A9 DUALLING
PERTH TO INVERNESS

Appendix A10.1

Peat Stability Risk Assessment

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

ATKINS mouchel

Table of contents

Tables

Illustrations

1. Introduction

1.1. Background

1.1.1. This report forms a Technical Appendix to Chapter 10: Geology, Soils and Groundwater of the A9 Dualling Tomatin to Moy Stage 3 Environmental Statement (ES), and should be read with reference to this chapter.

1.1.2. The scheme is located between the settlements of Tomatin and Moy in The Highland Council area, where peat and peaty soils have been identified within the DMRB Stage 2 assessment.

1.1.3. The potential risk of landslip hazards, as well as peaty soils and high groundwater levels were identified as potential constraints within the A9 DMRB Stage 1 assessment.

1.1.4. Feedback from stakeholders as part of the DMRB Stage 2 assessment have highlighted the requirement for a Soil and Peat Management Plan for the Proposed Scheme. Due to the presence of peat within the study area, including SNH Priority Peatland Classes 1 and 3, a peat stability assessment was also carried out as part of early Stage 3 design work to assess if there was a requirement for detailed peat stability work. This Technical Appendix details these assessments, including the fieldwork survey methods that were carried out and supplement the requirements for the Outline Soil and Peat Management Plan (Technical Appendix A10.2).

1.1.5. Blanket bog, raised bog and fens are widespread in Scotland, particularly in upland areas and have the potential to be affected by infrastructure developments. These are protected under the European Commission Habitats Directive 92/43/EEC and form part of the Scottish Biodiversity Strategy. These habitats are of high value due to their rarity and vulnerability and are susceptible to changes in hydrology.

1.1.6. Peatland landslides can occur after intense rainfall, or from other triggers such as unloading or loading of peat mass, with failures initiating slides which can result in peaty flows of debris[i]. This has the potential to affect downstream receptors such as surface watercourses, as well as other infrastructure such as roads, residential areas and farmland located downstream.

1.1.7. This peat stability landslide risk assessment follows the standard approach based on the Scottish Government’s Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments[i].

1.2. Scope of Work

1.2.1. The aims of this Peat Stability Assessment are to:

- undertake a review of available relevant site information
- undertake site survey work to characterise the prevailing ground conditions and identify existing or potential peat instability
- detail the findings of the above, reporting on any existing or potential instability, the likely causes and contributory factors
- assess the risk of instability

- provide recommendations on further work, mitigation measures and specific construction methods that should be implemented pre-construction to minimise the risk of peat instability at the development site

1.3. Study Area

1.3.1. The assessment study area extends to a 250m buffer of the Tomatin to Moy Stage 3 Proposed Scheme boundary.

2. Preliminary Risk Assessment

2.1. Introduction

2.1.1. The following guidance documents have been used to inform the assessment:

- Scottish Government 'Developments on Peatland: Site Surveys'[ii]
- SEPA Regulatory Position statement – Developments on Peat[iii]
- SNH 'Carbon-rich soil, deep peat and priority peatland habitats map'[iv]
- Scottish Executive 'Peat Landslide Hazard and Risk Assessment: Best Guidance Practice for Proposed Electricity Generation Developments'[i]

2.2. Information Sources

2.2.1. The desk studies included a review of the following information:

2.2.2. The desk studies included a review of the following information:

- Ordnance Survey digital raster mapping, 1:50,000 and 1:10,000 scale
- Ordnance Survey Terrain 5 Digital Terrain Model (DTM) data (5m resolution)
- Topographic Survey Data (for limited areas of the route)
- BLOM aerial photography (10cm resolution)
- British Geological Survey 1:50,000 digital geological mapping, bedrock, superficial and linear geology
- Scottish Natural Heritage (SNH) Carbon-rich soil, deep peat and priority peatlands habitat map[iv]
- Transport Scotland Scottish Road Networks Landslide Study[v]
- MacArthur Green NVC Survey Tomatin to Moy[vi] (May 2016 and February 2017)
- Transport Scotland 'A9 Dualling A9 Dualling Tomatin to Moy Advance Works Report on Ground Investigation' Final Report (December 2015)[vii]
- Soil Engineering 'Report on a Ground Investigation for A9 Dualling: Tomatin to Moy, Tomatin' Final Report (2016)[viii]
- Raeburn Engineering 'Report on the Ground Investigation for Dalraddy to Slochd' Draft Peat Probing Results (2017)
- A9 Dualling Northern Section: Tomatin to Moy Geotechnical Preliminary Sources Study Report[ix]
- Soil Survey of Scotland 1:250,000 mapping of soil types[x]

2.3. Baseline Conditions

2.3.1. Desktop studies show that peat is present across the Proposed Scheme area. Areas of deeper peat are mostly confined to isolated pockets, with shallower peat and peaty soils located across the study area. A large proportion of the study area features areas of conifer forestry and farmland, with a small proportion of built-up areas and other land uses such as quarrying.

2.3.2. The SNH Priority Peatland dataset indicates areas of Class 1 Priority Peatland within the Study Area, primarily east of the existing Tomatin South Junction at NH 827 262, west of the Funtack Burn at NH 785 327 and west of Lynebeg at NH 761 343. Further areas of Class 3 peatland were identified adjacent to the Class 1 areas. Superficial geology mapping also indicates areas of peat, located in woodland east of Tomatin, north of Dalmagarry Farm, west of Lynebeg and in the valleys of the Allt Creag Bheithin and Midlargs Burn west of Moy. There are also Class 5 areas of conifer forestry which have deeper peaty soils, including south of Moy and along the valley of the Allt Creag Bheithin. Soil mapping showed a large proportion of the Proposed Scheme features peaty podzols and peaty gleys, primarily around the Moy area. Full baseline conditions for the Proposed Scheme are discussed in detail within Chapter 10: Geology, Soils and Groundwater of the DMRB Stage 3 assessment. This chapter should be referred to for this information.

2.3.3. Illustrations 1 to 6 below provide photographs and descriptive text of a representative sample of the study area, detailing the range of landforms, vegetation and erosion patterns encountered.

2.3.4. Illustration 1 shows Tomatin Junction at 281mAOD looking west towards the existing A9 road. The area features primarily deciduous woodland which is boggy underfoot. There are isolated areas of deeper peat up to 2.1m in depth. Typical slope angles are less than 6 degrees.

Illustration 1: Boggy Woodland South-east of Tomatin Junction, Low Gradient with Areas of Deep Peat (NH 8009 2974)

2.3.5. Illustration 2 shows woodland adjacent to the Dalmagarry Burn at 274mAOD looking west towards the existing side road. The area features upland birch wood, which is boggy in places. There are isolated deeper areas of peat up to 2.2m in depth. Typical slope angles are between 6 and 12 degrees.

Illustration 2: Woodland South of Dalmagarry Burn Facing North, Featuring Small Defined Areas of Peat (NH 7920 3197)

2.3.6. Illustration 3 shows blanket bog within the Class 1 Priority Peatland area located south of the existing A9 at 302mAOD, facing east towards Lynebeg. This area of blanket bog features a number of artificial drains primarily running west-east, with peat depths of up to 5.6m in the centre of the peatland. Typical slope angles are less than 1 degree.

Illustration 3: Class 1 Peatland Facing East Towards Lynebeg, with Artificial Drains. Very Low Gradient Area and Wet Underfoot with Limited Peat Erosion (NH 7564 3427)

2.3.7. Illustration 4 shows a mix of blanket bog and upland heathland looking north towards the Allt Creag Bheithin, with the existing A9 crossing north-west to south-east. This area features moderate peat depths of up to 1.75m in defined areas. Slope angles are typically less than 6 degrees, with a gentle downward slope towards the north.

Illustration 4: Class 3 Peatland West of Moy, Facing North and Downslope Towards Existing A9 and Allt Creag Bheithin (NGR 7565 3450)

2.3.8. Illustration 5 shows an area of flush/bog ground adjacent to the existing A9 facing east, west of Moy and located north of the existing A9 road. This grassland area is boggy underfoot, with conifer woodland located upslope. This area is small and well defined with maximum peat depths of 1.5m towards the centre of this area. Slope angles are very low within the area of bog, typically less than 5 degrees.

Illustration 5: Upland Flush Area Adjacent to Existing A9 (NH 7416 3475)

2.3.9. Illustration 6 shows eroded peat north of Dalmagarry Farm, east of the existing A9. The area features low slope angles, and a number of artificial drains and areas of eroded and exposed peat. Maximum peat depths of 3.9m were recorded within the scheme footprint and slope angles are typically less than 6 degrees.

Illustration 6: Exposed Peat Facing East from Dalmagarry Farm Towards the Funtack Burn, Area Used for Grazing (NH 7836 3280)

2.4. Peat Depth Surveys

2.4.1. An initial peat walkover survey was carried out by a two person team in June 2015 as part of the DMRB Stage 2 assessment, reviewing areas of peat identified during the desk study within 250m of the scheme.

2.4.2. Five stages of peat probing surveys were subsequently carried out. The first peat probing survey was carried out as part of the Stage 2 Advanced Ground Investigation works in July 2015 over a three week period. Thirty areas were identified where peat may be present. A grid was created for each area, with each cell measuring 50m by 50m. Measurements were taken every 50m, and more frequent probing conducted (up at a frequency of up to every 5m) where changes in peat depths were located.

2.4.3. Access to some locations was restricted by dense forestry cover. The forest cover reduced physical access and also location-positioning data (from handheld GPS). Due to the presence of buried and overhead services within the study area, peat probing was not carried out where utility plans indicated these are present, primarily in built-up areas and along some existing highways verges.

2.4.4. These surveys focused on gaining a good overall understanding of the site and collecting peat depth data, where access was possible, under the Stage 2 proposed options scheme footprint.

2.4.5. Following data gathering and processing of the peat depth results, areas of confirmed or anticipated deeper peat were identified and initial observations relating to peat stability were made (using the factor of safety technique detailed later in this report, but with the abbreviated dataset available at this stage).

2.4.6. This information, together with input from other disciplines as part of the Stage 2 Assessment, helped to inform an emerging preferred route option for the Stage 3 assessment. The site was revisited in April 2016, December 2016 and March 2017, to gather further data and to refine knowledge of conditions in specific areas. This focused on collecting additional peat probing data as well as a number of peat cores. This information fed into the Stage 3 design process.

2.4.7. Due to the addition of the Tomatin South Junction, later in the design assessment, peat probing data was collected as part of the A9 Dalraddy to Slochd Ground Investigation works in March 2017. A total of 18 peat probing points were included in this area.

2.4.8. For all peat probing surveys the peat depths were measured using Van Walt peat probing rods, consisting of multiple connecting 0.94m fibreglass sections, with depths measured via tape measure to an accuracy of ±0.05m. The rods were pushed into the ground until they could be pushed no further and the depth recorded. There were a total of 1,394 peat depths recorded, no results exceeded the depth of peat probes, with the deepest record being 11.6m, located 226m from the nearest infrastructure, west of the Funtack Burn.

2.4.9. The underlying substrate can be estimated from the feel of the rod reaching total depth; for example, the rod suddenly hitting a solid surface with a ringing sensation would suggest bedrock, a 'gritty' feel at total depth suggests sandy or gravelly material, and a gradually increasing difficulty in pushing in the rod suggests clayey material underlying the peat.

2.4.10. In addition to peat probing data, information was available on peat depths from Ground Investigation works where peat was encountered. This data was collected during two phases of Ground Investigation work:

- Stage 2 Advanced Ground Investigation works – July 2015 (peat encountered at two borehole locations)
- Stage 3 Preliminary Ground Investigation works – August 2016 (peat encountered at 38 GI locations – 21 trial pit and 17 borehole locations)

2.4.11. The collected data from all peat probing surveys and other Ground Investigation data are summarised in Table A2.1; 60.5% of the 1,434 points (1,394 plus 40 GI locations) surveyed had a peat depth result of less than 0.5m, with 82.1% of the results less than 1.0m. The peat depth results are provided as Figure A10.1.1a-k.

Table A2.1: Results of Peat Probing Survey

Peat Depth Range (m)	No. of points	% of Points	Average Depth in range (m)
<0.5	868	60.5%	0.21
0.5 to <1.0	309	21.6%	0.68
1.0 to <1.5	95	6.6%	1.18
1.5 to <2.5	97	6.8%	1.82
≥2.5	65	4.5%	3.81
Total	1,434	100%	0.65

2.4.12. There are a number of locations with deeper peat in well-defined areas, often in areas of low slope angle, with a smaller number of isolated pockets of peat. Some erosion of peat was noted, particularly within the peatland area north of Dalmagarry Farm and east of Tomatin South Junction adjacent to the railway line.

Indicative Peat Depth Mapping

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

2.4.14. The resolution of DTM and base mapping must be taken into account, as using a very fine grid with a resolution identical to or finer than the DTM will return spurious results with a false indication of accuracy. A 50m grid was used as this is a fine enough scale to provide an appropriate level of detail for analysis but also sufficiently large to gain meaningful results from the 5m resolution DTM and derived slope model.

