Planning and Environmental Consultants

LAND, SOILS AND GEOLOGY

Slieveacurry Renewable Energy Development, Co. Clare

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8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO to carry out an assessment of the potential likely and significant effects of the proposed Slieveacurry Renewable Energy Development (Proposed Project) located in the townland of Glendine North and adjacent townlands, Co. Clare, on the Land, Soils and Geology aspects of the receiving environment.

The Proposed Project is described in full in Chapter 4: Description of the Proposed Project of this EIAR.

Where the 'Site' is referred to, this relates to the primary study area for the Proposed Project EIAR, as delineated by the EIAR Site Boundary.

Where the 'Proposed Wind Farm Site' is referred to, this refers to the portion of the Site containing the proposed 9 no. turbines and ancillary infrastructure, excluding the Proposed Grid Connection Site and Proposed Enhancement Site.

The 'Proposed Turbines' refers to the 9 no. turbines associated with the Proposed Wind Farm Site as outlined above. Where the 'Proposed Grid Connection Site' is referred to, this refers to the part of the Site containing only the extension to the existing 110kV substation at Slievecallan and the 33kV underground cabling route from the Proposed Turbines to the substation at Slievecallan.

Where the 'Proposed Enhancement Site' is referred to, this refers to the portion of the Site containing the proposed biodiversity and ornithology enhancement and management areas, excluding the Proposed Wind Farm Site and Proposed Grid Connection Site.

This chapter provides a baseline assessment of the environmental setting of the Proposed Project, as described in Chapter 4: Description of the Proposed Project, in terms of land, soils and geology and discusses the potential likely significant effects and cumulative effects that the construction, operation and decommissioning of the Proposed Project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to land, soils, geology and natural resources are recommended and the residual effects of the proposed project post-mitigation are assessed.

As detailed in Section 1.1.1 of the EIAR, the Proposed Project has been designed with consideration of the reasons for refusal on the previous application for a renewable energy development at the Site, in particular reasons regarding a key understanding of land and ground conditions, peat stability and peat and spoil management within the Site. This report provides an assessment of the potential effects of the Proposed Project on land, soils and geology, supplemented by additional geotechnical site investigations and assessment that has informed the design of the Proposed Project, while also addressing the previous reasons for refusal.

The Study Area with regard to Land, Soils and Geology for the Proposed Project is within a 2km distance of the EIAR Site Boundary as per IGI (2013) guidance. However, only direct effects on land, soils and geology within the Site are expected with regard the Proposed Project works (i.e. no indirect off-site effects).

8.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience includes soils, subsoils and geology. We routinely complete impact assessments for land, soils and geology, hydrology and hydrogeology for a large variety of project types including wind farms and renewable energy projects.

This chapter of the EIAR was prepared by Michael Gill and David Broderick.

David Broderick (P. Geo., BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with over 19 years' experience in both the public and private sectors. Having spent two years working in the Geological Survey of Ireland working mainly on groundwater and source protection studies David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into EIARs for a range of commercial developments. David has worked on the EIS/EIARs for Booltiagh WF, Cahermurphy (Phase I & II) WF, Glenmore WF, Crossmore WF and over 60 other wind farm related projects across the country.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer/Hydrologist with over 24 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Seven Hills Wind Farm, Glenmore Wind Farm, and Slievecallan Wind Farm, and over 100 other wind farm related projects across the country.

8.1.3 Relevant Legislation

This EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. The requirements of the following legislation are complied with:

- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84 of 1995, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001), S.I. No. 30 of 2000, the Planning and Development Act, and S.I. 600 of 2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/373/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act, 2000, as amended;

- S.I. No 296 of 2018: S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law; and,
- The Heritage Act 1995, as amended.

8.1.4 Relevant Guidance

The land, soils and geology chapter of this EIAR was prepared having regard, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Prepared for Energy Consents Unit Scottish Government, 2nd Edition. Dated April 2017; and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Commission 2017).

8.2 Assessment Methodology

8.2.1 Desk Study

A desk study of the Site and Study Area was completed in advance of undertaking the walkover survey and site investigations. This involved collecting all relevant geological data for the Site and surrounding area. This included consultation with the following data sources:

- Environmental Protection Agency database (**www.epa.ie**);
- Geological Survey of Ireland - Groundwater and Geology Databases (**www.gsi.ie**);
- Geological Survey of Ireland – Geological Heritage site mapping (**www.gsi.ie**);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 17 (Geology of Shannon Estuary). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd Edition (**www.epa.ie**); and,
- Aerial Photography, 1:5000-and-6-inch base mapping.

8.2.2 Baseline Monitoring and Site Investigations

A walkover survey, including geological mapping and investigations of the Site, were undertaken by David Broderick and Michael Gill of HES (refer to Section 8.1.2 above for qualifications and experience) on 7th and 8th November 2012, 11th September and 21st November 2019, 26th February 2021, 28th and 29th March, 26th April, 18th July 2024, 16th May and 3rd October 2025, and 05th and 20th March 2026.

The following geotechnical reports were prepared by Fehily and Timoney (FT) in support of the application:

- Geotechnical and Peat Stability Risk Assessment (GPSRA, **Appendix 8-1**)
- Peat and Spoil Management Plan (**Appendix 4-2**)

A total of no. 914 peat probes were carried out at the Site by FT, MKO, AGEC and HES since 2012. Peat depths across the Site have been thoroughly investigated.

A total of 7 no. trial pits were carried out under the supervision of FT, which included a trial pit at 5 no. of the 9 no. proposed turbine locations (T1, T2, T3, T5 and T6) and 2 no. trial pits at the proposed borrow pit location to investigate the underlying mineral soil lithology and subsoil/bedrock interface.

The intrusive ground investigations were supplemented by geophysical surveys (2D-resistivity (ERT) and Seismic Refraction (p-wave)), carried out by Minerex Geophysics Ltd. (MGX) on the 11th and 12th February 2025. The objectives of the non-intrusive surveys included further mapping of ground conditions at 4 no. turbine locations where access with an excavator was not feasible (T4, T7, T8 and T9) and also provide further detail on the proposed borrow pit location as a source of rock and for permanent storage of peat.

The objectives of the site investigations included mapping the distribution and depth of peat and mineral subsoils at the Proposed Wind Farm Site along with assessing the mineral subsoil / bedrock conditions at key Proposed Project locations (i.e. Proposed Turbines, temporary construction compounds, existing and proposed access roads, peat/spoil storage areas and borrow pit). This robust data set was used to inform the impact assessment and final layout design.

In summary, site investigations to address the Land, Soil and Geology section of the EIAR included the following:

- Walkover surveys and geological mapping of the Site area were undertaken to assess general ground conditions;
- A total of 914 no. peat probes were undertaken by HES, AGEC, MKO and FT to determine the thickness and geomorphology of the peat overlying parts of the Site;
- Trial pitting (7 no.) by FT and gouge cores (15 no.) by HES to investigate soil, peat and mineral subsoil lithology as well as depth to bedrock;
- Geophysical surveys by MGX to investigate ground conditions in areas of the Site not accessible by an excavator; and,
- Mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively.

The Geotechnical and Peat Stability Risk Assessment (GPSRA, April 2026) report prepared by FT (which includes the trial pit logs and MGX geophysical survey report) is included as **Appendix 8-1** of this EIAR.

8.2.3 Scope and Consultation

The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process and the list of Consultees is outlined in Section 2.7 of this EIAR.

The Geological Survey of Ireland (GSI) and the Health Service Executive (HSE) were the only bodies to respond with regard matters relating to land, soils and geology as summarised in **Table 8-1** below.

The GSI provided a standard response which recommended the use of their publicly available geological data sets in the preparation of the EIAR. These data sets, available to view at www.gsi.ie, have been used in the preparation of this chapter as detailed in Section 8.2.1 above. No specific matters or concerns were raised by the GSI regarding the Proposed Project.

Table 8-1 Summary Scoping Responses

Consultee	Matters Raised - Description	Addressed in Sections
HSE	*"A detailed assessment of the current ground stability of the site for the proposed windfarm development and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the impact construction work may have on the future stability of ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion".* *"Information should be provided on the make and model of the turbines and on construction details for the turbine foundations, including the depth and volume of concrete required. An accurate assessment of the potential impacts of the foundations on water quality and peat stability cannot be undertaken without this information".* *"The National Environmental Health Service recommends that a detailed Peat Stability/Geotechnical Assessment should be undertaken to assess the suitability of the soil for the proposed development. The EIAR should include provision for a peat stability monitoring programme to identify early signs of potential bog slides ('pre-failure indicators' see the Scottish Government's 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments 2017)".* *"The impact on sensitive receptors of the proposed development combined with any other wind farm/renewable energy developments in the vicinity should be considered. The EIAR should include a detailed assessment of any likely significant cumulative impacts of the proposed windfarm development".*	**Sections** 8.3.3.1, 8.3.3.2, 8.3.3.3, 8.3.3.4, 8.3.4.2, 8.3.10 & 8.7.2.5 and 8.7.7 **Appendix 8-1** Geotechnical and Peat Stability Assessment (including Geophysical Survey Report and Trial Pit Investigation Logs) **Appendix 4-2** Peat and Spoil Management Plan

8.2.4 Impact Assessment Methodology

Using information from the desk study and data from the site investigations, an assessment of the importance of the soil and geological environment within the Site is assessed using the criteria set out in **Table 8-2** (NRA, 2008).

Table 8-2 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional	Geological feature rare on a regional or national scale (NHA).

Importance	Criteria	Typical Example
	or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral Resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral Resource.

The guideline criteria (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable).

The descriptors used in this environmental impact assessment report are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 of this EIAR. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in **Table 8-3.**

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the existing environment, as listed in **Table 8-4.**

Table 8-3: Additional Impact Characteristics.

Impact Characteristic	Degree/ Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Unlikely	A low likelihood of occurrence of the impact.
	Likely	A medium likelihood of occurrence of the impact.

Table 8-4: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC / ecologically important area. › A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). › Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: › The extent or morphology of a cSAC / NHA / ecologically important area. › A minor hydrogeological feature. › Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends.
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

8.2.5 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Land, Soils and Geology Chapter of the EIAR.

The site investigations and follow up monitoring carried out were detailed for the purpose of assessing effects on Land, Soils and Geology and also for Proposed Project infrastructure design.

8.2.6 Study Area

The Study Area with regard to Land, Soils and Geology for the Proposed Project is within a 2km distance of the EIAR Site Boundary as per IGI (2013) guidance. However, only direct effects on land, soils and geology within the Site are expected with regard the Proposed Project works (i.e. no indirect off-site effects).

8.3 Existing Environment

8.3.1 Site Description and Topography

The Site is located approximately 7km south of Ennistimon, Co. Clare and 8km west of Inagh, Co. Clare. The Proposed Wind Farm Site comprises mainly of open blanket bog, coniferous forestry planted on blanket bog and poorly draining agricultural land on the east and south of the Site along with turbary plots.

The Proposed Wind Farm Site is served by a number of existing local, forestry and agricultural roads and tracks. These existing forestry tracks have been in operation for a significant number of years. It is proposed that up to 2.3km of these existing tracks will be utilised by the Proposed Project.

The Proposed Wind Farm Site is characterised by a northeast / southwest orientated topographical divide/ridge of high ground, where the ground slopes steadily to the northwest and southeast away from the ridge. The elevation range within the EIAR Site Boundary is between 67 and 261m OD.

5 no. Proposed Turbines are located within forestry (T1, T2, T4, T8 and T9) with the other 4 no. Proposed Turbines located on open peatland (T3, T5, T6 and T7).

The proposed 33kV underground cabling, which measures approximately 7.1km, will connect to the proposed extension to the existing Slievecallan 110kV substation located approximately 3.5km to the southeast of the Proposed Wind Farm Site.

