Planning and Environmental Consultants

LAND, SOILS AND GEOLOGY

Taurbeg Wind Farm Extension of Operational Life

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Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

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8. LAND SOILS AND GEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential likely and significant effects of the Proposed Project (Proposed Lifetime Extension for the existing Taurbeg Wind Farm and Proposed Offsetting Measures) on the Land, Soils and Geology aspects of the receiving environment.

Details of the Proposed Project are described in full in Chapter 4 of this Environmental Impact Assessment Report (EIAR).

In summary, planning permission is sought for the continued operation of the existing Taurbeg Wind Farm as permitted by Cork County Council (Pl Ref No: 02/3608) for a further period of 10 years from the date of the expiry of the current planning permission (2026) as per Condition No. 7 of the existing consent. The existing Taurbeg Wind Farm comprises of 11 no. turbines. The grid connection does not form part of the Proposed Lifetime Extension but is assessed cumulatively.

This chapter provides a baseline assessment of the environmental setting of the existing Taurbeg Wind Farm (i.e. the Site) and the Proposed Offsetting lands, in terms of land, soils and geology and discusses the potential likely significant effects that the Proposed Project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to land, soils and geology (i.e. natural resources) are recommended and the residual effects of the Proposed Project post-mitigation are assessed.

As detailed in Section 1.1.1 of the EIAR, this chapter uses for the following terminology: 'Proposed Lifetime Extension', 'the Site', the 'Proposed Offsetting Measures', 'Proposed Offsetting Lands' and the 'Proposed Project'.

8.1.2 Statement of Authority

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

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

This chapter of the EIAR was prepared by Michael Gill and Conor McGettigan.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is a Civil/Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in geological characterisation, peatland morphology, and surface water drainage design and SUDs design and surface water/groundwater interactions. Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF and over 100 other wind farm related projects across the country including the lifetime extension application for Booltiagh Wind Farm.

Conor McGettigan (BSc, MSc) is an Environmental Geoscientist with over 4 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.

8.1.3 Relevant Guidance

The Land, Soils and Geology chapter of this EIAR was prepared in accordance with, where relevant, the 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).

8.2 Assessment Methodology

8.2.1 Desk Study

A desk study of the Site and Proposed Offsetting lands was completed in January and February 2024 to collect all relevant geological data for the above. The desk study was completed to supplement site walkover surveys and previous site investigation data. The desk study information has been checked and updated, where necessary, in January and February 2025.

The desk study included consultation with the following data sources:

- Environmental Protection Agency database (**www.epa.ie**);
- Geological Survey of Ireland - Groundwater and Geology Databases (**www.gsi.ie**);
- Geological Survey of Ireland – Geological Heritage site mapping (**www.gsi.ie**);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 21 (Geology of Kerry - Cork). Geological Survey of Ireland (GSI, 1996);
- 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" base mapping.

The following documents relating to the Taurbeg Wind Farm were also reviewed and are referenced as required in this chapter:

- Whiteford Geoservices Ltd, 2004. Ground Investigation for Proposed Wind Farm Site at Taurbeg, Rockchapel, Co. Cork (Report No. 386/04) (refer to Appendix 8-2); and,
- Environmental Impact Statement for the existing Taurbeg Wind Farm Pl. Reg. Ref: N/02/3608 (2002).

8.2.2 Baseline Monitoring and Site Investigations

Site walkover surveys, including geological mapping, of the Site was undertaken by Conor McGettigan of HES (refer to Section 8.1.2 above for qualifications and experience) on 26th March and 14th August 2024. During these site visits observations were made on near surface geological features, accessible

bedrock was mapped and peat probing investigations were completed by HES within the Site. Additional walkover surveys and site investigations of the Proposed Offsetting lands were completed by GDG in October 2024.

Recent site investigations to address the Land, Soils and Geology Section of the EIAR included the following:

- HES completed site walkover surveys and geological mapping of bedrock outcrops at the Site on 26th March and 14th August 2024;
- A total of 10 no. gouge core sample points were undertaken by HES on 14th August 2024 across the site to investigate peat and underlying mineral soil lithology;
- Logging of subsoil exposures across the Site where mineral soils and peat profiles are exposed;
- Mineral subsoils and peat were logged according to BS: 5930 and Von Post Scale respectively;
- GDG completed site investigations at the Proposed Offsetting lands and the surrounding area in October 2024. In total 214 no. peat probes (107 no. within the Proposed Offsetting lands) and 16 no. shear vane tests (4 no. within the Proposed Offsetting lands) were completed.
- GDG completed a Peat Stability Risk Assessment for the Proposed Offsetting lands which is included as Appendix 8-1.

HES also completed a detailed review of the previous planning applications, associated planning files and site investigations prior to completing site investigations for the current application. Historic ground investigations have been completed at the Site undertaken by Whiteford Geoservices Ltd (June, 2004) as part of the pre-construction site investigation works for the existing Taurbeg Wind Farm (Pl. Reg. Ref: N/02/3608). This data was used to supplement the recent site investigations detailed above. A copy of the site investigation report is included as Appendix 8-2. These historic site investigations comprised:

- The excavation of 13 no. trial pits;
- The drilling of 2 no. boreholes;
- In situ California Bearing Ratio (CBR) testing;
- Ground resistivity testing (geophysical surveys) at turbine locations and the substation location; and,
- Laboratory testing of recovered soils samples for pH & sulphate.

8.2.3 Scope and Consultation

The scope for this EIAR has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Section 2.9 of this EIAR.

The Geological Survey of Ireland were the only consultees to respond with respect to the Land, Soils and Geological environment. Their responses are summarised in Table 8-1. The GSI response was informative in nature with regard sources of online data for baseline assessment purposes.

Table 8-1: Summary of Scoping Responses

Consultee	Description	Addressed in Section
GSI	The GSI encouraged the use of their various geological datasets when conducting the EIAR.	The publicly available GSI databases were used during the preparation of this chapter as detailed in Section 8.2.1. Nearby geological heritage sites are described in Section 8.3.7.

Consultee	Description	Addressed in Section
	The GSI note that there are no county geological sites in the vicinity of the proposed wind farm extension. The GSI recommends that geohazards are taken into consideration and note that the Landslide Susceptibility Viewer indicates areas of Moderately High to High Susceptibility in the vicinity of the wind farm area. The GSI recommend the use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential.	Geohazards and peat stability are considered in 8.3.9. The aggregate potential is described in Section 8.3.6.

8.2.4 Impact Assessment Methodology

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

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

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional 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 the site 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.

Importance	Criteria	Typical Example
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 Stage 6 of 7 of the information which must be included in an EIAR (EPA, 2022). 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 EIAR.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of effects are related to examples of potential likely significant effects on the geology and morphology of the existing environment, as listed in Table 8-3.

Table 8-3: Impact descriptors related to the receiving environment.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: › The extent or morphology of a cSAC. › Regionally important aquifers. › Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: › The extent or morphology of a cSAC / ecologically important area.

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

8.2.5 Limitations and Difficulties Encountered

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

8.2.6 Study Area

The study area for the land, soils and geological environment is limited to the Site, which relates to the primary study area for the Proposed Lifetime Extension of Taurbeg Wind Farm, as delineated by the EIAR Site Boundary, and the Proposed Offsetting lands located in Coom and Knockatee, Co. Kerry.

There is no potential for the Proposed Project to affect the land, soils and geological environment outside of the study area.

8.3 Existing Environment

8.3.1 Site Description and Topography

8.3.1.1 Taurbeg Wind Farm

The Site is located 3.5km south of Rockchapel and 10.5km northwest of Newmarket, Co. Cork. The Site is located in the townlands of Taurbeg, Glasheenanargid and Taurmore. The Site has a total area of ~112hectares (ha).

The Site is located in an upland setting and is situated on the southern foothills of the Mullaghareirk Mountain range. Topography within the Site ranges from ~302 metres above Ordnance Datum (mOD) in the northeast to ~405mOD in the southwest. The lowest elevations are found in the northeast of the Site, at the existing entrance to Taurbeg Wind Farm. Topography rises to the west and there are three local peaks within the Site, one standing at an elevation of ~392mOD in the north, with two local peaks standing at ~405mOD further south.

