8. LAND SOILS AND GEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland to carry out an assessment of the potential significant effects of the Proposed Development on the land, soil and geological environment.

This report provides a baseline assessment of the environmental setting of the Proposed Development, as described in Chapter 4, 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 Development 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.

Please note that in this chapter we refer to the Wind Farm Site (turbines, access roads, borrow pits, temporary construction compounds, metrological mast, forestry felling and all associated works), and the Underground Cable Route (7.1km long running from the Slieveacurry Wind Farm Site to Slievecallan substation), and the Proposed Development study area. Other elements of the Project are referenced accordingly (i.e. replacement planting lands and Slievecallan Wind Farm substation extension area etc).

The baseline environment, potential direct, indirect and cumulative impacts of replanting lands on the lands and soils environment has been assessed in the Section 6 of Appendix 4-3 Assessment of Forestry Replacement Lands.

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.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 18 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 Slievecallan Wind Farm, Cahermurphy (Phase I & II) Wind Farm, and Carrownagowan Wind Farm, and over 100 other wind farm related projects across the country.

David Broderick (BSc, H. Dip Env Eng, MSc) is a hydrogeologist with over 13 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 Slievecallan Wind Farm, Cahermurphy (Phase I & II) Wind Farm, and Oweninny Wind Farm, and over 60 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 (2017): Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements;
- Environmental Protection Agency (2015): Draft – Revised Guidelines on the Information to be contained in Environmental Impact Statements;
- Environmental Protection Agency (2003): Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements);
- Environmental Protection Agency (2002): Guidelines on the information to be contained in Environmental Impact Statements);
- 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); and,

- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

8.2 Assessment Methodology

8.2.1 Desk Study

A desk study of the Proposed Development site 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; and,
- General Soil Map of Ireland 2nd Edition (www.epa.ie).

8.2.2 Baseline Monitoring and Site Investigations

Geological baseline mapping was originally undertaken by HES in May 2020 for the previously proposed layout. An additional site visit was carried out on 26th February 2021 with regard the proposed revised layout.

A geotechnical assessment was also undertaken by Fehily Timoney and Company (FT) during the same period.

The objectives of the intrusive site investigations included mapping the distribution and depth of blanket peat at the site along with assessing the mineral subsoil / bedrock conditions beneath the peat at key development locations (i.e. proposed turbines & met mast, temporary construction compound, existing and proposed access roads, borrow pit locations, and walkover survey of the cable route). This data was used to inform the final layout design.

Site investigations to address the land, soil and geology section of the EIAR included the following:

- A total of over 700 no. peat probes depths were carried out by Fehily Timoney & Company (FT), MKO and HES to determine the depth and geomorphology of the blanket peat at the Proposed Development site;
- Trial pitting was undertaken by FT on 17th June 2021;
- A geotechnical assessment of peat stability by FT (March, 2021);
- Gouge cores were undertaken at key development locations (i.e. turbine, compound and borrow pits) to investigate peat and mineral subsoil lithology;
- Walkover survey and logging of bedrock outcrops and subsoil exposures; and,
- Mineral subsoils and peat were logged according to BS:5930 and Von Post Scale.

The Geotechnical & Peat Stability Assessment report prepared by FT is included as Appendix 8-1 of this EIAR.

8.2.3 Scope and Consultation

The scope for this EIAR has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.5 of this EIAR. There were no scoping responses with respect to land, soils and geology.

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 Proposed Development study area is assessed using the criteria set out in Table 8-1 (NRA, 2008).

Table 8-1 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 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.	Geological feature rare on a regional or national scale (NHA). 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, 2017) 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 (2017) Glossary of effects as shown in Chapter 1 of this EIS. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 8-2.

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 8-3.

Table 8-2: 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	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 8-3: 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.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
		› 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.
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 significant limitations or difficulties were encountered during the preparation of the Land, Soils and Geology Chapter of this EIAR.

8.3 Existing Environment

8.3.1 Site Description and Topography

The Proposed Development site is located in the townland of Glendine (and neighbouring townlands as described in Chapter 4) which is situated approximately 5km northeast of Milltown Malbay, Co. Clare. The Proposed Development EIAR study area, which is 793ha in area, is characterised by a northeast / southwest orientated topographical divide. The elevation range of the site is between 90 and 250m OD. The more elevated areas of the Wind Farm Site (i.e. >150m OD) are covered by blanket peat while the lower-lying areas are generally dominated by poorly draining peaty soil (grassland). Conifer plantations exist in the central more elevated area of the Wind Farm Site. Areas of cutover bog are frequent throughout the Wind Farm Site but are particularly evident on the eastern section of the site.

The planning application includes for the construction of underground electricity cabling to the existing Slievecallan 110kV substation. The cable route measures approximately 7.1 km in total and is mainly located on existing forest roads / land, existing Slievecallan access roads, agricultural land and within the public road corridor.

It is proposed to extend and expand the existing Slievecallan 110kV substation to accommodate the connection of the Proposed Development. The footprint of the proposed substation extension compound measures approximately 2,461 square metres. The proposed substation extension will be located on an existing cleared and level area.

8.3.2 Peat/Soils and Subsoils

The published soils map (www.epa.ie) for the Proposed Development study area is attached as Figure 8-1. The more elevated parts of the wind site are dominated by blanket peat (BktPt) with areas of peaty podzols (AminSRPT) where the soil is thin. Areas where the bedrock protrudes as steep rocky escarpments, which are frequent, soils are absent. On the lower slopes of the Wind Farm Site the

dominant soils types are poorly draining soils (AminPD) and poorly draining peaty soils (AminPDPT). Close to streams surface and groundwater gleys are mapped.

The dominant mapped soil type along the underground cable route is also blanket peat with sections of AminPD and AminPDPT.

The GSI subsoils map (www.gsi.ie) is attached as Figure 8-2. Blanket peat is dominant on the upper areas of the Wind Farm Site while shale and sandstone till are mapped on the lower lying areas of the site. Areas where the bedrock protrudes as steep rocky escarpments subsoils are absent. The mapped subsoils along the underground cable route are similar to the Wind Farm Site, with blanket peat being the most dominant.