The proposed 33kV underground cabling exits the Proposed Wind Farm Site through forestry for approximately 0.83km, onto a farm track for 0.55km before entering the public road corridor. It stays within the public road corridor for approximately 1.55km. the cable route then exits onto existing forestry /windfarm roads, following these for approximately 4.17km before reaching the proposed extension to the existing Slievecallan 110kV substation. The proposed substation extension will be

located on an existing cleared and level area where the ground elevation is at approximately 242m OD.

A total of 13 areas totalling c. 172.7 ha within the Site have been selected for biodiversity enhancement measures as part of the Proposed Project and to enhance the Site for species and habitats known to occur within the Site.

The Proposed Enhancement Site includes into ten areas of conifer plantation, referred to as Areas A, B, C, D, E, F, G, H, I and J. Additionally, there are two areas of farmland proposed for hen harrier habitat enhancement, referred to as Area 1 and Area 2 and one area of farmland proposed for marsh fritillary habitat enhancement, referred to as Area 3. Full details regarding the Biodiversity Management and Enhancement Plan (BMEP) for the Proposed Project are included in Chapter 4 and Appendix 6-4 of the EIAR.

8.3.2 Land Cover and Land Use

According to EPA Corine mapping (2018), the Proposed Wind Farm Site comprises forest and semi-natural areas, agricultural land and wetlands. Similar land cover is present at the Proposed Enhancement Site.

Current land-use at the Proposed Wind Farm Site and the Proposed Enhancement Site comprise commercial forestry, peat bog, turbary and third-party lands currently being used for agriculture and private forestry.

The Proposed Grid Connection Site is largely surrounded by agricultural land with pockets of forest and semi-natural areas and wetlands. Current land-use along the Proposed Grid Connection Site comprises primarily of public road corridor, as well as some instances of private land with the proposed substation located at the Slievecallan Wind Farm.

Enhancement Areas A, B, C, D, E, F, G, H, I, and J are currently commercial forestry. Area 1, Area 2 and Area 3 comprise agricultural land, the majority of which is classified as wet agricultural grassland which has evidence of past improvement or degraded.

Land-use in the wider landscape comprises a mix of agriculture, low density residential, renewable energy generation and commercial forestry.

8.3.3 Soils and Subsoils

8.3.3.1 GSI Mapping

The published Teagasc soils mapping (www.epa.ie) shows that the more elevated area of the Proposed Wind Farm Site (>200m OD) is largely covered by blanket peat (BktPt) with areas of peaty, poorly drained mineral soil (AminPDPT) mapped on steeper ground where bedrock is outcropping (i.e. areas where the bedrock protrudes as steep rocky escarpments) or present at shallow depths (i.e. subcrop).

Below an elevation of approximately 170m, poorly drained mineral soil (AminPD) is the dominant soil type. Close to watercourses surface and groundwater gleys are mapped.

The dominant mapped soil type along the Proposed Grid Connection Site and at the Proposed Enhancement Site areas is also blanket peat with areas of AminPD and AminPDPT.

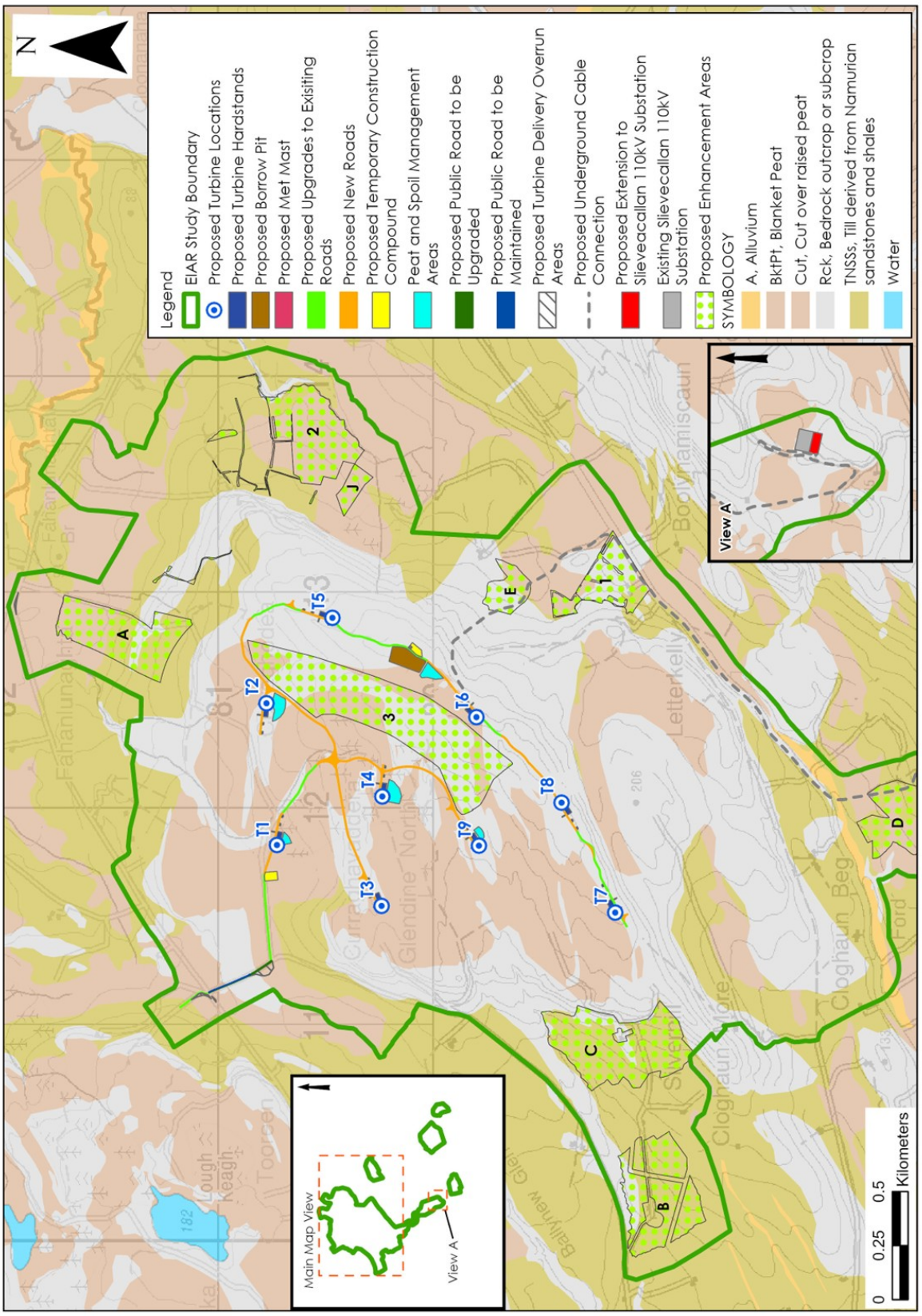
The GSI subsoils mapping (www.gsi.ie) also shows that blanket peat is dominant on the upper elevations of the Proposed Wind Farm Site with bedrock outcrop or subcrop mapped on steeper ground downslope of the blanket bog areas (areas where the bedrock protrudes as steep rocky

escarpments subsoils are absent). Namurian sandstone and shale tills are mapped on the lower lying areas of the Site.

The majority of the Proposed Wind Farm Site infrastructure, including 7 no. of the 9 no. Proposed Turbines, is located in areas mapped by the GSI as outcrop or subcrop (i.e. exposed or shallow bedrock) with 2 no. turbines mapped on blanket peat (T1 and T4). The proposed borrow pit is also located in an area mapped as outcrop or subcrop.

The mapped subsoils along the Proposed Grid Connection Site and at the Proposed Enhancement Site areas is similar to the Proposed Wind Farm Site, with blanket peat and sandstone and shale tills being the more dominant type, followed by bedrock outcrop or subcrop indicating shallow or absent subsoils. GSI subsoil mapping is shown as **Figure 8-1** below.

Figure 8-1 GSI Subsoils Map



8.3.3.2 Peat Depth Probing

A total of 914 no. peat depth probes were carried out at the Proposed Wind Farm Site by FT, AGEC, MKO and HES since 2012. Peat depths recorded across the Proposed Wind Farm Site ranged from 0 to 5m with an average depth of 0.7m. This would be considered shallow for upland blanket bog.

Approximately 81% of recorded peat depths were less than 1m and with 94% of less than 2.0m. A number of localised readings were recorded where peat depths were between 2m and 5m. A peat depth distribution plot for all 914 no. data points is shown as **Figure 8-2** below. A summary peat depth map is shown as **Figure 8-3** below.

The peat depths recorded at the Proposed Turbines varied from 0.2 to 2.0m with an average depth of 0.8m. Again, this would be considered shallow for upland blanket bog. Of the Proposed Turbines, only three recorded peat depths in excess of 1.0m (T1, T4 and T9). Please refer to **Table 8-6** below for average peat depths recorded at the Proposed Turbines.

With respect to the proposed new access roads, peat depths are typically less than 1.0m (average 0.8m) with localised depths of up to 2.7m recorded (along the main access road west of proposed turbine T1).

At the proposed borrow pit location, peat is absent or very shallow (0 – 0.2m) due to the prevalence of shallow subcrop bedrock.

Peat strengths recorded across the Site vary from 6 to 90kPa with an average of 25kPa. The lowest shear strength was recorded in the southwest of the Proposed Wind Farm Site, in the deepest area of peat. Overall, peats strengths are typical of drained peat.

Peat depths along the Proposed Grid Connection Site range from 0 to 1.9m along the proposed 33kV underground cabling route, with depths of <1m recorded along the public road section of the route.

Average peat depths recorded across the 13 no. Proposed Enhancement Site areas were variable and ranged between 0 and 4.3m. The majority of the Proposed Enhancement site areas had average peat depths of between approximately 0.5 and 1m. Refer to **Table 8-6** below for average peat recorded at each of the Proposed Enhancement Site areas.

