6. LAND SOILS AND GEOLOGY

6.1 Introduction

6.1.1 Background and Objectives

This section of the rEIAR identifies, describes and assesses the potential significant effects of the Subject Development on Land, Soils, and Geology and has been completed in accordance with the EIA guidance and legislation set out in Chapter 1: Introduction.

The Subject Development, detailed fully in Chapter 3 of this rEIAR, comprises of 25 no. deviations from the windfarm permitted under ABP-300460-17 (amended by ABP-303729-19). The Subject Development relates to wind farm roads and hardstand areas, peat storage and containment measures, borrow pits, environmental and water quality mitigation measures, and ancillary works. The Subject Development is located in the townlands of Meenbog and Croaghnoagh, near the twin towns of Ballybofey and Stranolar, Co. Donegal.

As described in Section 1.4.1 of this rEIAR, this Chapter uses the following terminology: the 'Site', the 'Permitted Development', the 'Subject Development', the 'Meenbog Windfarm' and the 'November 2020 Peatslide'.

This chapter presents:

- A description of the baseline sensitivity and importance of the receiving land, soils and geological environment based on the baseline site conditions prior to the onset of construction of the Meenbog Windfarm;
- The mitigation and monitoring measures which were implemented during the construction of the Meenbog Windfarm for the protection of the land, soils and geological environment;
- An assessment of the residual effects of the Subject Development on the land, soils and geological environment; and,
- An assessment of the cumulative effects from the Subject Development and other projects in the surrounding area.

6.1.2 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 rEIAR was prepared by Michael Gill, Conor McGettigan, and John Twomey.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. For example, Michael has worked on the EIARs for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 120 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 3 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the land, soils and geology chapters of environmental impact assessment reports for wind farm development on peatlands.

John Twomey (BSc) is a recent graduate of Earth and Ocean Science from University of Galway. John has assisted with the completion of geological impact assessments for a range of developments including quarries, windfarms and industrial developments.

6.1.3 Scope and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.5 of Chapter 2 of the rEIAR. Consultation responses relating to the land, soils and geological environment were received from the Geological Survey of Ireland and the Health Service Executive. A summary of the responses are detailed below in **Table 6-1**. Further details are outlined in Section 2.5.2 of this rEIAR.

Table 6-1: Summary Consultations with respect to the land, soils and geological environment

Consultee	Description	Addressed in Section
Geological Survey Ireland	*"Our records show that there is a CGS in the study area of the proposed wind farm[...]This site should be assessed as an environmental constraint. Ideally, the site should not be damaged or integrity impacted or reduced in any manner due to the proposed construction and modification of access roads, from traffic due to access road construction and turbine installation. This would include impacts that may be related to altered drainage patterns, changes in soil profiles and structures etc. However, this is not always possible, and in this situation appropriate mitigation measures should be put in place to minimize or mitigate potential impacts."*	6.5.2.7
	Landslides are common in areas of peat, rock near surface and in fine to coarse range materials (such as glacial tills), areas which are found within the proposed wind farm area. The Landslide Susceptibility map indicates variable landslide susceptibility within the study area, including areas of 'Moderately High' to 'High' susceptibility. We note in the scoping document, reference to the peat slide close to the wind farm that occurred in November 2020. The potential for run-out from peat failure should be addressed.	6.3.8 and 6.5.2.6
Health Service Executive	*"A detailed assessment of the current ground stability of the site for the proposed renewable energy development and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the impact construction work may have on the future stability of ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion."*	6.3.8 and 6.5.2.6
	"The Environmental Health Service recommends that a detailed Peat Stability/Geotechnical Assessment of the proposed site should be undertaken to assess the suitability of the soil for the proposed development. The EIAR should include provision for a peat stability monitoring programme to identify early signs of potential bog slides ('pre-failure indicators' see the Scottish Government's 'Peat Landslide Hazard and Risk	6.3.8

	Assessments: Best Practice Guide for Proposed Electricity Developments 2017)"	

6.1.4 Relevant Legislation

The rEIAR 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:

- Planning and Development Act, 2000 (as amended);
- Planning and 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;
- S.I. No. 296/2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018; and,
- The Heritage Act 1995, as amended.

6.1.5 Relevant Guidance

The Land, Soils and Geology chapter of this rEIAR was prepared in accordance with, where relevant, to guidance contained in the following documents:

- Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Commission 2017).

6.2 Methodology

6.2.1 Desk Study

A desk study of the Site was completed in January and February 2024 to collect all relevant geological data for the Site and the surrounding area. This study included consultation with the following data sources:

- Environmental Protection Agency database (www.epa.ie);
- Corine Land Cover and Land Cover Change Maps (www.land.copernicus.eu);
- 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 3 (Geology of South Donegal). Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie); and,
- Aerial Photography, 1:5000 and 6 inch base mapping.

6.2.2 Monitoring and Site Investigations

A comprehensive and robust geological dataset has been collected at the Site across multiple phases of site investigations.

HES completed a detailed review of the Permitted Development associated files and site investigations as part of the baseline land, soils and geological assessment of this rEIAR. The intrusive site investigations for the Permitted Development accumulated an extensive site specific dataset as detailed below. The previous site investigations relating to the land, soils and geological environment are as follows:

- HES and MKO have completed site inspections and walkover surveys at the Site on several dates in October 2014 and July 2017 for the preparation of the land, soils and geology chapter of the EIAR for the Permitted Development.
- The site investigations conducted by HES comprised of extensive geological mapping of bedrock exposures, peat and subsoil exposures, peat probing and gouge coring.
- Peat probing investigations allowed for the mapping of peat depths and peat depth distribution across the Site. A total of over 500 no. peat probes (HES, MKO and AGEC Ltd) were completed to determine the depth and geomorphology of the blanket peat.
- The mineral soil and bedrock interface was assessed at key infrastructure locations associated with the Permitted Development. A total of 30 no. gouge cores and 1 no. window sample were completed across the Site.
- Geotechnical investigations and a Peat Stability Risk Assessment Report (PSRA) were undertaken by AGEC Ltd in September and October 2014 and March 2017. The PSRA completed for the Permitted Development is included as Appendix 6-1.
- During these site investigations, all mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively.

Further site investigations were completed at the Site following the occurrence of a peat slide on 12th November 2020. These investigations are as follows:

- Fehily Timoney and Company (FTC) completed additional extensive site investigations and geotechnical analysis, with an assessment of the site stability submitted to Donegal Co. Co. (Appendix 6-2).
- In February 2021, Ionic Consulting produced a site-wide stability assessment (included as Appendix 6-3). This assessment was based on a significant amount of site-specific ground investigation data, including over 1,750 peat probes and shear vane results. The assessment was based on data accrued during the construction phase on the Meenbog Windfarm, with the site investigations completed between November 2019 and October 2020, and additional testing completed in December 2020 to May 2021.
- Furthermore, AFRY completed an assessment of the stability of the works completed to date on the Site in October 2023. A Technical Note arising from this site inspection is included in Appendix 6-4.

MKO have also completed several multi-disciplinary walkover surveys at each of the sites of the components of the Subject Development between 2021 and 2023.

The data obtained from all of these site investigations have been used in the characterisation and description of the baseline land, soils and geological environment presented in Section 6.3.

6.2.3 Impact Assessment Methodology

The EPA's Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022) states that there are 7 no. steps in the preparation of the EIAR. The initial steps relate to screening, scoping, the consideration of alternatives and the description of the project. Step 5 relates to the description of the baseline environment which is presented in Section 6.3 for the land, soils and geological environment. Step 6 relates to the assessment of impacts and is presented in Section 6.5.

The guideline criteria (EPA, 2022) require that the baseline environment is described in terms of the context, character, significance and sensitivity of the existing environment. In addition, using information from the desk study and data from the site investigations, an assessment of the importance of the land, soil and geological environment within the study area and Site is assessed using the criteria set out in **Table 6-2** (NRA, 2008).

Table 6-2 Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional 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 assessment of effects follows the description of the baseline environment and is Step 6 of the information which must be included in an EIAR. The guideline criteria for the assessment of effects states that the purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects. The likely effects are described with respect to their quality (positive, neutral or negative), significance (imperceptible to profound), extent (i.e. size of area or number of sites effected), context (is the effect unique of being increasingly experienced), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The descriptors used in this environmental impact assessment are those set out in the EPA, 2022 glossary of effects as shown in Chapter 1 of this rEIAR.

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 6-3**.

Table 6-3: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Geological and Hydrological Effects
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: The extent or morphology of a cSAC. Regionally important aquifers. Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: The extent or morphology of a cSAC / ecologically important area. A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: The extent or morphology of a cSAC / NHA / ecologically important area. A minor hydrogeological feature. Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Positive, Negative or Neutral	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
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.

6.2.4 Study Area

The study area for the land, soils and geological impact assessment is limited to within the Site boundary (i.e. the rEIAR Site Boundary). Due to the localised nature of the construction works, effects on the land, soils and geological environment will not extend beyond the immediate vicinity of the footprint of the Subject Development. Therefore, the Subject Development has no potential to impact the land, soils and geological environment outside of the Site.

6.2.5 Limitations and Difficulties Encountered

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

6.3 Establishing the Baseline Environment

6.3.1 Site Description and Topography

The Site is located in Co. Donegal, situated ~8km to the southwest of the towns of Ballybofey and Stranorlar, and ~12km northeast of Donegal Town. The eastern and southern boundaries of the Site are defined by the Northern Ireland border. The closest town in Northern Ireland is Castlederg which is located ~19km to the southeast. The Site has a total area of ~903ha (~9km^2).

The Site comprises of a mix of conifer forestry, blanket bog and the partially constructed Meenbog Windfarm. The elevation of the Site ranges between ~145 and 312 mOD (metres above Ordnance Datum). The majority of the Site slopes in a north-westerly direction towards the Bunadaowen River which flows through the Site. The southern section of the Site slopes to the southeast towards the Northern Ireland border.

Construction of the Meenbog Windfarm commenced in November 2019, with approximately 90% of the civil engineering works, including wind farm access roads, 110kV electrical substation, turbine hardstands, turbine foundations, and ancillary works substantially completed over the following 12-month period up to November 2020 when a peat slide occurred. The partially constructed Meenbog Windfarm, which includes the Subject Development, covers only a very small percentage (~1.1%) of the overall Site area.

6.3.2 Land (Land Cover)

6.3.2.1 Baseline Environment

Corine land cover maps (2018) show that the Site is comprised of coniferous forestry in the southeast, transitional woodland scrub in the northwest and a small area of peat bogs in the northwest and northeast.

In terms of the Subject Development, a total of 12 no. deviations are mapped by Corine to be located in areas of transitional woodland scrub, with a total development footprint of 62,270.28m^2 (~6.23ha). A total of 11 no. deviations are mapped in areas of coniferous forestry, with a total development footprint of 20,552.83m^2 (~2.06ha). Meanwhile, 1 no. deviation is mapped to be located on peat bogs, with a footprint of 577.29m^2 (~0.06ha) and 1 no. deviation mapped on the boundary between transitional woodland scrub and coniferous forestry with a footprint of 3,973.33m^2(~0.4). The location of the Subject Development with respect to Corine land cover mapping (2018) is presented in **Table 6-4.**

It is worth noting that Corine land cover maps are based on the interpretation of satellite imagery and national data, with a minimum mapping unit of 25ha and a minimum feature width of 100m. Therefore, this is a large scale dataset and does not pick up small scale variations in land and land cover.

However, the baseline land cover at the Site was verified during several walkover surveys completed by HES and MKO and from the inspection of recent aerial imagery completed as part of the baseline assessments for the Meenbog Windfarm. Upon review of this site-specific data, it has been found that the majority of the deviations were located in areas of coniferous forestry. Some of the deviations also occurred at the location of pre-existing forestry borrow pits. Forestry access tracks were also present in the vicinity of some of the deviations. The baseline receiving land environment at each deviation location is presented in **Table 6-4.**

6.3.2.2 Existing Environment

The locations of the deviations were the subject of comprehensive site walkover surveys completed by MKO on the 23rd and 24th August 2023 in order to characterise the current land environment .

