1. TECHNICAL ANNEX 7.3: PEAT LANDSLIDE HAZARD AND RISK ASSESSMENT

1.1 Introduction

This Technical Annex (TA) presents the Peat Landslide Hazard and Risk Assessment (PLHRA) for the construction and operation of a Tie-In connection to the proposed Creag Dhubh Substation from the existing 132 kV Inveraray to Taynuilt Overhead Line (OHL), as well as the temporary diversion of the existing 132 kV Taynuilt to Inveraray OHL to facilitate its connection to the substation and associated ancillary works. The Proposed Development would be located approximately 2.5 km south west of Cladich, Argyll and Bute (the 'Peat Study Area, 'PSA Site'), as illustrated in **Figure 7.3.1** of this TA**.**

This PLHRA has been undertaken to aid the design process and to inform the potential risk of peat slide at the PSA Site, as well as providing a precis of the geological and hydrological conditions for the Proposed Development.

This TA has been produced in accordance with guidance published by Scottish Environmental Protection Agency (SEPA), NatureScot (formerly Scottish Natural Heritage), and the Scottish Government, which is referenced in the following sections.

This TA is supported by the following Figures:

- **Figure 7.3.1: Peat Study Area**;
- **Figure 7.3.2: Proposed Development Layout**;
- **Figure 7.3.3: Peat Depth**;
- **Figure 7.3.4: Elevation**;
- **Figure 7.3.5: Slope Angle**;
- **Figure 7.3.6: Bedrock;**
- **Figure 7.3.7: Superficial Geology;**
- **Figure 7.3.7:Geomorphology and Hydrology**;
- **Figure 7.3.9: Factor of Safety**;
- **Figure 7.3.10.1 to 7.3.10.8: Contributing Factors**; and
- **Figure 7.3.11: Peat Slide Likelihood**.

1.2 Site Location

The Proposed Development is located approximately 2.5 km southwest of Cladich in Argyll and Bute. It lies adjacent to the existing 132 kV OHL from Taynuilt to Inveraray and proposed Creag Dhubh substation within commercial forestry plantation and the River Aray catchment.

The Site layout plan is shown in **Figure 7.3.2** which shows the Proposed Tie in towers, Temporary Pole Locations (P1 to P8) and the proposed Creag Dhubh Substation Site (the 'Substation Site'), consisting of additional land take to accommodate the ancillary works.

The western segment of the PSA Site is located within a large commercial conifer plantation which is in the process of being harvested. The surrounding land is a mix of regenerating moorland, conifers and a small number of large trees which have been retained. The majority of the PSA Site itself has already been harvested and comprises small immature trees, with some mature trees along the western boundary. There are no statutory or non-statutory designated ecological sites within the PSA Site. The nearest is Glen Etive and Glen Fyne Special Protection Area (SPA) which is approximately 500 m east of the PSA Site (Refer to **Chapter 4: Ecology and Ornithology, Volume 1** for further details).

The River Aray runs approximately 250 m to the east of the Proposed Development Site. The proposed new access track crosses the river using an existing culverted watercourse crossing. One forest drain crosses the north of the site flowing in a north-easterly direction and discharges into the River Aray to the east of the site. The wider surrounding area is sparsely populated with the nearest residential receptors at Cladich, approximately 2.5 km to the north east.

The PSA Site location and setting are described in more detail within **Chapter 3: Proposed Development and Alternatives** of the EA.

1.3 Methodology

1.3.1 Study Area

The peat study area focussed on the infrastructure development area of the PSA Site **(Figure 7.3.1).**

1.3.2 Desk Study

The PLHRA was undertaken following Scottish Government (2017). Peat Landslide Hazard and Risk Assessments, Best Practice Guidance [1]. A desk study and field surveys were implemented to gather baseline conditions of the site and allow a PLHRA to be completed. The desk study included an overview of the following elements to inform the baseline design:

- Bedrock and superficial geology from BGS Mapping[2];
- Peatland and peat characteristic information from Scottish Natural Heritage (NatureScot) carbon rich soils, deep peat and priority habitat guidance[3];
- Peat probing study undertaken by SLR Consulting in 2016[4] on behalf the Applicant to inform in the substation site selection process;
- Habitat survey information from **TA 4.1: Ecology and Ornithology Methodology and Results (Volume 2)**;
- Hydrogeological and Hydrology information from **Chapter 7: Hydrology and Geology (Volume 1)**; and
- Topographical information taken from published Digital Terrain Model (DTM) LIDAR data.

1.3.3 Field Study

A peat depth survey was undertaken within the PSA Site to understand the baseline peat conditions and potential constraints, and to inform the design of the Proposed Development to minimise, as far as practicable, the potential direct and indirect effect on peat and carbon rich soils.

Additional peat depth results have been taken from the adjacent Creag Dhubh, Creag Dhubh to Dalmally 275 kV OHL, and Creag Dhubh to Inverary, 275 kV OHL Survey to provide sufficient context to the interpolation within the PLHRA reporting.

The surveys listed below were undertaken by Ramboll on the following dates:

- Creag Dhubh Substation Project – March, August and November 2021;
- Creag Dhubh to Dalmally 275 kV Connection Project - March, August and November 2021;
- Creag Dhubh to Inveraray 275 kV Connection Project – April 2022; and
- Inveraray to Taynuilt Tie-In Connection to Creag Dhubh Substation– April 2022

[1] Energy Consents Unit Scottish Government (2017), Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments.
[2] BGS Geological Mapping https://mapapps.bgs.ac.uk/geologyofbritain/home.html
[3] Scottish Natural Heritage. (2016). Carbon and Peatland 2016 Map (http://map.environment.gov.scot/soil_maps/).
[4] SLR Consulting, 2016. Stronmilchan LT29 Sites A, B1, B, C, D, E and F - North Argyll 275/132kV substation & OHL Reinforcement.

Surveys followed best practice guidance published at the time of the surveys with regard to surveying for developments on peatland[5,6].

The Creag Dhubh Substation and Creag Dhubh to Inveraray 275 kV surveys are low density surveys and were carried out on a 50 m grid across the developable area of each project Site, with additional points taken as necessary.

The Proposed Development survey was undertaken at the proposed location of the permanent towers and temporary pole locations. For the tower locations, probing was undertaken at the centre point and at 10m intervals along cardinal points for a total of 50 m from the centre point of the tower.

For pole locations a 25 m cardinal point approach was adopted at each pole location. To provide potential for micrositing the pole locations, additional probes were undertaken along the proposed pole route at 50 m interval with further probe points taken at 25 m perpendicular offsets.

The probing was carried out using collapsible avalanche probes, allowing for probing in excess of 6 m. However, such depths were not reached. This peat depth data along with other environmental and engineering constraints were used to inform the layout of the Proposed Development. The Proposed Development area is shown on **Figure 7.3.2**.

The survey points and field data were collected using a handheld Trimble GPS unit. Peat depth data was modelled using Inversive Distance Weighted (IDW) interpolation in GIS software, and a depth model generated using incremented peat depth categories.

Peat cores were taken using a Russian auger, with a sample volume of 0.5 l, and field tests and observations were undertaken. The probing results are included on **Figure 7.3.3.**

1.3.4 Assumptions and Limitations

The peat probe surveys were undertaken where safe access was possible. Access to areas of dense vegetation and recently cleared plantation/brash were surveyed only where access was possible and where it was safe to do so.

The design of the Proposed Development has considered the presence and depth of peat, along with other technical and environmental constraints, and proposed infrastructure has been sited away from these areas and adjusted to avoid pockets of deep peat, where possible.

Peat probing and mapping has been used to inform the design process at strategic points in the design evolution of the Proposed Development where practicable. The peat survey probing points provide high resolution coverage of the PSA Site, and these revealed the peatland to be typically shallow (less than 0.5 m) but with several pockets of deeper peat. It is considered that the peat depths collected, and interpolations derived from these data, are representative of the PSA Site and have adequately informed the layout of the Proposed Development.

Where probing and investigation data is limited, conditions have been inferred based on visual inspection and geological and geomorphological interpretation, and based on interpolated peat depth data.

1.4 Results

1.4.1 Topography

The site topography is generally steep ground rising from East to west across the PSA Site between levels of 270 m and 200 m Above Ordnance Datum (AOD). Topography elevations are shown on **Figure 7.3.4**.

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5 Scottish Government, Scottish Natural Heritage, SEPA. (2017). *Peatland Survey. Guidance on Developments on Peatland*, online version only.

6 Scottish Renewables and SEPA (2012*). Development on Peatlands. Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste.*

1.4.2 Slope angles at the Site, as shown on **Figure 7.3.5**, are summarised below:

- Slope angles within the northwest of PSA Site are generally moderately steep (10.1 to 15°) or steep (15.1 to 20º);
- Slope angles to the southeast are moderate (5.1 to 10°), locally moderately shallow (2.1 to 5°), and
- Slope angles in the central regions of the PSA Site are Moderate (5.1 to 10°), locally steep (15.1 to 20°),

1.4.3 Geology

The 1:50,000 scale geological mapping available from the British Geological Survey (BGS)[7] shows the substation site to be underlain by Tayvallich Volcanic Formation, Metalava and Metatuff from the Argyll Formation. The 1:50,000 BGS mapping is shown on **Figure 7.3.6**.

The superficial geology of the site comprises Glacial deposits of Hummocky Till (diamicton. The 1:50,000 BGS mapping is shown on **Figure 7.3.7**.

BGS mapping shows no peat deposits are located at the site.

The Nature Scot (formerly Scottish Natural Heritage) carbon rich soils, deep peat and priority habitat mapping[3] shows Class 5 peat to be present across the site. This is associated with forestry areas, which are defined as 'Dominant vegetation cover is not a priority peatland habitat'.

1.4.4 Hydrogeology

The BGS 1:625,000 scale hydrogeology mapping defines the Argyll Group rocks underlying the Proposed Development area as impermeable. Any groundwater flow within the bedrock will be limited to the weathered zone or secondary fractures.

1.4.5 Surface Water Features

The River Aray watercourse to the east of the PSA Site does not form part of, or drain into, a designated surface water protection area.

The River Aray is classified within SEPAs River Basin Management Plan (RBMP) as being in overall 'Good' condition, with the physical condition and water quality of the watercourse also classified as being 'Good'. The River Aray ultimately discharges into coastal waters at Loch Fyne, which is designated as a Shellfish Water under the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order, 2013[8].

1.4.6 Geomorphology

Peat Geomorphology

Digital aerial photography and Digital Terrain Model (DTM) LIDAR data was used to interpret and map geomorphological features within the developable areas of the site. This interpretation and the resulting geomorphological map, as shown in **Figure 7.3.7: Geomorphology and Hydrology**, were subsequently verified during site walkover and surveys undertaken by an experienced peatland geomorphologist and hydrologist in March, August and November 2021.

The presence, characteristics and distribution of peatland geomorphological features have been defined to understand the hydrological function of the peatland, with reference to the balance of erosion and peat accumulation (or condition), and the sensitivity of peatland to potential land-use changes.

As noted above in Section 1.2, the PSA Site has been intensively managed for commercial forestry plantation and felling, with artificial drainage measures used. In some areas diffuse natural drainage systems were also noted. Within the commercial plantation and forestry areas it was noted that the acrotelmic peat was highly

[7] BGS Geological Mapping https://mapapps.bgs.ac.uk/geologyofbritain/home.html

[8] The Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order, 2013 [Accessed: 06/12/21]

modified as a result of planting and felling activities. No evidence of peat erosion or instability were generally noted within the forestry areas.

No significant evidence of instability features was identified outside of forest areas during the surveys, with no haggs, groughs, and other features noted. No major instability features, evidence of incipient instability or past landslides were recorded.

Results from the peat surveys are detailed within **TA 7.1: Peat Depth Survey Results (Volume 2)**. Overall, the peat depth within the developable area is relatively shallow (<0.5 m). However, several deeper pockets of peat are present (>1.0 m). The peat was found to be generally dry and in a state of moderate decomposition. This is likely to be due to the coniferous plantation and associated artificial drainage, which has resulted in modification to the integrity and composition of the peat and carbon rich soils.

1.5 Peat Instability

Types of Peat Instability

Peat instability can be defined as either 'minor instability' or 'major instability'[9], and observed by both field observations and through desk top review of aerial/satellite imagery of the PSA Site:

Minor instability can be defined as localised and small scale features that are not generally precursors to major failure and including gully sidewall collapses, pipe ceiling collapses, minor slumping along diffuse drainage pathways (e.g. along flushes). Indicators of minor instability include presence tension cracks, compression ridges, or bulges.

Major instability can be defined by peat landslides.

For the purposes of this assessment, landslide classification is split into three main types:

- multiple peat slides with displaced slabs and exposed substrate;
- bog burst with peat retained within the failed area; and
- multiple peat soil slides with displacement of thin soils exposing substrate.

The term 'peat slide' is used to refer to large-scale landslides and occur 'top-down' from the point of initiation on a slope in thinner peats (between 0.5 and 1.5 m) and on moderate slope angles (typically 5-15°).

The term 'bog burst' is used to refer to very large-scale failures where peat is typically deeper (greater than 1.0 m and up to 10 m) and more amorphous than sites experiencing peat slides, with shallower slope angles (typically 2-5°).

'Peaty soil slide' is used to refer to small-scale slab-like slides in organic soils generally <0.5 m thick.

1.6 Factors Contributing to Peat Instability

Peat landslides are caused by a combination of factors (such as triggering and preconditioning) and these are discussed in the Landslide Susceptibility Approach Section of this report. Triggering factors have an immediate or rapid effect on the stability of a peat accumulation whereas preconditioning factors can 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, and include:

- impeded drainage caused by a peat layer overlying an impervious clay or mineral base (hydrological discontinuity);
- a convex slope or a slope with a break of slope at its head (concentration of subsurface flow);
- proximity to local drainage, either from flushes, pipes or streams (supply of water);
- connectivity between surface drainage and the peat/impervious interface (mechanism for generation of excess pore pressures);

[9] Scottish Government (2017). Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity

- 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);
- increase in mass of the peat slope through peat formation, increases in water content or afforestation;
- 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;
- loss of surface vegetation and associated tensile strength (e.g. by burning or pollution induced vegetation change);
- increase in buoyancy of the peat slope through formation of sub-surface pools or water-filled pipe networks or wetting up of desiccated areas; and
- 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 a result of cumulative events:

- intense rainfall or snowmelt causing high pore pressures along pre-existing or potential rupture surfaces (e.g. between the peat and substrate);
- rapid ground accelerations (e.g. from earthquakes or blasting); unloading of the peat mass by fluvial incision or by artificial excavations (e.g. cutting);
- focusing of drainage in a susceptible part of a slope by alterations to natural drainage patterns (e.g.by pipe blocking or drainage diversion); and
- loading by plant, spoil or infrastructure.

