



GALETECH
ENERGY SERVICES



Islandmore Wind Farm

Environmental Impact Assessment
Report

Chapter 6: Land & Soil

Islandmore Wind Farm Limited

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6.1 INTRODUCTION

6.1.1 BACKGROUND AND OBJECTIVES

This chapter provides an assessment of the likely and significant effects of the project (and its secondary off-site elements), as described at **Chapter 3**, on land, soils and geological aspects of the receiving environment.

This chapter provides a baseline assessment of the environmental setting of the project (wind farm site, electricity line route and haul route) in terms of land, soils and geology and identifies the likely and significant effects that the construction, operation and decommissioning of the project will have on them, including an assessment of cumulative effects with other existing, permitted and proposed developments. Where required, appropriate mitigation measures to limit, reduce or avoid any identified likely and significant adverse effects (if any) on land, soils and geology are recommended.

6.1.2 DESCRIPTION OF THE PROJECT

In summary, the project comprises the following main components as described in **Chapter 3**:-

- 10 no. wind turbines, 3 no. with an overall height of 185m and 7 no. with an overall height of 150m;
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure and forestry felling;
- Works to the public road network along the turbine component haul route; and,
- 110kV electricity substation and installation of c. 7km of underground electricity line to facilitate connection of the wind farm to the existing Tonroe 110kV electricity substation at Ballaghaderreen, County Roscommon.

The project is located in north County Roscommon; c. 2km north of Ballaghaderreen, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo); and is located in close proximity to the county boundaries between counties Roscommon, Sligo and Mayo.

It is envisaged that turbine components will be transported from the Port of Galway through the counties of Galway, Mayo and Roscommon to the project site utilising, predominately, motorway and national roads. Accordingly, it is assessed that there is no likelihood of significant effects on land, soils or geology arising from the transport of turbine components and, therefore, these works have been scoped out from further assessment.

A full description of the project is presented in **Chapter 3**.

6.1.3 STATEMENT OF AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of geological/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 include water 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 associated grid connections.

This chapter was prepared by Michael Gill and David Broderick.

Michael Gill (P.Geo, BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 26-years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael has worked on the EIS/EIARs for Glenard Wind Farm, Cloncreen Wind Farm, and Seven Hills Wind Farm, and over 100 other wind farm related projects across the country.

David Broderick (P. Geo, BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with over 20-years' experience in both the public and private sectors. 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 Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David has worked on the EIS/EIAR for Oweninny Wind Farm, Cush Wind Farm, White Hill Wind Farm, Arderroo Wind Farm and Yellow River Wind Farm, and over 80 no. other wind farm related projects across the country.

6.1.4 RELEVANT LEGISLATION

This chapter has been 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.

Regard has also been had to the requirements of the following legislation:-

- S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1995, S.I. No. 352/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001);
- *Planning and Development Act 2000 (as amended)*;
- *Planning & Development Regulations 2001 (as amended)*;
- 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 ('the EIA Directive');and,
- S.I. No 296/2018: S.I. No. 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.

6.1.5 RELEVANT GUIDANCE

This chapter has been prepared having regard, where relevant, to the guidance contained in the following documents:-

- *Guidance Document on Wind Energy Developments and EU Nature Legislation* (European Commission, 2020);
- Environmental Protection Agency (2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*;
- Institute of Geologists Ireland (2013) *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements*;
- National Roads Authority (2008) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*;
- Department of the Environment, Heritage, and Local Government (2006) *Wind Energy Development Guidelines for Planning Authorities 2006*;
- Forestry Commission (2004) *Forests and Water Guidelines, Fourth Edition*. Publ. Forestry Commission, Edinburgh;
- COFORD (2004) *Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads*;
- Department of Housing, Planning & Local Government (2018) *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*;
- European Union (2017) *Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU)*; and,
- Institute of Environmental Management (IEMA) (2022) *A New Perspective on Land and Soil in Environmental Impact Assessment*.

6.2 METHODOLOGY

6.2.1 DESK STUDY

A desk study of the project site and study area (described at **Section 6.2.6** below) was completed in advance of undertaking the walkover surveys, visual assessments and site investigations. This involved collecting all relevant land, soil and geological information for the project site and study area. Data sources included:-

- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland – Groundwater and Geological Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 11 (Geology of South Mayo);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 12 (Geology of Longford-Roscommon);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- Ordnance Survey Ireland (OSI) – 6" and 1:5000 scale basemaps; and,
- Aerial photography (www.bing.com/maps; www.google.com/maps).

6.2.2 BASELINE MONITORING & SITE INVESTIGATIONS

An initial site walkover, constraints mapping and peat probing exercise were undertaken by HES on 6 September 2023.

Further ground surveys, surface water sampling and baseline monitoring was undertaken on 19 December 2024, 6 March 2025 and 9 April 2025.

A Geotechnical and Peat Stability Assessment, used to inform the assessment contained within this chapter, was carried out by Fehily Timoney & Company (FT) and is enclosed at **Annex 6.1 (Volume II)**.

Separately, a Peat and Spoil Management Plan has also been prepared by FT (see **Annex 6.2 (Volume II)**) which details the treatment and management of material excavated during the construction phase of the project.

Site investigations (trial pitting and rock core drilling) were carried out by Irish Drilling Limited (IDL) between 1 and 28 March 2025 under the supervision of FT and HES. Please refer to **Annex 6.1** for IDL Factual Report, trial pit logs and drilling logs.

In summary, site investigations/assessments used to inform this assessment include the following:-

- Detailed site walkovers and visual inspections to assess ground conditions;
- Land and drainage surveys;
- A trial pit investigation (13 no.) to determine subsoil lithology and depth to bedrock;
- 205 no. peat probe locations along with slope angle measurements were carried out by FT as part of the geotechnical and peat stability assessment;
- Rotary core drilling at the 2 no. locations for assessment of bedrock lithology and feasibility for on-site borrow pit;
- Logging and mapping of peat and subsoil exposures;
- Mineral subsoils were logged according to BS:5930; and,
- Detailed topographical LiDAR surveys (refer to **Annex 7.1 (Volume II)**).

6.2.3 RECEPTOR IMPORTANCE/SENSITIVITY CRITERIA

In addition to the utilisation of sensitivity and receptor importance criteria outlined within the above-mentioned EPA Guidance (EPA, 2022), this assessment, in accordance with National Roads Authority (NRA, 2008) guidance, quantifies the importance of the land, soil and geological environment at the project site and study area by applying the criteria set out in **Table 6.1**, with the impact magnitude and impact rating subsequently assessed using **Table 6.2** and **Table 6.3**.

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/SAC). • 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 high 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.

Table 6.1. Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

Magnitude	Criteria	Typical Examples
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves. • Irreversible loss of high proportion of local high fertility soils. • Removal of entirety of geological heritage feature. • Requirement to excavate / remediate entire waste site. • Requirement to excavate and replace high proportion of peat. • Organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves. • Removal of part of geological heritage feature. • Irreversible loss of moderate proportion of local high fertility soils. • Requirement to excavate / remediate significant proportion of waste site. • Requirement to excavate and replace moderate proportion of peat. • organic soils and/or soft mineral soils beneath alignment.

Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves. • Removal of small part of geological heritage feature. • Irreversible loss of small proportion of local high fertility soils and/or High proportion of local low fertility soils. • Requirement to excavate / remediate small proportion of waste site. • Requirement to excavate and replace small proportion of peat. • Organic soils and/or soft mineral soils beneath alignment.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• No measurable changes in attributes

Table 6.2: Estimation of Magnitude of Impact (NRA, 2008)

Importance of Tribute	Magnitude of Impact			
	Negligible	Small Adverse	Moderate Adverse	Large Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/Slight	Significant/ Moderate	Profound/ Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

Table 6.3: Estimation of Rating of Impact (NRA, 2008)

6.2.4 SCOPING AND CONSULTATION

The scope of this assessment has been informed by consultation with statutory consultees and other bodies with environmental responsibility. This consultation process is outlined in **Chapter 1** of this EIAR.

No specific concerns or particular matters were raised regarding land, soils and geology. The only relevant response was from the Geological Survey of Ireland (GSI) recommending the use of their datasets (refer to **Table 6.4** below). The full response from the below consultee is provided in **Annex 1.4**.

Consultee	Summary of Response	Addressed
Geological Survey of Ireland (GSI)	<i>"With reference to your email received on the 22 September 2024, concerning the Proposed Islandmore Wind Farm, Co Roscommon, we recommend using our various data sets when conducting the EIAR, SEA, planning and scoping processes for developments, plans and policies".</i>	Section 6.3

Table 6.4: Summary of Land, Soils and Geology Scoping Responses

6.2.5 LIMITATIONS AND DIFFICULTIES ENCOUNTERED

No limitations or difficulties were encountered during the preparation of this chapter. There are substantial desktop records detailing the characteristics of the project site, the project site was accessible thus allowing for a comprehensive assessment of site conditions, and the site investigations and baseline monitoring carried out were detailed and comprehensive.

6.2.6 STUDY AREA

In accordance with IGI (2013) guidance, the study area with regard land, soils and the geological environment is assessed to be within 2km of the project site.

However, given the characteristics of the project, it is assessed that only direct effects on land, soils and geology within the project site are expected likely to occur with no indirect effects or off-site effects.

6.3 DESCRIPTION OF THE EXISTING ENVIRONMENT

6.3.1 SITE LOCATION AND DESCRIPTION

The project site, which has an area of approximately 157ha, is located in north County Roscommon, c. 2km north of Ballaghaderreen, c. 13km east of Charlestown (Co. Mayo) and c. 6km southwest of Gorteen (Co. Sligo).