The construction of the Subject Development involved the replacement of natural ground with access roads and hardstand areas, borrow pits, peat storage areas and drainage measures. In some cases the deviations involved only a slight realignment of the permitted infrastructure while more significant changes occurred elsewhere. The conditions encountered by MKO during these walkover surveys are summarised in **Table 6-4**.

Table 6-4: Summary of the Land Environment

Deviation ID:	Corine Land Cover Mapping (2018)	EIAR Habitat Maps and Baseline Environment	Deviation Description	Deviation Footprint (m^2)	Observations During 2023 Walkover Surveys
1	Peat bogs	Existing quarry infrastructure with scrub, bare ground, an active quarry, ponds and access roads.	Entrance road off N15 (the hairpin bend)	577.287	A section of new access road was constructed in lieu of upgrading an existing hairpin bend. The works involved the relocation of an old quarry settlement pond. The area is now comprised of spoil and bare ground and recolonising bare ground. The relocated settlement pond is lined with plastic.
2	Transitional Woodland Scrub	Conifer plantations, an existing borrow pit and trackway.	Peat cell southeast of substation	6,094.518	Peat cells have been formed adjacent to site road. Deposited peat has begun to be revegetated.
3	Transitional Woodland Scrub	Conifer plantations	T10 access road	1,998.557	The area cleared for the road construction is now revegetating.
4	Transitional Woodland Scrub	Borrow pit surrounded by conifer plantations	Borrow Pit southwest of T12	22,898.53	The borrow pit area is partially backfilled with peat. Areas backfilled with peat have begun to vegetate.
5	Coniferous Forestry	Conifer plantation with forestry infrastructure.	T12 access road	2,335.36	The area cleared for the road construction is now revegetating.
6	Coniferous forestry	Conifer plantation	Peat containment berm near T8	1,495.428	The berm and the surrounding area are revegetating.
7	Coniferous forestry	Conifer plantation	T8 access road	875.567	The road was constructed less curved than the permitted layout and area cleared for the construction is now revegetating.
8	Coniferous Forestry	Conifer plantation with forestry infrastructure.	T1 access road	547.939	The area cleared for the road construction is now revegetating.
9	Coniferous Forestry	Conifer plantation with forestry infrastructure.	T2 access road	1,306.97	The area cleared for the road construction is now revegetating.
10	Coniferous forestry	Conifer plantation	T4 access road	784.902	The area cleared for the road construction is now revegetating.

Deviation ID:	Corine Land Cover Mapping (2018)	EIAR Habitat Maps and Baseline Environment	Deviation Description	Deviation Footprint (m^2)	Observations During 2023 Walkover Surveys
11	Transitional Woodland Scrub	Conifer plantation with access tracks.	Borrow pit (BP2) south of T15	3,295.45	The BP has been extended by ~10% of its originally proposed size. The BP has steep cliffs and a large peat backfill area which is revegetating.
12	Transitional Woodland Scrub	Conifer plantation with forestry infrastructure.	T15 hardstand and access road	4,533.887	The area cleared for the hardstand and road construction is now revegetating.
13	Transitional Woodland Scrub	Conifer plantation with forestry infrastructure.	T17 access road	919.269	The area cleared for the road construction is now revegetating.
14	Coniferous Forestry	Conifer plantation with forestry infrastructure.	T13 road alignment	1,731.26	The area cleared for the road construction is now revegetating.
15	Transitional Woodland Scrub	Conifer plantation with existing BP and track present.	Peat cell NW of T18	7,796.632	An unfinished peat cell has been established but peat deposition has not commenced.
16	Transitional Woodland Scrub	Conifer plantation with forestry infrastructure.	T14 turning head	227.3	The area cleared for the turning head construction is now revegetating.
17	Transitional Woodland Scrub	Conifer plantation	Peat cells near T15	13,807.3	Some revegetation has occurred on the peat storage cells and berms.
18	Coniferous Forestry	Conifer plantation with existing track	Peat cells near T17	3,875.367	Some revegetation has occurred on the peat storage cells and berms.
19	Transitional Woodland Scrub	Conifer plantation with existing tracks	Layby south of T10 with welfare facilities	143.753	The area cleared for the layby is now revegetating.
20	Transitional Woodland Scrub	Conifer plantation with forestry infrastructure.	Layby northeast of T15	90.45	The area cleared for the layby construction is now revegetating.
21	Transitional Woodland Scrub	Conifer plantation with forestry infrastructure.	T19 access road	467.235	The area cleared for the road construction is now revegetating.
22	Coniferous Forestry	Conifer plantation with forestry infrastructure.	T9 access road	958.663	The area cleared for the road construction is now revegetating.

Deviation ID:	Corine Land Cover Mapping (2018)	EIAR Habitat Maps and Baseline Environment	Deviation Description	Deviation Footprint (m^2)	Observations During 2023 Walkover Surveys
23	Coniferous Forestry	Conifer plantation with forestry infrastructure.	Additional Storage area and access road to T7	3,177.8	The area cleared for the road construction is now revegetating.
24	Transitional Woodland Scrub and Coniferous Forestry	Conifer plantation with existing tracks	Roadside berms and settlement ponds	3,973.33	The low level roadside berms and settlement ponds were noted to be recolonising.
25	Coniferous Forestry	Conifer plantation with existing tracks	Assessment of additional excavated borrow pit and peat storage cell at T-13	3,463.37	The originally proposed BP was slightly repositioned, peat deposited in the BP was noted to be revegetating.

6.3.3 Soils and Subsoils

The published Teagasc soils map (www.gsi.ie) for the local area shows that the Site is predominantly overlain by blanket peat (BktPT), with small local areas of mainly acidic, shallow, rock, peaty mineral soils (AminSRPT). In terms of the Subject Development, all deviations are mapped in areas of blanket peat. Other soils mapped in close proximity to the Subject Development include areas of AminSRPT soils mapped immediately to the northwest of deviation 1. Acid deep well drained mineral soils are also mapped to the north of deviation 1. These acid deep well drained mineral soils are mapped outside of the Site boundary.

The published subsoils map (www.gsi.ie) shows that the Site is underlain almost entirely by blanket peat (BktPt), with some small local areas of bedrock outcrop or subcrop (Rck) and till derived from metamorphic rocks (TMp). In terms of the Subject Development, all deviations are mapped to be underlain by blanket peat. Local areas of bedrock outcrop and till derived from metamorphic rocks are mapped in the vicinity of deviation 1.

A subsoil geology map for the Site is shown as Figure 6-1.

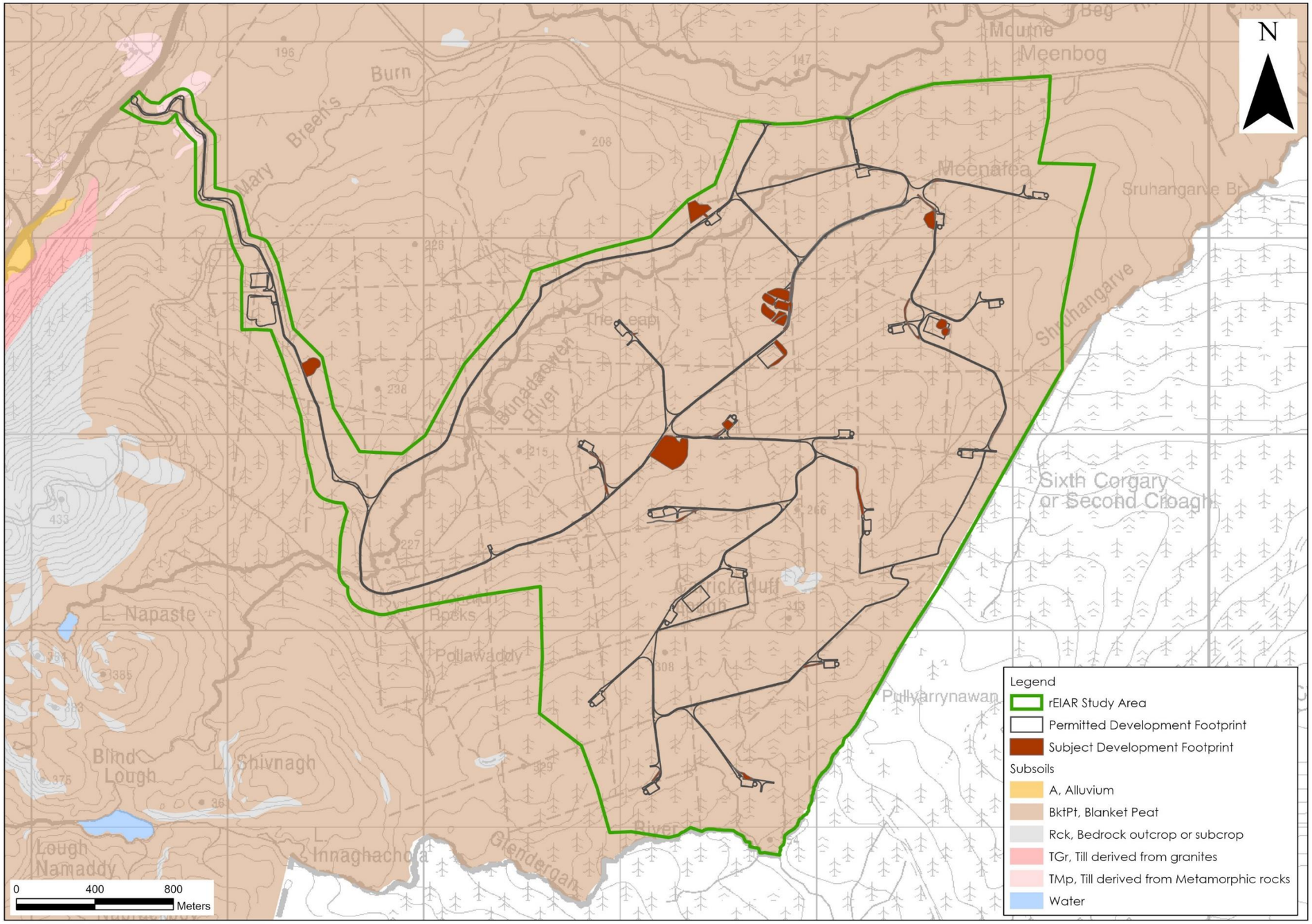

Figure 6-1: Local Subsoils Map (www.gsi.ie)

A total of ~500 no. peat probes were completed by HES, AGEC Ltd and MKO at the Site as part of the baseline assessment for the planning application for the Permitted Development. These previous site investigations showed that peat depths at the Site range from 0 to 5.8m with an average of 1.7m. The peat depth range distribution plot for the Site (**Figure 6-2**) shows that the majority of peat depths (~73%) were between 0.5 and 2m.

HES also completed 30 no. gouge cores as part of the baseline assessment for the Permitted Development. These investigations have shown that the peat at the Site is underlain by very thin mineral subsoil or lies directly on weathered or massive bedrock. This is consistent with observations made at several borrow pits and during the construction of the wind farm infrastructure. Based on the site investigations and observations, the mineral subsoils are present in localized thin pockets with depths typically less than 0.5m over bedrock. The weathered bedrock horizon (if present) at the peat/mineral subsoil is very thin (0.2 – 0.3m) and the underlying bedrock (discussed further below) is typical massive and very competent. Competent rock was encountered at 20 of the gouge core locations, with 10 no. locations encountering thin pockets of mineral soil over bedrock.