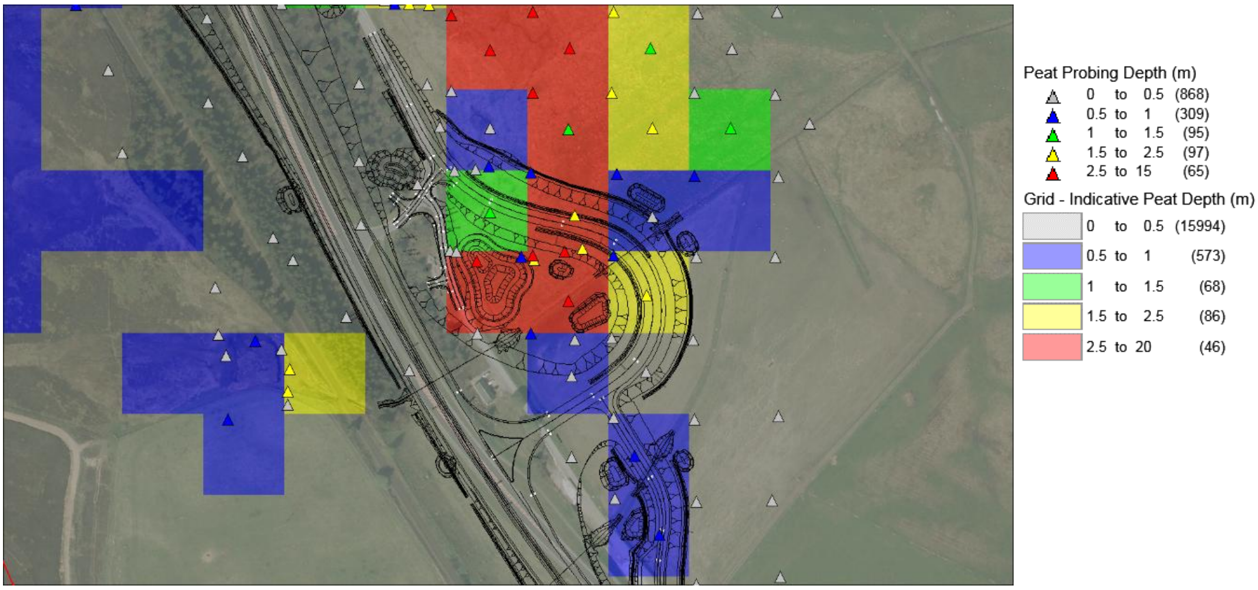
2.4.15. To inform the refinement of the infrastructure layout, the results of the initial peat probing survey were used to produce an extrapolated indicative peat depth map for the study area. A grid of 50m x 50m cells was overlaid across the site and a peat depth range assigned to each cell. The peat depth ranges used are detailed in Table A2.2.

Table A2.2: Indicative Peat Depth Categories

Peat Depth Range (m)	Peat Depth Category Number	Peat Depth Category
<0.5	1	No Peat
0.5 to <1.0	2	Shallow peat
1.0 to <1.5	3	Moderate
1.5 to <2.5	4	Deep
≥2.5	5	Very Deep

2.4.16. Blanket peat tends to form in areas with high rainfall and low temperatures. In the Scottish context, blanket peat can be 5m or more in thickness, especially in hollows or valleys, but is generally not much more than 3m deep and often much less. Peat depth category names and ranges were chosen in the context of road construction; for example, the cut-off between reusable fibrous peat and unusable amorphous peat is typically around 1.0m. The threshold depth for very shallow peat of 0.5m is based on the Soil Survey of Scotland definition[x], as used in the Scottish Government guidelines[i].

Illustration 7: Sample of Indicative Peat Depth Map



2.4.17. Illustration 7 shows an enlarged portion of the peat depth mapping. Each cell is 50m x 50m with areas of shallower than 0.5m (no peat) coloured grey, shallow peat coloured blue, moderate depth peat coloured green, deep peat in yellow and very deep peat coloured red. The full indicative peat depth map is included in Figure A10.1.1.

2.4.18. From observation it is clear that both slope and elevation have an influence on the development of peat, although the exact mechanism is not well understood and there is no mathematical growth/decay model for the development and depth of peat. However, slope and elevation factors may be used intuitively when extrapolating from peat sampling data in the creation of an indicative peat depth map. It can be seen that the deeper peat is generally found in flatter areas such as valleys, plateaux and hollows. Flat areas on hill summits tend to have relatively little peat; this is possibly due to a combination of exposure and slow growth rate as well as better drainage. Steep slopes also generally have less peat, owing for the most part to their better drainage and more rapid runoff.

2.4.19. As can be seen from Illustration 7 and Figure A10.1.1, where a cluster of peat probing points are all within the same peat depth category this has been taken as a good indication of the general peat depth in the surrounding area and the indicative peat depth map has been coloured accordingly. However, where clusters of peat probing points have returned depths in a wide range of depth categories a precautionary approach has been taken, with the indicative peat depth map being classified in line with the deepest category of peat found in the area. This leads to a conservative indicative peat depth map.

2.4.20. The peat depth category breakdown for both the actual probing data and the extrapolated grid is given in Table A2.3. In Table A2.3, the rows representing indicative peat depth grid data for 'measured depths' represents those cells generally closest to the planned infrastructure and thus more representative of site conditions.

Table A2.3: Peat Depth Category Breakdown

Peat Depth Category (m)		<0.5	0.5 - <1.0	1.0 - <1.5	1.5 - <2.5	2.5m+	Total
Probing Data	No. of points	868	309	95	97	65	1,434
	% of points	60.5%	21.6%	6.6%	6.8%	4.5%	100%
Indicative Peat Depth Grid	No. of cells	15,994	573	68	86	46	16,767
	% of cells	95.4%	3.4%	0.4%	0.5%	0.3%	100%
Indicative Peat Depth Grid (measured depths	No. of cells	527	197	60	65	46	895
	% of cells	58.9%	22.0%	6.7%	7.3%	5.1%	100%

2.4.21. The initial peat depth map was used to inform the scheme design. The areas identified as having deep peat were avoided as far as practicable, and considered with other constraints as part of the Stage 3 design development.

2.4.22. Peat contours and a peat depth raster file were also produced to assist with soil and peat volumes required for the Outline Soil and Peat Management Plan (detailed in Appendix A10.2), where further information on this methodology is detailed.

Preliminary Stability Analysis

2.4.23. Using the collated data a preliminary analysis of slope stability can be carried out using the infinite slope model. The stability of a slope can be assessed by calculating the factor of safety *F* which is the ratio of the sum of resisting forces (shear strength) and the sum of the destabilising forces (shear strength):

$$F = \frac{c' + (\gamma - m\gamma_w) z \, Cos^2 \beta \, Tan\varphi'}{\gamma z \, Sin\beta \, Cos\beta}$$

2.4.24. Where c' is the effective cohesion, γ is the unit weight of saturated peat, γ_w is the unit weight of water, m is the height of the water table as a fraction of the peat depth, z is the peat depth in the direction of normal stress, β is the angle of the slope to the horizontal and φ' is the effective angle of internal friction.

2.4.25. The Factor of Safety (FoS), F, represents the ratio of the forces resisting a slide to the forces causing the material to slide. Clearly, if F > 1 then the slope is stable and normally if F > 1.4 then there is a degree of comfort that the slope will not fail. The boundary value of 1.4 is in agreement with the current recommendations of Eurocode[xi].

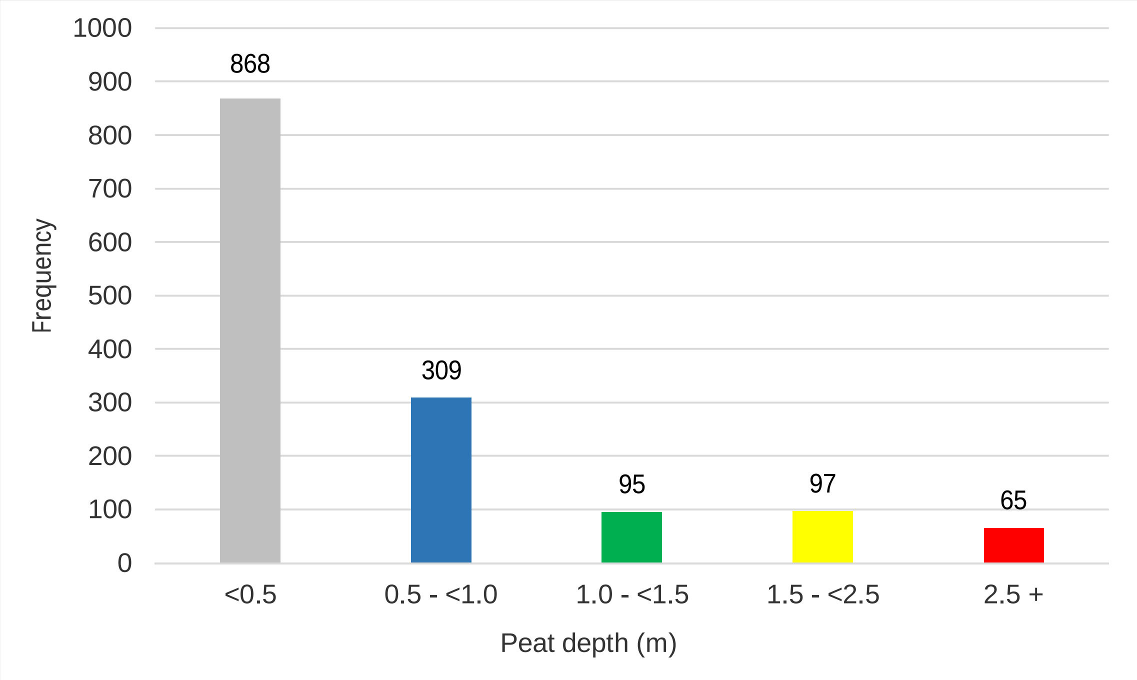
2.4.26. To obtain an indication of the stability of the peat under and adjacent to the scheme footprint, the factor of safety can be calculated for each peat probing location. In addition, to gain a better view of peat stability in the areas surrounding the infrastructure, factor of safety calculations can be carried out for the grid cells of the indicative peat depth map in the vicinity of the infrastructure.

2.4.27. In order to do this, the parameters for the FoS equation for each probing location and grid cell under construction must be known or be reasonably inferred.

2.4.28. The slope angle, β, can be derived from the DTM for the site. With the peat probing locations, a single slope angle value is generated for each point, whilst the DTM is interrogated for maximum, minimum and average slope values for each grid cell. The average slope angle has been used in the grid FoS calculations, although the other statistics provide useful supporting information on the variability of slope within the cells.

2.4.29. The actual peat depth measurements recorded for each probing location are used in calculating the point FoS values. For the grid-based FoS assessment it is necessary to convert the indicative peat depth ranges into a specific figure for each range for use within the calculation. Taking a conservative approach, the upper bound of each range has been used, where actual data is not held. Measured peat depths are presented as a histogram in Illustration 8.

Illustration 8: Peat Depth Histogram



2.4.30. The unit weight of water, γ_w, is known to be 1.0Mg/m3.

2.4.31. The bulk density of peat is known to vary with the level of decomposition. A literature review has found quoted in situ undrained bulk densities ranging from 0.5 to 1.4Mg/m^3. Laboratory analyses undertaken on samples collected having returned bulk density values generally ranging between 0.4 and 0.9Mg/m^3. Based on this experience and also externally published values[xii], an average bulk density value of 1.20Mg/m^3 has been used for the preliminary FoS calculations.

2.4.32. If it is assumed that an area of site is covered with active blanket bog, it follows that the peat must be completely saturated, with a water table at or close to the surface. On-site observations indicate that this assumption is only valid on limited, low slope angle, areas of the site as ground conditions were fairly dry underfoot across much of the site. Consequently, a water table ratio, m, of 1.0 has been chosen, which is considered conservative given most of the site exhibits drier conditions.

2.4.33. The angle of internal friction in peat also varies, decreasing with increasing decomposition and moisture content. In some instances, although not in this study area, 'quaking bog' has been observed where the peat takes the form of a slurry beneath a surface mat of vegetation. In such a situation the angle of internal friction will be very low. For the FoS calculations, a φ' value of 5° has been selected in line with the conservative approach.

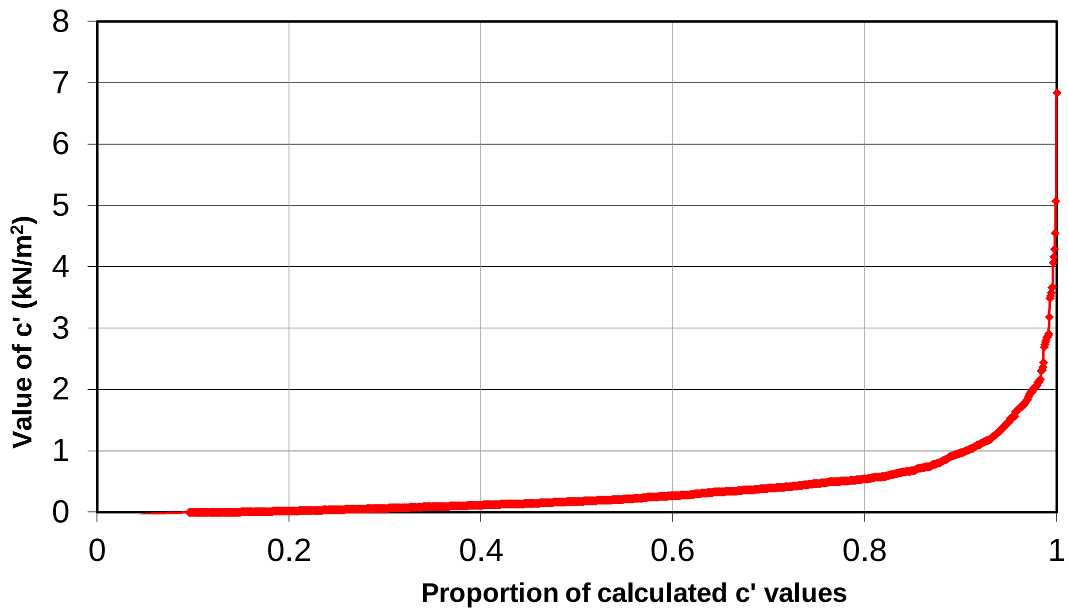
2.4.34. Finally, a value for the effective cohesion, c', must be derived. Literature values for c' in peat vary widely, ranging from 4.5 to 60kN/m2. To provide an indication of the cohesive strength of the peat at this site, a back-calculation using the FoS equation and actual peat depth probing data for the site has been completed. The techniques involved are discussed below.

