for the Proposed Development occupies an area of open moorland between the urban areas of Rochdale, Bury, Blackburn, Accrington and Halifax, consisting of Rooley Moor, Cowpe Moss, and Brandwood Moor, which collectively form part of the Southern Pennines. The Proposed Development is approximately 9.9 km² in area and is shown on Plate 1.1.

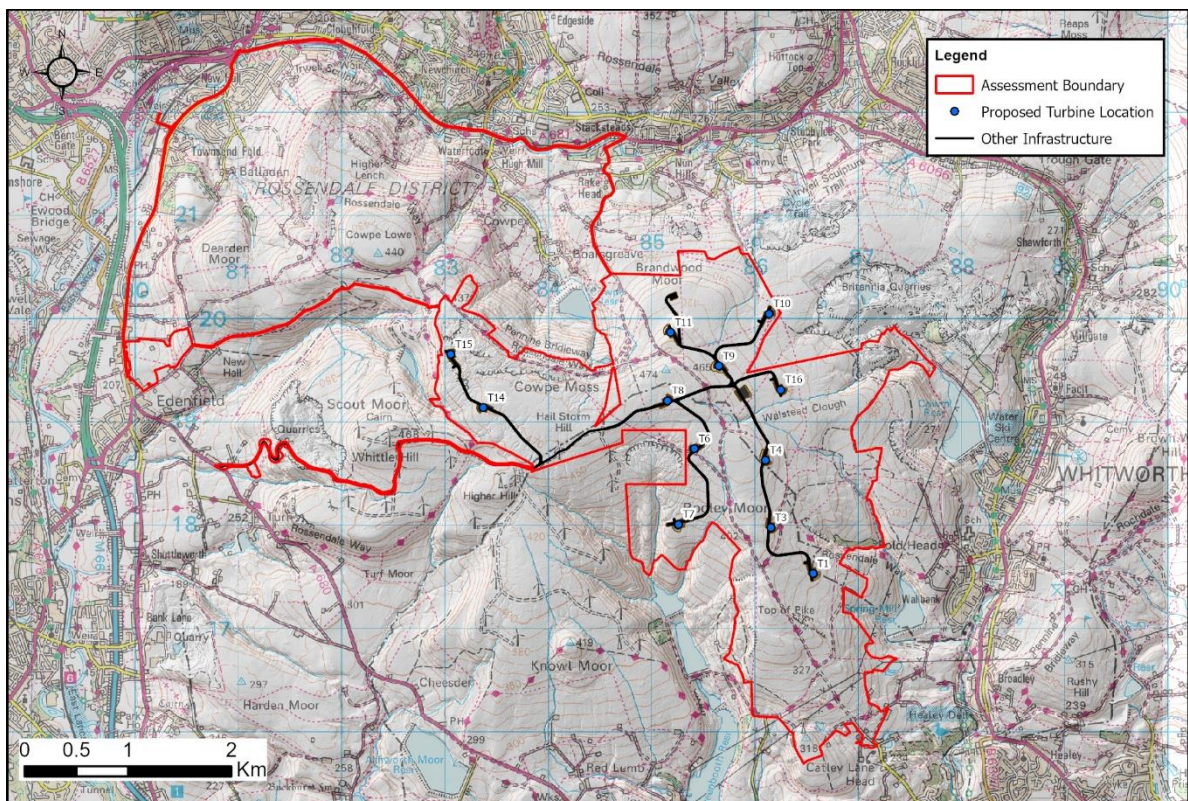


Plate 1.1 Location of the Proposed Development

The Proposed Development will comprise:

- 12 wind turbines of up to 180 m tip height with associated ancillary infrastructure including crane pads, laydowns and clearance areas.
- A substation and control building.
- A temporary construction compound.
- Access tracks and associated watercourse crossings.
- Underground electrical cabling.

It is industry good practice within the UK and Ireland to undertake peat landslide hazard and risk assessments (“PLHRA”) for infrastructure developments in peatlands. The relevant guidance

document for these assessments is provided by the Scottish Government (Scottish Government, 2017). These assessments are now undertaken for developments of all scales and form part of a suite of assessments of potential impacts on peatland resources alongside peat management plans and habitat management plans.

1.2. Scope of Work

The scope of the PLHRA is as follows:

- Characterise the peatland geomorphology of the site to determine whether prior incidences of instability have occurred and whether contributory factors that might lead to instability in the future are present across the site.
- Determine the likelihood of a future peat landslide under natural conditions and in association with construction activities associated with the Proposed Development.
- Identify potential receptors that might be affected by peat landslides, should they occur, and quantify the associated risks.
- Provide appropriate mitigation and control measures to reduce risks to acceptable levels such that the Proposed Development is developed safely and with minimal risks to the environment.

The contents of this PLHRA have been prepared in accordance with Scottish Government guidance in the absence of other guidance specific to England. The first edition of the Scottish Government Best Practice Guidance (“BPG”) was issued in 2007 and provided an outline of expectations for approaches to be taken in assessing peat landslide risks on wind farm sites. After ten years of practice and industry experience, the BPG was reissued in 2017, though without fundamental changes to the core expectations.

In section 4.1 of the BPG, the key elements of a PLHRA are highlighted, as follows (Scottish Government, 2017):

- i. An assessment of the character of the peatland within the application boundary including thickness and extent of peat, and a demonstrable understanding of site hydrology and geomorphology.
- ii. An assessment of evidence for past landslide activity and present-day instability e.g. pre-failure indicators.
- iii. A qualitative or quantitative assessment of the potential for or likelihood of future peat landslide activity (or a landslide susceptibility or hazard assessment).
- iv. Identification of receptors (e.g. habitats, watercourses, infrastructure, human life) exposed to peat landslide hazards; and
- v. A site-wide qualitative or quantitative risk assessment that considers the potential consequences of peat landslides for the identified receptors.

The spatial scope of this PLHRA is limited to the main infrastructure area within which turbines are proposed, as the proposed access track from the west comprises upgrade of the existing track to the Scout Moor Quarry (Scout Road).

Section 1.3 describes how this report addresses this indicative scope.

1.3. Report Structure

This report is structured as follows:

- Section 2 gives context to the landslide risk assessment methodology through a literature based account of peat landslide types and contributory factors, including review of any published or anecdotal information available concerning previous instability at or adjacent to the site.
- Section 3 provides a site description based on desk study and site observations, including consideration of aerial or satellite imagery, digital elevation data, geology and peat depth data.
- Section 4 describes the approach to and results of an assessment of peat landslide likelihood under both natural conditions and in association with construction of the Proposed Development.
- Section 5 describes the approach to and results of a consequence assessment that determines potential impacts on site receptors and the associated calculated risks.
- Section 6 provides mitigation and control measures to reduce or minimise these risks prior to, during and after construction.

Assessments within the PLHRA have been undertaken alongside assessments for the Outline Peat Management Plan (**Appendix 14.3**) and have been informed by results from the Peat Survey (**Appendix 14.2**). Where relevant information is available elsewhere in the Environmental Statement, this is referenced in the text rather than repeated in this report.

1.4. Approaches to assessing peat instability for the Proposed Development

This report approaches assessment of peat instability through both a qualitative contributory factor-based approach and via more conventional stability analysis (through limit equilibrium or Factor of Safety (FoS) analysis). The advantage of the former is that many observed relationships between reported peat landslides and ground conditions can be considered together where a FoS is limited to consideration of a limited number of geotechnical parameters. The disadvantage is that the outputs of such an approach are better at illustrating relative variability in landslide susceptibility across a site rather than absolute likelihood.

The advantage of the FoS approach is that clear thresholds between stability and instability can be defined and modelled numerically, however, in reality, there is considerable uncertainty in input parameters and it is a generally held view that the geomechanical basis for stability analysis in peat is limited given the nature of peat as an organic, rather than mineral soil.

To reflect these limitations, both approaches are adopted and outputs from each approach integrated in the assessment of landslide likelihood. **Error! Reference source not found.** Plate 1.2 shows the approach.

1.5. Team competencies

This PLHRA has been undertaken by a chartered geologist with 27+ years experience of mapping and interpreting peatland terrains and peat instability features. Geomorphological walkover survey was undertaken by the same individual. Peat depth probing was undertaken by Fluid Environmental Consulting, a highly experienced peatland survey team, and additional site observations and photographs were made available from these surveys to the PLHRA team.

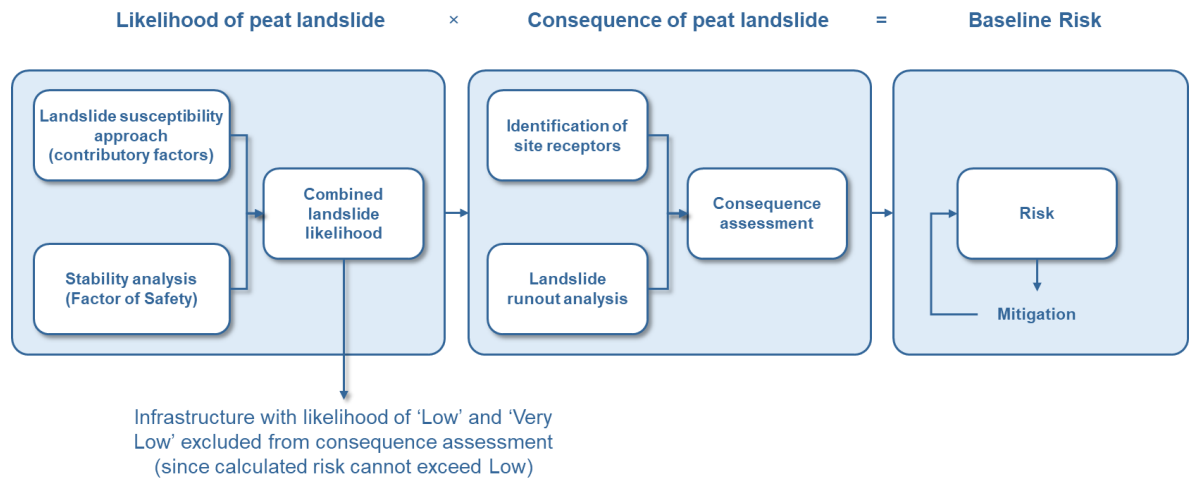


Plate 1.2 Risk assessment approach

2. BACKGROUND TO PEAT INSTABILITY

2.1. Peat Instability in the UK and Ireland

This section reviews published literature to highlight commonly identified landscape features associated with recorded peat landslides in the UK and Ireland. This review forms the basis for identifying similar features at the Proposed Development and using them to understand the susceptibility of the site to naturally occurring and human induced peat landslides.

Peat instability, or peat landslides, are a widely documented but relatively rare mechanism of peatland degradation that may result in damage to peatland habitats, potential losses in biodiversity and depletion of peatland carbon stores (Evans & Warburton, 2007). Public awareness of peat landslide hazards increased significantly following three major peat landslide events in 2003, two of which had natural causes and one occurring in association with a wind farm.

On 19th September 2003, multiple peat landslide events occurred in Pollatomish (Co. Mayo, Ireland; Creighton and Verbruggen, 2003) and in Channerwick in the Southern Shetland Islands (Mills et al, 2007). Both events occurred in response to intense rainfall, possibly as part of the same large-scale weather system moving northeast from Ireland across Scotland. The former event damaged several houses, a main road and washed away part of a graveyard. Some of the landslides were sourced from areas of turbary (peat cutting) with slabs of peat detaching along the cuttings. The landslides in Channerwick blocked the main road to the airport and narrowly missed traffic using the road. Watercourses were inundated with peat, killing fish inland and shellfish offshore (Henderson, 2005).

In October 2003, a peat failure occurred on an afforested wind farm site in Derrybrien, County Galway, Ireland, causing disruption to the site and large-scale fish kill in the adjoining watercourses (Lindsay and Bragg, 2004). The Derrybrien event triggered interest in the influence of wind farm construction and operation on peatlands, particularly in relation to potential risks arising from construction induced peat instability. In 2007, the (then) Scottish Executive published guidelines on peat landslide hazard and risk assessment in support of planning applications for wind farms on peatland sites in Scotland. The guidance has been in use since then and was updated in 2017.

Since then, a number of peat landslide events have occurred both naturally and in association with wind farms (e.g. Plate 2.1). In the case of wind farm sites, these have rarely been reported, however in December 2016, a plant operator was killed during excavation works in peat at the Derrysallagh wind farm site in Co. Leitrim (Flaherty, 2016) on a plateau in which several published examples of instability had been previously reported. Two occurrences of instability in association with construction works on the Viking Wind Farm were reported in July 2022 and in May 2024, though in both cases, these involved failure of peat or mineral spoil at track margins rather than the triggering of a new 'peat slide' by groundworks.

Other recent natural events include another failure in Galway at Clifden in 2016 (Irish News, 2016), Cushendall, Co. Antrim (BBC, 2014), in the Glenelly Valley, Co. Tyrone in 2017 (BBC, 2018), Drumkeeran in Co. Leitrim in July 2020 (Irish Mirror, 2020) and Benbrack in Co Cavan in July 2021 (The Anglo-Celt, 2021). Noticeably, the vast majority of reported failures since 2003 have occurred in Ireland and Northern Ireland, with one reported Scottish example occurring on the Shetland Islands (Mid Kame), an area previously associated with peat instability. No landslides have been reported in association with wind farms in England, though naturally occurring peat slides have been reported on a number of occasions in the North Pennines (Mills, 2002). A bog burst was documented on Crow

Hill near Haworth by Brontë in 1824, and this is likely the nearest recorded failure to the Site (Ross, 2021).

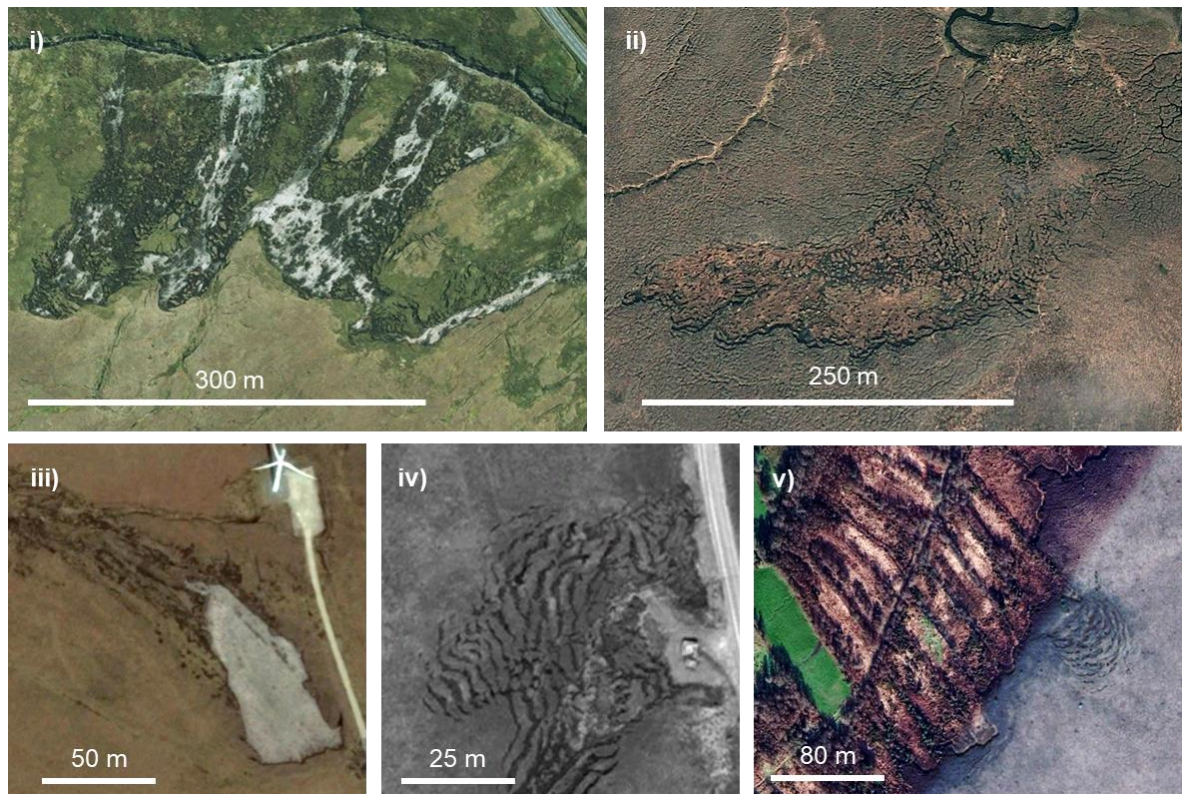


Plate 2.1 Characteristic peat landslide types in UK and Irish peat uplands: Top row - natural failures: i) multiple peat slides with displaced slabs and exposed substrate, ii) retrogressive bog burst with peat retained within the failed area; Bottom row - failures possibly induced by human activity: iii) peat slide adjacent to turbine foundation, iv) spreading around foundation, v) spreading upslope of cutting

Section 2.2 outlines the different types of peat instability documented in the UK and Ireland. Section 2.3 provides an overview of factors known to contribute to peat instability based on published literature.

2.2. Types of Peat Instability

Peat instability is manifested in a number of ways (Dykes and Warburton, 2007) all of which can potentially be observed on site either through site walkover or remotely from high resolution aerial photography:

- **minor instability:** localised and small-scale features that are not generally precursors to major slope failure and including gully sidewall collapses, pipe ceiling collapses, minor slumping along diffuse drainage pathways (e.g. along flushes); indicators of incipient instability including development of tension cracks, tears in the acrotelm (upper vegetation mat), compression ridges, or bulges / thrusts (Scottish Government, 2017); these latter features may be warning signs of larger scale major instability (such as landsliding) or may simply represent a longer term response of the hillslope to drainage and gravity, i.e. creep.
- **major instability:** comprising various forms of peat landslide, ranging from small scale collapse and outflow of peat filled drainage lines/gullies (occupying a few-10s cubic metres), to medium scale peaty-debris slides in organic soils (10s to 100s cubic metres) to large scale peat slides and bog bursts (1,000s to 100,000s cubic metres).