The Site is drained by several streams which ultimately drain to the Feale or Blackwater rivers. The Site comprises of a mixture of renewable energy production, coniferous forestry, peat bogs and transitional woodland scrub.

The existing Taurbeg Wind Farm is accessed via the wind farm site entrance off the L5005 local road, in the townland of Taurbeg and is served by a network of existing wind farm access roads.

8.3.1.1.1 *Existing Infrastructure*

The existing development footprint of Taurbeg Wind Farm is ~3.76ha, representing ~3% of the Site (~112ha).

Taurbeg Wind Farm comprises of 11 no. existing wind turbines, with an estimated installed capacity of 25.3 Megawatt (MW). The total footprint of the turbines and their associated hardstands is ~3,891m^2. The turbine base elevations range from 330mOD (T7) to 401mOD (T11). Each wind turbine is secured to a reinforced concrete foundation. No piled foundations have been installed at the Site. The existing foundations are circular in plan with an average area of 100m^2. The existing hardstand areas around each turbine comprise of levelled and compacted hardcore. The existing hardstand areas vary slightly at each of the 11 no. turbines, with an average area of 722m^2.

During the initial construction of the existing wind farm, existing tracks were upgraded, and new access roads were constructed to provide access within the Site and to connect wind turbines and associated infrastructure. Site roads were constructed of consolidated gravel with an average running width of 5.5m and a total length of 8.4km. The current footprint of the existing roads at the Site is 32,230m^2.

Each turbine is connected to the on-site electricity substation through underground medium voltage (MV) electricity and communications cabling. Multicore fibre-optic cabling connects each wind turbine to the wind farm control building. The electricity and fibre-optic cabling run in trenches below the ground surface, along the sides of or underneath the internal roadways. The routes of the cabling ducts follow the access tracks to each turbine location.

The existing substation compound measures ~1,428m^2. A 38kV underground cable runs between the onsite substation and a mast at the south of the Site. A 38kV overhead line runs from the mast to the existing Glenlara 110kV Substation.

There are no changes proposed to the existing Taurbeg Wind Farm infrastructure or grid connection as part of the Proposed Lifetime Extension.

8.3.1.2 Proposed Offsetting Measures

The Proposed Offsetting lands are located in townlands of Coom and Knockatee, Co. Kerry, ~12km west/southwest of the existing Taurbeg Wind Farm. The Proposed Offsetting lands consist of 4 no. parcels of land proposed for hen harrier habitat creation, 3 in the townland of Coom (Areas 1, 2 and 4) and 1 no. further north in the townland of Knockatee (Area 3).

The Proposed Offsetting lands are located on the slopes of Mount Eagle which stands at an elevation of 431mOD. Topography within the Proposed Offsetting lands is steeply sloping and ranges from ~200 to ~380mOD.

The Proposed Offsetting lands are located in an area dominated by coniferous forestry plantations. The northwestern Proposed Offsetting lands (~17.7ha) (Area 3) are located in an agricultural field whilst the remaining lands (~105.5ha) are located in coniferous forestry plantations (Areas 1, 2 and 4).

8.3.2 Land and Land Use

8.3.2.1 Taurbeg Wind Farm

Based on Corine land cover mapping (2018) the Site comprises of “peat bogs” with some areas of “transitional woodland scrub” to the north and “coniferous forestry” to the south. Land use in the wider surrounding area comprises primarily of “transitional woodland scrub” and “agricultural pastures” with some pockets of “coniferous forestry”. No significant land use changes have been recorded by historic Corine mapping (1990 - 2018).

The Taurbeg Wind Farm has been operational since March 2006. In terms of the existing Taurbeg Wind Farm infrastructure, all 11 no. turbines and the existing substation are mapped by Corine (2018) on peat bogs.

Site walkover surveys and the inspection of recent aerial photographs, completed by HES, have verified land use at the Site. These surveys confirmed that the Site is located in an upland area which is dominated by peat bogs, agricultural pastures, coniferous forestry, transitional woodland scrub and renewable energy production.

8.3.2.2 Proposed Offsetting Measures

The northern Proposed Offsetting lands, located in the townland of Knockatee, are mapped by Corine (2018) to be located in agricultural pastures (Area 3). The other 3 no. Proposed Offsetting lands are mapped in areas of transitional woodland scrub (Areas 1, 2 and 4).

Landcover in the surrounding land is mapped by Corine as peat bogs, moors and heathlands and coniferous forestry.

Landcover at the Proposed Offsetting lands has been verified by inspection of recent aerial imagery and site walkover surveys completed by GDG in October 2024. The walkover surveys confirmed that the Proposed Offsetting lands (with the exception of Area 3) comprised of extensive areas of upland blanket peat, much of which is afforested.

8.3.3 Peat/Soils and Subsoils

8.3.3.1 Taurbeg Wind Farm

The published Teagasc soils map (www.gsi.ie) for the area shows that the Site is predominantly overlain by blanket peat. Some areas of peaty poorly drained, mainly acidic mineral soils (AminPDPT) and

acidic poorly drained mineral soils (AminDW) are mapped around the periphery of the Site. Meanwhile, shallow, rocky, peaty/non-peaty mineral complexes (AminSPRT) are mapped in the valley of a stream to the south of T7. In terms of the existing Taurbeg Wind Farm infrastructure, 10 no. turbines and the existing onsite substation are mapped in areas of blanket peat whilst T6 is mapped in an area of acidic poorly drained mineral soils.

Similarly, the GSI subsoil mapping (www.gsi.ie) shows that blanket peat is the dominant subsoil type at the Site. Some tills derived from Namurian sandstones and shales are mapped around the periphery of the Site. Meanwhile, an area of bedrock outcrop or subcrop is mapped along a natural watercourse to the south of T7. In terms of the existing Taurbeg Wind Farm infrastructure, 10 no. turbines and the existing onsite substation are mapped in areas underlain by blanket peat. T6 is mapped to be underlain by till derived from Namurian sandstones and shales.

Subsoils mapped in the surrounding lands are the same as those mapped within the Site with alluvium deposits also mapped along several local watercourses.

A subsoil geology map for the Site is shown as Figure 8-1 below.

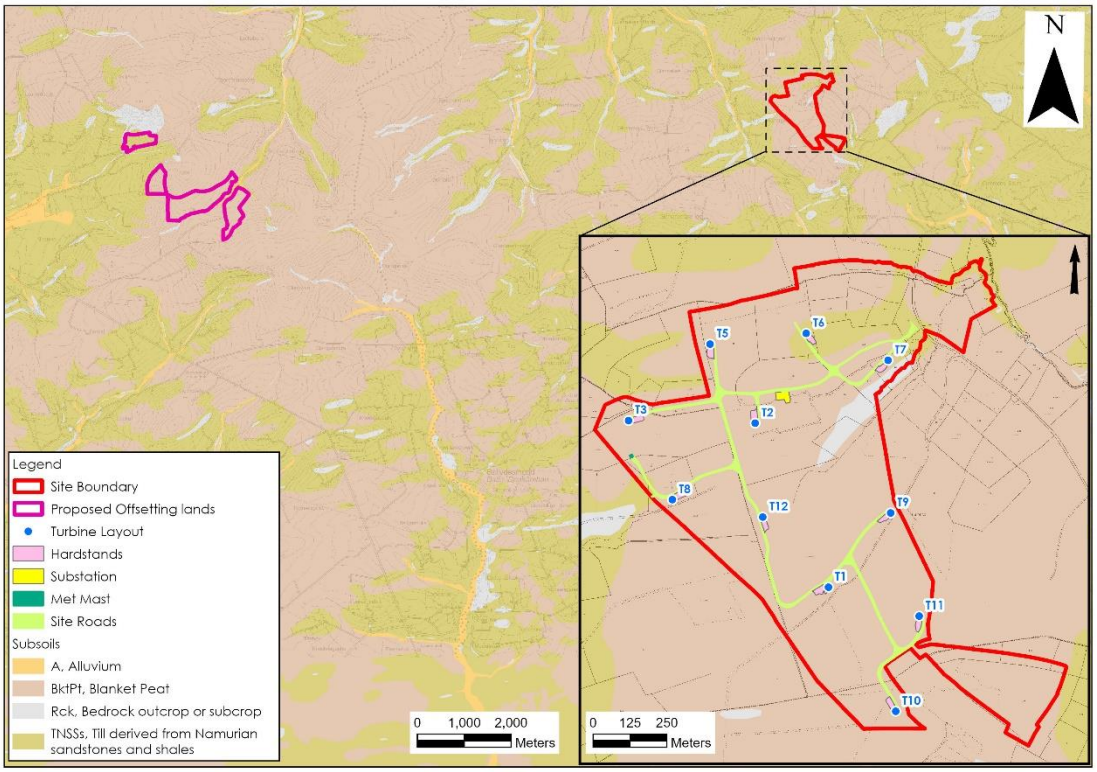

Figure 8-1: Subsoils Map (www.gsi.ie)

The soils and subsoils present at the Site have been confirmed by recent and historic site investigations comprising of gouge cores, boreholes and trial pits.