The project site is located in an upland peatland setting where the topography of the local area is generally undulating and sloping. The central portion of the project site is centred on a hill (c. 180m OD elevation), which slopes away to c. 160m OD to the east and west, c. 140m OD to the south and c. 150m OD to the north.

Land cover within the project site is predominately a mixture of cutover bogs, intact bogs and small pockets of agricultural fields. All 10 no. wind turbines are located on peat bogs.

The GSI have the bogs mapped as cutover raised bogs but some of the bog areas, particularly the northern portion of the project site, have a more blanket bog appearance. The bog, on the southern portion of the project site, has a raised bog appearance.

There are also pockets of forestry and semi-natural areas on the northeast and southeast of the project site which are planted-on peat bogs. Pockets of grassland are located in the northwestern parts of the project site.

The project site is accessed via a network of public roads that pass through the project site with the central north-south trending public road being utilised as the main spinal access road of the project.

The underground electricity line (grid connection route) connects to the Tonroe 110kV substation which is situated c. 1.2km to the south of the project site. The electricity line is approximately 7km in length and will generally be located within the carriageway of local public roads. The underground electricity line runs from the proposed 110kV on-site substation which is located in grassland in the northwestern portion of the project site.

The haul route works between the Port of Galway and the junction of the N5 and R293, will be of a temporary nature (i.e. street furniture alteration and placement of

hardcore at roundabouts and junctions) and will be contained within the carriageway of the roads.

From the junction of the R293 and L5501 to the proposed wind farm site entrances, the public roads will be subject to permanent upgrade works including the widening of the existing carriageways together with the reprofiling of some carriageways to remove existing road crests.

Additionally, existing roadside drainage arrangements may be altered to accommodate the widening of carriageways. All existing roadside drains will be widened/maintained.

6.3.2 LAND & LAND USE

Based on the Corine (2018) datasets, the project site is mapped mainly as 'peat bogs'. Land cover in the wider environs is predominantly agricultural with peat bogs, forest and semi-natural areas scattered across the area.

The underground electricity line will be predominately located within the carriageway of the local road network, with a c. 0.8km off-road section leading into the Tonroe 110kV substation.

6.3.3 SUPERFICIAL GEOLOGY

6.3.3.1 GSI Mapped Soils & Subsoils

Based on the GSI/Teagasc mapping (www.gsi.ie), soils within the wind farm site and bordering lands are mapped by the EPA (www.epa.ie) as mainly cut peat.

Between the junction of the R293 and L5501 to the southern extent of the wind farm, poorly drained acidic mineral soils (AminPD) are mapped along with peaty poorly drained mineral soil (AminPDPT). In the wider area of the overall project site, AminPD are mapped on the lands that surround bogs.

Subsoils within the wind farm are mapped by the GSI (www.gsi.ie) as almost exclusively cutover raised peat. Pockets of sandstone till (glacial till) derived from Lower Palaeozoic and Devonian Sandstones (TLPDSs) are mapped on the northwest of the wind farm. There are also localised areas of bedrock outcrop or subcrop (Rck) mapped to the northwest and south of the wind farm. All turbines are located on cutover raised peat.

Sandstone tills with pockets of Rck are mapped from the junction of the R293 and L5501 to the southern extent of the wind farm.

With regards to mapped soils along the underground electricity line route, it predominantly shows cut Peat along the northern and central sections, with poorly drained acidic mineral soils (AminPD) along the southern section. As stated above, the majority of the underground electricity line is located within the carriageway of public roads, where the interaction with soil will be minimal and no 'topsoils' are present.

Much like the soils described above for the underground electricity line, subsoils along the route are mapped by the GSI (www.gsi.ie) as mainly cutover raised peat along the northern and central sections, with sandstone tills mapped along the southern section including at the existing Tonroe 110kV. The underground electricity line will have limited interaction with mineral subsoils.

A GSI subsoil geology map is shown in

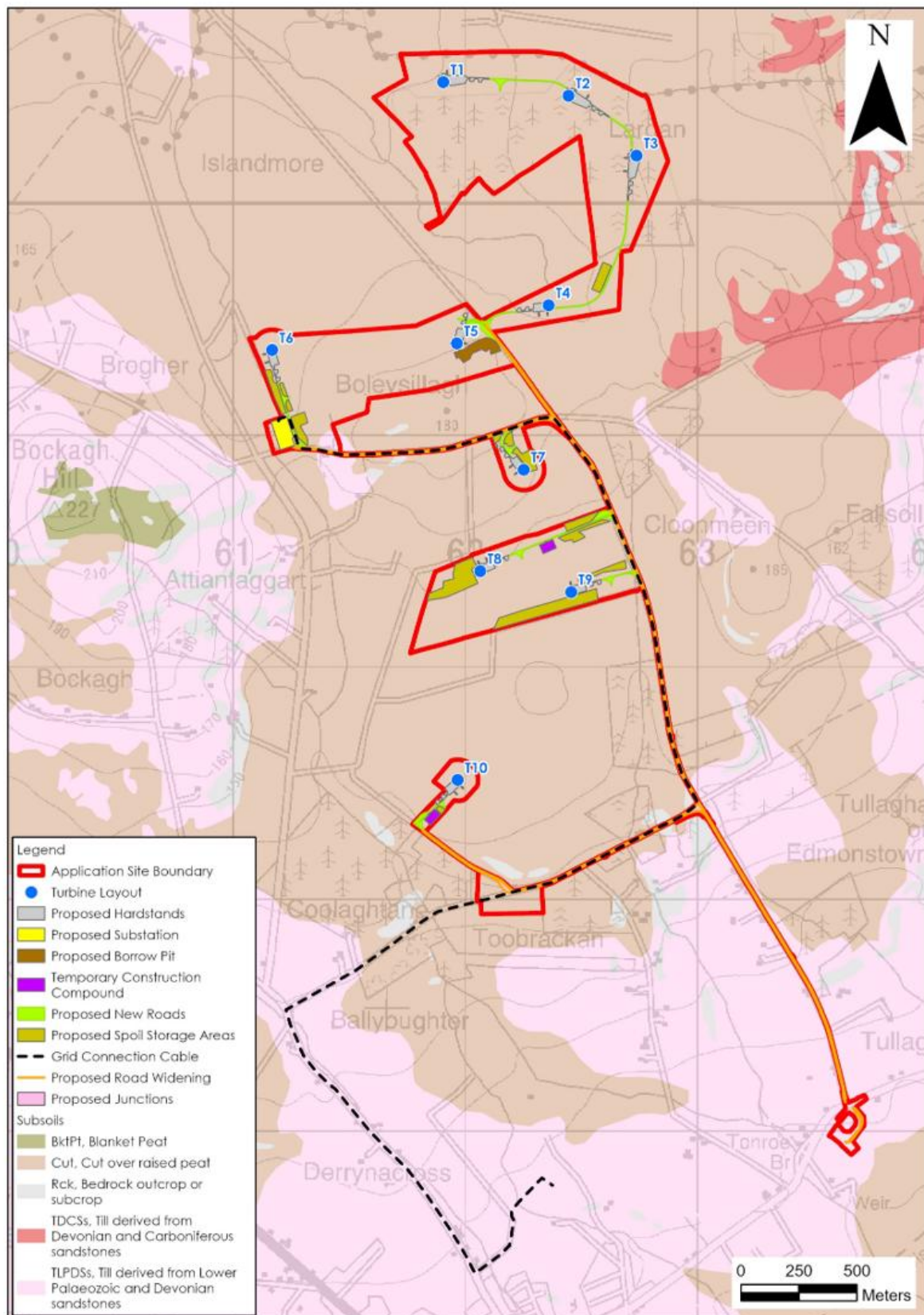
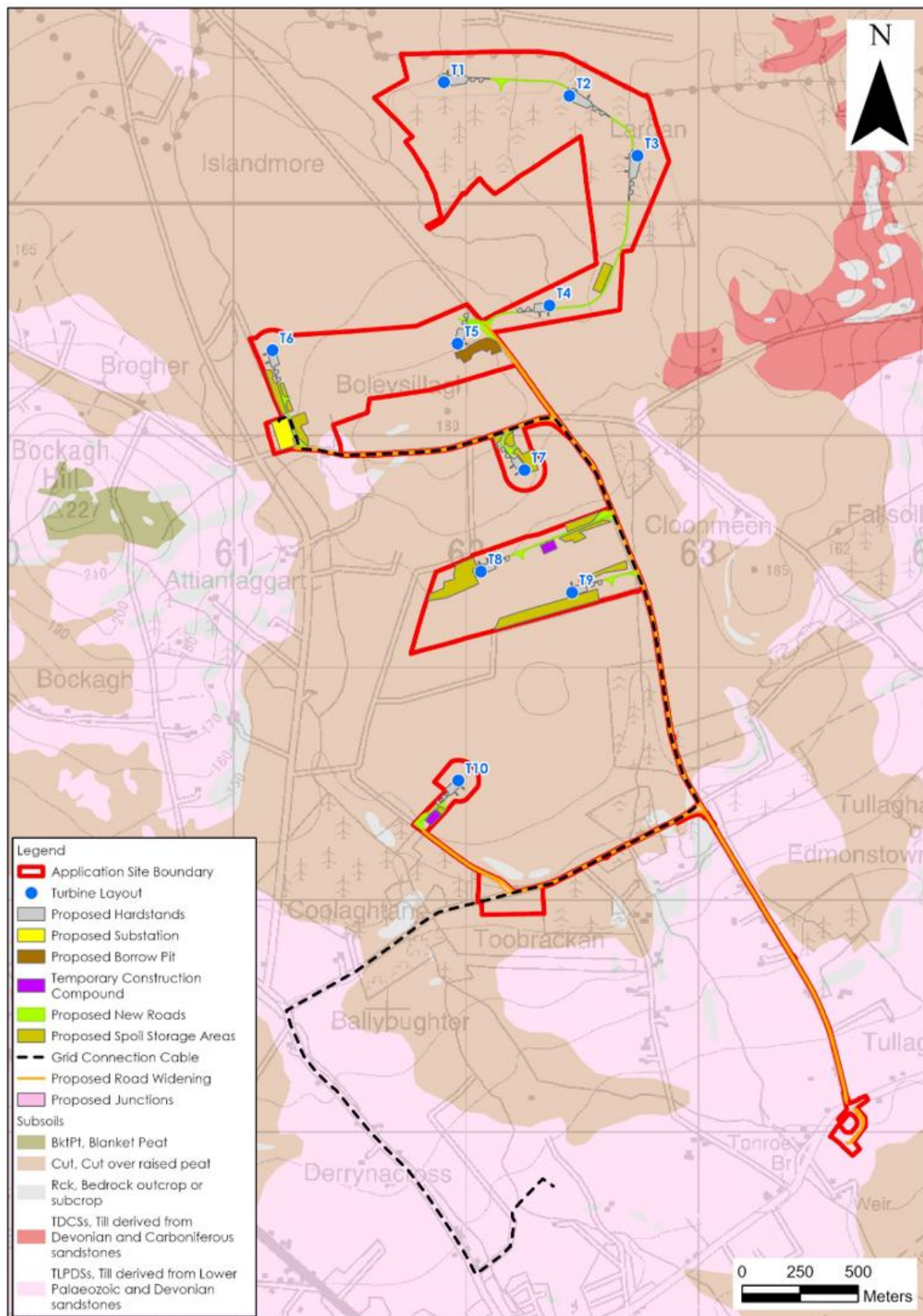