External environmental triggers such as rainfall and snowmelt cannot be mitigated, though they can be managed (e.g. by limiting construction activities during periods of intense rain). Unloading of the peat mass by excavation, loading of peat by plant and focusing of drainage can be managed and mitigated by careful design, site specific stability analyses, informed working practices and monitoring.

1.7 Approaches to Assessing Peat Instability

This report considers a qualitative contributory factor-based approach and 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 organic material, rather than mineral soil.

To reflect these limitations, both approaches are adopted and outputs from each approach integrated in the assessment of landslide likelihood. This is based on:

Probability of Peat Landslide x Consequence of Peat Landslide = Risk

1.8 Assessment of Peat Landslide Likelihood

1.8.1 Introduction

This section provides details on the landslide susceptibility and limit equilibrium approaches to the 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:

Risk = Probability of a Peat Landslide x Adverse Consequences

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

1.8.2 Limit Equilibrium Approach

Stability analysis has been undertaken using the infinite slope model to determine the FoS for a series of 25 m x 25 m cells within the developable area. The limit equilibrium approach[10] has been applied within areas where the peat thickness is over 0.5 m. The limit equilibrium approach is the most frequently cited approach for the quantitative assessment of the stability of peat slopes. The approach assumes that failure occurs by shallow translational land sliding, 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):

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

In this formula:

- c is the effective cohesion (kPa);
- γ is the bulk unit weight of saturated peat (kN/m3);
- γw 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 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 FoS between 1 and 1.4 is normally taken in engineering terms to indicate marginal stability (providing an allowance for variability in soil strength, depth to failure). Slopes with a FoS 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[11]. 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. With this in mind, representative data inputs have been derived from published literature and used for drained analysis only.

[10] Scottish Government (2017). Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity

[11] Boylan N and Long M (2014) Evaluation of peat strength for stability assessments

1.9 Data Inputs

Stability analysis was undertaken using GIS software and a 25 m x 25 m grid was superimposed on areas of peat only, with key input parameters derived for each grid cell. A 25 m x 25 m cell size was chosen because it is sufficiently small to define a minimum credible landslide size and avoid 'smoothing' of important topographic irregularities. Given the cell size of the input DTM, which provides a key input parameter, any smaller cell size would be unlikely to provide significant benefits.

Table 7.3.1 shows the input parameters and assumptions for the stability analyses undertaken. 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'.

Table 7.3.1: Geotechnical Parameters for Drained Infinite Slope Analysis

Parameter	Values	Rationale	Source
Effective Cohesion (c')	2, 5	Credible conservative cohesion values for humified peat based on literature review	5.5 - 6.1 - peat type not stated (Long, 2005)[12] 3, 4 - peat type not stated (Long, 2005)[5] 5 - basal peat (Warburton et al., 2003)[13] 7.74 - fibrous peat (Carling, 1976)[14] 4 - peat type not stated (Dykes and Kirk, 2001)[15] 7 – 12 - H7 peat (Huat et al, 2014)[16]
Bulk Unit Weight (γ)	10.5	From Laboratory test data	10.1 – catotelm peat (Mills, 2002)[17] 10.1 – Irish bog peat (Boylan et al, 2007)[18]
Effective Angle of Internal Friction (φ')	22	Credible conservative friction angle for humified peat based on literature review	40 – 65 - fibrous (Huat et al, 2014)[9] 50 – 60 - amorphous (Huat et al, 2014)[9] 36.6 - 43.5 - peat type not stated (Long, 2005)[5] 31 – 55 - Irish bog peat (Hebib, 2001)[19] 34 – 47 - fibrous sedge pear (Farrell & Hebib, 1997)[20] 32 – 57 - peat type not stated (Long, 2005)[5] 23 - basal peat (Warburton et al, 2003)[6] 21 - fibrous peat (Carling, 1976)[7]
Slope Angle from Horizontal (β)	Various	Mean slope angle per 25 m x 25 m grid cell	5 m DTM 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	1	Assumes peat mass is fully saturated (normal conditions	Assumed

[12] Long M (2005) Review of peat strength, peat characterisation and constitutive modelling of peat with reference to landslides
[13] Warburton et al (2003) Anatomy of a Pennine peat slide, Northern England. Earth Surface Processes and Landforms
[14] Carling (1976) Peat slides in Teesdale and Weardale, Northern Pennines, July 1973: description and failure mechanisms
[15] Dykes and Kirk (2001) Initiation of a multiple peat slide on Cuilcagh Mountain, Northern Ireland
[16] Huat et al (2014) Geotechnics of organic soils and peat
[17] Mills (2002) Peat slides: Morphology, Mechanisms and Recovery
[18] Boylan N, et al (2007) Peat slope failure in Ireland
[19] Hebib (2001) Experimental investigation of the stabilisation of Irish peat
[20] Farrell and Hebib (1997) The determination of the geotechnical parameters of organic soils

Table 7.3.1: Geotechnical Parameters for Drained Infinite Slope Analysis			
Parameter	**Values**	**Rationale**	**Source**
as a Proportion of Peat Depth (h)		during intense rainfall events or snowmelt, which are the most likely natural hydrological conditions at failure)	

Results

Figure 7.3.9 shows the results for drained analysis of the peat areas at the PSA Site for the more conservative of the two parameter sets above (ϕ' of 22° and c' of 5 kPa). The results indicate that even with conservative parameters, Factors of Safety demonstrate stability across the PSA Site (FoS >1.5). This is consistent with the lack of observation of instability features during the site walkover surveys.

1.10 Landslide Susceptibility Approach

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. The number and size of slope facets will vary from one part of the site to another according to the complexity of ground conditions. As with the limit equilibrium approach, facets were only defined in areas of true peat.

Eight contributory factors are considered in the analysis:

- slope angle (S);
- peat depth (P);
- substrate geology (G);
- peat geomorphology (M);
- drainage (D);
- forestry (F);
- slope convexity (C); 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 (SPL), the theoretical maximum being 24 (7 factors, each with a maximum score of 3):

$SPL = SS + SP + SG + SM + SD + SF + SC + SL$

In practice, a maximum score is unlikely, as the chance of all contributory factors having their highest scores in one location is very small.

Figures to show the spatial distribution of each factor across the site are included with this report.

1.10.1 Slope Angle (S)

Table 7.3.2 shows the slope ranges, their significance and related scores for the slope angle contributory factor. Slope angles were derived using the DTM 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'.

Table 7.3.2: Slope Classes, Significance and Scores		
Slope Range (°)	**Significance**	**Score**
>20.0	Failure typically occurs as peaty debris slides due to low thickness of peat	1
15.1-20.0	Failure typically occurs as peaty debris slides due to low thickness of peat	2
10.1-15.0	Failure typically occurs as peat slides, bog slides or peaty debris slides, a key slope range for reported population of peat failures	3
5.1-10.0	Failure typically occurs as peat slides, bog slides or peaty-debris slides, a key slope range for reported population of peat failures	3
2.1-5.0	Failure typically occurs as bog bursts, bog flows or peat flows; peat slides and peaty debris slides rare due to low slope angles	2
≤2.0	Failure is very rarely associated with flat ground, neutral influence on stability	0

Figure 7.3.10.1 shows the distribution of slope angle scores across the PSA Site. The results show that the slope angles across pole location route to the west of Site are predominantly moderately steep (5 to 15°). Slope angles generally moderate towards the Tower locations to the east, where they are shown to be shallow in nature(<2º)

1.10.2 Peat Depth (P)

Table 7.3.3 shows the peat depths, their significance and related scores for the peat depth contributory factor. Peat depths were derived from the peat depth reporting and the scoring reflects the peat depth ranges most frequently associated with peat slides (Evans and Warburton, 2007)[21]

Table 7.3.3: Peat Depth Classes, Significance and Scores		
Depth Range (m)	**Significance**	**Score**
>1.5	Sufficient thickness for any type of peat failure	2
1.0-1.5	Sufficient thickness for peat slide or bog slide	3
0.5-1.0	Sufficient thickness for peat or bog slide and peaty-debris slide but not for bog burst	3
<0.5	Organic soil rather than peat, failures would be peaty-debris slides	1
No Organic Soil	No organic soil and therefore failures cannot be interpreted as peat slides, neutral influence on stability	0

Figure 7.3.10.2 shows the distribution of peat depth scores across the PSA Site. The results indicate that the site is predominantly covered by peat thicknesses <0.5 m. Pockets of deep peat (0.5 to1.5m) are recorded to the north of proposed pole locations P4 and P5, and to the south of P1. Peat accumulation of >1.5m are shown to be present at the proposed Tower 35B location.

1.10.3 Substrate Geology (M)

Table 7.3.4 shows substrate type, significance and related scores for the peat depth contributory factor. The shear surface or failure zone of 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

[21] Evans & Warburton (2007) Geomorphology of Upland Peat: Erosion

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[22].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.

Table 7.3.4: Substrate Geology Classes, Significance and Scores		
Substrate Geology	**Significance**	**Score**
Glacial Till With Iron Pan	Failures often associated with underlying till; particularly where impermeable iron pan provides polished shear surface	3
Glacial Till	Failures often associated with underlying till	2
Impermeable Bedrock	Failures sometimes associated with bedrock, particularly if smooth top surface	1
Permeable Bedrock	Failures rarely associated with permeable bedrock (peat is often thin or absent), neutral influence on stability	0

Figure 7.3.10.3 shows the distribution of substrate geology scores across the PSA Site. The results indicate that the PSA Site is permanently underlain by impermeable bedrock, which is consistent with the solid geology outcrops noted during the survey. Isolated areas to the east around the existing access track show glacial till underlying the peat deposits.

1.10.4 Peat Geomorphology (G)

Table 7.3.5 shows geomorphological features which has been used within the assessment for the PSA Site, their significance and related scores.

Table 7.3.5: Peat Geomorphology Classes, Significance and Scores		
Geomorphology	**Significance**	**Score**
Adjacent/upslope (<50 m) to existing instability (peat slide, peaty-debris slide, bank failure)	Failures often associated with underlying till; particularly where impermeable iron pan provides polished shear surface	3
Incipient instability (tension crack, compression ridge, bulging, quaking bog)	Failures are likely to occur where incipient failure morphology is observed	3
Undrained intact planar peat	Failures are most frequently recorded in intact peat, planar peat	2
Diffuse natural drainage / pool / flush	Failures are often associated with areas of diffuse subsurface drainage (such as flushes)	2
Pipe / Collapsed Pipe	Failures are often associated with areas of soil piping	2
Existing Peat Slide	Failures typically stabilise and do not reactivate after the initial event	1
Gullied / Dissected / Hagged / Eroded Peat / Bare Peat / Bare Ground	Failures are rarely recorded in peat fragmentated by erosion	1

[22] Dykes A. and Warburton J. (2007) Mass movements in peat: A formal classification scheme. Geomorphology 76. (Evans & Warburton, 2007

Figure 7.3.10.4 shows the distribution of geomorphology scores across the PSA Site. The results indicate there are no significant geomorphological features associated with the site and no evidence of historic peat slide failure.

1.10.5 Drainage (D)

Table 7.3.6 shows artificial drainage feature classes, their significance and related scores. Transverse / oblique drainage lines may reduce peat stability by creating lines of weakness in the peat slope and encouraging the formation of peat pipes. Review of published literature indicates that a number of peat failures have been identified which have failed over moorland grips[23]. The influence of changes in hydrology become more pronounced the more transverse the orientation of the drainage lines are relative to the overall slope.

Table 7.3.6: Drainage Feature Classes, Significance and Scores	
Significance	**Score**
Failures are sometimes reported in association with artificial drains oblique/transverse to slope	3
Failures are rarely associated with artificial drains parallel to slope	1
Neutral influence on stability	0

Figure 7.3.10.5 shows the distribution of drainage feature scores across the PSA Site. Artificial drainage within Forestry areas was observed to be parallel to the slope during site walkover surveys.

1.10.6 Forestry (F)

Table 7.3.7 shows forestry classes, their significance and related scores.

Table 7.3.7: Forestry Classes, Significance and Scores		
Forestry Class	**Significance**	**Score**
Afforested area (with mature trees), ridge and furrows oblique to slope	Peat underlying forestry stands with rows aligned oblique to slope has inter ridge cracks which are conducive to slope instability	2
Afforested area (with mature trees), ridge and furrows aligned to slope	Peat underlying forestry stands with rows aligned with slope is conducive to slope instability, but less so than where rows are aligned oblique to slope	1
Deforested area (few or no trees), ridge and furrows oblique to slope	Peat underlying deforested stands has a higher water table and more neutral buoyancy, but retains inter ridge cracks (lines of weakness) conducive to instability; alignment of cracks oblique to slope is most conducive to instability	3
Deforested area (few or no trees), ridge and furrows aligned to slope	Peat underlying deforested stands has a higher water table and more neutral buoyancy, but retains inter ridge cracks (lines of weakness), however, orientation of these cracks is less critical when aligned to slope	2
Not Afforested	Neutral influence on stability	0

Figure 7.5.10.6 shows the distribution of forestry feature scores across the PSA Site and show that areas of the PSA Site have been extensively managed for both afforested and deforested areas. In both cases it was noted that the alignment of the forestry was predominantly aligned to the slope.

1.10.7 Slope Convexity (C)

Table 7.3.8 shows profile convexity classes, significance and related scores. Convex and concave slopes (i.e. positions in a slope profile where slope gradient changes by a few degrees) can be associated with the initiation

[23] Warburton J, Holden J and Mills AJ (2004). Hydrological controls of surficial mass movements in peat

point of peat landslides. 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.

Table 7.3.8: Convexity Feature Classes, Significance and Scores		
Convexity Feature	**Significance**	**Score**
Convex Slope	Peat failures are often reported on or above convex slopes	3
Concave Slope	Peat failures are occasionally reported in association with concave slopes	1
Rectilinear Slope	Rectilinear slopes show no particular predisposition to failure, neutral influence on stability	0

Figure 7.5.10.7 shows the distribution of convexity feature scores across the PSA Site. The analysis indicates that the PSA Site mostly comprise either rectilinear slopes or are undefined. Small areas of convex and concave slopes are present, generally associated with features such as artificial drainage ditches.

1.10.8 Land use (L)

Table 7.3.9 shows land use classes, significance and related scores. A variety of land uses have been associated with peat failures which form the scoring and potential for failure.

Table 7.3.9: Land Use Feature Classes, Significance and Scores		
Land Use	**Significance**	**Score**
Cutting / Turbary	Peat failures are often associated with peat cuttings/turbary	3
Adjacent Quarrying	Failures are occasionally reported adjacent to quarries (usually as bog bursts, bog flows or peat flows)	2
Burning	Failures are rarely associated with burning though this activity may create pathways for water to the base of peat	1
Other Land Use	Failures are rarely associated with other forms of land use	0

Figure 7.5.10.7 shows the distribution of land use feature scores across the site. As stated in Section 1.2 the PSA Site has been given over to commercial forest plantation. There was no evidence of peat cutting on-site. The nearest historic quarry is located approximately 400 m to the southwest of the PSA Site.