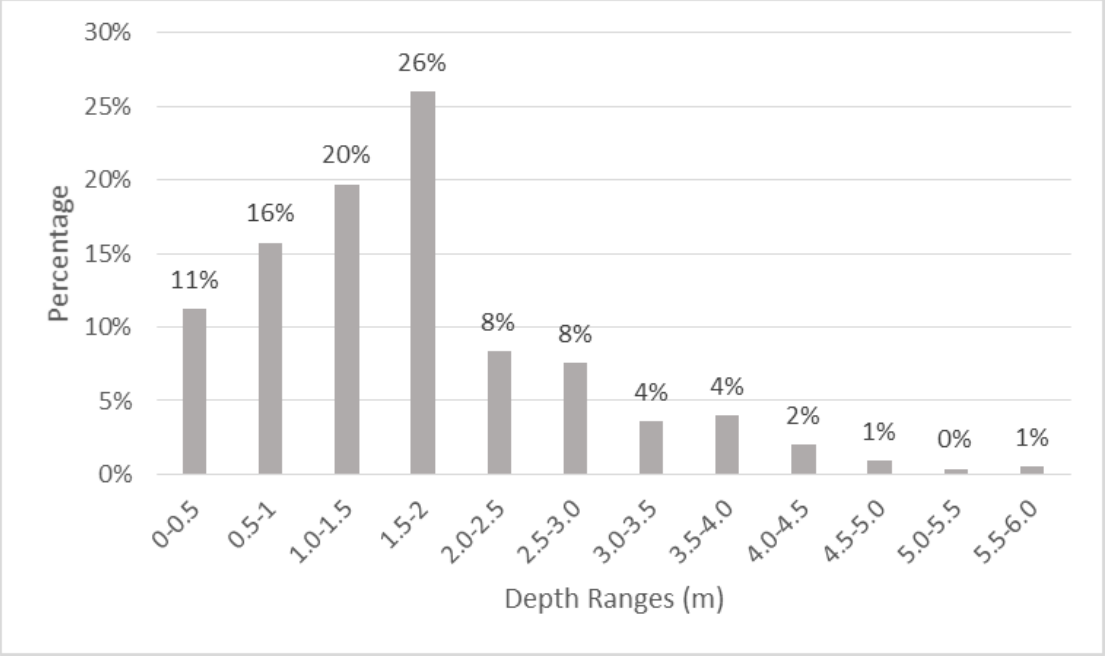

Figure 6-2: Peat Depth Distribution Plot (Combined HES, AGEC and MKO dataset))

Due to the comprehensive nature of the site investigations completed as part of the original baseline assessment for the Permitted Development, site investigation data is available in the vicinity of most deviation locations. The peat depths within and in the vicinity of the Subject Development range from 0 to 3.4m, with site investigations only recorded peat depths in excess of 2m in the vicinity of 3 no. deviations. A map of the site investigation locations with respect to the Subject Development is shown as **Figure** 6-3

Ionic Consulting completed additional site inspections and intrusive investigations during the construction phase of the Meenbog Windfarm. Ionic completed peat probing and shear vane testing across the Site between November 2019 and October 2020, with further testing being completed in December 2020 to May 2021 following the November 2020 Peatslide. The siteworks completed by Ionic involved a total of ~1,750 no. peat strength and peat depth probes at the Site. The results of these investigations were used to inform the peat stability assessment (refer to Section 6.3.8.3). The Ionic site investigations included an investigation of peat depths at or immediately adjacent to the deviation locations. According to the Ionic data, the peat depths at the deviation locations range from 0.1 to 2.9m.

Table 6-5 presents the Ionic peat depths at the deviation locations. This table also includes the peat depths from the baseline assessment for the planning application for the Permitted Development. For many of the deviation locations, the EIAR peat probe locations are not sited precisely at the deviation location, with the nearest probes being up to 30m away. However, these previous baseline data have been included to provide an overview of the range of peat depths across the wider Site.

In summary, based on the comprehensive geological dataset which has been accrued for the Site, the general geological profile is summarised as follows:

- The site is overlain by blanket peat, with depths typically ranging from 0.5 to 2m. Although the peat depth is locally variable with areas of shallow and deeper peat (the maximum measured peat depth of 5.8m is not located in the vicinity of any element of the Subject Development).
- The peat is underlain by mineral subsoil or weathered bedrock.

The construction of the Meenbog Windfarm, including the construction of the Subject Development, has resulted in the removal and excavation of peat and spoil at infrastructure locations. To date, it is estimated that the amount of peat/spoil excavated and stored at the Site is 325,500m^3.

Table 6-5: Summary of Peat Depth Data

Deviation ID:	Nearest Site Investigation Location (EIAR)	Peat Depth at nearest site investigation location (m) (EIAR)	Peat Depth (m) (Ionic 2021)
1	3 no. peat probes within ~25m	0 – 1.4	0.3 – 1.8
2	1 no. peat probe ~15m to S	0.9	0.8 – 1.1
3	4 no. peat probes within deviation area and 4 no. probes within 20m	0.4 – 1.8	0.6 – 1.9
4	3 no. peat probes within area and 6 no. peat probes within 30m	0 – 1.8	0.1 - 1.5
5	1 no. peat probe within area and 7 no. probes within 30m	1.2 – 1.8	1.5
6	1 no. peat probe ~30m to S	0.8	1.7
7	1 no. peat probe ~10m to SE	0.3	1.7
8	3 no. peat probes within deviation area	0.8 – 1.2	1.8
9	1 no. peat probe ~30m to S	2.7	0.5 – 2.6
10	2 no. peat probes within 10m	1.5 – 2.7	2 – 2.5
11	5 no. peat probes within 30m	0.5 – 1.1	0.5
12	2 no. peat probes within deviation area	0.7 – 1.1	1
13	1 no. peat probe ~10m to SW	1.0	0.8 – 1.4
14	1 no. peat probe within deviation area	0.7	1.2
15	1 no. peat probe ~20m to E	1.0	1.5
16	1 no. peat probe ~25m to E	1.9	0.8 – 1.6
17	2 no. peat probes within 10m	0.2 – 0.6	1
18	1 no. peat probe within deviation area and 5 no. probes within 25m	0.9 – 1.6	0.8 – 1.2
19	4 no. peat probes within 60m	1.2 – 1.6	0.6 – 1.8
20	1 no. peat probe ~22m to NE	1.1	0.6 – 1.7
21	3 no. peat probes within 20m	1.0 – 1.8	1.2 – 2.2
22	2 no. peat probes within deviation area	1.3 – 1.9	1.9
23	2 no. peat probes within deviation area	3.0 – 3.4	2.9
24	2 no. peat probes within 10m	0.8 – 1.4	-
	2 no. peat probes within 40m	0.4 – 1.3	-
	1 no. peat probe ~15m to E	0.7	-
25	4 no. peat probes within 20m	1.6 – 2.0	0.5 – 2.8

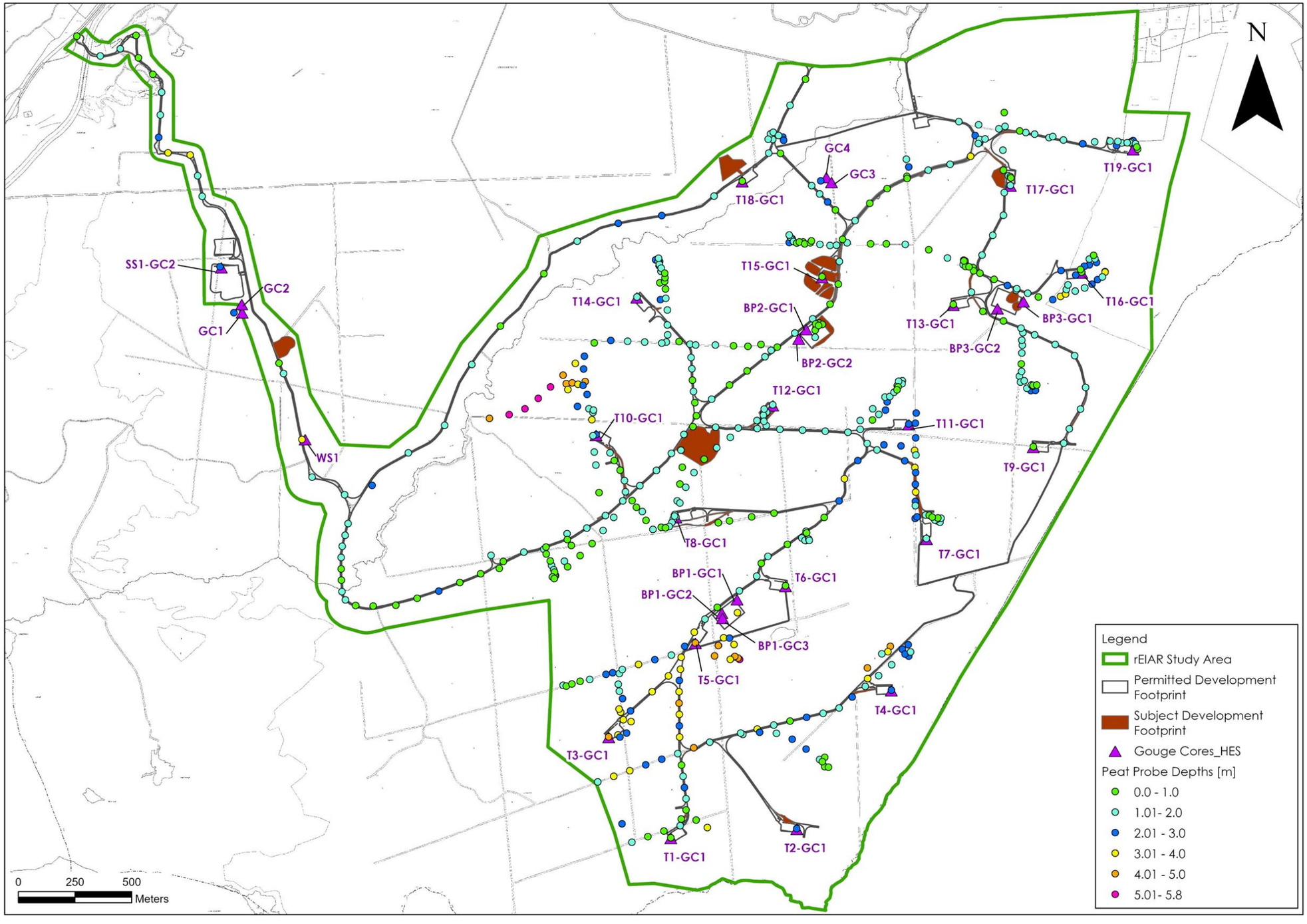

Figure 6-3: EIAR Site Investigation Locations

6.3.4 Bedrock Geology

Based on the GSI bedrock mapping (www.gsi.ie), the Site is underlain by a total of 3 no. bedrock geological formations.

Much of the Site is underlain by Lough Eske Psammite Formation comprising of feldspathic psammite, quartzite and marble. The southern section is underlain by the Lough Mourne Formation which is noted to comprise of coarse and feldspathic pale pink psephites in a pale green chloritic matrix. A small area in the west of the site, at the existing site entrance is underlain by the Barnesmore Granite.

In terms of the Subject Development, a total of 3 no deviations (deviations 8, 9 and 10) are mapped to be underlain by the Lough Moure Formation. All other deviations are underlain by the Lough Eske Psammite Formation.

The Site is underlain by 1 no. mapped structural geological feature. A northeast-southwest orientated fault, referred to as the Barnesmore Fault, is mapped in the vicinity of the existing site entrance, ~40m northwest of deviation 1.

The GSI also map several areas of bedrock outcrop within the Site. This is supported by the site investigations and field observations which revealed the occurrence of shallow bedrock across the Site.

Bedrock is exposed at a number of existing borrow pit and road cuttings across the Site, and these exposures generally confirm the mapped geology as outlined above. The bedrock was typically noted to be massive and very competent with a thin upper weathered zone at some locations.

A bedrock geology map is shown as **Figure 6-4** below.

The construction of the Meenbog Windfarm, including the construction of the Subject Development, has resulted in the removal and excavation of bedrock at some infrastructure locations and from borrow pits. To date, it is estimated that the amount of bedrock excavated at the Site is 288,000m^3.