Whiteford Geoservices Ltd (June 2004) completed a programme of site investigations during the pre-construction phase of Taurbeg Wind Farm (Appendix 8-2). These historic site investigations comprised of the excavation of 13 no. trial pits (at the turbine locations (one of which, T4, was not constructed) and the substation location), the drilling of 2 no. boreholes (at T1 and T12) and laboratory testing of recovered soil samples. These historic site investigations found the typical stratigraphy of the existing Taurbeg Wind Farm Site to be as follows:

- The site is overlain by PEAT which ranges in thickness from 0.2 to 2.5m;

- The peat depth in the 13 no. trial pits ranged from 0.2 to 1.7mbgl (metres below ground level) whilst BH1 completed at T1 recorded a peat depth of 2.5m;
- The peat is typically underlain by a light brown CLAY which was often noted to be sandy. These clay deposits ranged in thickness from 0.3 to 1.0m;
- The sandy clay is typically underlain by a medium dense coarse GRAVEL or gravelly CLAY; and,
- The full thickness of the soil/subsoil profile ranged from 0.86 to 5.1m at which depths weathered bedrock was encountered.

HES verified the nature of the soils and subsoils at the Site through the completion of gouge cores (10 no.) and the logging of soil/subsoil exposures. During these site investigations, no peat was encountered at T7 on the lower ground in the east of the Site. A gouge core completed in the vicinity of T7 encountered brown silty clayey soils. Where present the peat depths across the Site range from 0.1 to 1.8m. The peat is typically shallow with only 2 no. gouge cores encountering peat depths in excess of 0.5m. 1.65m of peat was encountered near T8 whilst 1.8m of peat was encountered near T12. The gouge cores typically encountered an orange-brown gravelly clay beneath the peat.

The locations of the recent and historic site investigation points are shown in Figure 8-2.

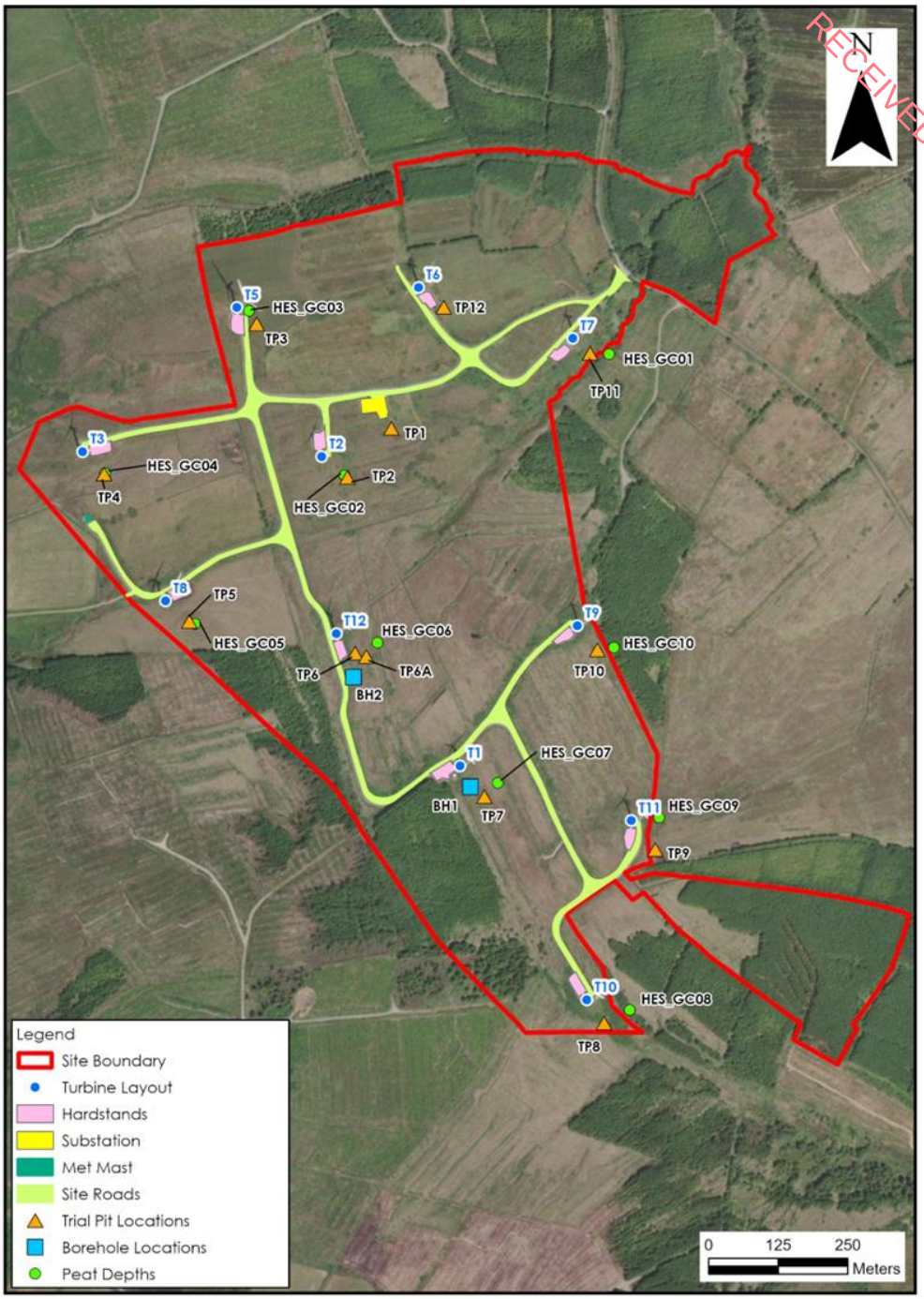

Figure 8-2: Site Investigation Map (Taurbeg Wind Farm)

8.3.3.2 Proposed Offsetting Measures

The published Teagasc soils map (www.gsi.ie) shows that Proposed Offsetting areas 1 and 4 are overlain entirely by blanket peat. Meanwhile, peaty poorly drained mineral soils (AminPDPT) and mineral alluvium are mapped along a stream between Area 1 and Area 4. Area 2 is overlain predominantly by blanket peat with some acid deep well drained mineral soils (AminDW) and acid poorly drained mineral soils (AminPD) mapped along the western perimeter of Area 2. No peat is mapped in the vicinity of Area 3 with the mapped soils in this area comprising of acidic deep well drained mineral soils (AminDW), acidic poorly drained mineral soils (AminPD) and acidic shallow well drained mineral soils (AminSW).

The GSI subsoil map (www.gsi.ie) shows that the Proposed Offsetting areas 1 and 4 are underlain by blanket peat. A small area of alluvium and tills derived from Namurian sandstones and shales is mapped between Area 1 and Area 4. Area 2 is underlain predominantly by blanket peat with some tills in the west. Meanwhile, Area 3 is mapped to be underlain largely by tills derived from Namurian sandstones and shales with some bedrock outcrop or subcrop mapped in the northwest.

Site walkover surveys and peat probing were completed by GDG in October 2024 in areas 1, 2 and 4. The initial surveys targeted a larger area of the Proposed Offsetting lands and included a total of 214 no. peat probes, 107 of which are located within the final chosen Proposed Offsetting lands. Peat thicknesses within the Proposed Offsetting lands ranged from 0 to 3.2m with a median value of 1.6m. 23% of the recorded peat depths within the Proposed Offsetting lands were less than 1m and 72% were less than 2m.

The locations of the peat probes with respect to the Proposed Offsetting lands are shown in Figure L-2 of Appendix 8-1 (Peat Stability Risk Assessment Report).