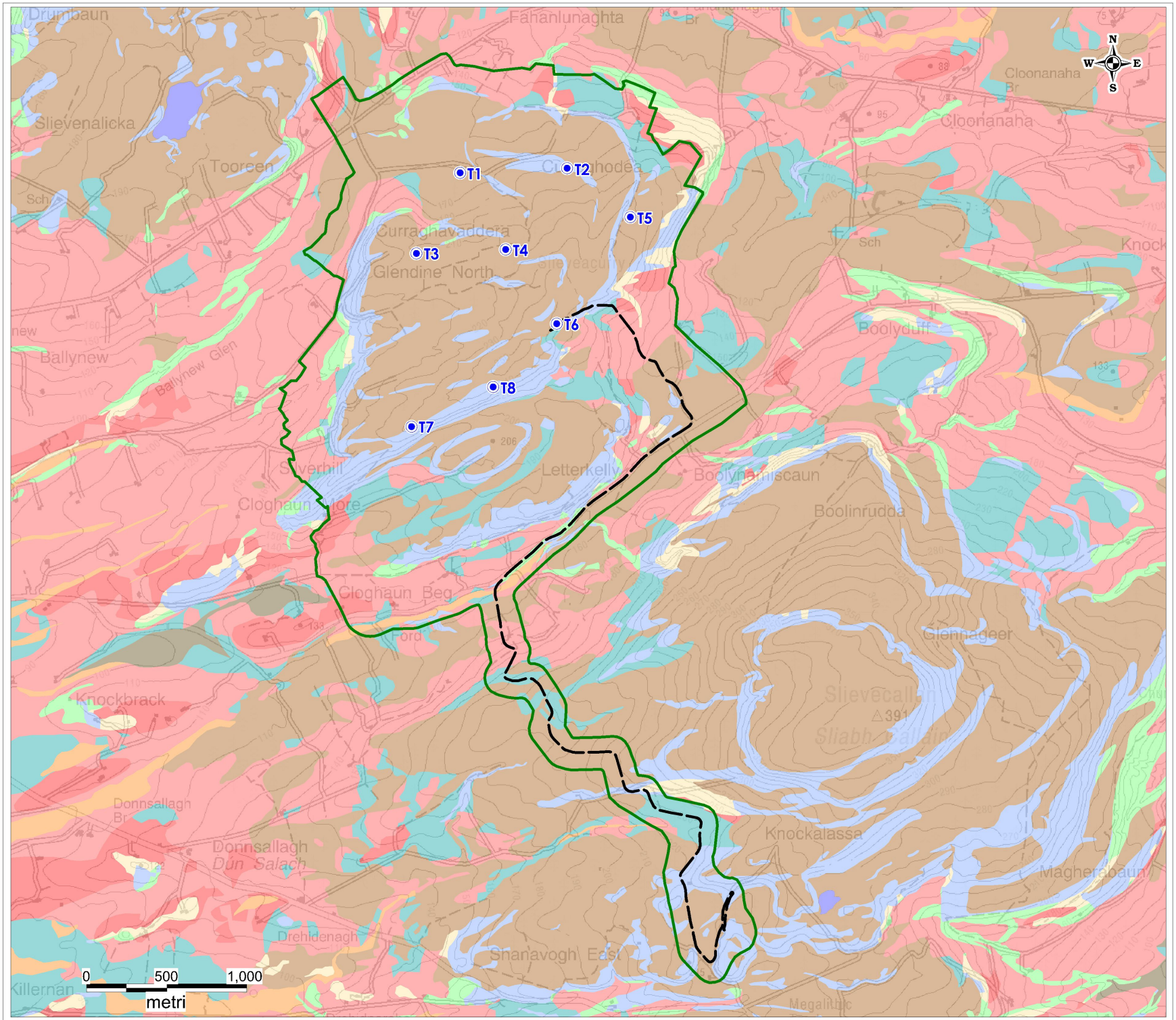
Over 700 no. peat probes were undertaken within the Proposed Development Site. A gouge core was also undertaken at each of the key development locations (i.e. turbines, substation extension, borrow pits and construction compounds) to investigate peat and mineral subsoil lithology.

Peat depths at the Wind Farm Site ranged from 0 to 4.5m with an average of 0.6m. Approximately 95 percent of peat depth probes recorded peat depths of less than 2.0m. 82% of the probes recorded peat depths of less than 1.0m with 95% of peat depth probes recorded peat depths of less than 2.0m. A number of localised readings were recorded where peat depths were 2.0 to 2.7m. The deeper peat areas were avoided when optimising the Wind Farm Site layout. The peat depths recorded at the turbine locations varied from 0.2 to 2.1m with an average depth of 0.9m.

With respect to the existing and proposed access roads, peat thicknesses are typically less than 2m with localised depths of 2.7m. A summary peat depth map for the Wind Farm Site and Underground Cable Route is shown in Figure 8-3.

The average peat depth across the Underground Cable Route is 0.25m with most peat depths being 0.1m or less. Peat depth maps for the Proposed Development are shown in Figure 8-3 and Figure 8-4.

A total of 7 no. trial pits were carried out at the Wind Farm Site. A trial pit was carried close to proposed turbine locations T1, T2, T3, T5 and T6 and 2 no. were completed at the proposed borrow pit location. Bedrock at the aforementioned turbines was met a depths ranging between 0.8 and 1.8m below ground level. Depth to bedrock at the proposed borrow pit location was less than 0.5m.



Legend

- EIAR Site Boundary
- Proposed Grid Route
- Proposed Turbine Layout
- Alluvial
- Deep well drained soil
- Poorly Drained Soil
- Peaty poorly drained soil
- Poorly drained Shallow Soil
- Shallow, rocky, peaty/non-peatymineral complexes
- Well drained Shallow Soil
- Blanket peat
- Cutover peat
- Water