1.10.9 Likelihood Scores

The eight contributory factor layers shown on **Figures 7.3.10.1 to 7.3.10.7** were combined in GIS software to produce likelihood scores for a peat landslide. 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, and are described in **Table 7.3.10** below.

Table 7.3.10: Likelihood Classes Derived from the Landslide Susceptibility Methodology			
Summed Contributory Factor Scores	**Typical Site Conditions Associated with Score**	**Qualitative Likelihood**	**Peat Landslide Likelihood Score**
≤6	Unmodified peat with no more than low weightings for peat depth, slope angle, underlying geology and peat morphology	Very Low	1

Table 7.3.10: Likelihood Classes Derived from the Landslide Susceptibility Methodology			
Summed Contributory Factor Scores	**Typical Site Conditions Associated with Score**	**Qualitative Likelihood**	**Peat Landslide Likelihood Score**
7-11	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
12-16	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
17-21	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 7.3.10 describes likelihood class criteria and professional judgement was used. For a factor to have a moderate or higher likelihood of a peat landslide, a likelihood score would be required equivalent to both the worst case peat depth and slope angle scores (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 12 or greater would be equivalent to at least a moderate likelihood of a peat landslide. This is considered a reasonable approach given that the maximum score attainable is 24.

Table 7.3.11 shows the risk level and required mitigation measures for the Proposed ITE/ITW infrastructure locations.

Table 7.3.11: Risk Level and Mitigation				
Proposed Infrastructure Location	**Peat Depth m (Max)**	**Slope Angle (Average)**	**Risk Level**	**Comment/Mitigation**
Pole P1	1.3	6	Low	Deep peat recorded but Low risk due to low likelihood. Refer to **Section 4** for Mitigation
Pole P2	0.0	10	Very Low	No peat recorded>0.5 m depth. No mitigation required
Pole P3	0.1	7	Very Low	No peat recorded>0.5 m depth. No mitigation required
Pole P4	1.0	10	Moderate	Deep peat to north with moderate slope angle (5-10°). Refer **Section 4** for mitigation
Pole P5	1.1	7	Moderate	Deep peat to north with moderate slope angle (5-10°). Refer **Section 4** for mitigation
Pole P6	0.4	17	Very Low	No peat recorded>0.5 m depth. No mitigation required
Pole P7	0.3	15	Very Low	No peat recorded>0.5 m depth. No mitigation required
Pole P7	0.5	12	Very Low	No peat recorded>0.5 m depth. No mitigation required

Table 7.3.11: Risk Level and Mitigation				
Proposed Infrastructure Location	**Peat Depth m (Max)**	**Slope Angle (Average)**	**Risk Level**	**Comment/Mitigation**
Tower T35A	0.5	10	Very Low	No peat recorded>0.5 m depth. No mitigation required
Tower T35B	1.9	5	Low	Deep peat recorded but Low risk due to low likelihood. Refer to **Section 4** for Mitigation
Tower T36A	0.5	7	Very Low	No peat recorded>0.5 m depth. No mitigation required
Tower T36B	0.4	7	Very Low	No peat recorded>0.5 m depth. No mitigation required
Permanent Access Track	0.5	Variable	Very Low	No peat recorded >0.5 m based on interpolated peat depth data. If isolated pockets of deep peat is encountered then mitigation measures will be required to minimise disturbance of peat. This could include micrositing or use of floating track construction (refer to **Section 4**).

1.11 Results

The results of the Peat Slide Likelihood are shown on **Figure 7.3.11** and indicate that the majority of the PSA Site is considered to be of 'low' or 'very low' likelihood of a peat landslide. Two areas of moderate risk are highlights at Temporary pole P4 and P5 locations. However when assessed against the Factor of Safety results then both areas are shown to be stable.

In order for there to be a "High" or "Medium" risk associated with the Proposed Development, combined peat landslide likelihood must be "Moderate" or higher at an infrastructure location, as defined by Scottish Government Best Practice Guidance[5].

Where combined peat landslide likelihoods are assessed as "Low" or "Very Low", post-consent site investigations and application of good practice construction mitigation methods should be employed prior to and during construction as detailed in Section 1.12 below.

1.12 Consequence Evaluation

Based on the assessment of consequence of risk methodology, as defined by best practice Guidance, three receptors have been identified at the Site, and are assessed for consequence in **Table 7.3.12** below:

- watercourses;
- non-riverine habitats; and
- Proposed Development infrastructure

Table 7.3.12: Assessment of Consequence and Risk				
Receptor	**Consequence**	**Score**	**Justification for Score**	**Consequence Scale**
Watercourses	Increased turbidity and acidification, fish kill, blockage of drainage, effects on private water supplies	3	Water Quality, Flood risk and Private water supplies have been assessed within **Chapter**	High

Table 7.3.12: Assessment of Consequence and Risk				
Receptor	**Consequence**	**Score**	**Justification for Score**	**Consequence Scale**
			7:Hydrology and Geology, Volume 1.	
Non-riverine Habitats	Medium term loss of vegetation cover, disruption of peat hydrology, carbon release	3	Effects on peatland habitats, though the effects of peat landslides are generally short in duration	High
Proposed Development Infrastructure	Damage to infrastructure, possible injury, loss of life	5	Loss of life, though unlikely, is a severe consequence; financial implications of damage and repair to infrastructure are less significant	Extremely high

shows how the Risk Level is defined for each of the consequences when applied to Low or Very Low likelihood classification which is considered applicable for the Site.

Table 7.3.13: Risk levels derived from Likelihood vs Consequence				
Receptor	**Qualitative Likelihood (See Table 7.3.11)**	**Consequence Scale/ Score (See Table 7.3.12)**	**Risk Level**	**Minimum Distance to Receptor**
Watercourses	Low (2)	High (3)	Low	50m
Non-riverine Habitats	Low (2)	High (3)	Low	50m
Proposed Development Infrastructure	Low (2)	Extremely High (5)	Low	Approx 1.7km (Tullich Farm)

Based on the combined Qualitative Likelihood vs Consequence and the findings within the FoS assessment previously outlined, it is considered that the combined risk level of peat landslide in association with the construction of the Proposed Development is assessed as being Low risk. This assessment of Risk level is based on low likelihood vs high or very high consequence as outlined in Table 5.3 of SEPA best practice guidance**Error! Bookmark not defined.** and illustrated in the Image 1-1 extract below.

Table 5.3 Indicative risk levels

		Adverse consequence				
		Extremely High	**High**	**Moderate**	**Low**	**Very Low**
Peat landslide probability or likelihood	Almost certain	High	High	Moderate	Moderate	Low
	Probable	High	Moderate	Moderate	Low	Negligible
	Likely	Moderate	Moderate	Low	Low	Negligible
	Unlikely	Low	Low	Low	Negligible	Negligible
	Negligible	Low	Negligible	Negligible	Negligible	Negligible

Image 1-1 Table 5.3: Extract from Scottish Government (2017). Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments

1.13 Peat Slide Risk Assessment and Mitigation

A comprehensive intrusive geotechnical investigation should be undertaken post-consent to support the engineering design of the substation platform. The peat present within the foundation footprint of the proposed tower location, and re-used in accordance with the recommendations within the Peat Management Plan.

Appropriate field and laboratory testing would also be undertaken as part of the comprehensive ground investigation to confirm the peat stability baseline within the wider PSA Site to cover the areas affected by the tracks and ancillary infrastructure, and further design mitigation used as appropriate to reduce the likelihood of peat instability (where required).

A geotechnical risk register would be prepared detailing any ground risks identified during the ground investigation and providing mitigation measures as appropriate. The risk register should be considered a live document and updated throughout the phases of the Proposed Development. The monitoring requirements discussed in the following paragraphs would be undertaken by the Applicant's contractor.

During construction of the Proposed Development the following mitigation would be undertaken for excavations:

- a geotechnical risk register would be prepared for the Proposed Development following intrusive investigations post consent and location specific stability analyses;
- site inspections and audits would be undertaken at scheduled intervals 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 would be overseen by an appropriately qualified geotechnical engineer with experience of construction on peat sites;
- awareness of peat instability and pre-failure indicators would be incorporated in site induction, tool box talks, and training to enable all site personnel to recognise ground disturbances and features indicative of incipient instability;
- monitoring checklists would be prepared with respect to peat instability addressing all construction activities forming the Proposed Development;
- use of appropriate supporting structures around peat excavations where required (e.g. for the Tower Foundations) 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; and
- minimise the effects of construction on natural drainage by ensuring natural drainage pathways are maintained or diverted such that there is no significant alteration of the hydrological regime of the site; 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).

During construction of the Proposed Development the following mitigation would be undertaken for excavated tracks:

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

The proposed construction methodology for the proposed pole locations will comprise limited excavation at each proposed pole location using conventional plant vehicles.

It is envisaged that employing safe working practices, such as excavation supports, and limiting the duration of open excavations during construction will reduce the potential for peat instability.

During construction of the Proposed Development the measures outlined within a Detailed Peat Management would be implemented, and the following mitigation would be undertaken for temporary storage of peat and restoration activities:

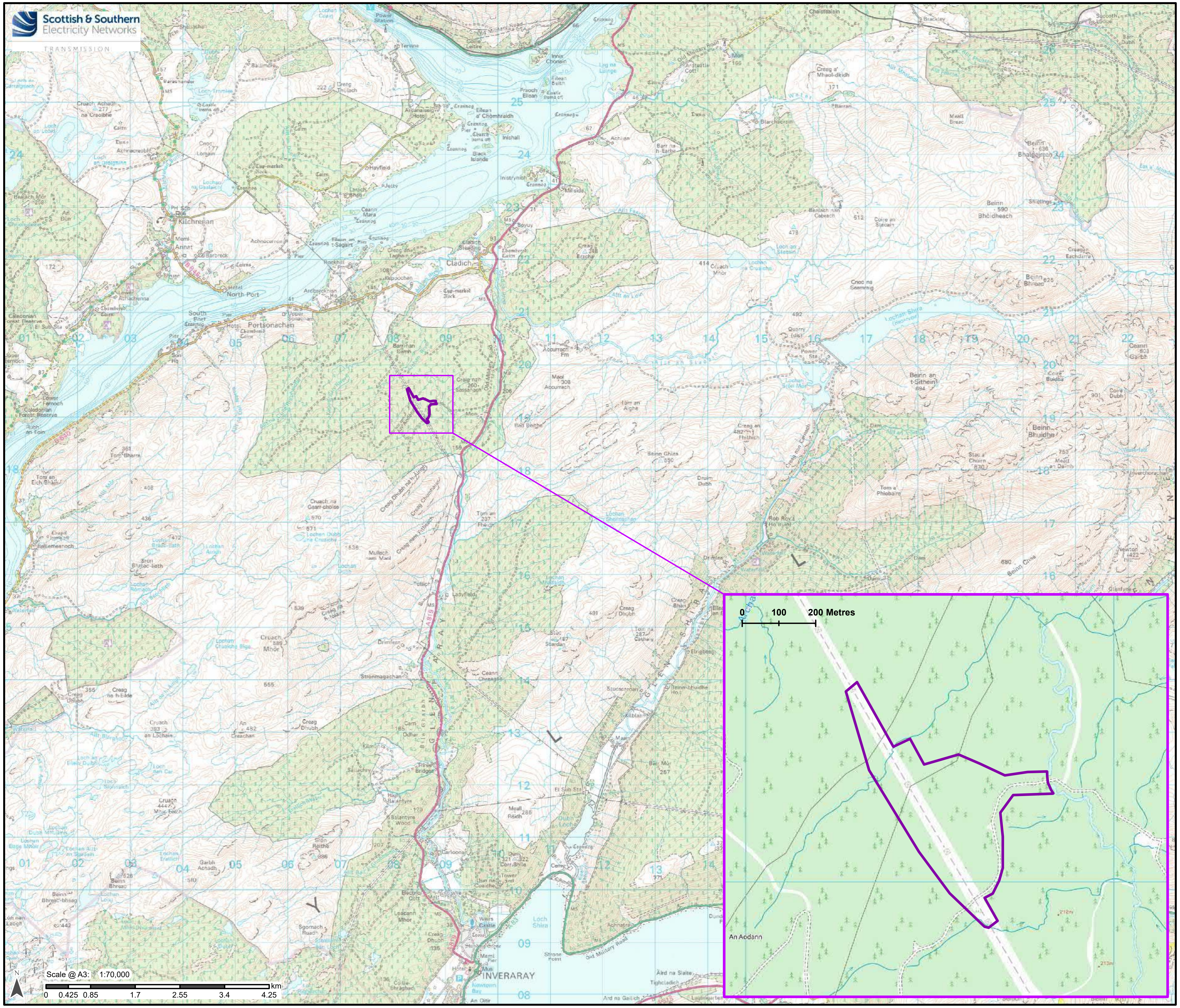
- where practicable, ensure temporary stores of peat are located on non-peat soils to minimise potential for instability of the underlying soils;
- avoid storing peat on slope gradients >3° and preferably store on ground with neutral slopes and natural downslope barriers to peat movement; and
- monitor effects of wetting / re-wetting stored peat on surrounding peat areas, and prevent water build up on the upslope side of peat mounds.

1.14 Conclusion

The majority of the Site is considered to be low or very low risk with regards to peat slide risk.

Where areas of moderate risk have been identified then micrositing of pole locations away from areas of deep peat is considered best practice.