Figure 6.1 below.



6.3.3.2 Peat Probing

A total of 205 no. peat probes were carried out by FT at the project site during August 2024, March 2025 and January 2026.

Peat depths recorded during the site walkovers and from the ground investigations ranged from 0m to in excess of 7.2m with an average peat depth of 1.8m. 73% of peat depth probes recorded peat depths of less than 3m; while a number of localised readings recorded peat depths between 3.5m to 7.2m.

The peat depths recorded at the turbine locations varied from 1.1m to in excess of 7.2m, with an average depth of 3.8m. With respect to the new access tracks, peat depths are typically less than 2.5m, with localised depths of up to 5.0m recorded.

1: RC-02 was drilled approximately 70m from turbine T9 location. **2:** Not Determined (ND)

Table 6.5 below includes a summary of peat depths at key project infrastructure locations.

A summary peat depth map is shown as **Figure 6.2** below.

6.3.3.3 Trial Pits

A total of 13 no. trial pits were carried out at the project site between 26 March and 1 April 2026. Trial pits were carried out at each of the 10 no. turbines and at the 110kV substation location. Refer to **Annex 6.1 (Volume II)** for trial pit logs.

A summary of the subsoil lithology encountered at the project site is as follows:-

- Peat – Typically described as soft black amorphous to fibrous Peat. Peat thicknesses ranged from 0.3m to >4.0m from trial pits;
- Alluvium - grey, soft to firm slightly sandy slightly gravelly SILT with rare cobbles. Recorded below the peat layer in TP03 (base of layer not proven). Recorded below the peat in TPT08 between 1.5 and 2.1mbgl (metres below ground level);
- Granular Glacial Till - Typically described as grey slightly sandy fine to GRAVEL with frequent cobbles, or as very silty very gravelly medium to coarse SAND with occasional cobbles. The thickness of the layer is variable across the project site; and,
- Cohesive Glacial Till – described as a stiff light grey CLAY in rotary core RC02, the only location this material was recorded (refer to **Section 6.3.3.4** below).

Where a trial pit could not extend deep enough to encounter the mineral subsoil layer below the peat, a hand gouge core (GC) was carried to determine the subsoil type.

Refer to **1:** RC-02 was drilled approximately 70m from turbine T9 location. **2:** Not Determined (ND)

Table 6.5 below for hand gouge core locations and subsoil lithology. Bedrock was not encountered at any of the trial pit locations.

Trial pit and soil gouge core locations are illustrated in **Figure 6.3** below.

Infrastructure	Investigation ID	Average Peat Depth Range (m)	Depth to Bedrock (m)	Summary of Mineral Subsoil Lithology
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T1	TP-T01	4.1	>4.1	Cobbles and Boulders over silty, gravelly SAND
T2	TP-T02 & GC-T2	2.8	>3.1	Sandy, gravelly SILT
T3	TP-T03	2.45	>3.4	Gravelly sandy SILT
T4	TP-T04	3.7	>4.3	Gravelly silty SAND
T5	TP-T05	0.6	>4.3	SILT over SAND & GRAVEL
T6	TP-T06	4.7	>3	Gravelly silty SAND
T7	TP-T07	2.2	>3.3	Silty gravelly SAND
T8	TP-T08	2.65	>4	Sandy SILT over GRAVEL
T9	TP-T09 & RC-02 ¹	>7.2	>7.2	CLAY
T10	TP-T10	3.2	>2.6	Gravelly sandy SILT
110kV Substation	TPSS-01/02	1.1	>3.7	Gravelly sandy peaty SILT & Silty SAND
Borrow Pit	RC-01	<0.5	2.0	GRAVEL
Construction Compound (T10)	GC-SS1	0.25	ND ²	Gravelly sandy SILT
Construction Compound (T8)	GSC-SS2	0.25	ND	Gravelly SILT

1: RC-02 was drilled approximately 70m from turbine T9 location. 2: Not Determined (ND)

Table 6.5: Summary of Site Investigations

Based on the criteria in **Table 6.1** above, mineral subsoils are assessed to be of Low importance, while peat is assessed to be of Medium importance.

6.3.3.4 Investigation Drilling

Rotary core drilling carried out at the borrow pit location (IDL Hole ID: RC-01) and near turbine location T9 (IDL Hole ID: RC-02) encountered bedrock at both locations.

At RC-01, bedrock was encountered at 2m below ground level (bgl), where topsoil on GRAVEL over weathered bedrock was reported.

At RC-02, bedrock was encountered at 5mbgl, where PEAT on stiff CLAY over weathered bedrock was reported.

Please refer to **Section 6.3.4.2** below for further details of the bedrock drilling investigations.