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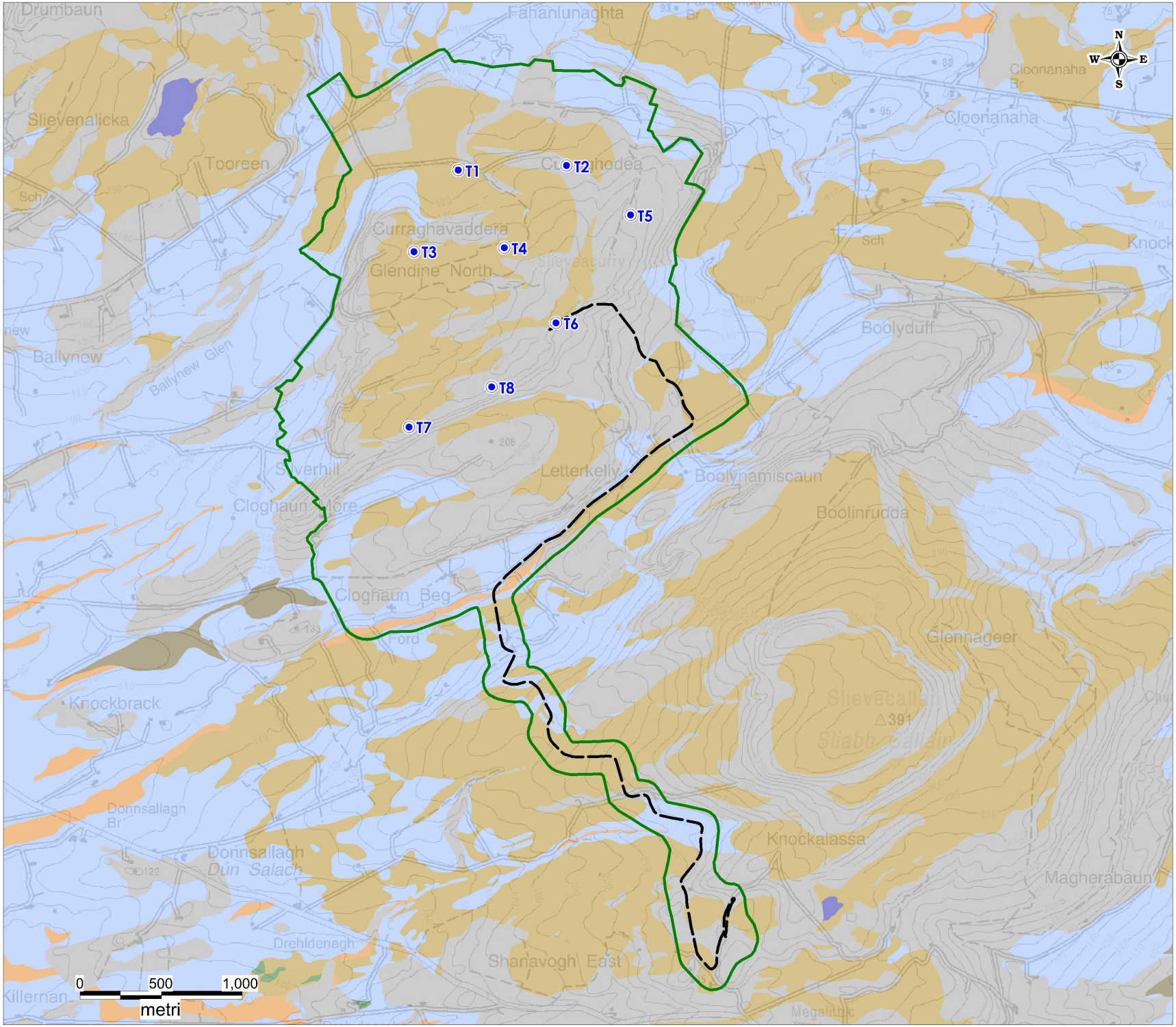
Client: MKO	
Job: Slieveacurry Renewable Energy Development	
Title: Local Soils Map	
Figure No: 8-1	
Drawing No: P1159-4-1121-A3-801-00B	
Sheet Size: A3	Project No: P1159-4
Scale: 1:22,500	Drawn By: GD
Date: 11/11/2021	Checked By: MG



Legend

- EIAR Site Boundary
- Proposed Grid Route
- Proposed Turbine Layout
- Alluvium
- Blanket Peat
- Cut over raised peat
- Bedrock outcrop or subcrop
- Till derived from Namurian sandstones and shales
- Water

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Client: MKO	
Job: Slieveacurry Renewable Energy Development	
Title: Local Subsoils Map	
Figure No: 8-2	
Drawing No: P1159-4-1121-A3-802-00B	
Sheet Size: A3	Project No: P1159-4
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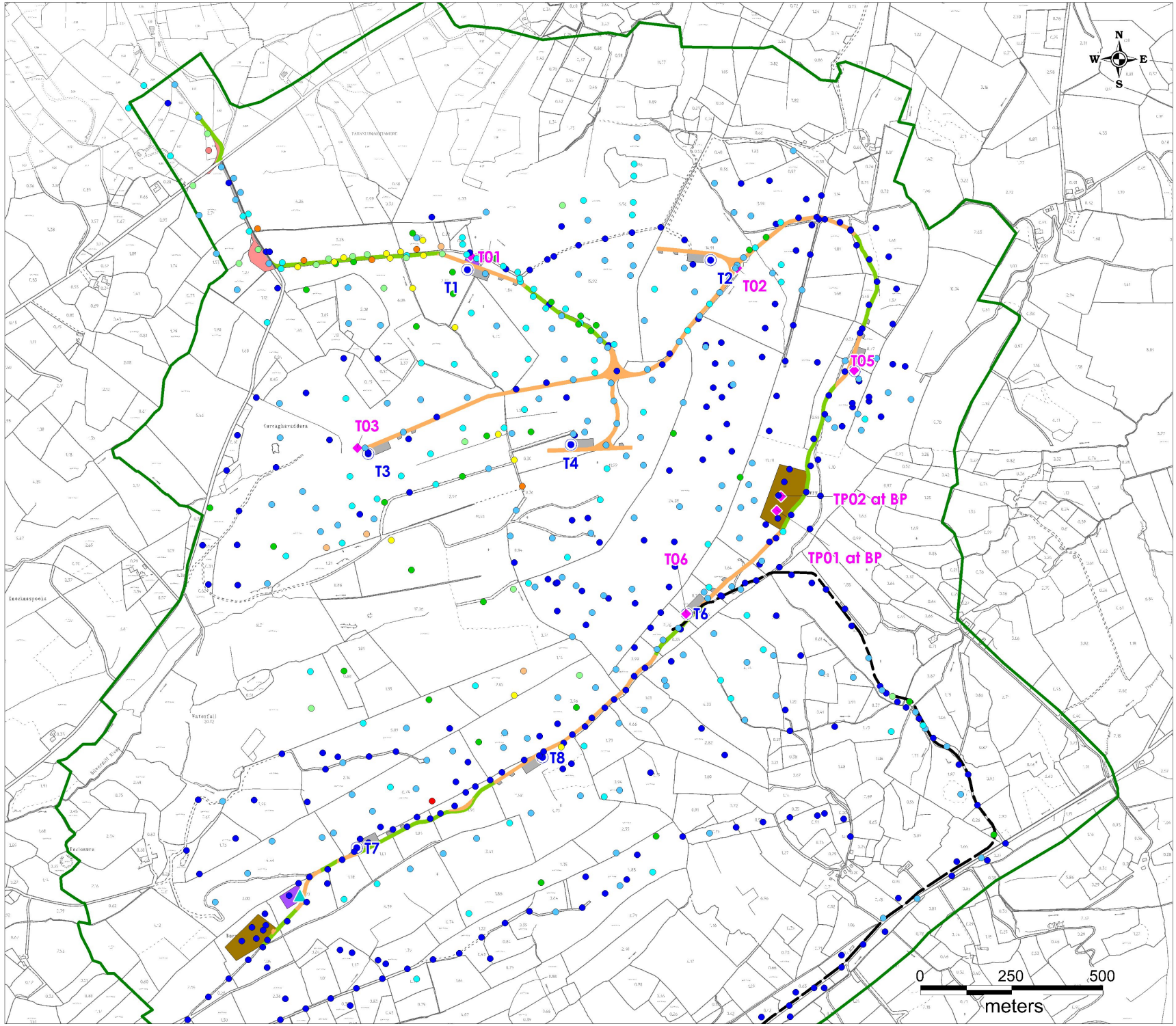