FIGURES



Legend

Peat Study Area

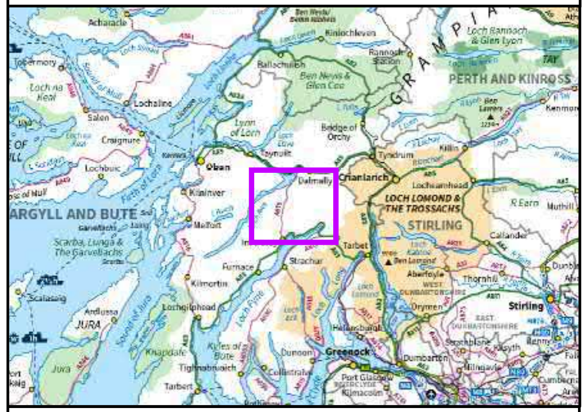


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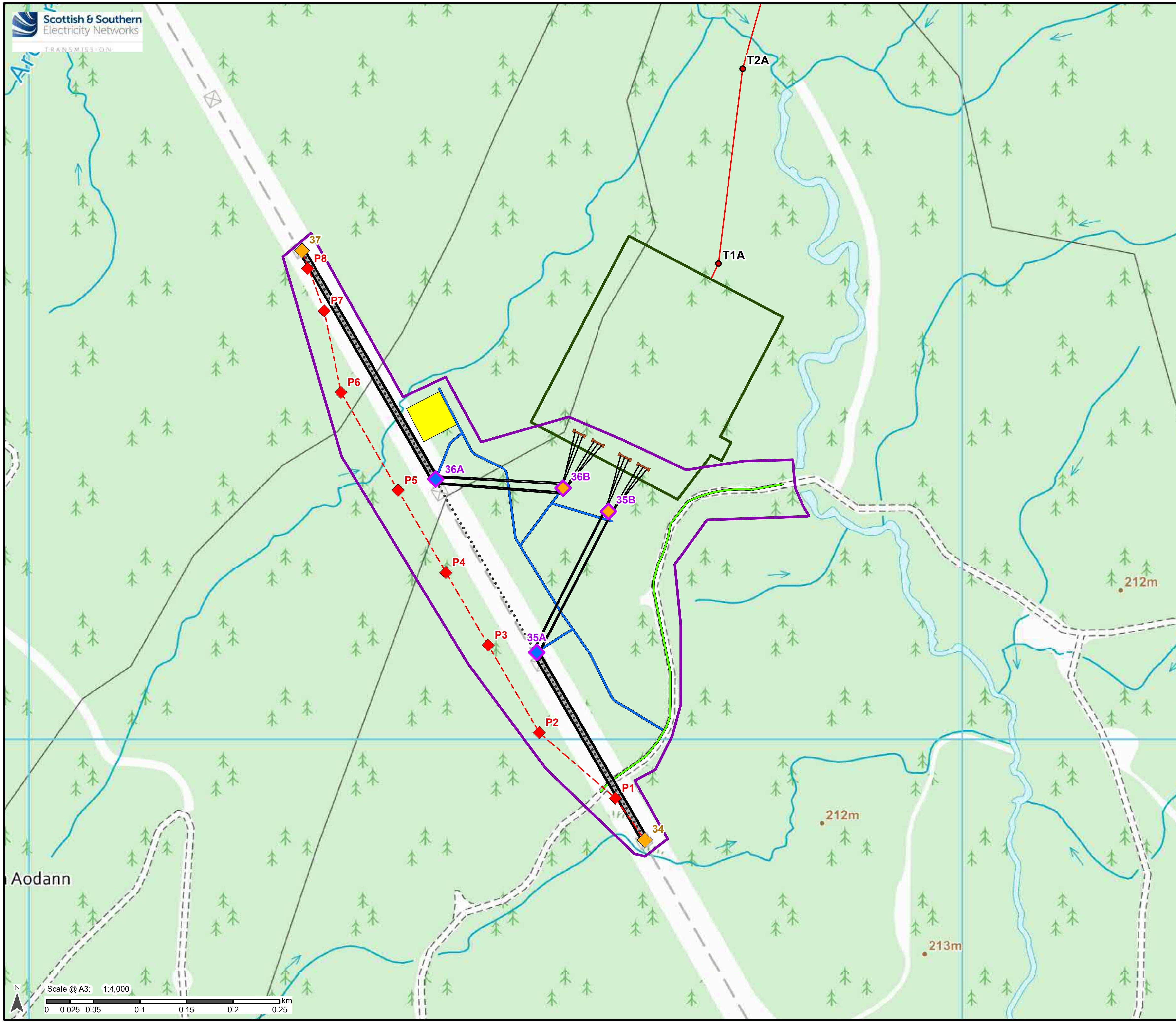
Figure 7.3.1: Peat Landslide Hazard and Risk Assessment: Peat Study Area

Drawn by: AB

Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.1_PeatStudyArea_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
- Proposed Temporary Diversion Route
- Proposed Temporary Diversion Poles
- Access Tracks - Existing Upgrade
- Access Tracks - New Stone Permanent
- Turning Head
- Peat Study Area

Existing Inveraray to Taynuilt OHL

- Existing Connection
- Section of Existing OHL to be Removed
- Existing Towers

Wider Argyll and Kintyre 275 kV Strategy

- Proposed Creag Dhubh to Dalmally 275kV Connection Towers
- Proposed Creag Dhubh to Dalmally 275kV Connection
- Proposed Creag Dhubh Substation

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Figure 7.3.2: Peat Landslide Hazard and Risk Assessment: Proposed Development Layout

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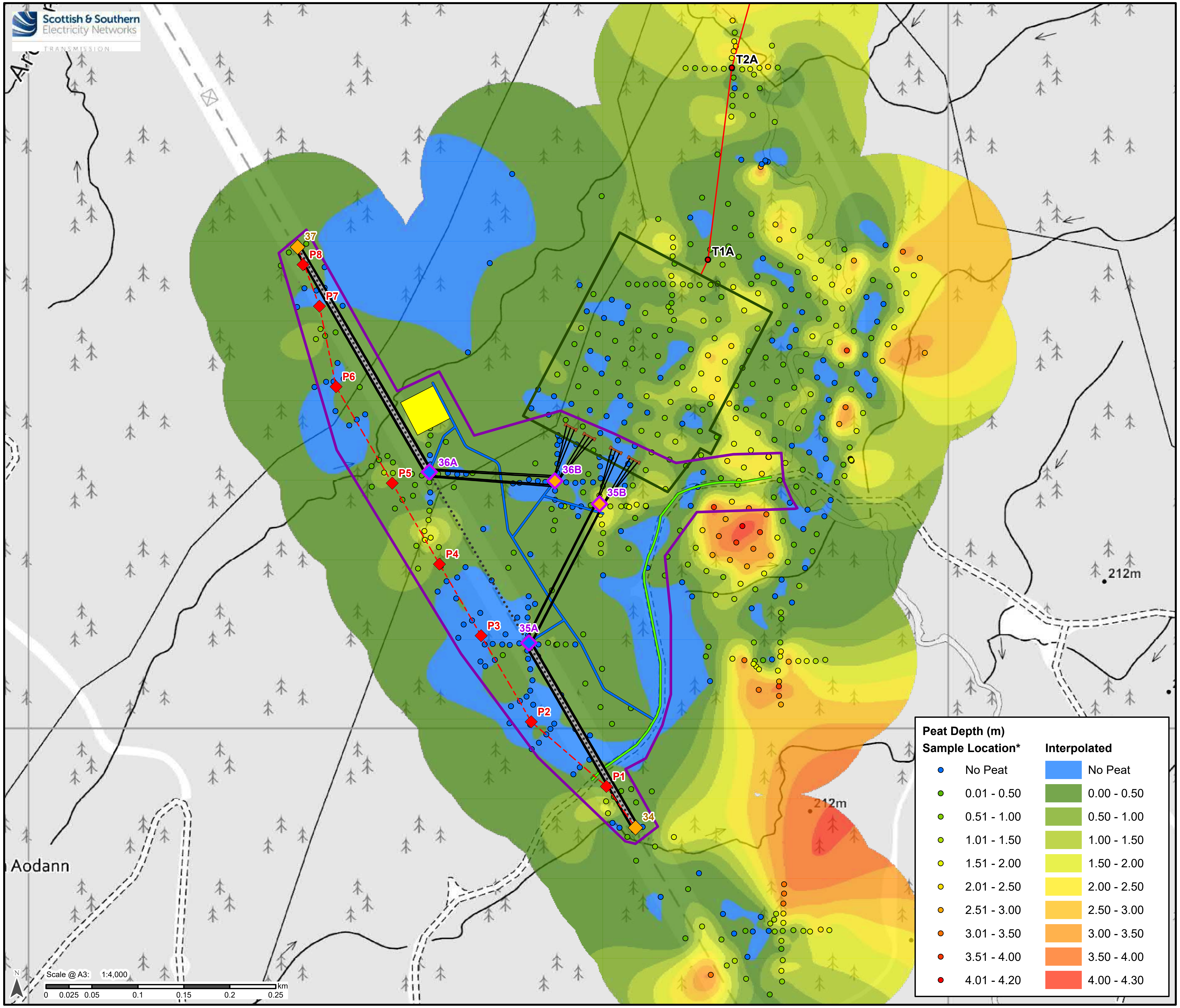
Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.2_ProposedDev_B



Peat Depth (m)

Sample Location*		Interpolated	
	No Peat		No Peat
	0.01 - 0.50		0.00 - 0.50
	0.51 - 1.00		0.50 - 1.00
	1.01 - 1.50		1.00 - 1.50
	1.51 - 2.00		1.50 - 2.00
	2.01 - 2.50		2.00 - 2.50
	2.51 - 3.00		2.50 - 3.00
	3.01 - 3.50		3.00 - 3.50
	3.51 - 4.00		3.50 - 4.00
	4.01 - 4.20		4.00 - 4.30

Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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- Proposed Temporary Diversion Poles
- Access Tracks - Existing Upgrade
- Access Tracks - New Stone Permanent
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Existing Inveraray to Taynuilt OHL

- Existing Connection
- Section of Existing OHL to be Removed
- Existing Towers

Wider Argyll and Kintyre 275 kV Strategy

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- Proposed Creag Dhubh Substation

*Peat data outwith the Study Area is shown to provide a greater understanding of the nature of peat in the wider area.

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Figure 7.3.3: Peat Landslide Hazard and Risk Assessment: Peat Depth

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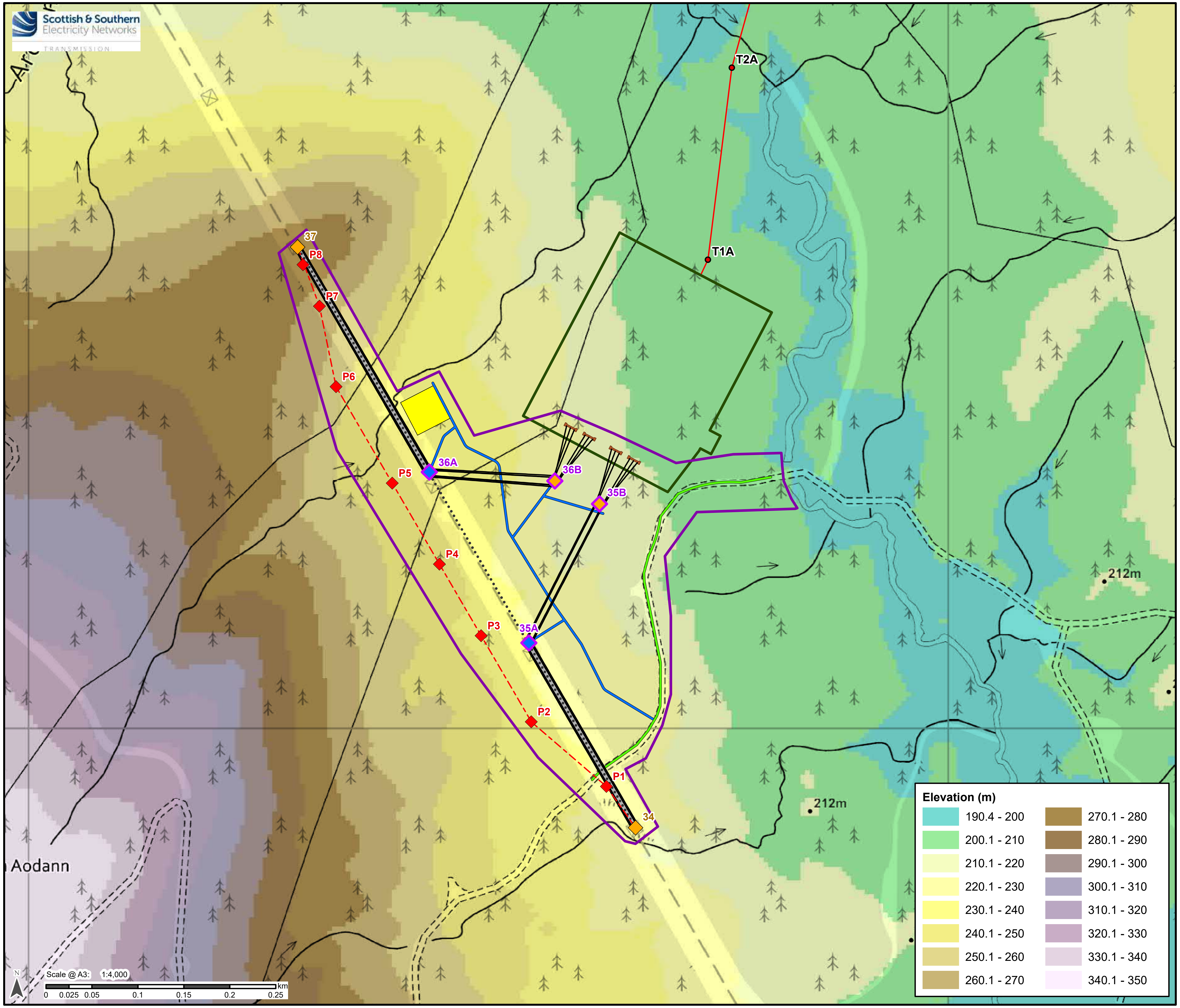
Drawing: R170_3673_ITEITW_Fig7.3.3_PeatDepth_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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- Peat Study Area

Existing Inveraray to Taynuilt OHL

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- Section of Existing OHL to be Removed
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Wider Argyll and Kintyre 275 kV Strategy

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Figure 7.3.4: Peat Landslide Hazard and Risk Assessment: Elevation