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

Evans and Warburton (2007) present useful contextual data in a series of charts for two types of large-scale peat instability – peat slides and bog bursts. The data are based on a peat landslide database compiled by Mills (2002) which collates site information for reported peat failures in the UK and Ireland. Separately, Dykes and Warburton (2007) provide a more detailed classification scheme for landslides in peat based on the type of peat deposit (raised bog, blanket bog, or fen bog), location of the failure shear surface or zone (within the peat, at the peat-substrate interface, or below), indicative failure volumes, estimated velocity and residual morphology (or features) left after occurrence.

For the purposes of this assessment, landslide classification is simplified and split into three main types, typical examples of which are shown in Plate 2.1. Dimensions, slope angles and peat depths are drawn from charts presented in Evans and Warburton (2007). The term “peat slide” is used to refer to large-scale (typically less than 10,000 of cubic metres) landslides in which failure initiates as large rafts of material which subsequently break down into smaller blocks and slurry. Peat slides occur ‘top-down’ from the point of initiation on a slope in thinner peats (between 0.5 m and 1.5 m) and on moderate slope angles (typically 5°-15°, see Plate 2.2).

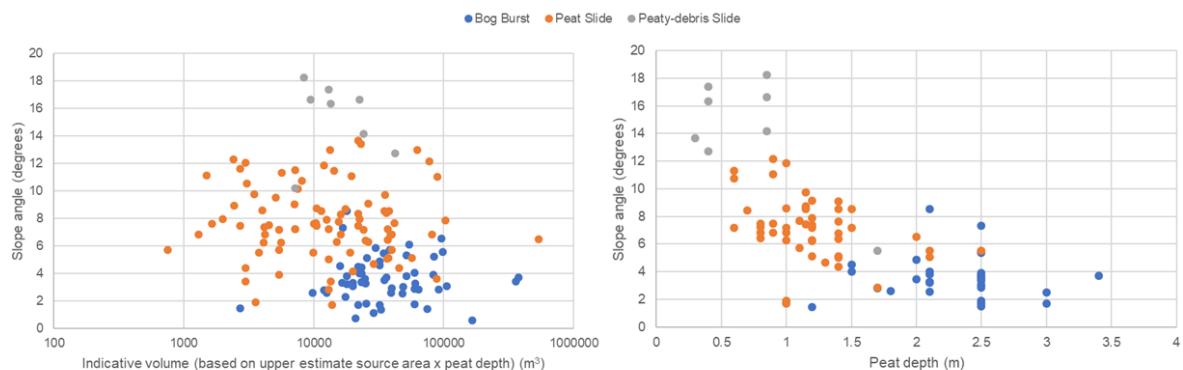


Plate 2.2 Reported slope angles and peat depths associated with peat slides and bog bursts (from literature review of locations, depths and slope angles, after Mills, 2002)

The term “bog burst” is used to refer to very large-scale (usually greater than 10,000 of cubic metres) spreading failures in which the landslide retrogresses (cuts) upslope from the point of failure while flowing downslope. Peat is typically deeper (greater than 1.0m and up to 10m) and more amorphous than sites experiencing peat slides, with shallower slope angles (typically 2°-5°). Much of the peat displaced during the event may remain within the initial failure zone. Bog bursts are rarely (if ever) reported in Scotland other than in the Western Isles (e.g. Bowes, 1960).

The term “peaty soil slide” is used to refer to small-scale (1,000s of cubic metres) slab-like slides in organic soils (i.e. they are <0.5 m thick). These are similar to peat slides in form, but far smaller and occur commonly in UK uplands across a range of slope angles (Dykes and Warburton, 2007). Their small size means that they often do not affect watercourses and their effect on habitats is minimal.

There are no published failures or news reports of landslides in proximity to the Proposed Development. Review of the nearby wind farms in similar settings (Hyndburn Wind Farm, Coal Clough Wind Farm, Todmorden Wind Farm, Reaps Moss Wind Farm, Crook Hill Wind Farm and the operational SMWF show no evidence of failures in association with construction).

2.2.1. Factors Contributing to Peat Instability

Peat landslides are caused by a combination of factors – triggering factors and reconditioning factors (Dykes and Warburton, 2007; Scottish Government, 2017). Triggering factors have an immediate or rapid effect on the stability of a peat deposit whereas preconditioning factors influence peat stability over a much longer period. Only some of these factors can be addressed by site characterisation.

Preconditioning factors may influence peat stability over long periods of time (years to hundreds of years), and include:

- i. Impeded drainage caused by a peat layer overlying an impervious clay or mineral base (hydrological discontinuity).
- ii. A convex slope or a slope with a break of slope at its head (concentration of subsurface flow).
- iii. Proximity to local drainage, either from flushes, pipes or streams (supply of water).
- iv. Connectivity between surface drainage and the peat/impervious interface (mechanism for generation of excess pore pressures).
- v. Artificially cut transverse drainage ditches, or grips (elevating pore water pressures in the basal peat-mineral matrix between cuts, and causing fragmentation of the peat mass).
- vi. Increase in mass of the peat slope through peat formation, increases in water content or afforestation.
- vii. Reduction in shear strength of peat or substrate from changes in physical structure caused by progressive creep and vertical fracturing (tension cracking or desiccation cracking), chemical or physical weathering or clay dispersal in the substrate.
- viii. Loss of surface vegetation and associated tensile strength (e.g. by burning or pollution induced vegetation change).
- ix. Increase in buoyancy of the peat slope through formation of sub-surface pools or water-filled pipe networks or wetting up of desiccated areas.
- x. Afforestation of peat areas, reducing water held in the peat body, and increasing potential for formation of desiccation cracks which are exploited by rainfall on forest harvesting.

Triggering factors are typically of short duration (minutes to hours) and any individual trigger event can be considered as the 'straw that broke the camel's back':

- i. Intense rainfall or snowmelt causing high pore pressures along pre-existing or potential rupture surfaces (e.g. between the peat and substrate).
- ii. Rapid ground accelerations (e.g. from earthquakes or blasting).
- iii. Unloading of the peat mass by fluvial incision or by artificial excavations (e.g. cutting).
- iv. Focusing of drainage in a susceptible part of a slope by alterations to natural drainage patterns (e.g. by pipe blocking or drainage diversion).
- v. Loading by plant, spoil or infrastructure.

External environmental triggers such as rainfall and snowmelt cannot be mitigated against, though they can be managed (e.g. by limiting construction activities during periods of intense rain).

Unloading of the peat mass by excavation, loading by plant and focusing of drainage can be

managed by careful design, site specific stability analyses, informed working practices and monitoring.

2.2.2. Consequences of Peat Instability

Both peat slides and bog bursts have the potential to be large in scale, disrupting extensive areas of blanket bog and with the potential to discharge large volumes of material into watercourses.

A key part of the risk assessment process is to identify the potential scale of peat instability should it occur and identify the receptors of the consequences. Potential sensitive receptors of peat failure are:

- The development infrastructure and turbines (damage to turbines, tracks, substation, etc).
- Site workers and plant (risk of injury / death or damage to plant).
- Wildlife (disruption of habitat) and aquatic fauna.
- Watercourses, lakes and reservoirs (particularly associated with public water supply).
- Site drainage (blocked drains / ditches leading to localised flooding / erosion).
- Visual amenity (scarring of landscape); and
- Public footpaths or publicly accessible areas.

While peat failures may cause visual scarring of the peat landscape, most peat failures revegetate fully within 50 to 100 years and are often difficult to identify on the ground after this period of time (Feldmeyer-Christe and Küchler, 2002; Mills, 2002). Typically, it is short-term (seasonal) effects on watercourses that are the primary concern or impacts on public water supply.

3. BASELINE CONDITIONS

3.1. Topography

The Proposed Development lies on gently rolling uplands between c. 250 m AOD and 476 m AOD. In the west, proposed turbines are distributed just south of the summit plateau of Cowpe Moss, which peaks at 476 m AOD. Elevations fall very gently to the east towards the eastern turbine cluster and Rooley Moor, and then rapidly away from the summits towards reservoirs and valleys below. Figure 14.4.1 shows the elevation of the Site and Plate 3.1 shows a perspective view of the Proposed Development with key geographical features labelled.

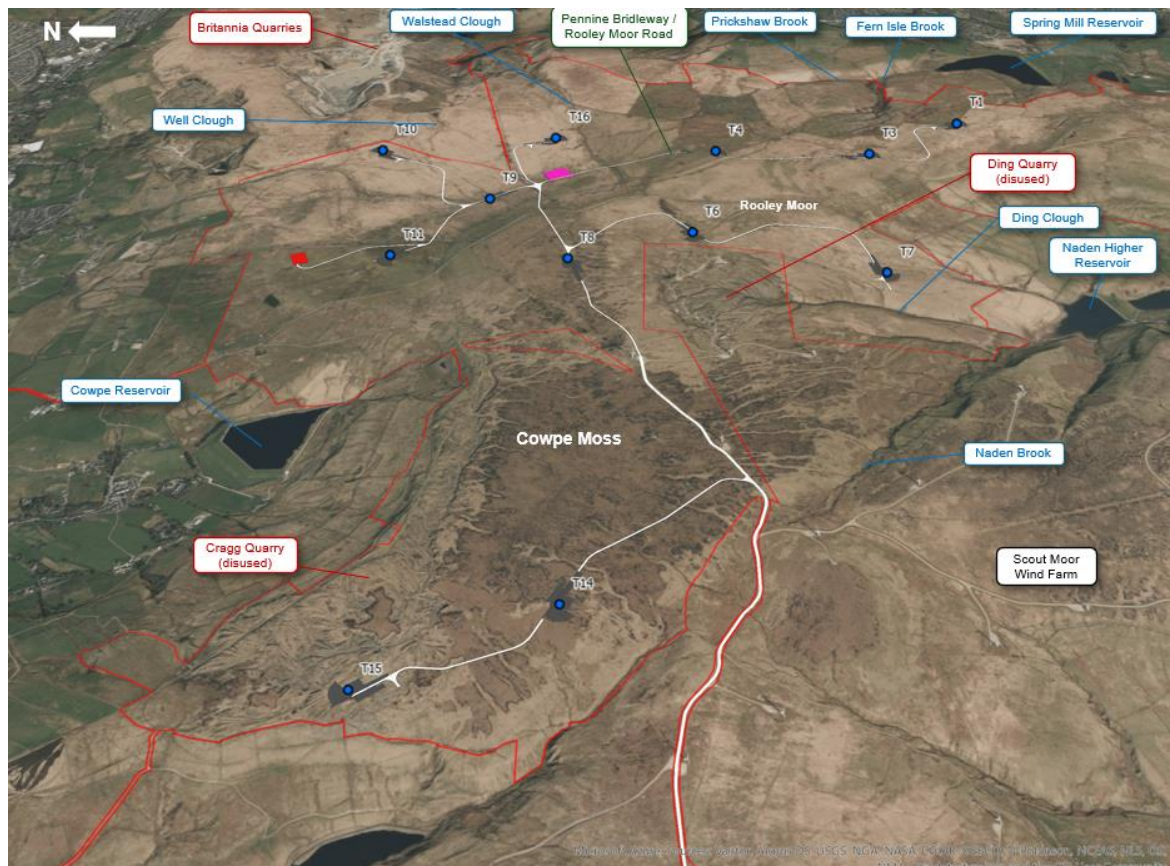


Plate 3.1 Perspective view of site showing key geographical features referenced in the text

Figure 14.4.2 shows slope angles across the Site. Slopes are very gentle on Cowpe Moss, rapidly steepening around the plateau, and similarly gentle across most of the turbine area in the east of the Site. Slopes steepen rapidly into the valley sides away from the summits.

3.2. Geology

The inset panel of Figure 14.4.3 shows the solid geology of the site mapped from 1:50,000 scale publicly available BGS digital data and indicates the Site to be underlain by Upper Haslingden Flags, Rossendale Formation, Pennine Lower Coal Measures Formation, and Woodhead Hill Rock. The northern and southern areas of the site are predominantly underlain by the Pennine Lower Coal Measures Formation and Woodhead Hill Rock, which consist of interbedded grey mudstone, siltstone, sandstone, and coal seams. In contrast, the eastern, western, and parts of the central areas are dominated by the Upper Haslingden Flags and Rossendale Formation.

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

The main panel of Figure 14.4.3 shows the superficial geology of the site, also derived from BGS digital data, indicating peat to be present over much of the summit areas, except where slopes steepen. Isolated pockets of glacial till and diamicton head are shown to be present in the southern half of the Site.

The Site has been extensively quarried on all sides, with quarry workings present within areas previously shown as moorland on historical maps of the Site, most notably on Cowpe Moss. The mapped position of the moorland limit ('bog or moss') in 1854 when quarries were less extensive is shown as a purple dashed line on Figures 14.4.3 and 14.4.6, illustrating the extent to which peatland has been damaged by previous human activity. Further information on geology is provided in Chapter 14 of the Environmental Statement.

3.3. Hydrology

The Site is drained by numerous watercourses, some named and some minor unnamed headwater tributaries, many discharging into reservoirs that supply drinking water to the wider area. Chapter 14 provides full details, and Figure 14.4.4 shows the main reservoirs and named watercourses. Key reservoirs in proximity to the Site boundary are Cowpe Reservoir, Scout Moor High Level Reservoir, Naden Higher Reservoir, Naden Middle Reservoir, Spring Mill Reservoir and Cowm Reservoir. Chapter 14 notes the reservoirs to be of very high sensitivity.

Key watercourses include Fern Isle Brook and Prickshaw Brook (which drain into Spring Mill Reservoir), Naden Brook and Ding Clough (into Naden Higher Reservoir), Walstead Clough (into Cowm Reservoir), Cowm Brook (into the Britannia Quarries area) and Well Clough.

There has been some modification of the peatland by artificial drainage, though this is not extensive. Drains are also shown on Figure 14.4.4.



Plate 3.2 a) a typical small watercourses high within the Site, b) headwater gully on the south side of Cowpe Moss

3.4. Land Use

The Site has a range of land uses reflecting its proximity to built up areas that surround the hill summits. Amenity uses include the Pennine Bridleway and Rossendale Way and non-designated heritage asset Rooley Moor Road, alongside numerous footpaths. Mountain biking and horse-riding occur on the summits and within the former quarry areas, particularly in Cragg Quarry.

Quarrying has previously been extensive across the Site, although most quarries are now disused. Plate 3.3a to d) show typical quarry features. In the northwest of the Site, Cragg Quarry hosts an isolated plateau of blanket bog that is now disconnected from peat on all sides. The effect of quarrying on the bog extent is shown by the purple dashed line on Figures 14.4.3 and 14.4.6.

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

While not a direct land use, the summit moorland supports the supply of water to the reservoirs distributed around the Site, both in terms of moderating water quality (this potentially being poorer where degraded peat drains into watercourses) and moderating flood hydrographs (drained areas producing 'flashier' hydrological responses).

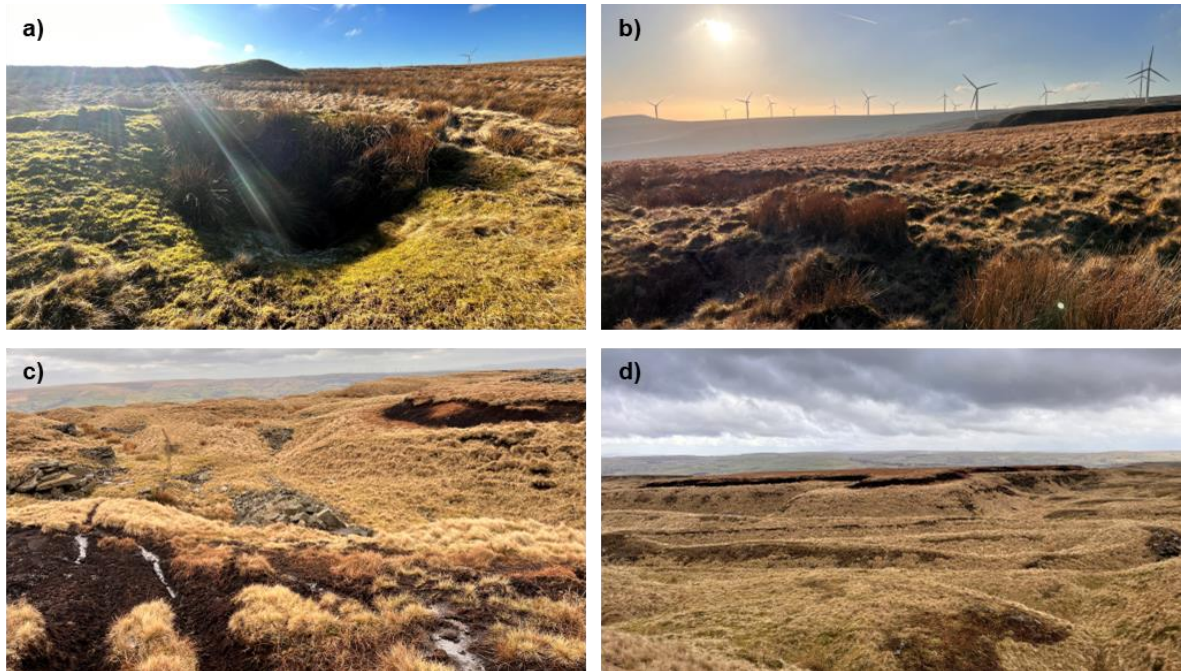


Plate 3.3 Quarry features: a) disused shaft east of the Rossendale Way, b) undulating spoil on Rooley Moor above Ding Clough, c) highly undulating terrain and bare peat at Tottington Higher End Moor, d) an isolated peat plateau in the centre of Cragg Quarry

3.5. Peat Depth and Character

Peat depth probing was undertaken by Penny Anderson Associated and latterly by Fluid Environmental Consulting in several phases in accordance with industry best practice guidance (Scottish Government, 2017):

- An initial Phase 1 survey was undertaken by Penny Anderson Associates on a 75 m grid collecting 1,809 probes.
- In October 2024, detailed probing was undertaken by Fluid along tracks at 50 m intervals with 10 m offsets and on a 10 m grid within infrastructure footprints, totalling 2,903 locations.
- A further phase of probing was undertaken by Fluid in December 2024 following layout revisions, adding 2,462 probes.
- In February 2025, another 2,594 probes were collated along with 10 cores.
- A further 1,667 probes were collected in March 2026, focusing on the revised layout.