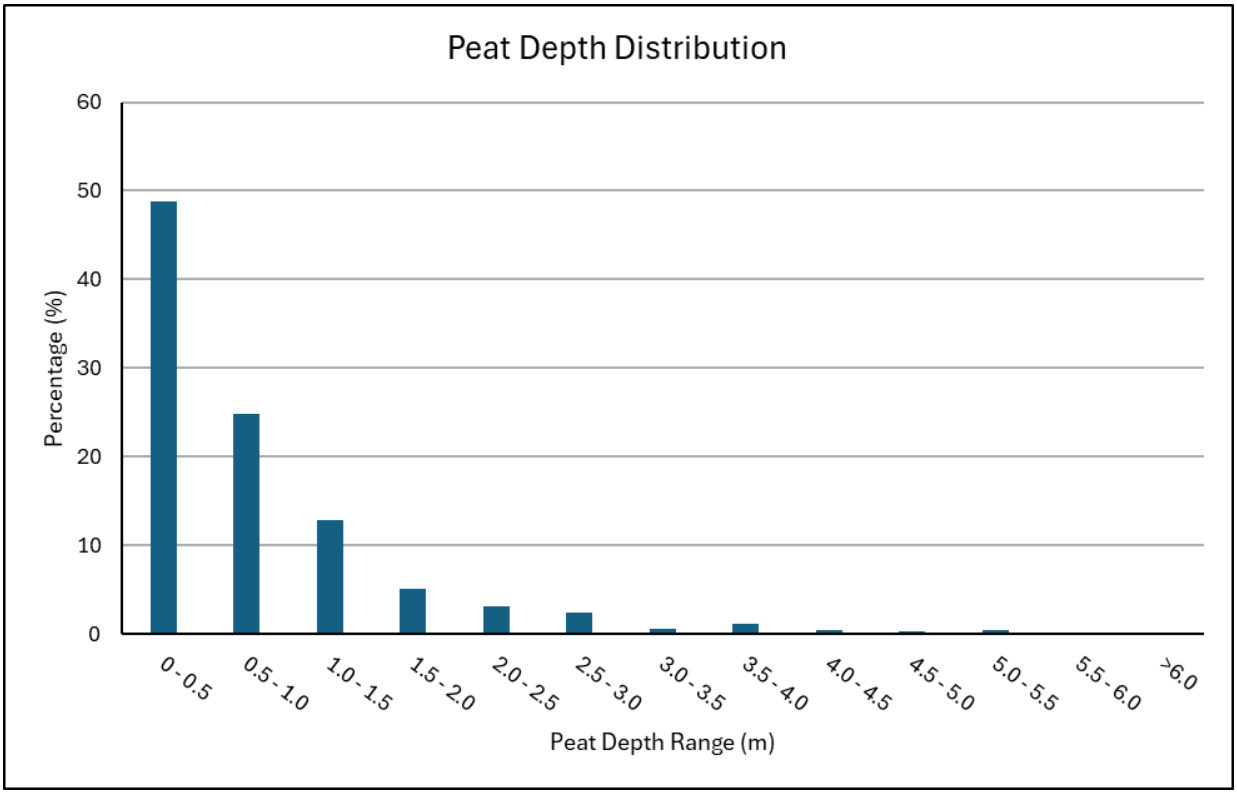
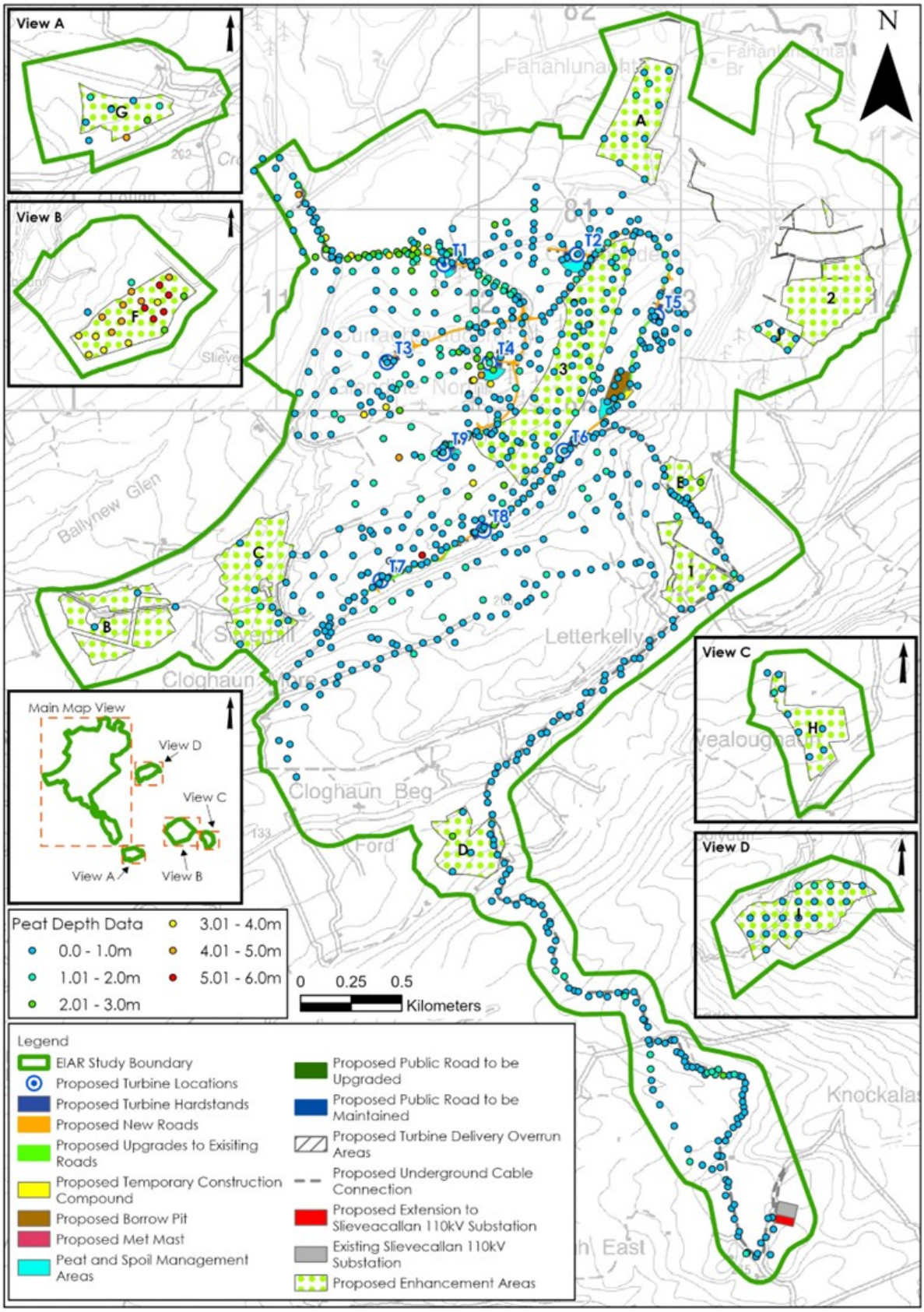


Figure 8-2 Peat Depth Distribution Plot

Figure 8-3 Summary Peat depth Map



8.3.3.3 Trial Pit Investigations

A total of 7 no. trial pits were carried out under the supervision of FT at the Proposed Wind Farm Site on 17th June 2021. Refer to **Figure 8-4** (site investigation map) for trial pit locations.

The dominant subsoil encountered was soft to firm gravelly CLAY and SILT, with bedrock been encountered at all of the trial pit locations.

Refusal on bedrock (presumed) was recorded in all 7 no. trial pits. Depth to bedrock is shallow at the Proposed Wind Farm Site and ranged between 0.3m and 2m with an average of 1.5m at the trial pit locations.

This is consistent with the GSI subsoil mapping (refer to **Figure 8-1** above) which shows bedrock outcrop or subcrop widely mapped across the Proposed Wind Farm Site.

Trial pits were carried out at 5 no. Proposed Turbines (T1, T2, T3, T5 and T6) as these were the only turbines that could be accessed by an excavator during the site investigations. The other Proposed Turbines were not accessible for trial pitting and therefore geophysical surveys and hand augering were carried out as an alternative to investigate depth to bedrock (refer to Section 8.3.3.4 below for these results).

Depth to bedrock at Proposed Turbines where trial pits were carried out ranged between 0.8m (T5) and 1.8m (T1) with an average of 1.2m. A summary of the trial pit investigation undertaken at key Proposed Wind Farm Site infrastructural locations is shown in **Table 8-6** below.

Two trial pits (TP01 & TP02) carried out at the proposed borrow pit location encountered shallow bedrock at the respective depths of 0.2 and 0.5m.

Trial pit logs are attached to the Geotechnical and Peat Stability Risk Assessment Report (GPSRA, refer to **Appendix 8-1).**

8.3.3.4 Geophysical Survey

Minerex Geophysics Ltd. (MGX) carried out 2D-Resistivity (ERT) and Seismic Refraction (p- wave) surveys on 11th and 12th of February 2025. Refer to the Geotechnical and Peat Stability Assessment report (GPSRA, April 2026) prepared by FT (**Appendix 8-1)** which includes the MGX geophysical survey report. The geophysics survey locations are shown on **Figure 8-4** below.

The survey was carried out at four Proposed Turbines (T4, T7, T8 and T9) and at the proposed borrow pit location. The aim of the survey was to gain information on the ground conditions and depth to rock at locations which were not accessible with an excavator. A summary of the geophysical interpretations is presented in **Table 8-5** below.

The ground conditions (substrata layers) were generally interpreted as follows (in order of depth from ground level):

- Soft or loose soil overburden
- Stiff to hard overburden
- Poor to fair weathered bedrock (sandstone/siltstone)
- Good to very good quality bedrock (sandstone/siltstone)

The depth to good quality competent bedrock at Proposed Turbines T4, T7 and T8 ranged between 1 and 5m below ground level (mbgl). The depth to good quality bedrock was slightly deeper at proposed turbine location T9 where it varied between 4.5 and 6.5mbgl.

The depth to good quality bedrock across the proposed borrow pit footprint ranged between 1 to 3mbgl.

Table 8-5: Summary of Geophysical Survey Interpretations

Location	Strata Layer ID*	Interpretation of Lithology
Turbine 4	Layer 1	Soft or loose soil with a thickness of between 2 – 3m
	Layer 2a	Very stiff to hard overburden or poor to fair weathered SILTSTONE with a thickness of between 0.5 - 2.5m
	Layer 3a	Top of the good to very good SILTSTONE is between 3 and 5mbgl (metres below ground level)
Turbine T7	Layer 1	Soft or loose soil with a thickness of between 0.5 – 1m
	Layer 2a	Poor to fair weathered SANDSTONE with a thickness of between 1.5 – 3m
	Layer 3a	Top of the good to very good SANDSTONE is between 2 and 4mbgl (metres below ground level)
Turbine T8	Layer 1	Soft or loose soil with a thickness of between 0.5 – 1m
	Layer 2a	Poor to fair weathered SANDSTONE with a thickness of between 0.5 – 2m
	Layer 3a	Top of the good to very good SANDSTONE is between 1 and 3mbgl (metres below ground level)
Turbine T9	Layer 1	Soft or loose soil with a thickness of between 0.5 – 1m
	Layer 2a	Very stiff to hard overburden or poor to fair weathered SILTSTONE with a thickness of between 2.5 – 4.5m
	Layer 3a	Top of the good to very good SILTSTONE is between 4.5 and 6.5mbgl (metres below ground level)
Borrow Pit	Layer 1	Soft or loose soil with a thickness of between 0.2 – 2m
	Layer 2a	Poor to fair weathered SANDSTONE with a thickness of between 0.5 – 2m
	Layer 3a/3b	The depth to the top of the good to very good SANDSTONE ranges between 1 – 3mbgl

