8 SOILS AND GEOLOGY

8.1 INTRODUCTION

This chapter assesses the effects of the proposed Tirawley Wind Farm development (i.e. the Proposed Development) on the soils and geology environment. Where significant adverse effects are likely, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Proposed Development:

- Construction of the Proposed Development
- Operation of the Proposed Development
- Decommissioning of the Proposed Development (final phase)

The Proposed Development refers to all elements of the application for the construction and operation of the proposed Tirawley Wind Farm (**Chapter 2: Development Description**). This chapter of the EIAR is supported by Figures provided in Volume III and by the following Technical Appendix document provided in **Volume IV** of this EIAR:

- **Technical Appendix 8.1** Peat Stability Risk Assessment. Whiteford Geoservices Ltd. 15th April 2026

A Construction Environmental Management Plan (CEMP) is appended to the EIAR in **Technical Appendix 2.1**. This document will be developed further into a Site-Specific Tirawley Wind Farm CEMP post consent / pre-construction once a contractor has been appointed. The CEMP will cover the construction of the Proposed Development. It will include all of the mitigation recommended within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Technical Appendix 18.1**.

8.1.1 Assessment Structure

In line with the revised EIA Directive and EPA EIAR Guidelines 2022 the structure of this Soils and Geology chapter is as follows:

- Details of the assessment methodology utilised for desk and field studies, in the context of legal and planning frameworks.
- Description of baseline conditions at the Wind Farm Site.
- Identification and assessment of effects to soils and geology associated with the Proposed Development, during the construction, operational and decommissioning phases of the Proposed Development.
- Mitigation measures to avoid or reduce the effects identified.
- Identification and assessment of residual effect of the Proposed Development considering mitigation measures.

- Identification and assessment of cumulative effects, if and where applicable. This Chapter of the EIAR has been prepared by John Whiteford, Whiteford Geoservices Limited (WGL).

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.2.1 Assessment Methodology

The following assessments were undertaken in order to evaluate the potential effects of the Proposed Development on the soils, geology and ground stability aspects of the environment at the Wind Farm Site:

- Characterise the topographical, geological and geomorphological regime of the Proposed Development from the data acquired through desk study and onsite surveys.
- Consider ground stability issues as a result of the Proposed Development, its design and methodology of construction.
- Assess the combined data acquired and evaluate any likely effects on the soils, geology and ground stability aspects of the environment.
- If effects are identified, consider measures that would mitigate or reduce the identified effect.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

8.2.2 Relevant Legislation and Guidance

This assessment complies with the European Directive 2014/52/EU which requires Environmental Effect Assessment for certain types of major development before development consent is granted. This assessment was undertaken in accordance with the following Irish legislation (transposition of the aforementioned directive):

- SI No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

In addition to this planning legislation, environmental legislation relevant to geological, geotechnical, hydrological and hydrogeological aspects of the environment were referred to, such as:

- SI No. 30 of 2000: Planning and Development Act 2000 (e.g. Sections 212 (1) f; Part IV, 6; Fifth Schedule Condition 21).
- SI No. 600 of 2001: Planning and Development Regulations 2001,
- SI No. 4 of 1995: The Heritage Act 1995,
- SI No. 33 of 2000: The Wildlife (Amendment) Act, 2000.

The Mayo County Development Plan (2022-2028) was also consulted as part of the EIA process.

This assessment has been prepared using, inter alia, the following guidance documents, which take account of the aforementioned legislation and policy:

- Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Guidelines.
- Environmental Protection Agency (EPA) (2015) Advice Notes for Preparing Environmental Impact Statements – DRAFT September 2015 (Supersedes 2003 version).
- EPA (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports – May 2022 (Supersedes 1997, 2002 and 2017 versions)
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A Guide.
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry.
- National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1.
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance.
- BSI (1999) Code of Practice for Site Investigations - BS 5930.
- NPWS (2015) National Peatlands Strategy.
- DHPLG (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change and Wind Energy Development Guidelines 2006.

8.2.3 Desk Study

A desk study consisting of a review of all available datasets, information, and literature resources relevant to the Wind Farm Site has been completed. The most current datasets and information maintained by the Environment Protection Agency (EPA), Geological Survey of Ireland (GSI), Ordnance Survey of Ireland (OSI) and the National Parks and Wildlife Service (NPWS) were reviewed to assist in establishing the hydrological and hydrogeological characterisation of the Wind Farm Site. This involved the following components:

- Acquire and compile relevant available maps of the Proposed Development.
- Study and assess the proposed locations of turbines, Site Access Tracks and 110 kV Substation relative to available data onsite topography and slope gradients.
- Study and assess the proposed locations of turbines, Site Access Tracks and 110 kV Substation relative to available data onsite soils, subsoil and bedrock geology.
- Study and assess the Peat Stability Risk Assessment (PLHRA), (**Appendix 8.1**).
- Overlay Ordnance Survey of Ireland (OSI) 1:250,000, 1:50,000 and 1:10,560 (6") maps with AutoCAD plan drawings.
- Overlay Geological Survey of Ireland (GSI) Geology maps (1:100,000) to determine site bedrock geology and the presence of any major faults or other anomalies.
- Overlay Geological Survey of Ireland (GSI) Landslide Susceptibility maps to determine site landslide susceptibility risk classification.
- Overlay Environmental Protection Agency (EPA) and Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil at the Wind Farm Site.
- Search of the GSI landslide database for records of landslide mass movement events at and near the Study Area.
- Search of National Parks and Wildlife Service designated sites of Co. Mayo.

8.2.4 Field Work

8.2.4.1 Preliminary Geotechnical Investigations, Site Walk Over and Observations

Following completion of the desk study, an initial site walkover survey was undertaken by J. Stothers and J. Whiteford in October 2022 and then further augmented by additional fieldwork in August 2023, March 2024 and November 2025. Fieldwork consisted of the following:

- A site visit and walkover assessment of the main Wind Farm infrastructure and Grid Connection Route (GCR).
- Determination of soil and peat characteristic at each turbine consisting of probing and hand auguring to determine soil / peat thickness, shear vane testing and an assessment of peat decomposition according to Von Post.
- Reconnaissance to identify sensitive receptors with respect to potential peat, soils landslide.
- Identification of potential pre-failure indicators, failure preconditions and potential triggers within the vicinity of the main infrastructure.
- Preliminary determination of superficial soils at the main infrastructure.

As a result of this preliminary assessment, peat soils were determined to be a particular risk with respect to the Proposed Development. In order to further assess the significance of the

risk from peat stability and landslide hazard, further detailed site investigations were undertaken, as per the recommendations contained in Peat Landslide Hazard and Risk Assessment: Prepared for Energy Consents Unit, Scottish Government Second Edition 2017, hereafter referred to as "the Scottish Guidance".

These site investigations consisted of the following campaign:

- Bedrock and sub-soils outcrop logging and characterisation at proposed turbine locations.
- Detailed peat depth probing within the footprint of the Wind Turbine Foundation and hardstand where access permitted.
- Gouge core samples of the soils, peat and superficial soils were also recovered along with additional shear strength and peat decomposition data.

8.2.5 Evaluation of Potential Effects

8.2.5.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development (EPA, 2017). The EPA provides guidance on the assessment methodology, including defining general descriptive terms in relation to magnitude of effects however, in terms of qualifying significance of the receiving environment the EPA guidance also states that:

"*The value of the superficial/ solid geology should be identified to allow an assessment of the effect of the proposed development to be considered adequately*" (EPA, 2015)

Potential effects arising from a proposed development in terms of soils and geology will be limited to a localised scale, and therefore in describing the sensitivity of soils and geology it is appropriate to rate such while considering the value of the receiving environment or site attributes. To facilitate the qualification of geological attributes, guidance specific to land and soils as set out by National Roads Authority (NRA), and guidance specific to landscape as set out by Scottish National Heritage (SNH) has been used in conjunction with EPA guidance.

The following table presents rated categories and criteria for rating site attributes (NRA, 2008).