In total 11,435 probes have been used to characterise peat at the Site. Further detail of the Fluid probing campaigns is provided in Appendix 14.4.2.

Interpolation of peat depths to produce a peat model was undertaken in the ArcMap GIS environment using a natural neighbour approach. This approach was selected because it preserves recorded depths at each probe location, unlike some other approaches (e.g. kriging), is computationally simple, and minimises 'bullseye' effects. The approach was selected after comparison of outputs with three other methods (inverse distance weighted, kriging and TIN).

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

The peat depth model is shown on Figure 14.4.6 with probing locations superimposed. Peat has been defined as any predominantly organic deposit >0.3 m in depth, unless proven otherwise by coring (e.g. if the organic horizon is 0.25 m deep but the total probed depth is 0.35 m). It is not practical to verify depths at every probe location, and therefore this conservative approach allows for a precautionary characterisation of the extent and depth of peat across the Site.

In summary:

- Peat depth is variable across the Site, being deepest on Cowpe Moss in the west (up to 4 m), and on the lower slopes east of the Rossendale Way (up to 3 m).
- In the southern half of the Site, peat becomes patchy and isolated, as well as relatively shallow (typically <1.0 m).
- Where slopes steepen away from the plateaux, peat is largely absent, sometimes because of quarrying, and sometimes due to the severity of slopes.

Comparison of the peat depth model with the layout indicates that significant efforts have been made during layout design to site infrastructure out of the deepest peat areas and to route access tracks onto shallower peat. Appendix 14.4.3 provides further detail on peat avoidance.

3.6. Peatland Geomorphology

Satellite imagery was used to interpret and map features within the site boundary. Additional imagery from different epochs available on both Google Earth™ and bing.com/maps was also referred to in order to validate the satellite imagery interpretation. The resulting geomorphological map (Figure 14.4.6) was subsequently verified during a site walkover undertaken in January 2025 by a Chartered Geologist and peatland geomorphologist with over 27 years' experience of assessing peat landslides. Plates 3.2 to 3.5 show typical features identified during the walkovers.

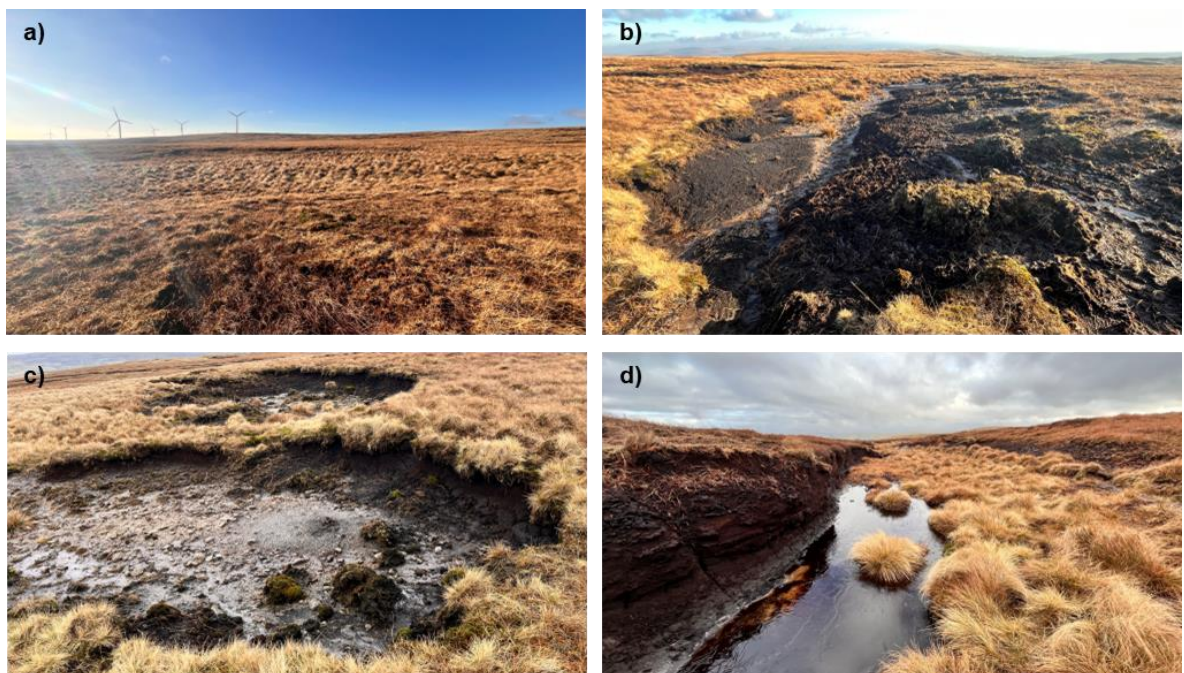


Plate 3.4 a) an area of 'quaking bog' on the southeast side of Cowpe Moss to the southeast of T9, b) bare peat on Cowpe Moss, c) exposed substrate geology after complete loss of peat, d) eroding and oxidising gully sidewall on Cowpe Moss

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

Figure 14.4.6 shows the key features of the site. The presence, characteristics and distribution of these features are helpful in understanding the hydrological function of a peatland, the balance of erosion and peat accumulation (or condition), and the sensitivity of a peatland to potential land-use changes.

The Site can be roughly divided into east and west with regards to its peatland character. Typical peatland geomorphological features are largely confined to the west, with an extensive set of gullies cutting in towards the summit of Cowpe Moss. These are often wide and shallow but regularly have bare sidewalls and signs of active erosion (e.g. Plate 3.4d). Nearer their upper extents, gullies flatten and may be visible as shallow depressions of bare peat (e.g. Plate 3.4b). Where erosion is particularly acute, the underlying geology is exposed (e.g. Plate 3.4c). Trampling and vehicle tracks have contributed to the loss of surface vegetation on Cowpe Moss, which is often thin and patchy (e.g. Plate 3.5a).

Bog pools were largely absent from the Site, though standing water is present (e.g. Plate 3.5b) but with relatively little botanical interest.

In the east, slopes are generally slightly steeper than on Cowpe Moss, and where this is the case, peat thins and grasses dominate with little evidence of *Sphagnum* species (Plate 3.5d). Lower down on the slopes to the east, the peatland becomes expansive with numerous drains cut into the moorland (see Figure 14.4.4) contributing to the widespread presence of *Molinia* (purple moor grass, e.g. Plate 3.5c).

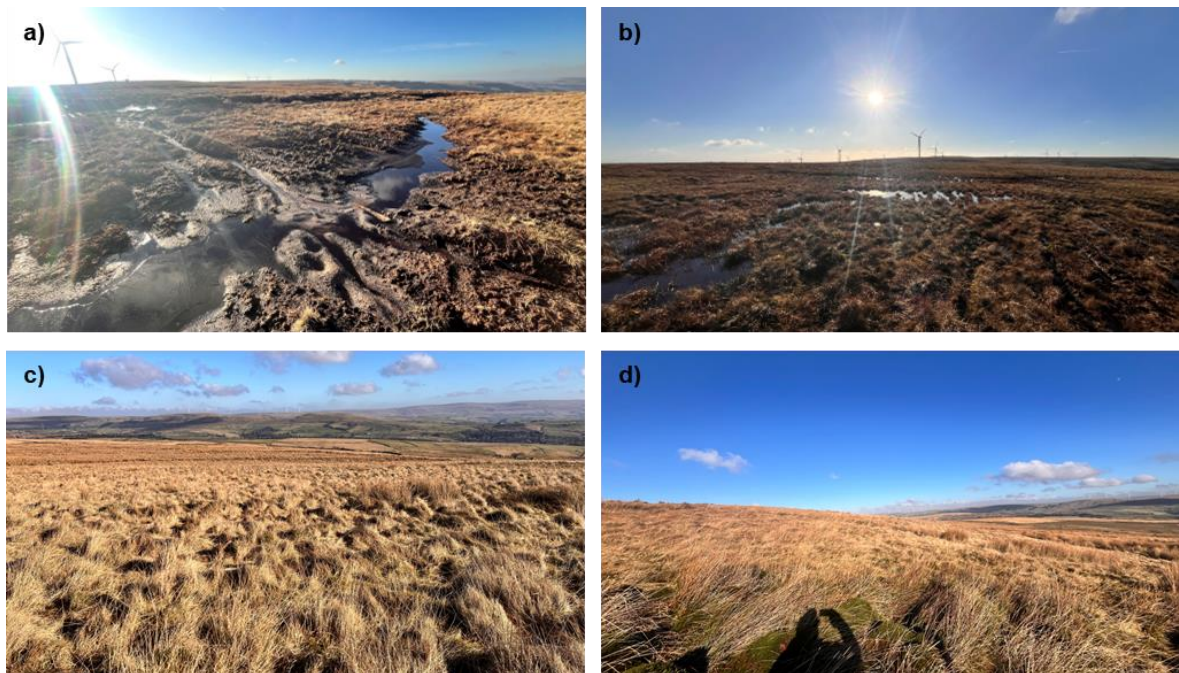


Plate 3.5 a) 'poaching' of the bog surface by trampling leading to bare peat and exposure of mineral sediment on Cowpe Moss, b) standing water / bog pool looking towards Scout Moor Wind Farm, c) dense *Molinia* east of the Rossendale Way, d) typical midslope conditions in thinner / absent peat, with long grasses and minimal mosses

While no peat landslides were observed during the site walkover, a small area of quaking bog (Plate 3.4a) was identified to the northeast of Ding Quarry, and this has been avoided by wind farm infrastructure.

4. ASSESSMENT OF PEAT LANDSLIDE LIKELIHOOD

4.1. Introduction

This section provides details on the landslide susceptibility and limit equilibrium approaches to assessment of peat landslide likelihood used in this report. The assessment of likelihood is a key step in the calculation of risk, where risk is expressed as follows:

$$\text{Risk} = \text{Probability of a Peat Landslide} \times \text{Adverse Consequences}$$

The probability of a peat landslide is expressed in this report as peat landslide likelihood and is considered below.

Due to the combination of moderate slopes and thinner peat at this site, the most likely mode of failure is peat slides, and this is the failure mechanism considered in this report. This is in keeping with the most likely mode of failure for the peat depths and slope angles present at the site (see Plate 2.2 and Figures 14.4.1 and 14.4.5).

4.2. Limit Equilibrium Approach

4.2.1. Overview

Stability analysis has been undertaken using the infinite slope model to determine the Factor of Safety (FoS) for a series of 25 m x 25 m grid cells within the Proposed Development boundary. This is the most frequently cited approach to quantitatively assessing the stability of peat slopes (e.g. Scottish Government, 2017; Boylan et al, 2008; Evans and Warburton, 2007; Dykes and Warburton, 2007; Creighton, 2006; Warburton et al, 2003; Carling, 1986). The approach assumes that failure occurs by shallow translational landsliding, which is the mechanism usually interpreted for peat slides. Due to the relative length of the slope and depth to the failure surface, end effects are considered negligible and the safety of the slope against sliding may be determined from analysis of a 'slice' of the material within the slope.

The stability of a peat slope is assessed by calculating a Factor of Safety, F , which is the ratio of the sum of resisting forces (shear strength) and the sum of driving forces (shear stress) (Scottish Government, 2017):

$$F = \frac{c' + (\gamma - h\gamma_w)z \cos^2 \beta \tan \phi'}{\gamma z \sin \beta \cos \beta}$$

In this formula c' is the effective cohesion (kPa), γ is the bulk unit weight of saturated peat (kN/m³), γ_w is the unit weight of water (kN/m³), z is the vertical peat depth (m), h is the height of the water table as a proportion of the peat depth, β is the angle of the substrate interface (°) and ϕ' is the angle of internal friction of the peat (°). This form of the infinite slope equation uses effective stress parameters, and assumes that there are no excess pore pressures, i.e. that the soil is in its natural, unloaded condition. The use of cut and fill foundations and tracks across almost the whole construction footprint suggest this is an appropriate approach. The choice of water table height reflects the full saturation of the soils that would be expected under the most likely trigger conditions, i.e. heavy rain.

Where the driving forces exceed the shear strength (i.e. where the bottom half of the equation is larger than the top), F is < 1 , indicating instability. A factor of safety between 1 and 1.4 is normally

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

taken in engineering to indicate marginal stability (providing an allowance for variability in the strength of the soil, depth to failure, etc). Slopes with a factor of safety greater than 1.4 are generally considered to be stable.

There are numerous uncertainties involved in applying geotechnical approaches to peat, not least because of its high water content, compressibility and organic composition (Hobbs, 1986; Boylan and Long, 2014). Peat comprises organic matter in various states of decomposition with both pore water and water within plant constituents, and the frictional particle-to-particle contacts that are modelled in standard geotechnical approaches are different in peats. There is also a tensile strength component to peat which is assumed to be dominant in the acrotelm, declining with increasing decomposition and depth. As a result, analysis utilising geotechnical approaches is often primarily of value in showing relative stability across a site given credible and representative input parameters rather than in providing an absolute estimate of stability. Representative data inputs have been derived from published literature for drained analyses considering natural site conditions.

4.2.2. Data Inputs

Stability analysis was undertaken in ArcMap GIS software. A 25 m x 25 m grid was superimposed on the full site extent and key input parameters derived for each grid cell. In total, c. 17,450 grid cells were analysed. A 25 m x 25 m cell size was chosen because it is sufficiently small to define a credible landslide size and avoid 'smoothing' of important topographic irregularities.

Two forms of analysis have been undertaken:

- i. **Baseline stability:** input parameters correspond to undisturbed peat, prior to construction, and under water table conditions typically associated with instability (i.e. full saturation). Effective stress parameters are used in a drained analysis.
- ii. **Modified (loaded) stability:** input parameters correspond to disturbed peat, subsequent to construction, with peat loaded by floating track and typical vehicle loads. Total stress parameters are used in this undrained analysis.

Areas where peat has been excavated (e.g. the excavated peat itself and the peat upslope of the excavation) have not been modelled since it is assumed that safe systems of work will include buttressing of / support to excavations.

Table 4.1 shows the input parameters and assumptions for the baseline stability analysis. The shear strength parameters c' and ϕ' are usually derived in the laboratory using undisturbed samples of peat collected in the field and therefore site specific values are often not available ahead of detailed site investigation for a development. Therefore, for this assessment, a literature search has been undertaken to identify a range of credible but conservative values for c' and ϕ' quoted in fibrous and humified peats. FoS analysis was undertaken with conservative ϕ' of 20° and values of 2 kPa and 5 kPa for c' . These values fall at the low end of a large range of relatively low values (when compared to other soils).

Table 4.2 shows the input parameters and assumptions for the modified stability analysis. The analysis employs a 6 m wide floating track, and assumes representative loads for a multi-axle crane with maximum axle load of 12 t moving over the floated surface. The analysis assumes pre-loading of the peat by floating track during which the track is built in layers and pore pressures are allowed to dissipate. The combined weight of the track and peat are then modelled in an undrained analysis utilising the heaviest vehicle loads likely to use the access the track. The assessment is only relevant to floating track sections.

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

Parameter	Values	Rationale	Source
Effective cohesion (c')	2, 5	Credible conservative cohesion values for humified peat based on literature review	5, basal peat (Warburton et al., 2003) 8.74, fibrous peat (Carling, 1986) 7 - 12, H8 peat (Huat et al, 2014) 5.5 - 6.1, type not stated (Long, 2005) 3, 4, type not stated (Long, 2005) 4, type not stated (Dykes and Kirk, 2001)
Bulk unit weight (γ)	10.5	Credible mid-range value for humified catotelmic peat	10.8, catotelm peat (Mills, 2002) 10.1, Irish bog peat (Boylan et al 2008)
Effective angle of internal friction (ϕ')	20, 30	Credible conservative friction angles for humified peat based on literature review (only 20° used in analysis)	40 - 65, fibrous peat (Huat et al, 2014) 50 - 60, amorphous peat (Huat et al, 2014) 36.6 - 43.5, type not stated (Long, 2005) 31 - 55, Irish bog peat (Hebib, 2001) 34 - 48, fibrous sedge peat (Farrell & Hebib, 1998) 32 - 58, type not stated (Long, 2005) 23, basal peat (Warburton et al, 2003) 21, fibrous peat (Carling, 1986)
Slope angle from horizontal (β)	Various	Mean slope angle per 25 m x 25 m grid cell	5 m digital terrain model of site
Peat depth (z)	Various	Mean peat depth per 25 m x 25 m grid cell	Interpolated peat depth model of site
Height of water table as a proportion of peat depth (h)	1	Assumes peat mass is fully saturated (normal conditions during intense rainfall events or snowmelt, which are the most likely natural hydrological conditions at failure)	

Table 4-1 Geotechnical parameters for drained infinite slope analysis

Parameter	Values	Rationale	Source
Undrained shear strength (S_u)	5	Published values show undrained shear strength is typically very similar to effective cohesion (c')	4-30, medium and highly humified (Boylan et al, 2008) 4, more humified (Boylan et al, 2008) 5.2, peat type not stated (Long et al, 2005) 5, Irish bog peat (Farrell and Hebib, 1998)
Bulk unit weight (γ)	10.5	Reduction in volume under floating road is balanced by increased density, so pre-load parameters are used	See Table 4-1
Slope angle from horizontal (β)	Various	Credible slope angles for which floating tracks are proposed	See Table 4-1
Peat depth (z)	Various	Reduction in volume (i.e. depth) under floating road is balanced by increased density, so pre-load parameters are used	See Table 4-1
Crane axle load (t)	12 t	Maximum haul weight that is not considered an "abnormal load", corresponds to 8 axle 96 t (800 t capacity) crane	

Table 4-2 Geotechnical parameters and assumptions for undrained infinite slope analysis

4.2.3. Results

The outputs of the drained analysis (effective stress) are shown for both parameter combinations in Figure 14.4.7. The main panel shows the best estimate combination which indicates the vast majority of the Site to be stable with all of the core infrastructure located on areas which stable characteristics. The conservative (worst-case) parameters indicate wider areas of marginal stability and instability but these results are not consistent with site observations nor with the stability of peat in general – peat landslides are very rare occurrences given the wide distribution of peat soils in England, Scotland and Wales.