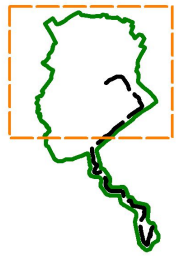
Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Grid Route
- Proposed Met Mast
- Proposed Construction Compound
- Proposed Borrow Pit
- Proposed Hardstand
- Proposed New Roads
- Existing Roads Proposed to be Upgraded
- Junction Works Area
- Existing Public Road
- Public Road Expansion Area
- Trial Pit Locations

Peat Depth (m)

0 - 0.5m	2.5 - 3.0m
0.5 -1.0m	3.0 - 3.5m
1.0 - 1.5m	3.5 - 4.0m
1.5 - 2.0m	4.0 - 4.5m
2.0 - 2.5m	5.5 - 6.0m

KEY PLAN



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Client: MKO

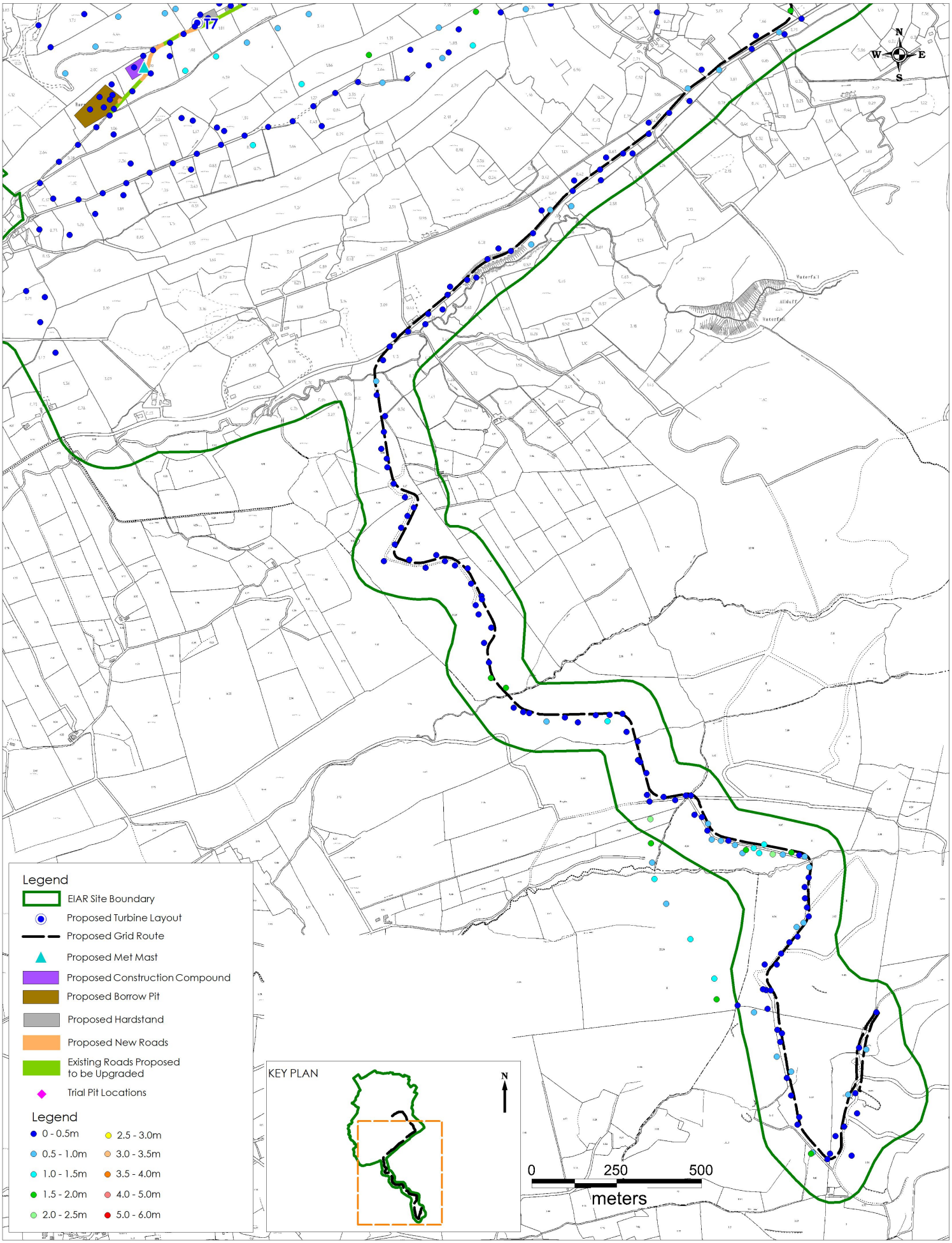
Job: Slieveacurry Renewable Energy Development

Title: Local Peat Depth Map

Figure No: 8-3

Drawing No: P1159-4-1121-A3-803-00B

Sheet Size: A3	Project No: P1159-4
Scale: 1:10,000	Drawn By: GD
Date: 11/11/2021	Checked By: MG



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Job: Slieveacurry Renewable Energy Development	Sheet Size: A3	Project No: P1159-4
Title: Local Peat Depth Map	Scale: 1:10,000	Drawn By: GD
Figure No: 8-4	Date: 11/11/2021	Checked By: MG

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The trial pit logs are included in the Geotechnical Peat Stability Assessment report which is included as Appendix 8-1 of this EIAR.