Table 8.1: Criteria for Rating Site Attributes – Soils and Geology Specific

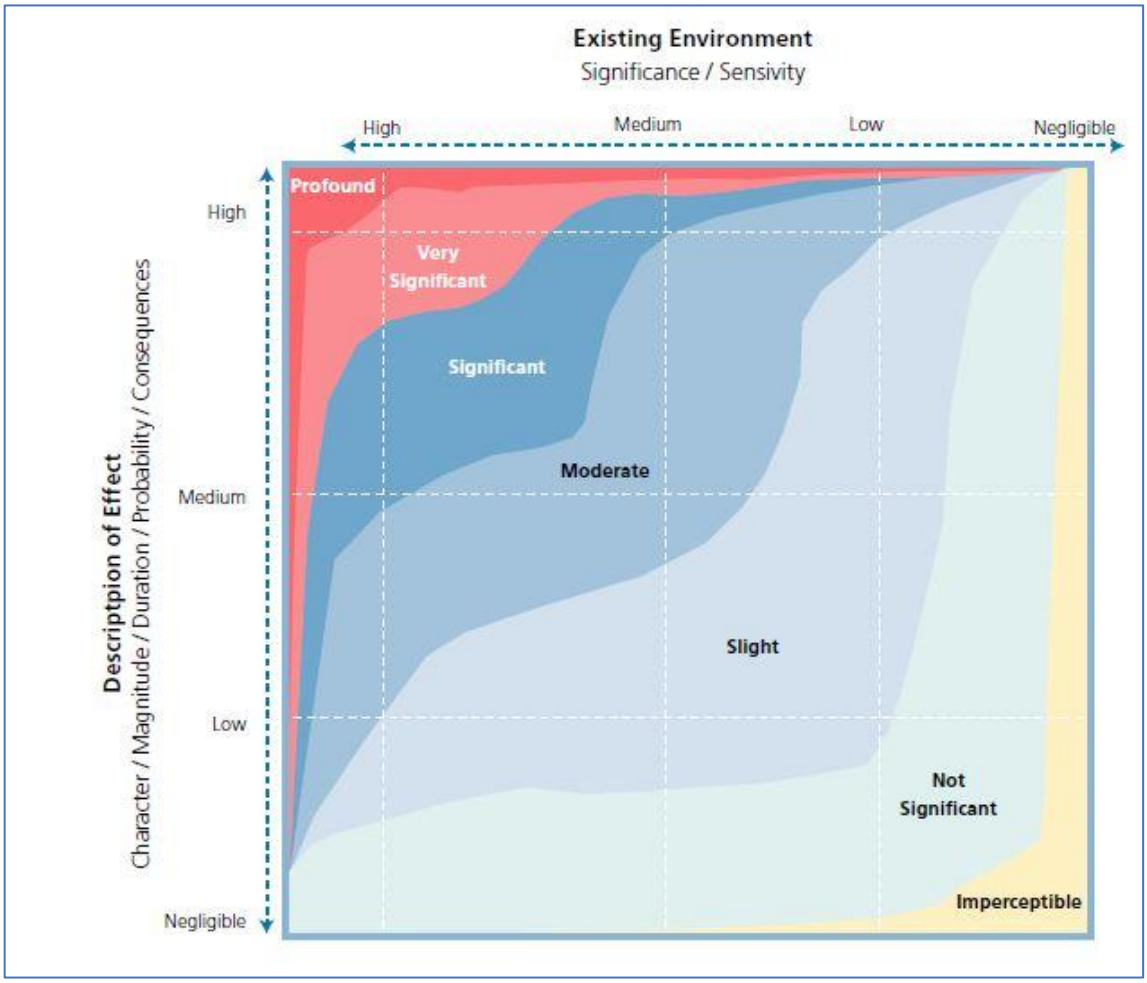
Importance	Criteria	Typical Examples
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying route is significant on a national 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 route 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,	Contaminated soil onsite with previous light industrial usage

Importance	Criteria	Typical Examples
	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 route is moderate on a local scale*	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 route 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

*Relative to the total volume of inert soil disposed of and/or recovered

The sensitivity of the receiving geological environment is defined by the baseline quality, as well as its potential to absorb change and for substitution.

The diagram shown in **Graph 8.1** presents how comparison of the character of the predicted effect to the sensitivity of the receiving environment can determine the significance of the effect (EPA 2022, Graph 3.4).



Graph 8.1: Comparison of the Character of the Predicted Effect to the Significance / Sensitivity of the Receiving Environment (EPA, 2022)

8.2.5.2 Magnitude

The magnitude of potential effects arising as a product of the Proposed Development are defined in accordance with the criteria provided by the EPA, as presented in the following table (EPA 2022 graph 3.4). These descriptive phrases are considered general terms for describing potential effects of the Proposed Development, and provide for considering baseline trends, for example, a Moderate effect is one which *is consistent with the existing or emerging trends*.

Table 8.2: Describing the Magnitude of Effects

Magnitude of Effect	Description
Imperceptible	An effect capable of measurement but without noticeable consequences.
Slight	An effect that alters the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with the existing or emerging trends.
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An effect which obliterates all previous sensitive characteristics.

In terms of soils and geology, magnitude is qualified in line with relevant guidance, as presented in the following table (NRA, 2008). These descriptive phrases are considered development specific terms for describing potential effects of the Proposed Development, and do not provide for considering baseline trends and therefore are utilised to qualify effects in terms of weighting effects relative to site attribute importance and scale.

Table 8.3: Qualifying the Magnitude of Effect on Soil and Geological Attributes

Magnitude of Effect	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of the majority (>50%) of geological heritage feature.
Moderate Adverse	Results in effect on integrity of attribute or loss of part of attribute.	Removal of part (15-50%) of geological heritage feature.
Small Adverse	Results in minor effect on integrity of attribute or loss of small part of attribute.	Removal of small part (<15%) of geological heritage feature.
Negligible	Results in an effect on attribute but of insufficient	No measurable changes in attributes.

Magnitude of Effect	Description	Example
	magnitude to affect either use or integrity.	
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.

8.2.5.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential effects, rating of significant environmental effects is done in accordance with relevant guidance, as presented in **Table 8.4** below which is, in effect, a risk matrix.

This matrix qualifies the magnitude of potential effects, based on the weighting of these effects in light of their importance and/or sensitivity of the receiving environment. In terms of Soils and Geology, the general terms for describing potential effects (**Table 8.2: Describing the Magnitude of Effects**) are not linked directly with the Development specific terms for qualifying potential effects (**Table 8.3: Qualifying the Magnitude of Effect on Soil and Geological Attributes**) therefore, both descriptive (**Table 8.4**) and qualifying (**Table 8.5**) terms are used in describing potential effects of the Proposed Development. This is largely driven by the likely localised characteristic of potential effects arising as a product of the Proposed Development in terms of Soil and Geology, and the separation of land areas based on baseline conditions (**Section 8.5**).

Table 8.4: Weighted Rating of Significant Environmental Effects

Sensitivity (Importance of Attribute)	Magnitude of Effect			
	Negligible (0-2%)	Small (2-15%)	Moderate (15-50%)	Large (>50%)

Sensitivity (Importance of Attribute)	Magnitude of Effect			
Extremely High	Slight / Moderate	Significant	Profound	Profound
Very High	Slight	Significant / Moderate	Profound / Significant	Profound
High	Slight / Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

8.2.5.4 Scoping Responses and Consultation

Information has been provided by a number of consultee organisations during the assessment, and this is summarised in **Table 8.5**. The response to each point raised by consultees is also presented within the table, demonstrating where the design of the Proposed Development has addressed responses to specific issues indicated by respective consultees.

Table 8.5: Scoping Responses and Consultation

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
Health Service Executive (West) (Environmental Health Service)	Email dated 06/03/23	<u>Generally, the Environmental Impact Assessment should examine all likely significant effects and provide the following information for each:</u> a) Description of the receiving environment b) The nature and scale of the effect c) An assessment of significance of the effect d) Proposed mitigation measures e) Residual effects The applicant should also consider the findings if the High Court judgement issued in the judicial review of the Derryadd Wind Farm. (2021 IEHC 390 [20202 No. 557 JR] P. Sweetman v An Bord Pleanála) The HSE will consider **the final EIAR accompanying the planning application** and will make comments to the planning authority on the methodology used for assessing the likely significant effects and the evaluation criteria used in assessing the significance of the effect. This report only comments on the Environmental Impacts of the proposed development. It is based on an assessment of the correspondence submitted to this office dated 6th January 2023. <u>Decommissioning Phase</u> The EIAR should detail what the eventual fate of the turbines and associated material will be, i.e. will the material be recycled or how will it be disposed of. Information should also be provided regarding the	Analysis of the baseline, including nature and scale, in respect to existing land, soils and geology is presented in section **8.3 Baseline Description**. An analysis of potential effects is presented in **section 8.4 Assessment of Potential Effects**. Proposed mitigation and Residual Effects is detailed in **section 8.5 Mitigation measures and Residual Effects.** Potential effects, mitigation and residual effects relate to all phases of the Proposed Development. A detailed Peat Landslide Hazard Assessment has been undertaken in line with the appropriate guidance. For the full report refer to **Technical Appendix 8.1**.