The outputs feed into the identification of potential landslide source zones based on the presence of 2 or more contiguous cells of FoS <1.4 (marginal stability or instability) of c. 50 in length or footprint. This reflects the tendency of regularised grids to produce single cell outliers in results (i.e. spurious results). Two contiguous cells of similar value would indicate a trend more reflective of the locality.

The outputs of the undrained analysis incorporating crane loads on floating track are also shown on inset panels on Figure 14.4.7 which indicates that all proposed lengths of floating track are in areas with Factors of Safety indicating stability.

4.3. Landslide Susceptibility Approach

4.3.1. Overview

The landslide susceptibility approach is based on the layering of contributory factors to produce unique 'slope facets' that define areas of similar susceptibility to failure. These slope facets vary in size and are different to the regular grid used for the FoS approach. The number and size of slope facets varies from one part of the site to another according to the complexity of ground conditions. In total, c. 13,600 facets were considered in the analysis, with an average area of c. 1,025 m² (or an average footprint of c. 32 m x 32 m), consistent with smaller to medium scale peaty soil or peat slides reported in the published literature.

Eight contributory factors are considered in the analysis: slope angle (S), peat depth (P), substrate geology (G), peat geomorphology (M), drainage (D), slope curvature (C), forestry (F), and land use (L). For each factor, a series of numerical scores between 0 and 3 are assigned to factor 'classes', the significance of which is tabulated for each factor. The higher a score, the greater the contribution of that factor to instability for any particular slope facet. Scores of 0 imply neutral / negligible influence on instability.

Factor scores are summed for each slope facet to produce a peat landslide likelihood score (S_{PL}), the maximum being 24 (8 factors, each with a maximum score of 3).

$$S_{PL} = S_S + S_P + S_G + S_M + S_D + S_C + S_F + S_L$$

In practice, a maximum score is unlikely, as the chance of all contributory factors having their highest scores in one location is very small. The following sections describe the contributory factors, scores and justification for the Proposed Development.

4.3.2. Slope Angle (S)

Table 4-3 shows the slope ranges, their association with instability and related scores for the slope angle contributory factor. Slope angles were derived from the 0.5 m LiDAR digital terrain model shown on Figure 14.4.2 and scores assigned based on reported slope angles associated with peat

landslides rather than a simplistic assumption that 'the steeper a slope, the more likely it is to fail' (e.g. Plate 2.2).

Slope range (°)	Association with instability	Peat slide
≤2.5	Slope angle ranges for peat slides are based on lower and upper limiting angles for observations of occurrence (see Plate 2.2 and increase with increasing slope angle until the upper limiting angle e.g. peat slides are not observed on slopes <2.5).	0
2.5 - 5.0		1
5.0 - 7.5		3
7.5 - 10.0		3
10 - 15.0		3
>15.0		3

Table 4-3 Slope classes, association with instability and scores

Figure 14.4.8 shows the distribution of slope angle scores across the site, which are generally high away from the plateau and summit areas.

4.3.3. Peat Depth (P)

Table 4-4 shows the peat depths, their association with instability and related scores for the peat depth contributory factor. Peat depths were derived from the peat depth model shown on Figure 14.4.6 and reflect the peat depth ranges most frequently associated with peat landslides (see Plate 2.2).

Peat depth range (m)	Association with instability	Peat slide
>1.5	Bog bursts are the dominant failure mechanism in this depth range where basal peat is more likely to be amorphous	1
0.5 - 1.5	Peat slides are the dominant failure mechanism in this depth range where basal peat is less likely to be amorphous	3
<0.5	Organic soil rather than peat, failures would be peaty-debris slides rather than peat slides or bog bursts and are outside the scope	0

Table 4-4 Peat depth classes, association with instability and scores

The distribution of peat depth scores is shown on Figure 14.4.8. Scores are highest around the periphery of the plateau where depths fall into the 0.5 – 1.5 range.

4.3.4. Substrate Geology (G)

Table 4-5 shows substrate type, association with instability and related scores for the substrate geology contributory factor. The shear surface or failure zone of reported peat failures typically overlies an impervious clay or mineral (bedrock) base giving rise to impeded drainage. This, in part, is responsible for the presence of peat, but also precludes free drainage of water from the base of the peat mass, particularly under extreme conditions (such as after heavy rainfall, or snowmelt).

Peat failures are frequently cited in association with glacial till deposits in which an iron pan is observed in the upper few centimetres (Dykes and Warburton, 2007). They have also been observed over glacial till without an obvious iron pan, or over impermeable bedrock. They are rarely cited over permeable bedrock, probably due to the reduced likelihood of peat formation.

Substrate Geology	Association with instability	Peat slide
Cohesive (clay) or iron pan	Failures are often associated with clay substrates and/or iron pans	3
Granular clay or clay dominated alluvium	Failures are more frequently associated with substrates with some clay component	2
Granular or bedrock	Failures are less frequently associated with bedrock or granular (silt / sand / gravel) substrates	1

Table 4-5 Substrate geology classes, association with instability and scores

Probing undertaken across the site indicated primarily bedrock or granular substrates using the refusal method, although localised areas of granular clay are present in the east of the Site. These have been mapped and are shown on Figure 14.4.8.

4.3.5. Peat Geomorphology (M)

Table 4-6 shows the geomorphological features typical of peatland environments, their association with instability and related scores. Being an open moorland site (rather than afforested), there is a strong degree of confidence in the identification and mapping of these features, where present.

Geomorphology	Association with instability	Peat slide
Incipient instability (cracks, ridges, bulging)	Failures are likely to occur where pre-failure indicators are present	3
Planar with pipes	Failures generally occur on planar slopes, and are often reported in areas of piping	3
Planar with pools / quaking bog	Bog bursts are more likely in areas of perched water (pools) or subsurface water bodies (quaking bog)	2
Flush / Sphagnum lawn (diffuse drainage)	Peat slides are often reported in association with areas of flushed peat or diffuse drainage	3
Planar (no other features)	Failures generally occur on planar slopes rather than dissected or undulating slopes	2
Peat between rock outcrops	Failures are rarely reported in areas of peat with frequent rock outcrops	1
Slightly eroded (minor gullies)	Failures are rarely reported in areas with gullying or bare peat	1
Heavily eroded (extensive gullies) / bare peat	Failures are not reported in areas that are heavily eroded or bare	0
Afforested / deforested peatland	Considered within Forestry (F), see below	0

Table 4-6 Peat geomorphology classes, association with instability and scores

Figure 14.4.8 shows the geomorphological classes from Figure 14.4.6 re-coloured to correspond with Table 4-6. Much of the site comprises planar slopes with the exception of gullied areas around the periphery of Cowpe Moss and areas where peat is thin, absent or drained in the centre of the Site.

4.3.6. Artificial Drainage (D)

Table 4.7 shows artificial drainage feature classes, their association with instability and related scores. Transverse (or contour aligned) / oblique artificial drainage lines may reduce peat stability by creating lines of weakness in the peat slope and encouraging the formation of peat pipes. A number of peat failures have been identified in published literature which have failed over moorland grips (Warburton et al, 2004). The influence of changes in hydrology becomes more pronounced the more transverse the orientation of the drainage lines relative to the overall slope.

Drainage Feature	Association with instability	Peat slide
Drains aligned along contours (<15 °)	Drains aligned to contour create lines of weakness in slopes	3
Drains oblique (15-60°) to contour	Most reports of peat slides and bog bursts in association with drainage occurs where drains are oblique to slope	2
Drains aligned downslope (<30° to slope)	Failures are rarely associated with artificial drains parallel to slope or adjacent to natural drainage lines	1
No / minimal artificial drainage	No influence on stability	0

Table 4-7 Drainage feature classes, association with instability and scores

The effect of drainage lines is captured through the use of a 30 m buffer on each artificial drainage line (producing a 60 m wide zone of influence) present within the peat soils at the site. Each buffer is assigned a drainage feature class based on comparison of the drainage axis with elevation contours (transverse, oblique or aligned, as shown in Table 4-7). Buffers are shown on Figure 14.4.8.

4.3.7. Slope Curvature (C)

Table 4-8 shows slope (profile) curvature classes, association with instability and related scores. Convex and concave slopes (i.e. positions in a slope profile where slope gradient changes by a few degrees) have frequently been reported as the initiation points of peat landslides by a number of authors. The geomechanical reason for this is that convexities are often associated with thinning of peat, such that thicker peat upslope applies stresses to thinner 'retaining' peat downslope. Conversely, buckling and tearing of peat may trigger failure at concavities (e.g. Dykes & Warburton, 2007; Boylan and Long, 2011). However, review of reported peat landslide locations against Google Earth elevation data indicates that the majority of peat slides occur on rectilinear (straight) slopes and that the reporting of convexity as a key driver may be misleading. Accordingly, rectilinear slopes are assigned the highest score.

Profile Curvature	Association with instability	Peat slide
Rectilinear Slope	Peat slides are most frequently reported on rectilinear slopes, while bog bursts are often reported on rectilinear slopes	3
Convex Slope	Peat slides are often reported on or above convex slopes while bog bursts are most frequently associated with convex slopes	2
Concave Slope	Peat failures are occasionally reported in association with concave slopes	1

Table 4-8 Slope curvature classes, association with instability and scores

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

The LiDAR digital terrain model was used to identify areas of noticeable slope curvature across the site. An ArcGIS geoprocessing model was used to calculate slope curvature into concave, convex and rectilinear slopes and 'flat' areas, i.e. those with minimal rate of gradient change on subdued terrain. Curvature scores are shown on Figure 14.4.8 in accordance with Table 4-8 above.

4.3.8. Forestry (F)

Table 4-9 shows forestry classes, their association with instability and related scores. A report by Lindsay and Bragg (2004) on Derrybrien suggested that row alignments, desiccation cracking and loading (by trees) could all influence peat stability.

Forestry Class	Association with instability	Peat slide
Deforested, rows oblique to slope	Deforested peat is less stable than afforested peat, and inter ridge cracks oblique to slope may be lines of weakness	3
Deforested, rows aligned to slope	Deforested peat is less stable than afforested peat, but slope aligned inter ridge cracks have less impact	2
Afforested, rows oblique to slope	Afforested peat is more stable than deforested peat, but inter ridge cracks oblique to slope may be lines of weakness	2
Afforested, rows aligned to slope	Afforested peat is more stable than deforested peat, but potentially less stable than unforested (never planted) peat	1
Windblown	Windblown trees have full disruption to the underlying peat and residual hydrology due to root plate disturbance	0
Not afforested	No influence on stability	0

Table 4-9 Forestry classes, association with instability and scores

Only a small area in the east of the site is afforested and scored accordingly on Figure 14.4.8.

4.3.9. Land use (L)

Table 4-10 shows land use classes, association with instability and related scores. A variety of land uses have been associated with peat failures (see 2.2.1). While it is hypothesised that burning may cause desiccation cracking in peat and facilitate water flows to basal peat (and potential shear surfaces), there is little evidence directly relating burnt ground to peat landslide events.

Land Use	Association with instability	Peat slide
Machine cutting	Machine cutting may compartmentalise slopes, but has been reported primarily in association with peat slides	3
Quarrying	Quarrying may remove slope support from upslope materials, and has been observed with spreading failures (bog bursts)	2
Hand cutting (turbary)	Hand cutting may remove slope support from upslope materials, and has been reported with raised bog failures	1
Burning (deep cracking to substrate)	Failures are rarely associated with burning, but deep desiccation cracking will have the most severe effects	2
Burning (shallow cracking)	Failures are rarely associated with burning, shallow desiccation cracking will have very limited effects	1
Grazing	Failures have not been associated with grazing, no influence on stability	0

Table 4-10 Land use classes, association with instability and scores

Aside from grazing, which is likely to have a minimal effect, quarrying is the primary land use on site. Buffer zones have been applied to the upslope sides of quarries to reflect potential undermining of the peatland by loss of the adjacent ground surface. The buffers are shown on Figure 14.4.8.

4.3.10. Generation of Slope Facets

The eight contributory factor layers shown on Figure 14.4.8 were combined in ArcMap to produce approximately 11,600 slope facets. Scores for each facet were then summed to produce a peat landslide likelihood score. These likelihood scores were then converted into descriptive 'likelihood classes' from 'Very Low' to 'Very High' with a corresponding numerical range of 1 to 5 (in a similar format to the Scottish Government BPG).

Summed Score from Contributory Factors	Typical site conditions associated with score	Likelihood (Qualitative)	Landslide Likelihood Score
≤ 7	Unmodified peat with no more than low weightings for peat depth, slope angle, underlying geology and peat morphology	Very Low	1
8 - 12	Unmodified or modified peat with no more than moderate or some high scores for peat depth, slope angle, underlying geology and peat morphology	Low	2
13 - 17	Unmodified or modified peat with high scores for peat depth and slope angle and / or high scores for at least three other contributory factors	Moderate	3
18 - 21	Modified peat with high scores for peat depth and slope angle and several other contributory factors	High	4
> 21	Modified peat with high scores for most contributory factors (unusual except in areas with evidence of incipient instability)	Very High	5

Table 4-11 Likelihood classes derived from the landslide susceptibility approach

Table 4-11 describes the basis for the likelihood classes. A judgement was made that for a facet to have a moderate or higher likelihood of a peat landslide, a likelihood score would be required exceeding both the worst case peat depth and slope angle scores summed (3 in each case, i.e. 3 x 2 classes) alongside three intermediate scores (of 2, i.e. 2 x 3 classes) for other contributory factors. This means that any likelihood score of 13 or greater would be equivalent to at least a moderate likelihood of a peat landslide. Given that the maximum score attainable is 24, this seems reasonable.

4.3.11. Results

Figure 14.4.9 shows the outputs of the landslide susceptibility approach for peat slides. The results indicate that the majority of the site has a 'Low' or 'Very Low' baseline likelihood of failure with only small areas of Moderate likelihood. The Moderate areas are mainly located on the east facing slopes east of the Rossendale Way where peat depths are moderate, slopes are moderate, and clay is locally present.

4.3.12. Combined Landslide Likelihood

Figure 14.4.10 shows in purple any proposed areas of infrastructure of greater than 25 m in length intersecting with areas of Moderate or higher landslide likelihood (from the contributory factor approach) or Factor of Safety of 1.4 or less (from the limit equilibrium approach, both for Best Estimate parameters and crane loaded floating track). A 25 m overlap has been selected as this is considered the minimum size of a potentially environmentally significant landslide. In order for there to be a “Medium” or “High” risk (Scottish Government, 2017), likelihoods must be “Moderate” or higher (see Plate 4.1 below) and hence this provides a screening basis for the likelihood results. In this version of the assessment produced in April 2026, 4 infrastructure locations overlap with areas of “Moderate” landslide likelihood.

		Adverse Consequence (scores bracketed)				
		Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)
Peat landslide likelihood (scores bracketed)	Very High (5)	High	High	Medium	Low	Low
	High (4)	High	Medium	Medium	Low	Negligible
	Moderate (3)	Medium	Medium	Low	Low	Negligible
	Low (2)	Low	Low	Low	Negligible	Negligible
	Very Low (1)	Low	Negligible	Negligible	Negligible	Negligible

Score	Risk Level	Action suggested for each zone
17 - 25	High	Avoid project development at these locations
11 - 16	Medium	Project should not proceed in MEDIUM areas 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 post-consent investigation in LOW areas to refine risk level and/or mitigate any residual hazards through micro-siting or specific design measures
1 - 4	Negligible	Project should proceed with good practice monitoring and mitigation of ground instability / landslide hazards at these locations as appropriate

Plate 4.1 Top: risk ranking as a product of likelihood and consequence; Bottom: suggested action given each level of calculated risk

Section 5 of this report describes the consequence assessment and risk calculation for all areas where infrastructure intersects “Moderate” likelihood of a peat landslide.

5. ASSESSMENT OF CONSEQUENCE AND RISK

5.1. Introduction

In order to calculate risks, the potential consequences of a peat landslide must be determined. This requires identification of receptors and an assessment of the consequences for these receptors should a peat landslide occur. This section describes the consequence assessment and then provides risk results based on the product of likelihood and consequence.

5.2. Receptors

Peat uplands are typically host to the following receptors: watercourses and associated water supplies (both private and public), terrestrial habitats (e.g. groundwater dependent terrestrial ecosystems or GWDTEs) and infrastructure, both those that are related to the wind farm and other infrastructure, e.g. footpaths, roads and power lines. Although the Site is surrounded by urban areas, none of these are sufficiently close to the main infrastructure area that any properties or dwellings would be considered at risk. Receptors considered in the consequence assessment are discussed below.

5.2.1. Watercourses, reservoirs and private water supplies

Section 3.3 and Chapter 14 detail the numerous watercourses and public water supply reservoirs that drain from and receive water from the site respectively. For this consequence assessment, all public water supply reservoirs are considered to be of Very High sensitivity and all watercourses that drain to them, including minor headwater tributaries are considered to be of High sensitivity.

Two private water supplies have been identified within the Site, but neither is in an area identified to be exposed to potential peat instability, and these receptors are excluded from the consequence assessment.

While watercourses may receive debris from landslides originating mid-slope, they must be of suitable cross-section and depth (in spate, i.e. during heavy rainfall conditions) to be able to convey material downstream. Furthermore, existing artificial barriers constructed along watercourses (e.g. fences to restrict movement of grazing stock, or culverts under tracks and roads) may act to arrest the movement of debris caught up in watercourses.

5.2.2. Habitats

While blanket bog habitats are valuable, they generally recover from instability events through revegetation over a matter of years to decades and therefore a consequence score of 3 is assigned for all open blanket bog habitats within the Proposed Development site (Table 5-1), reflecting their relatively degraded state and lack of higher quality NVC communities.