Estimation of Cohesive Strength

2.4.35. A range of field and laboratory tests can be carried out to determine the effective cohesion of a material. However, owing to its fibrous and thixotropic nature and the variation in strength with decomposition, peat is a particularly difficult material to analyse both in the field and in the laboratory. An alternative approach to assessing the strength of the peat is to rearrange the FoS equation to calculate a value of c' at actual peat probing locations. Essentially, this approach assumes that if the hillside is stable then the material must have at least a certain minimum strength.

2.4.36. Each peat probing location visited is known to have been stable at the time of the visit and therefore must have a FoS of at least 1. If we assume conservatively that F=1 and use values for the other parameters as discussed above, the FoS equation can be rearranged to allow derivation of a value for c' at each probing location. Slope angles for the probing points are generated from the DTM. It is important to note that the value of c' calculated for each location represents the minimum cohesive strength necessary for the peat to be stable at that location. In fact, the shear strength may be, and in most cases probably is, considerably higher.

Illustration 9: Estimate of Minimum Cohesive Strength, c'



2.4.37. Within the study area, 1,434 locations have been surveyed during the different phases of fieldwork, c' values for each of these have been calculated and the distribution of these values is shown in Illustration 9. For example, reading from the graph, 0.8 (or 80%) of the probing locations required a c' value of 0.54kN/m2 or less to be stable and retain peat on the slope.

2.4.38. From this work it is possible to state, with confidence, that across the site as a whole the shear strength of the peat is unlikely to be less than 3.65kN/m^2 as this is the value of the 99.5th percentile point on the graph. The basis for making this statement depends upon:

- The deliberate choice of conservative values for assumed parameters such as bulk density and water table level, coupled with the assumption of an FoS of 1 when back-calculating c' values.
- Recognition of what the calculations are stating, which is that these are the minimum strengths that would be required, not the actual in situ strengths. Therefore, where slopes are gentle and the peat shallow, very little shear strength is required to ensure stability of the slope. This accounts for the vast majority of the lower values.

- Assuming a reasonable degree of homogeneity for peat properties, in particular strength, across the site. This seems reasonable, except for very shallow peat where the acrotelm, which is more fibrous, represents a significant proportion of the total depth. Such areas are, in any case, unlikely to be areas of concern.
- Given the above considerations, it is the higher strength values that are relevant. If this were not the case then one would expect large areas of the site to be denuded of peat as it would not have the strength to adhere to the hillsides.

2.4.39. For the purposes of the Factor of Safety Assessment a *c'* value of 3.65kN/m^2 has been used. This value is very conservative in comparison with estimates derived from other sites around Scotland, largely due to the shallow peat found on most slopes within the study area. The actual effective cohesion of any peat within the study area is therefore likely to be considerably higher than 3.65kN/m^2 (compare with literary values of 4.5 – 60kN/m^2), however, this value has been chosen to ensure a conservative assessment using data from the site.

Preliminary Stability Analysis Results

2.4.40. Having assigned measured or inferred values to each parameter in the FoS equation, it is now possible to calculate the FoS value for each probing location coinciding with proposed infrastructure and for each cell of the indicative peat depth grid in the vicinity of the infrastructure. The results of the FoS assessment for the probing points and site grid are summarised in Table A2.4. The FoS assessment maps generated with these values are shown in Figure A10.1.2. Once again, the grid cell values where measured data is available is considered more representative as is generally closer to the planned infrastructure and this shows that 63% of grid cells recorded maximum depths of less than 0.5m.

Table A2.4: Summary of Factor of Safety Assessment

Factor of Safety	No peat in Grid (less than 0.5 m)	≥3.0	1.4 - <3.0	1.0 - <1.4	<1.0	Total
Probing Data (points)	-	1,322	92	12	8	1,434
% of points	-	92.2%	6.4%	0.8%	0.6%	100%
Grid Cells	15,994	590	155	18	10	16,767
% of Grid Cells	95.4%	3.5%	0.9%	0.1%	0.1%	100%
Grid Cells (with measured data)	527	263	78	17	10	895
% of Grid Cells (with measured data)	58.9%	29.4%	8.7%	1.9%	1.1%	100%

2.4.41. In selecting the 99.5th percentile value of the back-calculated c' strengths, one is implicitly condemning 0.5% of the sample locations to failure, plus any similar cells across the site as a whole. As can be seen, there are a very small number of cells with a FoS value of less than 1; in theory these should either have failed or currently be failing. In reality this is unlikely to be the case and these results are a consequence of the conservative approach adopted. A similarly low number of points and cells have a FoS between 1.0 and 1.4, where stability can be considered marginal. The cells that fall into both these categories are scattered in clusters across the site, the majority are a reasonable distance from site infrastructure and therefore based upon conservatively estimated, rather than actual, peat depths.

2.4.42. Note that where peat depth is less than 0.5m, these cells were not considered as peat and are removed from further stability investigation.

2.4.43. To summarise, 98.6% of the peat probing locations on the site have a FoS of 1.4 or greater, where stability can be assumed with a degree of comfort. In relation to grid cells with measured depths (i.e. predominantly those grid cells closest to infrastructure), cell locations with FoS values greater than 1.4 (including cells with peat less than 0.5m depth) represent 97.0% of the site, again these are locations where stability can be assumed with a degree of comfort.

2.4.44. The results demonstrate that the vast majority of the infrastructure will be built in areas where there is a degree of comfort in inferring stability. The cells identified as having marginal stability are generally clustered into areas where deeper peat and moderate or steep slopes occur within the same grid cell. Such areas, where close to planned infrastructure, have been considered further as potential risk areas.

3. Ground Investigation

3.1. Introduction

3.1.1. Following the initial desktop factor of safety assessment, a number of areas were highlighted as having potential risk of peat landslide. These areas were reviewed and in order to gain representative ground investigation data, fieldwork was undertaken at four of the six locations in April 2016, with a further five core locations visited in December 2016. The cores taken were also chosen in consideration of peat areas under the footprint, to inform peat typology for the Soil and Peat Management plan.

3.1.2. Following the final desktop factor of safety assessment, 12 areas were highlighted as having potential risk of peat landslide, shown in Figure A10.1.3, with four areas where cores were collected. These areas were revisited to gain representative ground investigation data.

- Areas A and B – no peat core collected from Area A due to presence of tree roots. One peat core collected within Area B (TM-PC-15) for Von Post analysis only
- Area C – one peat core (TM-PC-02) collected adjacent to Dalmagarry Burn
- Area D - no peat core was collected at this area, with superficial geology, NVC and soil mapping indicating this area is unlikely to contain peat
- Areas E and F – no peat core was collected in these areas due to lack of connectivity to the scheme, with the Highland Main Line railway located between the areas and the Proposed Scheme
- Area G – no peat core was collected at this location
- Area H – Class 1 Priority Peatland - one core (TM-PC-03) collected during April 2016 visit (outside of Area H). Following design refresh, a further two cores (TM-PC-12 and TM-PC-13) were collected closer to the mainline carriageway, near an area of proposed cutting during second site visit
- Area I – small defined area of peat identified in forestry area upslope of pond access track, no peat core collected
- Areas J and K – smaller discrete pockets of peat identified along the proposed SuDs pond access track, no peat cores were collected
- Area L – existing forestry tracks, one peat core (TM-PC-17) collected for Von Post analysis only during March 2017

3.2. Methodology

3.2.1. At each of the peat core locations, measurements were made or samples taken to determine the following parameters:

- peat probing to maximum depth to improve definition of peat depth characteristics at each location
- peat cores gained by Russian corer to base of peat for laboratory analysis of bulk density, moisture content and total organic carbon
- description of peat core and photograph of core
- Von Post classification of peat core
- in-situ shear strength at shallow depth (0.3m)

3.2.2. Coring was undertaken using a Russian corer, using 1m extension rods to reach the base of the peat. Following photography of the extracted core (provided in Appendix C), a 0.25m length of undisturbed core was carefully removed into a marked plastic bag, which was sealed and then transported for laboratory analysis for bulk density and moisture content. Samples were collected on the 14th April 2016, and delivered to the laboratory on 18th April 2016 for analysis. In the second set of peat core collections, the samples were collected on 7th December 2016 and delivered to the laboratory for analysis on Friday 9th December 2016. Three of the samples taken correspond with Areas C and H.

3.2.3. Von Post classification was evaluated immediately after core extraction and lab sample bag transfer, using the remaining core material. This process involved evaluating water expression and colour of any water expressed, peat expression and noting plant material extracted in the core.

3.2.4. Shear strength tests were undertaken using an Impact Shear Vane SL810. The 0.3m extension was used with the 33mm blade vane. The shear strength constant of the 33mm blade was 0.3271, translating from a 30 division site result to a shear strength of 11kPa (equivalent to 11kN/m^2). Shear strength tests were undertaken at a depth of 0.3m, with three tests within 10m of the core location, enabling minimum, mean and maximum data at each location.

3.2.5. For the final set of peat core samples a different sampling approach was used to show the change in peat decomposition with depth. At each of the peat core locations (Areas B and L), Von Post classifications were taken at up to 0.25m intervals for the full depth of the core.

3.3. Results

3.3.1. The weather conditions during this work were dry and overcast (14th April 2016), with cold dry weather and frozen ground experienced during the second site visit (7th December 2016). The locations and results are detailed in Tables A3.1 and A3.2. Core locations are shown on Figure A10.1.3, with photographs provided in Annex C.

3.3.2. The weather conditions during this work were dry and mild (22nd March 2016). The locations and results are detailed in Table A3.2. Core locations are shown on Figure A10.1.3. All samples were collected on 23rd March 2017.

Table A3.1: Ground Investigation Data

Location ID Sample date Peat Area (where applicable)	Core NGR	Depth of core sample taken (m)	Von Post Class	Moisture Content (%)	Bulk density (Mg/m^3)	Dry Bulk density (Mg/m^3)	Total Organic Carbon Content (%)	Lowest Shallow hand shear vane at 0.3m (kN/m^2)
TM-PC-02 14/04/16 Area C	NH 791 319	1.0	H3 Very Weakly Decomposed	676	0.822	0.106	31.1	8
TM-PC-03 14/04/16	NH 756 342	3.0	H4 Slightly Decomposed	1041	0.822	0.077	34.6	7
TM-PC-04 14/04/16	NH 757 345	1.0	H4 Slightly Decomposed	733	0.935	0.112	35.8	8
TM-PC-06 14/04/16	NH 746 347	1.0	H4 Slightly Decomposed	755	0.87	0.102	36.1	7
TM-PC-10 08/12/16	NH 784 326	3.74	H6 Strongly Decomposed	858	0.52	0.05	24.8	10
TM-PC-11 08/12/16	NH 783 328	1.0	H7 Strongly Decomposed	558	0.53	0.06	9.8	6
TM-PC-12 08/12/16 Area H	NH 759 342	1.0	H7 Strongly Decomposed	784	0.51	0.06	24.5	10
TM-PC-13 08/12/16 Area H	NH 759 343	1.9	H6 Strongly Decomposed	784	0.40	0.06	24.5	11
TM-PC-14 08/12/16	NH 760 345	1.5	H5 Moderately Decomposed	1,358	0.44	0.03	25.6	12

Table A3.2: Peat Cores featuring Von Post classification results to full depth

Location ID Peat Area	Core NGR	Depth of core (m)	Von Post Classification
TM-PC-15 Area B	NH 799 299	0 – 0.50	H3 Very weakly decomposed
		0.50 – 0.75	H3 Very weakly decomposed
		0.75 – 1.00	H4 Weakly Decomposed
		1.00 – 1.25	H5 Moderately Decomposed
		1.25 – 1.40	n/a – grey fine silt/sand
TM-PC-16	NH 784 326	0 – 0.2	H3 Weakly Decomposed
		0.2 – 0.30	H4 Weakly Decomposed
		0.3 – 0.50	H5 Moderately Decomposed

Location ID Peat Area	Core NGR	Depth of core (m)	Von Post Classification
		0.5 – 0.75	H4-H5 Moderately decomposed
		0.75 – 1.00	H5 Moderately decomposed
		1.00 – 1.25	H5 Moderately decomposed
		1.25 – 1.50	H6 Strongly decomposed
		1.50 – 1.75	H7 Strongly Decomposed
		1.75 – 2.00	H8 Strongly Decomposed
		2.00 – 2.25	H8 to H9 Very strongly decomposed
		2.25 – 2.50	H8 Very strongly decomposed
		2.50 – 2.75	H5 Moderately Decomposed
		2.75 – 3.00	H5 Moderately Decomposed
		3.00 – 3.25	H8 Very strongly decomposed
		3.25 – 3.50	H8 Very strongly decomposed
TM-PC-17 Area L	NH 726 350	0 – 0.25	H3 Very weakly decomposed
		0.25 – 0.50	H4 Weakly Decomposed
		0.50 – 0.75	H5 Moderately Decomposed
		0.75 – 1.00	H5 Moderately Decomposed
		1.00 – 1.25	H5 Moderately Decomposed
		1.25 – 1.50	H5 Moderately Decomposed

3.4. Interpretation

3.4.1. Bulk density measurements were taken from the core samples. These returned bulk density results between 0.40 and 0.93Mg/m^3 for the nine peat samples, with an average value of 0.656Mg/m^3. This is less than the theoretical value of 1.20Mg/m^3 used in the initial FoS calculations, which confirms the desktop method as being conservative. Full details of the laboratory results are provided in Appendix B.