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		proposed methodology to be used for the disposal of the materials forming the foundations of the wind turbines. The EIAR should indicate the proposed future use of the wind farm site at the end of the planning permission period. <u>Siting, Location and details of Turbines</u> The EIAR should include a map and a description of the proposed location of each of the proposed wind turbines. The Environmental Health Service expects that details (height and model) of the turbines to be installed will be available at the time planning permission is sought and will be included in the EIAR. Details of turbine foundation structures, including depth, quantity and material to be used should be included in the EIAR. <u>Surface and Ground Water Quality</u> The proposed development has the potential to have a significant effect on the quality if both the surface and ground water. All drinking water sources, both surface and ground water, that maybe affected by this proposed development, must be identified. Public and Group Water Scheme sources and supplied should be identified in addition to any private wells supplying potable water houses in the vicinity of the proposed development. Measures to ensure that all sources and supplies are protected should be described.	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		The Environmental Health Service recommends that a walk over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes. Any potential significant effects to drinking water sources should be assessed. Details of bedrock, overburden, vulnerability, groundwater flows, aquifers and catchment areas should be considered when assessing potential effects and any proposed mitigation measures. Any effects on surface water as a result of construction of the underground cables should be identified and addressed in the EIAR. <u>Geotechnical and Peat Stability Assessment</u> A detailed assessment of the current ground stability of the site for the proposed wind farm extension and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the effect construction work may have on the future stability of ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion. Information should be provided on the make and model of the turbines and on construction details for the turbine foundations, including depth and volume of concrete required. An accurate assessment pf the potential effects of the foundations on water quality and peat stability cannot be undertaken without this information.	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		The Environmental Health Service recommends that a detailed Peat Stability Assessment should be undertaken to assess the suitability of the soil for the proposed development. The EIAR should include provision for a peat stability monitoring programme to identify early signs of potential bog slides ('pre-failure indicators' see the Scottish Government's 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments 2017). <u>Cumulative Effects</u> All existing or proposed wind farm developments in the vicinity should be clearly identified in the EIAR. The effect on sensitive receptors of the proposed development combined with any other wind farm developments in the vicinity should be considered. The EIAR should include a detailed assessment of any likely significant cumulative effects of the proposed renewable energy development.	
Inland Fisheries Ireland (IFI)	Email Dated 12/06/2023	Response received 12/06/2023 *"The proposed site crosses numerous watercourses including the Cloonaghmore River, Gortmore Stream and numerous smaller costal watercourses. The Cloonaghmore River provides important salmon, brown trout and sea trout habitat. The Cloonaghmore River is under environmental pressure and salmon stocks have declined below their conservation limit, that is the number of adult salmon returning to spawn required for a sustainable fishery. All catchments within the proposed area have been allocated good ecological status in the River Basin*	Land. Soils and geology have the potential to cause indirect effects on these sensitive environments. For these reasons watercourses, waterbodies and groundwater aquifers have been assessed in detail as part of the baseline assessment (see **section 8.3**) and assessment of potential effects (see **section 8.4**). Mitigation employed to reduce

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		Management Plan and this must be maintained to comply with the Water Framework Directive. The coastal rivers *No development or activity should be permitted in these catchments that may hinder or prevent the recovery of salmon stocks or the protection of their ecological status.* *The EIS should assess the potential effects the proposed development may have included damage to the aquatic and associated riparian habitat, pollution of water, changes to hydrology, introduction of non-native species and interference with upstream and downstream movement of aquatic life. The assessment should include all aspects of the development, which includes the construction of 31 wind turbines, turbine foundations, hardstanding areas, borrow pit, access tracks, electrical substation, grid connection, facilitating works on the public road network and at private properties to accommodate the delivery of turbine components etc. IFI request the following be assessed as part of the EIA.* 1. *All watercourses that will receive drainage from the construction site including the turbines or the access roads must be assessed.* 2. *Several watercourses/drains may exist on site which are not marked on the OSI maps and must be subject to the proposed aquatic buffer zone and surveys.* 3. *Groundwater vulnerability ranges from moderate to extreme across the site. The location of turbines and main construction works must avoid high groundwater vulnerability areas.*	adverse potential effects are provided in **section 8.5.** The specific risk from peat landslide has been captured in a peat landslide hazard assessment which has been undertaken for the Proposed Development. **Refer to Technical Appendix 8.1**.

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		4. The GSI Landslide Susceptibility Classification for the site ranges from low to moderate. All parts of the proposed development including roads, turbines, excavation and deposition area must be restricted to the low landslide susceptibility areas. A geotechnical survey must be carried out and the potential for soil movement and landslides should be assessed fully for all areas of the site and all proposed activities including borrow pits, peat deposition sites, settlement ponds, turbines and access roads. The effect these works will have either directly or by vibration on the stability of the soils should be assessed. Site stability monitoring may be required during the construction phase of the proposed development. *5. The effect of site drainage must be assessed including the pumping of waters from excavations such as turbine excavations. Settlement ponds and other silt treatment/mitigation measures must be engineered to ensure sufficient retention times are provided for sediment settlement. The silt traps should be designed to minimise the movement of silt especially during intense precipitation events where silt traps maybe hydraulically overloaded. It is essential that they are located with good access to facilitate monitoring, sampling and maintenance.* *6. Watercourse crossings existing on site or along the proposed delivery routes must be assessed to determine if works will be required to facilitate site access and the potential effects of such works. The locations and design of any proposed new watercourse*	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		crossings should be provided. IFI requests consultation in relation to the design; length, slope and width of any instream structure, temporary or permanent. Clear span structures such as Bailey bridges should be used where possible. There must be no negative effect on fish passage because of the proposed development. 7. *No watercourse diversions are to be carried out to facilitate the development including site roads.* 8. *An assessment of the site transport routes must be carried out to identify any bridge or culvert replacement or improvement works. Including temporary modifications to facilitate turbine delivery to site.* 9. *All instream works or other works which may affect directly on a watercourse should only be carried out during the open season which is from 1st July to 30th of September (to avoid effecting on the aquatic habitat during the spawning season.) It would be important that this is included in the contract for construction.* 10. *It is recommended that a suitably qualified person be on site for the duration of works to ensure:* • *All mitigation measures identified are implemented prior to and during the construction phase, as appropriate.* • *Continual assessment to ensure the mitigation measures are effective including assessment of adjacent peats for cracking/instability.*	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		• *Cessation of works should slippage indicators develop and/or settlement arrangements are inadequate for suspended solid removal in surface waters.* • *Arrangements are established in relation to a contact protocol for the relevant statutory bodies on progress of works.* *In summary IFI request the following to be addressed:* • *Water quality* • *Surface water hydrology* • *Areas of natural heritage importance* • *Sediment transport"*	
Geological Survey of Ireland	Email Dated 21/03/2023	**Geoheritage** Killala Area, Co. Mayo (GR 121833, 327262), under IGH theme: IGH 7 Quaternary. This field of discrete glaciotectonic ridges and interspersed glacial features form a body of tectonised proglacial features west of the Moy Estuary, in a coastal embayment. The Site covers an area ~7 km wide (west-east) at its widest point, along a coastal strip of almost 5 km north-south, on the western side of the estuary, and includes numerous ridge features. Link to Site Report: MO068. With the current plan, there are no envisaged effects on the integrity of current CGSs by the Proposed Development. However, if the Proposed Development plan is altered, please contact Clare Glanville	These aspects have been considered for the preparation of this Chapter together with the data sources suggested. Our findings in relation to these aspects are included in the following sections:- Analysis of the baseline, including nature and scale, in respect to existing land, soils and geology is presented in **section 8.3 Baseline Description.** An analysis of potential effects is presented in **section 8.4 Assessment of Potential Effects.**

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		(Clare.Glanville@gsi.ie) for further information and possible mitigation measures if applicable. **Groundwater** The Groundwater Data Viewer indicates aquifers classed as a 'Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones', a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones' and a 'Locally Important Aquifer - Bedrock which is Generally Moderately Productive' underlie the Wind Farm site boundary and grid connection route. The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas. (GWFlood) and the data may be useful in relation to Flood Risk Assessment (FRA) and management plans. Maps and data are available on the Map viewer. Geological Survey Ireland has completed Groundwater Protection Schemes (GWPSs) in partnership with Local Authorities, and there is now national coverage of GWPS mapping. A Groundwater Protection Scheme	Proposed mitigation and Residual Effects is detailed in **section 8.5 Mitigation measures and Residual Effects.** A detailed Peat Landslide Hazard Assessment has been undertaken in line with the appropriate guidance. For the full report refer to **Technical Appendix 8.1.**

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		provides guidelines for the planning and licensing authorities in carrying out their functions, and a framework to assist in decision-making on the location, nature and control of developments and activities to protect groundwater. The Groundwater Protection Response overview and link to the main reports is here: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/projects/protecting-drinking-water/what-is-drinking-water-protection/county-groundwater-protection-schemes/Pages/default.aspx **Geological Mapping** Geological Survey Ireland maintains online datasets of bedrock and subsoils geological mapping that are reliable and accessible. We would encourage you to use these data which can be found here, in your future assessments. Please note we have recently launched QGIS compatible bedrock (100K) and Quaternary geology map data, with instructional manuals and videos. This makes our data more accessible to public and external stakeholders. QGIS compatible data can be found in our downloadable bedrock 100k .zip file on the Data & Maps section of our website. **Geohazards** Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides, flooding and	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		coastal erosion are the most prevalent of these hazards. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so. 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 boundary area. Geological Survey Ireland has information available on landslides in Ireland via the National Landslide Database and Landslide Susceptibility Map both of which are available for viewing on our dedicated Map Viewer. Associated guidance documentation relating to the National Landslide Susceptibility Map is also available. Geological Survey Ireland also engaged in a national project on Groundwater Flooding. The data from this project may be useful in relation to Flood Risk Assessment (FRA) and management plans and is described in more detail under 'Groundwater' above. **Natural Resources (Minerals/Aggregates)** Geological Survey Ireland provides data, maps, interpretations and advice on matters related to minerals, their use and their development in our Minerals section of the website. The Active Quarries, Mineral	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		Localities and the Aggregate Potential maps are available on our Map Viewer. We would recommend use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. In keeping with a sustainable approach, we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed wind farm development are sustainably sourced from properly recognised and licensed facilities, and that consideration of future resource sterilization is considered. **Geophysical data** Geological Survey Ireland produces high-resolution geophysical data (Magnetic field, electrical conductivity, natural gamma-ray radiation) of soils & rocks as part of the Tellus programme. These data currently cover approximately 75% of the country and provide supporting geological information on a regional scale useful for assessing environmental impact and risk. investigation works for large scale projects. **Guidelines** The following guidelines may also be of assistance: • Institute of Geologists of Ireland, 2013. Guidelines for the Preparation of the Soils, Geology and Hydrogeology Chapters of Geology in Environmental Impact Statements.	