Receptor and type	Consequence	Score	Justification for Consequence Score
Watercourses (aquatic habitats)	Short term increase in turbidity and acidification, potential fish kill	2	Undesignated watercourses, no sensitive species noted
Watercourses (feeding public water supplies)	Short term increase in sediment load potentially affecting water supplies	4	Minor remedial works may be required

Receptor and type	Consequence	Score	Justification for Consequence Score
Reservoirs (public water supplies)	Sediment load with potential for complex remedial work to maintain supplies.	5	Potential medium term effects.
Terrestrial habitats (blanket bog)	Short to medium term loss of vegetation cover, disruption of peat hydrology, carbon release	3	Blanket bog habitats of moderate quality, no long term effects following remedial works.
Public rights of way	Possible injury to walkers / track users (though loss of life unlikely)	5	Loss of life considered to be highest consequence event
Wind farm infrastructure (Project)	Damage to infrastructure, injury to site personnel, possible loss of life	5	Loss of life, though very unlikely, is a severe consequence; financial implications of damage and re-work are less significant

Table 5-1 Receptors considered in the consequence analysis**5.2.3. Public rights of way**

Unlike many upland peatlands in the UK subject to wind farm infrastructure, the Site is very accessible to the public and the network of footpaths and tracks is in regular use. Typically, landslide events occur during periods of intense rainfall or poor weather, or if in association with construction (for the few reported events), during the construction phase, when site access is tightly controlled and there is active monitoring of ground stability. Nevertheless, there is a small possibility that a landslide may occur some time after construction with the potential to runout over footpaths or tracks, and a consequence score of 5 has been assigned.

5.2.4. Infrastructure

Infrastructure that would be most affected in the event of a peat landslide would be the Proposed Development infrastructure (public water supply reservoirs are considered separately). These effects would be most likely during construction, at which time personnel would be using the access track network or be present at infrastructure locations for long periods. While commercial losses would be important to the Applicant, loss of life / injury would be of greater concern, and a consequence score of 5 is assigned for any infrastructure locations subject to potential peat landslides (Table 5-1). However, risks to life can be mitigated through safe systems of working. These infrastructure risks are not considered to be 'environmental' risks and are not explicitly considered in the consequence assessment below.

5.3. Consequences**5.3.1. Overview**

A consequence assessment has been undertaken by determining the potential for landslides sourced at infrastructure locations with a Moderate natural likelihood of peat instability to impact the receptors identified above. For example, if a turbine is located in a Moderate (likelihood score of 3) area of open slope and is located 50 m from a watercourse (with a consequence score of 5), it is probable that a landslide triggered during construction would reach that watercourse. The calculated risk would be a product of the likelihood and consequence scores (likelihood: 3 x consequence: 5 = risk: 15, see Plate 4.1) and be equivalent to a "Medium" risk.

In order to determine the likelihood of impact on watercourses and infrastructure, 'runout pathways' have been defined that show the estimated maximum footprint of the landslide. Runout pathways are divided in a downslope direction into 50 m, 100 m, 250 m and 500 m zones on the basis of typical runout distances detailed in Mills (2002). The likelihood of runout passing from one runout zone to the next (e.g. from the 50 m zone into the 100 m zone) is based on the proportion of the published peat landslide population that reaches each runout distance shown on Plate 5.1 (0-50 m: 100%, 50-100 m: 87%, 100-250 m: 56%, 250-500 m: 44%). The source zone area is either footprint of hardstandings or non-linear infrastructure or where an access track is the source, the track length multiplied by a typical landslide downslope length of 25 m.

Figure 14.4.10 shows in purple all infrastructure locations that overlap with Moderate likelihoods, and Factors of Safety <1.4.

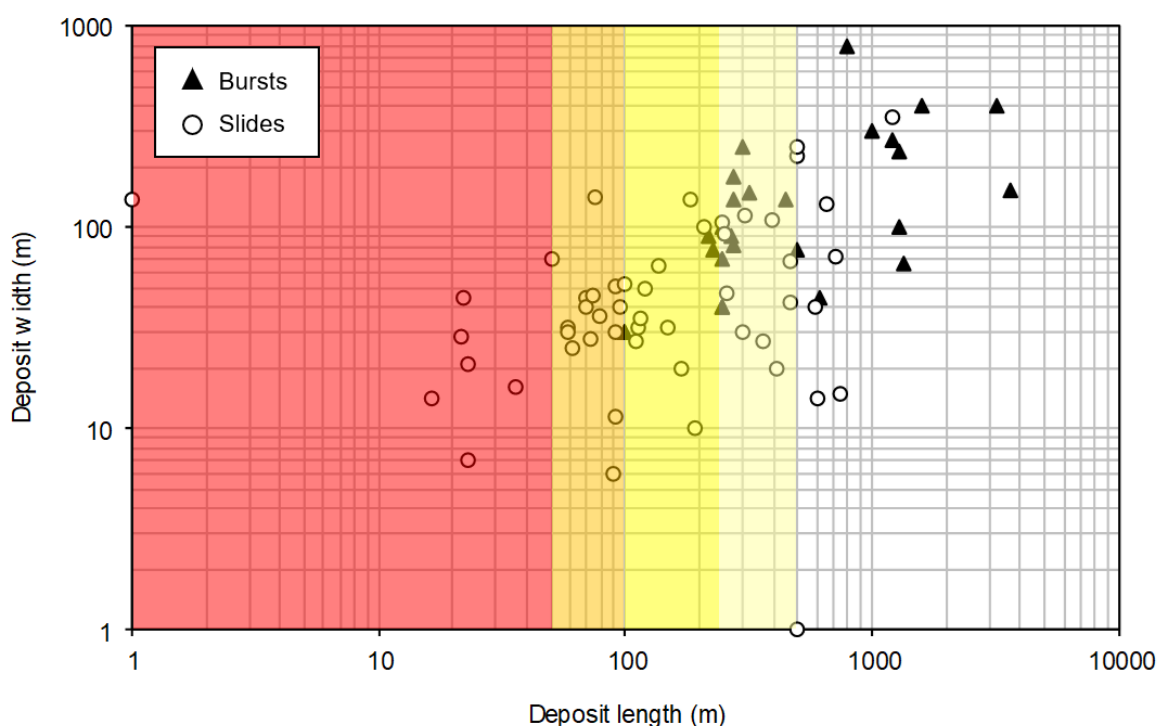


Plate 5.1 Runout distances for published peat landslides (after Mills, 2002), colours on the plot correspond to runout pathway zones on Figure 14.4.10

5.3.2. Local limits on runout (Watercourses)

If any of the runout pathways defined on Figure 14.4.10 reach watercourses within 500 m of the source zone, then runout is regarded as impacting the associated watercourse receptor and risk is calculated as the product of consequence (dependent on the watercourse consequence score) and likelihood (from section 4). If watercourses contain physical barriers (e.g. weirs), are highly sinuous within low floodplains and may encourage stranding of debris, or if streams are too small to convey material, then runout may also be considered to stall where these restrictions come into effect. Only one source zone (4) and associated runout pathway corresponds to this condition.

5.3.3. Local limits on runout (slope curvature)

Plate 5.1 shows runout distances based on published literature. Typically, runout distances would be expected to be less where slope angles decline with distance from the source zone (i.e. on concave

Technical Appendix 14.4 - Peat Landslide Hazard and Risk Assessment

slopes) whereas the full runout lengths shown on Plate 5.1 may be achievable on steepening (convex) slopes or rectilinear slopes. At the Proposed Development, there are no pronounced concavities within the mapped runout zones and therefore this constraint does not come into effect.

5.3.4. Local limits on runout (peat thickness in source zone)

Landslide runout may be “supply-limited” by the availability of peat material generated in the failure or source zone. Typically, mobilised material thins with increasing distance from the source zone as rafts of landslide material break down into blocks, and blocks become abraded and roll, breaking down further into a blocky slurry (Plate 5.2).

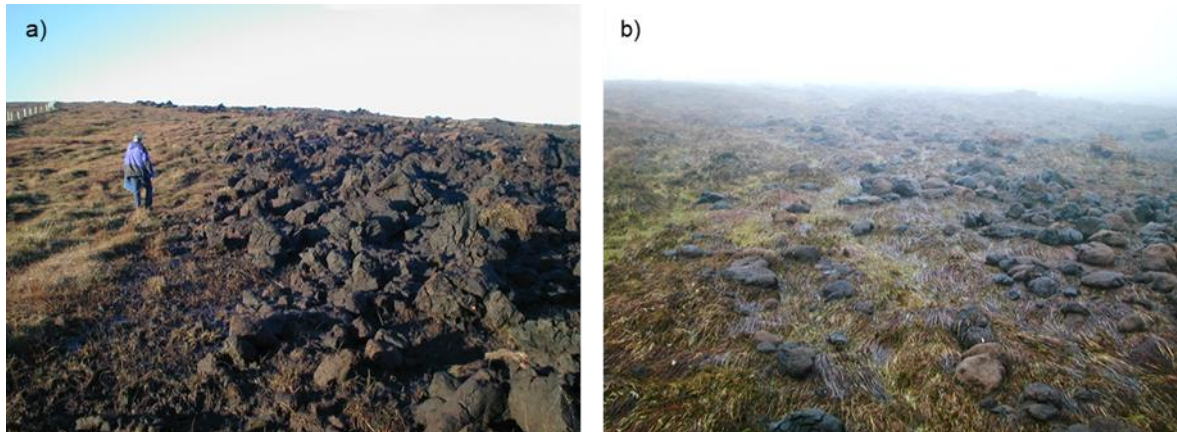


Plate 5.2 Examples of landslide runout (Dooncarton, Co. Mayo): a) blocky debris mid-slope, b) abraded and rolled blocks in lower slope

Following identification of runout zones, additional analysis has been undertaken to approximate this effect. The analysis assumes a source volume equivalent to the source footprint (if *not* a track) multiplied by depth, or if a track section, then the track length overlapping the Moderate likelihood / FoS <1.4 cells, multiplied by this same track length and then by depth. The resulting volumes are then distributed over the full runout pathway (i.e. mobilised volume / runout area) to generate an average thickness of deposit.

As the runout length and area increases, the volume thins, in keeping with observed peat landslide deposits. Where deposits fall below 0.2 m in thickness, it is assumed that runout will stall due to the roughness of surface vegetation relative to the thickness of landslide material (i.e. runout is ‘depth constrained’). If the thickness is calculated to be 0.2 m or less in the zone adjoining a watercourse, then it is judged that the runout will stall prior to reaching it or be negligible in volume on entry and there will be no significant impact on that watercourse (even if a landslide occurs).

All four runout pathways become supply limited prior to reaching the end of their runout zones, or, in the case of source zone 4, the associated watercourse (in runout zone 250-500 m).

Plate 5.3 shows a schematic of the full runout approach to assessing consequences.

.

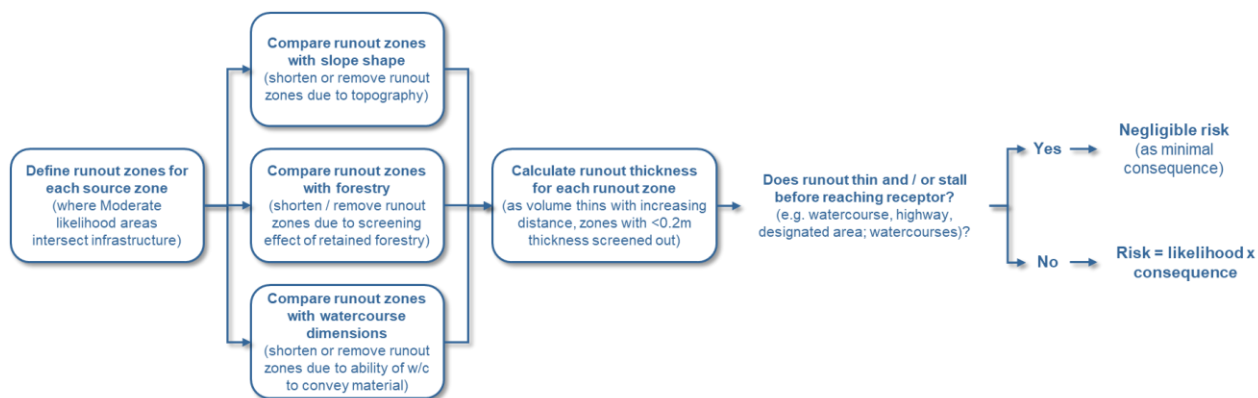


Plate 5.3 Runout approach to assessing consequences

5.3.5. Results of runout analysis

All four identified source zones have the potential to runout downslope. Source zone 4 is the only one with potential to reach a watercourse, source zones 1 to 3 potentially producing runout that would terminate mid-slope.

Were runout to occur from source zone 1, it would have the potential to impact other wind farm infrastructure further downslope. These risks are not environmental in nature and are likely to be straightforward to mitigate through good engineering practice and careful monitoring of ground conditions during construction (see section 6).

Were runout to occur from source zone 3, it would likely cross over a public footpath, however, the area in question is currently within the infrastructure footprint, and it is highly likely that access to this area will be controlled during construction. Subsequent to construction, risks would be negligible since the peat area affected would no longer be present given the track junction at that location.

5.4. Calculated Risk

Risk levels have been calculated as a product of likelihood and consequence and are shown on Figure 14.4.11 for each runout pathway. Each runout zone is colour coded to match the risk rankings shown on Plate 5.1. Where runout in a zone becomes constrained by depth (supply of material) or other limit (e.g. a structure, slope concavity, etc) then the risk zone is hatched rather than solid (e.g. in the lower runout zone from source zone 9). For each zone, the score for the most sensitive receptor has been chosen for the risk calculation (i.e. a precautionary approach).

Figure 14.4.11 indicates that risks are calculated to be “Low” to “Negligible” for potential runout from the 4 source zones. No source locations have a “Medium” or “High” calculated risk. It should be noted that simultaneous occurrence of failures from all source zones is extremely unlikely, since landslides in peat, including peatland subject to construction, are rare events. The intention of the analysis is to identify the locations in which instability is most likely, and identify needs for site-specific mitigation if risks are calculated to be Medium or High.

Based on the risks calculated, site-wide good practice measures should be sufficient to manage and mitigate any construction induced instability risks. This is considered in the next section.

6. RISK MITIGATION

6.1. Overview

A number of mitigation opportunities exist to further reduce the risk levels identified at the Proposed Development site. These range from infrastructure specific measures (which may act to reduce peat landslide likelihood, and, in turn, risk) to general good practice that should be applied across the site to engender awareness of peat instability and enable early identification of potential displacement and opportunities for mitigation.

Risks may be mitigated by:

- i. Post-consent site specific review of the ground conditions contributing to Moderate likelihoods which may result in a reduced likelihood, and in turn, further reduction in risk; examples include review of drains along east facing slopes, or exclusion of presence of clay.
- ii. Precautionary construction measures – including use of monitoring, good practice and a geotechnical risk register relevant to all locations.

Based on the analysis presented in this report, risks are calculated to be “Low” or “Negligible” across the site, and site-specific mitigation is not required to reduce risks pre-consent. Sections 6.2 to 6.4 provide information on good practice pre-construction, during construction and post-construction (i.e. during operation).

6.2. Good Practice Prior to Construction

Site safety is critical during construction, and it is strongly recommended that detailed intrusive site investigation and laboratory analysis are undertaken ahead of the construction period in order to characterise the strength of the peat soils in the areas in which excavations are proposed, particularly where these fall in areas of Moderate (or greater, if present) likelihood. These investigations should be sufficient to:

1. Determine the strength of free-standing bare peat excavations.
2. Determine the strength of loaded peat (where excavators and plant are required to operate on floating hardstandings or track, or where operating directly on the bog surface).
3. Identify sub-surface water-filled voids or natural pipes delivering water to the excavation zone, e.g. through the use of ground penetrating radar or careful pre-excavation site observations.

A comprehensive Geotechnical Risk Register should be prepared post-consent, but pre-construction, detailing sequence of working for excavations, measures to minimise peat slippage, design of retaining structures for the duration of open hole works, monitoring requirements in and around the excavation and remedial measures in the event of unanticipated ground movement. The risk register should be considered a live document and updated with site experience as infrastructure is constructed. Ideally, a contractor with experience of working in deep peat should be engaged to undertake the works.

6.3. Good Practice During Construction

The following good practice should be undertaken during construction:

For excavations:

- Use of appropriate supporting structures around peat excavations (e.g. for turbines, crane pads and compounds) to prevent collapse and the development of tension cracks.
- Avoid cutting trenches or aligning excavations across slopes (which may act as incipient back scars for peat failures) unless appropriate mitigation has been put in place.
- Implement methods of working that minimise the cutting of the toes of slope, e.g. working up-to-downslope during excavation works.
- Monitor the ground upslope of excavation works for creep, heave, displacement, tension cracks, subsidence or changes in surface water content.
- Monitor cut faces for changes in water discharge, particularly at the peat-substrate contact.
- Minimise the effects of construction on natural drainage by ensuring that natural drainage pathways are maintained or diverted such alteration of the hydrological regime of the site is minimised or avoided; drainage plans should avoid creating drainage/infiltration areas or settlement ponds towards the tops of slopes (where they may act to both load the slope and elevate pore pressures).

For cut tracks:

- Maintain drainage pathways through tracks to avoid ponding of water upslope.
- Monitor the top line of excavated peat deposits for deformation post-excavation.
- Monitor the effectiveness of cross-track drainage to ensure water remains free-flowing and that no blockages have occurred.

For floating tracks:

- Allow peat to undergo primary consolidation by adopting rates of road construction appropriate to weather conditions.
- Identify 'stop' rules, i.e. weather dependent criteria for cessation of track construction based on local meteorological data.
- Run vehicles at 50% load capacity until the tracks have entered the secondary compression phase.
- Prior to construction, setting out the centreline of the proposed track to identify any ground instability concerns or particularly wet zones.

For storage of peat and for restoration activities:

- Ensure stored peat is not located upslope of working areas or adjacent to drains or watercourses.
- Undertake site specific stability analysis for all areas of peat storage (if on sloping ground) to ensure the likelihood of destabilisation of underlying peat is minimised.
- Avoid storing peat on slope gradients $>3^\circ$ and preferably store on ground with neutral slopes and natural downslope barriers to peat movement.
- Monitor effects of wetting / re-wetting stored peat on surrounding peat areas, and prevent water build up on the upslope side of peat mounds.