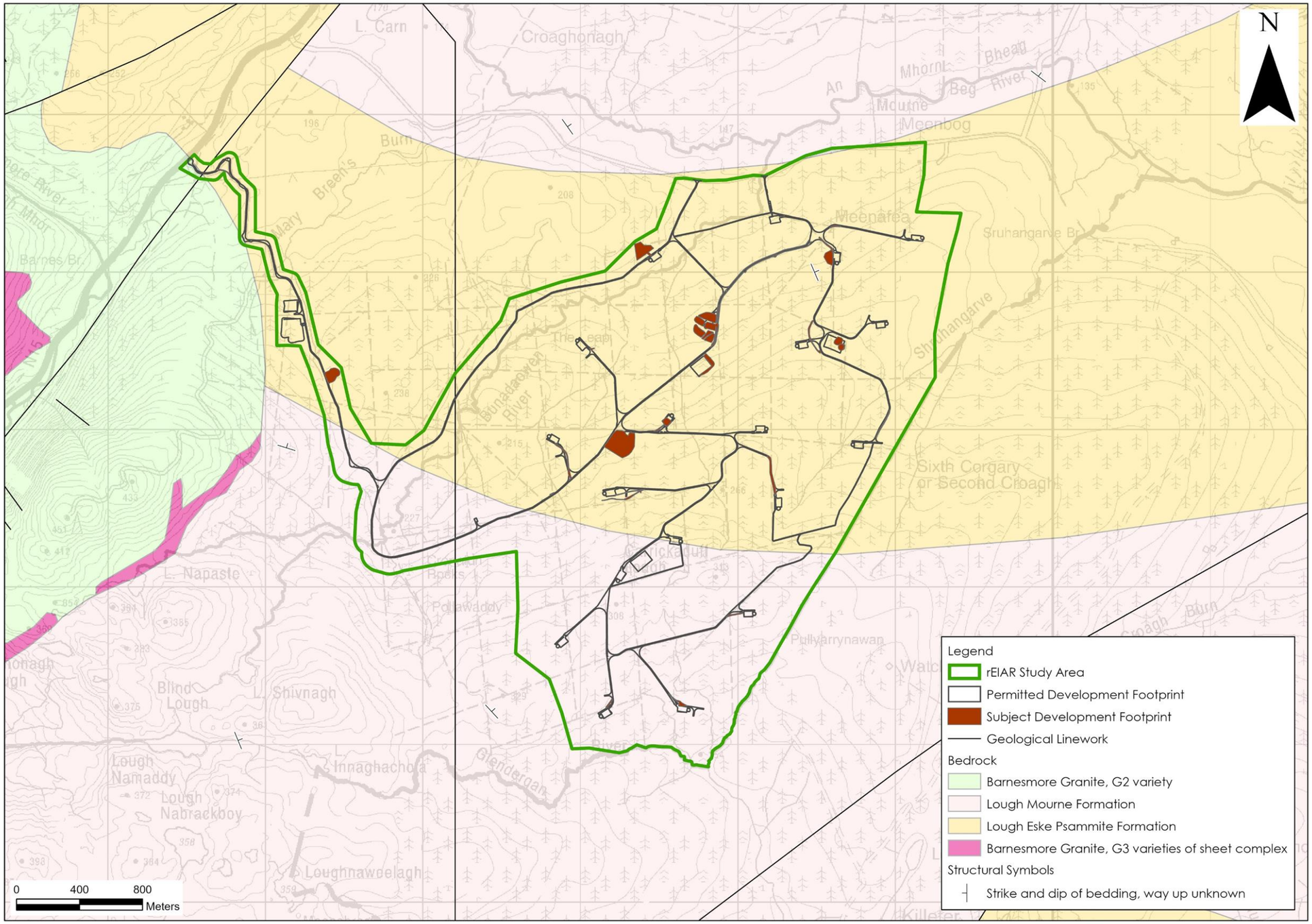

Figure 6-4: Bedrock Geology Map

6.3.5 Geological Resource Importance

The GSI Online Database accessed via the Public Data Viewer (www.gsi.ie) does not record the presence of any active quarries or pits within the Site. The closest mapped active quarry is Kiltole Quarry, near Strabane, located ~18.5km to the northeast.

Furthermore, the GSI do not record the presence of any historic quarries or pits within the Site. A historic sand and gravel pit is mapped immediately to the west of the existing site entrance. This pit is recorded as being active between 1975 and 1995.

The GSI record several mineral localities to the west of the Site (www.gsi.ie). The presence of gravel is recorded near the existing site entrance in the townland of Cashelnavean. The presence of sand and gravel is also recorded at several other localities in the vicinity of the N15 along the Barnesmore Gap. Several occurrences of uranium have also been reported to the west of the N15, associated with the Barnesmore Granite.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock aggregate potential of the Site ranges from Very Low to High. Much of the Site is mapped as having Low to Moderate potential with only localised areas of high potential. The bedrock at the Site could be used on a "sub-economic" local scale for construction purposes. The bedrock has been used previously to facilitate the construction of the Meenbog Windfarm, with several borrow pits now present at the Site.

The vast majority of the Site is not located within an area mapped for granular aggregate potential (i.e., potential for gravel reserves). However, an area in the west is mapped as having Very High potential for gravel reserves. This location corresponds to the location of deviation 1.

The peat and subsoil deposits at the Site can largely be considered to be of "Low" importance due to the largely thin occurrence, given the fact that peat is not designated in this area, and is significantly degraded in most places as a result of forestry plantations and associated drainage.

6.3.6 Geological Heritage Sites

A small area in the west of the Site is located within the Barnesmore Gap County Geological Site (CGS) (Site Code: DL002). This CGS is recommended as a geological Natural Heritage Area (NHA) and is described as a deep mountain pass running northeast-southwest between Croaghconnellagh and Barnesmore mountains. It is of geological importance due to excellent exposures of glacial channels and moraines. Deviation 1 is located within the mapped extent of this CGS.

There are no other Geological Heritage sites within 5km of the Site.

A map of local geological heritage sites is included as Figure 6-5 below.

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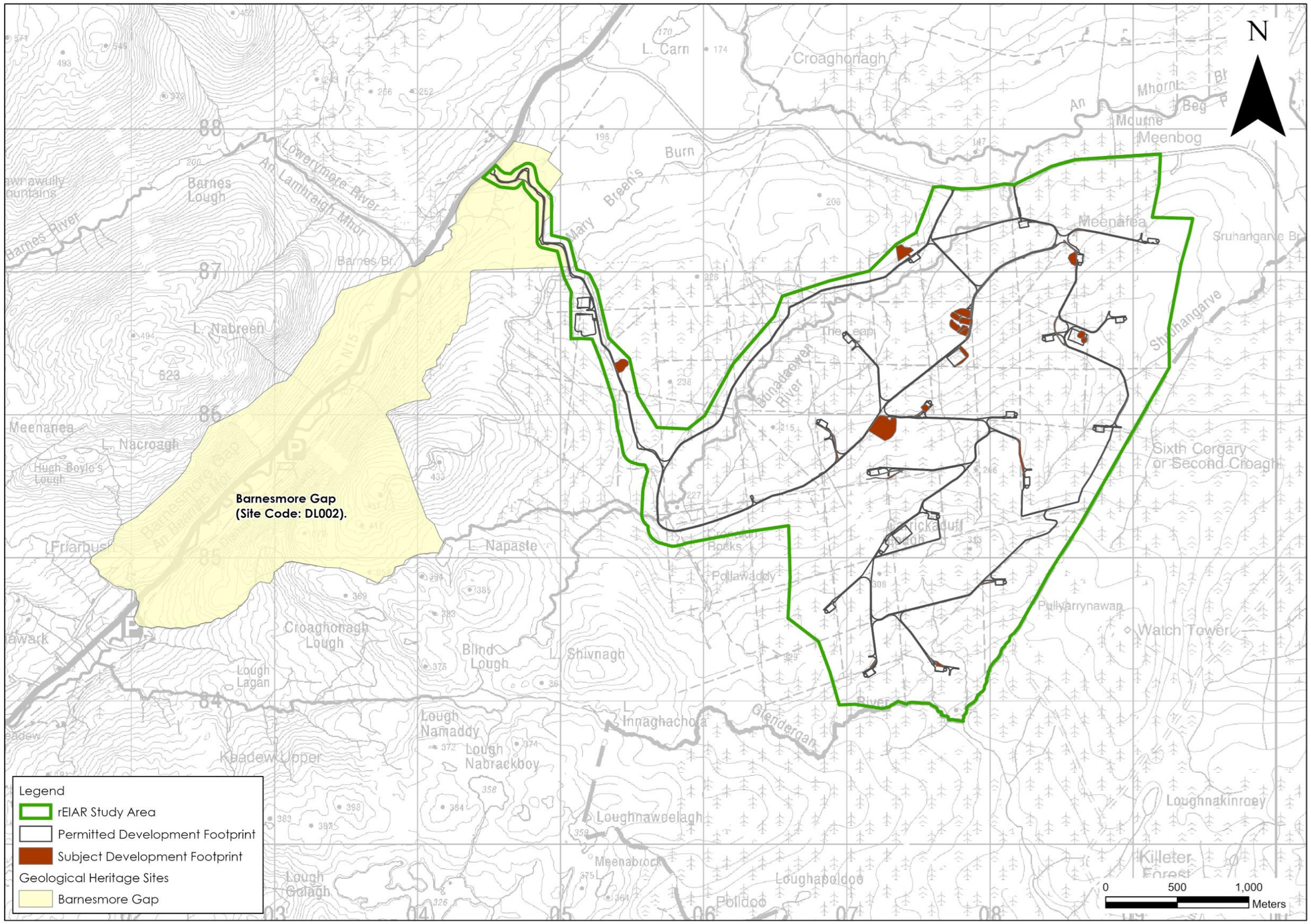

Figure 6-5: Geological Heritage Sites

6.3.7 Soil Contamination

There are no known areas of soil contamination within the Site. During site walkovers and site investigations, no areas of contamination concern were identified within the Site. Several borrow pits associated with the Permitted Development are located within the Site however no contaminated tailings were recorded during the site walkover surveys.

According to the EPA online mapping (www.epa.ie), there are no licensed waste facilities or dump sites located within or in the vicinity of the Site.

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

6.3.8 Peat Stability

6.3.8.1 Desk Study

The GSI record the occurrence of 1 no. landslide within the Site (www.gsi.ie). This event dates from 12th November 2020 and occurred during the construction of the Permitted Development. The GSI list the landslide mechanism as being a peat slide. This event is mapped by the GSI to be located ~250m southwest and upgradient of the closest element of the Subject Development (deviation no. 23). This event and subsequent site inspections are discussed in Section 6.3.8.3 below.

The GSI also record an additional historic landslide event ~600m south of deviation 1 and to the west of the Site. This event dates from 1963 and a road cutting was identified as a contributing factor to this historic landslide event (www.gsi.ie).

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring based on the soil type and the slope. The landslide susceptibility of the Site is classified by the GSI (2023) as ranging from "low" to "high" susceptibility, with the higher risk areas corresponding to steeper slopes within the Site.

In terms of the Subject Development, the majority of the deviations are mapped in areas of low to moderately low susceptibility. 3 no. deviations (Deviation 4, 8 and 11) are mapped in areas of moderately high susceptibility of a landslide. No deviations are mapped in areas of high landslide susceptibility. This map is to the scale of 1:50,000 and is therefore superseded by site-specific stability assessments.

6.3.8.2 Permitted Development Peat Stability Risk Assessment

6.3.8.2.1 *Introduction*

A Peat Stability Risk Assessment (PSRA) was completed for the Permitted Development by AGEC Ltd (October, 2017). This report is attached as Appendix 6-1.