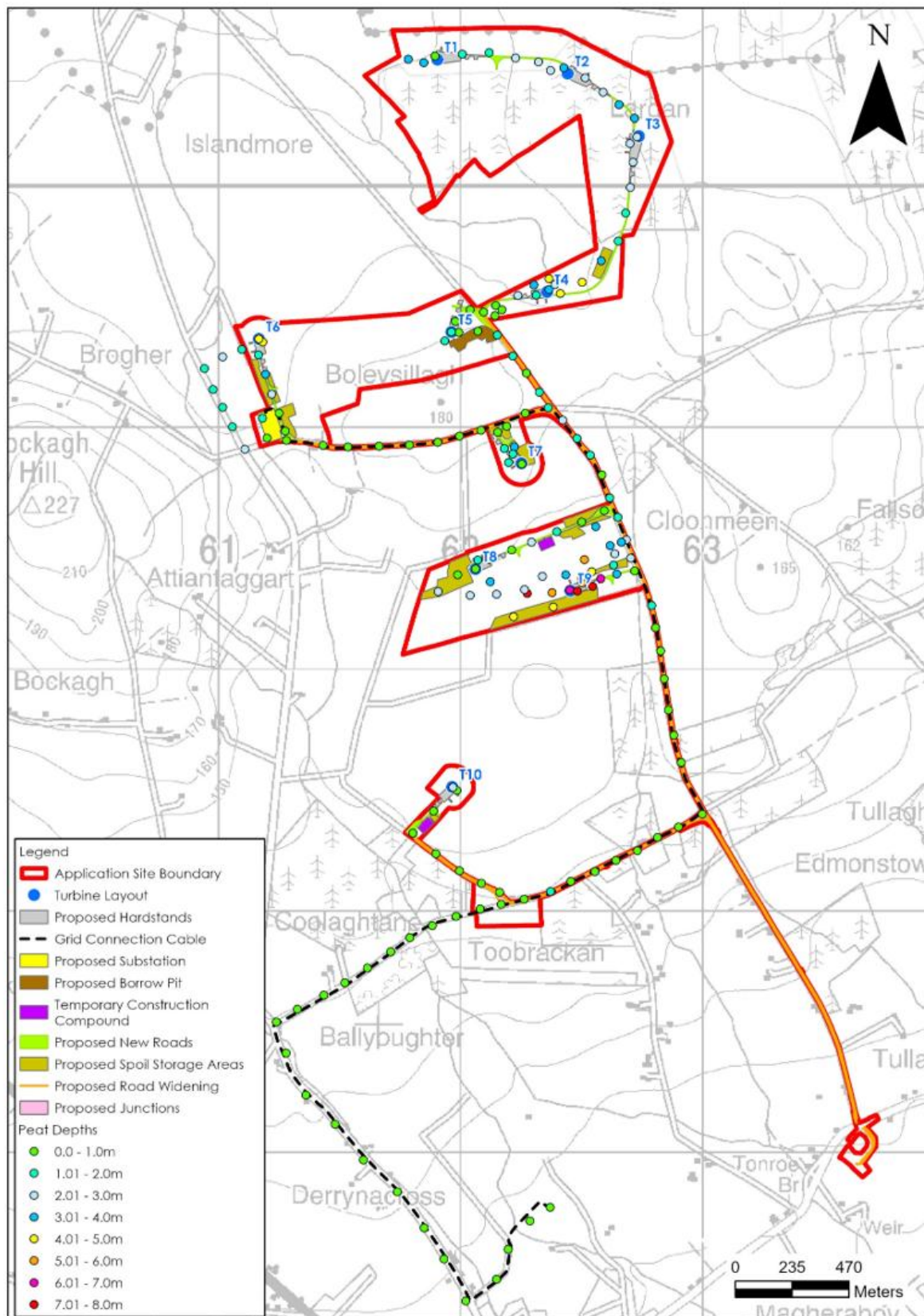


Figure 6.2: Summary Peat Depth Map

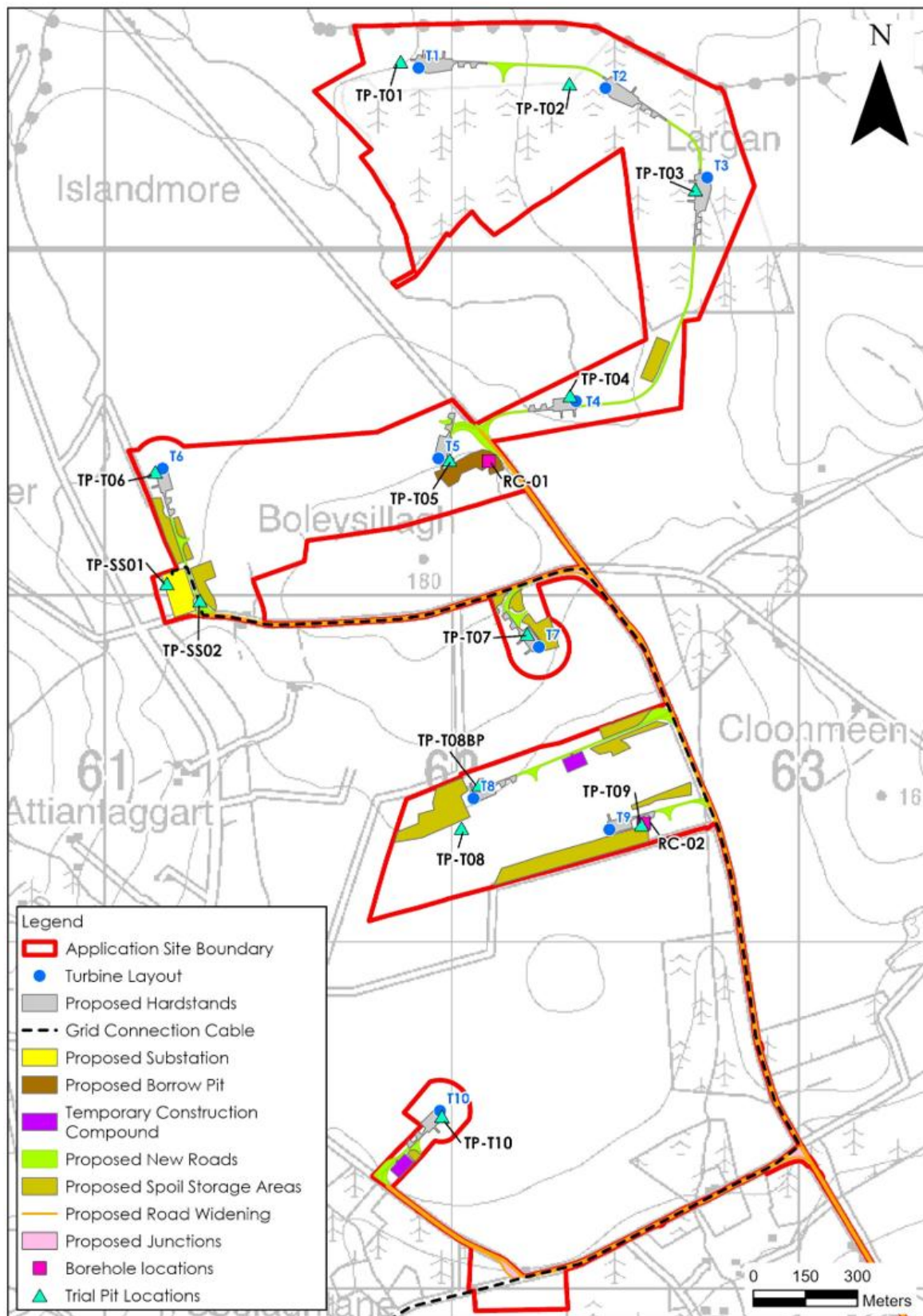


Figure 6.3: Site Investigation Map

6.3.3.5 Soil Contamination

There are no known areas of soil contamination within the project site or in its immediate environs. During the site walkovers and intrusive site investigations, no areas of contamination concern were identified.

According to the EPA online mapping database (<http://gis.epa.ie/Envision>), there are no licensed waste facilities within or in the immediate environs of the project site.

There are no historic mines within or in the immediate vicinity of the project site which are likely to have contaminated tailings and could give rise to adverse environmental effects.

6.3.4 BEDROCK GEOLOGY

6.3.4.1 GSI Mapping

The GSI bedrock mapping (www.gsi.ie) for the area shows that the project site is underlain by 4 no. bedrock units. The bedrock units that underlie the project site are mostly non-calcareous as described below; and therefore, are not susceptible to karstification. No pure limestones are present at the project site. The closest GSI mapped karst feature is located 3.5km to the northeast of the project site.

The bedrock unit underlying the southern portion of the wind farm is mapped as 'Basalts and other Volcanic Rocks' which includes turbine locations T9 and T10.

Most of the northern portion of the wind farm is mapped as 'Devonian Old Sandstones' which includes turbine locations T3 to T8 as well as the borrow pit and 110 kV electricity substation. The 2 no. northern turbines (T1 & T2) are underlain by 'Silurian Metasediments'.

The southern end of the project site, which is limited to haul route works, is mapped as 'Dinantian Mixed Sandstone, Shales and Limestone'.

With regards to the mapped bedrock along the underground electricity line route, its underlain by the same formations that underlie the project site with the exception of the Silurian (undifferentiated) rock.

Bedrock at the project site and underground electricity line route have mapped faults with the majority of these faults running in a southeast-northwest direction. These faults are assessed as unlikely to be of any significance with regard the project.

A bedrock geology map for the area is shown in Figure 6.4 below.

6.3.4.2 Investigation Drilling

Rotary core drilling carried out at the borrow pit location (IDL Hole ID: RC-01) and near turbine location T9 (IDL Hole ID: RC-02), where both encountered SANDSTONE bedrock.

Summary core logs are shown at **Table 6.6** below; while full details are provided at **Annex 6.1 (Volume II)**.

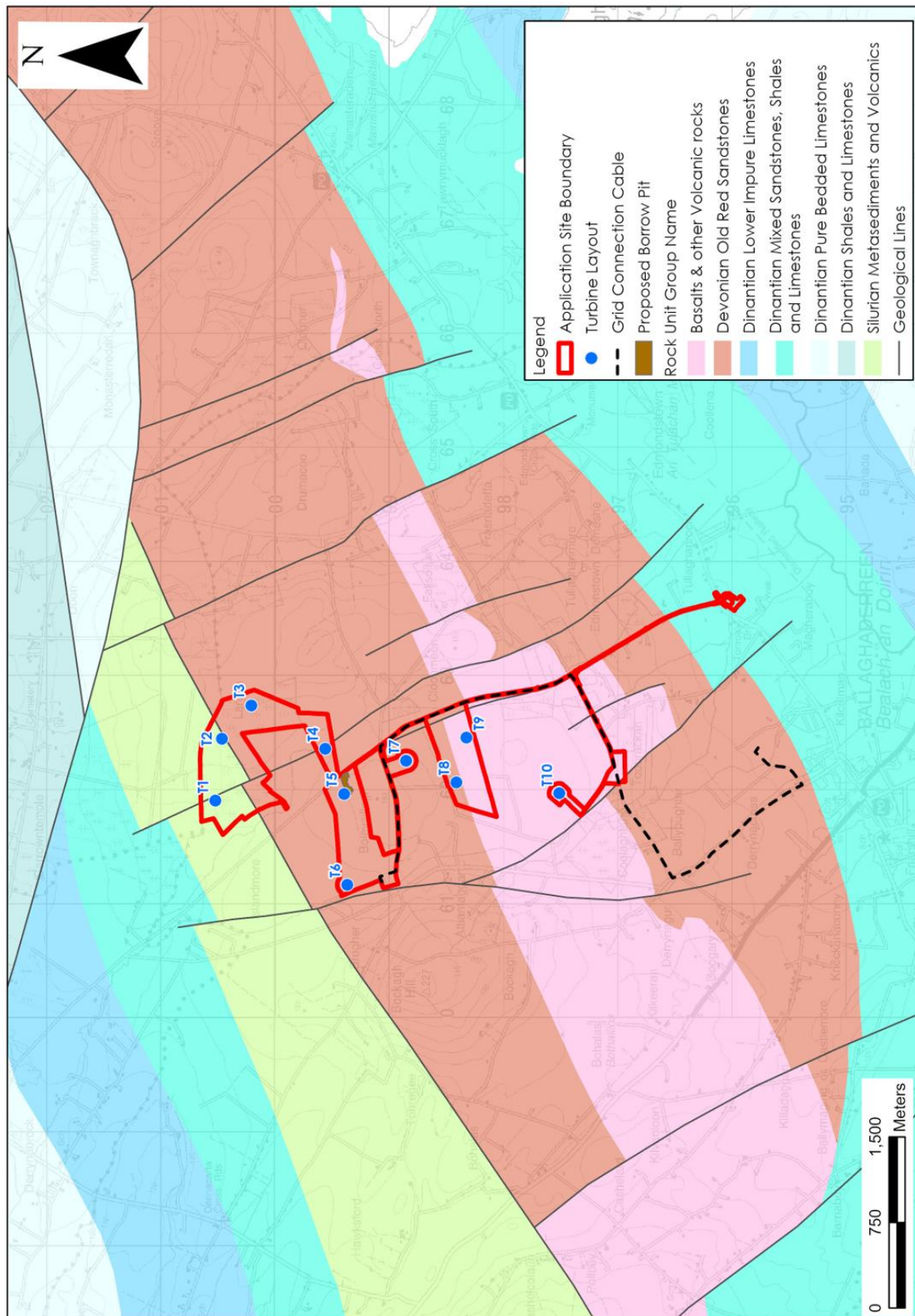
At RC-01, weathered sandstone bedrock was encountered between 2mbgl and 6.8mbgl, which in turn was underlain very strong sandstone down to 8.5mbgl, below which it became weathered again. The GSI mapped geology at RC-01 is 'Devonian Old Sandstones'.