- Undertake regular monitoring of emplaced peat in restoration areas to identify evidence of creep or pressure on retaining structures (dams and berms).
- Maximise the interval between material deliveries over newly constructed tracks that are still observed to be within the primary consolidation phase.

In addition to these control measures, the following good practice should be followed:

- The geotechnical risk register prepared prior to construction should be updated with site experience as infrastructure is constructed.
- Full site walkovers should be undertaken at scheduled intervals to be agreed with the Local Authority to identify any unusual or unexpected changes to ground conditions (which may be associated with construction or which may occur independently of construction).
- All construction activities and operational decisions that involve disturbance to peat deposits should be overseen by an appropriately qualified geotechnical engineer with experience of construction on peat sites.
- Awareness of peat instability and pre-failure indicators should be incorporated in site induction and training to enable all site personnel to recognise ground disturbances and features indicative of incipient instability.
- A weather policy should be agreed and implemented during works, e.g. identifying 'stop' rules (i.e. weather dependent criteria) for cessation of track construction or trafficking.
- Monitoring checklists should be prepared with respect to peat instability addressing all construction activities proposed for site.

It is considered that taken together, these mitigation measures should be sufficient to reduce risks to construction personnel to Negligible by reducing consequences to minor injury or programme delay (i.e. Moderate consequences) with a Very Low likelihood of occurrence.

6.4. Good Practice Post-Construction

Following cessation of construction activities, monitoring of key infrastructure locations should continue by full site walkover to look for signs of unexpected ground disturbance, including:

- Ponding on the upslope side of infrastructure sites and on the upslope side of access tracks.
- Changes in the character of peat drainage within a 50 m buffer strip of tracks and infrastructure (e.g. upwelling within the peat surface upslope of tracks, sudden changes in drainage behaviour downslope of tracks).
- Blockage or underperformance of the installed site drainage system.
- Slippage or creep of stored peat deposits.
- Development of tension cracks, compression features, bulging or quaking bog anywhere in a 50 m corridor surrounding the site of any construction activities or site works.

This monitoring should be undertaken on a quarterly basis in the first year after construction, biannually in the second year after construction and annually thereafter; in the event that unanticipated ground conditions arise during construction, the frequency of these intervals should be reviewed, revised and justified accordingly.

REFERENCES

The Anglo-Celt (2021) Hillwalker captures aftermath of landslide.

<https://www.anglocelt.ie/2021/07/22/hillwalker-captures-aftermath-of-landslide/> accessed 23/07/2021

BBC (2014) Torrential rain leads to landslides in County Antrim. <https://www.bbc.co.uk/news/uk-northern-ireland-28637481> accessed 19/07/2018

BBC (2018) Glenelly Valley landslides were 'one-in-3,000 year event'. <https://www.bbc.co.uk/news/uk-northern-ireland-43166964> accessed 19/07/2018

Boylan N, Jennings P and Long M (2008) Peat slope failure in Ireland. *Quarterly Journal of Engineering Geology*, 41, pp. 93–108

Boylan N and Long M (2011) In situ strength characterisation of peat and organic soil using full-flow penetrometers. *Canadian Geotechnical Journal*, 48(7), pp1085-1099

Boylan N and Long M (2014) Evaluation of peat strength for stability assessments. *Geotechnical Engineering*, 167, pp422-430

Bowes DR (1960) A bog-burst in the Isle of Lewis. *Scottish Geographical Journal*. 76, pp. 21-23

Carling PA (1986) Peat slides in Teesdale and Weardale, Northern Pennines, July 1983: description and failure mechanisms. *Earth Surface Processes and Landforms*, 11, pp. 193-206

Creighton R (Ed) (2006) *Landslides in Ireland*. Geological Society of Ireland, Irish Landslides Working Group, 125p

Creighton R and Verbruggen K (2003) *Geological Report on the Pollatomish Landslide Area, Co. Mayo*. Geological Survey of Ireland, 13p

Cullen C (2011) Peat stability – minimising risks by design. Presentation at SEAI Wind Energy Conference 2011, 45p

Dykes AP and Kirk KJ (2001) Initiation of a multiple peat slide on Cuilcagh Mountain, Northern Ireland. *Earth Surface Processes and Landforms*, 26, 395-408

Dykes A and Warburton J (2007) Mass movements in peat: A formal classification scheme. *Geomorphology* 86, pp. 73–93

Evans MG & Warburton J (2007) *Geomorphology of Upland Peat: Erosion, Form and Landscape Change*, Blackwell Publishing, 262p

Farrell ER and Heib S (1998) The determination of the geotechnical parameters of organic soils, *Proceedings of International Symposium on Problematic Soils, IS-TOHOKU 98, Sendai, 1998, Japan*, pp. 33–36

Feldmeyer-Christe E and K  chler M (2002) Onze ans de dynamique de la vegetation dans une tourbiere soumise a un glissement de terrain. *Botanica Helvetica* 112, 103-120

Flaherty R (2016) Man dies in suspected landslide at wind farm in Co Sligo. *Irish Times*, 13/12/2013, <https://www.irishtimes.com/news/crime-and-law/man-dies-in-suspected-landslide-at-wind-farm-in-co-sligo-1.2903750>, accessed 19/07/2018

Heib S (2001) *Experimental investigation of the stabilisation of Irish peat*, unpublished PhD thesis, Trinity College Dublin

Henderson S (2005) Effects of a landslide on the shellfish catches and water quality in Shetland. Fisheries Development Note No. 19, North Atlantic Fisheries College

Hobbs NB (1986) Mire morphology and the properties and behaviour of some British and foreign peats. Quarterly Journal of Engineering Geology, London, 1986, 19, pp. 7–80

Huat BBK, Prasad A, Asadi A and Kazemian S (2014) Geotechnics of organic soils and peat. Balkema, 269p

Irish News (2016) Major landslide sees 4,000 tonnes of bog close popular Galway tourist route.
<https://www.independent.ie/irish-news/major-landslide-sees-4000-tonnes-of-bog-close-popular-galway-tourist-route-34830435.html> accessed 19/07/2018

Irish Mirror (2020) Photos show massive mudslides in Leitrim after heavy flooding.
<https://www.irishmirror.ie/news/irish-news/mudslides-drumkeeran-leitrim-flooding-photos-22281581>
accessed 01/09/2021

Lindsay RA and Bragg OM (2004) Wind farms and blanket peat. A report on the Derrybrien bog slide. Derrybrien Development Cooperative Ltd, Galway, 149p

Long M (2005) Review of peat strength, peat characterisation and constitutive modelling of peat with reference to landslides. Studia Geotechnica et Mechanica, XXVII, 3-4, pp. 67–88

Mills AJ, Moore R, Carey JM and Trinder SK (2007) Recent landslide impacts in Scotland: possible evidence of climate change? In: McInnes, R. et al (Eds) Landslides and climate change: challenges and solutions, Proceedings of Conference, Isle of Wight, 2007

Mills AJ (2002) Peat slides: Morphology, Mechanisms and Recovery, unpublished PhD thesis, University of Durham

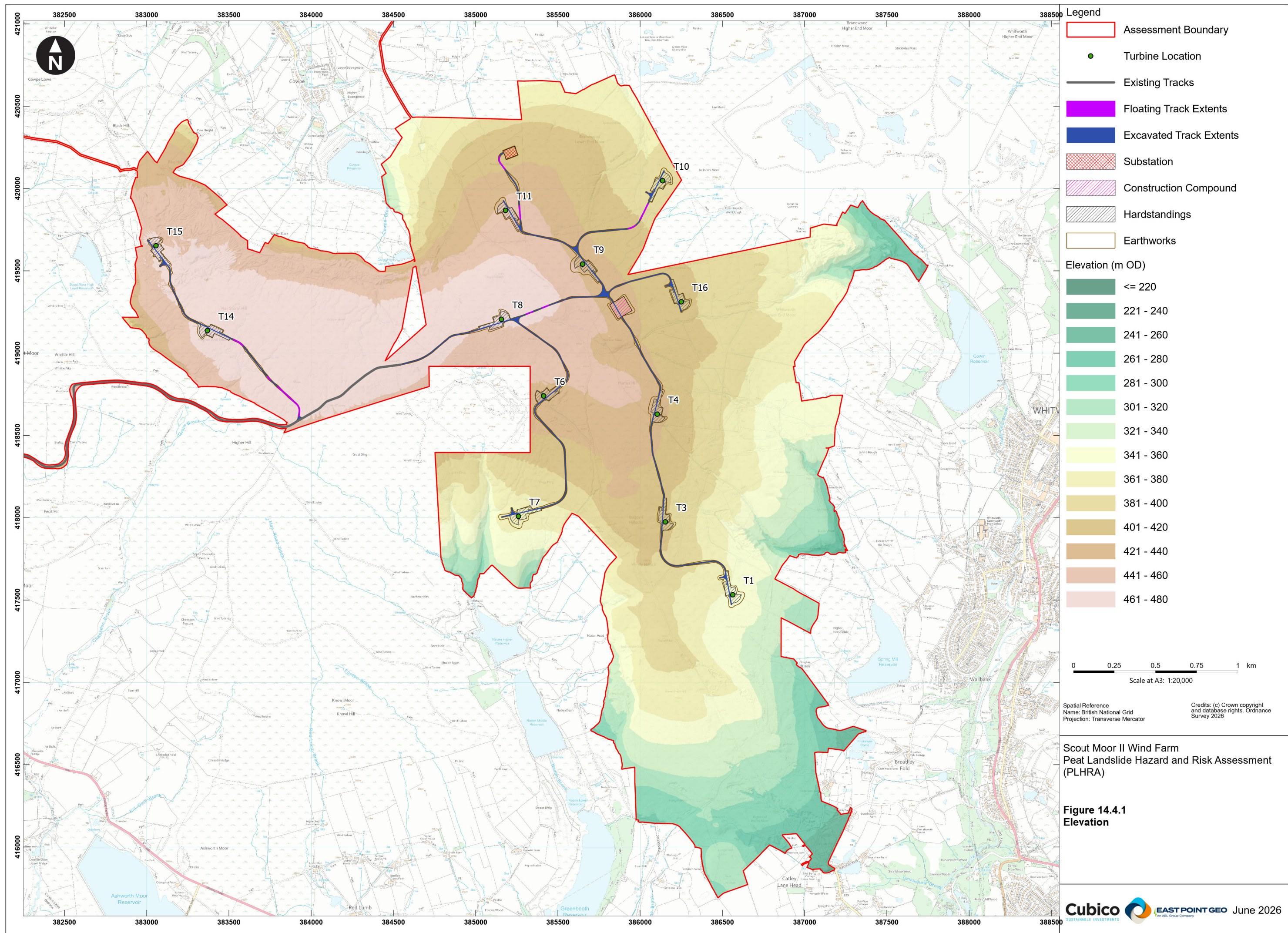
Ross S (2021) Charlotte Bronte at the Anthropocene. State University of New York Press, 334p

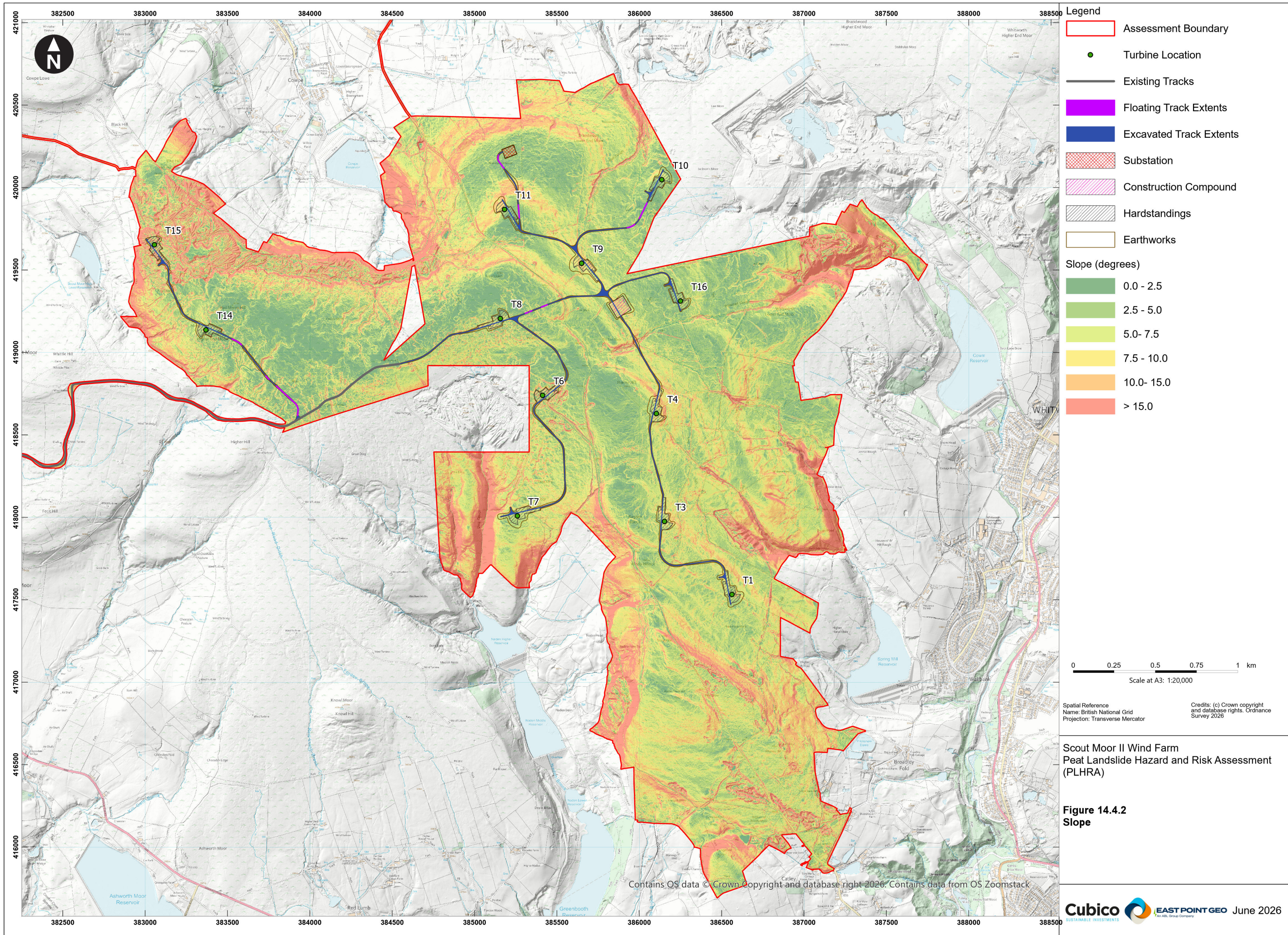
Scottish Government (2017) Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments (Second Edition). Scottish Government, 84p

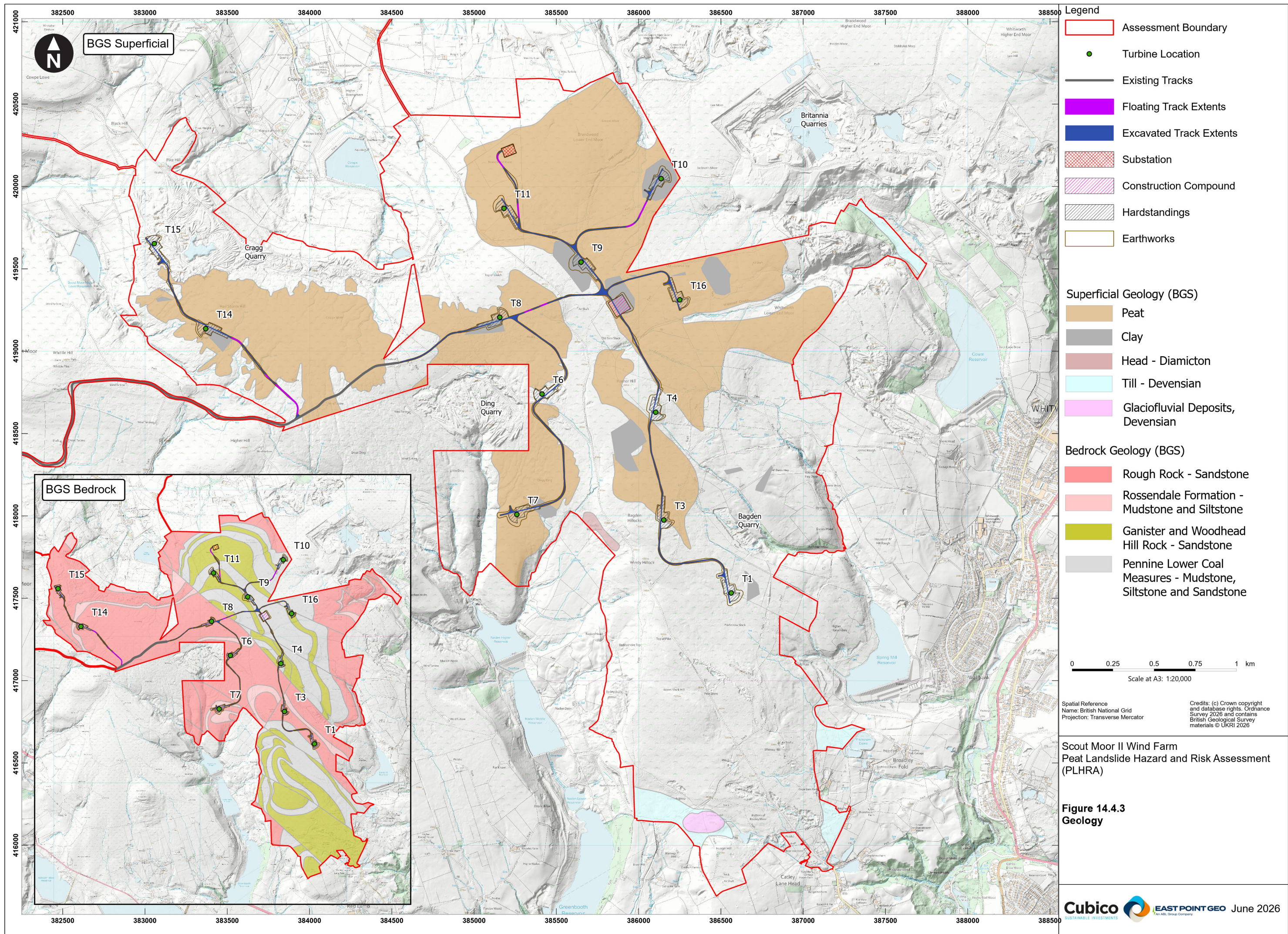
The Shetland Times (2015) Mid Kame landslip on proposed windfarm site.
<http://www.shetlandtimes.co.uk/2015/10/30/mid-kame-landslip-on-proposed-windfarm-site> accessed 19/07/2018