*Refer to Table 2 of the MGX report for layer interpretation

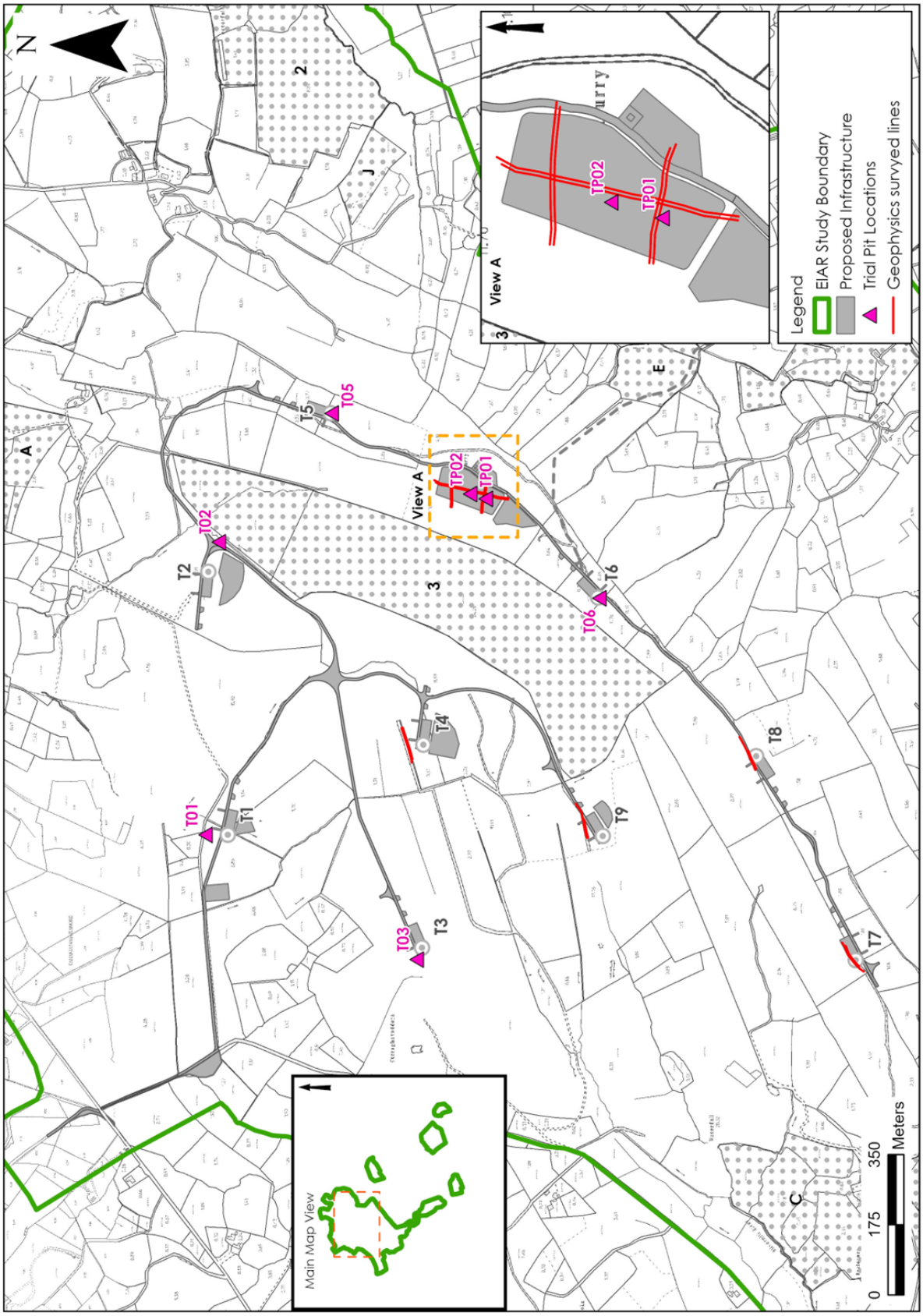
Table 8-6 below provides a summary of the peat probing, trial pit and geophysical investigations carried out at the Site.

Table 8-6: Summary of Site Investigations at Proposed Project Infrastructure Locations

Location ID	Site Investigation ID	Probe Average Peat Depth (m)	Presumed Depth to Bedrock (mbgl)	Summary Description of Mineral Subsoil Lithology
T1	T01*	1.6	1.8	Soft to firm grey slightly sandy slightly gravelly CLAY
T2	T02	0.6	1.4	Firm grey slightly sandy CLAY
T3	T03	0.4	1.0	Firm light brown gravelly SILT
T4	R4/S4#	1.6	3 to 5	Soft or loose soil over very stiff to hard overburden
T5	T05	0.7	0.8	Firm light brown to grey slightly sandy CLAY
T6	T06	0.8	0.9	Firm to stiff grey slightly gravelly Clay
T7	R7/S7	0.5	2 to 4	Soft or loose soil
T8	R6/S6	0.6	1 to 3	Soft or loose soil
T9	R5/S5	1.5	3 to 6.5	Very stiff to hard overburden
Borrow Pit	TP01 & TP02	0.1	0.2 to 0.5	Firm grey/grey, brown CLAY
Met Mast	GC10	0.15	ND	Firm grey slightly sandy CLAY
Const Comp N	GC11 - GC12	2	ND	Grey slightly gravelly Clay
Const Comp S	GC13 - GC14	0.15	ND	Greyish brown Clay
BMEP Area A	GC-A	0.85	ND	Soft sandy CLAY
BMEP Area B	GC-B	0	ND	Soft sandy CLAY/SILT
BMEP Area C	GC-C	0.37	ND	Soft sandy SILT
BMEP Area D	GC-D	0.64	ND	Soft sandy CLAY
BMEP Area E	GC-E	0.81	ND	Gravelly CLAY
BMEP Area F	GC-F	4.33	ND	Gravelly CLAY/SILT
BMEP Area G	GC-G	1.44	ND	Soft sandy SILT
BMEP Area H	GC-H	0.64	ND	Gravelly CLAY/SILT
BMEP Area I	GC-I	0.63	ND	Soft sandy CLAY/SILT
BMEP Area J	GC-J	0	ND	Gravelly CLAY/SILT
BMEP Area 1	GC-1	0.47	ND	Soft sandy CLAY/SILT
BMEP Area 2	GC-2	0	ND	Soft CLAY/SILT
BMEP Area 3	GC-3	0.48	ND	Soft sandy CLAY/SILT

*Trial pit ID/ # Geophysics ID/ ND Not Determined

Figure 8-4 Site Investigation Map



8.3.4 Bedrock Geology

8.3.4.1 GSI Mapping

The underlying bedrock strata at the Site are mapped as Undifferentiated Namurian Shales of the Central Clare Group. GSI bedrock mapping is shown as **Figure 8-5** below.

This bedrock type comprises cyclothemic sequences of sandstones, siltstone and shale, interpreted to be the result of delta progradation with main channels and point bar deposits and sub-deltaic minor cycle units. A typical cyclothem sequence consists of a laminated shale unit with a fossil bearing (goniatite) marine band at the base, a thick laminated to massive grey siltstone unit in the middle and a thick upper unit, usually dominated by laminated sandstone.

Faults within the bedrock of this region are generally present in a southwest northeast orientation. Two northeast southwest trending faults are mapped to intersect the Site. There are no stability issues considered likely to occur due to the presence of the fault.

Bedrock outcrops are frequent on the more elevated and steeper areas of the Proposed Wind Farm Site. More specifically outcropping rock occurs as terraces on the mountain sides and along valley sides. These terraces create steep escarpments and have an absence of soils and subsoils.

There are also a number of existing borrow pits locally outside of the Proposed Wind Farm Site. Where visible, inspected outcrops and exposures at existing borrow pits were noted to contain thickly bedded, dark grey Shale bedrock which is consistent with the description of the Central Clare Group rocks described by the Geological Survey maps (GSI, 1999).

8.3.4.2 Site Investigations

A total of 7 no. trial pits were carried out under the supervision of FT at the Proposed Wind Farm Site. Refer to **Figure 8-4** (site investigation map) for trial pit locations.

Refusal on bedrock (presumed) was recorded in all 7 no. trial pits. Depth to bedrock is shallow at the Proposed Wind Farm Site and ranged between 0.3m and 2m with an average of 1.5m at the trial pit locations.

Results of the MGX geophysical survey interpreted bedrock as SILTSTONE or SANDSTONE based on changes in the resistivities. At Proposed Turbines T7, T8 and the proposed borrow pit, there is a layer of SANDSTONE interpreted above the SILTSTONE. At T4 and T9, the rock is interpreted as SILTSTONE. Refer to **Table 8-5** above for a summary of the geophysical survey results.

The depth to good quality competent bedrock at Proposed Wind Farm Site ranged between 1 and 6.5mbgl.

The geophysical survey at the proposed borrow pit confirmed its viability as a source of construction rock material where good to very good quality SANDSTONE was identified as depths between 1 – 3mbgl across the proposed extraction footprint.

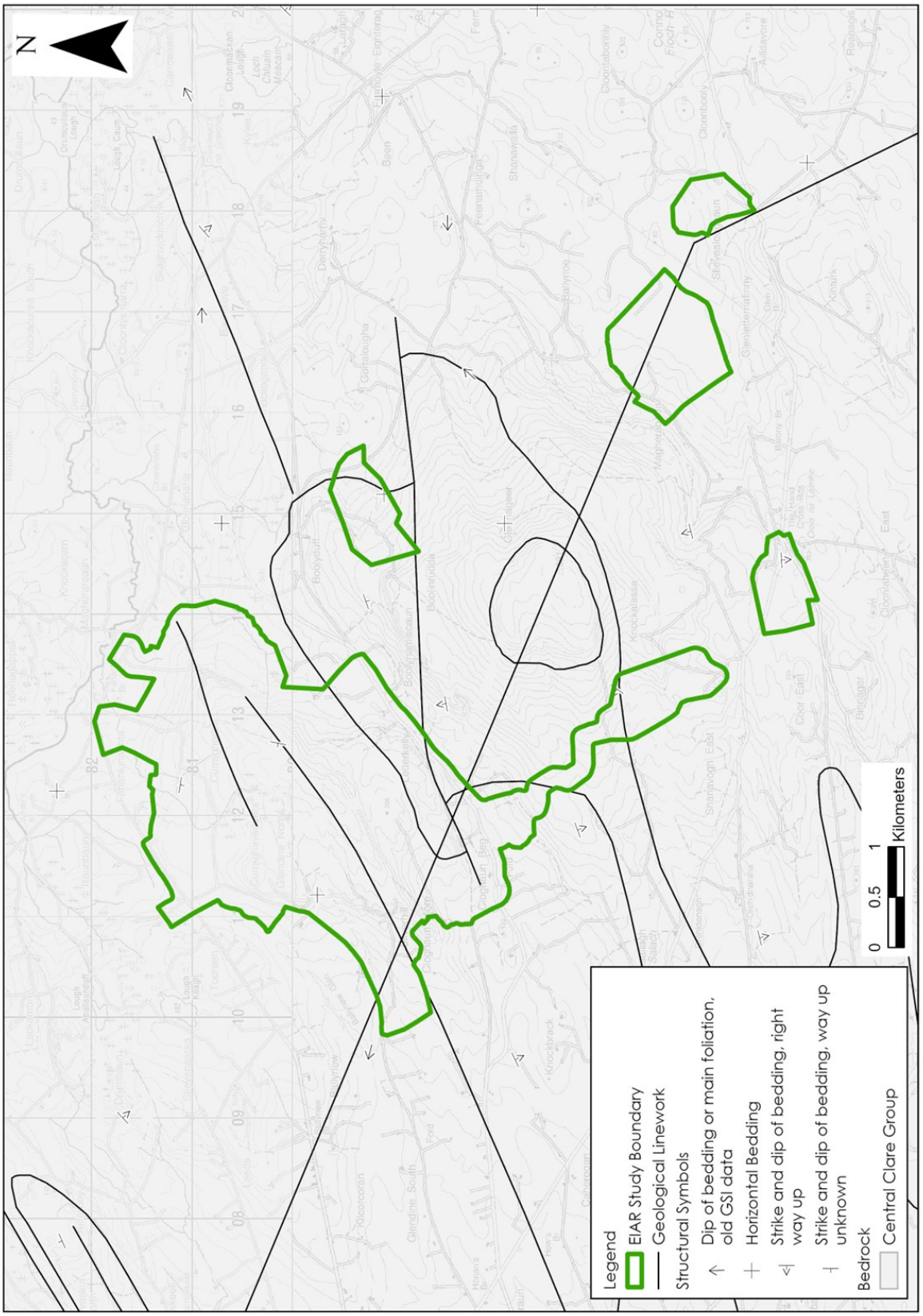


Figure 8-5 GSI Bedrock Geology Map

8.3.5 Geological Resource Importance

The siltstone/sandstone bedrock at the Site can be classified as being of "Low" importance because it is locally abundant. The bedrock could be used on a "sub-economic" local scale for construction purposes.

The peat deposits at the Site are classified as "Low" importance as the peat is not designated in this area and is significantly degraded in most places at the Site as a result of forestry related drainage, rill ploughing and turbary peat cutting. Similar peat deposits are also locally abundant in the Study Area. Refer to **Table 8-2** above for criteria.