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		• EPA, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)	
Rescoping 2025/2026			
Geological Survey of Ireland (GSI)	Received 21/01/2026	Geological Survey Ireland is the national earth science agency and is part of the Department of Climate, Energy and the Environment. We provide independent geological information and interpretation and gather various data for that purpose. Please see our website for data availability. With reference to your email received on the 12 December 2026, concerning the proposed Tirawley Wind Farm, Co Mayo - Scoping Request, we recommend using our various data sets when conducting the EIAR, SEA, planning and scoping processes for developments, plans and policies. For more detailed information on how to access this data please access 'Data and Maps' Data & Maps (gsi.ie) on our 'Geoscience for planning' webpage. Use of our data or maps should be attributed correctly (please refer to each individual dataset's metadata for correct attribution). For specific data available for Environmental Assessment and Planning topics please follow this link [Data by Environmental Assessment and Planning Topic (gsi.ie)], where you will find our data arranged by environmental assessment topic. Other Comments Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. The data would be redacted for confidentiality and added to Geological Survey Ireland's	Detailed information in respect of soils and geology, available through the GSI online mapping portal, has been consulted for the preparation of **Chapter 8**.

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to the Geological Mapping Unit, at mailto:GeologicalMappingInfo@gsi.ie. If we can be of any further help, please do not hesitate to contact me Clare Glanville, or my colleague Trish Smullen at GSIPlanning@gsi.ie.	
Health & Safety Authority (HSA)	Received 13/12/2025	I wish to acknowledge receipt of your correspondence dated 26/11/2025, regarding the above. The Health and Safety Authority (the Authority), acting as the Central Competent Authority under the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. 209 of 2015) gives technical advice to the Planning Authority when requested, under regulation 24(2) in relation to: (a) the siting and development of new establishments; (b) modifications to establishments of the type described in Regulation 12(1); (c) new developments including transport routes, locations of public use and residential areas in the vicinity of establishments, where the siting, modifications or developments may be the source of, or increase the risk or consequences of, a major accident. Your correspondence appears to be outside the scope of the above and we have no comments to forward	The design of the Project has involved an iterative process of design, where one of the major constraints has been proximity of the main infrastructure to sensitive receptors. **Chapter 8** has reviewed the potential effects associated with the proximity of construction, operation and decommissioning work to all forms of sensitive receptor. The potential for Peat Landslide to occur is separately considered in **Technical Appendix 8.1.**

8.3 BASELINE DESCRIPTION

8.3.1 Introduction

An investigation of the existing land, soils and geology characteristics of the study area was conducted by undertaking a desk study, consultation with relevant authorities and site-based fieldwork surveys. All data collected has been interpreted to establish the baseline conditions within the study area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

8.3.2 Site Description

The proposed Wind Farm Site is located within the townlands of Ballymurphy, Ballynaleck, Barnhill Lower, Barnhill Upper, Barroe, Billoos, Carn, Carrickanass, Carrowmore, Castlelackan Demesne, Castletown, Conaghra, Glebe, Lackanhill, Lecarrowntemple, Lissadrone East and Lissadrone West.

8.3.3 Haul Route

The Turbine Delivery Route (TDR) and the Construction Haul Routes (CHR) will utilise Site Entrance [1-14]. The Site Entrances are shown on (**Figure 2.1**).

There are currently three proposed options haul route options:

Option 1: It is proposed that turbine nacelles, tower hubs and rotor blades will be landed in Killybegs Port (Donegal). From there, they will be transported to the Wind Farm Site via the R263, N56, N15, N4, N59, L-1141, R294, L-1119, N59, L-1108, R315, L-51722, L-51732 and the R314 as shown on **Figure 2.7**.

Option 2: It is proposed that turbine nacelles, tower hubs and rotor blades will be landed in Galway Port (Galway). From there, they will be transported to the Wind Farm Site via the R339, R336, N83, N17, N5, L-1331, N5, N58, N26, N59, L-1108, R315, L-51722, L-51732 and the R314 on **Figure 2.8**.

Option 3: It is proposed that turbine nacelles, tower hubs and rotor blades will be landed in Foynes Port (Limerick). From there, they will be transported to the Wind Farm Site via the N67, N69, N18, M18, M17, N17, N5, L-1331, N5, N58, N26, R294, N59, L-1108, R315, L-51722, L-51732 and the R314 as shown on **Figure 2.9**.

8.3.4 Grid Route

The new 110 kV Onsite Substation at Tirawley Wind Farm will connect via underground 110 kV cable, over a length of 13.55 km, through the townlands of Barroe and onto the townlands of Carrad More, Rathbaun, Carrickanass, Cloonavarry, Doonamona, Rathcash, Castlereagh, Rathowen West, Rathowen East, Magherabrack, Cloonawillin, Killala, Mullafarry, Lisglennon, Tawnaghmore Lower, Ballinteean and Carrowreagh, before

connecting to the existing Tawnaghmore 110 kV Substation in the townland of Tawnaghmore Upper.

8.3.5 Bedrock Geology

According to the GSI online database the Wind Farm Site is predominantly underlain by the Downpatrick Formation, with the Moyny Point Limestone Member and Mullaghmore Sandstone Formation also present within the Wind Farm Site boundary.

These rock formations can be described as follows: -

The Downpatrick Formation

A sequence of interbedded sedimentary rock types comprising near shore marine mudstones and siltstones; alluvial and deltaic sandstones and siltstones and fully marine bioclastic limestones interbedded with calcareous shales.

The Moyny Point Limestone.

Characterised by tabular-bedded limestone and shale.

The Mullaghmore Sandstone Formation

A series of cyclical units of siltstones and shales which coarsen upwards into medium to coarse grained sandstones.

8.3.6 Soils and Subsoils

A study was made of available geological information for the area (OSI Online Database) and this together with preliminary geotechnical investigations were employed to assess the natural geology present across the Wind Farm Site. These studies indicate the following prevailing soils and geology:

Organic Topsoil or Peat (Blanket Peat), overlying,

Glacial Till derived from Sandstones and Limestones

Partially weathered to destructured Sandstone and Siltstone rock was occasionally exposed within shallow excavations.

Groundwater was often a feature of the investigations.

8.3.6.1 Peat Depths

Peat depths within the Redline Boundary of the main site are given in **Table 8.6** below.

Table 8.6: Peat Depth Distribution by Category

Peat Depth Category	Number of Survey Points (% of total)
0.00 m to 0.50 m	1988 (86.1%)
> 0.50 m to 1.00 m	289 (12.5%)

Peat Depth Category	Number of Survey Points (% of total)
> 1.00 m to 2.00 m	31 (1.3%)
>2.00 m to 3.00 m	1 (<0.1%)
>3.00 m to 4.00 m	1 (<0.1%)
>4.00 m	0 (0%)

The table shows that the majority of the peat covering the Redline Boundary area of the main site lies in the range of 0.00 – 0.50 m in thickness. Peat thickness of 0.50 m or less are considered negligible and further stability assessment is not required.

Only 13.9% of the Wind Farm Site recorded peat thickness in excess of 0.50 m. The median peat depth recorded was 0.33 m, with a mean depth over the main site of 0.36 m.

8.3.7 Geological Resource Importance

The Geological Survey of Ireland (GSI) website for this area shows that there are no active quarries close to the Wind Farm Site. The nearest active quarry is as follows:

1. Mullafarry Quarry (Limestone rock) 6.1 km southeast of Tirawley Wind Farm and 2.5 km southwest of Killala.

No records of shafts or adits associated with mineral exploration have been recorded within the immediate vicinity. Some copper, lead, zinc and iron mineralisation has been exploited locally, but these localities are all historic and the workings disused. There is no evidence that sufficient concentrations of such minerals exist within the locality to currently warrant commercial exploitation.

The lands upon which Tirawley Wind Farm are categorised by GSI to range from very low to very high for crushed rock aggregate potential. Approximately 70% of the site is categorised to be of very low to moderate crushed rock aggregate potential and 30% to be high and occasionally very high crushed rock aggregate potential.

Although, the rock formations underlying the development have some limited potential for use as an aggregate resource the lack of any existing commercial quarry enterprise in the immediate vicinity indicates that either the rock quality is too variable or of insufficient strength / durability to be exploitable as a commercial economic resource.