8.3.4 Bedrock Geology

8.3.4.1 Taurbeg Wind Farm

Based on the GSI bedrock mapping (www.gsi.ie) the Site is underlain by 2 no. bedrock geological formations. The northern section of the Site is underlain by the Glenoween Shale Formation which is comprised of grey silty mudstones. Meanwhile, the south of the Site is underlain by the Cloone Flagstone Formation which is composed of greywackes, siltstones and silty mudstones. In terms of the existing Taurbeg Wind Farm infrastructure, a total of 9 no. turbines and the onsite substation are mapped to be underlain by the Glenoween Shale Formation. Meanwhile, T10 and T11 are mapped to be underlain by the Cloone Flagstone Formation.

There is 1 no. large southwest to northeast orientated fault mapped within the Site. This fault is mapped ~700m from the closest existing turbine (T11). The GSI also map the presence of an anticlinal fold axis in the south of the Site, also trending in a southwest to northeast direction. The GSI do not map any bedrock outcrops within the Site.

A bedrock geology map is shown as Figure 8-3 below.

The trial pits completed by Whiteford Geoservices (2004) as part of the original baseline assessment found that the depth to weathered sandstone and mudstone bedrock at the turbine and substation locations ranged from 0.86 to 2.9m. No weathered rock was encountered in 3 no. trial pits completed at T1 and T12. However, the boreholes completed at these locations encountered rock at depths of 4.0m (T12) to 5.1m (T1).

These previous site investigations typically describe the bedrock at the Site as comprising of dark grey, laminated mudstone and siltstone and yellowish or red thinly bedded to massive sandstones.

During the site walkover surveys completed by HES, bedrock outcrops were recorded in several of the streams draining the Site and was consistent with the description provided by the GSI and that encountered during the previous site investigation works.

8.3.4.2 Proposed Offsetting Measures

The vast majority of the Proposed Offsetting lands are mapped by the GSI to be underlain by the Glenoween Shale Formation. Meanwhile, the Cloone Flagstone Formation is mapped to underlie the western section of the northern Proposed Offsetting lands in the townland of Knockatee (Area 3). The Cloone Flagstone Formation is noted to comprise of greywacke, siltstone and silty shale.

There is 1 no. large east/northeast to west/southwest orientated fault to underlie the southern section of the Proposed Offsetting lands. The GSI map several areas of bedrock outcrop near the summit of Mount Eagle.

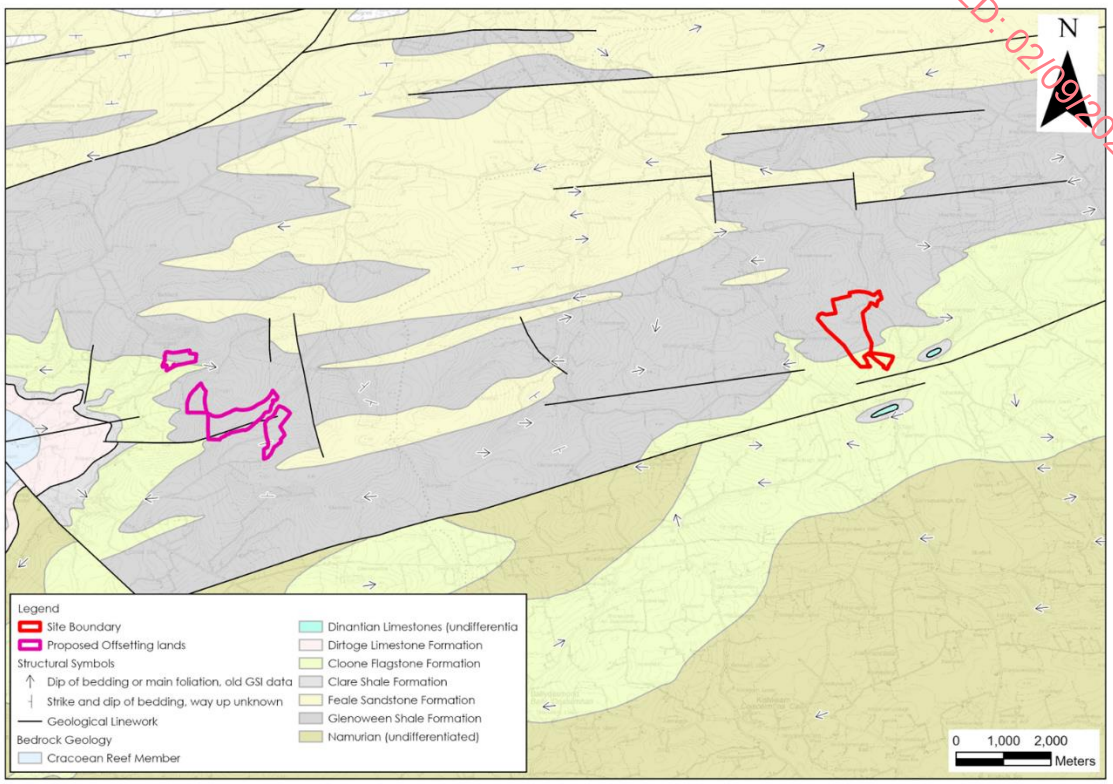

Figure 8-3: Bedrock Geology Map (www.gsi.ie)

8.3.5 Geological Resource Importance

8.3.5.1 Taurbeg Wind Farm

The GSI Online Database accessed via the Public Data Viewer (www.gsi.ie) does not record the presence of any active bedrock quarries or sand and gravel pits within the Site or in the surrounding lands. The closest mapped active quarry is located at to the southwest of Ballydesmond village, ~10km southwest of the Site. Furthermore, the GSI do not record the presence of any historic quarries or pits within the Site.

A borrow pit was used to win stone for access tracks associated with the construction of the Taurbeg Wind Farm. This borrow pit was located towards the north of the site and was permitted under planning reference 05/602. This borrow pit which facilitated the construction of the wind farm has been restored.

The GSI do not record any mineral localities within the Wind Farm Site or in the surrounding lands. Coal is noted to be present in the townland of Knockawinna, ~6.6km to the northwest of the Site.

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'. The vast majority of the site is mapped as having 'Very Low' potential for rock extraction with only very small, localised areas of 'High' potential. The bedrock at the Site could be used on a "sub-economic" local scale for construction purposes.

The Site is not mapped in an area of granular aggregate potential (i.e. potential for gravel reserves). There are some localised areas of 'Very Low' potential in the surrounding lands, along local watercourses. The peat and subsoil deposits at the Site can be considered to be of 'Low' importance as the peat is not designated in this area.

8.3.5.2 Proposed Offsetting Measures

There are no active quarries or sand and gravel mapped by the GSI in the immediate vicinity of the Proposed Offsetting lands. The closest mapped bedrock quarry is located ~2.4km northwest of the Proposed Offsetting lands.

The GSI do not record any mineral localities in the local area. The closest mapped mineral locality is ~3.1km to the west, where an old quarry is mapped in the townland of Kilquane.

The GSI online Aggregate Potential Mapping Database (www.gsi.ie) shows that the crushed rock aggregate potential of the Proposed Offsetting lands ranges from 'Very Low' to 'Moderate'. Bedrock has not been extracted in this area due to the presence of the overlying peat deposits.

Furthermore, the Proposed Offsetting lands are not mapped in an areas of granular aggregate potential. The peat and subsoils can be considered to be of low importance, and they have been degraded by the forestry plantations in this area.

8.3.6 Geological Heritage Sites and Designated Sites

8.3.6.1 Taurbeg Wind Farm

There are no recorded geological heritage sites within the Site (www.gsi.ie).

The closest geological heritage sites include:

- Ballinatona, Meelin Spring County Geological Site (CGS) (Site Code: CK003). This CGS is described as a warm spring and a groundwater supply source and is located ~5km to the east of the Site;
- Trinity Well CGS (Site Code: CK085) is described as a warm spring with religious association. This CGS is located to the west of Newmarket and ~7.65km southeast of the Site; and,
- Owentaraglin River CGS (CK070) comprises of a number of tight meanders along the course of the Owentaraglin River, south of Kishkeam. This CGs is situated ~7.5km to the southwest.

There are no other geological heritage sites within 10km of the Site.