8.3.6 Geological Heritage and Designated Sites

There are no GSI mapped County Geological Heritage sites within 8km of the Site.

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). The Site does not physically interact with any designated site.

Designated sites downstream of the Site include the Mid-Clare Coast SPA (Site Code 004182) and Carrowmore Point to Spanish Point and Islands SAC/pNHA (Site Code 001021) both of which are located approximately 9km to the west of the Site at coastal locations.

Inagh River Estuary SAC/pNHA (site Code 000036) is located approximately 8.5km to the northwest of the Site, also at a coastal location.

Hydrologically connected Designated Sites downstream of the Site are assessed in Chapter 9 (Hydrology/hydrogeology).

8.3.7 Soil Contamination

There are no known areas of soil contamination on the Site. During the site walkovers and site investigations no areas of contamination concern were identified.

According to the EPA online mapping (https://gis.epa.ie/EPAMaps/), there are no licensed waste facilities on or within the immediate environs of the Site.

There are no historic mines at or in the immediate vicinity of the Site that could potentially have contaminated tailings.

8.3.8 Economic Geology

The GSI online Aggregate Potential Mapping Database shows that the Site is located within an area mapped as being typically Very Low to Low in terms of crushed rock aggregate potential and with no potential for granular aggregate potential (i.e. potential for gravel reserves).

8.3.9 Geohazards

The GSI Landslide database (www.gsi.ie) does not record any historic landslides within 50km of the Site or in the surrounding lands.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at a given location. The Proposed Wind Farm Site is mapped as having Low to High susceptibility which would be typical given the presence of blanket bog.

Refer to Section 8.3.10 below for a summary of the Geotechnical and Peat Stability Risk Assessment (GPSRA, **Appendix 8-1**) which was carried out by FT. All Proposed Project infrastructure elements are located in areas of low risk of peat instability.

There are no stability issues considered likely to occur due to the presence of mapped bedrock faults.

There is no possibility of karst features being present due to the bedrock geology type.

8.3.10 Geotechnical and Peat Stability Assessment

A Geotechnical and Peat Stability Risk Assessment Report (GPSRA) (FT, April 2026) is attached in **Appendix 8-1**. Summary data and conclusions from that report are provided below.

8.3.10.1 Introduction

Fehily Timoney and Company (FT) was engaged to undertake GPSRA of the Site.

Hydrological, hydrogeological and ecological factors were also assessed in the Geotechnical and Peat Stability Risk Assessment Report, and interaction between FT, HES and MKO was undertaken throughout the iterative design process, with consideration given to the reasons for refusal as outlined in Section 8.1.1 above. The assessment was done in accordance with guidance contained in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017).

A constraints study was initially undertaken by the Environmental (MKO), Hydrological (HES) and Ecological (MKO) members of the project design team to determine the developable area on the Site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT.

8.3.10.2 Hydrological Considerations

The hydrological factors with regard to peat stability were assessed using a combination of desk study data, aerial photography (historical and contemporary), topographic lidar data flow path drainage analysis, site walkovers, field drainage mapping and gouge coring. Detailed drainage maps were prepared along with hydrological constraints mapping for on-site drainage features and wet areas.

Many of the pre-conditions as described by (PLHRAG, Scottish Government, 2017) are hydrological in nature and are listed in the guidance as follows:

- Impeded drainage caused by a peat layer overlying an impervious clay or mineral base (hydrological discontinuity, especially an iron pan at the base of the peat deposit);
- 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); and,
- Connectivity between surface drainage and the peat/impervious interface (mechanism for generation of excess pore pressures).

Identifying any pre-conditions at the Site was a key part of the hydrological constraints assessment carried out in conjunction with project design team.

8.3.10.3 Peat Slides – Lessons Learned

This peat stability assessment has been undertaken taking into account peat failures that have occurred on peatland sites (such as recent failures at Shass Mountain 2020, Co. Leitrim and Meenbog 2020, Co. Donegal) on a national level. The lessons learned from both peat slide events have been incorporated into the design of this project and the construction methodologies to be implemented. The Meenbog failure occurred during the construction of a section of floating road on sidelong ground in an area of weak peat. It is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments for the turbines/access roads.

8.3.10.4 Peat Stability - Desk Study

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring. The landslide susceptibility of the Proposed Wind Farm Site was classified by the GSI (2024) as ranging from "low" to "high" susceptibility, which is expected given the terrain present (Blanket bog). This assessment is provided by the GSI as guide to the relative susceptibility of an area. The GSI mapping should not be treated as "Hazard" maps which show the potential to cause damage by frequency/probability or intensity or "Risk" maps which shows loss potential.

There are no recorded peat failures within the Site (GSI, 2025). The nearest recorded peat failures are located some 50km from the Site. These failures occurred at Corbehagh in 1935, Slieve Bearnagh in 2003 and Maghera in 2004 and were all described as flow type failures. Based on the Geological Survey of Ireland's dataset viewer (GSI, 2025) the Corbehagh and the Maghera sites are situated within 500m of each other.

There are non-peat failures recorded 16 to 17km north of the Site. The failure at Ballaghline is reported to have occurred in 1900, no description of the failure is given. The more recent failure at Doonnagore is reported to have occurred in 2011, no description of the failure is given.

8.3.10.5 Peat Stability Analysis

An analysis of peat sliding was carried out at all the main infrastructure locations across the Site. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The FoS provides a direct measure of the degree of stability of the slope. A FoS of less than 1.0 indicates that a slope is unstable, a FoS of greater than 1.0 indicates a stable slope.

The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3. For the purposes of this assessment, a design FoS of 1.4 has been adopted, as a conservative value.

The assigned probability of instability associated with a given FoS value is described in **Table 8-7** below. Hydrological and hydrogeological factors were also assessed in the Geotechnical and Peat Stability Risk Assessment Report (GPSRA), and interaction between FT and HES was undertaken throughout the iterative design process.

No peat failures/landslides are recorded at the Site which suggests that site conditions do not pre-dispose themselves to failures/landslides.

The hand vane results indicate undrained shear strengths in the range 6 to 90kPa, with an average value of ~30kPa. The strengths recorded would be typical of well drained peat as is present at the Site.

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from back-

analysis, was estimated at 2.5kPa. The recorded undrained strength at the Site is greater than the lower bound values for Derrybrien indicating that there is no close correlation to the peat conditions at the Derrybrien site and that there is less likelihood of failure on the Site.

Table 8-7: Probability Scale for Factor of Safety.

Scale	Factor of Safety	Stability
1	1.40 or greater	Acceptable
2	1.0 to 1.4	Marginally Stable
3	<1.0	Unstable

8.3.10.6 Peat Stability Assessment Results

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To assess the factor of safety for a peat slide, an undrained[1] (short-term stability) and drained (long-term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

The drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

As mentioned above, the Geotechnical and Peat Stability Risk Assessment Report (GPSRA) is attached in **Appendix 8-1**.

8.3.10.7 Undrained Analysis

A summary of undrained analysis results are presented in **Table 8-8**. As outlined above the undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface.

[1] *For the stability analysis two load conditions were examined, namely*

Condition (1): *no surcharge loading*
Condition (2): *surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.*

The calculated FoS for load condition 1 is in excess of 1.40 for each of the 280 locations analysed with a range of FoS of 3.11 to 687.58, indicating a relatively low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.40 for each of the 280 locations analysed with a range of FoS of 1.42 to 114.59, indicating a low risk of peat instability.

Table 8-8: Summary Factor of Safety Results (undrained condition)

Turbine No./Waypoint	Factor of Safety for Load Condition	
	Condition (1)	Condition (2)
T1	17.20	8.6
T2	6.22	2.56
T3	43.01	12.29
T4	5.74	3.83
T5	11.50	4.93
T6	8.71	2.90
T7	34.41	11.47
T8	5.11	1.70
T9	7.65	4.59
Met Mast	86.22	7.84
Construction Compound North	6.37	4.65
Construction Compound (at met mast)	86.22	7.84
Access Roads	3.11 to 29.81	1.81 to 4.61
BMEP Area A	5.77	2.89
BMEP Area B	No Peat	
BMEP Area C	7.50	2.32
BMEP Area D	2.51	1.75
BMEP Area E	3.51	1.75
BMEP Area F	6.88	5.73
BMEP Area G	4.28	2.98
BMEP Area H	9.93	6.70

Turbine No./Waypoint	Factor of Safety for Load Condition	
	Condition (1)	Condition (2)
BMEP Area I	5.77	2.89
BMEP Area J	6.63	3.75

8.3.10.8 Drained Analysis

Summary of drained analysis results are presented in **Table 8-9**. As outlined above, the drained loading condition applies in the long-term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

The calculated FoS for load condition 1 is in excess of 1.40 for each of the 280 locations analysed with a range of FoS of 2.07 to 458.39, indicating a relatively low risk of peat instability.

The calculated FoS for load condition 2 is in excess of 1.40 for each of the 280 locations analysed with a range of FoS of 1.92 to 165.45, indicating a low risk of peat instability.

Table 8-9: Summary Factor of Safety Results (drained condition)

Turbine No./Waypoint	Factor of Safety for Load Condition	
	Condition (1)	Condition (2)
T1	11.47	12.41
T2	4.15	3.66
T3	28.67	17.73
T4	3.83	5.52
T5	7.66	7.10
T6	5.80	4.15
T7	22.94	16.55
T8	3.41	2.38
T9	5.10	6.62
Met Mast	57.48	11.29
Construction Compound North	4.25	6.71
Construction Compound (at met mast)	57.48	11.29
Access Roads	2.07 to 19.87	2.59 to 8.28

Turbine No./Waypoint	Factor of Safety for Load Condition	
	Condition (1)	Condition (2)
BMEP Area A	8.28	6.36
BMEP Area B	No Peat	
BMEP Area C	7.50	2.32
BMEP Area D	6.11	5.60
BMEP Area E	4.98	3.81
BMEP Area F	31.3	30.54
BMEP Area G	10.48	9.61
BMEP Area H	8.25	3.40
BMEP Area I	8.28	6.36
BMEP Area J	11.09	9.17

8.3.10.9 Risk Assessment

A Geotechnical and Peat Stability Risk Assessment Report (GPSRA) was carried out for the infrastructure elements at the Proposed Project. This approach adheres to best practice guidance for geotechnical/peat stability risk assessments as given in PLHRAG Guidance (2017) and MacCulloch (2005).

For each of the main infrastructure elements, a risk rating (product of probability and impact) is calculated. Where a location is rated 'Medium' or 'High', control measures are required to reduce the risk to at least a 'Low' risk rating. Where a subsection is rated 'Low' or 'Negligible', routine control measures are required.

The results of the GPSRA for potential peat failure at the Site infrastructure is presented as a Geotechnical Risk Register in Appendix B of **Appendix 8-1**.

The risk rating for each infrastructure element of the Proposed Project is designated as Low following some mitigation/control measures being implemented.

Details of the required infrastructure specific mitigation/control measures can be found in Appendix B of the GPSRA (**Appendix 8-1)** and the general infrastructure specific control measures are summarised below:

- Detailed ground investigation to confirm peat, mineral soil and bedrock condition and properties;
- Use of experienced geotechnical staff for confirmatory site investigation;
- Maintain hydrology of area as far as possible by maintaining the flow of water in existing drains to prevent the build-up of water pressures in the peat, leading to the peat becoming "buoyant"; and,

- Use of contractors with experience in working peat and trained operators to carry out the work.

8.3.10.10 Peat Stability Assessment Conclusions

In summary, the findings of the GPSRA showed that the Site has an acceptable margin of safety, is suitable for the Proposed Project and is considered to be of a low risk for peat failure provided appropriate control measures, such as implementing and maintaining an appropriate drainage system, are implemented.