Table 8-4: Summary of Peat Depths and Mineral Subsoil Lithology at Proposed Development Locations

Probe ID	Easting	Northing	Average Peat Depth (m)	Summary of Underlying Mineral Subsoil Lithology
T1	111820	180748	1.8	Soft grey gravelly CLAY
T2	112486	180776	0.6	Soft grey sandy CLAY
T3	111548	180243	0.4	Weathered rock or Gravelly SILT
T4	112104	180269	1.0	Soft brown SILT
T5	112881	180471	0.7	Sandy Clay
T6	112422	179805	0.8	Soft grey gravelly CLAY
T7	111517	179163	0.5	Soft brown SILT
T8	112026	179412	0.6	Firm grey CLAY
Compound South	111330	179019	0.1	Firm grey CLAY
Compound North	111835	180773	1.8	Soft grey CLAY
Borrow Pit 1	111226	178909	0.15	Firm brown CLAY
Borrow Pit 2	112688	180126	0.15	Firm grey CLAY
Met Mast	111311	179007	0.1	Soft grey SILT
Substation Ext	113510	176008	0	Mineral Subsoils absent

The typical peat profile encountered at the Proposed Development was a dark brown, poorly humified fibrous PEAT (Von Post H6/H7), becoming soft dark brown humified PEAT (Von Post H7/H8) with few fibres at depth. In addition, dark brown, well humified slightly fibrous PEAT, becoming brown/black very well humidified PEAT with depth was also encountered.

The mineral subsoils underlying the peat at the Proposed Development were either soft CLAY or soft SILT. Subsoil exposures indicate that a depth of between 0.5 and 1m of subsoil exist over bedrock, however depths exceeding this are likely to exist within valleys and on the lower areas of the Wind Farm Site.

8.3.3 Bedrock Geology

The underlying bedrock strata at the Proposed Development site are mapped as Undifferentiated Namurian Shales of the Central Clare Group. 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. A bedrock geology map is shown as Figure 8-5.

Faults within the bedrock of this region are generally present in a southwest northeast orientation. A number of northeast southwest trending faults are mapped to intersect through the site.

Bedrock outcrops are frequent on the more elevated areas of the 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 located around the Wind Farm Site. Inspected outcrops and quarries 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 Geological Resource Importance

The sandstone & shale bedrock at the Proposed Development site is classified as "Low" importance. The bedrock could be used on a "sub-economic" local scale for construction purposes.

The peat deposits at the Proposed Development site is classified as "Low" importance as the peat is not designated in this area and is significantly degraded in most places at the Wind Farm Site as a result of forestry related drainage and rill ploughing. Similar peat deposits are also locally abundant in the study area. Refer to Table 8-1 for classification criteria.

8.3.5 Geological Heritage Sites

There are no recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within 5km of the Proposed Development.

8.3.6 Soil Contamination

There are no known areas of soil contamination on the site of the Proposed Development. During the site walkovers, no areas of contamination concern were identified.

According to the EPA online mapping (http://gis.epa.ie/Envision), there are no licensed waste facilities on or within the immediate environs of the site of the Proposed Development.