8.3.8 Features of Geological Heritage

The Geological Survey of Ireland (GSI) also maintains a database for known Geological Heritage Sites in Ireland. Details of the sites are taken from the GSI website and reproduced in **Tables 8.7A** to **8.7G** below.

Table 8.7A: Audited Geological Site at Killala Area

Site Code	MO068
Site Name	Killala Area
IGH Theme 1	IGH7
County	Mayo
Description	An extensive area of ridges on the west side of the Moy Estuary at Killala
Designation	CGS.
Geological	Proglacial glaciotectonic landforms
Coordinates (IG)	121833, 327262
Coordinates (ITM)	521801.407, 827268.915

Table 8.7B: Audited Geological Site at Bartragh Island

Site Code	MO00
Site Name	Bartragh Island
IGH Theme 1	IGH13
County	Mayo
Description	A long and narrow sandy island that separates the shallow, south-western area of Killala Bay from the open water to the northeast.
Designation	CGS.
Geological	Coastal Geomorphology
Coordinates (IG)	124257, 329803
Coordinates (ITM)	524224.851, 829810.269

Table 8.7C: Audited Geological Site at Ross Strand and Spinc

Site Code	MO091
Site Name	Ross Strand and Spinc
IGH Theme 1	IGH11
County	Mayo
Description	Rocky coastline and beaches on the west side of Killala Bay
Designation	CGS, recommended for Geological NHA
Geological	Tertiary gabbro, Killala/Ross Gabbro
Coordinates (IG)	122386, 332913
Coordinates (ITM)	522353.671, 832919.379

Table 8.7D: Audited Geological Site at Kilcummin Head

Site Code	MO065
Site Name	Kilcummin Head
IGH Theme 1	IGH8
County	Mayo
Description	A low rocky and cliff coastline at the NW side of Killala Bay
Designation	CGS, recommended for Geological NHA
Geological	Glacial features, Lw. Carb. Rocks
Coordinates (IG)	120613, 337730
Coordinates (ITM)	520581.645, 837735.014

Table 8.7E: Audited Geological Site at Downpatrick Head

Site Code	MO050
Site Name	Downpatrick Head
IGH Themes 1, 2 & 3	IGH8, IGH13 & IGH3
County	Mayo
Description	A rocky shoreline, sheer cliffs, sea-caves, blowholes and a sea-stack.
Designation	CGS, recommended for Geological NHA.
Geological	Fossiliferous rocks, Trace fossils, Caves, Blowholes, Sea Stack, sea cliffs
Coordinates (IG)	112350, 342190
Coordinates (ITM)	512319.995, 842193.931

Table 8.7F: Audited Geological Site at Stella Maris

Site Code	MO096
Site Name	Stella Maris
IGH Theme 1	IGH8
County	Mayo
Description	A coastal section of exposed strata on the west side of Bunatrahir Bay.
Designation	CGS, recommended for Geological NHA
Geological	Sandstone, Limestone
Coordinates (IG)	109556, 340267

Site Code	MO096
Coordinates (ITM)	509526.779, 840271.927

Table 8.7G: Audited Geological Site at Brookhill Delta

Site Code	MO019
Site Name	Brookhill Delta
IGH Theme 1	IGH7
County	Mayo
Description	Sand and gravel pit on the crest of a ridge near Ballycastle
Designation	CGS, recommended for Geological NHA
Geological	Glaciomarine delta foresets
Coordinates (IG)	109202, 337439
Coordinates (ITM)	509172.930, 837444.526

8.3.9 Landslide Susceptibility

The GSI maintains a Landslide Susceptibility Map for Ireland.

These records indicate no significant historic soils and rock movement within the Wind Farm Site boundary, although such events are recorded within the region.

GSI landslide susceptibility mapping also shows that the site has a predominately low to moderately low landslide susceptibility, although small discrete areas of high susceptibility are also present within the Redline Boundary.

The closest landslide events are approximately 6.3 km northwest and 6.0 km southwest of the Redline Boundary.

8.3.10 Peat Slide Risk Assessment

A Peat Stability Hazard and Landslide Risk Assessment (PLHRA) for the Wind Farm Site was carried out by Whiteford Geoservices Limited (WGL).

The following schedule summarises the relevant hazard ranking, applicable post mitigation, to the main infrastructure at Tirawley Wind Farm:

1. Turbine AT01 and Site Access Track — NEGLIGIBLE hazard
2. Turbine AT02 and Site Access Track — NEGLIGIBLE hazard
3. Turbine AT03 and Site Access Track — NEGLIGIBLE hazard
4. Turbine AT04 and Site Access Track — NEGLIGIBLE hazard
5. Turbine AT05 and Site Access Track — NEGLIGIBLE hazard
6. Turbine AT06 and Site Access Track — NEGLIGIBLE hazard

7.	Turbine AT07 and Site Access Track	NEGLIGIBLE hazard
8.	Turbine AT08 and Site Access Track	NEGLIGIBLE hazard
9.	Turbine AT09 and Site Access Track	NEGLIGIBLE hazard
10.	Turbine AT10 and Site Access Track	NEGLIGIBLE hazard
11.	Turbine AT11 and Site Access Track	NEGLIGIBLE hazard
12.	Turbine AT12 and Site Access Track	NEGLIGIBLE hazard
13.	Turbine AT13 and Site Access Track	NEGLIGIBLE hazard
14.	Turbine AT14 and Site Access Track	NEGLIGIBLE hazard
15.	Turbine AT15 and Site Access Track	NEGLIGIBLE hazard
16.	Turbine AT16 and Site Access Track	NEGLIGIBLE hazard
17.	Substation and BESS	NEGLIGIBLE hazard
18.	Met Mast	NEGLIGIBLE hazard

8.3.11 Designated Sites

The following areas which lie close to the Wind Farm Site are designated according to the Government of Ireland's EPA Map Viewer:

- Glenamoy Bog Complex SAC / NHA (Ref 000500)
- Lackan Salt Marsh and Kilcummin head SAC / NHA (Ref 000516)
- Killala Bay/Moy Estuary SAC / NHA (Ref 000458)
- Bellacorick Bog Complex SAC / NHA (Ref 001922)
- Killala Bay/Moy Estuary SPA (Ref 004036)
- Creevagh Head NHA (Ref 000482)

8.4 ASSESSMENT OF POTENTIAL EFFECTS

8.4.1 Do Nothing Alternative

The "Do Nothing Alternative" is the effect on the site should the proposed Tirawley Wind Farm not be constructed. In this case, it is envisaged that the current land use would remain as it is now, with continued forestry and low intensity grazing for cattle and sheep. Other Do-Nothing Effects are detailed in **Table 8.8**.

Table 8.8: Do Nothing Effect

Item	Assessed Element	Assessed Condition Pre-Construction	Net Effect Anticipated Post-Construction
1	Water Regime – Response to Storm events	Combination of Mobile and Perched	Installation of an effective drainage network will result in a small net reduction in the

Item	Assessed Element	Assessed Condition Pre-Construction	Net Effect Anticipated Post-Construction
		groundwater at site of wind farm infrastructure. Because of lack of effective drainage storm events result in an elevated risk of soil movement.	risk of soil movement during storm events. Do Nothing results in: Slight negative effect.
2	Water Regime - Erosion of slopes	Current slopes within the site are susceptible to soil erosion during high rainfall events. Consequently, the risk of peat landslide is elevated.	Construction works tend to smooth / stabilise surface water run-off. This results in a slight improvement in landslide susceptibility at the site. Do Nothing results in: Slight negative effect.
3	Stabilisation of Soils	Peat Stability Assessment indicated some locations to be at a LOW hazard of landslide.	Construction works, using the mitigation protocols discussed, can be expected to result in a small net improvement in soil stability. Do Nothing results in: Slight negative effect.
4	Land Contamination	Negligible contamination of nature soils and groundwater was encountered at Tirawley Wind Farm.	There will be small negative effect to groundwater as a result of the construction of the new wind farm that will decrease following completion of construction, but will remain at a minor level throughout the lifetime of the wind farm. .

Item	Assessed Element	Assessed Condition Pre-Construction	Net Effect Anticipated Post-Construction
			The use of imported construction materials will mean that there will be a low to medium long-term effect on the soils and geology environment that will continue for at least the lifetime of the wind farm. Do Nothing results in: Slight positive effect.