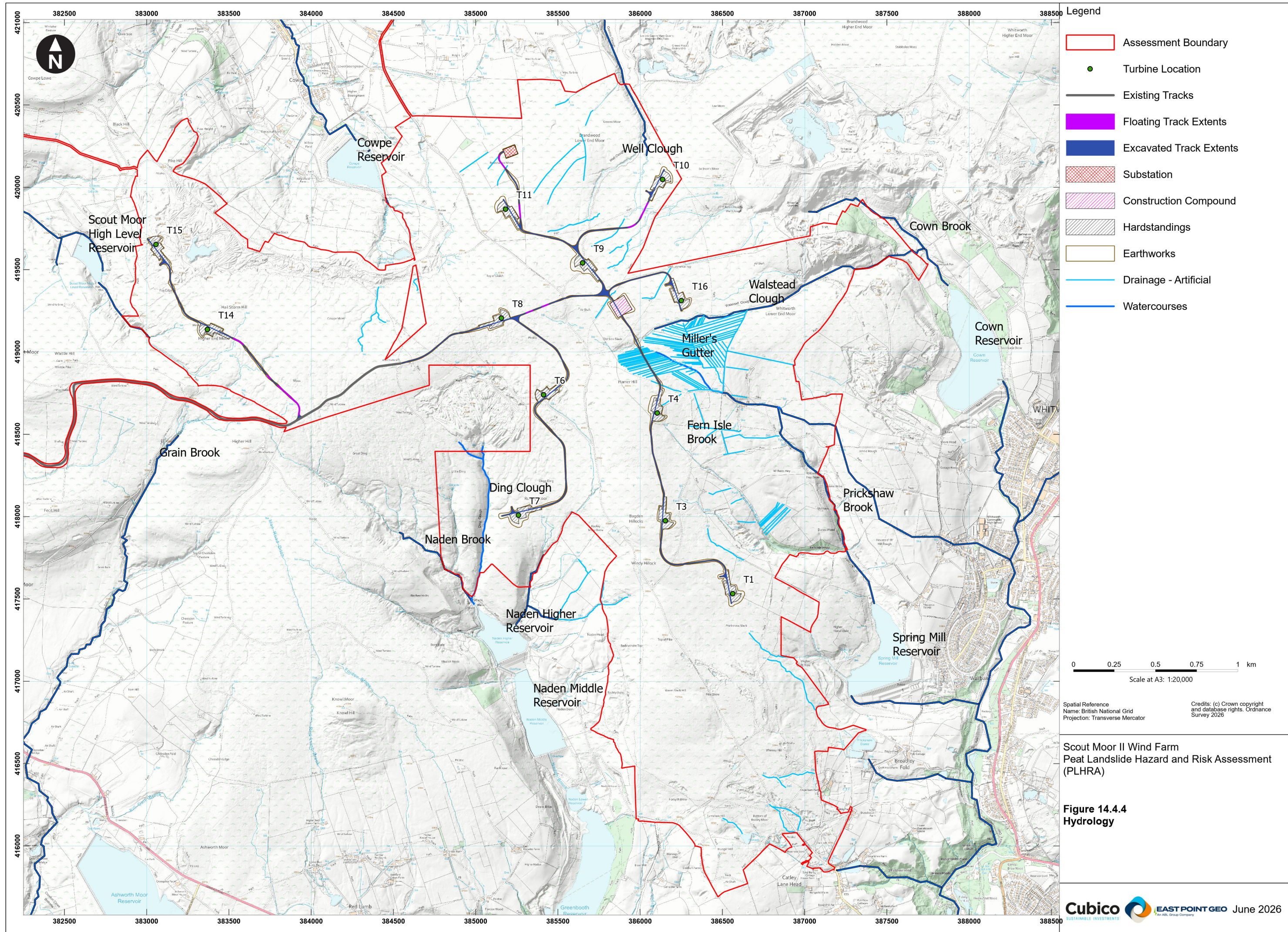
Warburton J, Holden J and Mills AJ (2004). Hydrological controls of surficial mass movements in peat. Earth Science Reviews, 67, pp. 139-156

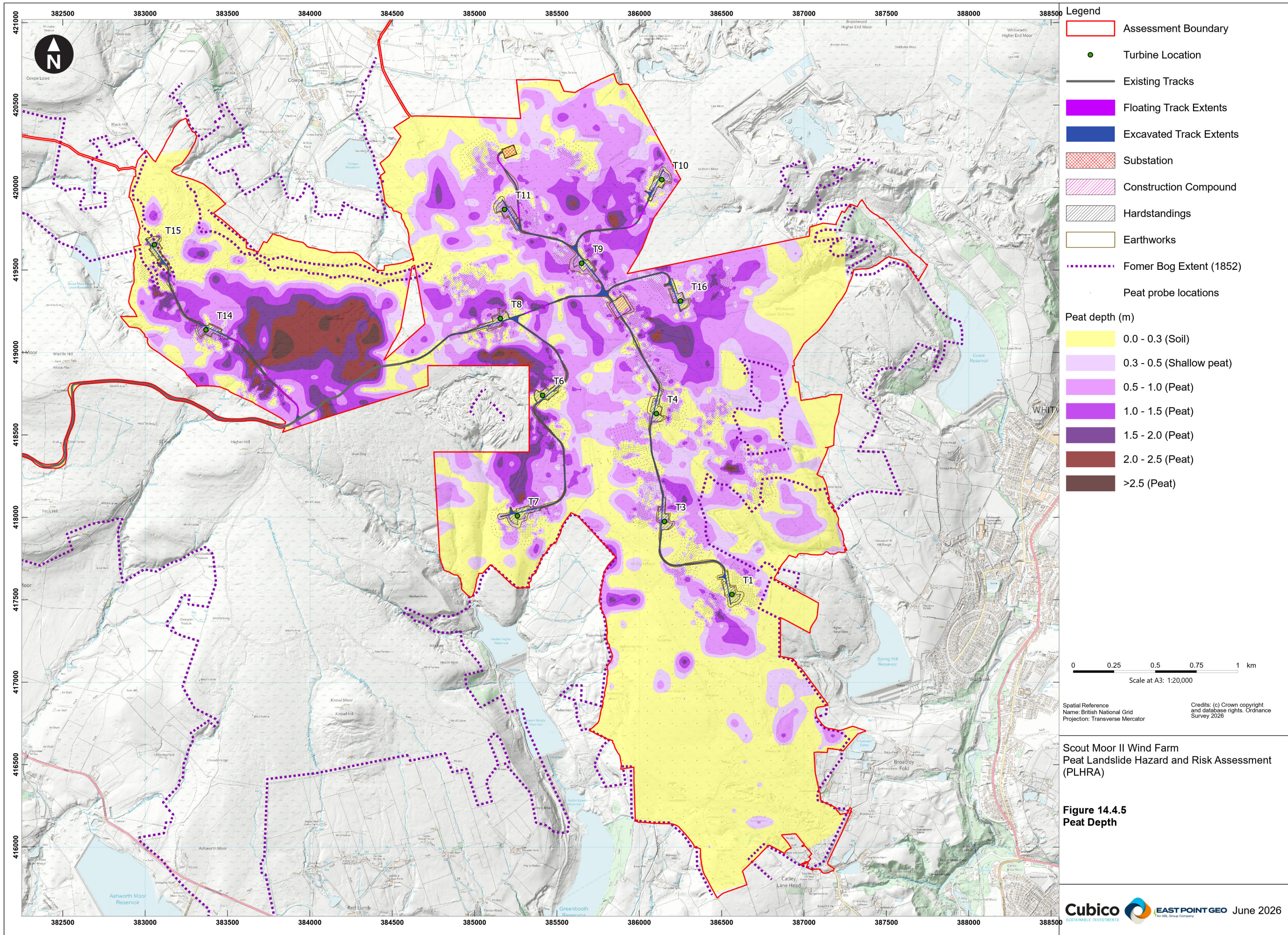
Warburton J, Higgitt D and Mills AJ (2003) Anatomy of a Pennine peat slide, Northern England. Earth Surface Processes and Landforms, 28, pp. 457-473