A map of local geological heritage sites is shown below as Figure 8-4.

The Site is mapped within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protected Area (SPA) (Site Code: 004161).

8.3.6.2 Proposed Offsetting Measures

There are no recorded geological heritage sites within the Proposed Offsetting lands.

The closest audited geological heritage site is the Owentaraglin River CGS (Site Code: CK070). This site comprises of a number of tight meanders along the course of the Owentaraglin River, located ~11.6km to the southwest.

There are 3 no. unaudited geological sites to the west of the Proposed Offsetting lands. These include:

- Ballynahallia Quarry Cave, which is recommended for Geological NHA, is located ~5.3km to the southwest.
- Tobermaing CGS, which contains a karst spring, is located ~6.4km to the west; and,
- Crag Cave, which is recommended for Geological NHA, located ~6.1km to the west.

Furthermore, the Proposed Offsetting lands are also mapped within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protected Area SPA. This SPA is a very large site centred on the borders between Cork, Kerry and Limerick. The SPA consists of a variety of upland habitats, though almost half is afforested (NPWS, 2015). The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier. It is a conservation objective to restore the extent and quality of both open heath and bog habitats within the SPA as these habitats can provide important nesting and foraging resources.

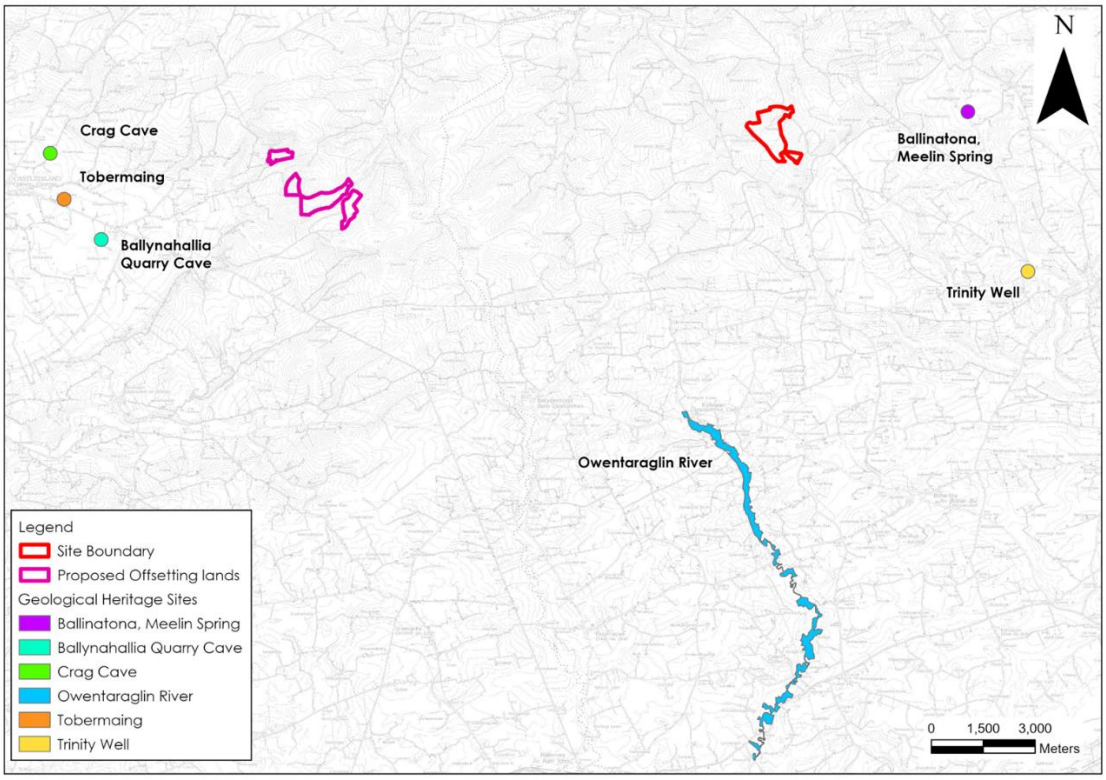

Figure 8-4: Geological Heritage Sites (www.gsi.ie)

8.3.7 Soil Contamination

8.3.7.1 Taurbeg Wind Farm

There are no known areas of soil contamination within the Site. During the site walkovers and site investigations, no areas of contamination concern were identified. No historic borrow pits which may have contaminated tailings were identified within the Site.

According to the EPA online mapping (www.epa.ie), there are no licensed waste facilities or dump sites located within the Site. The are no EPA mapped waste facilities within 10km of the Site.

8.3.7.2 Proposed Offsetting Measures

There are no known areas of soil contamination in the vicinity of the Proposed Offsetting lands.

8.3.8 Peat Stability

8.3.8.1 Taurbeg Wind Farm

The GSI do not record the occurrence of any historic landslides within the Site (www.gsi.ie). The closest recorded landslide is located ~11km to the west. This event dates from November 2020 and is described as a peat slide which occurred in an area of mixed forestry at Knockfeha, Co. Kerry. A historic landslide is also mapped ~12km to the southeast of the Site. This landslide near Kanturk dates from 1839 and is described as a peat slide which occurred in a blanket bog in which the peat was over 10ft thick.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring. The landslide susceptibility of the Wind Farm Site was classified by the GSI (2023) as ranging from "low" to "high". The areas of susceptibility are localised, with the majority of the Site having "low" to "moderately low" landslide susceptibility.

There will be no construction activities associated with the Proposed Lifetime Extension, and therefore no peat stability assessment has been carried out at the Site.

The original EIAR found that the existing Taurbeg Wind Farm was suitable from a peat stability perspective, and the existing wind farm was constructed without any peat stability issues. The main risk related to the construction work activities and earthworks are associated with the construction of the wind farm. The risks are significantly lower for an operational wind farm.

There have been no reported occurrences of ground instability or peat slides during the both the construction and operational phase of the Taurbeg Wind Farm.

Furthermore, walkover surveys at the Site, completed by HES in 2024, did not record any signs of peat instability. The survey consisted of a visual inspection of the existing infrastructure and drainage on site. The assessment found that the Site is, in general, in good condition with little or no rutting on access roads and adequate drainage provided. The site infrastructure in general appears to be founded on natural gravels below the level of the peat and clay upper layers. All turbine hardstandings were viewed and the interior road network was traversed by jeep as well as on foot. No signs of instability were recorded.

8.3.8.2 Proposed Offsetting Measures

8.3.8.2.1 *Introduction*

GDG completed a Peat Stability Risk Assessment Report (PSRA) (2025) for the Proposed Offsetting lands and is attached in Appendix 8-1.

The PSRA is restricted solely to the assessment of the Proposed Offsetting Measures. No peat is recorded in the northernmost Proposed Offsetting lands, which are currently comprised of agricultural pastures. The PSRA concentrates on the other 3 no. pockets of lands proposed for deforestation.

8.3.8.2.2 *Desk Study*

The GSI record a historic landslide immediately to the south of the Proposed Offsetting lands. This landslide event dates from 15th November 2020 and is described as a peat flow. Based on the inspection of recent aerial imagery, there appears to have been 2 no. peat slides in the lands to the southwest of the Proposed Offsetting lands (Area 4). The GSIs landslide susceptibility of the Proposed Offsetting lands was classified by the GSI (2023) as ranging from "low" to "high". The areas of high susceptibility are located on the western slopes of Mount Eagle.

8.3.8.2.3 Mount Eagle Bog Peat Slides

The PSRA states that 2 no. large peat slides have been identified as having occurred immediately adjacent to the Proposed Offsetting lands since 2012 (south of Area 4). The source zone associated with a pre-2019 peatslide, referred to in the PSRA as Mount Eagle – A, is located at a minimum distance of 150m east of the Proposed Offsetting lands, Meanwhile the source zone associated with Mount Eagle - B (peat slide dating from November 2020) is located 280m to the southeast. The Mount Eagle Bog Landslides have been assessed in detail by Fehily Timoney (FT) and the Geological Survey of Ireland (FT/GSI, 2024).