8.4.2 Construction Phase Potential Effects

The Proposed Development is characterised by the following civil engineering works to provide the necessary infrastructure to complete the Tirawley Wind Farm as described in **Chapter 2: Development Description** of the Proposed Development:

- Construction of 16 no. Vestas V117 (4.3 MW) IEC IIA – T wind turbines. This specific model with a blade tip height of 135 m, was selected as the candidate turbine and its associated parameters were used to determine the significant environmental effects associated with the Proposed Development.
- Construction of permanent Turbine Hardstands and Turbine Foundations.
- Change the use of a residential site and vacant dwelling to a Permanent Operations Compound consisting of an operations office, storage area and staff parking.
- Construction of two Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. (35-year life cycle) meteorological mast with a height of up to 80 m and a 4 m lightning pole on top.
- Construct 5 no. new permanent Site Entrances as described in the EIAR **Chapter 17: Traffic and Transport** and **Figure 2.1**.
- Upgrade 9 no. existing Site Entrances as described in the EIAR **Chapter 17: Traffic and Transport** and **Figure 2.1**.
- Road construction works along the TDR and the site consisting of the construction of approximately 9.64 km of new Site Access Tracks through the Wind Farm Site. The upgrading of 1.76 km of Private Access Tracks within the Redline Boundary and along the TDR, to include, road verge widening, hedge trimming and all associated

infrastructure and drainage works as described in EIAR **Chapter 17: Traffic and Transport** and the TDR Report **Appendix 17.1**.

- Development of an internal site drainage network and sediment control systems.
- Construction of 1 no. permanent 110 kV electrical substation including control buildings with welfare facilities, all associated electrical plant and equipment, security fencing and gates, all associated underground cabling, wastewater holding tank and all ancillary structures and works.
- Installation of battery arrays located within container units (20 no. units) and associated electrical plant for grid stabilisation adjacent to the Onsite Substation building (with up to 150 MW storage capacity) with surrounding palisade fence 2.65 m in height.
- All associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation and battery arrays.
- All associated site development works including berms, landscaping, and soil excavation.
- Forestry felling of approximately 31.86 ha of coniferous forest will be required to facilitate the construction of the Proposed Development.
- All works associated with the permanent connection of the wind farm to the national electricity grid comprising of a 110 kV underground cable system in permanent cable ducts from the proposed, permanent, onsite substation, in the townland of Barroe to the existing Tawnaghmore substation at the Killala Business Park.
- Works for new and upgraded entrances include clearing visibility splays of vegetation, widening the entrances to allow HGVs turn onto local unnamed public roads and the R314, excavation to solid formation level, installation roadside drainage features, placing entrance sub-base with rockfill materials, placing capping level and providing surface dressing where necessary.
- Upgrade works on the TDR
- 3 no. peat and mineral soil storage areas within an abandoned quarry at Lacken Hill, together with 14 no. other discrete sites, within the Redline Boundary. Restoration of the abandoned quarry following completion of the construction phase and restoration of the wind farm following decommissioning.

The direct and indirect effects of the construction activities, and their expected duration are discussed further in the following sections. The effect on use of land and on natural resources required to carry out the works which relate to soils and geology is also discussed.

8.4.2.1 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur during construction excavation and is an unavoidable consequence of the Proposed Development. Removal of the soil and bedrock is considered to be a permanent effect as it would not normally be reversed although some reinstatement of the soils is possible after decommissioning. No further subsoil or bedrock removal will be required during operation. The overall potential effects here are considered to be of moderate significance, permanent and negative.

8.4.2.1.1 Land Take

Some land take will be required during the construction and operation of the wind farm. This will be required for construction of Site Access Tracks, Turbine Foundations, 110 kV Substation, Met Mast and for parts of the haul route which require temporary widening. Temporary land take would also be needed for construction of grid cables both on and off the site. The potential effects here are considered to be of moderate significance, permanent and negative.

8.4.2.1.2 Excavations

Excavations will be required for most aspects of the Proposed Development including for turbines, Turbine Hardstand areas, Site Access Tracks, haul route, Site compounds, cable trenches and GCR. Estimates of excavation areas are presented in **Chapter 2 Development Description**, **Section 2.6.15** and as volumes in **Section 8.4.2.1.11** of this report. The potential effects here are considered to be of moderate significance, permanent and negative.

8.4.2.1.3 Turbines and Hardstand areas

The material encountered at each turbine and infrastructure location is considered to be mostly shallow topsoil or peat overlying glacial till soils and bedrock. It is expected that excavations for the majority of infrastructure will be taken down to either bedrock or a suitably competent glacial till soil stratum is reached. Due to the depth of the excavation required for the Turbine Foundations (approximately 3.5 m), some excavation of rock may also be required. The exact depth of excavation will be determined at detailed design stage. Excavations will require imported granular fill material to upfill the excavation to the levels required for construction. This action is considered to have an insignificant, permanent, negative effect on the environment.

It is proposed that the granular fill material will be obtained from locally approved quarries considering the precise specification usually required for this type of material.

Preliminary ground investigation in the form of peat probing and gouge coring has been carried out to inform the depth of excavation and upfill required.

The potential effect of extracting material from external quarries includes extra pressure on transport routes and increased fuel consumption. This is discussed in **Chapter 17: Traffic and Transport**. Only licenced quarries will be used for this purpose. All imported material will be fully tested in accordance with industry standards. Only verified clean, inert material will used. The potential effects here are considered to be of moderate significance, permanent and negative.

8.4.2.1.4 Site Access Tracks

Site Access Tracks will be needed to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the Wind Farm. The tracks will be constructed using unbound crushed aggregates and incorporate drainage to maintain the performance of the pavement during wet weather.

The roads will be constructed in stable areas predominantly as founded or occasionally as floating roads (where required to fulfil some other geotechnical or environmental purpose). Founded roads are excavated down to and constructed up from a competent geological stratum (e.g. glacial till or rock), whereas floated roads are built directly on top of the peat and soft soils. The roads shall be constructed to average heights of 0.5 m to 1.0 m above existing ground level.

Preliminary ground investigations have been carried out to inform the depth of excavation and upfill required for the Site Access Tracks. The estimated volumes of excavated and imported materials are given in **Chapter 2**: **Development Description**.

Soil sealing is the covering of a soil with an impermeable material; it often affects agricultural land, puts biodiversity at risk and increases the risk of flooding. The use of impermeable material is an inevitable direct effect to some extent of most types of construction. Permeable geotextile is usually placed at the base of access tracks, along with other infrastructure, as part of their typical design. However, this will have an imperceptible, negative, permanent effect due to the relatively small footprint of infrastructure and its location.

The potential effect of extracting material from external quarries includes for the extra pressure on transport routes and increased fuel consumption. This is discussed in **Chapter**

17: Traffic and Transport. Only licenced quarries will be used. All imported material will be fully tested in accordance with industry standards. Only verified clean, inert material will used. The potential effects here are considered to be not significant, permanent and negative.

8.4.2.1.5 Site Haul Route

Haul Routes will generally use the existing public roads. However, some widening will be required at acute turns, within third party lands. Generally, the effects associated with this will be as per the Site Access Track construction but on a very minor scale and reversible. The effects are considered to be not significant, temporary, negative effects.

8.4.2.1.6 Bedrock Excavations

Bedrock excavations will be required at some of the Turbine Foundations, Turbine Hardstands, Site Access Track excavations and possibly for substation excavations. A detailed assessment of the bedrock character has not been undertaken at this stage; however, the initial visual assessment suggests that the bedrock will predominantly comprise weak to strong sandstone, siltstone or shale rock. A portion of this material should be suitable for re-use after crushing and screening and would be of use as granular fill for Site Access Track construction.

The detailed construction stage ground investigations will inform the quality and strength of the bedrock, where present. Heavy breakers will be required in areas where deep or large excavations are required in strong rock. Blasting will be avoided whenever possible. The long-term effects of bedrock excavation are considered to be not significant, permanent and negative.

8.4.2.1.7 Site Cable Trenches

Cable trenches throughout the Wind Farm Site will be excavated to an anticipated depth of 1.335 m, depending on the detailed design. Excavation of topsoil, peat, glacial till and bedrock will be required. Imported granular fill will be used to surround the cables, however the majority of the excavated soils will be used for backfilling with only minor amounts being removed and used elsewhere for berm landscaping. The effects associated with excavations for cable trenches are considered to be not significant, temporary and negative.

8.4.2.1.8 Grid Connection Cable

Grid connection trenches will also be excavated along the GCR to Tawnaghmore 110 kV Substation in the townland of Tawnaghmore Upper. The trenches will be predominantly

within roads and verges, to an anticipated depth of 1.335 m, depending on the detailed design. Excavation of road aggregates, topsoil, peat, glacial till and bedrock will be required. The trenches will be backfilled using imported granular material. The excavated material will be disposed of offsite as inert landfill or recycled for use elsewhere. The effects associated with excavations for cable trenches are considered to be not significant, permanent and negative.

8.4.2.1.9 Borrow Pit

No borrow pits are proposed as part of this Proposed Development.

8.4.2.1.10 Temporary Construction Compound

Two Temporary Construction Compounds (TCC) will be employed. The first compound is to the north of the Wind Farm Site and is currently a farmyard consisting of a hayshed, cattle shed and stables. See **Section 2.7.7**. The second is the Permanent Operations Compound. Refer to **Section 2.7.8.** The potential effects here are considered to be not significant, temporary and negative.