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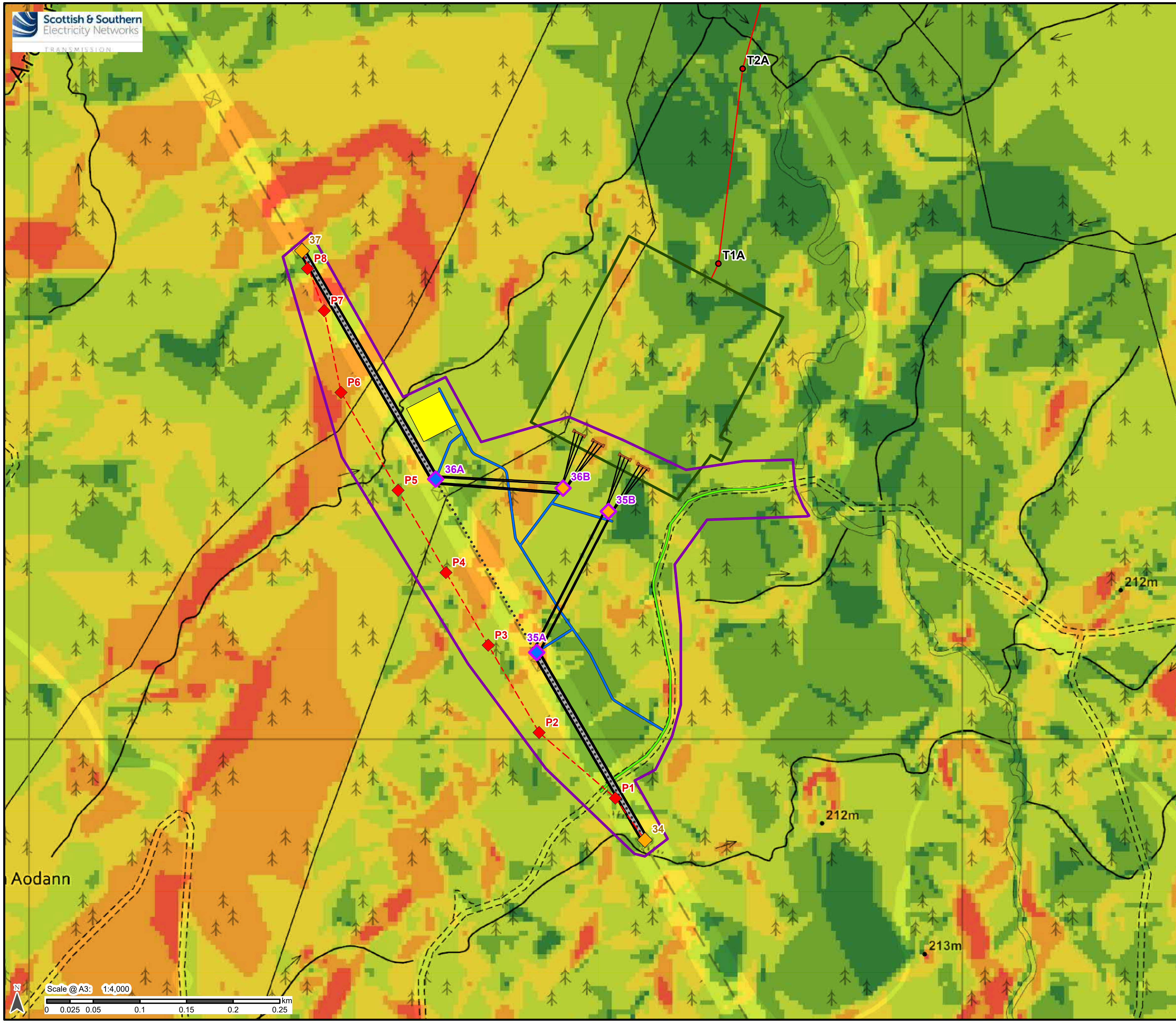

Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
- Proposed Temporary Diversion Route
- Proposed Temporary Diversion Poles
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- Access Tracks - New Stone Permanent
- Turning Head
- Peat Study Area

Existing Inveraray to Taynuilt OHL

- Existing Connection
- Section of Existing OHL to be Removed
- Existing Towers

Wider Argyll and Kintyre 275 kV Strategy

- Proposed Creag Dhubh to Dalmally 275kV Connection Towers
- Proposed Creag Dhubh to Dalmally 275kV Connection
- Proposed Creag Dhubh Substation

Slope Angle (Degrees)

- 0.1 - 2
- 2.1 - 5
- 5.1 - 10
- 10.1 - 15
- 15.1 - 20
- >20

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Figure 7.3.5: Peat Landslide Hazard and Risk Assessment: Slope Angle

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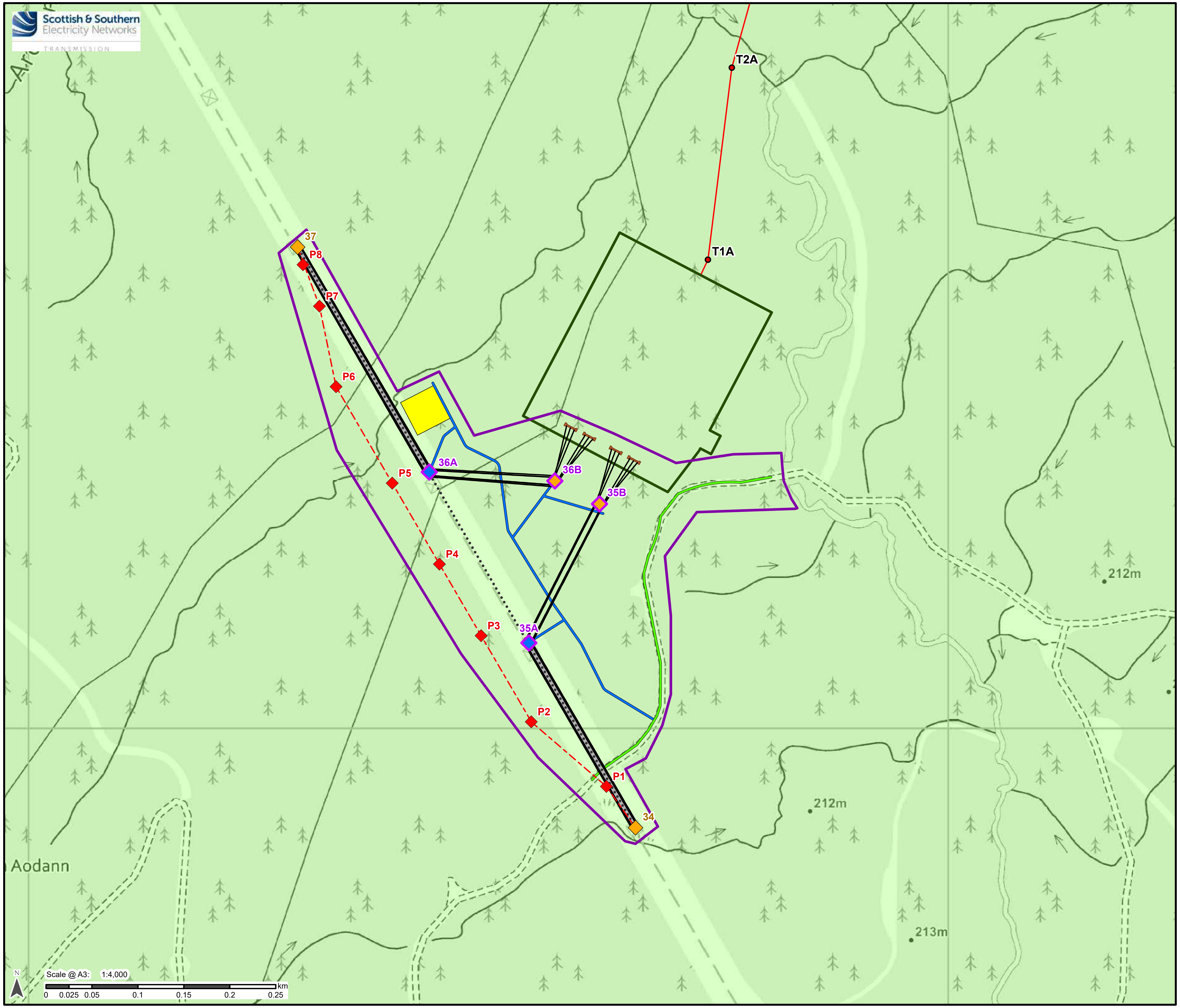
Drawing: R170_3673_ITEITW_Fig7.3.5_SlopeAngle_B



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Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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- Peat Study Area

Existing Inveraray to Taynuilt OHL

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Wider Argyll and Kintyre 275 kV Strategy

- Proposed Creag Dhubh to Dalmally 275kV Connection Towers
- Proposed Creag Dhubh to Dalmally 275kV Connection
- Proposed Creag Dhubh Substation

BGS Bedrock Geology 50k

- Tayvallich Volcanic Formation - Metalava and Metatuff

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Project: 1700003673

Title:
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Figure 7.3.6: Peat Landslide Hazard and Risk Assessment: Bedrock Geology

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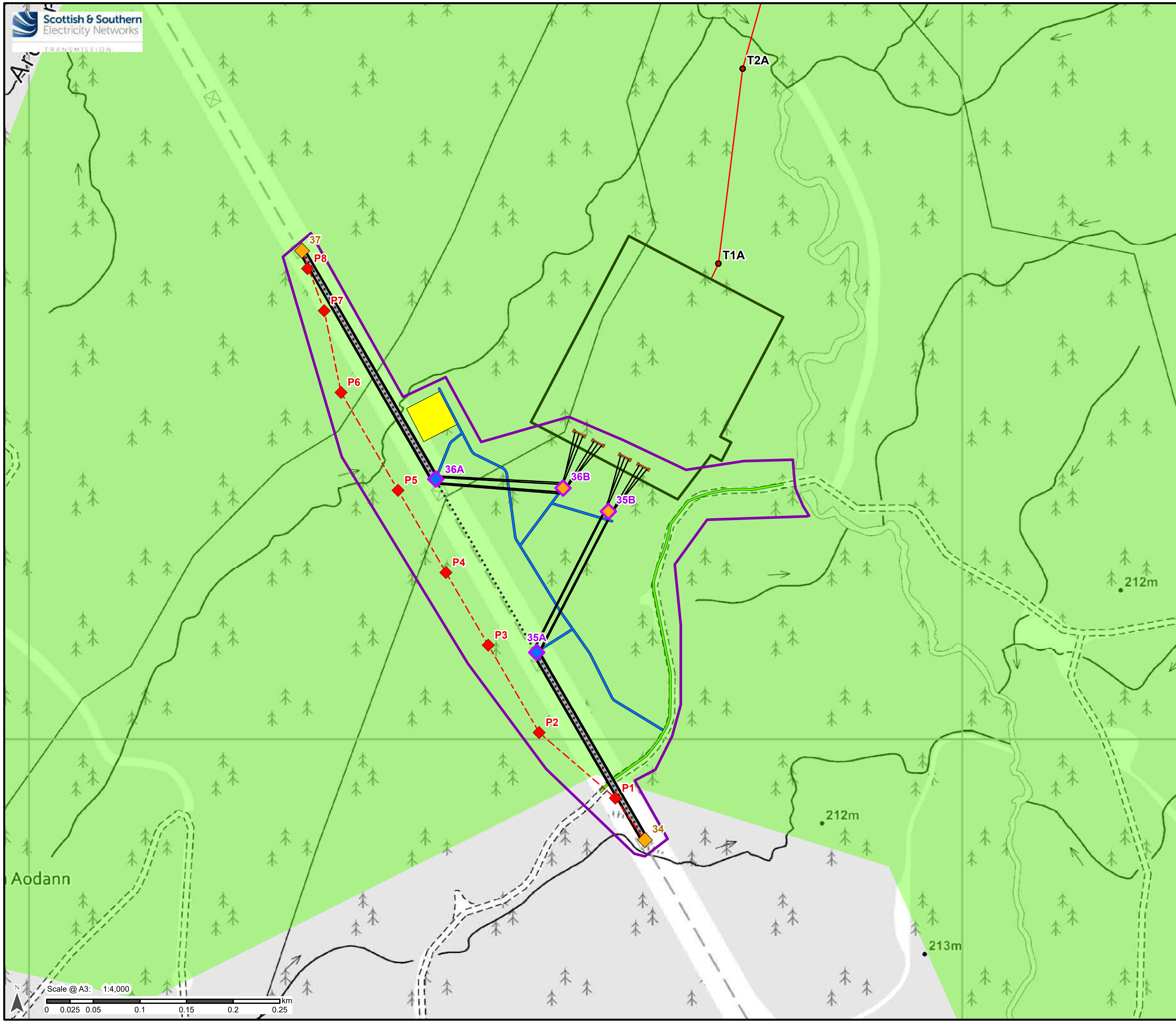

Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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Existing Inveraray to Taynuilt OHL

- Existing Connection
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- Existing Towers

Wider Argyll and Kintyre 275 kV Strategy

- Proposed Creag Dhubh to Dalmally 275kV Connection Towers
- Proposed Creag Dhubh to Dalmally 275kV Connection
- Proposed Creag Dhubh Substation

Superficial Geology (BGS 625k)

- Till

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Project: 1700003673

Title:
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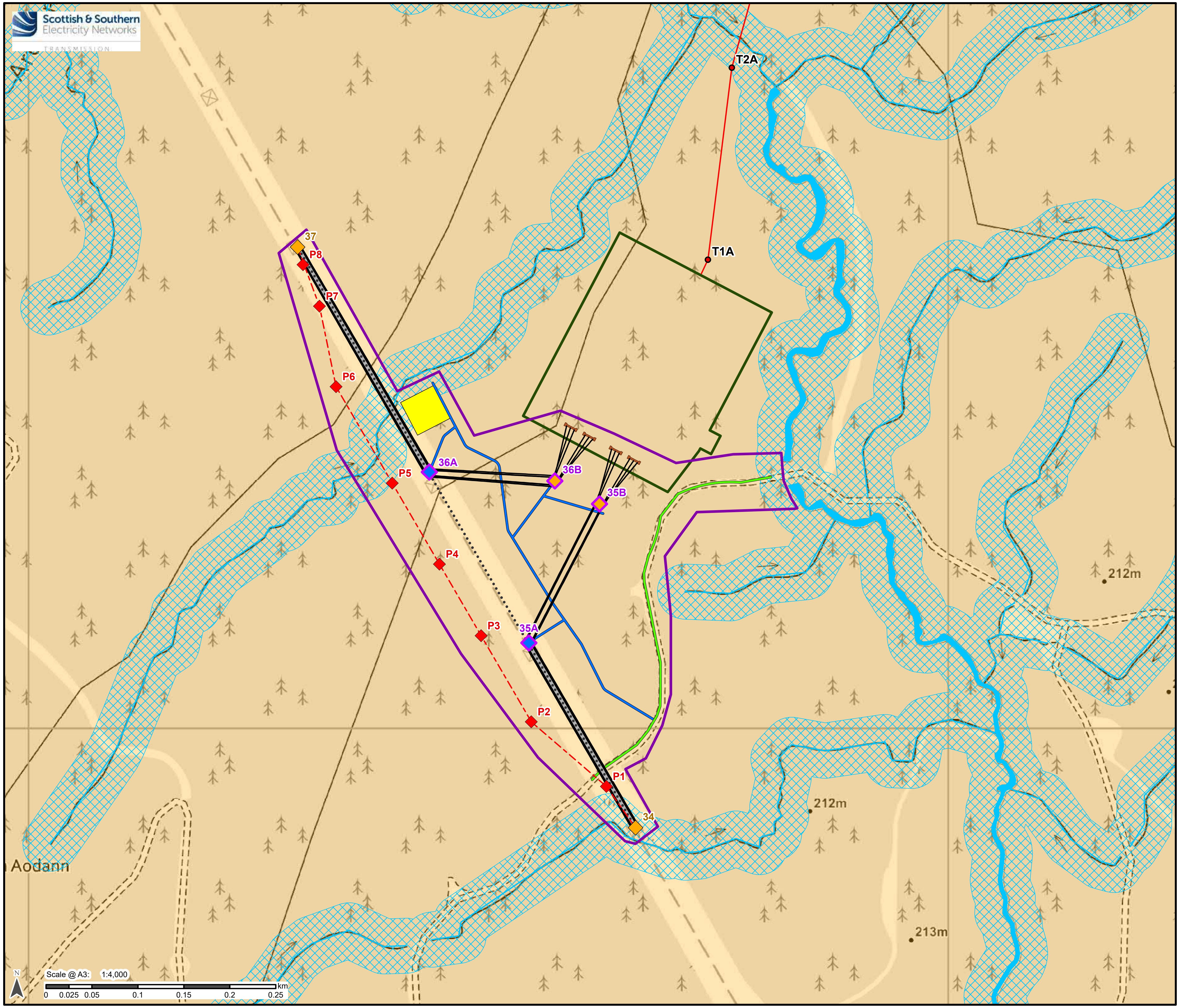
Figure 7.3.7: Peat Landslide Hazard and Risk Assessment: Superficial Geology