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

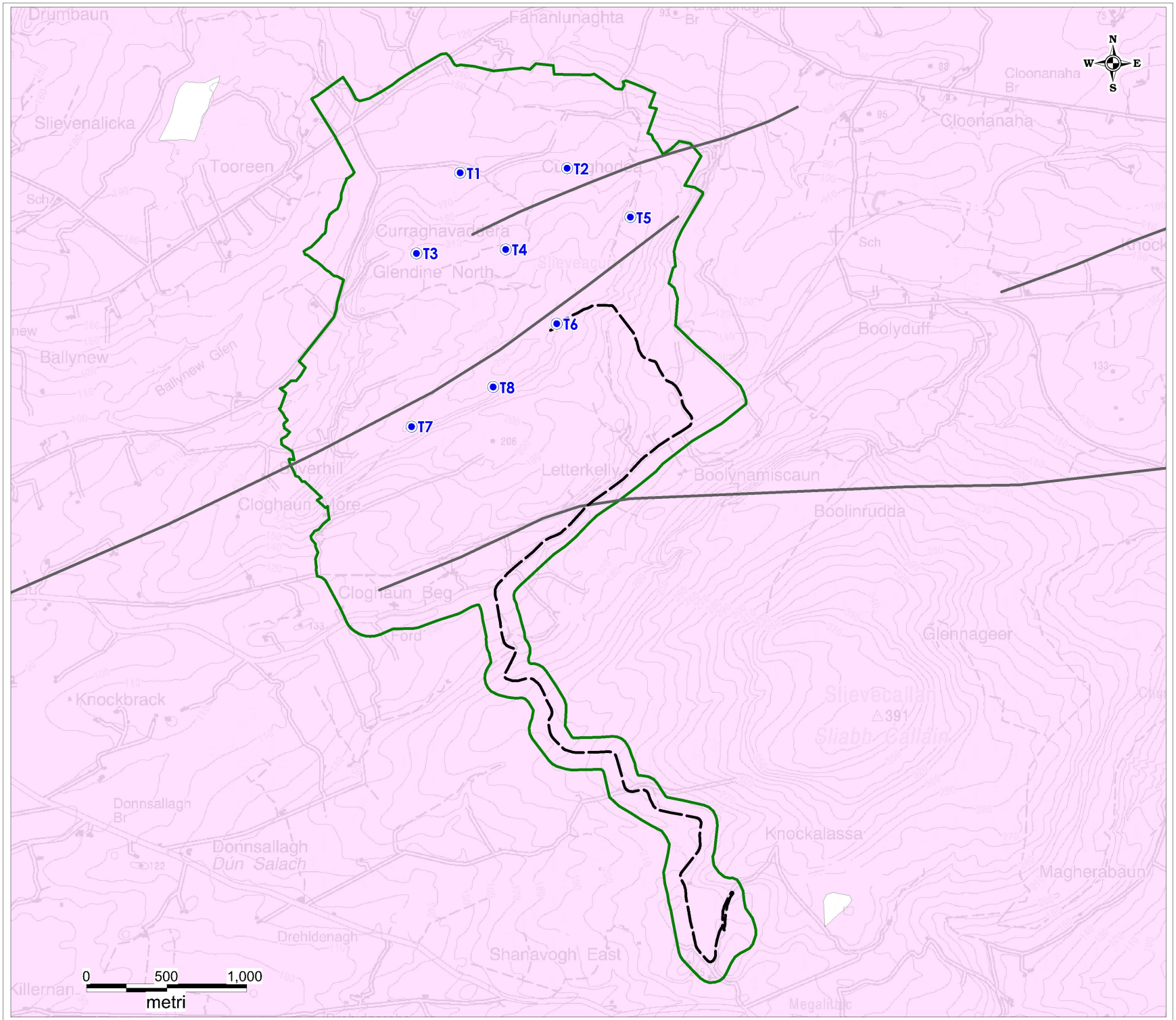
8.3.7 Economic Geology

The GSI online Aggregate Potential Mapping Database shows that the Proposed Development 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).

8.3.8 Peat Stability Assessment

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

An analysis of peat sliding was carried out at all the main infrastructure locations across the Wind Farm Site as shown on Figure 8-3 for both the undrained and drained conditions. The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The minimum required Factor of Safety (FoS) is 1.3 based on BS6031:1981: Code of Practice for Earthworks (BSI, 2009). The assigned probability of instability associated with a given FoS value is described in Table 8-5.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Grid Route
- Namurian Undifferentiated
- Mapped Faults

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Client: MKO	
Job: Slieveacurry Renewable Energy Development	
Title: Local Bedrock Geology Map	
Figure No: 8-5	
Drawing No: P1159-4-1121-A3-805-00B	
Sheet Size: A3	Project No: P1159-4
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No peat failures/landslides are recorded on the Proposed Development site which suggests that site conditions do not pre-dispose themselves to failures/landslides.

A walkover survey and peat probing of the underground cable route and substation extension identified no peat stability issues and therefore there was no requirement to carry out the detailed analysis as described below for the Wind Farm Site.

Table 8-5 Probability Scale for Factor of Safety for Peat

Scale	Factor of Safety	Probability
1	1.30 or greater	Negligible/None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.1	Probable
5	<1.0	Very Likely

8.3.8.1 Peat Stability Assessment Results

Undrained Analysis[1]

The results of the undrained analysis for the peat at the proposed infrastructure locations are presented in Table 8-6, Table 8-7 and Table 8-8. The analysis was done for 2 no. conditions which are described in a footnote to the table.

Table 8-6 Factor of Safety Results (undrained condition)

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition[2]	
			Condition (1)	Condition (2)
T1	111820	180748	24.92	16.14
T2	112486	180776	9.07	3.54
T3	111548	180243	57.34	16.38
T4	112104	180269	11.5	5.75
T5	112881	180471	15.54	6.61
T6	112422	179805	11.61	3.87

[1] An undrained analysis was carried out, which applies in the short-term during construction. The undrained analysis would be considered the most critical condition for the peat slopes.

[2] *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.*

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition[2]	
			Condition (1)	Condition (2)
T7	111517	179163	42.48	4.25
T8	112026	179412	5.03	1.89
Construction Compound south	111330	179019	46.78	4.25
Construction Compound north	111835	180773	25.47	16.37
Met Mast	111311	179007	46.78	4.25
Southern Borrow Pit	111214	178900	15.10	2.52
Northern Borrow Pit	112730	180092	13.23	4.41
Underground Cable Route	Varies	Varies	4.85	3.18

Table 8-7 Factor of Safety Results for Peat Slopes along Access Roads (undrained condition)

Location	Factor of Safety for Load Condition[2]	
	Condition (1)	Condition (2)
Entrance road to T1	9.17	6.55
T1 to Main Junction	8.38	4.39
Main Junction to T2	34.68	5.78
Spur road to T3	22.05	5.09
Spur road to T4	8.27	3.67
Road from T2 to T5	76.53	12.76
Road from T5 to T6	127.66	11.61
Road from T6 to T8	54.92	4.99
Road from T7 to T8	458.46	41.68

Table 8-8 Factor of Safety Results for Settlement Ponds (undrained condition)

Location	Settlement Pond Number	Factor of Safety for Load Condition[2]	
		Condition (1)	Condition (2)
T1	SP-B4	24.92	16.14
T2	SP-E4	9.07	3.54
T3	SP-C4	57.34	16.38
T4	SP-D2	11.50	5.75
T5	SP-G1	15.54	6.61
T6	SP-J2	11.61	3.87
T7	SP-K4	10.75	3.77
T8	SP-K2	5.03	1.89
Met Mast	SP-L4B	23.91	2.17

Drained Analysis[3]

The results of the drained analysis for the peat at the proposed infrastructure locations are presented in Table 8-9, Table 8-10 and Table 8-11.

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

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
T1	111820	180748	12.46	17.48
T2	112486	180776	4.53	3.79
T3	111548	180243	28.67	17.73
T4	112104	180269	5.75	6.21
T5	112881	180471	7.77	7.14
T6	112422	179805	3.46	3.38
T7	111517	179163	21.24	16.12
T8	112026	179412	2.43	1.94

[3] A drained analysis was carried out, which examines the effect of in particular, rainfall on the existing stability of the natural peat slopes on site.