This PSRA was completed following the principles in Peat Landslide Hazard and Risk Assessments (PHLRA): Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2007). The assessment of peat stability included:

- A desk study;
- Site walkover surveys including peat depth probing and shear vane testing;
- Consideration of hydrological factors;
- Compilation of a peat depth contour plan for the site;
- Determination of a Factor of Safety (FoS) for over 500 no. points across the site;
- Identification of Construction Buffer Zone Areas which have an elevated risk and where mitigation measures are required;

- Consultation between geotechnical, hydrological, and ecological disciplines within the Project Team; and,
- Compilation of a risk register to assess the design and risks at the infrastructure locations.

6.3.8.2.2 Walkover Surveys and Site Investigations

AGEC completed walkover surveys in September and October 2014 and March 2017 in order to record any sign of instability in the peat deposits, the presence of wet areas and areas of deeper peat and to record slope inclinations and breaks in slope. The findings concluded that:

- The blanket peat at the site is shallow, with some local deeper deposits in the flatter areas of the site;
- Peat depths ranged from 0 to 5.8m, with an average of 1.7m;
- The areas of deeper, weak peat were highlighted and buffered to ensure that the wind farm development infrastructure and construction avoided these areas;
- Slope angles ranged from 1 to 9 degrees; and,
- Shear vane testing indicated undrained shear strengths of 5 to 50kPA, with an average of 16kPA. The lower results were recorded in the areas of deeper weak peat which were avoided during the construction of the wind farm development. Elsewhere the results were typical of shallow, well drained peat. Peat strengths at sites of known peat failures are generally very low, for example the undrained shear strength at the Derrybrien failure was estimated to be 2.5kPA.

6.3.8.2.3 Peat Stability Analysis and Results

The peat stability assessment analysed the stability of the natural peat slopes for individual areas of the site, including at turbine locations and along access roads.

The purpose of the analysis was to determine the Factor of Safety (FoS) of the peat slopes. The FoS is a numerical value of the stability on individual areas of a peatland. The FoS is calculated by a combination of geotechnical information and site characteristics which are obtained from desk study and site walkovers including the property of the peat, shear strength, depth, slope geometry underlying strata and groundwater etc. The factor of safety provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force.

Provided the available shear resistance is greater than the downslope destabilising force then the factor of safety will be greater than 1.0 and the slope will remain stable. If the factor of safety is less than 1.0 the slope is unstable and liable to fail. The acceptable range for factor of safety is typically from 1.3 to 1.4. 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 6-6** below.

An undrained analysis was carried out, which applies in the short-term during construction. For the undrained condition, the calculated FoS for load conditions (1) & (2) for the 540 no. locations analysed, shows that at all locations an acceptable FoS of greater than 1.3 was calculated, indicating a low risk of peat instability.

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. For the drained condition, the calculated FoS for load conditions (1) and (2) for the 540 no. locations analysed, shows that at all locations an acceptable FoS of greater than 1.3 was calculated, indicating a low risk of peat instability.

The risk assessment at each infrastructure location identified a number of mitigation/control measures to reduce the potential risk of peat failure. The PSRA stated that sections of access roads to the nearest infrastructure element should be subject to the same mitigation/control measures that apply to the nearest infrastructure element.

Table 6-6: Probability Scale for Factor of Safety.

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 1.10	Probable
5	<1.0	Very Likely

6.3.8.2.4 *Summary of PSRA and Conclusions for Subject Development*

The findings, which involved analysis of over 540 locations, showed that the Site, and all infrastructure locations, had an acceptable margin of safety and that it was suitable for the now Permitted Development The findings of the PSRA included recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety.

In terms of the Subject Development, the areas assessed by AGEC and the 25 no. deviation areas are shown on **Figure 6-6** below. The majority of the Subject Development is located within or overlaps with areas which were previously assessed by AGEC. These areas were found to have a FoS in excess of 1.3. Therefore, in accordance with **Table 6-6**, the risk of a peat slide at these deviation locations, based on site-specific data, was found to be negligible.

However, 6 no. deviations were either located outside the area assessed by AGEC or were assessed for an alternative infrastructure. Whilst the 2017 PSRA did not demonstrate peat stability at all the deviation locations an assessment of peat stability was completed at all Subject Development locations in 2021. The results of these assessments are discussed in Section 6.3.8.3.

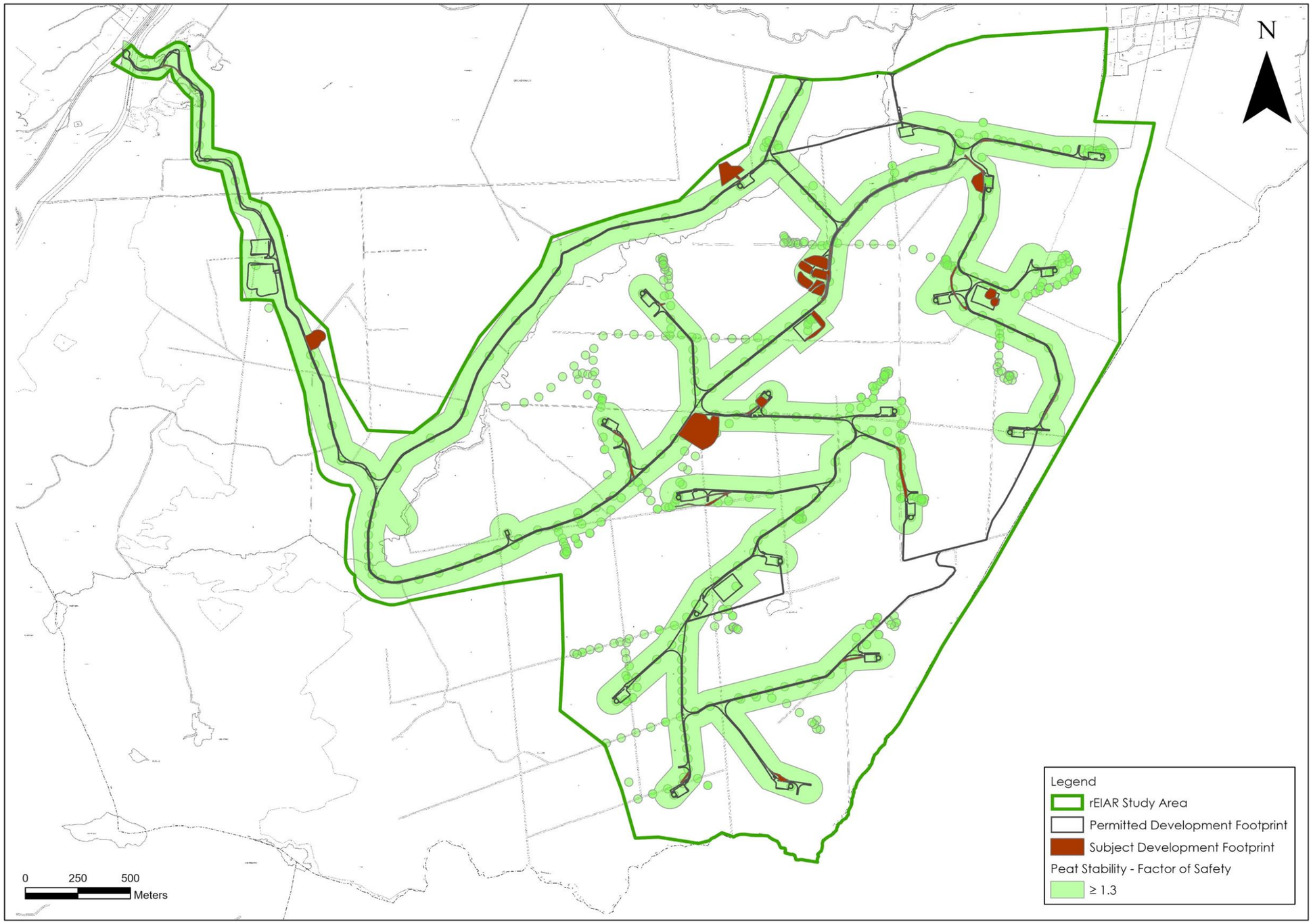

Figure 6-6: PSRA Peat Stability Assessment Results (AGEC, 2017) and Deviation Areas

6.3.8.3 November 2020 Peatslide

On 12th November 2020, during the construction of a permitted access road to T7, a peat failure occurred. The works that were underway at the time in the area where the peat slide occurred, were fully permitted and were being undertaken in line with the project design that had been subject to both Environmental Impact Assessment (EIA) and Appropriate Assessment (AA).

2021 Site Stability Assessments

Following the November 2020 Peatslide, the Environmental Protection Agency (EPA) took the lead to ensure that the necessary follow-up investigations were completed and that any required remediation measures were implemented. The EPA engaged the services of ARUP Consulting Engineers, to advise and represent the EPA on the geotechnical and peat stability aspects of the follow-up investigations.

Fehily Timoney and Company (FTC) completed a Peat Stability Assessment of the Meenbog Wind Farm Site in August 2021. The assessment was prepared for the purpose of complying with the EPA's Direction under Regulation 8(1)(b) of the European Communities (Environmental Liability) Regulations 2008. The assessment was completed in accordance with the guidance in the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Development (PLHRA, 2017). Prior to completion this report was revised to address all issues which arose following several consultations with the EPA. The FT report comprised a site-wide stability assessment, including an overview of the ground conditions at the Site, site investigations, an assessment of the constructed works, a review of the November 2020 Peatslide and a qualitative assessment of peat stability. The FTC report is attached as (Appendix 6-2).

In addition, Ionic Consulting were engaged complete a quantitative stability assessment with respect to the windfarm infrastructure, including both the as-built elements and the remaining work areas. Therefore, the Ionic assessment included an assessment of the stability of the peat at the Subject Development locations. The Ionic report provides a detailed quantitative peat stability assessment along all proposed infrastructure at the site which was produced using data that had been obtained from ground investigation compiled up to end of April 2021 together with more recent data obtained up to August 2021. The ground investigation comprises a significant amount of data (including over 1750 peat probes and shear vane results). The quantitative stability assessment was included as Appendix D to the FTC report and is provided separately as Appendix 6-3 of this rEIAR.

Ionics quantitative assessment included a stability analysis of original undisturbed peat, side casted peat, floating roads, peat storage areas and peat stabilisation areas. The report did not assess the stability of solid roads, hardstands etc, which have been built on a solid formation and were therefore deemed to be safe and stable. The Ionic Consulting report states amongst its conclusions, that:

> *"The site has been shown to be stable based on a quantitative assessment with the exception of a short section of the T4 floating road which will be upgraded ..... As well as an area to the south west of T7 which is outside of the works area.....*
>
> *Ionic Consulting can therefore confirm that the overall site is currently stable based upon this detailed assessment carried out along all roads, hardstandings, borrow pits, peat storage areas and peat stabilisation areas".*

Following extensive additional site investigation work, geotechnical analysis, site meetings and reporting undertaken by both Fehily Timoney and Company and Ionic Consulting, the EPA concluded in April 2021 that the issues identified had been satisfactorily addressed and that the Site was deemed to be stable. The factors which resulted in this peat slide are understood to have been a combination of several factors including the construction works and antecedent rainfall.

The Subject Development was not deemed to be a contributing factor to the November 2020 Peatslide.

AFRY Site Inspection

AFRY Ireland Ltd (formerly Ionic Consulting) completed a site inspection of the Site on 19th October 2023 to assess the overall stability of the wind farm from a geotechnical perspective and to assess whether there has been any instability since the 2021 stability assessments.

The Technical Note arising from this site inspection is attached as Appendix 6-4 and concluded that:

> "*the overall site is currently stable based upon our assessment of the roads, hardstanding's, borrow pits, peat storage areas and peat stabilisation areas*".

Since the failure, there has been no indication from any of the assessments that the construction of the Subject Development was responsible for the November 2020 Peatslide.

6.3.9 Receptor Importance and Sensitivity

This section discusses the sensitivity of the receiving environment in terms of the Subject Development and identifies those sensitive receptors which will be carried forward into the assessment of effects.