At RC-02, weathered sandstone bedrock was encountered between 5mbgl and 7.4mbgl, which in turn was underlain very strong sandstone down to 15mbgl. The GSI mapped geology at RC-02 is 'Basalts and other Volcanic Rocks'.

Based on the criteria in **Table 6.1** above, local bedrock is assessed to be of Low importance as it is not an economically viable aggregate resource in this area.

BH ID	Location	Depth Range (mbgl)	Summary Log
RC-01	Borrow Pit	0 – 0.3 0.3 – 2.0 2.0 – 6.8 6.8 – 8.5 8.5 – 15.0	Topsoil GRAVEL (subsoil) SANDSTONE (Weathered) SANDSTONE (very strong) SANDSTONE (Weathered)
RC-02	Turbine T9 (70m setback)	0 – 3.8 3.8 – 5.0 5.0 – 7.4 7.4 – 15.0	PEAT CLAY (Stiff) SANDSTONE (Weathered) SANDSTONE (very strong)

Table 6.6: Summary Drilling Logs



6.3.5 PEAT STABILITY ASSESSMENT

6.3.5.1 Introduction

Fehily Timoney and Company (FT) was engaged to undertake a Geotechnical and Peat Stability Assessment of the project site (refer to **Annex 6.1 (Volume II)**). The assessment was completed in accordance with guidance contained in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017).

Hydrological, hydrogeological and ecological factors were also assessed in the Geotechnical and Peat Stability Assessment Report, and interaction between FT, HES and GES were undertaken throughout the iterative design process.

A site visit was carried out on 6 September 2023 in the company of members of the wider project team.

A constraints study was then undertaken by the environmental, hydrological and ecological members of the project design team to determine the developable area on the project site, prior to the site reconnaissance by engineering geologists/geotechnical engineers from FT.

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 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 such pre-conditions at the project site was a key part of the geological and hydrological constraints assessment carried out in conjunction with project design team.

An analysis of peat stability was carried out at all the main infrastructure locations at the project site. Due to the proposed route of the underground electricity line along public roads, no assessment of peat stability was required along the route.

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, while a FoS of greater than 1.0 indicates a stable slope.

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 the assessment, a design FoS of 1.3 was adopted, as a precautionary approach.

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and the basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional approach, EC7 does not provide a direct measure of stability, since global Factors of Safety are not used.

As such, and in order to provide a direct measure of the level of safety on a site, EC7 partial factors have not been used in the stability assessment. The results are given in terms of FoS.

The assigned probability of instability associated with a given FoS value is described in **Table 6.7** below.

No peat failures/landslides are recorded on the project site which suggests that project site conditions do not pre-dispose themselves to failures/landslides. The landslide susceptibility at the project site is classified by the GSI (2022) as Low to Moderately-Low susceptibility, which is expected given the generally flat terrain present.

The hand vane results indicate undrained shear strengths are in the range 5kPa to 60kPa, with an average value of approximately 20kPa. The strengths recorded would be typical of well-drained peat as is present at the project 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 Wind Farm failure (AGEC, 2004) as derived from back-analysis, was estimated at 2.5kPa.

The recorded undrained strength at the project site is significantly 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 a significantly lesser likelihood of failure on the project site¹.

Scale	Factor of Safety	Stability
1	1.3 or greater	Acceptable
2	1.0 to 1.3	Marginally Stable
3	<1.0	Unstable

Table 6.7: Probability Scale for Factor of Safety

6.3.5.2 Peat Stability Results

Stability of a peat slope is dependent on several factors. 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

¹ Derrybrien Wind Farm is located in County Galway and was the subject of a significant peat slide in 2003.

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 undrained² (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; and,
- 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.

A summary of the FoS 'undrained analysis' is presented in **Table 6.8** and the 'drained analysis' in **Table 6.9** ; while full results can be found in **Annex 6.1**.

The calculated FoS for both load conditions in the drained and undrained scenarios is in excess of 1.30 for each of the infrastructure locations (163 no. locations), indicating a low risk of peat instability.

The risk rating for each infrastructure element at the project is designated 'Low' or 'Negligible' following the implementation of some mitigation/control measures.

In summary, the findings demonstrate that the project site has an acceptable margin of safety, is suitable for the project and is assessed to be at low risk of peat failure or ground instability. The findings include recommendations and control measures for construction work in peat lands to ensure that all works adhere to an acceptable standard of safety.

Infrastructure ID	Factor of Safety for Load Condition	
	Condition 1	Condition 2
T1	2.55	2.09
T2	2.87	2.16
T3	4.10	3.02
T4	2.30	1.91
T5	22.92	13.75
T6	2.30	1.91
T7	2.30	1.73
T8	7.68	3.64
T9	2.39	2.10
T10	12.28	9.05
Substation	4.31	2.87
Construction Compound (T10)	9.55	7.47
Construction Compound (8)	3.08	2.27
Access Tracks (range)	2.16 – 5.90	1.6 – 4.19
Peat Storage Substation	5.77	2.31
Peat Storage Turbine T4	2.40	1.87
Peat Storage Turbine T6	2.03	1.57
Peat Storage Turbine T7	3.70	2.80

² For the stability analysis two load conditions were examined; namely, Condition 1: no surcharge loading, and Condition 2: surcharge of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case.

Infrastructure ID	Factor of Safety for Load Condition	
	Condition 1	Condition 2
Peat Storage Turbine T8	24.56	18.09
Peat Storage Turbine T9	2.50	2.05

Table 6.8: Factor of Safety Results (Undrained Condition)

Infrastructure ID	Factor of Safety for Load Condition	
	Condition 1	Condition 2
T1	1.70	3.01
T2	1.92	3.10
T3	2.73	4.36
T4	1.53	2.76
T5	15.28	19.87
T6	1.53	2.76
T7	1.54	2.48
T8	5.12	5.23
T9	1.59	3.03
T10	7.90	12.73
Substation	2.87	4.14
Construction Compound (T10)	6.37	10.79
Construction Compound (8)	8.72	8.18
Access Tracks (range)	1.44 - 6.37	2.3 – 12.11
Peat Storage Substation	8.28	5.98
Peat Storage Turbine T4	1.60	1.70
Peat Storage Turbine T6	6.68	6.38
Peat Storage Turbine T7	2.47	4.04
Peat Storage Turbine T8	69.80	65.50
Peat Storage Turbine T9	10.56	10.26

Table 6.9: Factor of Safety Results (Drained Condition)

6.3.6 GEOLOGICAL RESOURCE IMPORTANCE

According to the GSI natural resource mapping, the project site has a 'very low to low' crushed rock aggregate potential. There is also a low potential for granular aggregates.

Based on the criteria in **Table 6.1** and the GSI aggregate potential above, the local bedrock underlying the project site is assessed to have a Low importance.

6.3.7 GEOLOGICAL HERITAGE SITES & DESIGNATED SITES

County Geological Sites (CGS) are areas chosen by Geological Survey Ireland and local authorities for their scientific, educational, cultural, or visual geological value.

No part of the project site is mapped within a geological heritage site. The closest geological heritage site to the project site is Ugool (Site Code: MO099) ~9.5km to the west of the project. The site is described as small exposures of fossiliferous bedrock along a small stream in the boundary of Ugool Townland (refer to Figure 6.5 below).

Designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). There are no designated sites within the project site or adjacent to it, which can be directly affected (from a land, soil and geology perspective) by the construction, operation or decommissioning of the project.

The project site is hydrologically connected to the River Moy SAC (Site Code: 002298). At its closest point to the northwest, this designated site is located approximately 4.9km downstream of the project site and is hydrologically connected via the Owengarve [Sligo] River.