8.4.2.1.11 Volumes of Material to be Excavated

We anticipate the following quantities of Peat, Glacial Till soils and Rock to be generated during construction of the Wind Farm:

Infrastructure Element	**Topsoil / Peat (m^3)**	**Till / Bedrock (m^3)**
Turbine Foundations	4,223	27,286
Turbine Hardstands	27,202	9,005
Blade Laydown	26,608	0
Turbine Transformers	175	49
Site Access Tracks	25,868	10,347
Substation, BESS and Building	5,376	4,156
Met Mast	138	83
Temporary Compounds	1,350	810
Internal Cabling	2,364	1,891
110 kV Cable Trench	4,065	6,789
Totals	**97,507**	**60,444**

8.4.2.1.12 Summary of Effects Due to Subsoil and Bedrock Removal

A general summary of the pre-mitigation effects associated with subsoil and bedrock removal is presented in **Table 8.9**.

Table 8.9: Effect Summary – Subsoil and Bedrock Removal

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Subsoil and bedrock removal	Direct	Negative	Moderate	**Moderate**	Site	Conforms to baseline	Likely	Permanent

8.4.2.2 Storage and Stockpiles

8.4.2.2.1 Overview

It is expected that the majority of unusable spoil generated onsite will be either peat or glacial till mineral soils. It is expected that the majority of rock (and possibly minor quantities of glacial till) will be reused for the construction of Site Access Tracks. The peat will be placed (up to 3 m high) within a designated area at Lacken Hill. As a worst case, stockpiling of peat can give rise to increased pore pressures and the possibility of a bog burst or peat slide. Careful management of the spoil and ongoing landslide risk assessments will minimise the possibility of a landslide occurring.

A series of berms constructed from aggregate will be used to build a series of individual "cells" within the footprint of the existing quarry. These berms will be of sufficient size to safely confine both mineral soils and peat while filling operations progress.

Separate "cells" for mineral soil deposition and peat deposition will be employed. Prior to construction suitable drainage will be laid within the base of each "cell" and then covered by a thin layer of gravel and a permeable geotextile, such as "Terram".

Following construction of the rear and side berms (if required) infilling will commence, starting at the rear and working forwards until filled. Peat is anticipated to consolidate quickly following the inevitable loss of water content to site drainage but will nevertheless remain very weak. No further compaction is anticipated. The mineral soils will be compacted during deposition by means of the tracking of excavation plant and is expected to be relatively competent on completion of disposal works.

Following completion of spoil deposition works at the site, each "cell" will be closed off by means of a final aggregate containment berm. A certain amount of peat or topsoil will be

retained onsite in order to provide a thin layer of capping over the mineral soil "cell", placed before the "cells" are closed.

Final restoration will involve the seeding and planting of the top of the now filled quarry with a suitable mix of grasses and low shrubs.

The restored quarry will be included in the monitoring plan for the completed wind farm.

8.4.2.2.2 Spoil Management

The handling, management and re-use of excavated materials are of importance during the construction phase of the Proposed Development. Excavated material will arise from all infrastructure elements of the windfarm (foundations, tracks, hardstands etc.). Peat should be stockpiled no higher than 2 m and follow the recommendations set out in the NRA Guidelines for the Management of Waste from National Road Construction Projects (NRA, 2014). Where contained within a "cell" structure with perimeter berms constructed out of crushed rock, thickness of up to 3.0 m of peat spoil can be safely stored.

There is potential for a moderate negative effect on soil due to erosion of inappropriately handled excavated materials. However, any effects from the handling of excavated materials will be managed through good site practice. A robust sediment and erosion plan, greatly reduces the risk of erosion or sediment release to surface waters.

Organic matter loss can occur when wet peat is excavated and allowed to dry in the open air. Peat material is a major source of carbon, and the loss of organic matter leads to an emission source of carbon dioxide (CO_2) and nitrogen dioxide (NO_2). A Carbon Calculator can be found in **Chapter 10: Air Quality and Climate**, which addresses the effect of loss of carbon to the atmosphere through the drying out of peat excavated as part of the Proposed Development.

As per the provisions of the **Construction Environmental Management Plan (CEMP) Management Plan 4, Peat and Spoil Management Plan**, all peat and mineral soil spoil not suitable for re-use during the construction phase, will be stored at 17 no. designated storage areas located within the Redline Boundary. All excavated bedrock will be re-used for the construction of Site Access Tracks. The process of spoil management is expected to have a slight negative effect on the receiving environment.

8.4.2.2.3 Summary of Effects Due to Storage and Stockpiles

A summary of the pre-mitigation potential effects associated with soil/rock storage and stockpiles is given in **Table 8.10**.

Table 8.10: Effect Summary – Storage and Stockpiles

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Compaction, erosion and degradation of peat arising from vehicular movement	Direct	Negative	Moderate	Slight	Localised	Conforms to baseline	Likely	Long term / Permanent
Stability issues and slope failure arising from vehicular movement (Localised displacement)	Direct or Indirect / Secondary	Negative	Moderate	Slight	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent
Stability issues and slope failure arising from vehicular movement (Landslide – worst case)	Indirect / Secondary	Negative	Significant	Moderate	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent
Subsidence and settlement of newly established and upgraded Site tracks	Direct	Negative	Moderate	Slight	Localised	Conforms to baseline. Normal	Likely	Permanent
Compaction, erosion and degradation	Direct or Indirect /Secondary	Negative	Moderate	Slight	Localised	Contrast to baseline	Likely	Long term / Permanent

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
arising from vehicular movement (Localised displacement)								

8.4.2.3 Vehicular Movement

8.4.2.3.1 Overview

Vehicle movement will occur primarily during the construction phase of the Wind Farm. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). During the operation phase, vehicles will be limited to occasional maintenance vehicles only. Effects are considered to be slight, permanent and negative.

8.4.2.3.2 Compaction, Erosion and Degradation

Compaction of soils will occur during construction and to a limited extent during operation and decommissioning. In general, compacted soils will be excavated during construction, and access to soils away from hardstanding areas will be prevented. Ongoing compaction of soils will occur in areas of floated road construction, which will continue during operation and decommissioning. Compaction effects are considered to be not significant, permanent and negative.

Erosion and degradation of exposed soils will also occur, primarily during construction. Erosion and degradation effects are also considered to be not significant, permanent and negative.

8.4.2.3.3 Peat Stability and Slope Failure

The effects of peat stability and slope failure are discussed in **Section 8.3.10** and in the PLHRA in **Appendix 8.1**. Whilst the possibility of a peat slide is considered to be low, poorly managed construction activities (including traffic movement) can increase the risk. Any peat slide or slope failure which occurs will be localised due to the generally thin peat and the topography of the Wind Farm Site. However, given the proximity of several designated sites,

both to the north and south of the Wind Farm Site, any peat slide may result in some damage to nearby habitats. The effect of this is significant, permanent and negative.

8.4.2.3.4 Haul Route and Site Access Tracks

There will be few changes to the existing public roads except for temporary widening at locations on the haul route to allow a load bearing surface and temporary changes to two roundabouts along the haul route. Some compaction of the underlying soils may occur, although this will be slight. The effects associated with vehicle movements along the haul route is not significant, permanent and negative.

Vehicle movement along the Site Access Tracks will again result in a slight compaction of the underlying soils, particularly in areas where floated roads are constructed. The effects associated with vehicle movements along the Site Access Tracks is not significant, permanent and negative.

8.4.2.3.5 Summary of Effects Due to Vehicular Movement

A summary of the pre-mitigation effects associated with vehicle movement is given in **Table 8.11**.

Table 8.11: Effect Summary – Vehicular Movement

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Compaction, erosion and degradation of peat arising from vehicular movement	Direct	Negative	Moderate	Slight	Localised	Conforms to baseline	Likely	Long term / Permanent
Stability issues and slope failure arising from vehicular movement (Localised displacement)	Direct or Indirect / Secondary	Negative	Moderate	Slight	Localised / Potentially Regional	Contrast to baseline	Likely	Long term / Permanent
Stability issues and slope failure arising from vehicular movement (Landslide – worst case)	Indirect / Secondary	Negative	Significant	Moderate	Localised / Potentially Regional	Contrast to baseline	Unlikely	Permanent
Subsidence and settlement of newly established and upgraded Site tracks	Direct	Negative	Moderate	Slight	Localised	Conforms to baseline. Normal	Likely	Permanent

8.4.2.4 Soil Contamination

8.4.2.4.1 Overview

Use of waste materials during construction, operation and decommissioning will be minimised by good site practices and waste management plans. The following sections present the possible effects primarily associated with the use of construction plant.

8.4.2.4.2 Hydrocarbons

Wherever there are vehicles and plant in use, there is the potential for a direct hydro-carbon release which may contaminate the soil and subsoil. A spill has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution. Any spill of fuel or oil would potentially present a moderate, long-term negative effect on the soil and geological environment. Good site practice will mitigate any effect in both the short-term and long-term (refer to **Section 8.5**).

8.4.2.4.3 Wastewater and Sanitation

Wastewater/sewerage from the TCC with be placed in holding tanks, which will be emptied periodically. Chemicals will be used to reduce odours. The waste will be taken to a local wastewater sanitation plant for treatment. Wastewater or sewerage leakage is not anticipated in a responsibly managed site. The effects associated with wastewater and sewerage is considered to be not significant, permanent and negative.