Based on the criteria set out in **Table 6-2** above, the soils and peat at the Site can be classed as being of low importance as the overlying peat deposits are not designated in this area and are significantly degraded as a result of the commercial forestry operations.

The bedrock geology underlying the Site can be classed as being of medium importance where the bedrock could be used on a sub-economic scale. The Barnesmore Gap County Geological Site (CGS) in the west of the Site can be considered as being of high importance due to its designation as a county geological heritage site.

Based on the preceding desk study and characterisation of the baseline environment, the following receptors will be included in the assessment of significant effects:

- The land at the location of the deviations;
- The peat, soils and subsoils at the location of the deviations;
- The underlying bedrock geology; and,
- The Barnesmore Gap CGS.

6.4 Characteristics of the Subject Development

The Subject Development is described in full in Chapter 3 of the rEIAR.

The Subject Development comprises the 25 no. deviations for which substitute consent is being sought. These deviations are described in full in Chapter 3 (**Table 3-1**) and have a total development footprint of 8.8ha.

6.5 Assessment of Significant Effects and Mitigation Measures

6.5.1 Do-Nothing Scenario

Under the Do-Nothing scenario, the 25 deviations that comprise the Subject Development would be removed and restored to the greatest extent practicable. The Meenbog Wind Farm would then be completed in accordance with the current planning permission (ABP Ref: PA05E.300460). This approach may lead to environmental effects due to the potentially extensive groundworks required to remove and restore the existing peat cells, portions of access roads, laybys, and hardstands, and peat containment berm. New access road sections and hardstands would then be constructed in the slightly different, and less optimal, locations shown on the permitted Meenbog Wind Farm plans. Unauthorised

borrow pits would be backfilled to the greatest extent possible with spoil and peat and revegetated. Unauthorised peat cells would be dismantled and the stored peat material would be removed from the site for disposal elsewhere.

This approach may lead to effects on the land, soils and geological environmental due to the potentially extensive groundworks required to remove and restore the existing peat cells, portions of access roads, laybys, hardstands, and peat containment berm. New access road sections and hardstands would then have to be constructed in the slightly different, and less optimal, locations shown on the plans for the Permitted Development. The borrow pits which form part of the Subject Development would be backfilled to the greatest extent possible with peat/spoil and revegetated. The peat cells which form part of the Subject Development would be dismantled and the stored peat material would be removed from the Site for disposal elsewhere.

The effects of the Do-Nothing Scenario on the land, soils and geological environment are assessed as follows:

- The effect on the land environment would involve the restoration and revegetation of the footprint of the 25 no. deviations which have a total area of ~8.8ha. This would have a positive effect on the land environment, with the removal of the deviations, and the backfilling of the borrow pits. However, in reality complete restoration to pre-development conditions is unlikely and difficult to achieve given the felling, ground disturbance and works completed to date.
  The above positive effect on the land within the Subject Development site would be offset by the construction of the Permitted Development footprint as per the Permitted Development planning drawings. This would result in the replacement of peat bogs and coniferous forestry with hardstands, access roads, laybys and borrow pits. These infrastructure locations have been found to be less optimal that the locations of the Subject Development. This would have a potential negative effect on the land environment.
- The Do-Nothing scenario would also involve the removal and disturbance of peat, spoil and bedrock in the construction areas. This would have a permanent and negative effect on peat, spoil and bedrock in these excavation areas. Excavated materials would be used in the backfilling of the borrow pits.
- The increased volume of traffic and machinery on site would increase the risk of contamination of peat, subsoils and bedrock via accidental spills and leaks.

The 'Do-Nothing Scenario would have a greater effect than the selected option of optimizing the wind farm layout based on site conditions. The construction phase of the Subject Development has been successfully completed and will not cause any significant effects on the land, soils and geological environment by leaving it in place.

Based on the above, it is considered that the "Do-Nothing" scenario would likely have a greater effect on the land, soils and geological environment than the proposed option of leaving in-situ and regularising the Subject Development through the substitute consent process.

6.5.2 Construction Phase – Assessment of Effects and Mitigation Measures

This section presents an assessment of the effects on the land, soils and geological environment which occurred during the construction of the Subject Development. The construction phase of the Meenbog Windfarm began in November 2019 and works were suspended in November 2020.

6.5.2.1 Effects on Land (Land-Take)

The baseline environment at the deviation locations largely comprised coniferous forestry, with existing forestry access tracks and pre-existing forestry borrow pits also present at some deviation locations. The Subject Development resulted in an alteration of the baseline environment, within the footprint of the Subject Development. The land change comprised of felling of coniferous forestry and the replacement of

natural ground with access roads and hardstand areas, borrow pits, peat storage areas and drainage measures within the Subject Development locations (8.8ha). In some cases the deviations involved only a slight realignment of the permitted infrastructure while more significant changes occurred elsewhere.

These works have resulted in a change in the land environment within the footprint of these deviation areas.

Pathways: Excavation and infrastructure construction.

Receptors: Land.

Mitigation Measures:

Whilst the location, alignment and size of the Subject Development differs from the original proposals detailed in the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the rEIAR, and implemented in the CEMP.

Assessment of Effects:

There have been no effects on the land environment outside of the footprint of the Subject Development.

The loss of ~8.8ha of peat bogs and coniferous forestry has not had a significant effect on the land environment within the overall Site. The footprint of the Subject Development represents ~1% of total Site area. Therefore, the Subject Development has resulted in only a very small percentage change in landcover across the Site.

The assessment of effects on the land environment is as follows:

- The majority of the deviations are small, are located only partially outside the Permitted Development footprint and relate to only a slight relocation or realignment of the Permitted Development infrastructure. Due to the nature and small-scale of these deviations, their footprint is similar to that of the Permitted Development. Therefore, these deviations would not have resulted in any significant change in the land environment and the effects are comparable to those assessed in the original EIAR.
- The greatest potential for changes in the land environment would have occurred at the location of the borrow pits as these deviations have the some of the largest footprints associated with the Subject Development:
  - Deviation 4 has a footprint of 22,899m².
  - Deviation 11 has a footprint of 3,290m².
  - Deviation 25 has a footprint of 8,463m².

  However, the locations of these deviations were chosen for a variety of reasons designed to reduce any impacts on the land environment.
  - Deviation 4 was excavated at the site of an existing forestry BP which reduced the effects on the land environment. This BP was excavated in lieu of excavating the permitted BP1 borrow pit which was not used due to peat stability concerns.
  - The BP at Deviation 25 was subject to minor micrositing and repositioning due to local topography, reducing the potential effects on the land environment.

  Site walkover surveys have revealed that these BPs have been partially restored, with peat from elsewhere on the Site as per the methodology detailed in the CEMP, with the deposited peat noted to be revegetating.
- Recent site walkover surveys have found that the land environment at many of the deviation locations is now comprised of infrastructure whilst the surrounding land, which was cleared to facilitate the construction works, is revegetating.
- The peat cells, berms and settlement ponds are also noted to be revegetating.

Furthermore, the construction of these deviations has been in line with recent trends within the Site (*i.e.* the construction of the Permitted Development). The effects on the land environment are similar to those which would have occurred if the Meenbog Windfarm was constructed in accordance with the Permitted

Development planning drawings. The Permitted Development had an overall footprint of 25.8ha which represented ~2.6% of the study area for the Meenbog Wind Farm development. This loss of land was deemed to be an acceptable consequence of the Permitted Development.

The Subject Development was deemed necessary for a variety of reasons, detailed in Chapter 3, and given the small scale of the deviations on a site-scale, the associated change in the land environment is seen as an acceptable consequence of the construction of the Meenbog Windfarm.

Residual Effect: The deviations were deemed necessary for a variety of reasons, detailed in Chapter 3, and given the small scale of the deviations on a site-scale and even more so on a local scale, the associated change in the land environment is seen as an acceptable consequence of the construction of the wind farm development. The residual effect is a negative, direct, slight, permanent, likely effect on land (land-take).

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

6.5.2.2 Peat, Subsoil and Bedrock Excavation

Peat depths at deviation locations ranged from 0.1 – 2.8 (Ionic, 2021). Peat was excavated to subsoil level at most deviation locations in order to facilitate the construction of the Subject Development infrastructure. Peat and subsoils were also stripped from the borrow pits in advance of rock extraction. Rock was extracted from the borrow pits to provide materials for the construction of the wind farm. Several additional peat storage areas which were set up to safely manage the excess peat excavated during construction works.

These construction phase activities, excavation of peat and bedrock and storage of peat, at the deviation locations resulted in the permanent removal and relocation of in-situ peat, subsoil and bedrock. This had a permanent effect on the peat, subsoils and bedrock at the deviation locations.

Pathway: Extraction/excavation.

Receptor: Peat, subsoil and bedrock.

Mitigation Measures:

The EIAR for the Permitted Development prescribed detailed mitigation measures relating to the excavation of peat, spoil and bedrock.

Whilst the location, alignment and size of the Subject Development differs from the original proposals detailed in the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the EIAR, and implemented in the CEMP.

The mitigation measures implemented during the construction works, as detailed in the CEMP, were as follows:

- All infrastructure was placed in areas with shallower peat where possible;
- The existing forestry road network was used to reduce peat excavation and borrow pit volumes where possible;
- Floating roads (where geotechnically acceptable to do so) were used to reduce peat excavation volumes;
- The peat and subsoil removed during the construction phase was localised to the wind farm infrastructure location where practicable;
- The excavated peat was either used for landscaping, side-casting or was placed in the borrow pits and engineered peat cells;
- Side-cast rock aggregate was used to form the base of new roads;
- Sensitive habitats and designated sites were avoided;
- A minimal volume of peat, subsoil and rock was excavated and removed to allow for infrastructure works to take place in comparison to the total volume of these materials present on the site due to optimisation of the wind farm design;
- Construction of settlement ponds to be volume neutral, and all excess material used locally to form pond bunds and surrounding landscaping; and,

- The peat placed in peat cells was allowed to revegetate.

Assessment of Effects: We note that earthworks of this type, scale and magnitude have been granted permission and successfully completed at similar sites around the country. Indeed, the construction of the Permitted Development and the associated removal of peat, subsoil and bedrock has been permitted at the Site. The EIAR for the Permitted Development estimated the volumes of peat/spoil and bedrock to be excavated to be ~330,227m^3 and 307,810m^3 respectively.

To date, it is estimated that the amount of peat and spoil excavated and stored at the Site is 325,500m^3, and the project engineers estimate that a further 14,500m^3 will be moved and stored in order to complete the development. This means that there has been an increase of 8,180m^3 of peat/spoil removed as a result of the development in comparison to the volume detailed and assessed in the EIAR for the Permitted Development. This represents an increase of ~2.5%.

To date the total amount of rock extracted is 288,000m^3, and the project engineers have determined that a further 39,000m^3 of rock will be required to be extracted to complete the project. In total that would be an increase of 19,190m^3 more than that was assessed in the EIAR, or an increase of ~6.2%.

Assuming a worst-case scenario for the Subject Development (*i.e.* that the excess peat/spoil and rock was removed solely from the 25 no. deviations), the effect on peat, spoil and bedrock is the removal of 8,180m^3 of peat and spoil and the excavation of 19,190m^3 of bedrock. The increase in the volume of material excavated is minor in comparison to the total volumes excavated as a result of the Permitted Development as presented in the EIAR for the Permitted Development. Furthermore, on a site-scale, the effect is negligible as these volumes only represent a small percentage of the total volumes of peat present across the wider Site.

In reality, the excess volume of material excavated to date is likely to have been distributed across the Site and not solely restricted to the footprint of the Subject Development. Therefore, the volumes of peat and spoil excavated at the deviation locations is comparable to what would have been excavated had the development been constructed as per the Permitted Development plans. The EIAR for the Permitted Development likely underestimated the volumes of material which would require excavation to facilitate the wind farm development. Additional peat storage areas were created to safely manage the peat generated during the construction phase.