Turbine No./Waypoint	Easting	Northing	Factor of Safety for Load Condition	
			Condition (1)	Condition (2)
Construction Compound south	111330	179019	23.39	4.59
Construction Compound north	111835	180773	12.73	17.73
Met Mast	111311	179007	23.39	4.59
Southern Borrow Pit	111214	178900	11.70	4.15
Northern Borrow Pit	112730	180092	6.61	4.74
Underground Cable Route	Varies	Varies	2.42	3.51

Table 8-10 Factor of Safety Results for Peat Slopes along Access Roads (drained condition)

Location	Factor of Safety for Load Condition	
	Condition (1)	Condition (2)
Entrance road to T1	4.59	7.09
T1 to Main Junction	4.19	4.73
Main Junction to T2	17.34	6.21
Spur road to T3	11.02	5.47
Spur road to T4	4.13	3.95
Road from T2 to T5	38.27	13.79
Road from T5 to T6	63.83	12.54
Road from T6 to T8	27.46	5.34
Road from T7 to T8	229.23	45.13

Table 8-11 Factor of Safety Results for Settlement Ponds (drained condition)

Location	Settlement Pond Number	Factor of Safety for Load Condition	
		Condition (1)	Condition (2)
T1	SP-B4	12.46	17.48
T2	SP-E4	4.53	3.79
T3	SP-C4	28.67	17.73

Location	Settlement Pond Number	Factor of Safety for Load Condition	
		Condition (1)	Condition (2)
T4	SP-D2	5.75	6.21
T5	SP-G1	7.77	7.14
T6	SP-J2	5.80	4.15
T7	SP-K4	5.37	4.04
T8	SP-K2	2.52	1.96
Met Mast	SP-L4B	11.96	2.19

The calculated FoS for undrained and drained conditions for the locations analysed, show that all locations have an acceptable FoS of greater than 1.3, indicating a negligible/none (refer to Table 8-5) risk of peat failure.

In summary, the findings of the geotechnical assessment showed that the Proposed Development site has an acceptable margin of safety and is suitable for the Wind Farm Site and Underground Cable Route. Overall, the peat characteristics on the Wind Farm Site and Underground Cable Route are similar to that encountered on many developed wind farm sites.

8.4 Characteristics of the Proposed Development

The Proposed Development site works will involve removal of peat, subsoil and bedrock for hardstanding and access track emplacement, and also during excavations along the underground cable route. Minor earthworks will also be completed at the Slievecallan Wind Farm substation extension area.
Crushed rock for construction will be sourced from 2 no. proposed borrow pits. It is proposed that these borrow pits will be reinstated with peat and spoil excavated as part of the construction phase of the Proposed Development. Estimated volumes of peat, subsoil and bedrock to be removed are shown in Table 8-12 and Table 8-13 respectively.

Not all of the peat and soil excavated will be sent to the borrow pits for reinstatement, a portion will be cast aside (i.e. side cast) and used for reinstatement and landscaping works around the Wind Farm Site. Any bedrock excavated during cut and fill works will be used for filling along the development site footprint.

Spoil arisings from the Underground Cable Route will be used as backfill in the first instance, any excess arisings not suitable for backfill will be side cast[4] along the route. If there are locations where side casting is not suitable, arisings will be deposited in the on-site borrow pits or off-site permitted facility.

Further details are provided in the Peat and Spoil Management Plan for the works which is included in Appendix 4-2.

[4] *Material will be placed to one or both sides of the works area (i.e. along access roads) and stored permanently at that location. The material will be sealed vegetation will grow on the sidecast material over time.*

Table 8-12: Summary of Excavated Peat and Spoil Volumes

Development Component	Peat Volume (m^3)	Spoil – Non-Peat (m^3)	Comment
8 No. Turbines & Hardstands	18,700	18,600	Hardstanding area and foundation footprint
Access Roads	31,200	12,400	-
Borrow Pits (2 no.)	4,000	18,000	Borrow pit footprint
Met Mast	0	400	-
Construction Compounds (2 no.)	600		-
Cable Trench	1,300	5300	7.1km in length
Total	**55,800**	**54,700**	**Total = 110,500m^3 (peat and spoil volume)**

Note: A bulk factor of 20% has been applied to excavation volumes as a worst-case estimate

Table 8-13: Estimated Borrow Pit Bedrock Excavation Volumes

Borrow Pit No.	Volume (m^3)
BP1	20,000
BP2	65,000
Estimated Total	**85,000**

8.5 Likely Significant Effects on Land, Soils and Geology

8.5.1 Do Nothing Scenario

An alternative land-use option to the development of a renewable energy project at the Proposed Development 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.

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.

8.5.2 Construction Stage - Likely Significant Effects and Mitigation Measures

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

8.5.2.1 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 Development as Listed in Table 8-12 above. 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 shown in Table 8-12 and Table 8-13 above.

Pathway: Extraction/excavation

Receptor: Peat, subsoil and bedrock

Potential Pre-mitigation Impact: Negative, slight/moderate, direct, high probability, permanent impact on peat, subsoil and bedrock.

- Placement of turbines and associated infrastructure in areas with shallow peat where possible;
- 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 Development 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 pits. 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 Impact: The granular soil/peat deposits and bedrock at the Proposed Development site is classified as of "Low" and "Low" importance respectively. The peat is already degraded by forestry and drainage. The overall Proposed Development site area is extensive while the Proposed Development footprint (8.2ha) is approximately c 1% of the overall EIAR study area (803ha). The impact is the disturbance and relocation of c 110,500m^3 of peat and spoil and 85,000m^3 of rock during construction. The design measures incorporated into the Proposed Development 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. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

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

8.5.2.2 Contamination of Soil by Leakages and Spillages and Alteration of Peat/Soil Geochemistry

Plant and machinery will be run on oils and fuels. Oils will also be present in the 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 Impact: Negative, slight, short term, medium probability impact on peat, soils and bedrock.

Proposed Mitigation Measures:

- On site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel;
- Fuels stored on site will be minimised. Storage areas where required will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used during construction will be regularly inspected for leaks and fitness for purpose;
- All waste tar material arising from the chipping and resurfacing of the temporary construction access road will be removed off-site and taken to licenced waste facility; and,
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Construction and Environmental Management Plan (Appendix 4.4 of this EIAR). Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.

Residual Impact: 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 is considered to be - Negative, imperceptible, direct, short-term, low probability effect on peat and subsoils and bedrock. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

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

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

Peat and spoil removed from turbine locations and access roads and all elements of the proposed project listed in Table 8-8, will be used for landscaping, cast aside alongside designated access roads and used to reinstate the 2 no. proposed borrow pits. The majority of peat will be permanently stored in the on-site borrow pits with a smaller proportion cast aside and landscaped at locations carefully selected by the project geotechnical expert and project hydrologist. 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. Two types of felling are proposed: permanent felling and temporary felling. Permanent felling will be undertaken in and around the footprint of the proposed development (i.e. access roads, turbines etc). Temporary felling will be carried out around all turbines to reduce turbulence effects or bat mitigation. 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 Impact: Negative, slight, low probability impact on peat, subsoils and bedrock.