GDG completed detailed walkover surveys and peat probing in the areas of these historic peat slides. The PSRA concludes that the main conditioning factors which led to the peat slides included:

- The cutting of artificial drainage ditches parallel to topographic contours which may have resulted in localised surface water ponding, leading to increased lubrication and buoyancy at the base of the peat profile.
- Areas of extremely wet, saturated peat were recorded by GDG in the vicinity of the source zones with very low shear vane readings.
- The presence of a slight convex break in slope close to the assumed failure initiation points.
- The afforested and drained nature of the area is hypothesised to have contributed to disruption of the hydrological regime.
- Mount Eagle A is likely to have been instrumental in condition the failure of Mount Eagle B as it removed lateral and downslope support

GDG's walkover surveys also noted an area of significant peat scarps directly upslope of an area of extremely shallow peat 20-200m south of the Proposed Offsetting lands. Visible tension cracks were recorded on the scarps which are located in close proximity to a significant convex break in slope. GDG hypothesis that this area could represent an area of relic instability which pre-dates the afforestation. A second area with visible tension cracking was recorded ~260m south of the Proposed Offsetting lands and directly south of a firebreak. GDG state that this may represent the early stages of a peat failure.

8.3.8.2.4 Peat Stability Analysis and Assessment

An analysis of the risk of a peat slide occurring was carried out across the Proposed Offsetting lands.

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 8-4 below.

Table 8-4: Factor of Safety Limits.

Factor of Safety (FoS)	Slope Stability
FoS≥1.3	Stable and safe

Factor of Safety (FoS)	Slope Stability
1≤FoS<1.3	Stable but not safe
FoS	Unstable

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

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

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

The undrained loading condition applies in the short-term during the deforestation works and until works induced pore water pressures dissipate. A conservative value of 4kPA was adopted for the undrained shear strength across the Proposed Offsetting lands.

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

The factors of safety obtained for the two different conditions (undrained and drained) and for the two surcharge scenarios (no surcharge and 10kPa of peat surcharge (equivalent to 1m of peat) are presented in both table format and map format in the PSRA and are summarised below. The FoS was calculated at each peat probe location and was completed semi-automatically in GIS for the areas between the peat probes.

Undrained Analysis

For the undrained condition almost all areas of the Proposed Offsetting lands have an FoS>1.3 and are considered to be stable and safe. Some small areas along the southeastern and southwestern boundaries of Area 1 and 4 have an FoS<1, with these risk areas being caused by locally steeper slopes close the edge of the forestry, where the topography dips towards the local watercourse and towards machine excavated firebreaks.

For the undrained condition with a surcharge of 10kPa, the vast majority of the Proposed Offsetting lands are considered to be stable and safe (FoS>1.3). However, there are some areas in the north of Area 2 and along the south and eastern boundaries of Areas 1 and 4 which have an FoS between 1-1.3 or <1. The low FoS in the north corresponds to an area where there is no peat, and is not considered to represent a true risk. The risk areas along the southern and eastern boundaries are caused by locally steep slopes.

Drained Analysis

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

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

For the drained condition, almost all of the Proposed Offsetting lands are considered to be stable and safe, with only small areas on the southeastern and northern extremities of area 1 and 4 respectively (associated with local steep slopes in Areas 1 and 4) have an FoS<1.

Similarly, for the drained condition with a surcharge of 10kPA, only small areas along the on the southeastern and northern extremities of area 1 and 4 respectively of Areas 1 and 4 had FoS<1 with the vast majority of the lands returning FoS values >1.3.

8.3.8.2.5 *PSRA Conclusions*

The findings of the PSRA showed that the Proposed Offsetting lands predominantly have an acceptable margin of safety and are suitable for the Proposed Offsetting Measures. Some very localised areas are deemed to have a higher risk of instability due to local topography. It is considered that these areas do not present a significant peat slide risk if the mitigation measures outlined in Section 8 of the PSRA are implemented, and that the residual risk is manageable.

Based on the available data, the fieldwork, and GDG's professional judgement, it is concluded that significant peat slides are unlikely on the Proposed Offsetting lands with diligent peat management and careful consideration of the peat conditions at the Proposed Offsetting lands during the Proposed Offsetting Measures.

8.4 Receptor Sensitivity and Importance

Based on the criteria set out in Table 8-2 above, the peat and soils at the Site and at the Proposed Offsetting lands can be classed as being of low importance as the peat is not designated in these areas.

The bedrock geology underlying the Site and the Proposed Offsetting lands can be classed as being of medium importance where the bedrock could be used on a sub-economic scale.

The land, peat, soils and bedrock geological formations at the Site and at the Proposed Offsetting lands will be included in the impact assessment due to their proximal location to the Proposed Project and the potential direct effects that the Proposed Project may have on these receptors.

All geological heritage sites have been screened out of the impact assessment due to their distant location from the Site and the Proposed Offsetting lands. There is no potential for effects to occur on these geological heritage sites.

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protected Area SPA will be included in the impact assessment as the Site and the Proposed Offsetting lands are located within this designated site.

The peat stability at the Site and at the Proposed Offsetting lands will also be included in the land, soils and geological impact assessment.

8.5 Characteristics of the Proposed Project

Planning permission is being sought for the Proposed Lifetime Extension of Taurbeg Wind Farm as permitted by Cork County Council under planning regulation ref N/2002/3608, for a further period of 10 years from the date of expiry (2026) per Condition no. 7 of the original planning consent issued, with decommissioning of the wind farm at the end of the proposed extension period.

The Proposed Project is described in full in Chapter 4 of this EIAR and relates to the extended operation of all elements of the existing wind farm and the Proposed Offsetting Measures for the purposes of hen harrier.

There are no alterations proposed to the existing wind farm infrastructure, therefore, there are no requirements for construction works or reinstatement works for the Proposed Lifetime Extension.

Typically, daily operational phase maintenance traffic will consist of four-wheel drive vehicles or vans with no off-road requirements.

During the Proposed Lifetime Extension, occasionally vehicles or plant may be necessary for maintenance of access roads, drainage networks and hardstands along with some minor landscaping works.

Small amounts of granular material may be imported to maintain access tracks and hardstands during the Proposed Lifetime Extension which will place intermittent minor demand on local quarries.

Meanwhile, the Proposed Offsetting Measures comprise the permanent removal of c. 105.5 ha of coniferous plantation forestry and the restoration of c17.7 ha of farmland for the benefit of hen harrier. Full details of the Proposed Offsetting Measures are also outlined in Chapter 4 and Appendix 7-7.

8.6 Likely Significant Effects and Associated Mitigation Measures

8.6.1 Do Nothing Scenario

If the Proposed Lifetime Extension were not to proceed, the existing Taurbeg Wind Farm turbines will be decommissioned in 2026, as per the existing permission.

During decommissioning of the wind farm, it is intended to limit groundworks other than to rehabilitate constructed areas such as turbine bases and hardstanding areas. This will be done by covering with topsoil to encourage vegetation growth and reduce run-off and sedimentation. The turbines will be removed and transported off-site and the turbine concrete bases will remain in the ground and backfilled.

A Decommissioning Plan is proposed as part of the Proposed Lifetime Extension. This is presented in Appendix 4-3 of this EIAR.

8.6.2 Proposed Offsetting Measures - Likely Significant Effects and Mitigation Measures

There are no proposed construction works associated with the Proposed Lifetime Extension.

The only works associated with the Proposed Project relate to the Proposed Offsetting Measures. These works are assessed in terms of the land, soils and geological environment below.

8.6.2.1 Potential Effects on Landcover/Land Take Due to Proposed Offsetting Measures

The main objective of the Proposed Offsetting Measures is to create, maintain and improve habitats for the benefit of hen harrier. It is proposed to permanently remove c. 105.5 hectares of plantation forestry which will create more biodiverse upland habitats suitable for foraging hen harrier. Approximately 10ha of felled material will be permanently removed offsite, with the remaining 95.5 ha of felled material being stacked into windrows on site.

Regarding the farmland area, this land will be permanently restored for the benefit of hen harrier through restoration measures such as planting and restoring of hedgerow, implementation of a rotational grazing scheme, linear wildlife crop sowing, cease on fertiliser application and predator fencing. The Proposed Offsetting Measures will have a positive effect on the land environment in these areas.

Pathway: Deforestation, targeted offsetting measures in the agricultural field including grassland management, wildlife crop planting and hedgerow maintenance.

Receptor: Land and Landcover.