3.4.2. The Von Post classifications of the peat cores ranged from very weakly (H3) and slightly decomposed peat (H4), to areas where there was more decomposed peat (H6 to H8 classifications). Von Post classification generally increased with depths, with all cores showing at least moderately decomposed peat (H5) below 1m depth.

3.4.3. The recorded peak shear strengths were all taken at shallow depth (0.3m), with three tests taken within 10m of one another at applicable locations. Individual results varied between 6 and 22kN/m^2, with an overall average value of 11.1kN/m^2. The lowest mean shear value at any single location was 6kN/m^2. Generally, high shear strengths would be expected to be recorded in this upper 0.3m of peat owing to the more fibrous nature of the peat often encountered at this depth. In previous studies it has been found that minimum strength tends to be recorded in the central part of the peat column where shear strength was measured at three or more depths, with a slight increase close to the total depth. As shear vane values at the site were limited to shallow depth there is no trend apparent at this site. However, it would be expected that there would be a general correlation with depth, similar to that observed at other sites.

3.4.4. Peat core TM-PC-11 reported unusually low values for Total Organic Carbon. The results were queried with the laboratory but no explanation can be provided for this low result.

3.4.5. The samples collected in December 2016 also had much lower bulk density and dry bulk density values than the previous samples. No explanation was provided for these, given the same equipment and field staff were used. These results have been considered to be erroneous.

3.4.6. All measured shear strengths from the hand vane shear tests were at least 6kN/m^2, which is substantially higher than the value used in the initial desktop FoS analysis (which used 3.65kN/m^2 as the 99.5th percentile value), with the average site test result similar to the maximum back-calculated shear strength, which was 6.85kN/m^2). This is in line with expectations and confirms the conservative nature of the analysis method.

4. Detailed Assessment

4.1.1. Figure A10.1.2 shows the Proposed Scheme overlaid on the Factor of Safety mapping, from which it is clear to see areas which have been identified as at high or moderate risk of instability as red or yellow cells, respectively. The cells cluster into 12 areas, each of which has been allocated an identification letter and are shown on Figure A10.1.3. For each of these specific areas, a detailed assessment has been undertaken and reported. This includes description of the peat depths, factor of safety values, local characteristics and geotechnical data recorded, alongside GIS images and available photographs. These datasheets also identify site-specific mitigation and a revised risk level. The individual datasheets for each area are provided in Annex A.

4.1.2. The images provided display the FoS values for grid cells of stability concern (each measuring 50 m x 50 m), with cells highlighted of concern in descending order from those of most concern, coloured red (FoS <1), followed by yellow (1 to 1.4), as per Table A2.4 colour-coding. The probe location squares are coloured to identify the FoS category for each probe location, using the FoS colour range noted above, and each point labelled with the peat depth.

4.1.3. Five areas (A, B, C, E and L) were initially highlighted as at potentially high risk of peat landslide (red cells), based on factor of safety values of <1. Seven areas (D, F, G, H, I, J and L) were initially highlighted as at potentially moderate risk of peat landslide (yellow cells), based on factor of safety values between 1 and <1.4.

4.1.4. The 'Good Practice and Design' information on the datasheet details measures which are considered as part of the design and including standard good practice for particular locations. These are discussed in more detail in Section 5.

4.1.5. There are also a number of specific mitigation measures that should be deployed at each location to reduce risk. These are identified as part of the 'Specific Mitigation and Residual Risk'. The residual risk information on the datasheet reflects the refined risk level judgement, following consideration of specific characteristics for each area, using applicable ground investigation information and the identification and application of any appropriate mitigation measures during design, construction and operation.

4.1.6. Following review, taking into account local characteristics, good practice design and mitigation, all locations are considered as of low risk of peat instability.

5. Mitigation and Good Practice Measures

5.1.1. The purpose of the peat slide risk assessment is to identify areas of the site which are potentially at most risk of peat instability and thereafter assess construction impacts. Where avoidance is not possible mitigation measures require to be implemented. In addition to specific mitigation measures which may be deployed at particular locations, there are a number of generic construction good practice measures that should be considered. A number of these are set out in Table A5.1 below (NB this list is not exhaustive).

5.1.2. It should also be noted that areas of peat were considered as part of the DMRB Stage 2 and 3 design process, to minimise impacts where possible. However, as no risks specifically relating to peat stability risks were identified, this was not considered further within the design process.

5.1.3. Good practice guidance documents, such as Floating Roads on Peat[xiii], Managing Geotechnical Risk[xiv] and Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments[i] should be consulted to inform the design and construction processes. All site investigation work will be undertaken in compliance with relevant British Standards, including BS 5930: 1999[xv] and BS 6031: 2009[xvi].

5.1.4. The application of good practice techniques during forestry clearance will also act to reduce the potential for peat instability, in terms of both likelihood of occurrence and magnitude of any event. Following forestry clearance, in areas with previously restricted access, surveys shall be undertaken to record peat depths and for evidence of peat instability.

Table A5.1: Good Practice and Mitigation Measures

Potential Actions	Good Practice	Mitigation Measure
1. Geotechnical specialist on-site during the construction phase to undertake advance inspection, carry out regular monitoring and advise	P	P
2. Maintain and update geotechnical risk register or similar management system	P	P
3. Construction staff should be made aware of peatslide indicators and emergency procedures (see below)	P	P
4. Emergency procedures should include steps to be taken on detection of an incipient peatslide or of the event occurring	P	
5. Microsite the proposed infrastructure in order to avoid the problem area (subject to non-violation of other constraints)	P	
6. Ensure that good ground- and surface water control, such as moor gripping or drainage ditches, is in place in advance of construction activities	P	
7. Installation of stand pipes / piezometers to monitor ground water levels and pore pressures		P
8. Ensure artificial drainage does not concentrate flows onto slopes or into excavations	P	
9. Ensure that sediment control measures are incorporated into all artificial drainage measures	P	

Potential Actions	Good Practice	Mitigation Measure
10. Earthmoving activities should be restricted during and immediately after heavy and/or prolonged rainfall events	P	
11. The construction plan should minimise the extent and duration of open excavations and bare ground	P	
12. Avoid placing excavated material or other forms of loading on breaks-in-slope or other potentially unstable slopes	P	
13. Avoid removing slope support, particularly where slope stability has been highlighted as of concern.	P	P
14. Establish / re-establish vegetation as soon as possible to improve slope stability and provide sediment transport control	P	
15. Modify slope geometry to provide a 'weighted toe'		P
16. Use of retaining structures, such as gabions for terracing		P
17. In worst case, debris nets and/or deflection systems to protect installations		P
18. Forestry clearance activities should be undertaken following good practice, including careful positioning of log piles to avoid overloading of slope, sediment control and consideration of retaining tree roots in situ for soil stabilisation in appropriate locations	P	

5.1.5. On-site staff who are close to the project are often the best placed to provide advance notification of potential problems, provided they are trained to do so and there is a reporting mechanism in place. There are a number of recognised indicators for slope failures and these may indicate a potential peatslide or the commencement of a peatslide event. The suspected identification of any of these indicators should be assessed by specialist geotechnical personnel. The factors discussed below are particularly applicable to low velocity peatslides:

- the development of tension fracture cracking across the slope or in semicircular patterns
- boggy ground or new springs appearing at the base of slopes
- sudden reactivation of spring lines
- creep and bulging of ground
- displacement and leaning of trees, fence posts, dykes, etc.
- breaking of underground services

6. Summary and Recommendations

6.1.1. The study area for the Proposed Scheme between Tomatin to Moy has been assessed for the risk of slope instability using a quantitative assessment method based on plane failure analysis. The areas of the site highlighted as having low Factors of Safety coincident with or adjacent to the proposed scheme footprint have been considered in more detail.

6.1.2. The conservative nature of the methodology applied leads to identification of the least stable areas on any specific site, meaning that on inherently stable sites, the procedure will still identify locations initially considered of high or moderate risk, with this risk relative to the remainder of the site. Five areas with 'High' risk and seven areas with

'Moderate' risk were initially highlighted in Section 4 (Detailed Assessment), based on peat probing and desktop factor of safety calculations specific to this site. For each area, the potential effect of road construction was considered and re-assessed based on specific characteristics of each location including ground investigation data, with deeper peat primarily located in flat areas at the bottom of slopes, with appropriate mitigation measures recommended, where necessary, to then arrive at a residual risk level.

6.1.3. Following review, there are no areas of ongoing concern, with all areas identified as being of low residual risk.

6.1.4. Further peat depth measurement, geotechnical assessment and testing will be necessary in certain localised areas to provide more specific data on physical parameters and to allow for appropriate mitigation. The need for this should be targeted to the areas identified in Section 7 and any additional areas of concern identified by surveys following forestry clearance.

6.1.5. The need for risk management has been emphasised throughout this report and should include the regular review of a geotechnical risk register, supported by appropriate actions within the Construction Method Statement (CMS) when that stage is reached. It would also be considered useful to undertake shear vane measurements at mid and full depth of peat for highlighted locations of concern where peat depths were greater than 1.0m.

6.1.6. This document lists a number of design, good practice and mitigation measures. Whilst this list is not exhaustive, and it is expected that a competent design consultancy and contractor will use these and other techniques as appropriate.

7. References

[i] Scottish Executive. (2006). 'Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments. Available from http://www.gov.scot/Publications/2006/12/21162303/1 Accessed 14th July 2016.
[ii] Scottish Government. (2014). Guidance on Developments on Peat - Site Survey.
[iii] SEPA. (2010). Regulatory Position Statement 'Developments on Peat'.
[iv] Scottish Natural Heritage (SNH). (2015). Carbon-rich soil, deep peat and priority peatland habitats map. Consultation Document.
[v] Scottish Executive. (2005). Scottish Road Network Landslides Study. July 2005.
[vi] MacArthur Green. (2016). Tomatin to Moy NVC Survey.
[vii] Transport Scotland (2015). A9 Dualling Tomatin to Moy Advance Works, Invernessshire, Highland. Report on Ground Investigation. Final Report.
[viii] Atkins Mouchel Joint Venture. (2016). Report on a Ground Investigation for A9 Dualling: Tomatin to Moy, Tomatin.
[ix] Atkins Mouchel Joint Venture (AMJV). (2016). A9 Dualling Northern Section: Tomatin to Moy Geotechnical Preliminary Sources Study Report. Scottish Road Network Landslides Study.
[x] Soil Survey of Scotland Staff. (1970-1987). Soil maps of Scotland (partial coverage) at a scale of 1:25000. Macaulay Institute for Soil Research, Aberdeen. Available at http://www.soils-scotland.gov.uk/data/soil-survey (accessed 1st December 2015).
[xi] BSI (2004 & 2007). Geotechnical design. Eurocode 7: BS EN 1997-1: 2004 & BS EN 1997-2: 2007, British Standards Institute.
[xii] Lindsay (2010). Peatbogs and carbon: a critical synthesis to inform policy development in oceanic peat bog conservation and restoration in the context of climate change. University of East London Environmental Research Group. Accessed January 2017.
[xiii] FCE & SNH (2010). Floating Roads on Peat. Scottish Natural Heritage and Forestry Civil Engineering.
[xiv] Clayton, C. R. I. (2001). Managing Geotechnical Risk: Improving Productivity in UK Building & Construction. Thomas Telford, London.

[xv] BSI (1999). Code of practice for site investigations. BS 5930:1999, British Standards Institute.
[xvi] BSI (2009). Code of practice for earthworks. BS 6031: 2009, British Standards Institute.