Proposed Mitigation Measures

All excavated material will be completed in accordance with the Peat and Spoil Management Plan. 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[5] (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 a9as presented in Section 9.5.2.1 of Chapter 9.)

Residual Impact: 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 effected is considered - Negative, slight, direct, short-term, medium probability effect on peat and subsoils by erosion and wind action. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

[5] >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.

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

8.5.2.4 Peat Instability and Failure

Peat instability or failure refers to a significant mass movement of a body of peat that would have a significant effect on the Proposed Development site and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. The consequence of peat failure at the Proposed Development site 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.

Pathway: Vehicle movement and excavations.

Receptor: Peat subsoils.

Potential Pre-mitigation Impact: Direct, negative, significant, low probability impact on peat and subsoils.

Mitigation Measures:

Based on the recommendations and control measures given in the FT Geotechnical Peat Stability Assessment (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 negligible/none risk of peat instability/failure at the Proposed Development site (i.e. all elements of the proposed wind farm infrastructure and Underground Cable Route as listed in Table 8-8 and Table 8-9).

The risk assessment at each turbine location 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 Development 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 Impacts: A detailed Geotechnical and Peat Stability Assessment 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 Development. With the implementation of the control measures outlined above the residual effect is - Negative, imperceptible, direct, low probability, permanent effect on peat and subsoils. The residual impact will be the same for any selected turbine that is within the range of dimensions for which planning permission is sought.

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

8.5.2.5 Slievecallan Wind Farm Substation Extension Works

Minor earthworks are required for substation extension works. These include for increasing the size of the substation footprint. These extension works are described in Section 4.3.5 of this EIAR.

Pathway: Extraction/excavation/landscaping.

Receptor: Peat and subsoil

Potential Pre-Mitigation Impact: 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;
- All works are temporary in nature.

Residual Impact: The substation extension related earthworks are minor in nature and will be temporary in durations. 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.

8.5.2.6 Turbine Delivery Route Works

Minor earthworks are required for turbine delivery. These include for temporary widening of existing roads and junctions. These TDR works are described in Section 14.1.8 of the EIAR.

Pathway: Extraction/excavation/landscaping.

Receptor: Peat and subsoil

Potential Pre-Mitigation Impact: 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 Impact: 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. The residual impact will be the

same for any selected turbine that is within the range of dimensions for which planning permission is sought.

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

8.5.3 Operational Stage - Likely Significant Effects and Mitigation Measures

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

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.

8.5.3.1 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 Impact: Negative, indirect, imperceptible, short term, likely impact bedrock

Proposed Mitigation Measures:

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

Residual Impact: The use aggregate 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 is considered to be - Negative, imperceptible, indirect, short-term, low probability effect on bedrock.

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

8.5.3.2 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 Impact: Negative, direct, slight, short term, unlikely impact 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 and accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns will be contained in the Environmental Management Plan for the Proposed Development operational phase.

Residual Impact: 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 is considered to be - Negative, imperceptible, direct, short-term, low probability 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.

8.5.3.3 Use of Oils in Turbine Transformers During Operational Stage

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. 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 Impact: Negative, direct, slight, short term, unlikely impact 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 Environmental Management Plan for the wind farm operational phase.

Residual Impact: 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 is considered to be - Negative, imperceptible, direct, short-term, low probability 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.

8.5.4 Decommissioning Stage - Likely Significant Effects and Mitigation Measures

The potential impacts associated with decommissioning of the Proposed Development 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 8.5.2 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, hard standing areas, and the substation. 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. However, 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 Development 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 Development.

8.5.5 Risk of Major Accidents and Disasters

None, as indicated above the risk of a landslide at the Proposed Development site is determined to be negligible/none.

8.5.6 Post Construction Monitoring

None required as no significant effects will occur.

8.5.7 Potential Cumulative Impacts

The land, soils and geological impact assessment undertaken above in this chapter outlines that significant effects are unlikely due to the localized nature of the construction works. Impacts on land soil and geology will not extend beyond the immediate vicinity of the Proposed Development Site. The proposed replanting works will not have any effect on land, soils and geology.

Therefore, no cumulative impacts between the Proposed Development (, and other existing, permitted or proposed projects, listed in Section 2.6 of this EIAR, on land soils and geology will occur as there can be no interaction due to distance and separation.

Tree felling has negligible effects on land, soils and geology as no significant excavations are required during tree felling and therefore the surrounding commercial forestry will not contribute to cumulative effects associated with the Proposed Development construction.

The proposed replanting lands are located in counties Longford, Mayo & Roscommon and therefore will not contribute to potential cumulative impacts with the proposed wind farm development in terms of impacts on soils and geology. The potential direct, indirect and cumulative impacts of replanting lands on soils and geology has been assessed in the Section 6 of Appendix 4-3 Assessment of Forestry Replacement Lands.

8.5.8 Summary

Excavation of peat, subsoil and bedrock will be required for site levelling and for the installation of the Proposed Development infrastructure. This will result in a permanent removal of peat, subsoil and bedrock at most excavation locations. Excavated peat will be utilized to re-instate the borrow pit locations (2 no.) and a portion of the excavated peat will also be used for reinstatement and landscaping works around the Wind Farm Site or side cast at designated areas. The handling and management of peat will be undertaken in accordance with the Peat & Spoil Management Plan. Storage and handling of hydrocarbons/chemicals will be carried out using best practice methods (as outlined in Section 8.5.2.2). Measures to prevent peat and subsoil erosion during excavation, reinstatement and permanent placement in borrow pits will be undertaken to prevent water quality impacts. All works will be completed in accordance with the Peat and Spoil Management Plan.

A peat stability assessment undertaken for the Proposed Development site shows that there is a negligible/none risk of peat instability/failure at the Wind Farm Site, substation extension and along the proposed construction access roads.

No significant impacts on the land, soil and geology of the Proposed Development site will occur during the construction and operational phases of the development, and none are anticipated during the decommissioning phase.

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