Furthermore, there was no loss (removal) of peat, spoil or bedrock within the Site as a result of the Subject Development. These materials were just relocated within the site and/or used for construction of the development.

As stated in Section 6.3.8, a peat slide occurred at the Site on 12th November 2020. However, the Subject Development did not in any way contribute to this peat slide event and the associated movement and loss of peat materials from the Site.

Residual Effect: The granular subsoils and peat at the Site can be classified as of "Low" importance and the bedrock of "Medium" importance. The negative effect was the disturbance and relocation of ~8,180m^3 of peat and spoil and 19,190m^3 of bedrock during construction.

Based on the design and mitigation measures incorporated into the construction of the Meenbog Windfarm (which includes the Subject Development) as described above, combined with the small footprint of the Subject Development on a site-scale, the residual effect is considered to be a negative, slight, direct, permanent effect on peat, subsoils and bedrock due to disturbance and relocation.

Significance of Effects: For the reasons outlined above, and with the implementation of the mitigation measures, we consider that there has not been significant effects on peat, subsoils and bedrock.

6.5.2.3 Contamination of Soil and Bedrock by Leakages and Spillages

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 have the potential to result in significant effects

(i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

In addition, the release of untreated wastewater from welfare facilities can result in significant effects (i.e. contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Pathway: Peat and subsoil and underlying bedrock pore space.

Receptors: Peat and subsoil, bedrock.

Mitigation Measures:

The EIAR for the Permitted Development prescribed detailed mitigation relating to the storage and management of fuels on-site.

Whilst the location, alignment and size of the deviations differ from those which were detailed in the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the CEMP.

The mitigation measures implemented during the construction works were as follows:

- Minimal refuelling or maintenance of construction vehicles or plant took place on site. Off-site refuelling occurred at a controlled fuelling station;
- Wherever possible, vehicles were refuelled off-site, particularly for regular road-going vehicles. On-site refuelling of machinery was carried out at designated refuelling areas at various locations throughout the Site. Heavy plant and machinery were refuelled on-site by a fuel truck that came to the Site as required on a scheduled and organised basis. Other refuelling was carried out using mobile double skinned fuel bowser. All refuelling was carried out outside designated watercourse buffer zones. Only designated trained and competent operatives were authorised to refuel plant on-site. Mobile measures such as drip trays and fuel absorbent mats were used during refuelling operations as required. All plant and machinery were equipped with fuel absorbent material and pads to deal with any event of accidental spillage.
- Fuels storage on-site was minimised. Storage areas where required were bunded appropriately for the fuel storage volume for the time period of the construction;
- The plant used during construction was regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages was detailed within the Construction and Environmental Management Plan (Appendix 3-2 of this EIAR). Spill kits were available to deal with and accidental spillage in and outside the re-fuelling area.

Assessment of Effects: No adverse effect. No significant pollution events, spillages of hydrocarbons or contamination of any kind were recorded during the construction of the Subject Development.

Residual Effect: The use and storage of hydrocarbons is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been implemented during the construction phase. These mitigation measures broke the pathway between the potential source and the receptor. Therefore, the residual effect is considered to be a negative, imperceptible, direct, short-term effect on peat, subsoils and bedrock.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures we conclude that there has not been significant effects on peat, subsoils and bedrock.

6.5.2.4 Erosion of Exposed Subsoils and Peat During Construction

Peat was removed from the Subject Development locations and was used for landscaping, site-cast at appropriate locations or placed within the borrow pits and/or peat cells. In the absence of mitigation measures, there would have been a high likelihood of erosion of peat and spoil during excavation and construction works due to vehicle movement, surface water and wind action.

The effects of the Subject Development in terms of peat stability is assessed separately in **Section 6.5.2.6**.

The main effects associated with this aspect relate to the water environment, and therefore this aspect is further assessed in detail in Chapter 7 Hydrology and Hydrogeology.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Peat and subsoil.

Mitigation Measures:

The EIAR for the Permitted Development prescribed detailed mitigation measures relating to the storage and management of peat and subsoils on-site.

Whilst the location, alignment and size of deviations differ from those which were detailed in the Permitted Development plans, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the EIAR for the Permitted Development and outlined in the CEMP. Therefore, the mitigation at the deviation locations was equivalent to the mitigation planned for the consented development areas.

Standard mitigation measures for the prevention of the subsoil erosion were implemented during the construction works. These were similar to those detailed in the CEMP which were implemented for consented elements. The implemented mitigation measures were as follows:

- The project geotechnical engineer carried out inspections and monitoring of all development on site and did not note any concerns with any of the deviations;
- Erosion control measures were implemented before any site clearance works commenced;
- The area of exposed ground was minimised by maintaining pre-existing vegetation that would otherwise have been subject to erosion;
- All peat clearance works were delayed before construction began to ensure that stripping did not occur months in advance of construction activities;
- Silt fences were installed around stockpiles to limit the movement of entrained sediment in surface water runoff;
- All stockpiles were located away from drains and watercourses and all drains and watercourses were protected by silt trapping apparatus such as silt fences;
- No work was permitted near watercourses during or after prolonged rainfall or an intense rainfall event;
- Appropriate silt control measures were installed such as silt-traps, check dams and settlement ponds;
- During felling and forestry works, brash mats were 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 mats were renewed when they became heavily used and worn. Brash mats were used along all off-road routes to protect soil from compacting and rutting;
- All controls were regularly inspected and maintained and vegetation had re-established; and,
- All works were completed in accordance with the above mitigation measures which were detailed in the CEMP.

Assessment of Effects: No adverse effects. No erosion events relating to the Subject Development have been recorded. The revegetation of the BPS, peat cells and settlement ponds has proven to be successful in retaining peat and preventing erosion.

Residual Effect: Peat soils and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this all excavation works were completed in accordance with the provisions of the CEMP for the Permitted Development. All material remained within the Site and reseeding and planting was completed to bind landscaped peat and spoil together. Following implementation of the mitigation measures detailed above, it is concluded that the residual effect is a negative, slight, direct, short-term effect on peat and subsoils by erosion and wind action.

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

6.5.2.5 Excavation and Reinstatement of Borrow Pits

Three of the larger deviations (deviations 4, 11 and 25) relate to borrow pits. The removal of the overlying peat and spoil and the extraction of bedrock was completed at these deviation locations to facilitate the construction of the wind farm development. Peat was also stored at these locations to manage excess peat generated during the construction activities.

- Deviation 4 concerns the BP southwest of T12. At this location an existing forestry BP was expanded to win stone on-site ahead of gaining access to the windfarm BPs. Excavation continued at this existing forestry BP in lieu of the permitted BP1 which was not used due to peat stability concerns.
- Deviation 11 relates to the consented BP2 to the south of T15. The BP has been expanded slightly beyond the original BP2 footprint.
- Deviation 25 related to the consented BP3 and peat storage cells. This BP was slightly repositioned to suit local topography.

Pathway: Extraction/excavation.

Receptor: Peat, subsoil and bedrock.

Mitigation Measures:

The CEMP for the Permitted Development set out the guidelines and the methodology for the construction and reinstatement of the on-site borrow pits. Whilst the location, alignment and size of the borrow pits at deviations 4, 11 and 25, differ from those which were detailed in the original planning application, these borrow pits were excavated as per the methodology and guidelines prescribed in the CEMP.

The mitigation measures implemented during the excavation and reinstatement of these borrow pits as outlined in the CEMP are as follows:

- Prior to excavation, the areas to be used to the BPs were marked out at the corners using ranging rods or timber posts. Drainage and associated settlements were installed around the perimeter;
- The initial excavation involved the removal of peat and overburden deposits. These materials were used to form a berm on the downhill side of the BP;
- Interceptor drainage ditches were excavated on all sides of the BP;
- The bedrock material was extracted from the BP and stockpiled or used as required;
- Excavation works were undertaken and supervised by an experienced contractor and suitably qualified personnel;
- The borrow pits were developed with stable ground inclinations;
- The stability of the rock faces were inspected by the Project Geotechnical Engineer upon excavation to ensure stability;
- As the BP excavations progressed deeper, any ingress of water was removed via pumping to settlement ponds;
- When extraction ceased, the uphill face of the rock was stepped and deposits of soil placed which assisted the revegetation of the rock face;
- Upon the removal of the required volumes of material (for the construction of the infrastructure elements at the wind farm) from the BPs it is proposed to reinstate the pits using excavated peat and spoil;
- The borrow pits are designed and constructed in a way which will allow the excavated peat and spoil to be placed safely, with areas within the borrow pits designated for the storage of excavated peat;
- Rock buttresses were constructed within the borrow pits to help retain placed peat and spoil. The founding stratum for each buttress was inspected and approved by the Project Geotechnical Engineer; and,
- Infilling of peat and spoil commenced at the back of the borrow pit and progress towards the pit entrance.

Residual Effects: The bedrock at the Site can be classified as being of 'Medium' importance, while the peat and soils can be classified as being of 'Low' importance. The overall Site is extensive (903ha) while the footprint of the BPs (2.9ha) is approximately 0.3% of the overall Site area. The effect is the excavation of peat and the use of bedrock for the construction of the Meenbog Windfarm. Based on the design measures, as detailed in the CEMP, combined with the 'Medium' and 'Low' importance of the bedrock and peat deposits, the residual effect is a negative, slight, direct, permanent effect on peat, subsoils and bedrock due to their disturbance and relocation within the Site.

Significance of Effects: For the reasons detailed above, and with the implementation of the listed mitigation measures, no significant effects on peat, subsoils or bedrock have occurred.

6.5.2.6 Peat Instability and Failure

A Peat Stability Risk Assessment (PSRA) was carried by AGEC Ltd (October, 2017) for the main infrastructure elements for the Permitted Development. The assessment considers the guidelines for geotechnical/peat stability risk assessments as given in PLHRA (2007). This EIAR peat stability risk assessment is attached in full as Appendix 6-1.

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on the Permitted Development and the surrounding environment. The potential significant effects of peat failure at the 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 PSRA found that that the site of the Meenbog Windfarm development and all consented development areas had an acceptable margin of safety and that the overall site was suitable for the Permitted Development.

As shown on **Figure 6-6** above, the vast majority of the deviations are located within or overlap with areas which were previously assessed by AGEC and were found to have a FoS in excess of 1.3. A subsequent quantitative peat stability assessment was completed by Ionic (2021) (included as Appendix 6-3) concluded that the Site, including areas adjacent to all elements of the Subject Development was stable. and found that the Site was stable. A subsequent site inspection completed in 2023 also concluded that the Site is stable. Therefore, the risk of a peat slide occurring at these deviation locations, based on site-specific data, was found to be low.

Pathway: Peat slide/Landslide.

Receptor: People, land and infrastructure.

Mitigation Measures:

The PSRA (AGEC, 2017) for the Permitted Development, attached as Appendix 6-1, assessed the risk of peat instability at the Meenbog Wind Farm development site and prescribed detailed mitigation and control measures to ensure that the construction of the wind farm development did not impact the stability of the Site.

Whilst the location, alignment and size of 25 no. deviations differ from those which were detailed in the original planning application, these infrastructure elements were constructed as per the methodology and guidelines prescribed in the PSRA.

The standard mitigation measures implemented at all deviation locations during the construction works with respect to peat stability, as detailed in the PSRA and included in the CEMP, were as follows:

- The project geotechnical engineer carried out inspections and monitoring of all development on site and did not note any concerns with any of the deviations;
- Experienced and competent contractors were appointed;
- The Site was supervised by experienced and qualified personnel;
- Sufficient time was allocated for the project;
- Prevented undercutting of slopes and unsupported excavations;
- Maintained a managed robust drainage system;
- Prevented placement of loads/overburden on marginal ground;
- Set up, maintained and reported findings from monitoring systems (as outlined in the PSRA);
- Ensured construction method statements were developed and agreed before works commenced and all method statements were followed by the contractor; and,
- Revised and amended the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.

As stated above, some deviation locations are located outside of the area assessed in the AGEC PSRA. These deviations and any additional mitigation measures which were implemented are detailed in **Table 6-7** below.