The findings include mitigation/control measures for construction work in peat lands, all of which will be implemented in full to ensure that all works adhere to an acceptable standard of safety.

This section summarises the report on assessment of peat stability undertaken by FT. The GPSRA is included as **Appendix 8-1** of this EIAR.

8.4 Summary of Site Geology & Geotechnical Conditions

A detailed description of the geology of the Site is presented in this chapter.

Regional baseline geological data is available from the GSI through their online map viewer (www.gsi.ie). The bedrock across the Site is mapped as the Central Clare Group (SILTSTONE and SANDSTONE).

Subsoils are predominantly mapped as blanket peat and Namurian sandstone and shale tills by the GSI. A significant area of the Site is also mapped as bedrock outcrop or subcrop where subsoils are absent and bedrock is close to ground surface. This geological setting is favourable for a wind farm development as only shallow founding depths will be required to encounter competent strata.

The Proposed Project investigations and geotechnical assessments were extensive and consisted of 914 peat depth probes, 7 no. trial pits and geophysical surveys. The geophysical survey profiling was carried out over total distance of 765m.

The geological setting of the Site has been thoroughly examined, and the geological/hydrogeological setting is fully understood.

Site investigations and geotechnical assessments are summarised as follows:

- The results of the peat stability analysis showed all locations to have low risk of peat instability;
- Peat depths recorded across the Site ranged from 0 to 5m with an average depth of 0.7m, which is considered shallow for blanket bog;
- Approximately 74% of recorded peat depth were less than 1m and with 94% of less than 2.0m;
- The peat depths recorded at the Proposed Turbines varied from 0.2 to 2.0m with an average depth of 0.8m (this is considered shallow peat, turbines have successfully been constructed in several metres of peat);
- Of the 9 no. Proposed Turbines, only 3 no. recorded peat depths in excess of 1m (i.e. T1, T4 and T9);
- With respect to the new proposed access roads, peat depths are typically less than 1.0m (average 0.8m) and therefore most roads will be constructed by excavate and replace method;
- At the proposed borrow pit location, peat depths are very shallow (0 - 0.2m);

- No evidence of past failures or any significant signs of peat instability were noted on site by FT at the time of the geotechnical walkover surveys;
- The geotechnical hand vane results indicate undrained shear strengths in the range 6 to 90kPa, with an average value of about 30kPa;
- The strengths recorded would be typical of well drained peat as is present on the Site;
- Mineral subsoils were typically described as soft to firm gravelly CLAY or SILT;
- Refusal on bedrock (presumed) was recorded in all 7 no. trial pits at depths ranging from 0.3 to 2m;
- Depth to bedrock at Proposed Turbines where trial pits were carried out (T1, T2, T3, T5 and T6) ranged between 0.8m and 1.8m with an average of 1.2m;
- Geophysical surveys identified competent bedrock at Proposed Turbines T4, T7 and T8 at depths ranging between 1 and 5m below ground level (mbgl). Depths to bedrock at proposed turbine location T9 varied between 4.5 and 6.5mbgl;
- The investigations indicate that deep foundation excavations will not be required due to the shallow depth of competent bedrock strata;
- Geophysical surveys carried out at the borrow pit identified competent, strong SANDSTONE/SILTSTONE at shallow depths ranging from 1 to 3mbgl;
- No bedrock faults or fractures were identified by the geophysical surveys; and,
- The geophysical survey demonstrates that the bedrock proposed for extraction at the proposed borrow pit is strong, competent and fit for the purpose of rock extraction and follow-on permanent storage of peat/spoil.

8.5 Receptor Sensitivity and Importance

Based on the criteria set out in **Table 8-2** above, the soils and peat at the Site can be classed as being of low importance as the overlying peat and soil deposits are not designated in this area and are degraded in places as a result of the forestry and peat cutting operations and associated drainage.

The soils and subsoils along the Proposed Grid Connection Site can also be considered as being of low importance as the proposed 33kV underground cabling route is located predominantly along existing public roads and private access tracks, and no peat or soils deposits are designated along the Proposed Grid Connection Site. The bedrock geology underlying the Site can be classed as being of medium importance where the bedrock could be used on a sub-economic scale.

The land, peat, soils and bedrock geological formations underlying the Site are scoped in for impact assessment due to their proximal location to the Site and the potential effects that the Proposed Project may have on these receptors.

No geological heritage site or designated site will be scoped in for impact assessment due to their distant location from the Site and no potential for direct or indirect effects.

There is no potential for the Proposed Project to affect the land, soils and geological environment outside of the Site. Therefore, there is no potential for effects to occur on any geological heritage site or designated site

8.6 Characteristics of the Proposed Project

The Proposed Project will involve the removal of peat, soils, subsoils and bedrock in order for access roads, internal cabling network, hardstanding emplacement, turbine foundations, peat and spoil management areas, crane hardstands, construction compounds, drainage works and met mast installation. Minor earthworks will also be completed at the proposed extension to the existing Slievecallan 110kV substation.

It is proposed that bedrock won from the on-site borrow pit (i.e. siltstone/sandstone) will be used to construct the sub-base layer of proposed upgraded and new access roads, hardstand areas and turbine base areas. Once installed the subbase layer will be overlain by a clean capping layer of high-grade limestone which will be sourced from local quarries. Please note that limestone is a sedimentary rock and is used country wide for public road construction. Limestone typically has a high strength/weight bearing capacity and is not prone to erosion.

The estimated quantity of available rock within the proposed borrow pit is 100,000m^3. Conservative assumptions were made in estimating the quantity of rock available in the borrow pit.

Generally, the construction methodology for constructing any structure or platform foundation, such as a turbine base, hardstand or substation extension, involves removing all soft material is required to a depth where a suitable bearing material is encountered. Based on the site-investigation data it is expected gravity foundations may be constructed at all Proposed Turbines. The maximum excavation depth at the Proposed Turbine is expected to be approximately 3m.

2.5km of existing access tracks will be utilised for the Proposed Project. Existing access tracks account for 30% of the total length of Proposed Wind Farm Site access roads (7.9km).

In addition, 5.2km of new access track will be constructed at the Proposed Wind Farm Site. Due to the typically shallow nature of the peat along the route of the proposed new roads, this will mainly be carried out using the excavate and replace technique with only minor floating road requirement.

Crane hardstands, the met mast and the temporary construction compounds will all be constructed using the founded technique. The material excavated is required to be properly managed and stored and should be re-used in other elements of the Proposed Project infrastructure.

The quantities of peat and spoil requiring management at the Site have been calculated and are presented in **Table 8-10** below.

The total estimated combined volume of peat and spoil to be managed following excavations during the construction phase of the Proposed Project is approximately 124,500m^3 (this includes a contingency factor of 10% to allow for increase in volume upon excavation). It should be noted that the aforementioned peat and spoil volume will be extracted and transported throughout the Site on a sequential basis.

It is proposed to manage overburden generated through construction activities locally within the Proposed Wind Farm Site, in the 5 no. designated peat/spoil storage areas, for landscaping at the Proposed Turbines and reinstatement of the proposed borrow pit.

The total capacity of the identified peat and spoil management areas, including the proposed landscaping and sidecasting is approx. 133,400m^3 (refer to **Table 8-11** below) and therefore, there is more than enough capacity to manage the total volume of peat and spoil requiring management for both the Proposed Wind Farm Site and Proposed Grid Connection Site.

The majority of material excavated along the proposed underground cabling will be transported back to the Proposed Wind Farm Site for storage. However, some excess spoil material generated during the

underground cabling route construction will be transported by permitted waste contractors to a suitable permitted/licensed site for disposal/recovery. This is dependent on the road makeup at locations along the Proposed Grid Connection Site. The main contractor will determine the appropriate location for management of arisings from the Proposed Grid Connection Site.

Further details are provided in the Peat and Spoil Management Plan (FT, 2026a(a)) for the works which is included in **Appendix 4-2.**

The Proposed Project includes areas proposed for enhancement under the BMEP included in **Appendix 6-4**. There will be no peat or spoil waste generated by the BMEP.

Table 8-10 Worst Case Peat, Mineral Soil (Spoil) Excavation Volumes

Development Component	Peat Volume(m^3) (approx.)	Spoil Volume(m^3) (approx.)
9 no. Turbines and Hardstanding Areas (including foundations)	23,000	37,100
Access Roads	31,000	13,000
Temporary Construction Compounds (2 no.)	450	450
Meteorological Mast	100	200
Borrow Pit	2,600	10,000
Underground Cabling Connection	1,300	5,300
Sub-Total	**58,450**	**66,050**
Total (m^3)	**124,500**	

Table 8-11 Peat/Spoil Placement Reinstatement Areas

Development Component	Peat and Spoil Volume(m^3) (approx.)	Comment
Peat and Spoil Management Areas	20,400	Up to 1.2m in height across clearfell areas adjacent to turbines, where slopes are relatively shallow and 1.5m in height in spoil storage area adjacent to borrow pit.
Landscaping	18,000	It is estimated that 1,500m^3 of peat will be required for landscaping purposes and a further 500m^3 of spoil as ballast backfill to turbines at each of the 9 no. turbine locations.

Development Component	Peat and Spoil Volume(m^3) (approx.)	Comment
Borrow Pit	95,000	Refer to Section 6.5 of the Peat & Spoil Management Plan
Total	**133,400**	-

8.7 Likely Significant Effects on Land, Soils and Geology

8.7.1 'Do-Nothing' Scenario

An alternative land-use option to the development of a renewable energy project at the Site would be to leave the Site as it is, with no changes made to existing land-use practices. Commercial forestry operations would continue at the Site.

If the Proposed Project were not to proceed, the opportunity to capture part of County Clare's valuable renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources by 2030 and the reduction of greenhouse gas emissions. The opportunity to generate local employment and investment and to diversify the local economy would also be lost.

Furthermore, as this application includes a BMEP **(Appendix 6-4**) to be implemented during the development's operation, the opportunity to enhance the site for biodiversity, at a local scale, would also be lost

Drainage carried out in areas of existing access road and coniferous plantations and farmland continue to function and may be extended in the case of coniferous plantation. Coniferous forestry will be felled as forestry compartments reach maturity. Re-planting of these areas with more coniferous trees is likely to occur. Plantations will be reploughed where necessary to facilitate afforestation.

The land, soils and geology would remain largely unaltered as a result of the 'Do-Nothing' Scenario.

8.7.2 Construction Stage - Likely Significant Effects and Mitigation Measures

The likely impacts of the Proposed Project and mitigation measures that will be put in place to eliminate or reduce them are shown below.

8.7.2.1 Potential Effects on Land (Land-Take) and Land Use

The Proposed Project include the construction of 9 no. Proposed Turbines, associated hardstand areas, 2 no. temporary construction compounds, substation extension, 1 no. borrow pit, new access roads and upgrades to the existing road network. The permanent built infrastructure footprint of the Proposed Project infrastructure is 8.7ha which accounts for only 0.69% of the Site (1,260ha).

The Proposed Project construction works will result in local topographic changes with the removal of overburden at the Proposed Wind Farm Site. There will be no effects on the lands adjoining the Site.

The Proposed Project will result in the excavation of a temporary narrow trench to accommodate the proposed underground cabling. This trench will be reinstated once the cabling is emplaced with a comparable ground surface (tarmacadam or subsoil/topsoil). Therefore, no effects on land or landuse will occur along the majority of the Proposed Grid Connection Site.

TDR works will only require street furniture alteration and temporary local road widening and therefore will have no effect on land or landuse.

Pathways: Excavation and infrastructure construction.

Receptors: Land (i.e. land upon which the Proposed Project will occur).