Annex A. Identified Peat Stability Risk Area Descriptions

Initial High Peat Stability Risk Areas

Area A

Area B

Area C

Area E

Area L

Initial Moderate Peat Stability Risk Areas

Area D

Area F

Area G

Area H

Area I

Area J

Area K

Legend

Infrastructure
[black line] Proposed Scheme Footprint

Geormorphology
[grey line] Contours (5m)

Hydrology
[cyan line] Watercourse (OS 1:10k mapping)
[cyan fill] Waterbody (OS 1:10k mapping)

Peat Stability Assessment
[magenta outline] Detailed Assessment Areas
[diamond symbol] Peat Core Locations

Factor of safety (FoS) Points

[red square]	0 to 1	(8)
[yellow square]	1 to 1.4	(12)
[green square]	1.4 to 3	(92)
[blue square]	3 +	(1322)

Factor of Safety (FoS) Grid

[light grey]	0	(15994)
[purple]	1	(590)
[light green]	2	(155)
[yellow]	3	(18)
[pink]	4	(10)

Figures

A10.1.1 Indicative Peat Depth Grid and Peat Depth Point Data

A10.1.2 Factor of Safety Grid and FoS Point Data

A10.1.3 Detailed Assessment areas

Area A South-east of Tomatin Junction NGR NH 801 297

Infrastructure Planned:

The new Tomatin junction and slip road with associated cuttings and embankments are planned in the north-west of this area, plus a SuDS pond in the south-east, at the base of an existing embankment. Alterations may also be required to the existing embankments as part of the upgrade.

Cells identified of initial high risk (FoS < 1) and moderate risk (FoS 1 to < 1.4) have relatively minor infrastructure planned, primarily alterations to the existing embankment and these occur at locations where peat depths records are typically less than 1.0m.

Area Description:

This area is downslope of the existing A9 carriageway and features peat depths ranging from 0.1 to 2.2m, with an average depth of 1.03m. Deep peat is concentrated in a 30m x 30m zone of low gradient boggy woodland, noted as being wet underfoot, downslope of the existing A9 embankment.

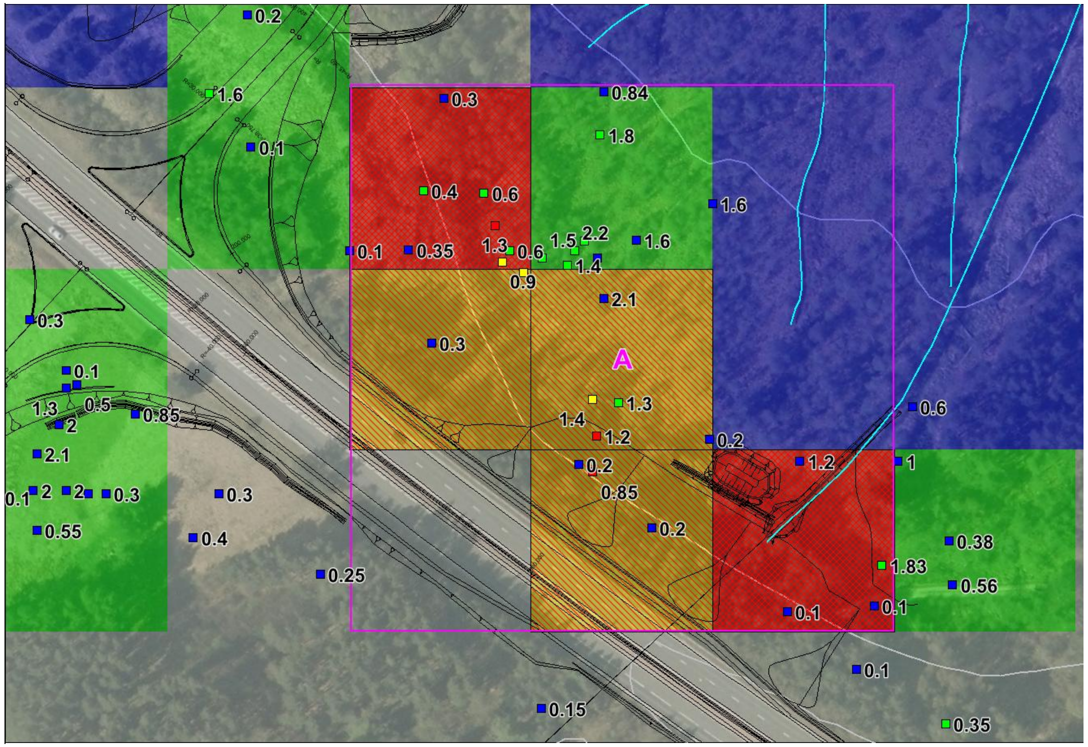
This area is generally flat, however, a maximum slope angle of around 30 degrees is recorded on an existing A9 embankment.

The factor of safety values for peat probes ranged from 0.88 to 18.31, for local grid cells the highest concern factor of safety value was 0.73. The area was identified as of initial high risk based on FoS, primarily due to the high slope angles associated with the existing embankments and deeper peat recorded nearby within same grid cells. However, deep peat is located on much gentler slopes within same cells and is therefore not coincident. No instability was noted during site surveys. No peat core was obtained in this area due, with the presence of tree roots preventing core collection from deep peat.

Downstream receptors include a number of unnamed field drains to the north, which flow into the River Findhorn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 1.40.

Initial Risk - High



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where new or altered embankments are planned, underlying peat is to be removed, in order to improve stability of infrastructure. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area B Proposed Tomatin Junction NGR NH 799 299	Initial Risk - High

Area B Proposed Tomatin Junction NGR NH 799 299

Infrastructure Planned:

The new Tomatin junction, slip roads, SuDS ponds and associated cuttings and embankments are planned in this area. Alterations may also be required to the existing embankments as part of the upgrade.

Cells identified of initial high risk (FoS < 1) and moderate risk (FoS 1 to < 1.4) have relatively extensive junction infrastructure planned, these occur at locations where peat depths records range up to 2.0m.

Area Description:

This area is downslope of the existing A9 carriageway and features peat depths ranging from 0.1 to 2.0m, with an average depth of 1.08m. Deep peat is concentrated in a 50m x 50m zone of blanket bog within woodland, noted to be wet underfoot during site surveys.

The area is generally low gradient, however, the existing A9 embankment has a maximum slope angle of around 30 degrees.

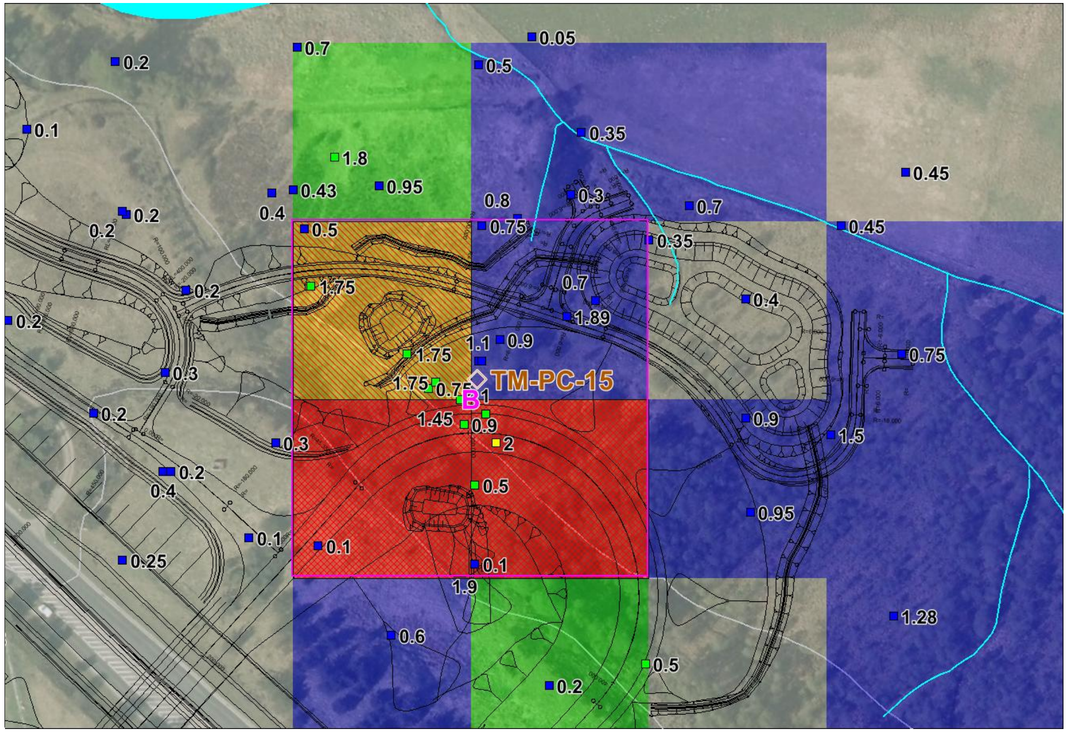
The factor of safety values for peat probes ranged from 0.55 to 35.66, for local grid cells the highest concern factor of safety value was 0.76. The area was identified as of initial high risk using FoS, primarily due to the high slope angles associated with the existing embankments and deeper peat recorded nearby within same grid cells. However, deep peat is typically located on gentler slopes. No instability was noted during site surveys.

One peat core (TM-PC-15) was taken in this area, with Von Post class of H5 Moderately Decomposed reported, these results were not used for analysis.

Downstream receptors include a number of unnamed field drains to the north, which flow into the River Findhorn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 1.49.

Initial Risk - High



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where infrastructure crosses peat, underlying peat is to be removed, in order to improve stability of road infrastructure.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area C Dalmagarry Burn NGR NH 7917 3197

Initial Risk - High

Infrastructure Planned:

This area is within the scheme footprint of the Proposed Dalmagarry Burn realignment, and new SuDS pond access tracks. It is also downslope of engineered slopes associated with the widening of the mainline carriageway.

Cells identified of initial high risk (FoS < 1) have include the existing A9 carriageway, plus the widened dual carriageway and embankments planned, in close proximity to the Dalmagarry Burn, these occur at locations where peat depths records range up to 2.2m.

Area Description:

This area is downslope of the existing Ruthven Road and road embankment and features peat depths ranging from 0.0 to 2.2m, with an average depth of 0.97m. Sands and gravels are exposed in places, with deep peat concentrated in a 50m x 10m area of low gradient upland birchwood, which was wet underfoot at time of survey.

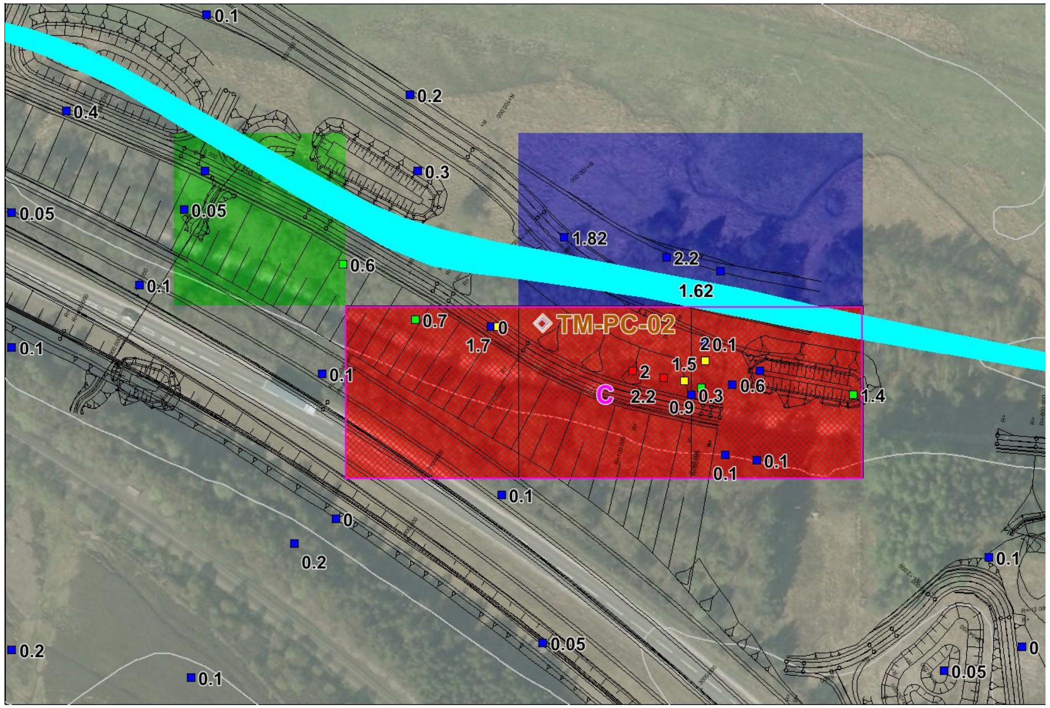
The area is generally flat, with an average slope angle of 7 degrees, with steeper slopes closer to the existing embankment.

The factor of safety values for peat probes ranged from 0.74 to 1000* (*for locations with 0.0 m depth record), for local grid cells the highest concern factor of safety value was 0.57, with the 2.20m individual peat depth record within this cell. The area was identified as of initial high risk using FoS, primarily due to the high slope angles associated with the existing embankments and deeper peat recorded nearby within same grid cells. However, deep peat is typically located on much gentler slopes these cells. No instability was noted during site surveys.

Peat core TM-PC-02 was obtained in this area. Peat was classified as H3 Very Weakly Decomposed at 3m depth.

Downstream receptors include the Dalmagarry Burn, which flows east into the River Findhorn.