Drawn by: AB Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.7_SuperficialGeology_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
- Proposed Temporary Diversion Route
- Proposed Temporary Diversion Poles
- Access Tracks - Existing Upgrade
- Access Tracks - New Stone Permanent
- Turning Head
- Peat Study Area

Existing Inveraray to Taynuilt OHL

- Existing Connection
- Section of Existing OHL to be Removed
- Existing Towers

Wider Argyll and Kintyre 275 kV Strategy

- Proposed Creag Dhubh to Dalmally 275kV Connection Towers
- Proposed Creag Dhubh to Dalmally 275kV Connection
- Proposed Creag Dhubh Substation

Hydrology

- Watercourse
- Waterbody
- Surface Water Buffer (30m)

Hydrogeology 625k - Rock Unit

- 2C,Unnamed Extrusive Rocks, Neoproterozoic

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Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.8: Peat Landslide Hazard and Risk Assessment: Geomorphology and Hydrology

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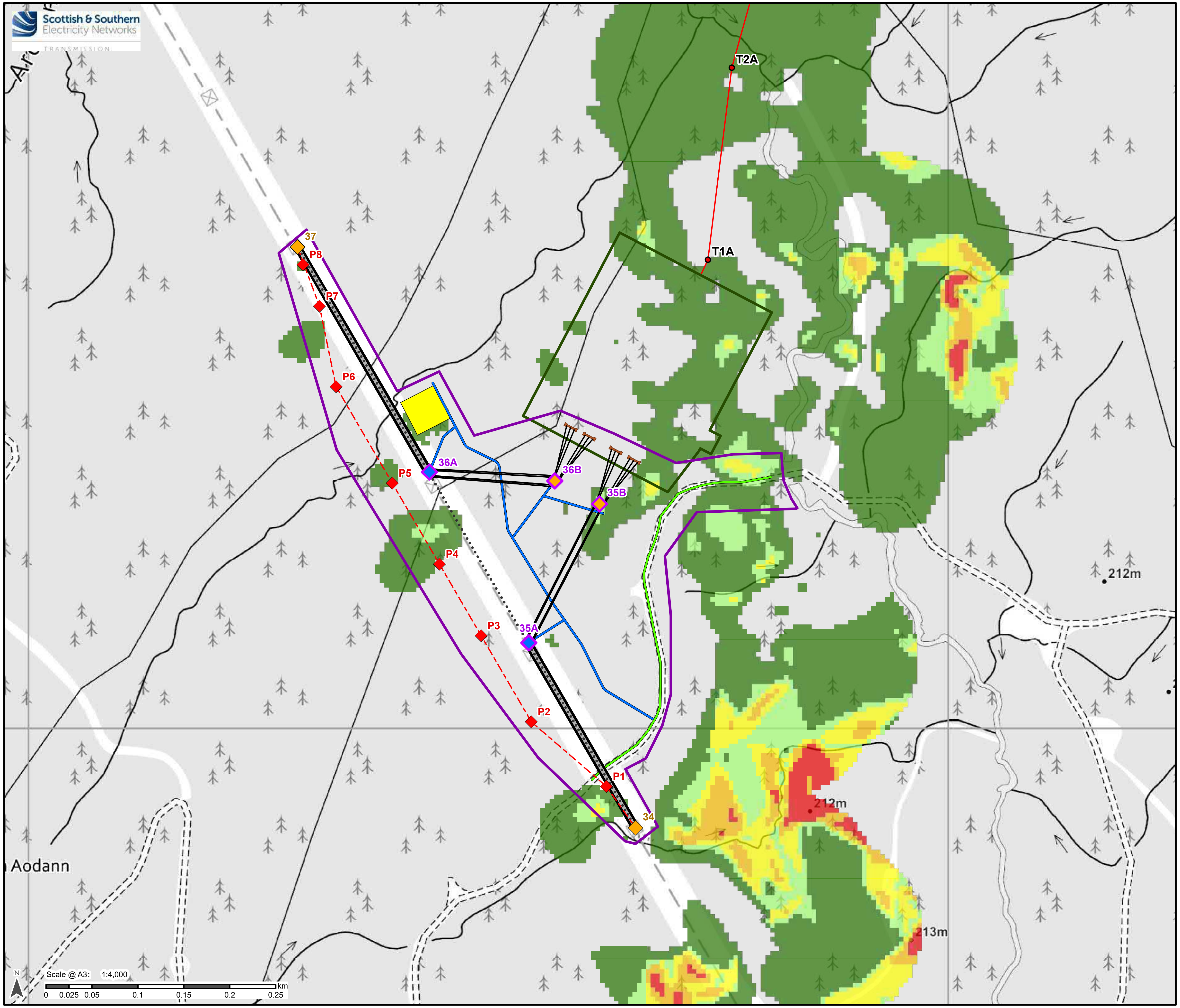
Drawing: R170_3673_ITEITW_Fig7.3.8_GeomorphAndHydro_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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Wider Argyll and Kintyre 275 kV Strategy

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Factor of Safety

- < 1.0 (unstable)
- 1.0 - 1.4 (marginally unstable)
- 1.4 - 2.0 (stable)
- 2.0 - 3.0 (stable)
- > 3.0 (stable)

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Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.9: Peat Landslide Hazard and Risk Assessment: Factor of Safety

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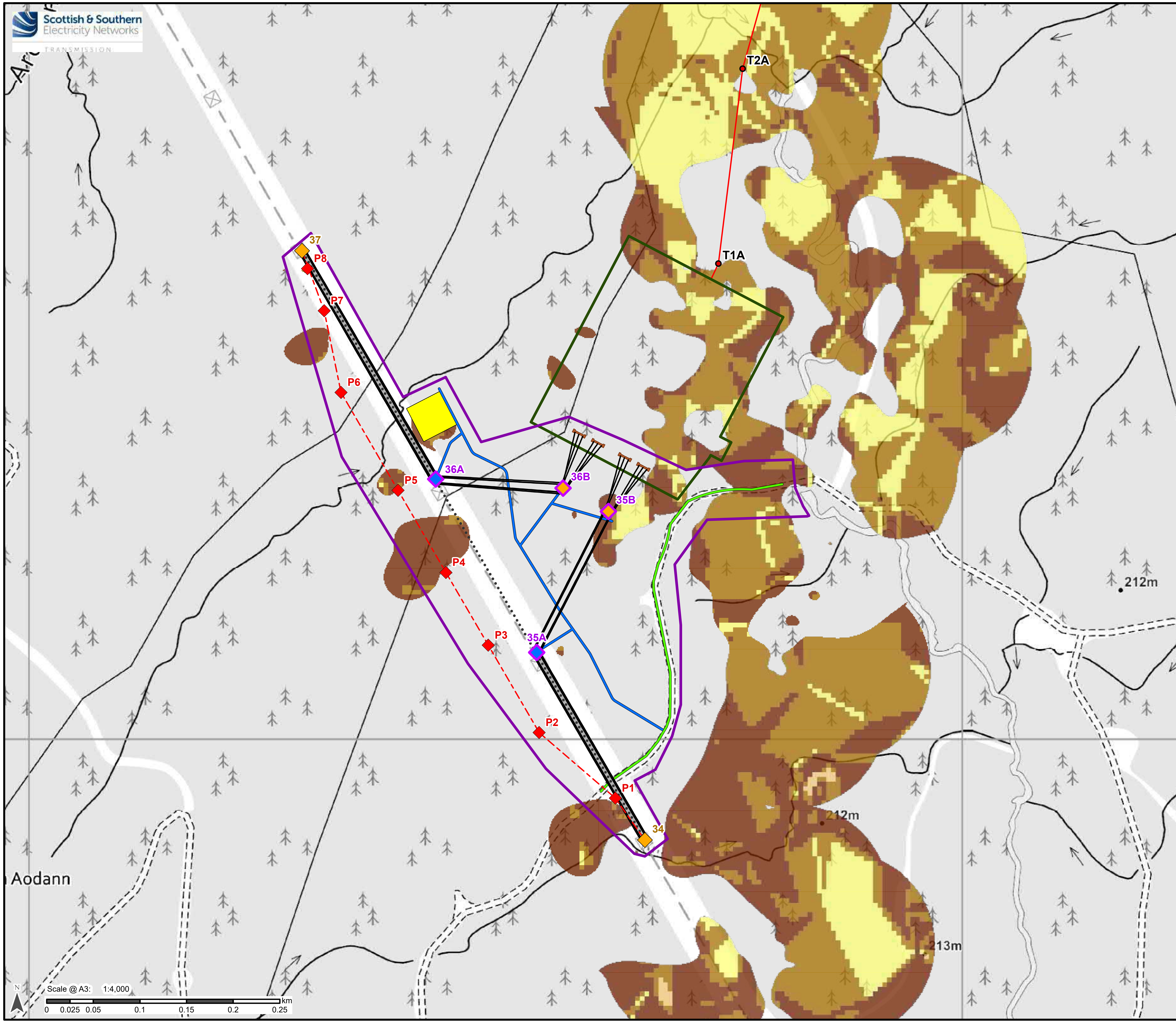
Drawing: R170_3673_ITEITW_Fig7.3.9_FactorOfSafety_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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Slope Angle Scores (S)

- Score 0: <= 2 deg
- Score 1: >20 deg
- Score 2: 2 - 5 deg and 15 - 20 deg
- Score 3: 5 - 15 deg

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Project: 1700003673

Title:
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Figure 7.3.10.1: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Slope Score

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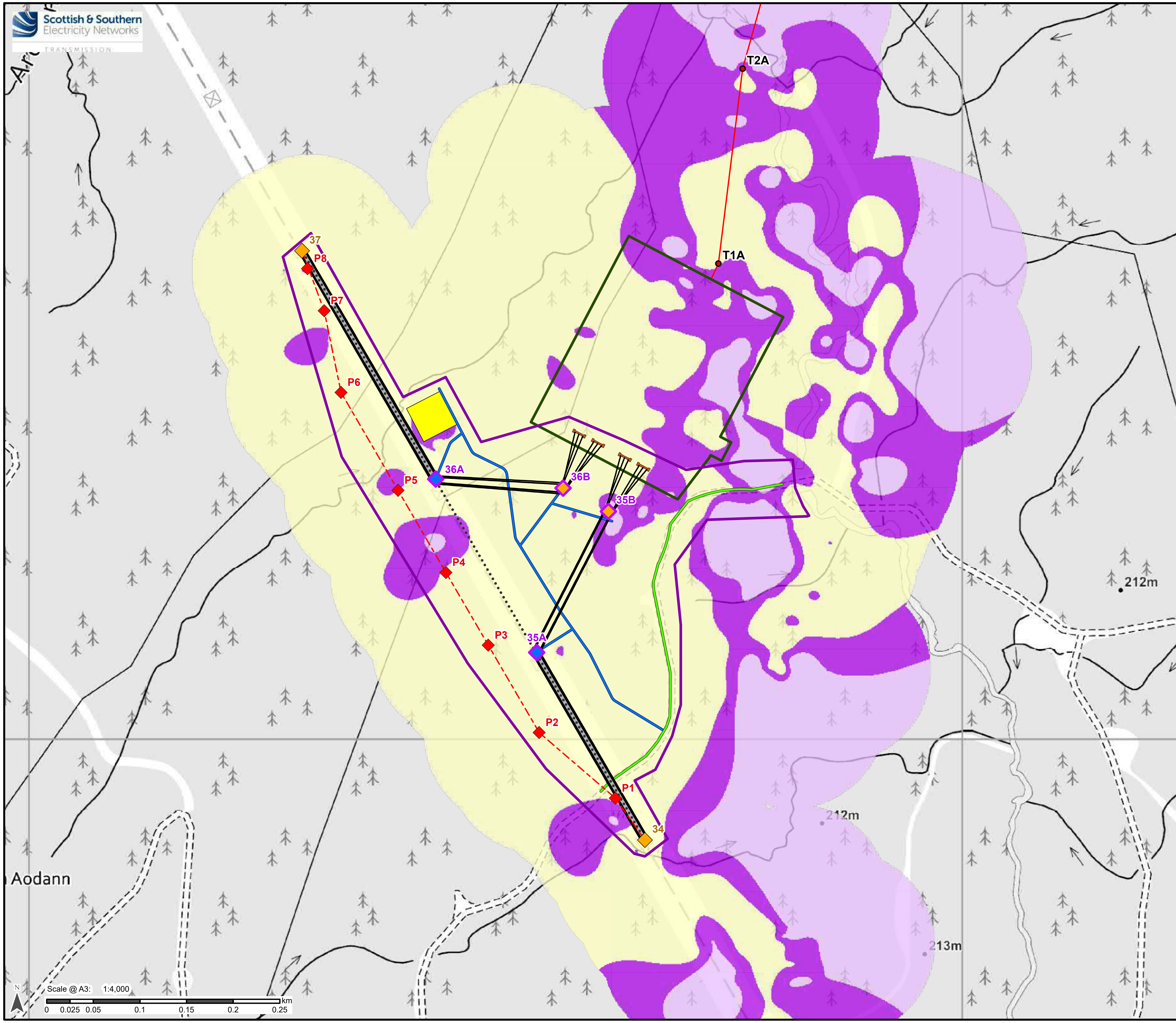
Drawing: R170_3673_ITEITW_Fig7.3.10.1_ContribFactSlope_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
- New Angle Towers to Replace Existing Online Towers
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Existing Inveraray to Taynuilt OHL

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Wider Argyll and Kintyre 275 kV Strategy

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- Proposed Creag Dhubh to Dalmally 275kV Connection
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Peat Depth Scores (P)

- Score 1: < 0.5 m
- Score 2: >1.5 m
- Score 3: 0.5 - 1.5 m

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Project: 1700003673

Title:

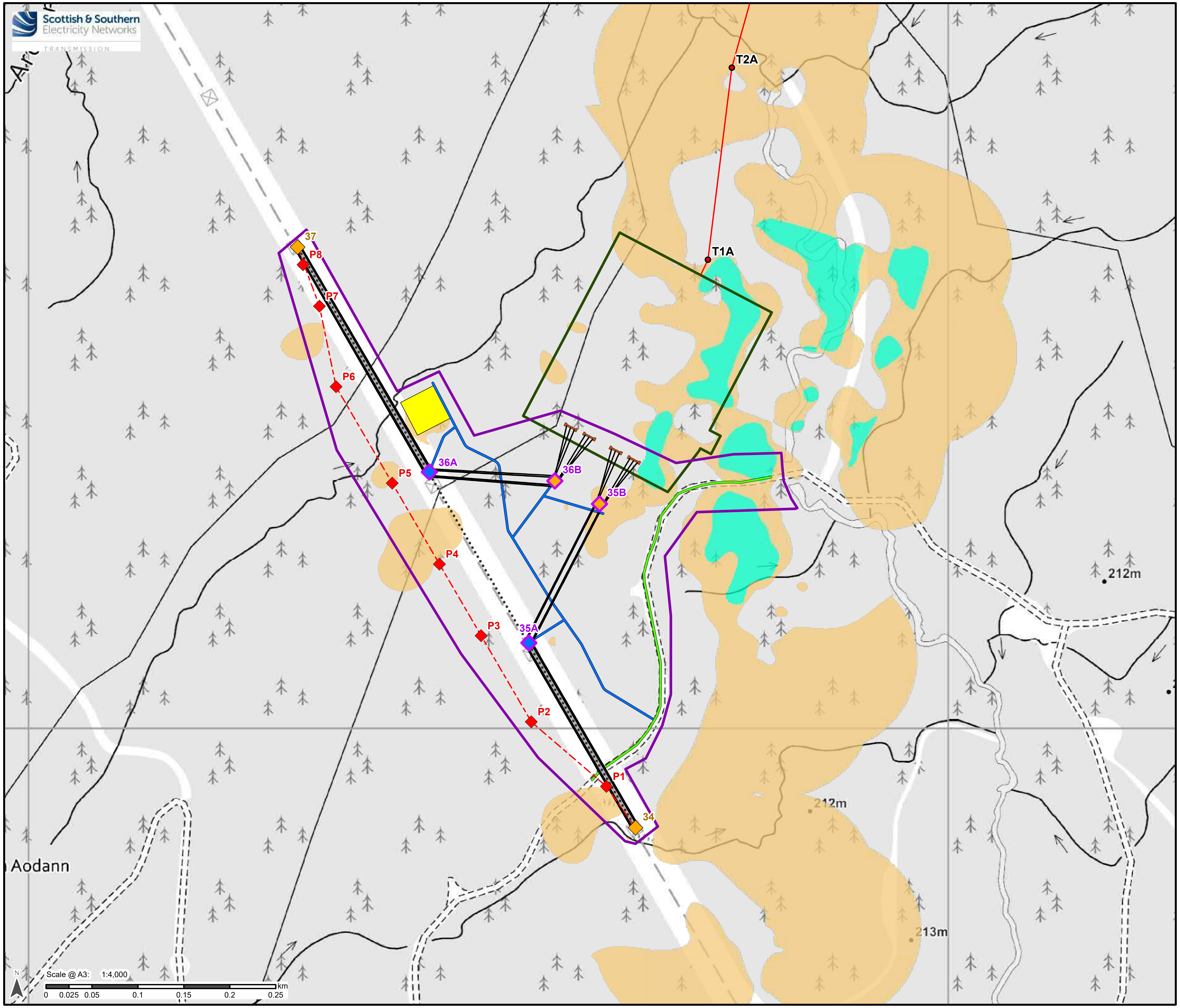
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.2: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Peat Depth Score

Drawn by: AB

Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.10.2_ContribFactPeat_B



Legend

Proposed Development

- Proposed Tie-In
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- Proposed Terminal Towers
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Existing Inveraray to Taynuilt OHL

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Wider Argyll and Kintyre 275 kV Strategy

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Substrate Geology Scores (G)

- Score 1: Impermeable Bedrock
- Score 2: Glacial Till

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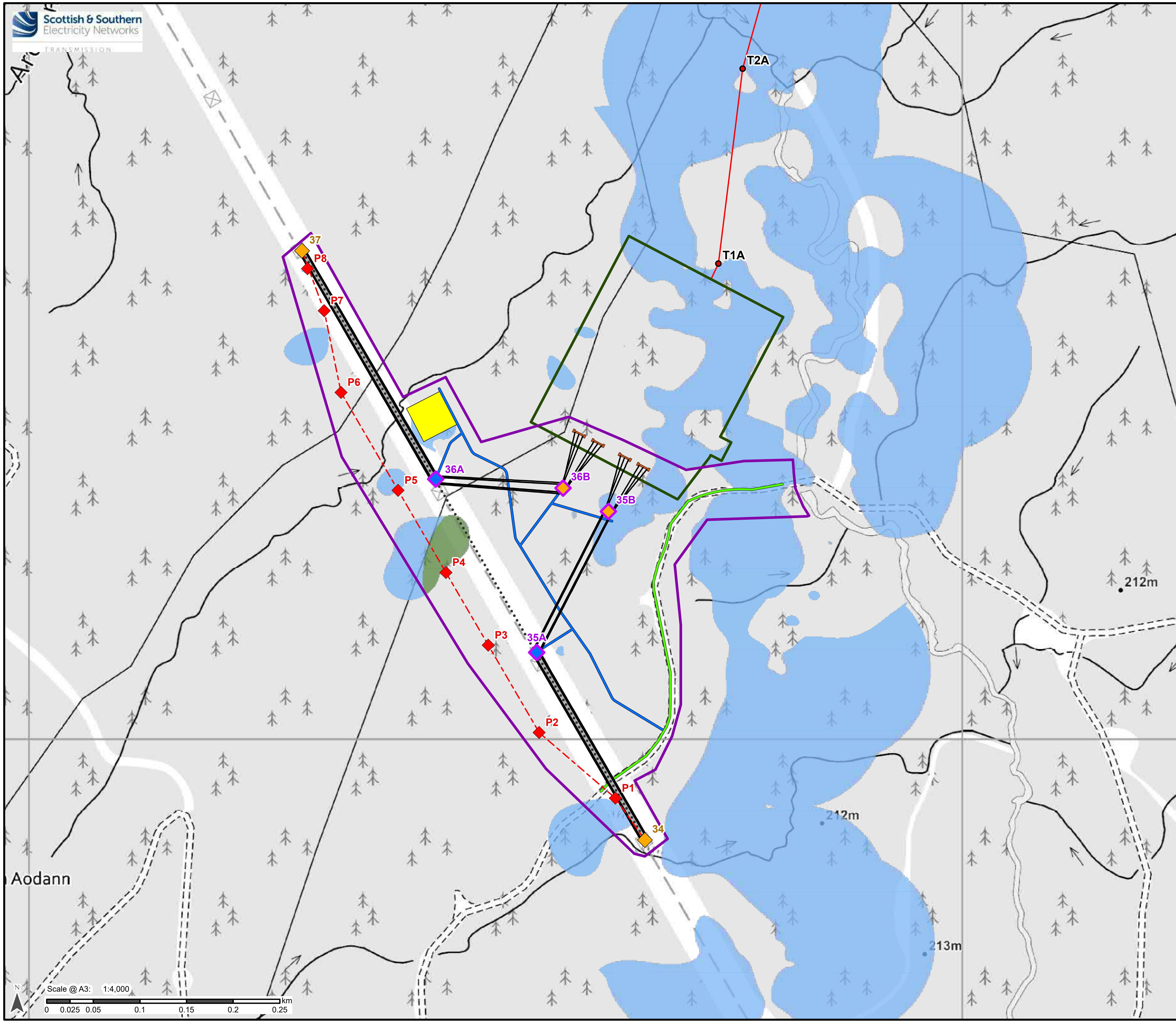
Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.3: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Substrate Geology Score

Drawn by: AB
Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.10.3_ContribFactSubstGeo_B



Legend

Proposed Development

- Proposed Tie-In
- Proposed Tie-In - Gantries
- Proposed Terminal Towers
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Existing Inveraray to Taynuilt OHL

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Peat geomorphology scores (M)

- Score 0: No peat
- Score 2: Flush/diffuse natural

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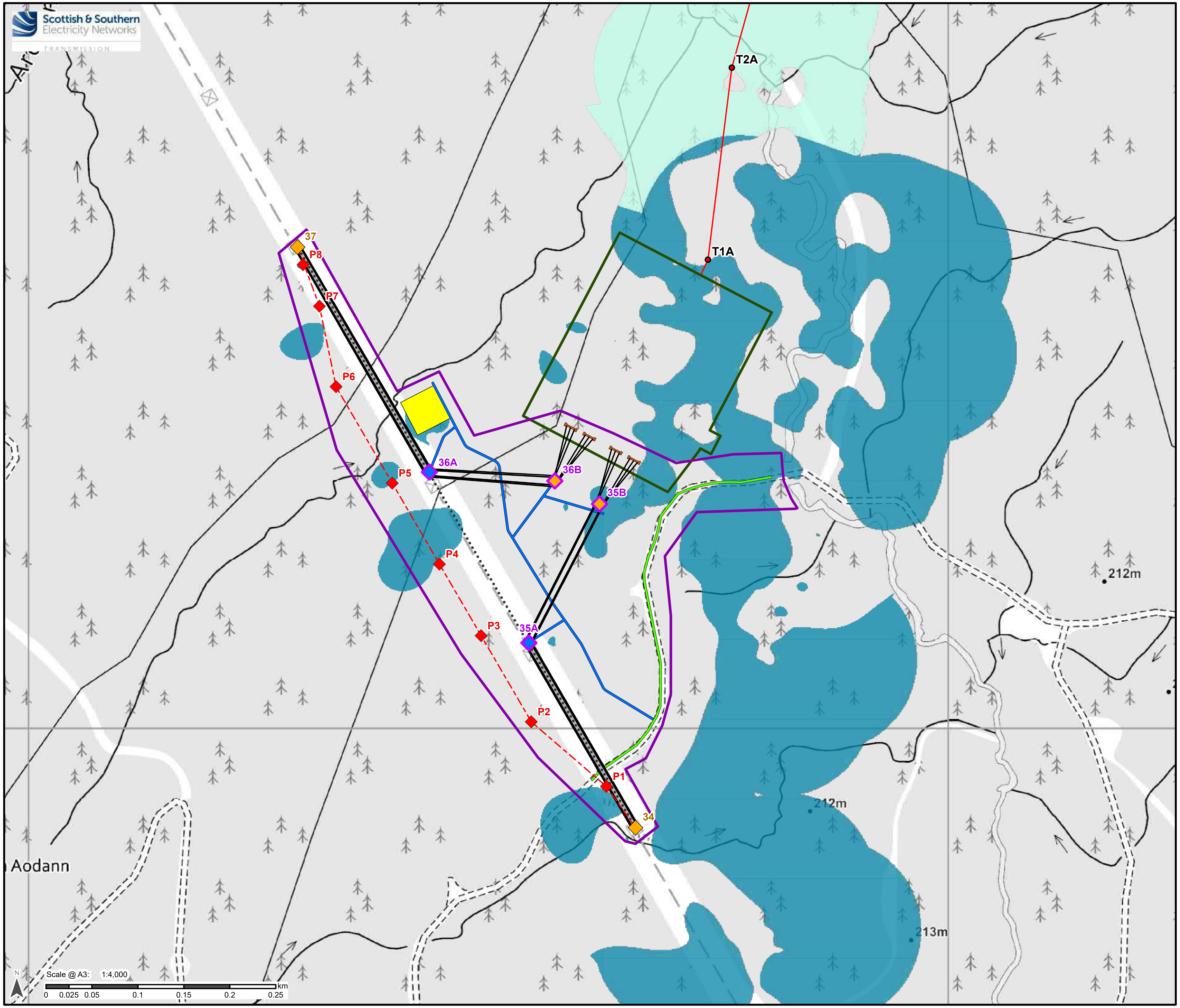
Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.4: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Peat Geomorphology Score

Drawn by: AB   Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.10.4_ContribFactGeomorph_B



Legend

Proposed Development

- Proposed Tie-In
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Existing Inveraray to Taynuilt OHL

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Drainage Scores (D)

- Score 0: No drainage lines
- Score 1: Drain aligned to slope

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Project: 1700003673

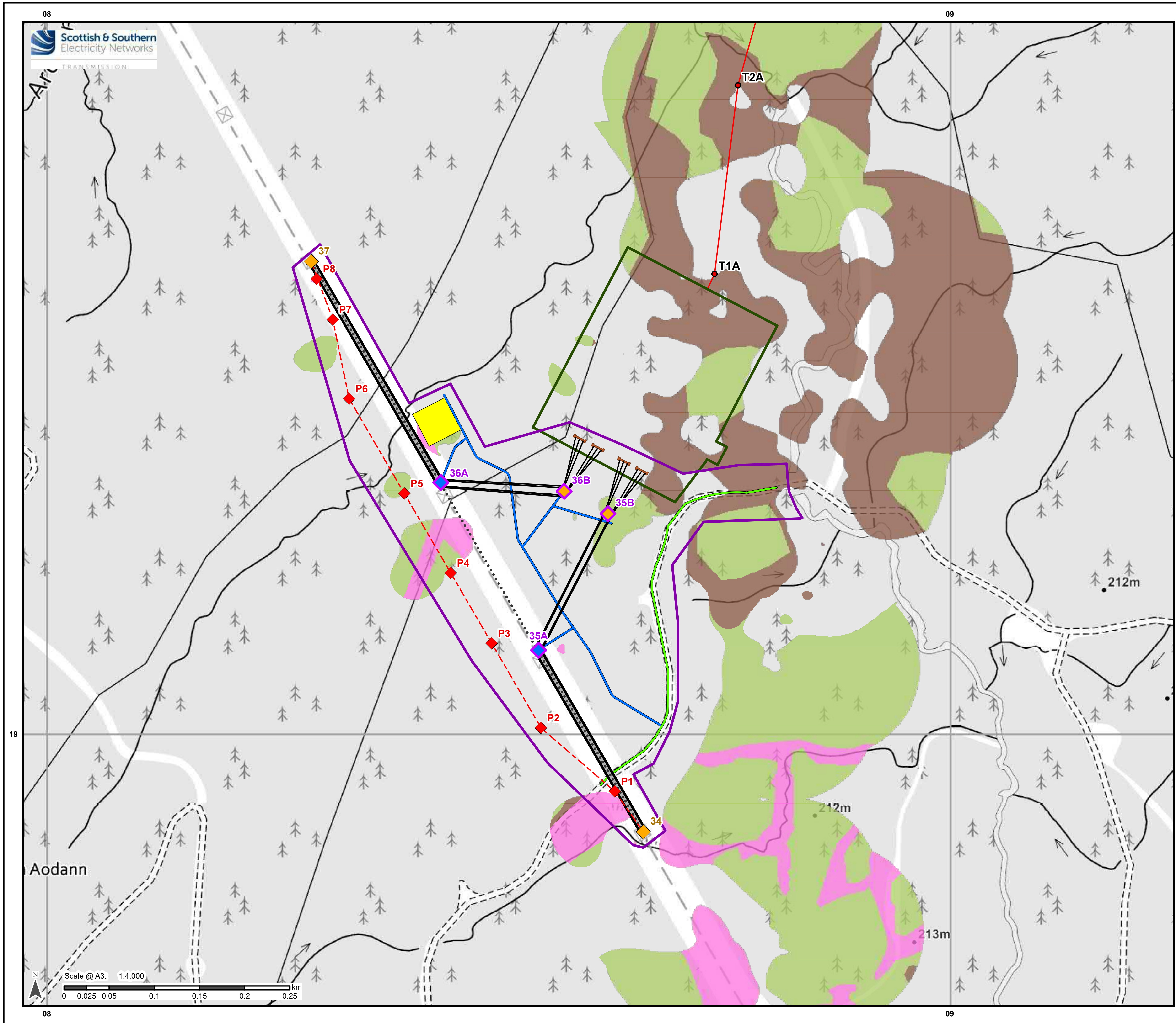
Title:

Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.5: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Drainage Score

Drawn by: AB Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.10.5_ContribFactDrainage_B



Legend

Proposed Development

- Proposed Tie-In
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Forestry Scores (F)

- Score 0: Not afforested
- Score 1: Afforested aligned
- Score 2: Deforested aligned

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Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.6: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Forestry Score

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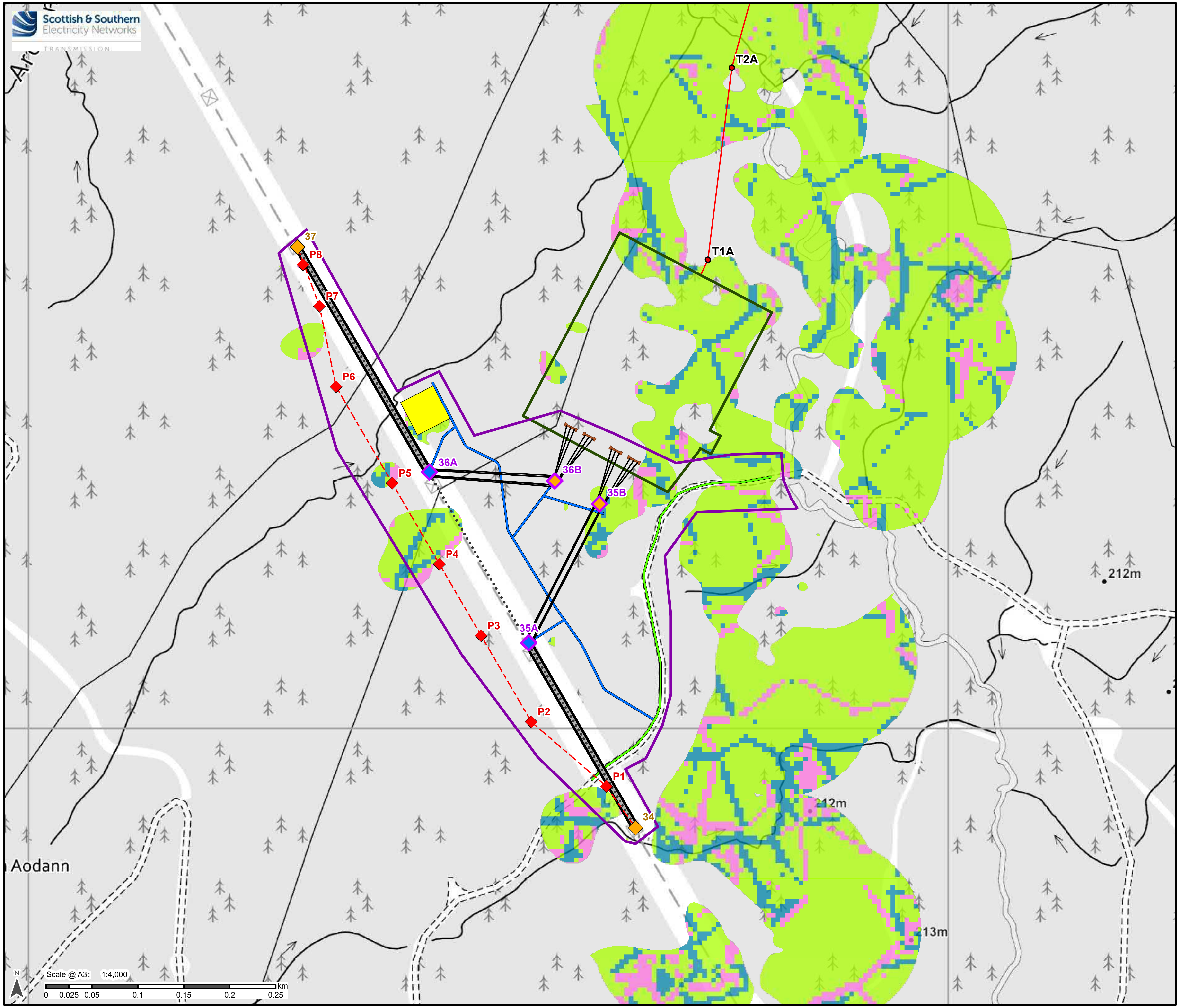
Drawing: R170_3673_ITEITW_Fig7.3.10.6_ContribFactForestry_B



Legend

Proposed Development

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Profile convexity scores (C)

- Score 0: Rectilinear slope
- Score 2: Concave slope
- Score 3: Convex slope

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Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.7: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Convexity Score

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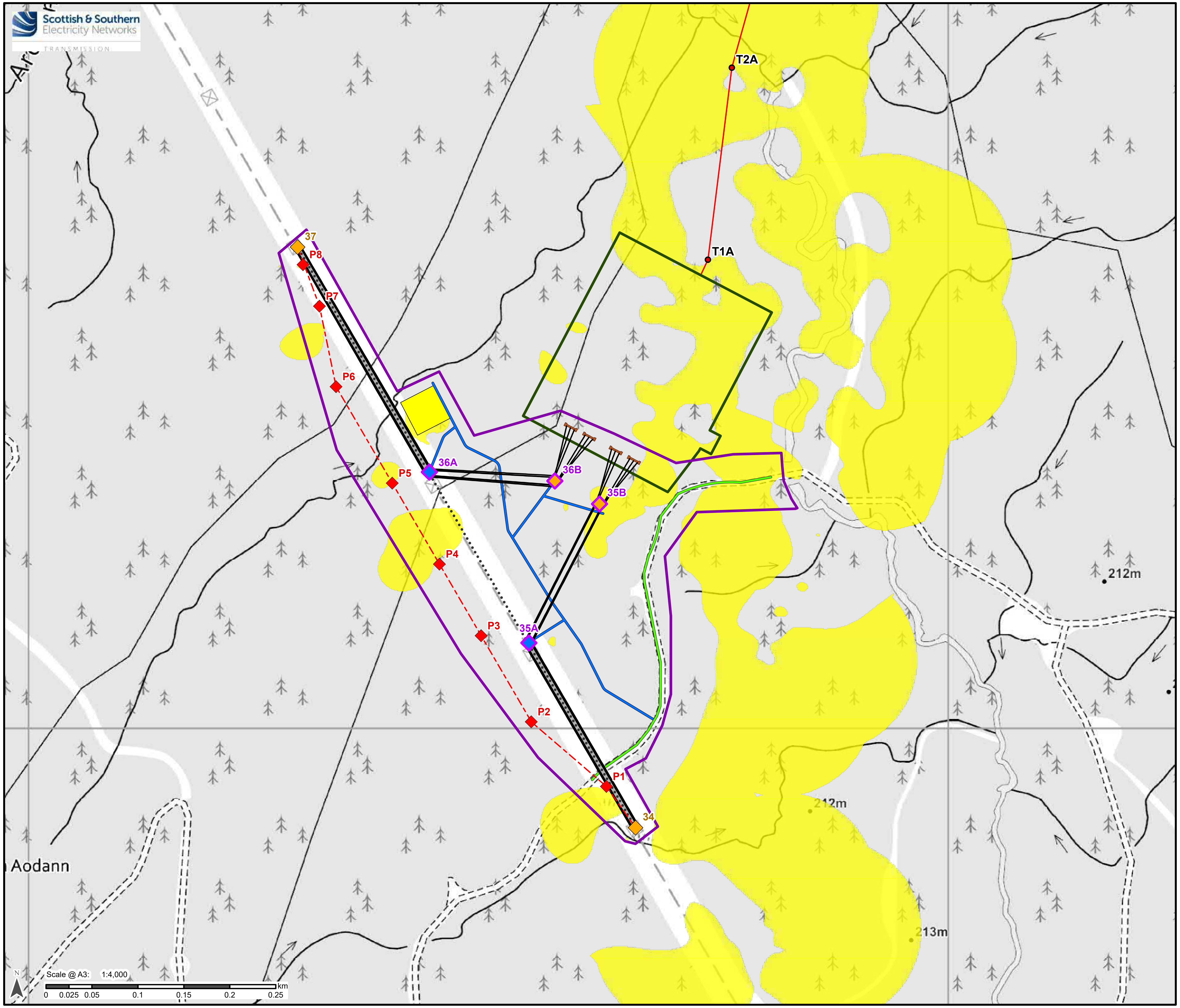
Drawing: R170_3673_ITEITW_Fig7.3.10.7_ContribFactConvexity_B



Legend

Proposed Development

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Existing Inveraray to Taynuilt OHL

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Wider Argyll and Kintyre 275 kV Strategy

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Land Use Scores (L)

- Score 0: Other land use

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Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.10.8: Peat Landslide Hazard and Risk Assessment: Contributing Factor - Landuse Score

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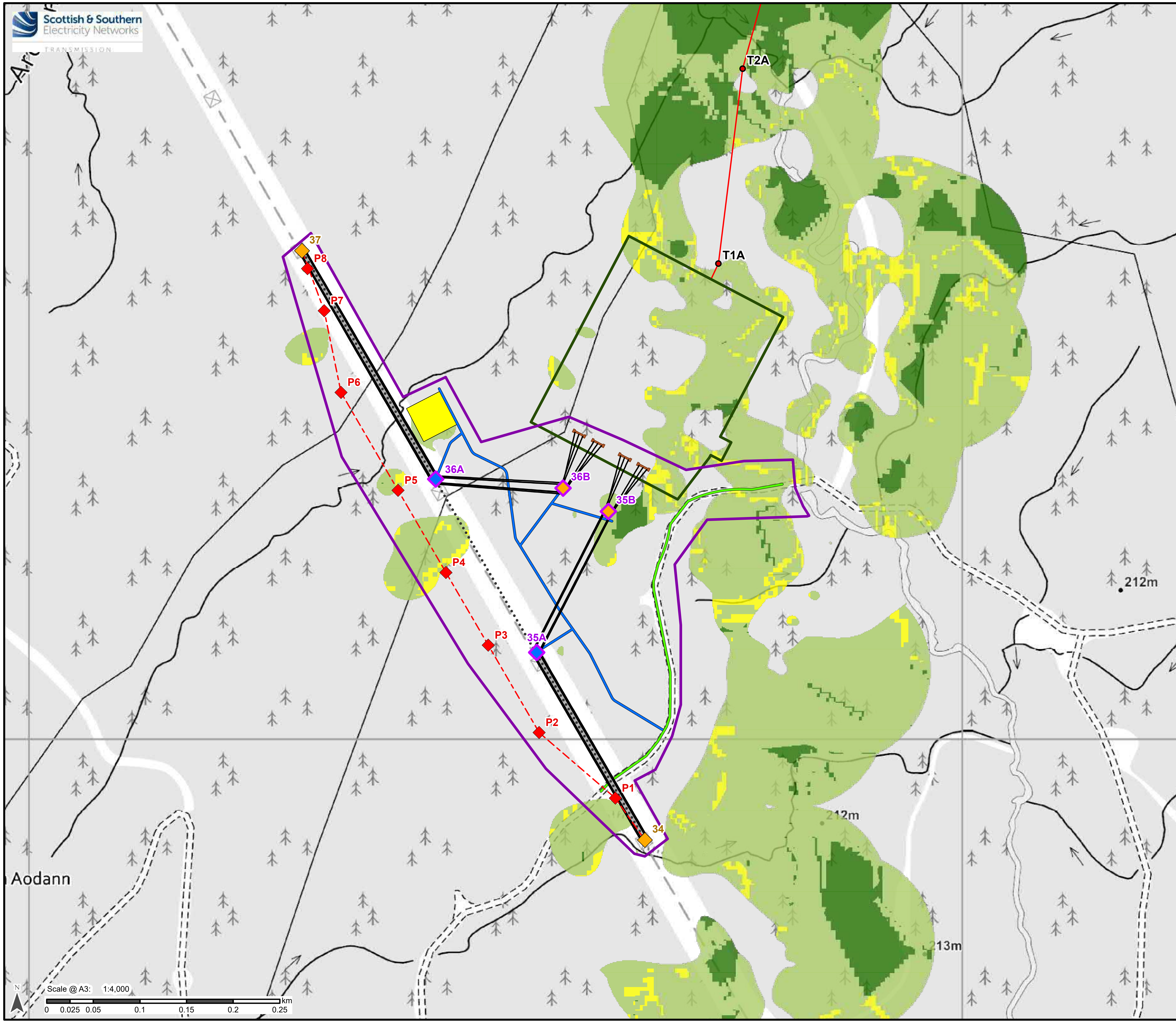
Drawing: R170_3673_ITEITW_Fig7.3.10.8_ContribFactLanduse_E



Legend

Proposed Development

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- Proposed Tie-In - Gantries
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Existing Inveraray to Taynuilt OHL

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Summed Score / Likelihood Score

- 2 - 6 (Very Low, 1)
- 7 - 11 (Low, 2)
- 12 - 16 (Moderate, 3)

Project No: LT000029
Project: 1700003673

Title:
Inveraray – Taynuilt Tie-In to Creag Dhubh Substation

Figure 7.3.11: Peat Landslide Hazard and Risk Assessment: Peat Slide Likelihood

Drawn by: AB
Date: 10/02/2023

Drawing: R170_3673_ITEITW_Fig7.3.11_PeatSlideLikelihood_B

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