Pre-Mitigation Potential Effect: Negative, slight, direct, permanent, likely effect on land (land-take) within the Site. In the absence of mitigation measures, there will be no potential for significant effects on land at the Site.

Mitigation Measures / Impact Assessment: The proposed underground cable connection is located predominantly along existing private roads. There will be no change in the land environment along the existing roads, whereby the roads will be reinstated with a comparable ground surface. The use of the existing road network reduces the area which will be altered or disturbed as a result of the works associated with the proposed underground cable connection.

Following the construction phase areas of the Proposed Project will be replaced by hardstand areas with a permanent built infrastructure footprint of 8.7ha. This represents a change in landcover of ~0.69%.

The loss of coniferous forestry (20.7ha) and peatland (10.1ha) for the construction of the permanent built infrastructure footprint will not have a significant effect on land at the Site due to the small permanent built infrastructure footprint of the Proposed Project (0.69%). The loss of the 123ha of coniferous forestry for Hen Harrier Habitat enhancement would constitute a change of land use as well. The loss of this land is minimal on a local and regional scale and therefore, the effects of land loss is negligible.

All felling operations will be completed in line with the Forest Service's published policy and will be subject of a Limited Felling Licence (LFL). The Forest Service policy requires replacement or replanting on a hectare for hectare basis for the footprint of the infrastructure developments. Therefore, while the loss of coniferous forestry (144ha) will be a permanent change to the land at these locations, all forestry lost will be replaced elsewhere within Ireland as per the Forest Service felling policy.

Given the undulating nature of the local topography resulting from the quaternary deposits, any change in topography is likely to be minimal in the overall landscape.

Residual Effect: The residual effect will be a negative, direct, slight, likely, permanent effect on land and landuse.

Significance of Effects: For the reasons outlined above (small development footprint), no significant effects on land (land-take) will occur.

8.7.2.2 Peat, Subsoil Excavation and Bedrock Excavation

Excavation of peat, subsoil and bedrock will be required for site levelling and for the installation of infrastructure and foundations for the access roads and turbines and all element of the Proposed Project. There are no peat excavation works required during tree felling. This will result in a permanent loss of peat, subsoil and bedrock at excavation locations. Estimated volumes of peat and bedrock to be removed are presented in Section 8.6 above.

Pathway: Extraction/excavation

Receptor: Peat, subsoil and bedrock

Potential Pre-mitigation Effect: Negative, moderate, direct, high probability, permanent effect on peat, subsoil and bedrock.

Proposed Mitigation Measures by Design:

All work will be in accordance with the Peat and Spoil Management Plan (FT. 2026 (a)) detailed in Sections 4.9.11 and 4.9.12 of Chapter 4 and **Appendix 4-2**. The Proposed Project design has been iteratively developed using comprehensive site-specific site investigation dataset, which includes peat probes, trial pits and geophysical surveys.

- Placement of turbines and associated infrastructure in areas with shallow peat where possible (this has been confirmed by extensive site investigations);
- Use of the existing road network to reduce peat excavation and borrow pit volumes;
- The peat and subsoil which will be removed during the construction phase will be localised to the Proposed Project infrastructure;
- No turbines or related infrastructure will be constructed near or on any designated sites such as NHAs, SACs or SPAs;
- A minimal volume of peat and subsoil will be removed to allow for infrastructural work to take place in comparison to the total volume present on the Site due to optimisation of the layout by mitigation by design; and,
- The majority of peat excavated during road construction will be permanently stored in the on-site borrow pit and at dedicated peat/spoil storage areas. A smaller proportion of excavated peat will be cast aside and landscaped at locations carefully selected by the project geotechnical expert and project hydrologist.

Residual Effect: The granular soil/peat deposits and bedrock at the Site is classified as of "Low" and "Low" importance respectively. The peat is already degraded by forestry and drainage. The overall Site area is extensive while the Proposed Project footprint (8.7ha) is approximately c 0.69% of the overall EIAR study area (1,260ha).

The design measures incorporated into the Proposed Project as described above in particular the avoidance of deeper peat areas combined with the 'low' importance of the deposits means that the residual effect is considered Negative, direct, slight, Likely, permanent impact on peat, subsoil and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.2.3 Contamination of Soil by Leakages and Spillages

Plant and machinery will be run on oils and fuels. Oils will also be present in the proposed extension to the existing Slievecallan 110kV substation. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to land, soils and associated ecosystems. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Soil and bedrock pore space.

Receptor: Peat, subsoil and bedrock

Potential Pre-mitigation Effect: Negative, slight, short term, likely effect on peat, soils and bedrock.

Proposed Mitigation Measures:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Where possible, off-site refuelling will occur at a controlled fuelling station;
- On-site re-fuelling will be undertaken using a double skinned bowser with spill kits kept on site for accidental leakages or spillages;
- Only designated trained operatives will be authorised to refuel plant on-site;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- Fuels stored on-site will be minimised. All storage areas will be bunded appropriately for the duration of the construction phase. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose; and,
- An emergency response plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan (which is contained in **Appendix 4-5**).

Residual Effect: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be a negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.2.4 Erosion of Exposed Subsoils and Peat During Tree Felling, Access Road and Turbine Base Construction Work

Peat and spoil removed from the Proposed Turbines, access roads and all elements of the Proposed Project listed in **Table 8-10**, will be used for landscaping, cast aside alongside designated access roads, used to reinstate the proposed borrow pit and placed within designated peat/spoil storage areas at the Proposed Turbines.

Where possible, the peat acrotelm (surface vegetation layer) will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the borrow pits. Re-seeding and spreading/planting of heather and moss cuttings will also be carried out in these areas. These measures will prevent erosion of stored peat in the short term until vegetation has established and binds the peat/soils together and presents erosion. A full Peat and Spoil Management Plan for the development is presented as **Appendix 4-2**.

With regard to tree felling, there will be no generation of peat that will require storage/management. 20.7 ha of permanent felling will be undertaken in and around the permanent built infrastructure footprint of the Proposed Project (i.e. access roads, turbines etc). Felling will be carried out around all Proposed Turbines to reduce turbulence effects or bat mitigation. Permanent removal of c. 123.3 ha of forestry will also be required for the BMEP as detailed in **Appendix 6-4.**

During tree felling there is a potential to generate peat particles and silts in surface water runoff due to tracking of machinery and disturbance of the peat surface.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Peat, Subsoil & weathered bedrock

Potential Pre-mitigation Effect: Negative, slight, permanent likely effect on peat, subsoils and bedrock.

Proposed Mitigation Measures

- All excavated material will be completed in accordance with the Peat and Spoil Management Plan (FT. 2026 (a)), refer to **Appendix 4-2**). Material will be moved over the least possible distance.
- Any excess peat will be moved to peat storage areas or will be temporarily surrounded by earthen berms to prevent erosion. This will prevent erosion of soil. Silt fences will be installed around temporary stockpiles to limit movement of entrained sediment in surface water runoff. The use of earthen berms and silt fencing around earthworks and spoil mounds will prevent egress of water from the works.
- In order to minimize erosion of mineral subsoils stripping of peat will not take place during extremely wet periods[2] (to prevent increased silt rich runoff). Temporary drainage systems (as outlined in Section 9.3.17 of the Chapter 9) will be required to limit runoff impacts during the construction phase.
- During tree felling brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. These best practice measures related to water quality protection are incorporated into the forestry management and mitigation measures as presented in Section 9.5.2.1 of Chapter 9.)

Residual Effect: Peat soils and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works will be completed in accordance with the detailed Peat and Spoil Management Plan, material will be moved the least possible distance, and reseeding and planting will be completed to bind landscaped peat and spoil together. Following implementation of these measures the residual effect is negative, imperceptible, direct, permanent, likely effect on peat and subsoils by erosion and wind action.

Significance of Effects: For the reasons outlined above, and with the implementation of the proposed mitigation measures, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.2.5 Peat Instability and Failure

Peat instability and failure are risks at the Site during the construction phase and are assessed herein. Peat instability is not considered to be a risk along the Proposed Grid Connection Site due to the nature of the proposed works and the limited extent of peat along the route.

A GPSRA was carried out for the main infrastructure elements at the Site. This approach takes into account guidelines for geotechnical/peat stability risk assessments as given in PLHRAG (2017) and MacCulloch (2005).

Peat instability or failure refers to a significant mass movement of a body of peat that would have a significant effect on the Site and the surrounding environment. Peat failure excludes localised

[2] >10 mm/hr (i.e. high intensity local rainfall events);
>25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
>half monthly average rainfall in any 7 days.

movement of peat that could occur below an access road, creep movement or erosion type events. The consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by particulates;
- Degradation of the environment.

However, the findings of the GPSRA (FT, 2026), which involved analysis of 280 no. locations, showed that all Proposed Project infrastructure elements are located in areas of low risk as discussed in Section 8.3.10 above.

Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase of the Proposed Project to ensure peat failures do not occur on site.

Faulting was considered as part of the GPSRA (FT, 2026), and it has been concluded that there is no risk on peat or rock stability from mapped bedrock faults.

Pathway: Vehicle movement and excavations.

Receptor: Peat subsoils.

Potential Pre-mitigation Effect: Direct, negative, slight, unlikely effect on peat and subsoils. The findings of the GPSRA (FT, 2026) showed that the Site has an acceptable margin of safety, is suitable for the Proposed Project and is considered to be low risk of peat failure. In the absence of mitigation measures, there will be no potential for significant effects on peat and subsoils at the Site. However, mitigation measures discussed below will be implemented for best practice adherence.

Mitigation Measures:

Based on the recommendations and control measures given in the FT GPSRA (**Appendix 8-1**) report being strictly adhered to during construction and the detailed stability assessment carried out for the peat slopes which showed that the site has an acceptable margin of safety, there is a low risk of peat instability/failure at the Site (i.e. all elements of the Proposed Project, including the Proposed Enhancement Site which is part of the Proposed Project but is included here for clarity) as listed in **Table 8-8** and **Table 8-9**).

The risk assessment at each of the Proposed Turbines identified a number of control measures to reduce further the potential risk of peat failure. Access roads to turbines will be subject to the same relevant control measures that apply to the nearest turbine.

The following measures incorporated into the construction phase of the Proposed Project will assist in the management of the risks for this Site;

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report findings from monitoring systems;

- Ensure construction method statements are followed or where agreed modified/ developed; and,
- Revise and amend the Geotechnical Risk Register as construction progresses.

Please refer to **Appendix 8-1** for proposed turbine specific, road section and underground cable route mitigation measures.

Residual Effect: A detailed Geotechnical and Peat Stability Assessment (GPSRA) has been completed for the development site proposal. The findings of that assessment have demonstrated that there is a low risk of peat failure, at the site as a result of the Proposed Project. With the implementation of the control measures outlined above the residual effect is - Negative, imperceptible, direct, unlikely, permanent effect on peat and subsoils.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.2.6 Slievecallan 110kV Substation Extension Works

Minor earthworks are required for substation extension works. These include for increasing the size of the substation footprint by 3,950 square metres. These extension works are described in Section 4.4.5 of this EIAR.

Pathway: Extraction/excavation/landscaping.

Receptor: Soil and subsoil

Potential Pre-Mitigation Effect: Negative, imperceptible, direct, likely, temporary effect on land, soil and subsoil.

Proposed Mitigation Measures:

- All works are minor and localised and cover very small areas;
- All works are temporary in nature.

Residual Effect: The proposed substation extension related earthworks are minor in nature and will be temporary in durations. Residual effects are Negative, imperceptible, direct, likely, permanent effect on land, soil and subsoil.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils or subsoils will occur.