Recalculating FoS for lowest cell, using local shear vane and bulk density values at TM-PC-02 (8kN/m^2 and 0.822Mg/m^3) results in a revised FoS value of 1.61.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where infrastructure crosses peat, underlying peat is to be removed, in order to improve stability of road infrastructure.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area D Layby at Dalmagarry NGR NH 7887 3207	Initial Risk - Moderate

Infrastructure Planned:

This area includes road widening and associated embankment and engineered slopes to the north of the existing A9, with the Dalmagarry Burn planned to be diverted to a new course further north to enable this design.

A single moderate risk cell was initially identified (FoS value 1 to < 1.4), which includes the existing railway embankment, existing A9 carriageway and embankment plus the planned widened section and associated embankment, with peat depths of up to 1.0m.

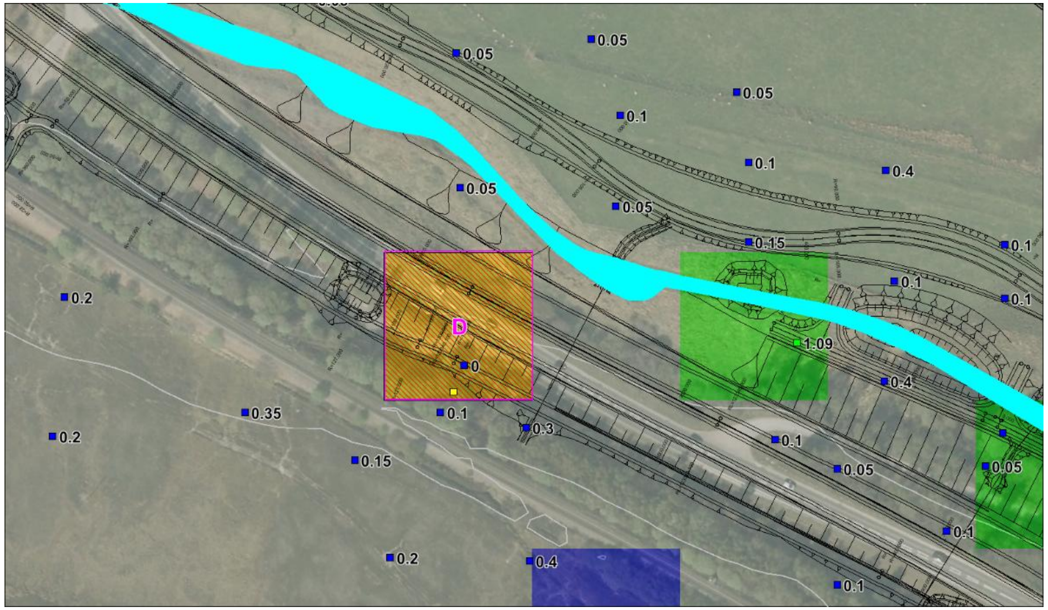
Area Description:

This area includes woodlands downslope of the HML and associated embankment near an existing A9 layby, with peat depths ranging from 0.0 to 1.0m and an average depth of 0.50m. Deeper peat is concentrated in a 10m x 10m area of birchwood, noted as dry underfoot during site survey.

The area features a steep area of embankment separating the road and the railway, with an average slope angle of 15 degrees, with gentle slope towards the road. The factor of safety values for peat probes ranged from 1.03 to 1000* (*for 0.0 m depth record), for local grid cells the highest concern factor of safety value was 1.36, with an isolated 1.0 m individual peat depth record within this cell. The area was identified as of initial moderate risk using FoS, primarily due to the high slope angles associated with the existing railway embankment with a peat depth record of 1.0m in a well-defined small area of flat ground adjacent to the embankment slope. No instability was noted during site surveys. No peat core was obtained from the area.

Downstream receptors include the existing and new A9 carriageway and Dalmagarry Burn, which flows east into the River Findhorn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.71.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where infrastructure crosses peat, underlying peat is to be removed, in order to improve stability of road infrastructure.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area E Railway near existing Moy Junction NGR NH 7832 3257	Initial Risk - High

Infrastructure Planned:

There is very limited upgrading work planned in this area, restricted to drainage improvements and installation of a new culvert. This area is located uphill and west of the existing A9 carriageway, with carriageway widening and junction improvement planned to the east.

A single cell was identified of initial high risk (FoS < 1), with no infrastructure planned in this cell.

Area Description:

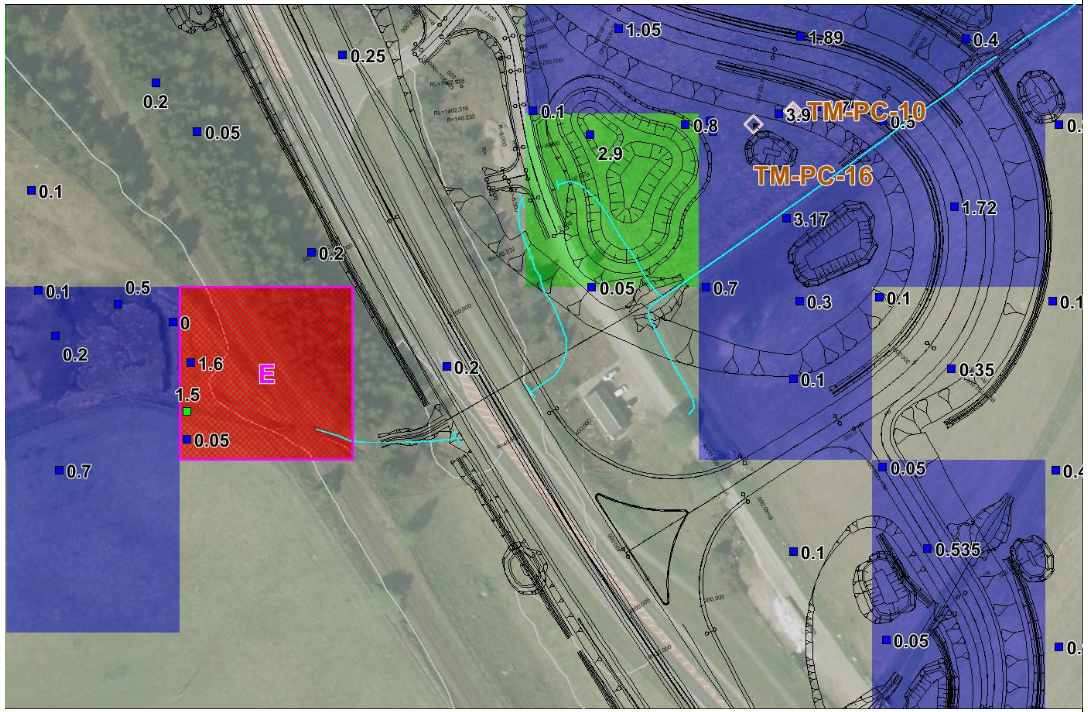
This area is located adjacent to the HML on the lower slopes of Carn na Loinne, with peat depths ranging from 0.05 to 1.6m, with an average depth of 1.05m. Sands and gravels are exposed in places and deep peat is concentrated in a 15m x 20m area of birchwood. This area features a well-defined small flush zone, with pooled water and wet underfoot, located at the lowest point of a wider heathland zone.

The area has an average slope angle of 13 degrees, which reduces in gradient towards the railway. The factor of safety values for peat probes ranged from 1.71 to 35.3, the highest concern factor of safety value for a grid cell was 0.99, with a peat depth record of up to 1.6m within this flush zone. The area was identified as of initial high risk using FoS, primarily due to the pocket of deeper peat confined to the small flush zone with shallower local slope exhibited at this location within this cell. No peat instability was noted during site surveys.

No peat cores were taken in this area.

Downstream receptors include the HML and an unnamed tributary immediately south, which flows east towards peatland and the Funtack Burn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3) results in a revised FoS value of 1.92.



Good Practice and Mitigation:

It is highly unlikely there shall be any peat stability influence in this area due to relative position of planned works.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area F Proposed Moy Railway Crossing NGR NH 7797 3312

Infrastructure Planned:

This area features the proposed mainline carriageway structure over the railway, with engineered slopes downslope and north-east of this area, and a SuDS pond access track located south-west and uphill.

A single moderate risk cell was initially identified (FoS value 1 to < 1.4), which includes the existing railway and the planned crossing section, with peat depths of up to 1.4m.

Area Description:

This is the lower slopes of Carn na Loinne and includes a small flat area of birchwood at the base of the valley, with the railway located within this area. Peat depths range from 0.2 to 1.4m, with an average depth of 0.73m. The deeper peat in this area is located in a defined zone of approximately 10m x 10m.

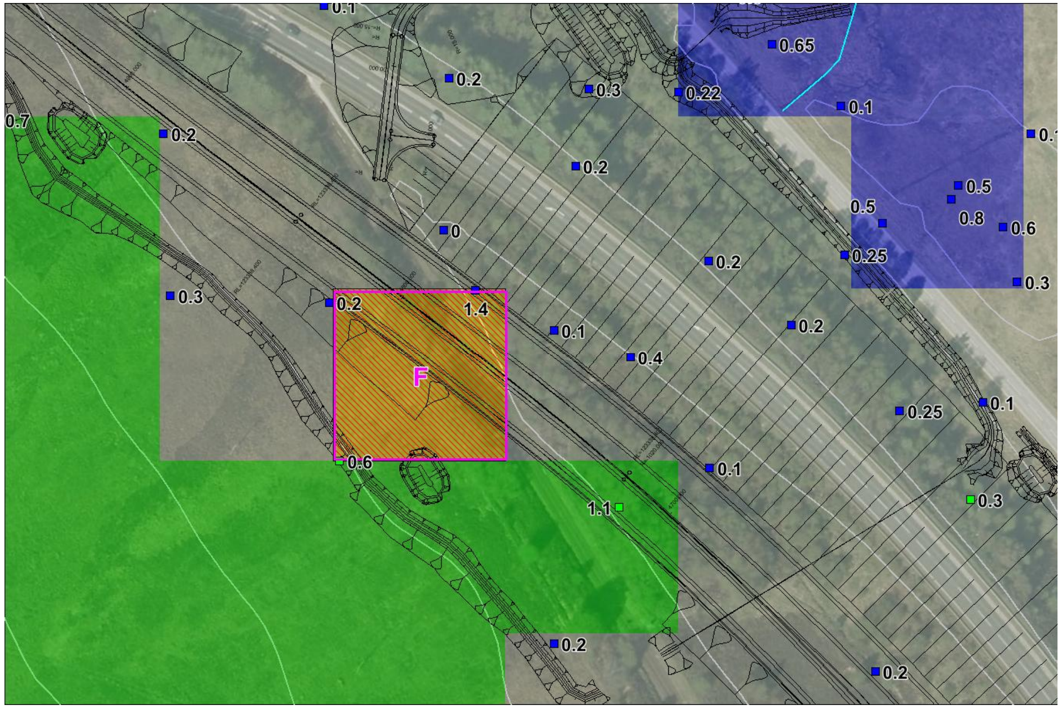
Steeper slopes are found west and upslope of the railway, with an average slope angle of 12 degrees, with gradient reducing closer to the railway and the base of the valley. The factor of safety values for peat probes ranged from 2.8 to 6.6, for local grid cells the highest concern factor of safety value was 1.13, with an isolated 1.40m individual peat depth recorded within this cell, at the base of the valley. The area was identified as of initial moderate risk using FoS, primarily due to the higher slope angles within the area, the location of deeper peat is in a low gradient zone of limited size, as indicated by adjacent shallower peat probes of 0.0 and 0.1m depth. This deeper peat zone is downhill of the local slope, with limited further peat instability potential.

No peat core was obtained from the area.

Downstream receptors include the A9 carriageway and an unnamed tributary of the Funtack Burn north-east of this area.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3) results in a revised FoS value of 2.22.

Initial Risk - Moderate



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where infrastructure crosses peat, underlying peat is to be removed, in order to improve stability of road infrastructure.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area G Forestry Area south of Moy NGR NH 774 **3342**	**Initial Risk - Moderate**

Infrastructure Planned:

This area is upslope of mainline carriageway widening and associated drainage 100m north-east and downslope, with nearby deep cuttings where mainline widening is cutting into the existing hillslope south-east of this area.

Cells identified of moderate risk (FoS 1 to < 1.4) have no infrastructure planned.

Area Description:

This area is upslope of the existing A9 carriageway with peat depths downslope of this area ranging from 0.2 to 0.6m, with an average depth of 0.4m. This area is within conifer forestry on moderate slopes uphill of the mainline carriageway.