Tullaghanrock Bog SAC (Site Code: 002354) and Callow Bog SAC (Site Code: 000595) are located to the southeast and approximately 1.6km and 2.7km downstream of the project site respectively.

Lough Gara SPA (Site Code: 004048) and pNHA (Site Code: 000587) is located c. 6km downstream of the project site, and the lakes main inflowing river is the River Lung which drains the southern portion of the project site.

There are also several pNHA designated sites located along the banks of the Owengarve River, approximately 5.5km downstream of the project site. These bogs include Gowlaun Bog pNHA, Tawnaghbeg Bog pNHA, Kilgarrieff Bog pNHA, and Derrynabrock Bog pNHA). Hydrological connectivity between the project site and these designated bogs will be limited to surface water flows in the Owengarve River (i.e. there is no groundwater flow connectivity with the project site and these designated bogs due to separation distances and the surface water flow regime).

No geological heritage site or designated site is scoped in for assessment of land, soil or geology effects due to their distant location from the project site (i.e. from a land, soils and geology perspective, only direct effects within the project site will occur). As described above and due to the characteristics of the project, there is no likelihood of the project affecting the land, soils and geological environment outside of the project site.

Further details of the assessment of likely indirect hydrological/hydrogeological effects on downstream designated sites can be found at **Chapter 7**. Based on the criteria in **Table 6.1** above, designated sites have a Very High importance.

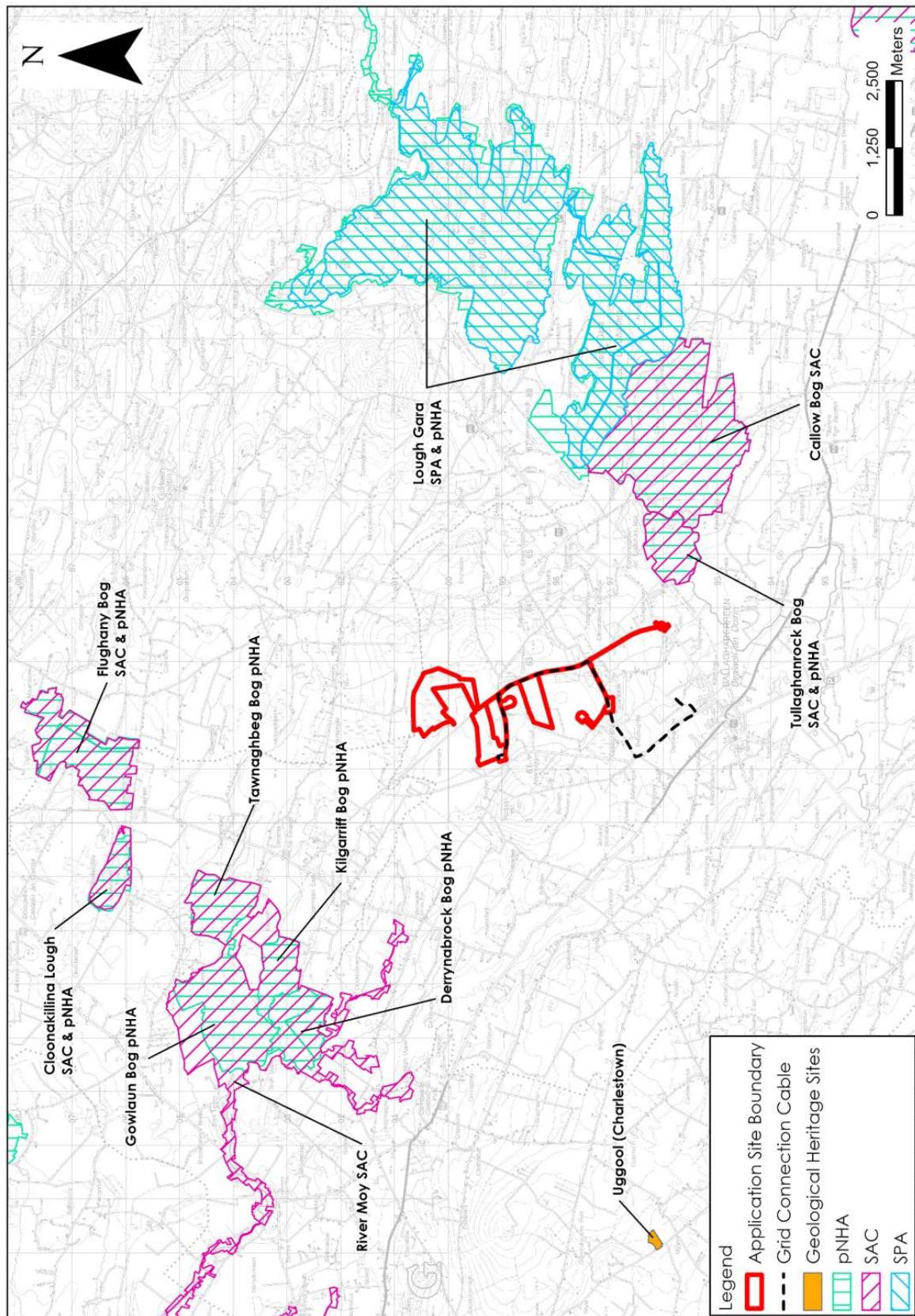


Figure 6.5: Designated Sites & Geological Heritage Sites

6.4 DESCRIPTION OF LIKELY EFFECTS

6.4.1 CHARACTERISTICS OF THE PROJECT

The project will typically involve the removal of peat, soil, subsoil and possibly bedrock (if foundation piling is required) to facilitate the emplacement of access tracks, turbine foundations, crane hardstands, electricity substation and underground electrical cabling.

The turbine foundations will either be gravity design or piled foundation depending on more detailed site investigations. The excavations volumes calculated in **Note:** A factor of 10% (bulking factor of 10%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

Table 6.10 below assume a gravity design as this is the worst-case scenario because excavation volumes and spoil volumes will be higher.

Gravity foundations depths are expected to be between 3m and 5m deep, depending on ground conditions at each turbine location, with an approximate diameter of c. 27m for turbines T1-T3 and c. 24m for turbines T4-T8 and T10. For the piled turbine foundations (T9), the foundation would likely be c. 20m in diameter and include multiple piles ranging from 1m to 2m in diameter extending to depths of c. 15-30m below ground level to suitable weight bearing substrate.

Floating access tracks are the predominant track construction type proposed for the project which, given the ground conditions and type of terrain present, is deemed an appropriate construction approach. Where shallower peat is present (<1.5m), excavate and replace (founded) type construction may be considered; while founded access tracks will be constructed adjacent to crane hardstandings.

It is proposed that bedrock (sandstone) won from the on-site borrow pit will be used to construct the sub-base layer of access tracks, hardstand areas and turbine base areas. The estimated volume of available rock, which was confirmed by investigation drilling, is 40,000m³.

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 quantities of peat and spoil requiring management at the project site have been calculated and are presented in **Table 6.10** below. The total estimated combined volume of peat and spoil to be managed following excavations during the construction phase of the project is approximately 171,200m³ (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 project site on a sequential basis.

Overburden/spoil will be utilised for reinstatement of excavated areas and for landscaping purposes. Excess material, or material which cannot be used for reinstatement, will be stored permanently at the borrow pit (when exhausted) and at dedicated spoil deposition areas located throughout the project site. **Table 6.11** below provides details of storage capacity at the reinstatement areas. The designated spoil deposition areas (including borrow pit) can accommodate up to c. 176,800m³ of material in total.

To maintain the geological integrity of the project site, it is proposed that generated spoil will firstly be deposited locally to its point of origin or at a location of similar geological characteristics.

Following the completion of the spoil deposition process, the dedicated spoil deposition areas also be graded to match existing profiles and allowed to vegetate naturally.

It should be noted that **Table 6.10** below does not include any material arising from the installation of the underground electricity line, estimated to be c. 5,000m³. This is due to the fact that such material is likely to predominately comprise aggregates and may be contaminated by asphalt, which would be inappropriate to permanently store at the project site. Therefore, all such material arising from the underground electricity line shall be removed from site and disposed at a licensed waste management facility.

It is, therefore, predicted that all spoil generated, which is suitable for storage via this method, will be stored permanently within the project site. However, certain materials (e.g. tarmac/road cuttings from haul route works and underground electricity line route) will be removed from site and disposed of at a licensed waste facility. As waste license permits are subject to renewal, it is not currently possible to confirm the precise location for the disposal of excess spoil; however, having reviewed the National Waste Collection Permit Office (NWCPO) database, there are a number of facilities within County Roscommon which currently accept soil, rock and other materials arising from construction projects.

Please refer to **Annex 6.2** for further details on the management and storage of spoil.

Project Element	Peat Volume (m ³)	Spoil/Non-Peat Volume (m ³)	Comment
10 no. turbine and hardstands	120,000	12,000	Hardstanding area and foundation footprint. Allowance included for mini-crane pads and blade finger hardstands associated with the main hardstand.
Access Tracks	8,500	700	Allowance includes for widening on bends, at junctions, laybys, and tie ins to hardstands.
2 no. Construction Compounds	-	-	Compounds will be floated, no peat/spoil to be excavated.
110kV Substation	13,000	1,000	-
Borrow Pit	8,000	8,000	-
Totals	149,500	21,700	Total = 171,200m ³ (peat and spoil volume)

Note: A factor of 10% (bulking factor of 10%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.