8.7.2.7 Turbine Delivery Route Works

Minor earthworks are required for turbine delivery. These will be limited to temporary measures including temporary local road widening, overruns of roundabout island and temporary relocation of some signs and street furniture. These TDR works are described in Section 4.6.2 of the EIAR.

Pathway: Extraction/excavation/landscaping.

Receptor: Peat and subsoil

Potential Pre-Mitigation Effect: Negative, imperceptible, direct, likely, temporary effect on land, peat and subsoil.

Proposed Mitigation Measures:

- All works are minor and localised and cover very small areas;
- These works are distributed over a wide area; and,
- All works are temporary in nature.

Residual Effect: The TDR related earthworks are minor in nature and will be temporary in durations. They are also separated from each other by considerable distances. Residual effects are Negative, imperceptible, direct, likely, temporary effect on land, peat and subsoil.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils or subsoils will occur.

8.7.2.8 Potential Effects from the Proposed Biodiversity Management and Enhancement Plan (BMEP)

As part of the above hen harrier enhancement plan, it is proposed to fell 123 ha of existing forestry along with the management of c. 20 hectares of agricultural grassland into species rich wet grassland for hen harrier habitat enhancement as well as an additional 29.4ha for Marsh Fritillary habitat management.

It is proposed to bolster and plant new hedgerow and riparian corridors within the eastern section of the Site, as well as manage existing hedgerows and areas of native scrub.

Some of these proposals will disturb local peat, soil and subsoil deposits and increase the likelihood of erosion of peat and subsoils. However, due to the largely non-invasive nature of the works the potential for effects on the soils and geological environment are limited. The works will have a positive effect on the land environment.

Pathway: Vehicle movement, restoration works, surface water and wind action.

Receptor: Land, peat/soil and subsoil.

Pre-Mitigation Potential Effect: Negative, direct, slight, likely effect on peat and subsoils due to disturbance associated with proposed restoration works. Positive, slight, direct, permanent effect on the land at the Proposed Enhancement Site. In the absence of mitigation measures, there will be no potential for significant effects on land, peat, soils and subsoils at the Proposed Enhancement Site.

Proposed Mitigation Measures:

All proposed habitat management and enhancement works will be in accordance with the best practice Forest Service regulation, policies and strategic guidance documents as well as Coillte, DAFM and NatureScot guidance documents to ensure minimal potential negative effects on the local peat, soil and subsoil environment.

Given the nature of the restoration measures the following mitigation measures are proposed:

- Before any works are completed silt fences will be installed to limit the movement of entrained sediment in surface water runoff;
- Proposed off-road routes will be walked in advance of any machinery;
- All machinery operators will be experienced;
- The Proposed Wind Farm Site will be walked before a machine goes off-road;
- Bog mats will be used where the excavator is required to travel over wet ground; and,
- A low ground pressure excavator with wide tracks (1.9m or greater) will be used to reduce compaction of the peat and subsoils.

Post-Mitigation Residual Effect: With the implementation of mitigation measures outlined above the residual effect will be a negative, direct, imperceptible, likely effect on peat, subsoils and weathered bedrock. There will be a slight, positive, permanent effect on land within the Proposed Wind Farm site.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on peat and subsoils.

8.7.3 Operational Stage - Likely Significant Effects and Mitigation Measures

Very few potential direct impacts are envisaged during the operational phase of the Proposed Project.

These may include:

- Maintenance of site roads;
- Some construction vehicles or plant will be necessary for maintenance of turbines which could result in minor accidental leaks or spills of fuel/oil; and,
- The transformer in the substation and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater.

8.7.3.1 Site Road Maintenance during the Operational Stage

In relation to indirect impacts, a small amount of granular material will be required to maintain access tracks/site roads during operation which will place intermittent minor demand on local quarries. Please note the on-site borrow pits will have been reinstated with excavated peat and spoil following the construction stage and will not be available to source aggregate during the operational phase.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, indirect, imperceptible, long term, likely impact on peat, subsoil and bedrock.

Proposed Mitigation Measures:

- Use of aggregate from authorised quarries for use in road and hardstand maintenance.

Residual Effect: The use of imported aggregates for site road maintenance will be minor and infrequent, and all material will be imported to the Site from local authorised quarries. The residual effect will be - Negative, imperceptible, indirect, long-term, unlikely effect on peat, subsoil and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils or geology will occur.

8.7.3.2 Site Vehicle/Plant Use During Operational Stage

Plant and site vehicles used in site maintenance will be run on fuels and use hydraulic oils. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to land, soils and associated ecosystems. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, direct, slight, short term, unlikely effect on peat, subsoil and bedrock.

Proposed Mitigation Measures:

- Vehicles used during the operational phase will be refuelled off site before entering the site;
- No fuels will be stored on-site during the operational phase; and
- Spill kits will be available in all site vehicles to deal with any accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be contained in the Construction and Environmental Management Plan (CEMP, refer to Appendix 4-5) for the Proposed Project operational phase.

Residual Effect: The use of hydrocarbons in plant and vehicles is a standard risk associated with all operational wind farm sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be - Negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.3.3 Use of Oils in Turbine Transformers During Operational Stage

The transformer in the substation extension and transformers in each turbine are oil cooled. There is potential for spills / leaks of oils from this equipment resulting in contamination of soils and groundwater. Hydrocarbon has a high toxicity to humans, and all flora and fauna, and is persistent in the environment.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

Potential Pre-Mitigation Effect: Negative, direct, slight, short term, unlikely effect on peat, subsoil and bedrock.

Proposed Mitigation Measures:

- All transformers and substation areas will be bunded to 110% of the volume of oil used in each transformer/substation;
- An emergency plan for the operational phase to deal with accidental spillages will be contained in the Construction and Environmental Management Plan (CEMP, refer to Appendix 4-5) for the wind farm operational phase.

Residual Effect: The use of hydrocarbons in transformers and substations is a standard risk associated with all operational wind farm sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be - Negative, imperceptible, direct, short-term, unlikely effect on peat and subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on land, soils, subsoils or bedrock will occur.

8.7.4 Decommissioning Stage - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the Proposed Project will be similar to those associated with construction but at a reduced magnitude due to the reduced scale of the works. Please refer to Section 8.7.2 above.

During decommissioning, it will be possible to reverse or at least reduce some of the potential impacts caused during construction by rehabilitating construction areas such as turbine bases and hard standing area. This will be done by covering hard surfaces with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation. Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude as the extent of the works will be less.

Some of the impacts will be avoided by leaving elements of the Proposed Project in place where appropriate.

Turbine and mast foundations would remain underground and would be covered with earth and allowed to revegetate. Leaving the foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant temporary environment nuisances such as noise, dust and/or vibration. Site roadways will be used during the operational phase by farm machinery and will provide a useful means of extracting the commercial forestry crop which exists on at the Site and therefore will be retained post decommissioning to facilitate these activities.

The proposed 33kV underground cabling connecting the Proposed Turbines to the proposed extension of the Slievecallan 110kV substation will be removed from the cable ducts. The cable ducting will be left in-situ as it is considered the most environmentally prudent option, avoiding unnecessary excavation and soil disturbance.

The proposed extension to the Slievecallan 110kV substation will remain in place as it will be part of the Electricity Grid under the ownership and control of the ESB Networks and EirGrid.

As noted in the Scottish Natural Heritage report (SNH) *Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms* (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the impacts will be avoided by leaving elements of the Proposed Project in place including the bases which will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

No significant impacts on the land, soils and geology environment are envisaged during the decommissioning stage of the Proposed Project.

8.7.5 Risk of Major Accidents and Disasters

Due to the nature of the Site, *i.e.* soft peat deposits, there is a risk of peat movement occurring. However, due to the generally thin nature of peat at the Site, the risk is low.

A comprehensive Geotechnical and Peat Stability Risk Assessment (GPSRA) (FT, 2026) has been undertaken for all Proposed Project infrastructure locations, and it concludes that with the implementation of the proposed control (mitigation) measures, the residual effect of a landslide occurring is determined to be imperceptible.

8.7.6 Post Construction Monitoring

None required as no significant effects will occur.

8.7.7 Potential Cumulative Impacts

Due to the localised nature of the proposed construction works, which will be kept within the Site, there is no potential for significant cumulative effects in-combination with other local developments on the land, soils and geology environment. The only way the Proposed Project can have in-combination effects with other off-site projects and plans is via the drainage and off-site surface water network, and this hydrological pathway is assessed in Chapter 9: Hydrology and Hydrogeology.

The turbine delivery route and junction works will only require relatively localised excavation works outside the Site and therefore will not contribute to any significant cumulative effects.

8.7.8 Summary

Excavation of peat, subsoil and bedrock will be required for site levelling and for the installation of the Proposed Project infrastructure. This will result in a permanent removal of peat, subsoil and possibly bedrock at most excavation locations. Excavated peat will be utilized to re-instate the borrow pit and will also be used for reinstatement and landscaping works around the Site. The handling and management of peat will be undertaken in accordance with the Peat and Spoil Management Plan (PSMP, FT, 2026) (Appendix 4-2). Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods.

Measures to prevent peat and subsoil erosion during excavation, reinstatement, and permanent placement in borrow pit will be undertaken to prevent water quality impacts.

A Geotechnical and Peat Stability Assessment (FTC, 2026) (Appendix 8-1) undertaken for the site shows that there is a low risk of peat instability/failure at the Site and along the proposed construction access road.

No significant impacts on the land, soil, and geology of the Site will occur during construction, operation, or during decommissioning phases.

Our assessment also concludes that there will be no cumulative effects on land, soil and geology environment as a result of the Proposed Project.

8.8 EIA Classification Summary

Please see the below table for a summary of all identified impacts for the Proposed Project relating to land soils and geology.

Table 8-12: Assessment Classification Summary.

Topic	Pre-Mitigation Effect	Mitigation Section Reference	Residual Effect	Significance
Construction Phase				
Land and Land-Use	Permanent, Slight, Negative	Section 8.7.2.1	Permanent, Slight, Negative	Not Significant
Peat and Subsoil Excavation	Permanent, Moderate, Negative	Section 8.7.2.2	Permanent, Slight, Negative	Not Significant
Leakages and Spillages	Short-Term, Slight, Negative	Section 8.7.2.3	Short-Term, Imperceptible, Negative	Not Significant
Erosion of Exposed Subsoils and Peat	Short-Term, Slight, Negative	Section 8.7.2.4	Permanent, imperceptible, Negative	Not Significant
Peat Instability and Failure	Permanent, Slight, Negative	Section 8.7.2.5	Permanent, Imperceptible, Negative	Not Significant
Slievecallan 110kV Substation Extension Works	Permanent, Imperceptible, Negative	Section 8.7.2.6	Permanent, Imperceptible, Negative	Not Significant
Turbine Delivery Route Works	Temporary, Imperceptible, Negative	Section 8.7.2.7	Temporary, Imperceptible, Negative	Not Significant
Biodiversity Management and Enhancement Plan	Permanent, Slight, Positive	Section 8.7.2.8	Permanent, Slight, Positive	Not Significant
Operational Phase				
Site Road Maintenance	Long-Term, Imperceptible, Negative	Section 8.7.3.1	Long-Term, Imperceptible, Negative	Not Significant
Site Vehicle / Plant Use	Short-Term, Slight, Negative	Section 8.7.3.2	Short-Term, Imperceptible, Negative	Not Significant

Potential effects from the Use of Oil in Transformers	Short-Term, Slight, Negative	Section 8.7.3.3	Short-Term, Imperceptible, Negative	Not Significant
Decommissioning Phase				
Land Soils and Geology	The potential impacts associated with decommissioning of the Proposed Project will be similar to those associated with construction but of reduced magnitude.	Section 8.7.4	Not Significant	Not Significant