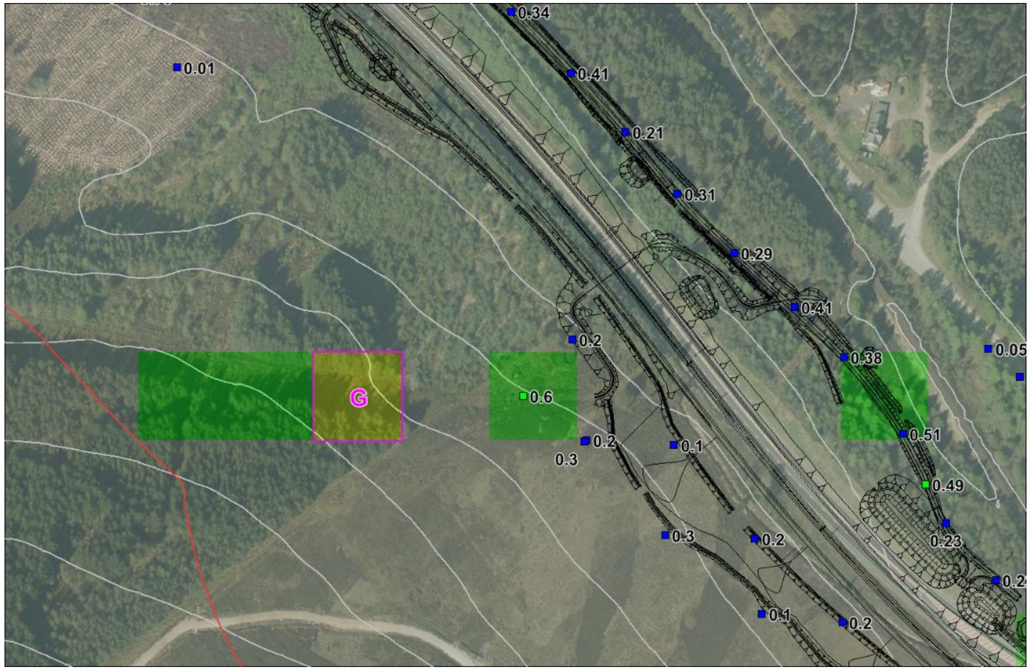
Slope angles in this area vary with slope angles of up to 20 degrees in places.

The factor of safety values for the 0.6m peat probe on the slope below this area ranged was 2.14, for local grid cells the highest concern factor of safety value was 1.34. The area features a moderate risk due to the higher slope angles on the slopes of Carn na Loinne combined with a conservative estimated 0.99m peat depth in this area, due to the presence of blanket bog habitat. Given the conservative indicative peat depths used for this area, the distance and limited works going on directly downslope there is unlikely to be any impact.

No peat core was obtained from the area.

Downstream receptors include an unnamed tributary of the Funtack Burn, 420m east of this area.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.68.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where new or altered embankments are planned, underlying peat will be removed in order to improve stability of infrastructure. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: No Risk.

Area H Peatland west of Lynebeg NGR NH 758 343	Initial Risk - Moderate

Infrastructure Planned:

This area features deep cuttings where northbound mainline widening is cutting into the existing hillslope north-east and downslope of this area. There is also new drainage planned in this area in the form of ditches.

No infrastructure is planned in this area, with a single moderate risk cell (FoS 1 to < 1.4) located 50m upslope of the cutting, in this area peat depths records are between 0.2m and 2.7m.

Area Description:

This area is upslope of the existing A9 carriageway and features peat depths ranging from 0.2 to 4.4m, with an average peat depth of 2.3m. Peat is generally deeper in the west and south of the area, set further back from the planned works.

The area is generally of low gradient (approximately 2 degrees), however, there is a hill accounting for higher slope angles of up to 29 degrees to the north-east where there is a small hill between Area H and the existing A9.

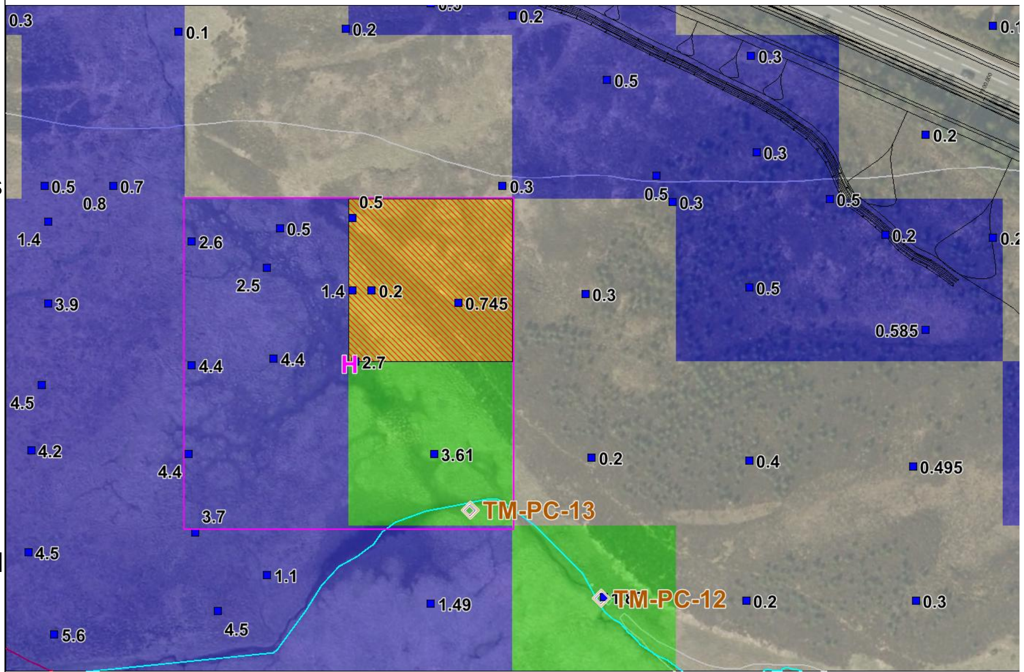
The factor of safety values for peat probes ranged from 4.0 to 96.6, for local grid cells the highest concern factor of safety value was 1.27m.

The area features a moderate risk due to the higher slope angles associated with the hill to the north-east, with deeper peat located south-west on the peatland, however these are not in the same location. Deeper peat is located within a flat basin 130m away and therefore stable.

Peat Core TM-PC-13 was collected and recorded Von Post results of H7 Strongly Decomposed. Gravel was recorded at the bottom of the peat core, indicating sand and gravel deposits below. No instability was noted during site surveys.

Downstream receptors include a number of unnamed field drains to the south, which flow into the Allt na Loine Moire.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.32.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. No embankments are planned in this area. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area I Woodland north of Allt Creag Bheithin NGR NH 801 297

Initial Risk - Moderate

Infrastructure Planned:

A new SuDS pond and access track are planned 50m south-east of this area, with northbound mainline carriageway widening and associated drainage located 80m south.

No infrastructure is planned in this area, with a single cell identified of moderate risk (FoS 1 to < 1.4), where peat depth records are between 0.3m and 2.0m deep.

Area Description:

This area is upslope of the existing A9 carriageway, adjacent to existing forestry, and features peat ranging from 0.3 to 2.0m, with an average depth of 0.96m. Deep peat is confined to a 10m x 10m area.

The area features shallow slope angle of around 9 degrees, sloping south-east towards the Allt Creag Bheithin.

The factor of safety values for peat probes ranged from 4.90 to 6.90, for local grid cells the highest concern factor of safety value was 1.32.

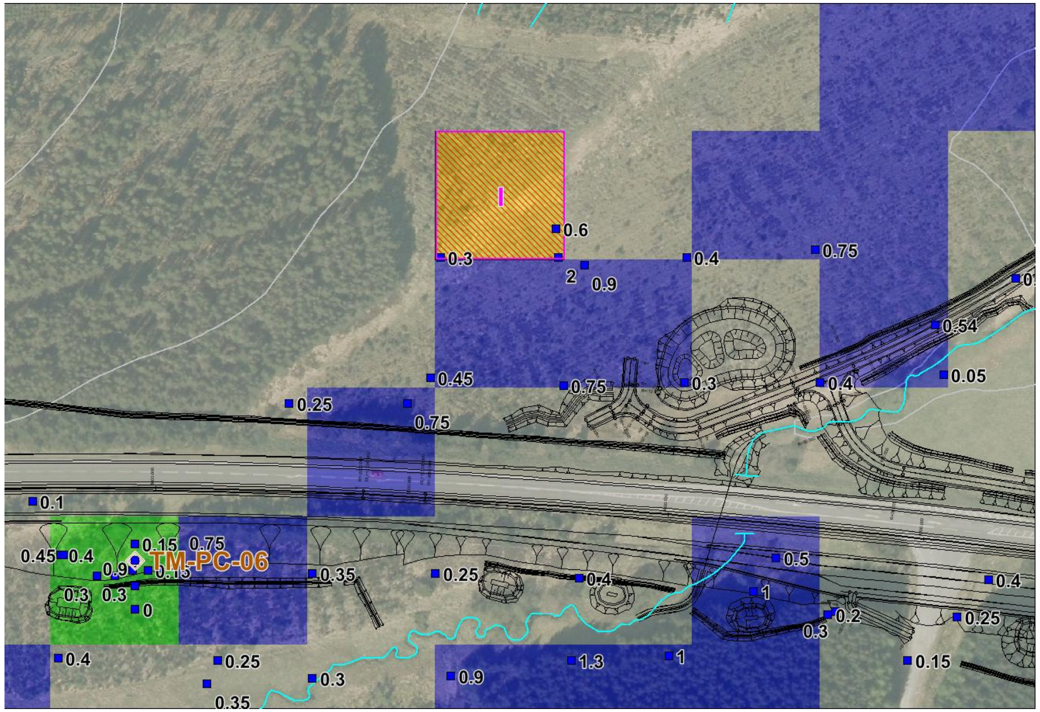
The area was identified as of initial moderate risk based on FoS, primarily due to the isolated zone of deep peat recorded. However, the deep peat is located on much gentler slopes within the cell. The distance from the scheme is sufficient that there is unlikely to be any impact.

No instability was noted during site surveys.

No peat core was obtained in this area.

Downstream receptors includes the new mainline carriageway and Allt Creag Bheithin watercourse.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density results from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.51.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where new or altered embankments are planned, underlying peat will be removed in order to improve stability of infrastructure. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area J Access Track NGR NH 737 344	Initial Risk - Moderate

Infrastructure Planned:

The access track to SuDS pond with associated cuttings and embankments are planned in the north-east of this area, plus associated drainage. Alterations may also be required to the existing forestry track in the south of this area. Floated track is planned for a section of forestry access track.

Three cells of moderate risk (FoS 1 to < 1.4) have been identified, one with relatively minor infrastructure planned with peat depths of up to 1.78m, with the other two featuring new access tracks and drainage at locations where peat depths records are between 0.84m and 1.88m.

Area Description:

This area is downslope of the existing A9 carriageway, with peat depths ranging from 0.20 to 1.88m. Slope angles in this area vary but are generally gentle and less than 10 degrees.

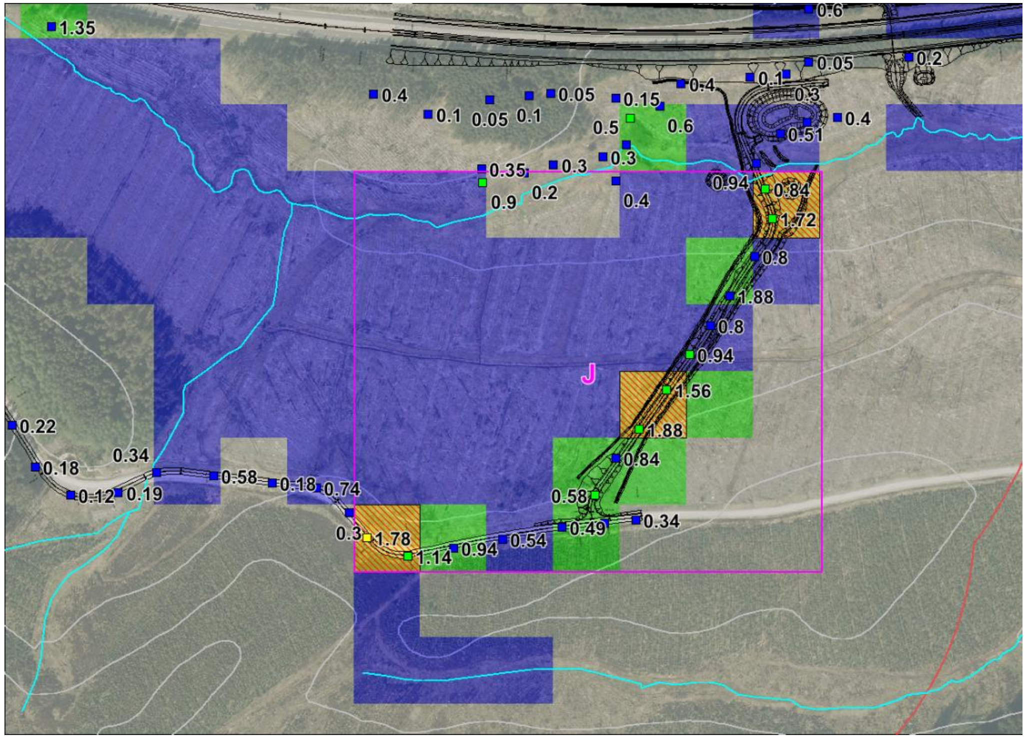
The factor of safety values for peat probes ranged from 1.25 to 10.66, for local grid cells the highest concern factor of safety value was 1.13.

The area features moderate risk in three areas due to deeper peat, however these are located on shallow slopes within each cell. One peat probing point features a FoS point value of 1.25, however this is along existing forestry track and no works are anticipated along this stretch. The other two areas along the pond access track feature deeper peat in an undulating area with varying slope angles. No instability was noted during site surveys.

No peat core was obtained in this area.

Downstream receptors include the Allt Creag Bheithin.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.17.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where infrastructure is planned, underlying peat will be removed, with forestry track to be potentially floated in order to improve stability of infrastructure and minimise peat excavation. Any additional load on the slopes is unlikely to result in peat instability. This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area K Forestry Track Junction NGR NH 726 350	Initial Risk - Moderate

Infrastructure Planned:

The upgraded windfarm/forestry access track with associated cuttings and embankments are planned in the centre of this area.