Potential Pre-Mitigation Effect: Significant, positive, direct, likely, long term effect on land and landcover in Areas 1, 2 and 4. Moderate, positive, direct, likely, medium-term effect on land in Area 3.

Impact Assessment:

The effect will be the loss of ~17.7ha of managed agricultural land and ~105.5ha of coniferous forestry. These areas will be replaced by grassland and open heath/bog habitats.

The Proposed Offsetting lands are located within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. The site synopsis report for this SPA states that almost half of this designated site is forested. A conservation objective for this SPA is to restore the extent and quality of the open heath and bog/scrub habitats which provide important nesting and foraging resources for the Hen Harrier. Therefore, the Proposed Offsetting Measures are in line with the conservation objectives of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA and will have a positive effect on the land environment.

Post Mitigation Residual Effect: The likely effect on land following the implementation of the Proposed Offsetting Measures is a significant, positive, direct, long term effect on land in Areas 1, 2 and 4 as these lands will be permanently deforested and with the land reverting to heath and open bog habitats. Meanwhile, a slight, positive, direct, long-term effect on Area 3 as the land will return to its current landuse at the end of the lifetime extension period.

Significance of Effects: For the reasons outlined above, it is considered that there will be a significant positive effect on landcover as a result of the Proposed Project.

8.6.2.2 Potential Effects Due to Erosion of Exposed Subsoils and Peat During Deforestation Associated with the Proposed Offsetting Measures

Deforestation is a major component of the Proposed Offsetting Measures with ~105.5ha of coniferous forestry proposed for deforestation.

During deforestation, there is a high likelihood of erosion of peat and spoil due to the disturbance of soils and subsoils associated with vehicle and plant movements. This also has associated potential effects on the aquatic environment, and therefore this aspect is further assessed in detail in Chapter 9 Hydrology and Hydrogeology.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Peat and subsoils.

Pre-Mitigation Potential Effect: Negative, direct, slight, likely effect on peat and subsoils due to disturbance associated with deforestation.

Proposed Mitigation Measures:

The scheduling of deforestation activity aims to ensure that the local environment including the local peat and subsoils are protected. Deforestation is in line with current best practice guidelines with all coupes being under 25ha.

Furthermore, all proposed deforestation works will be in accordance with the best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte and Forest Service guidance documents to ensure that deforestation results in minimal potential negative effects on the local peat, soil and subsoil environment.

In addition, the following mitigation measures will be implemented during deforestation operations:

- Before any works are completed silt fences will be installed to limit the movement of entrained sediment in surface water runoff;
- The harvester and the forwarder are designed specifically for the forest environment and are low ground pressure machines;
- All machinery will be operated by suitably qualified personnel;

- These machines will traverse the site along specified off-road routes (referred to as racks or brash mats);
- Brash mats will be placed on all routes off the forest road to support the vehicles on soft ground, reducing peat and mineral soil disturbance, compaction and erosion and avoiding the formation of rutted areas, in which surface water ponding can occur;
- As deforestation progresses, the harvester will collect brash produced by the deforestation and place it in front of the machine before it advances forward along the brash mat;
- The condition of the brash mats will be continually monitored and fresh brash will be applied when the brash mat becomes heavily used and worn, ensuring that the mat remains effective throughout the deforestation works; and,
- The location of brash mats will be chosen to avoid wet and potentially sensitive areas.

Post Mitigation Residual Effect: The proposed deforestation works will result in the disturbance and erosion of peat and subsoils. However, with the implementation of mitigation measures outlined above the residual effect is a negative, direct, insignificant, likely effect on peat and subsoils due to disturbance associated with deforestation operations.

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

8.6.2.3 Potential Contamination of Soil by Leakages and Spillages During the Proposed Offsetting Measures

Accidental spillage of petroleum hydrocarbons during refuelling of plant using in the Proposed Offsetting Measures 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 aquatic environment.

Pathway: Peat and subsoil and underlying bedrock pore space.

Receptor: Peat and subsoil, bedrock.

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

Proposed Mitigation Measures:

- All road-going vehicles will be refuelled off-site;
- On-site re-fuelling will be required for forestry and excavator machinery;
- The on-site refuelling will be undertaken at a dedicated refuelling area at the existing entrance to Area 2. The refuelling will be completed using a double skinned bowser with spill kits kept on site for accidental leakages or spillages;
- The bowser will be refilled by a fuel lorry;
- Absorbent materials and pads will be kept on site in the event of accidental spillages;
- Only designated trained operatives will be authorised to refuel plant;
- Taps, nozzles or valves associated with refuelling equipment will be fitted with a lock system;
- Fuels stored on-site will be minimised. All storage areas will be bunded appropriately for the duration of the Proposed Offsetting Measures. All bunded areas will be fitted with a storm drainage system and an appropriate oil interceptor. Ancillary equipment such as hoses, pipes will be contained within the bunded area;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and

signs of damage;
- The plant used during Proposed Offsetting Measures will be regularly inspected for leaks and fitness for purpose; and,

Post Mitigation Residual Effect: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with projects involving works. 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 and subsoils and bedrock.

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

8.6.2.4 Potential Effects on Peat Stability

A Peat Stability Risk Assessment Report (PSRA) was completed by GDG at the Proposed Offsetting lands. The approach presented in the PSRA is in compliance with the guidelines for geotechnical/peat stability risk assessment as given in PLHRA (2017) and MacCulloch (2005). The peat stability risk assessment is attached in full as Appendix 8-1.

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on the surrounding environment. The potential significant effects of peat failure at the Proposed Offsetting lands 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.

The key hazards posed to peat stability during the deforestation works include the application of surcharge by plant tracking and by the placement of windrows.

However, the findings of the PSRA showed that the Proposed Offsetting lands predominantly have an acceptable margin of safety and are suitable for the Proposed Offsetting Measures. Some very localised areas are deemed to have a higher risk of instability due to local topography and additional mitigation measures have been proposed in these areas.

Pathway: Vehicle movement and placement of windrow.

Receptor: Peat and subsoils.

Pre-Mitigation Potential Effect: The findings of the PSRA showed that the Proposed Offsetting lands have an acceptable margin of safety, are suitable for the Proposed Offsetting Measures and is considered to be at low risk of peat failure. The pre-mitigation residual effect is considered to be - Negative, significant, direct, long term, likely effect on peat and subsoils.

Proposed Mitigation Measures:

Firstly, the key mitigation with regard peat stability risk at the Proposed Offsetting lands was the completion of a robust, multidisciplinary, multi-phased site investigation and peat stability risk assessment carried out in accordance with best practice guidance (PLHRAG, Scottish Government, 2017). The Proposed Offsetting lands have been selected using an iterative process to remove areas of higher risk for peat instability.

The findings of the PSRA, which involved analysis at 111 no. locations within the Proposed Offsetting lands, showed that these lands have an acceptable margin of safety and are suitable for the Proposed Offsetting Measures. The nature of the Proposed Offsetting Measures, which do not include any excavations, further limit the potential for a peat slide.

Notwithstanding the above, the management of peat stability and appropriate work practices will be inherent during the Proposed Offsetting Measures to ensure peat failures do not occur on site.

The following control measures will ensure the management of the risks for this site:

- Deforestation will be completed during periods of low rainfall;
- Appointment of experienced and competent contractors;
- The forestry works will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project to proceed safely with all peat stability mitigation measures;
- Set up, maintain and report findings from monitoring systems, including sightline monitoring (installation of monitoring posts is recommended where works are taking place in areas where peat depths exceed 2m. Monitoring posts should be observed at least once a day);
- Maintain vigilance and awareness through Tool-Box-Talks on peat stability;
- Prevent undercutting of slopes and unsupported excavations;
- Prevent placement of loads/overburden on marginal ground;
- Manage and maintain a robust drainage system;
- Surface water drainage plans should be implemented to account for modified flows created by the works, which in turn may affect peat stability;
- Store felled material including windrow in permitted areas only;
- A method statement and risk assessment which considers the potential causes and mitigations of peat instabilities and landslide is required and must be regularly communicated to all site staff. An observational approach by all site staff to the ground conditions and the risks should be promoted and any changes in the ground or site conditions should be reported and the risk dynamically assessed.