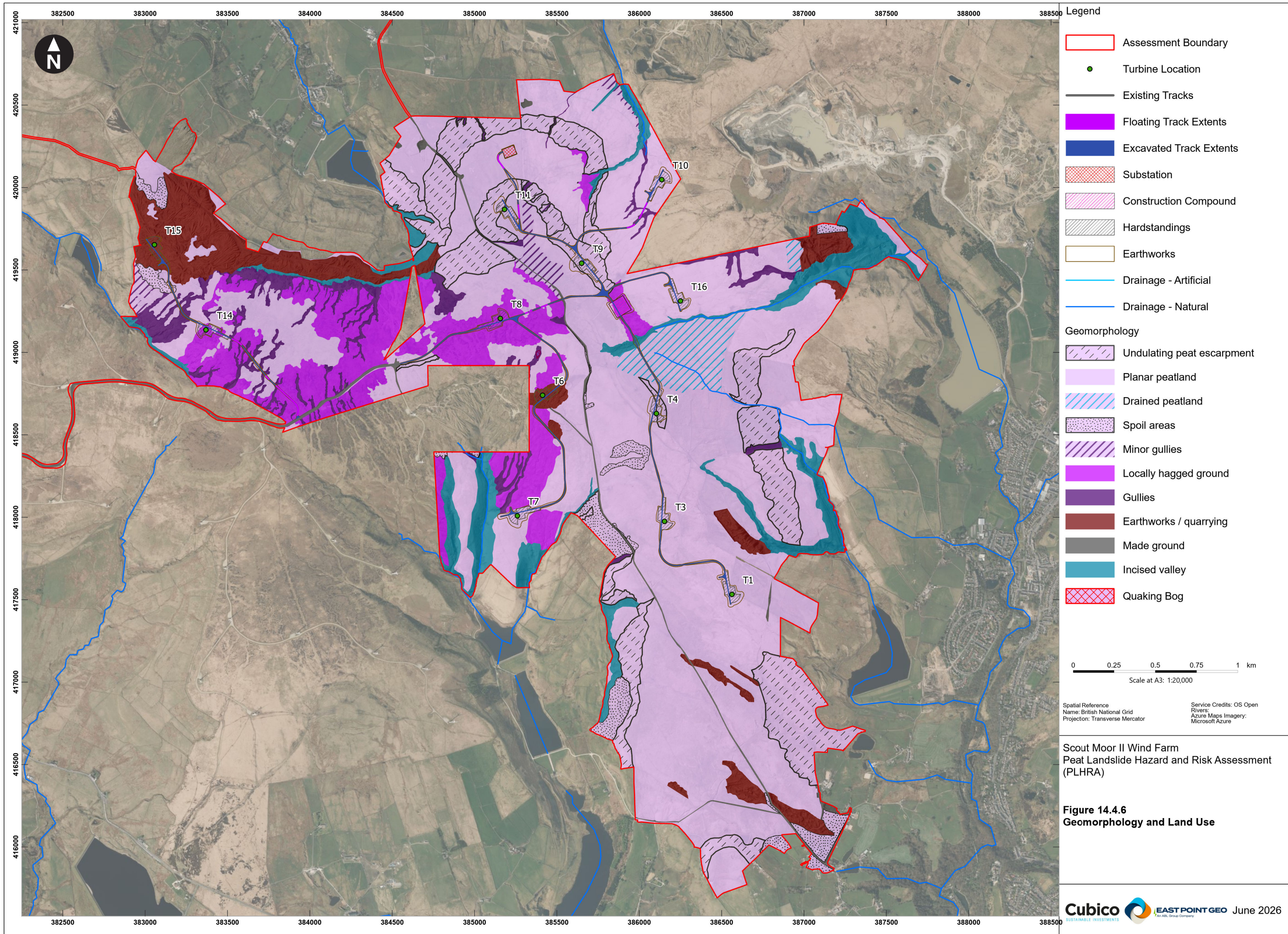


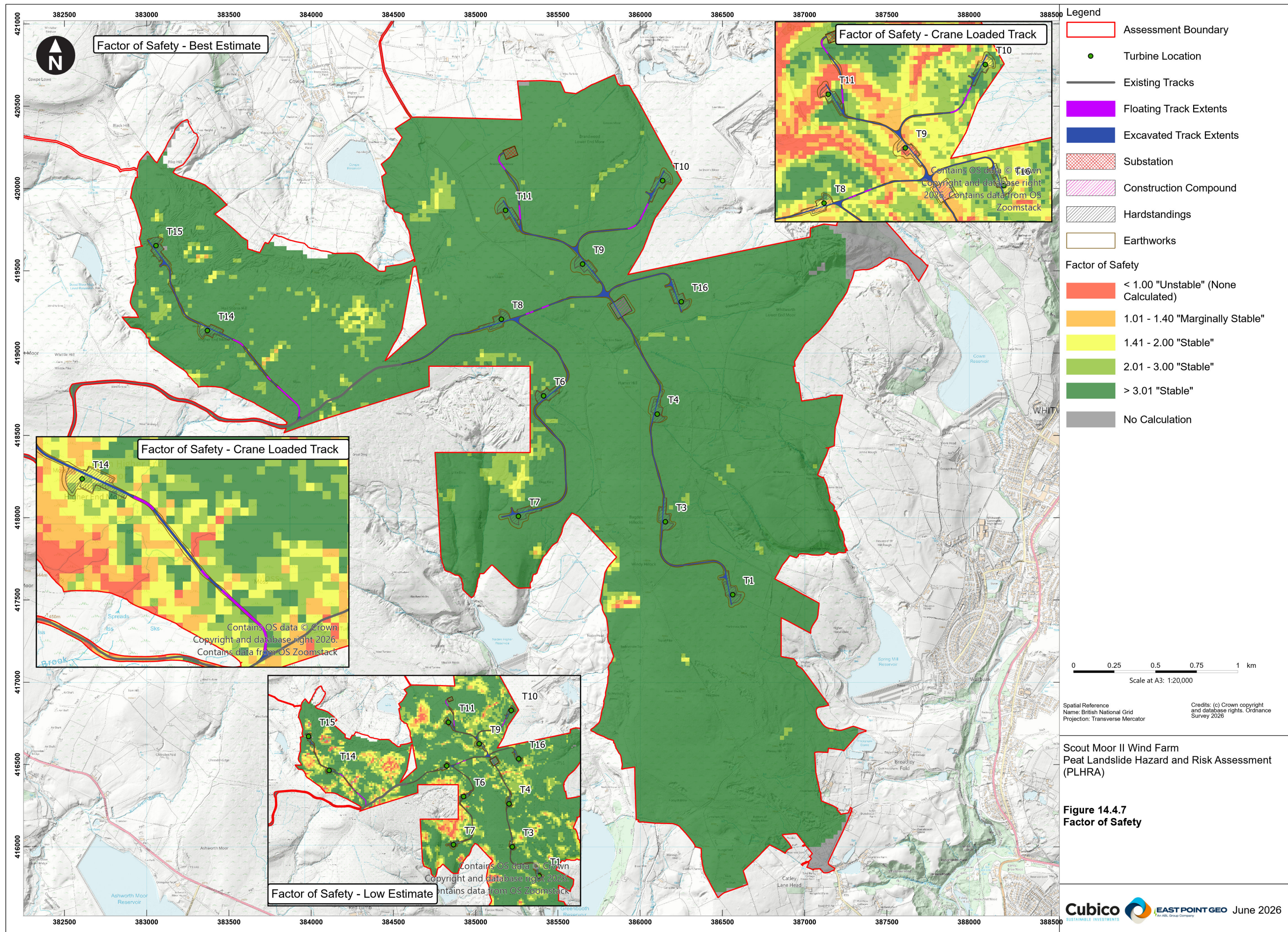


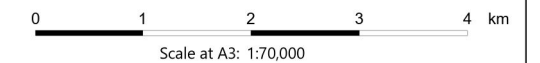
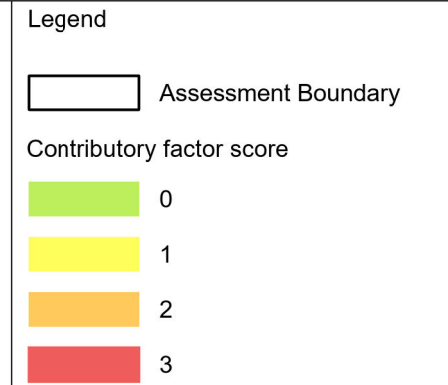
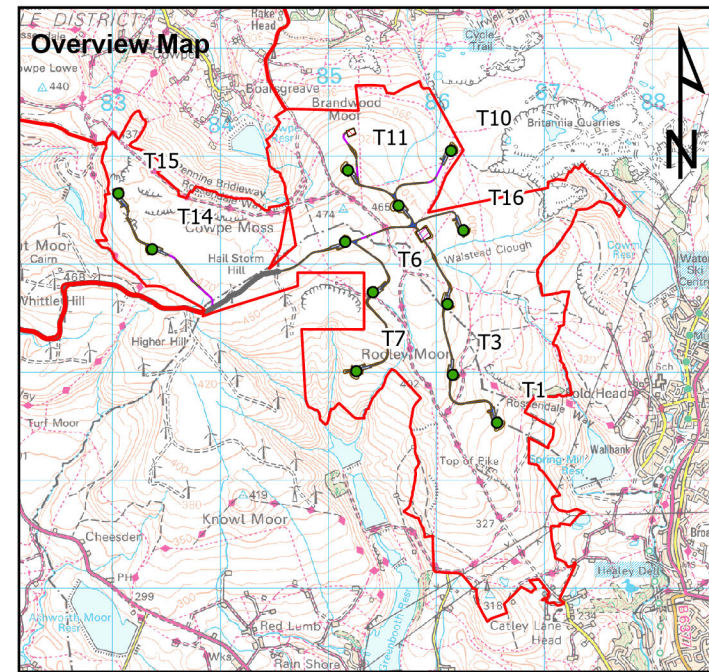
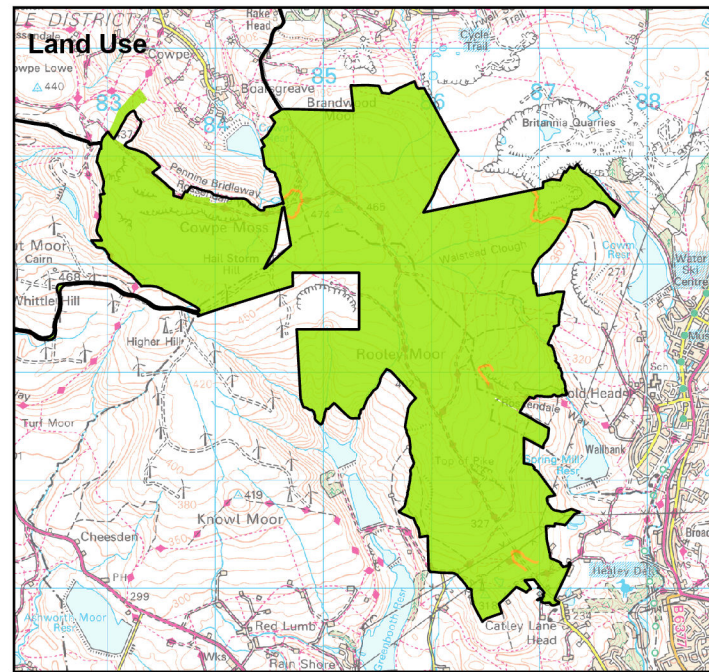
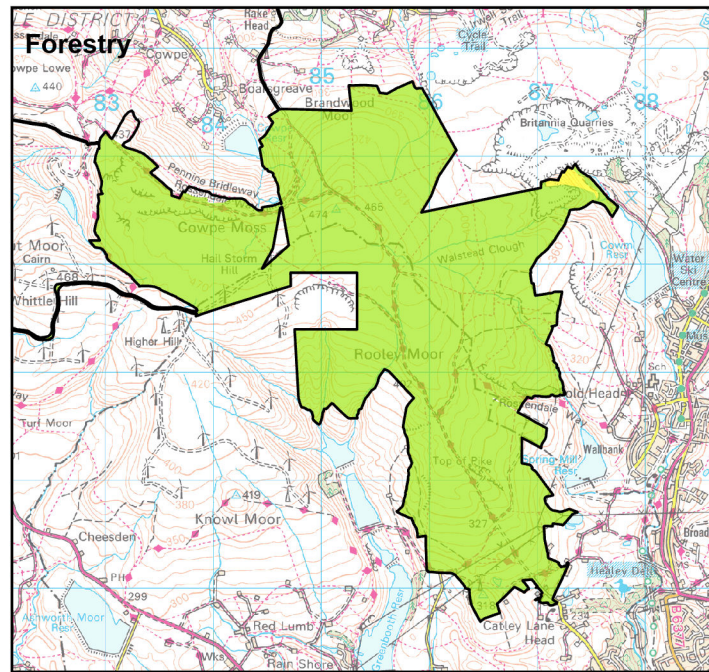
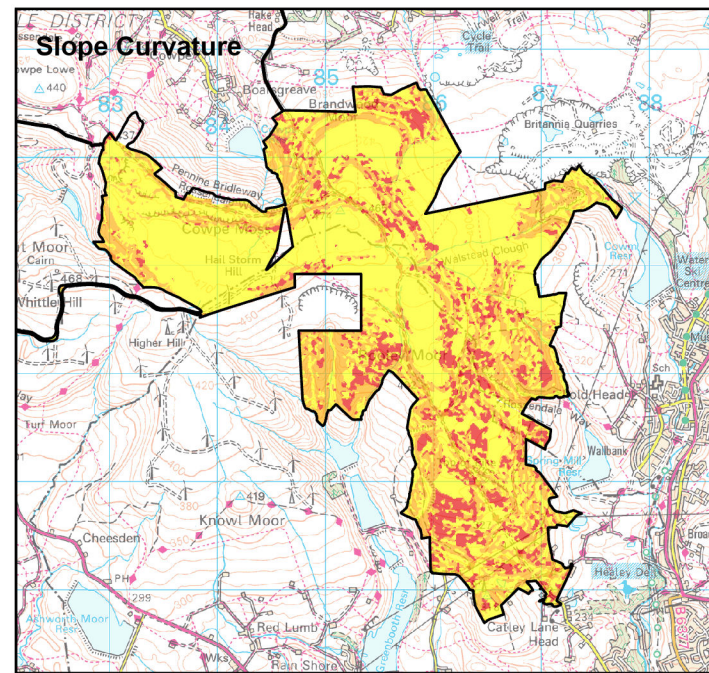
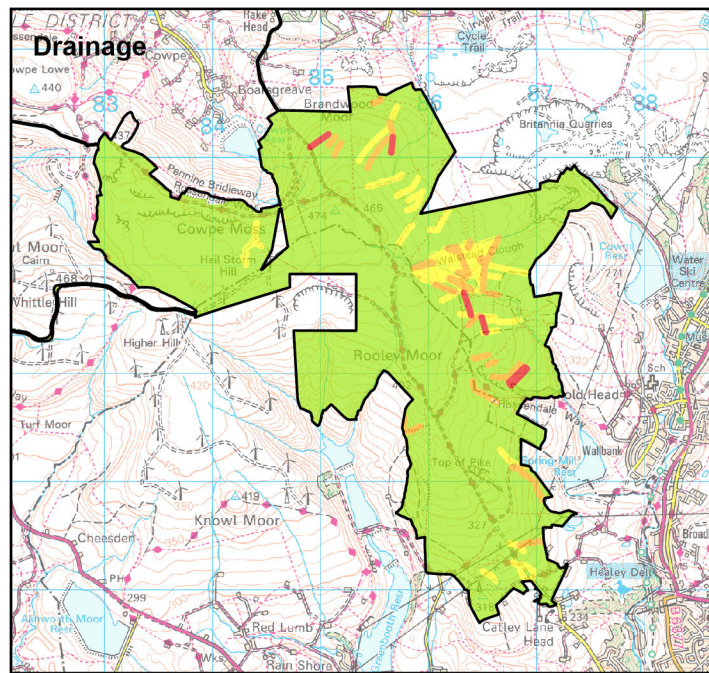
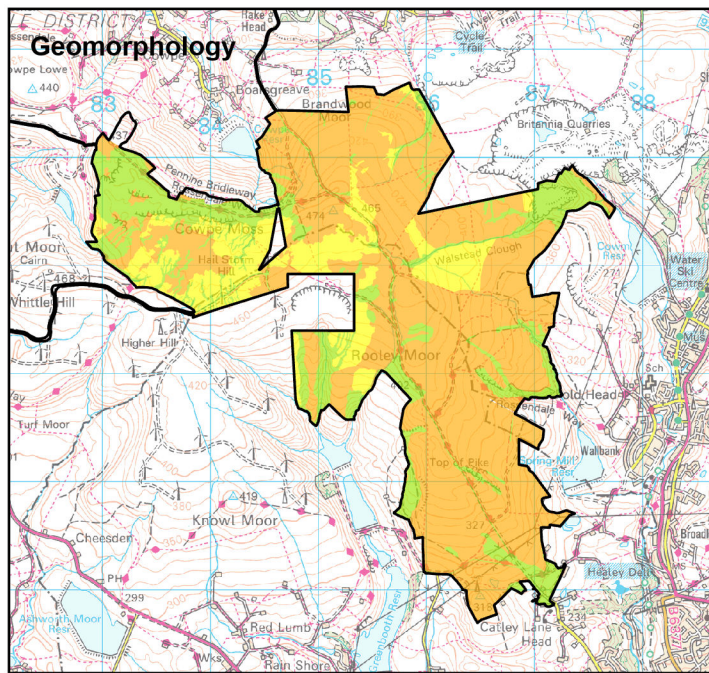
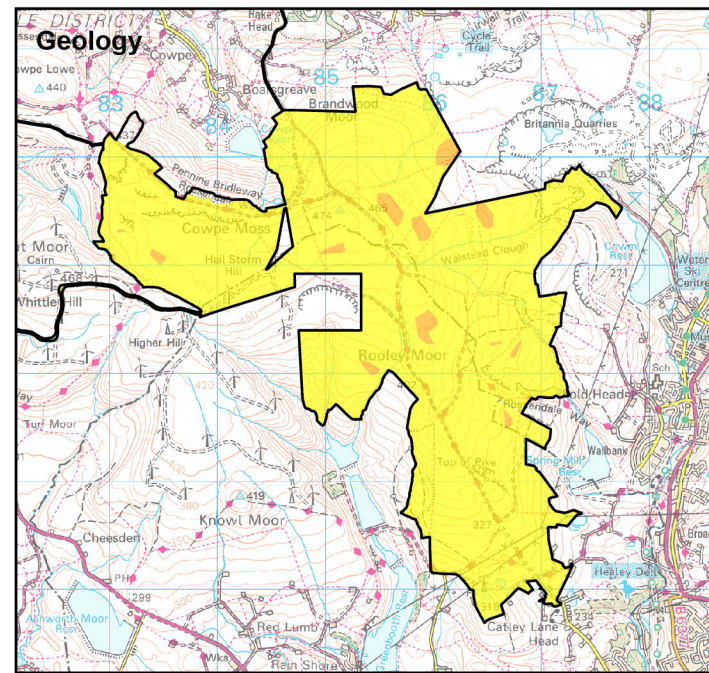
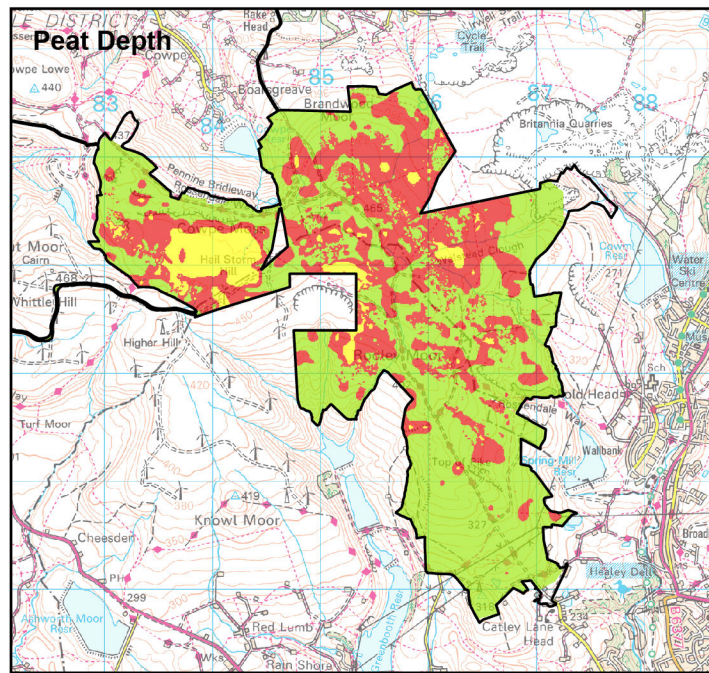
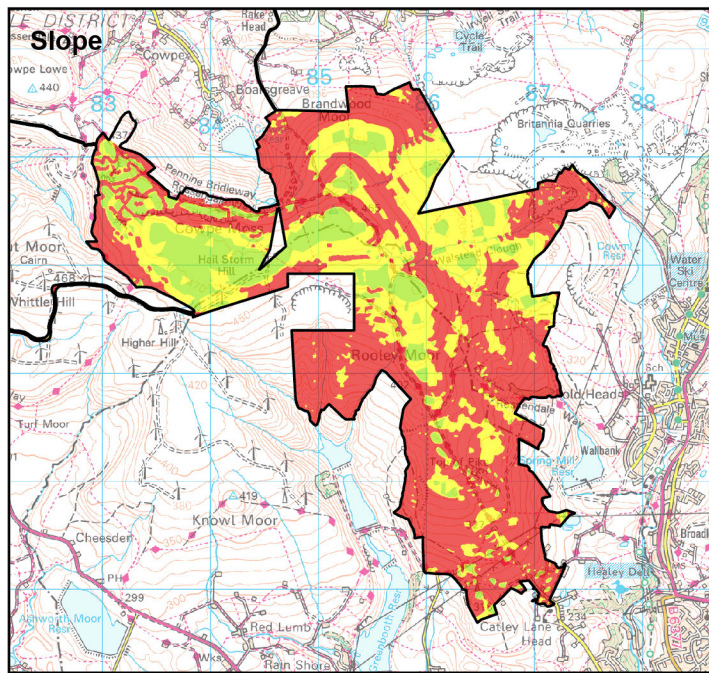










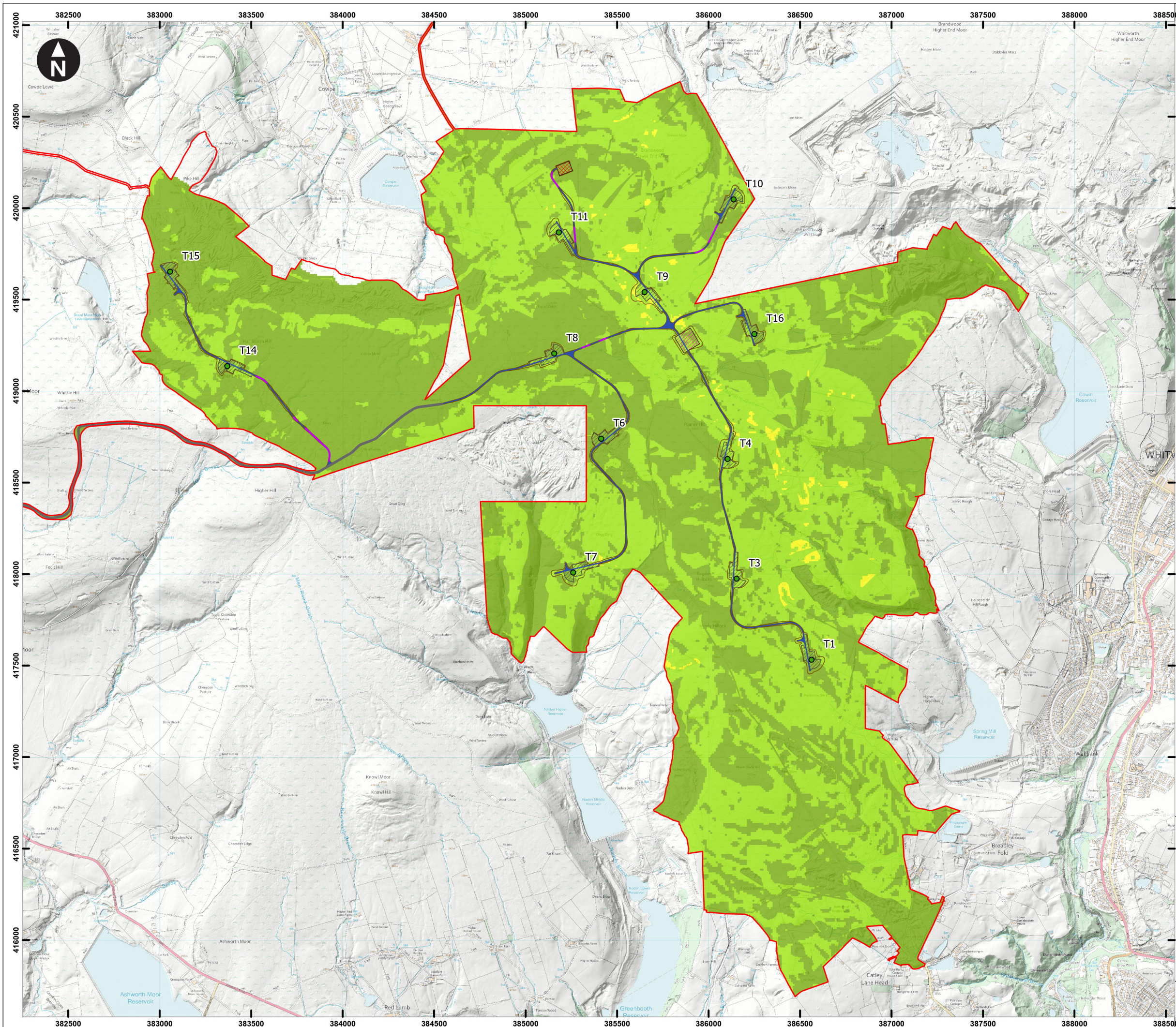


Spatial Reference
Name: British National Grid
Projection: Transverse Mercator

Credits: (c) Crown copyright
and database rights, Ordnance
Survey 2026

Scout Moor II Wind Farm
Peat Landslide Hazard and Risk Assessment
(PLHRA)

Figure 14.4.8
Landslide Likelihood - Contributory
Factors



Legend

- Assessment Boundary
- Turbine Location
- Existing Tracks
- Floating Track Extents
- Excavated Track Extents
- Substation
- Construction Compound
- Hardstandings
- Earthworks

Landslide susceptibility

- Very Low
- Low
- Moderate
- High (none calculated)
- Very High (none calculated)

0 0.25 0.5 0.75 1 km
Scale at A3: 1:20,000

Spatial Reference
Name: British National Grid
Projection: Transverse Mercator

Credits: (c) Crown copyright and database rights, Ordnance Survey 2026

**Scout Moor II Wind Farm
Peat Landslide Hazard and Risk Assessment (PLHRA)**

**Figure 14.4.9
Peat Landslide Likelihood**

June 2026

Location: XXXXXXXX (Add server storage location) Originator: Neil Thurston