A single cell was identified of moderate risk (FoS 1 to < 1.4) which has relatively minor infrastructure planned, primarily a new cutting and alterations to the existing embankment.

Area Description:

This area is upslope of the existing forestry track and features peat depths ranging from 0.54 to 1.28m, with an average depth of 0.91m. Deep peat is found adjacent to the watercourse.

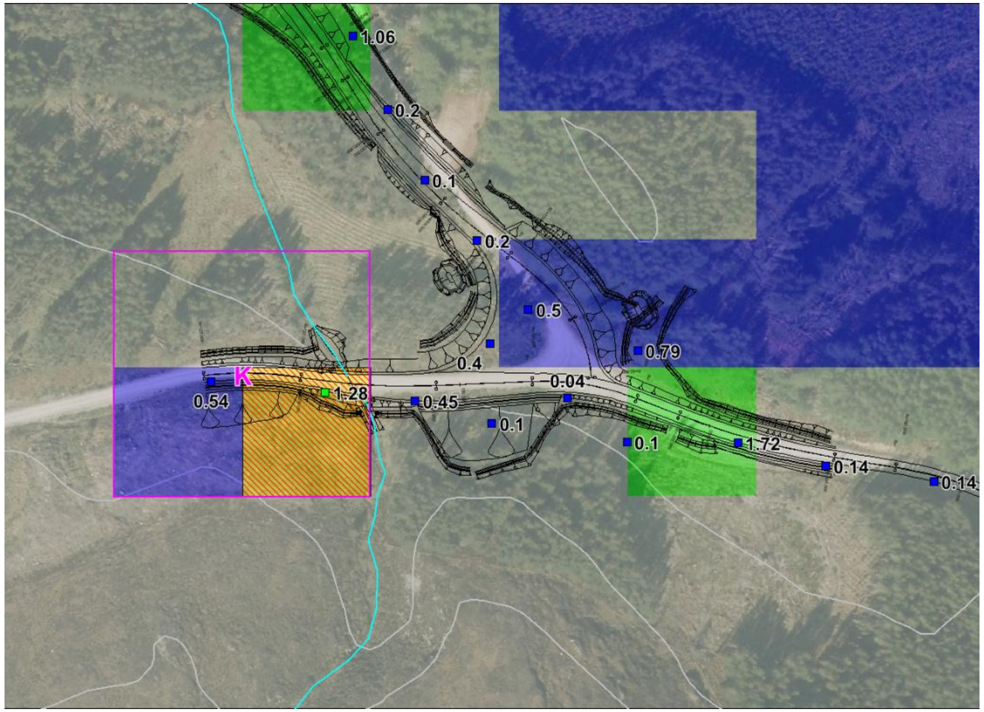
This area features moderate slope angles, with small sections of steeper slope angles along the embankment of the existing forestry track. The factor of safety values for peat probes ranged from 2.03 to 3.34, for local grid cells the highest concern factor of safety value was 1.29.

The area was identified as of initial moderate risk based on FoS, primarily due to the high slope angles associated with the existing embankments and deeper peat recorded on shallower slopes nearby within same grid cells, however, deeper peat and steeper slopes are not coincident. No instability was noted during site surveys.

No peat core was obtained in this area.

Downstream receptors include an unnamed tributary of the Midlairgs Burn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density results from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.54.Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 2.54.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where new or altered embankments are planned, underlying peat will be removed in order to improve stability of infrastructure. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Area L Woodland near Midlairgs Burn NGR NH 726 350

Initial Risk - High

Infrastructure Planned:

The new windfarm/forestry access track with associated cuttings and embankments are planned north-west of this area, plus a pond in the west of Area L at the base of an existing embankment. Alterations will be required to the existing embankments as part of the upgrade.

A single cell of initial high risk (FoS < 1) was identified, within which alterations to the existing embankment and a new SuDS pond are planned, with peat depth recorded of up to 2.17m.

Area Description:

This area is downslope of the existing A9 carriageway and features peat depths ranging from 0.1 to 2.17m, with an average depth of 0.73m. Deep peat is concentrated in a 10m x 10m zone of low gradient blanket bog, noted as being wet underfoot, downslope of the existing A9 embankment.

The area features steeper slopes at the existing A9 embankments, with shallower slope angles towards the Midlairgs Burn, with an average slope value of 10 degrees.

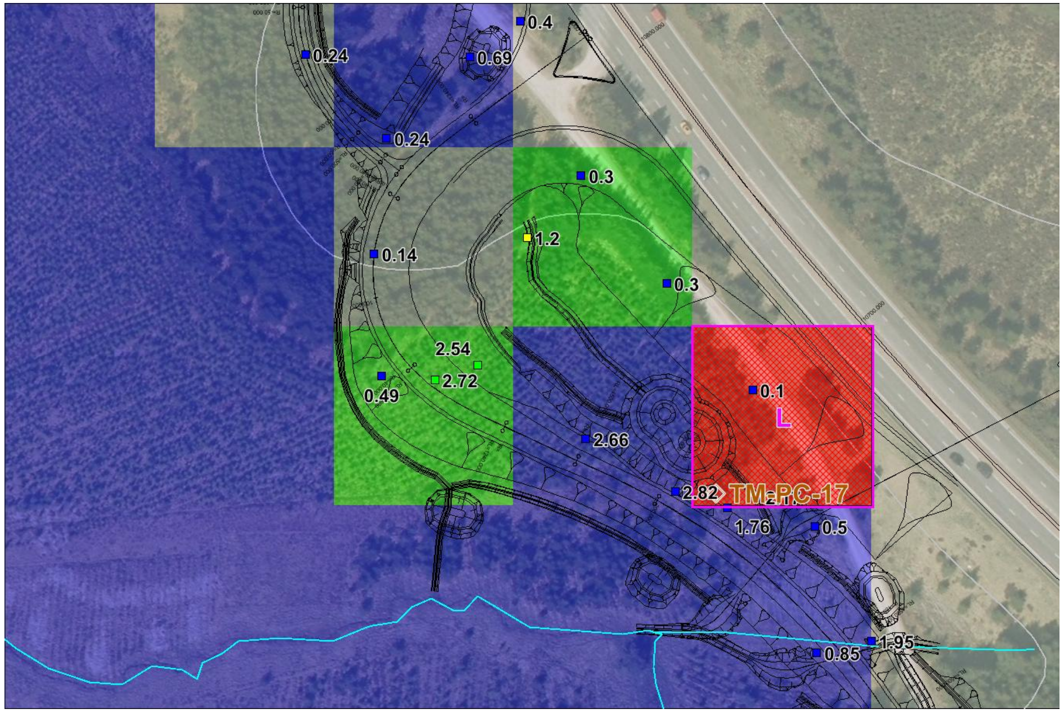
The factor of safety values for peat probes ranged from 4.4 to 17.1, for local grid cells the highest concern factor of safety value was 0.78.

The area was identified as of initial high risk based on FoS, primarily due to the high slope angles associated with the existing embankments and deeper peat recorded nearby within same grid cells. However, deep peat is located on much gentler slopes within same cells and is therefore not coincident. No instability was noted during site surveys.

Peat core TM-PC-17 was taken in this area, with cores taken down to 3.5m depth. The Von Post classification increased with depth, with the highest Von Post category recorded within the section as H8 Very Strongly Decomposed from 3m depth.

Downstream receptors include the Midlairgs Burn.

Recalculating FoS for the highest risk cell, using lowest shear vane and highest bulk density values from across the Proposed Scheme (6kN/m^2 and 0.935Mg/m^3, respectively) results in a revised FoS value of 1.48.



Good Practice and Mitigation:

Section 5 details standard good practice measures, including careful drainage design and monitoring of slopes. Where new or altered embankments are planned, underlying peat will be removed in order to improve stability of infrastructure. Any additional load on the slopes is unlikely to result in peat instability.

This area shall be noted on the Geotechnical Risk Register, with local presence of peat and potential slope stability issues recorded.

Residual Risk:

This is considered a stable location taking into account local plans and revised FoS.

Taking account of local characteristics, site-specific data and mitigation: Low Risk.

Annex B. Laboratory Results

bam ritchies

NATURAL MOISTURE CONTENT

A9 Tomatin to Moy

Client: Mouchel   Job No: 4506-163
Consultant:

Test Method - BS 1377:1990:Part 2:Method 3.2

Sample Identification				Moisture Content (%)
Hole ID	Type	Number	Depth	
TM-PC-02		348751	m	676
TM-PC-03		348752	m	1,041
TM-PC-04		348754	m	733
TM-PC-06		348755	m	755

bam ritchies

NATURAL BULK DENSITY

A9 Tomatin to Moy

Client: Mouchel   Job No: 4506-163
Consultant:

Test Method - BS 1377:1990:Part 2:Method 7.2

Sample Identification				Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)
Hole ID	Type	Number	Depth			
TM-PC-02		348751	m	676.0	0.822	0.106
TM-PC-03		348752	m	1041.0	0.882	0.077
TM-PC-04		348754	m	733.0	0.935	0.112
TM-PC-06		348755	m	755.0	0.87	0.102

bam ritchies

Summary of Classification Test Results

Project No.	Project Name
4506-169	Tomatin to Moy

Hole No.	Sample Ref	Sample Top	Sample Base	Sample Type	Soil Description	Density bulk Mg/m³	Density dry Mg/m³	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m³	Remarks
TM-PC-10	45061691	3.70		D		0.52	0.05	858						
TM-PC-11	45061692	0.00		D		0.53	0.06	784						
TM-PC-12	45061693	1.90		D		0.51	0.06	735						
TM-PC-13	45061694	2.94		D		0.40	0.06	558						
TM-PC-14	45061695	1.50		D		0.44	0.03	1,358						

Exova (UK) Ltd
70 Montrose Avenue
Hillington Park
Glasgow
G52 4LA

T: +44 (0)141 941 2022
F: +44 (0)141 952 7099
E: info@exova.com
W: www.exova.com

Exova

Test Certificate

Client: BAM Ritchies
Glasgow Road, Kilsyth, Glasgow, G65 9BL
Site: A9 Tomatin to Moy - Job No 4506-163
Date Tested: 26/04/16, 29/04/16
Date Reported: 29 April, 2016
Date Received: 21 April, 2016
Sample Type: Solid

Certificate No: 16/1944/G/S/C1
File No: 16/1944/G/S
Client Ref: RIT 170481

					Lab sample ref:	**C238346**	**C238347**	**C238348**	**C238349**
					Client sample ref:	**TM-PC-02**	**TM-PC-03**	**TM-PC-04**	**TM-PC-06**
					Date sampled:	**11/04/16**	**14/04/16**	**14/04/16**	**14/04/16**
					Sample matrix:	**S**	**OS**	**OS**	**OS**
Determinand	**Method**	**Units**	**ISO17025**	**LOD**					
Deviation Assessment									
Deviation(s)	C. Review	N/A	N/A	N/A		N/A	N/A	N/A	N/A
Sample Prep(C)									
EMR	EMR	%	N	0.1		<0.1	<0.1	<0.1	<0.1
% Stones	Stones	% w/w	N	0.1		<0.1	<0.1	<0.1	<0.1
Moisture Content @ <30°C	AN1	% w/w	Y	0.1		84.1	89.9	87.4	87.4
Sample Description	MCERTS ver4.		N			2	7D	7	7D
Misc									
TOC	AN48c	%	N	0.1		31.1	> 34.6	> 35.8	> 36.1

Exova (UK) Ltd
70 Montrose Avenue
Hillington Park
Glasgow
G52 4LA

T: +44 (0)141 941 2022
F: +44 (0)141 952 7099
E: info@exova.com
W: www.exova.com

Test Certificate

Client: BAM Ritchies
Glasgow Road, Kilsyth, Glasgow, G65 9BL
Site: A9 Tomatin to Moy - Job No 4506-169
Date Tested: 15 December, 2016
Date Reported: 24 January, 2017
Date Received: 15 December, 2016
Sample Type: Solid

Certificate No: 16/6214/G/S/C2
File No: 16/6214/G/S
Client Ref: RIT192852

Determinand	Method	Units	ISO17025	LOD	C258613	C258614	C258615	C258616	C258617
Client sample ref:					TM-PC-10 3.70m	TM-PC-11	TM-PC-12 1.90m	TM-PC-13 2.94m	TM-PC-14 1.50m
Date sampled:					13/12/16	13/12/16	13/12/16	13/12/16	13/12/16
Sample matrix (see notes):					OS	OS	OS	OS	OS
Deviation Assessment									
Deviation(s)	C. Review	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC	AN48c	%	N	0.1	24.8	24.5	24.5	9.8	25.6

Annex C. Peat Core Photos

Illustration 10: Peat Core TM-PC-02

Illustration 11: Peat Core TM-PC-03

Illustration 12: Peat core TM-PC-04

Illustration 13: Peat Core TM-PC-06

Illustration 14: Peat Core TM-PC-10

Illustration 15: Peat Core TM-PC-11

Illustration 16: Peat Core TM-PC-12

Illustration 17: Peat Core TM-PC-13

Illustration 18: Peat Core TM-PC-14