The PSRA identifies 5 no. Safety Buffer Zones where the low FoS value is caused by local factors such as locally higher slopes and do not represent a significant stability risk, provided the following mitigation measures are adhered to:

- The Safety Buffer Zones are to be marked out with warning tape;
- No large plant is permitted to enter these zones; and,
- No logs, windrows, stone or other material will be temporarily or permanently placed in these zones.

Material Storage Areas (18 no.) have also been identified in the PSRA where there is a low risk of instability in the natural state but are unsuitable for storage of materials. The mitigation measures prescribed for these areas include:

- No logs, windrows, stone or other materials will be temporarily or permanently placed in these areas;
- Any trees removed in these areas will be immediately removed and placed/stored at an appropriate locations;
- Plant used in these areas will be low ground bearing and only necessary plant will be used here; and,
- No excessive quantity or size of plant will be stored in these areas.

Where excessive movement has been observed in the installed monitoring (sightline monitoring) the following measures will be undertaken:

- All works will be suspended in the area;
- A competent Geotechnical Engineer will carry out an assessment of the peat instability including drainage. The competent Geotechnical Engineer will compile a report outlining the surveys undertaken, the potential cause of the instability, assessment of any increased risk caused by the instability, and the further measures required to manage this risk,
- An increased monitoring regime will be specified including increase in number of monitoring post lines, decrease on monitoring post spacing and an increase in the frequency of monitoring post observations,
- Should no further movement be detected, activities will be recommenced while maintaining the increased monitoring regime,
- Should further excessive movement be detected, the geotechnical engineer will need to be informed and the design of further reinstatement works will be required such as excavation of the disturbed material, installation of a granular berms or similar.

Post-Mitigation Residual Effect: A detailed PSRA has been completed for the Proposed Offsetting lands. The findings of that assessment have demonstrated that there is a low risk of peat failure as a result of the Proposed Offsetting Measures. With the implementation of the control measures outlined above the residual effect will be - Negative, imperceptible, direct, unlikely, long term effect on peat and subsoils.

Significance of Effects: No significant effects on soils and subsoils will occur.

8.6.3 Extended Operational Phase - Likely Significant Effects and Mitigation Measures

Very few potential direct impacts are envisaged during the Proposed Lifetime Extension. These may include:

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

8.6.3.1 Potential Effects Associated with Site Road Maintenance

In relation to indirect effects a small amount of granular material will be required to maintain access tracks/site roads during the Proposed Lifetime Extension 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 nearby 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.

8.6.3.2 Potential Effects Associated with 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 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.

There have been no accidental spillages or leakages of hydrocarbons at the Site to date.

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:

Adherence to the Operational and Environmental Management Plan (refer to Appendix 4-2 of the EIAR) with regard to the use of oils and fuels on the Site.

- Vehicles used during the Proposed Lifetime Extension will be refuelled off site before entering the site;
- Spill kits will be available in all site vehicles to deal with an accidental spillage and breakdowns; and,
- An emergency plan for the extended operational phase to deal with accidental spillages and breakdowns will be contained in the Operational and Environmental Management Plan.

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.

8.6.3.3 Potential Effects from Oils in Transformers

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

There have been no recorded spills or leaks of oils at the Site to date.

Pathway: Peat, subsoil and bedrock pore space.

Receptor: Peat, subsoil and bedrock.

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

Proposed Mitigation Measures:

- All transformers and substation areas are bunded to 110% of the volume of oil used in each transformer/substation; and,
- An emergency plan for the extended operational phase to deal with accidental spillages will be contained in the Operational and Environmental Management Plan.

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

8.6.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the existing Taurbeg Wind Farm will be similar to those associated with construction of the Taurbeg Wind Farm but of reduced magnitude due to the measures as detailed in the proposed Decommissioning Plan.

Upon decommissioning of the existing Taurbeg Wind Farm, the wind turbines will be disassembled. All above-ground turbine components will be separated and removed off-site. It is proposed to leave turbine foundations in place underground and to cover them with soil and reseed as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option as excavation works can be avoided.

It is proposed that site roadways will be left in situ, as appropriate and where required, to facilitate on-going access and any commercial forestry uses. It is proposed to leave underground cables in place where they are below a level likely to be impacted by typical agricultural works.

During decommissioning, it will be possible to reverse or at least reduce some of the potential impacts caused by the construction of Taurbeg Wind Farm by rehabilitating areas such as turbine bases, hard standing areas. This will be done by covering hardstand areas with peatland vegetation/scraw or poorly humified peat to encourage vegetation growth and reduce run-off and sedimentation. During the decommissioning works tried and tested, best practice, mitigation measures will be implemented at the site with respect to hydrocarbons and will ensure that there is no potential for the contamination of the soils and geological environment. However, as noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) technological advances and preferred approaches to reinstatement are likely to change during the Proposed Lifetime Extension. 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 of the Taurbeg Wind Farm.

The deforestation of 105.5ha of forestry and the restoration of 17.7ha of farmland for the benefit of hen harrier will be a permanent change on the land environment. There is no decommissioning phase associated with the Proposed Offsetting Measures.

8.6.5 Risk of Major Accidents and Disasters

Due to the nature of the Site (i.e. mountainous terrain with peat covered slopes) the main risk of a major accident or disaster would be associated with a peat slide.

However, the Taurbeg Wind Farm has been in operation for over 19 years without any major accidents or disasters, therefore none are likely to occur during the proposed 10-year lifetime extension.

Furthermore, the Proposed Lifetime Extension comprises the extension of life of an existing wind farm and no further construction works are proposed at the Site. Therefore, there will be no excavation or movement of peat which could contribute to instability. Geotechnical inspections of the Site and the existing infrastructure have not found any signs of instability and concluded that the site is in good condition.

Therefore, given the results of the geotechnical engineers combined with the absence of any construction works, the residual risk of a landslide occurring at the Site is determined to be negligible/none.

With regards to the Proposed Offsetting lands, the PSRA states that due to the high factors of safety and negligible risk of peat landslides identified on site, it is not anticipated that peat failure will occur on site. However, in the event of peat failure (e.g. tension cracking, surface rippling, sliding), the following measures will be implemented by the contractor:

- All members of the project team will be alerted immediately or as it is safe to do so;
- All site works will be ceased with immediate effect, and all available resources will be used for the management and mitigation of the risks posed by the event;
- Localised peat slides that do not present a risk to watercourses will be stabilised where possible by rock infill and granular material (to be sourced from nearby quarries). The area will then be assessed by competent engineers, and further stabilisation measures will be implemented where necessary; and,
- The key initial activity will be to prevent displaced materials from reaching any watercourses or sensitive environments. Given the terrain of the Proposed Offsetting lands, the key risk is the development of a propagation landslide or slip within topographic valleys and watercourses. Where possible, catch ditches on land or within these topographic valley and watercourses will be constructed to prevent further run out of the disturbed peat or spoil material.

The contractor will be responsible for providing suitable contingencies outlined within the Proposed Offsetting Measures method statement that will be prepared prior to the commencement of the works. The contractor will additionally need to undertake a confirmatory PSRA prior to the commencement of the Proposed Offsetting Measures.

8.6.6 Assessment of Health Effects

Potential health effects arise mainly through the potential for soil and ground contamination. The existing Taurbeg Wind Farm is not a recognized source of pollution (e.g. it's not a waste management site, or a chemical plant), and so the potential for effects during the Proposed Lifetime Extension are negligible.

Hydrocarbons will be used onsite during operation; however the volumes will be very small in the context of the scale of the Site and will be handled and stored in accordance with the Operational and

Environmental Management Plan and best practice mitigation measures. The potential worst case residual effects associated with soil or ground contamination are imperceptible and therefore, subsequent health effects are imperceptible.

8.6.7 Potential Cumulative Effects

As there is no requirement for significant excavations/earth works, there is no potential for significant cumulative effects in-combination with the grid connection and other local developments on the land, soils and geology environment.

Other projects outside the Site do not have the potential to reduce or increase the magnitude of effects of the Proposed Lifetime Extension on Land, Soils and Geology as off-site indirect effects will not occur due to the Proposed Lifetime Extension.

The only way the Proposed Lifetime Extension or Proposed Offsetting Measures can have cumulative effects with other off site projects and plans is via the drainage and off site surface water network, and this hydrological pathway is assessed in Chapter 9 Hydrology and Hydrogeology.

8.6.8 Post Construction Monitoring

None required.