Table 6.10: Summary of Estimated Spoil Volumes at Project Site

Location	Peat and Spoil Volume (m ³)	Comment
Borrow Pit (1 no.)	46,000	See Drawing P23-215-0600-0009 for further details (Annex 6.2)
Spoil Storage Areas	106,800	1.5m in height in designated peat storage areas, where slopes are relatively shallow (<5 degrees) (Drawing P23-215-0600-0005) (Annex 6.2)

Landscaping	24,000	It is estimated that 1,500m ³ of peat will be required for landscaping purposes at each of the 10 no. turbine locations. 500m ³ of spoil will be used as ballast backfill at each turbine location. An additional 2,000m ³ of landscaping is proposed at each of the temporary construction compounds.
Total	176,800m ³	

Table 6.11: Peat and Spoil Reinstatement Volumes & Locations

6.4.2 DO-NOTHING' IMPACT

In the event that the project is not progressed, existing land uses will continue and there will be no alteration to the land, soil or geological environment.

6.4.3 CONSTRUCTION PHASE

6.4.3.1 Soil, Subsoil and Bedrock Excavation

The excavation of peat, soil, subsoil and bedrock (where present) will be required for all groundworks; including site levelling, the installation of infrastructure (e.g. turbine foundations) and for crane hardstanding and access track (where founded tracks are constructed) formation and will, therefore, give rise to direct effects on these receptors. The excavation of subsoils will also be required along the underground electricity line route; while minor levels of excavation are predicted at haul route works locations.

Bedrock is likely only to be encountered at turbine locations if piling is carried out, as evidenced by the results of the preliminary site investigations undertaken.

Due to the shallow and linear nature of the works along the underground electricity line (c. 1.2m) and the fact that the spoil will be removed from site and disposed of at a licensed handling facility, effects subsoil and bedrock will not likely be significant.

These works will result in a direct, permanent loss of soil, subsoil and bedrock at excavated locations. The estimated excavation volumes are detailed in **Note:** *A factor of 10% (bulking factor of 10%) has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the Site.*

Table 6.10 above.

The overall effect is assessed as not likely to be significant due to the following:-

- The peat, soils, subsoils and bedrock at the project site are generally classified as 'low to medium' importance;
- A minimal volume of peat, soil, subsoil and bedrock; in comparison to the total resource present on the project site; will be removed to allow for the construction of the project;
- The peat, soil, subsoil, and bedrock which will be removed during the construction phase will be localised to the footprint of infrastructure only; and,
- No turbines or wind farm related infrastructure will be constructed within or near any designated sites for the protection of ecological features or geological heritage.

The excavation and relocation of material is an inevitable part of the project and no specific mitigation is required. The excavation of materials will be completed in accordance with best practice for the management and treatment of such materials. The overall final effect of the excavation of peat, soil, subsoil and bedrock is summarised in **Table 6.12** below.

The likely magnitude of effects on peat, soils, subsoils and bedrock is Small Adverse to Moderate Adverse.

Attribute	Description
Receptor	Peat, soils, subsoils and bedrock
Pathway/Mechanism	Excavations
Overall Effect	Negative, direct, slight to moderate, likely, permanent effect on peat, soil, subsoil and bedrock

Table 6.12: Peat, Soil, Subsoil and Bedrock Excavation Effect

6.4.3.2 Erosion of exposed peat, soil and subsoil at excavation and storage areas

The exposure of peat, soil and subsoils at locations of excavation and of spoil storage can increase the likelihood of soil erosion resulting in a direct physical effect on land and soil. However, given the relatively small footprint of the proposed excavation and spoil storage areas in the context of the overall project site, the likely pre-mitigation effect will not be significant.

The likely pre-mitigation effect of peat, soil and subsoil erosion is summarised in **Table 6.13** below. The likely magnitude of effect is Negligible to Small Adverse.

Attribute	Description
Receptor	Peat, soils and subsoils
Pathway/Mechanism	Vehicle movement, surface water erosion, and wind action.
Pre-Mitigation Effect	Negative, direct, slight, permanent, likely effect on peat, soil and subsoils.

Table 6.13: Peat, Soil & Subsoil Erosion Effect

6.4.3.3 Contamination of peat, soils and subsoils by leakages or spillages of hydrocarbons or other chemicals

The contamination of peat, soils and subsoils presents a direct effect on the geology of the project site. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk.

Hydrocarbon has a high toxicity to humans and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks are likely to result in significant effects (i.e. contamination of soils and subsoil on the geological environment). The likely pre-mitigation effect is assessed to be not significant due to the relatively low volumes of fuels/chemicals that will be kept on-site at any one time.

The pre-mitigation effect of soil contamination is summarised in **Table 6.14** below. The likely magnitude of effect is Negligible to Small Adverse.

Attribute	Description
Receptor	Peat, soil and subsoils
Pathway	Peat, soil and subsoil pore space.

Pre-Mitigation Effect	Negative, direct, slight, short-term, unlikely effect on, peat, soils and subsoils.
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Table 6.14: Peat, Soil & Subsoil Contamination Effect**6.4.3.4 Effects on Land & Land Use**

The total permanent project footprint (excluding spoil deposition areas) amounts to c. 8.6ha and, having regard to current land use activities, there will be no long-term effect on same.

The presence of the underground electricity line will not, being entirely sub-surface, result in any alteration to land or land-use. Similarly, the characteristics of the temporary haul route alteration works will not result in any permanent effect on land or land-use.

The pre-mitigation effect on land and land-use is summarised in **Table 6.15** below. The likely magnitude of effect is Small Adverse to Moderate Adverse.

Attribute	Description
Receptor	Land & Land Use
Pathway	Excavation and infrastructure construction
Pre-Mitigation Effect	Negative, slight to moderate, direct, likely, permanent effect on land and land use.

Table 6.15: Land & Land Use Effect**6.4.3.5 Peat Instability and Failure**

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on the project site and the surrounding environment. The potentially significant effects of peat failure at the project site may result in:-

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of infrastructure;
- Drainage disruption by blockage of drainage pathway by relocated peat and spoil;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by particulates; and,
- Degradation of the peat environment by relocation of peat and spoil.

However, the landslide susceptibility at the project site is classified by the GSI (2022) as Low to Moderately-Low susceptibility, which is expected given the generally flat terrain present.

In addition, the findings of the Geotechnical and Peat Stability Assessment (**Annex 6.1; Volume II**) found that the project site has an acceptable margin of safety and that the site is suitable for the project. Notwithstanding the above, the management of peat stability and appropriate construction practices will be inherent in the construction phase to ensure peat failures do not occur on site.

The pre-mitigation effect on ground and peat stability is summarised in **Table 6.16** below. The likely magnitude of effect is Small Adverse to Moderate Adverse.

Attribute	Description
Receptor	Peat Stability
Pathway	Excavation and infrastructure construction
Pre-Mitigation Effect	Negative, slight to moderate, direct, unlikely, permanent effect on peat stability

Table 6.16: Peat Stability and Failure

6.4.4 OPERATION PHASE

Following the completion of the construction phase, including the appropriate reinstatement and landscaping of the project site which will avoid the likelihood of erosion effects, very few (if any) effects on land and soils are likely during the operation phase of the project. These may include:

- Minor accidental leaks or spills of fuel/oil from vehicles associated with the ongoing maintenance of the wind farm; and,
- The transformers in each turbine may be oil-cooled. There is a risk of spills/leaks of oils from this equipment resulting in contamination of soils.

6.4.5 DECOMMISSIONING PHASE

The likely effects associated with decommissioning of the project will be similar to those associated with construction but of a substantially reduced magnitude (i.e. Negligible to Small Adverse). Activities which are likely to affect land & soil include the removal and reinstatement of turbine foundations, crane hardstandings and access tracks (where not retained); while some sub-surface elements such as the underground electricity line ducting will be left in situ to reduce effects.

6.4.6 ASSESSMENT OF CUMULATIVE EFFECTS

The land and soil impact assessment concludes that, in relation to the project, significant effects are unlikely to arise predominately due to the localised and near surface nature of the construction works and the absence of likely significant effects during the construction, operation and decommissioning phases.

Similarly, and given the small construction footprint and shallow earthworks proposed at the electricity substation, underground electricity line and haul route works; it is assessed that significant cumulative effects on land, soils and geology are unlikely to arise in-combination with the wind farm as a result of this secondary/off-site development and any effects are assessed to be not significant.

Given that all likely effects relating to the project as a whole are assessed to be direct, contained within the project site, and unlikely to extend beyond the project site; it is assessed that there is no pathway for the project to act in combination with other existing, permitted and proposed developments.

All known existing, permitted and proposed developments (as listed in **Chapter 1**) in the vicinity of the project have been assessed to determine the likelihood of cumulative effects arising. The majority of other developments are assessed to be of an insufficient scale such that significant cumulative effects could not arise or there is a substantial separation distance between the respective projects and, therefore, an absence of connectivity.

6.4.7 ASSESSMENT OF LIKELY HEALTH EFFECTS

The possibility of health effects, albeit unlikely, arises mainly from the potential for soil and ground contamination during construction. The project is not a recognised source of land or soil pollution and is not assessed as likely to result in land or soil pollution; and, therefore, significant effects during the construction, operation or decommissioning phases is unlikely.

Hydrocarbons will be used onsite during construction; however, the volumes will be small and will be handled and stored in accordance with best practice methods and appropriate mitigation measures. As a result, it is assessed that the likely residual effects associated with soil or ground contamination and subsequent health effects will be imperceptible.