Assessment of Effects: The construction of the Subject Development has not had an effect on peat stability. Calculations and peat stability assessments have demonstrated that the areas of the Subject Development are stable. All deviation locations have been stabilised following construction.

A site stability assessment completed by Ionic Consulting in 2021 stated that:

> *"Ionic Consulting can therefore confirm that the overall site is currently stable based upon this detailed assessment carried out along all roads hardstandings, borrow pits, peat storage areas and peat stabilisation areas".*

An additional site visit and inspection was completed in 2023 by AFRY (formerly Ionic Consulting). The associated technical note, based on site inspections and a review of all available data, found the overall site, including the location of the deviations, to be stable (Appendix 6-4).

Residual Effect: The findings of the original PSRA completed by AGEC in 2017 demonstrated that the Site was at low risk of peat failure and had an acceptable margin of safety prior to construction. A subsequent assessment by Ionic as reported in 2021 and 2023 (AFRY) found that all as built infrastructure, including all the deviations, are currently stable.

Given the findings of the PSRA, the assessments the post-construction site inspections, along with the implementation of the control measures prescribed in the CEMP, the residual effect is a negative, imperceptible, direct, permanent effect.

Significance of Effects: For the reasons outlined above, and with the application of the mitigation measures outlined above, no significant effects on people, land and infrastructure have occurred.

Table 6-7: Assessment of Effects Relating to Peat Stability

Deviation ID:	Effects	Mitigation Measures Employed	Assessment of Effects
2	This BP was not assessed for peat stability. Potential for negative, significant, direct, likely effect in the absence of mitigation measures.	Standard mitigation as detailed in the text above. A berm was constructed between the two peat storage cells to increase stability. Peat stability management was included in the CEMP and construction methodology for BPs was adhered to during construction.	No peat failure occurred. The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.
4	This location was not assessed for stability as a BP. Potential for negative, significant, direct, likely effect in the absence of mitigation.	Standard mitigation as detailed in the text above. A berm was constructed at each end of the peat cell to increase stability. Peat stability management was included in the CEMP and construction methodology for BPs was adhered to during construction.	No peat failure occurred. The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.
11	The BP was assessed in the PSRA but the extension was not. Potential for negative, significant, direct, likely effect in the absence of mitigation.	Standard mitigation as detailed in the text above. A berm was constructed at each end of the peat cell to increase stability. Peat stability management was included in the CEMP and construction methodology for BPs was adhered to during construction.	No peat failure occurred. The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.
15	Peat storage area location partially outside site footprint and therefore not assessed in the PSRA. Potential for a negative, significant, direct, likely effect in the absence of mitigation.	Standard mitigation as detailed in the text above. Mitigation equivalent to similar consented elements of the development.	No peat failure occurred. The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.
17	Peat storage area is located partially outside the site footprint and therefore not was assessed in the PSRA.	Standard mitigation as detailed in the text above. Construction was divided into successive stages in order to avoid overloading the weakest point on the downhill slope.	No peat failure occurred.

Deviation ID:	Effects	Mitigation Measures Employed	Assessment of Effects
	Potential for negative, significant, direct, likely effect in the absence of mitigation.	Construction began at a point directly to the south of T15 at a point tangential to the external dig radius of the WTG foundation adjacent to the existing road. Works were completed on the northbound berm, then turned to the west towards the higher elevation. This ensured that there was minimum risk of material movement in the northerly/easterly direction. Peat stability management was included in the CEMP.	The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.
18	Peat storage area is located partially outside the site footprint and therefore not was assessed in the PSRA. Potential for negative, significant, direct, likely effect in the absence of mitigation.	Standard mitigation as detailed in the text above. The NW corner was identified as the weakest point and the construction methodology was amended to prevent pressure on this point. Large rocks installed as 'open bonds' allowed for hydraulic pressure relief. Peat stability management was included in the CEMP.	No peat failure occurred. The post construction berm calculation has been completed to demonstrate stability. Therefore there was no residual effect.

6.5.2.7 Effect on the Barnesmore Gap CGS

The Barnesmore Gap County Geological Site (CGS) (Site Code: DL002) is located in the west of the Site. Deviation 1 is located in this area of the Site and overlaps with the mapped extent of this CGS.

The Barnesmore Gap is a deep pass oriented southwest–northeast, comprising a deep glacial channel. It splits the Blue Stack Mountains in two, with Croaghconnellagh on the northwest side and Barnesmore Mountain on the southeast. The gap is a glacial valley, Quaternary in age and was formed by the scouring effects of ice during the Last Ice Age. The site is of importance due to the presence of lateral moraines within the Gap are among the best examples in the country.

The excavation and emplacement of the access road at deviation 1 will have resulted in the removal of small volumes of soil and subsoil (and potential small volumes glacial tills) to facilitate access road construction.

Pathway: Excavation/removal of overburden.

Receptor: Geological Heritage Sites -Barnesmore Gap CGS.

Mitigation Measures:

The mitigation measures detailed in the preceding sections (and in the CEMP) were implemented with respect to the excavation of soils/subsoils and the storage of materials.

Assessment of Effects:

The Site is located at the northern periphery of this large CGS which has a total area of 577ha. Deviation 1 represents 0.02% of the total area of the CGS. Therefore, the effect of the construction of deviation 1 can be considered to be negligible in terms of the overall CGS.

Furthermore, the Permitted Development was consented as the footprint partially within the CGS, which was not deemed to have a significant effect.

Residual Effect Given the scale and nature of the works at deviation 1 the residual effect is a negative, imperceptible, direct, long-term effect on the Barnesmore Gap CGS.

Significance of Effects For the reasons outlined above, no significant effects on the Barnesmore Gap CGS have occurred.

6.5.3 Continued Construction Phase – Likely Significant Effects and Mitigation Measures

In the event that the Substitute Consent is obtained, the deviations would be left in situ and would become part of the consented wind farm development infrastructure. There would be no additional environmental effects associated with the Subject Development.

6.5.4 Likely Significant Effects During Operational Phase

Very few potential direct impacts are envisaged during the operational phase. These may include:

- In relation to indirect impacts a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.
- The use of plant and vehicles completing any minor maintenance have the potential to result in accidental spillages of hydrocarbons;

- The peat cells and restored BPs will revegetate over time having a positive impact on the local peatland environment.

These effects are the same regardless of whether the Substitute Consent is obtained or not. These effects are common across all operational wind farm sites. They are not influenced in any way by the Subject Development and whether or not it forms part of the Meenbog Windfarm infrastructure. For completeness, the effects on the land, soils and geological environment are detailed below.

6.5.4.1 Site Road Maintenance

In relation to indirect effects 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.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

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

Proposed Mitigation Measures:

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

Post-Mitigation Residual Effect: The use of 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, unlikely effect on bedrock.

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

6.5.4.2 Site Vehicle/Plant Use

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

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

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

Proposed Mitigation Measures:

- Vehicles used during the operational phase will be refuelled off site before entering the site;
- No fuels will be stored on-site during the operational phase; and
- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and,
- An emergency plan for the operational phase to deal with accidental spillages and breakdowns is contained in the CEMP (Appendix 3-2).

Post-Mitigation Residual Effect: The use of hydrocarbons in plant and vehicles is a standard risk associated with all operational wind farm sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor.

The residual effect is considered to be - negative, imperceptible, direct, short-term, unlikely effect on peat, subsoils, and bedrock.

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

6.5.5 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the consented Meenbog Wind Farm development will be the same regardless of whether the Subject Development is granted Substitute Consent.

Given the nature of the Subject Development it will have no bearing on the decommissioning phase of the Meenbog Windfarm. The Subject Development will not alter the decommissioning plan for the Meenbog Windfarm and it is likely that the components of the Subject Development would remain in situ in the event of decommissioning of the Meenbog Windfarm.

An outline decommissioning plan is contained in the CEMP in Appendix 3.2. The Decommissioning Plan will be updated prior to the end of the operational period in line with decommissioning methodologies that may exist at the time and will agree with the competent authority at that time.

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 Proposed 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".

No significant effects on the land, soils and geological environment will occur during the decommissioning phase.

6.5.6 Risk of Major Accidents and Disasters

Due to the nature of the Site, *i.e.* mountainous terrain with peat covered slopes, there is a risk of a landslide occurring.

A comprehensive Peat Stability Risk Assessment (AGEC, 2017) was undertaken for the Site and, and it concluded that with the implementation of the proposed control (mitigation) measures, the residual risk of a landslide occurring was determined to be negligible/none. However, a peatslide occurred in November 2020 and site investigation concluded that the slide resulted from a combination of several factors including the construction works and antecedent rainfall. The investigations concluded that the Subject Development was not deemed to be a contributing factor. Furthermore, site inspections following the November 2020 peat slide concluded that all infrastructure, including the Subject Development, are stable (AFRY, 2023).

6.5.7 Human Health Effects

Potential health effects arise mainly through the potential for soil and ground contamination. The Site is not a recognized source of pollution (e.g. it's not a waste management site, or a chemical plant), and there has been no record of hydrocarbons spillages or leaks associated with the Subject Development.

Hydrocarbons were used onsite during construction; however, the volumes were small in the context of the scale of the Subject Development, and the wider Permitted Development. All hydrocarbons were handled and stored in accordance with best practice mitigation measures. No health effects have occurred or will occur as a result of soil or ground contamination. Therefore, the subsequent health effects are imperceptible.

6.5.8 Potential Cumulative Effects

Due to the localised nature of the construction works, which were kept within the Site boundary, there was no potential for significant cumulative effects in-combination with other local developments (outside of the Site boundary) on the land, soils and geology environment. The only way that the Subject Development could have had in combination effects with other off-site projects and plans is via the drainage and off site surface water network, and this hydrological pathway is assessed in Chapter 7 Hydrology & Hydrogeology.

Permitted Development

The construction of the Permitted Development was occurring at the same time as the construction of the Subject Development (90% of the Meenbog Windfarm has been constructed to date). To date, the cumulative effects on land, soils and geological environment between the Subject Development and the Permitted Development can be summarised as follows:

- The loss of 27.8ha of peat bogs and coniferous forestry (8.8ha associated with the Subject Development). This equates to 3% of the overall Site area;
- The excavation and storage of approximately 325,500m^3 of peat/spoil at the Site; and,
- The excavation of approximately 288,000m^3 of bedrock.

The cumulative effects on the land, soils and geological environment are similar to the effects which were assessed in the EIAR for the Permitted Development. Due to the low and medium importance of the peat and bedrock at the Site, combined with the small footprint of both the Subject Development and the Permitted Development on a Site scale, no significant cumulative effects have occurred, are occurring or will occur as a result of the Subject Development and the Permitted Development.

November 2020 Peatslide

The November 2020 Peatslide occurred during the same time period as the construction of the Subject Development. The estimated cumulative effects on land, soils and geological environment between the Subject Development and the November 2020 Peatslide can be summarised as follows:

- The loss or degradation of approximately 14ha of peat bogs and coniferous forestry (8.8ha associated with the Subject Development). This equates to 1.5% of the overall Site area;

Due to the low and medium importance of the peat and bedrock at the Site, combined with the small footprint of both the Subject Development and the November 2020 Peatslide on a Site scale, no significant cumulative effects have occurred, are occurring or will occur as a result of the Subject Development and the November 2020 Peatslide.

6.5.9 Post Construction Monitoring

The monitoring of ground movement in relation to peat stability will be completed during the continued construction phase and the operation phase.

The monitoring plan is detailed in Appendix E of FT's Peat Stability Assessment of Meenbog Wind Farm Site (2021). In order to monitor the performance of the constructed works, a series of monitoring points will be established throughout the Site. These monitoring points will also be established in the vicinity of the Subject Development to ensure that there is no change in the stability of these areas. Any deviation of the posts would indicate potential movement of the peat. The monitoring will be completed weekly or following heavy rainfall.

6.6 Bibliography

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