6.4.8 RISK OF MAJOR ACCIDENTS AND DISASTERS

Due to the nature of the project site, i.e. soft peat deposits, there is an inherent risk of peat movement occurring. However, due to the generally flat, or gently sloping, nature of the project site, the risk is assessed to be low.

A Geotechnical and Peat Stability Assessment (FT, 2026) has been undertaken for the project, based on extensive field surveys, and concludes that with the implementation of the proposed control (mitigation) measures, the residual risk of a landslide occurring is assessed to be negligible to low.

6.5 MITIGATION AND MONITORING

6.5.1 CONSTRUCTION PHASE

6.5.1.1 Peat, soil, subsoil and bedrock excavation

The excavation of peat, soil, subsoil and bedrock will have a direct effect on the geological environment and no specific mitigation measures are proposed. The excavation and long-term storage of materials will be completed in accordance with best practice for the management and treatment of such materials.

However, to help offset the loss of peat at the proposed site, Habitat Management Plan (refer to **Annex 5.3**) has been prepared and comprises the following:-

- Drain management;
- Marginal, cell and contour bunding;
- Forest to bog restoration;
- Bare peat revegetation;
- Scrub removal;
- Cessation of turf cutting; and,
- Prevention of uncontrolled burning.

6.5.1.2 Erosion of Exposed Peat, Soil and Subsoil at Excavation and Storage Areas

The following avoidance and design measures are proposed to reduce erosion effects at excavation and spoil storage areas:-

- Mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood of soil and subsoil erosion and

avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;

- Excavated material will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping. Where material is not required for reinstatement or landscaping, it shall be immediately transported to the spoil deposition areas;
- Silt fences, and all necessary surface water management measures (including upslope interceptor drains), will be installed around all temporary stockpiles to limit movement of entrained sediment in surface water runoff. All slopes will be sealed with the bucket of an excavator;
- In order to minimise erosion during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- At the designated spoil deposition areas, material will be placed in layers to ensure stability is maintained and works will be undertaken in accordance with best practice construction methodologies. Works at the spoil deposition areas (including the borrow pit) will be monitored, on a weekly basis during the construction phase and monthly for a 6 no. month period thereafter, by an appropriately qualified Geotechnical Engineer. In the event that any ground stability issues arise, the Engineer will have the power to cease works until such time as remedial works have been completed to his/her satisfaction;
- Permanently mounded spoil; for example, berms surrounding turbines and hardstands, berms located along access tracks and the spoil deposition areas; will be seeded and grassed over at the earliest opportunity to prevent erosion; and,
- The underground electricity line (grid connection) trench will be reinstated to the required EirGrid/ESB Networks specification and in accordance with landowner requirements and will be reseeded or allowed to vegetate naturally (on agricultural land) or topped with asphalt (or similar along public roads) at the earliest opportunity to prevent erosion.

6.5.1.3 Contamination of Soils and Subsoils by leakages, spillages of hydrocarbons or other chemicals

The following measures are proposed to specifically prevent contamination of soils and subsoils:-

- The volume of fuels or oils stored on site will be minimised. All fuel and oil will be stored in an appropriately bunded area within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- 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 at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The 4x4 jeep will also be fully stocked with 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 absorbent mats will be used during all refuelling operations to avoid any accidental leakages;

- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during re-fuelling;
- All waste tar material arising from road cuttings (from trenching in public roads and haul route temporary alteration works) will be removed off-site and disposed of at a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works or to store it within the spoil deposition areas; and,
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage Construction and Environmental Management Plan (**Annex 3.4**). This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5.1.4 Land and Land Use

The change in land use within the project site is minimal (5.5% coverage at the project site) and, therefore, the effects are assessed to be not significant. Similarly, given the already generally cutover, drained and degraded nature of the bog surface at the project development areas, the effects are considered to be not significant.

However, to help offset the loss of peatland habitats, a Habitat Management Plan has been prepared and will be implemented at the project site (refer to **Annex 5.3**).

6.5ha of forestry will be felled to accommodate wind farm infrastructure. However, all tree coverage felled will be replaced at a replanting site which will be subject to technical approval through a separate consenting process. No specific measures, other than best-practice felling and replanting methodologies are proposed and the efficacy and appropriateness of these measures will be assessed, separately, through the felling and replanting licensing process. However, subject to the adherence to standard methodologies, no significant effects are assessed as likely.

6.5.1.5 Peat Stability and Failure

Firstly, the key mitigation with regard peat stability risk at the project site was the carrying out of a robust, multidisciplinary site investigation and peat stability risk assessment in accordance with best practice guidance (PLHRAG, Scottish Government, 2017).

The findings of the geotechnical and peat stability assessment demonstrates that the project site has an acceptable margin of safety and is suitable for the development of the project.

The assessment provides a number of mitigation/control measures to reduce the potential risk of peat failure at each infrastructure location.

The following control measures will be incorporated into the construction phase of the

project will ensure 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 localised peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Implementation of safety buffers around deep peat areas;
- Adhere to the spoil and peat storage restriction areas detailed in the Geotechnical and Peat Stability Assessment;
- Set up, maintain and report findings from monitoring systems as outlined in the Geotechnical and Peat Stability Assessment;
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor; and,
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.

6.5.2 OPERATION PHASE

Following the completion of construction activities and the revegetation of exposed soil as a result of excavations and spoil storage; it is assessed that, due to the absence of likely soil erosion effects, no mitigation measures are required.

Oil used in transformers (within each turbine, if required) and storage of oils/lubricants at the electricity substation could leak during the operation phase and result in adverse effects on soil and subsoils. Any oil storage tanks will be located in a roofed concrete bund capable of holding 110% of the stored oil volume. Turbine transformers will be located within the turbines, and any leaks will be fully contained within the turbine thus eliminating any pathway for leakages to affect land and soil.

6.5.3 DECOMMISSIONING PHASE

During decommissioning, it may be possible to reverse or at least reduce some of the likely effects caused during construction by rehabilitating construction areas such as turbine foundations and hardstanding areas. This will be done by removing wind farm infrastructure and restoring disturbed ground with previously excavated material where possible.

Decommissioning of the underground electricity line will involve the removal of the cabling from the ducting; however, the ducting will remain in situ to avoid further excavations and prevent environmental effects.

Other effects, such as possible soil compaction and any contamination by fuel leaks, will remain but will be of a substantially reduced magnitude. 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 and 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 effects will be avoided by retaining some elements of the project in place where appropriate; for example, access tracks within the site may be retained for forestry uses.

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

No significant effects on the land, soils or the geology environment are likely during the decommissioning stage of the project.

6.5.4 MONITORING MEASURES

There is no proposed monitoring programme for land and soils. However, during and post-construction, all excavated or raised areas (i.e. cut and fill) and reinstated/landscaped ground, including the spoil deposition areas, will be inspected for signs of erosion and instability by the Geotechnical Engineer appointed by the Developer. These inspections will be undertaken on a weekly basis during the construction phase and monthly, for a six-month period, post-construction.

6.6 RESIDUAL EFFECTS

6.6.1 CONSTRUCTION PHASE

The loss of land/land-use, loss of peat bogs and the excavation and relocation of peat, soil, subsoil and bedrock is an inevitable part of the project and therefore no specific mitigation measures, other than standard construction best practices, are proposed. As a result, the likely residual effect with respect to soil, subsoil, and bedrock excavation and loss of land/land use is assessed to be the same as the pre-mitigation effects, which is Slight-to-Moderate.

The residual effects with respect to soil/subsoil erosion and contamination effects are assessed to be imperceptible.

A detailed geotechnical and peat stability assessment has been completed for the project. The findings of that assessment demonstrate that there is a low risk of peat failure at the site as a result of the project.

With the implementation of the control measures outlined above, the residual effect is assessed to be negative, imperceptible, direct, permanent, unlikely effect on peat stability.

6.6.2 OPERATION PHASE

No significant residual effects are assessed as likely to occur during the operational phase.

6.6.3 DECOMMISSIONING PHASE

No significant residual effects are assessed as likely to occur during the

decommissioning phase.

6.7 SUMMARY

Excavations will be required for site levelling and for the installation of turbine foundations, crane hardstands, sections of access tracks, electrical cabling, substation and grid connection infrastructure. This will result in the permanent removal of peat, soil, subsoil and bedrock (where present) at excavation locations.

Overburden/spoil will be utilised for reinstatement of excavated areas etc. and for landscaping purposes. Excess material, or material which cannot be used for reinstatement, will be stored permanently at the project site.

Given that all likely effects relating to the project are assessed to be direct, contained within the immediate vicinity of the project site, and unlikely to extend beyond the project site; it is assessed that there is no pathway for the project to act in combination with other existing, permitted and proposed developments.

No geological heritage site or designated site is scoped in for impact assessment due to their distant location from the project site (i.e. from a land, soils and geology perspective, only direct effects within the project site will occur). There is no potential for the project to affect the land, soils and geological environment outside of the project site.

In conclusion, this assessment has determined that the project (including wind farm, underground electricity line and haul route works) will not likely to result in any significant effects on land, soils and the geological environment. Where effects of less significance are likely to occur, such as soil erosion or contamination (i.e. minor spills and leaks), the implementation of best-practice construction techniques and appropriate mitigation measures will ensure that any residual effects are imperceptible. Where it is not possible to implement mitigation measures, such as in respect of the direct excavation of peat, soil and subsoil, including loss of land, the level of effect is considered to be Slight-to-Moderate and will not likely be significant.