8.4.2.4.4 Construction Materials

All construction materials will be stored in secure areas. Any hazardous materials will be correctly stored within properly bunded areas in accordance with good site practice and in accordance with the Site Management Plan. The effects associated with the construction materials is considered to be not significant, permanent and negative.

8.4.2.4.5 General Waste

All construction and operation waste materials will be correctly sorted, recycled or disposed of accordance with good site practice and in accordance with the Site Management Plan. A policy of Reduce, Reuse and Recycle will apply. The effects associated with waste materials is considered to be not significant, permanent and negative.

8.4.2.4.6 Summary of Effects Due to Soil Contamination

The Proposed Development has the potential to give rise to the following pre-mitigation soil contamination effects, shown in **Table 8.12** below:

Table 8.12: Effect Summary – Soil Contamination

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Hydrocarbon contamination	Direct	Negative	Moderate	Slight	Localised*	Contrast to baseline	Likely	Long term / Permanent
Wastewater Sanitation contamination – Waste	Direct	Negative	Slight	Slight	Localised*	Contrast to baseline	Unlikely	Temporary
Wastewater Sanitation contamination – Chemicals	Direct	Negative	Moderate	Slight	Localised*	Contrast to baseline	Unlikely	Long term / Permanent
Construction Material contamination	Direct	Negative	Moderate	Slight	Localised*	Conforms to baseline	Likely	Long term / Permanent
General Waste contamination	Direct	Negative	Moderate	Slight	Localised*	Conforms to baseline	Likely	Long term / Permanent
* Contamination of soils / peat by hydrocarbons is considered a localised effect, however if hydrocarbon contamination is intercepted by surface water features the effect is potentially regional								

8.4.3 Decommissioning of the Wind Farm

In general, the potential effects associated with decommissioning will be similar to those associated with construction but of reduced magnitude because extensive excavation, and wet concrete handling will not be required. The potential environmental effect of soil storage and stockpiling and contamination by fuel leaks will remain during decommissioning. Effects are considered to be of moderate significance, permanent and negative.

8.4.4 Cumulative Effects

Cumulative effects of the Proposed Development with other developments in the region, as discussed in **Chapter 4: Planning Policy** Context, relate to the indirect effects that may arise due to the use of public roads as hauls routes to bring these materials to site. **Chapter 17: Traffic and Transport** details the scenarios whereby the materials will be imported onto site and assess the cumulative effects.

8.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

This chapter outlines the main mitigation measures which will be applied to the Wind Farm in order to reduce the effects of the effects outlined previously.

8.5.1 Design Phase

8.5.1.1 Mitigation by Avoidance

The opportunity to mitigate any effect is greatest at the design period. In this respect, a detailed site selection process was carried out by the Developer. This process identified deep peat and shallow bedrock as specific geotechnical constraints. The detailed site selection process is described in **Chapter 3: Alternatives**. Furthermore, within the chosen site, areas of deep peat and shallow bedrock were identified, and the infrastructure design sought to avoid those areas as much as possible.

It is expected that founded tracks will constitute the majority of the Wind Farm Site, however, floating tracks will also be considered in areas to fulfil a geotechnical requirement, should it arise. There remain some risks associated with the Proposed Development that cannot be mitigated through design and need to be managed during construction. Mitigation through design is especially applicable in the risk to human health during a project and this shall be exercised to minimise the negative risks present.

8.5.2 Construction Phase

8.5.2.1 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur throughout the construction of the Wind Farm and is unavoidable. However, the effects associated with this removal will be minimised using the following practices.

8.5.2.1.1 Mitigation by Avoidance

As mentioned previously, areas of deep peat and shallow bedrock have been avoided during construction by careful design of the Wind Farm.

8.5.2.1.2 Mitigation by Good Practices

Best practice will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any works commencing onsite.

The majority of the excavated peat and mineral soil spoil will be placed in the designated spoil storage area at Lacken Hill. Localised areas of landscaping will be sealed and levelled using the back of an excavator bucket to prevent erosion. The spoil repository will be restored to match the local environment when filling operations are complete.

8.5.2.1.3 Mitigation by Reduction

The disturbance of soil, subsoil and bedrock is an unavoidable effect of the Proposed Development, but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the effect on the geological aspects of the site. The management of geological materials is a critical component of controlling dust and sediment and erosion control.

8.5.2.1.4 Mitigation by Reuse

Bedrock will be re-used for construction of Site Access Tracks wherever possible. The bedrock will comprise predominantly granite and quartzite which, when crushed and graded, should provide a good sub-base for Site Access Track construction.

Peat, overburden, and rock will be reused where possible onsite to reinstate excavated areas where appropriate. Where possible, the upper vegetative layer will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the landscaped peat. These measures will prevent the erosion of peat in the short and long term.

8.5.2.1.5 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This may include the TCC, turning areas and materials storage areas. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage measures will be reinstated as required in order to minimise future erosion of the soils.

8.5.2.2 Storage and Stockpiles

8.5.2.2.1 Mitigation by Avoidance and Good Practice

As discussed previously, the opportunity to mitigate any effect is greatest at the design period. In this respect, a detailed site selection process was carried out by the Developer. This process identified deep peat and shallow bedrock as specific geotechnical constraints. The detailed site selection process is described in **Chapter 3: Alternatives**. Furthermore, within the chosen site, areas of deep peat and shallow bedrock were identified, and the

infrastructure design sought to avoid those areas where possible. In this respect, by minimising volumes of excavation, volumes for storage and stockpiles will also be reduced. Best practice will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with the Construction and Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any site works commencing.

8.5.2.2.2 Mitigation by Reduction

Whenever possible, soil and rock will be re-used on the Wind Farm Site immediately, thereby reducing the need for double handling, which will also reduce the requirements to stockpile soils. Generally excavated rock will be used immediately for Site Access Track construction. Excess Topsoil, peat and non-reuseable mineral soil will be transported to the long-term storage at one of the 17 no. designated storage areas. Whenever possible stockpiles will be avoided. Stockpiles of rock on peat soils will be avoided to prevent instability. Peat will only be stockpiled temporarily to a maximum height of 2m in areas of thin or absent peat and only in areas of shallow ground slopes, which have been assessed for stability by a suitably experienced geotechnical engineer. In the case of the 3 no. spoil repositories at Lacken Hill, a "cell" arrangement with perimeter berms constructed out of crushed rock will be employed to locally confine spoil at heights of up to 3 m. The precise design of the spoil repositories will be developed further at construction stage when the benefit of further ground investigation will aid final design and restoration landscaping.

8.5.2.3 Vehicular Movements

Vehicular movements will be restricted to the footprint of the Proposed Development, particularly with respect to the newly constructed Site Access Tracks. This implies that machinery must be kept on tracks and will not move onto areas that are not permitted for the Proposed Development.

Vehicular traffic onsite is reduced through the re-use of excavated material onsite which will reduce the need to source material from external quarries.

8.5.2.3.1 Mitigation by Avoidance and Good Practice

As discussed previously, excavation volumes have been reduced during the design phase by avoiding areas of deep peat, shallow bedrock and by avoiding excessive cut and fill during construction. This will result in reduced excavation volumes and therefore reduced site traffic.

Best practice will be applied during construction which will minimise double handling, again reducing the Site traffic. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

Excavated peat will only be moved short distances from the point of extraction and will be used locally for landscaping, thus again reducing the onsite traffic. Excavated rock (and any glacial till) will be used for access track construction as close to the source of extraction as possible.

8.5.2.4 Ground Stability

8.5.2.4.1 Mitigation by Avoidance and Good Practice

As discussed previously, careful design of the wind farm has reduced the amount of construction required in areas of deep peat, high slopes and other areas of potential ground instability. Additionally, the following mitigation measures will also be applied as recommended in the PLHRA (included as **Appendix 8.1**):

- Avoidance of floating roads in areas where ground slopes exceed 5 degrees to the horizontal.
- Avoidance of stockpiling on the peat
- Avoidance of peat berms in areas of potential instability (highlighted by elevated hazard rankings), where ground slopes exceed 5 degrees to the horizontal
- Additional engineered drainage in areas of construction
- Avoidance of drains discharging onto areas of weak or deep peat or areas of elevated hazard ranking
- Avoidance of blasting within 1 km of areas highlighted by elevated hazard rankings

As noted in the PLHRA, vehicular access to any areas of deep peat (>1.0 m) during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat, in particular areas of deep peat and the areas of

potential instability highlighted in the PLHRA. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met.

8.5.2.4.2 Emergency Response

The Construction Environmental Management Plan (CEMP) will include an emergency response to be applied in the event of a landslide or ground instability. In particular, catch fences and other physical barriers (i.e. concrete blocks) should be onsite and available in sufficient quantities to be used in the event of ground instability. A plan should be made to prevent or divert any landslide away from protected areas (NHA, SPA, SAC).

8.5.2.5 Soil Contamination

The CEMP will be developed to include the checking of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the Proposed Development. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

8.5.2.5.1 Mitigation by Avoidance and Good Practice

A fuel management plan will be prepared (and included in the CEMP) which will incorporate the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Only designated trained operators will be authorised to refuel plant onsite.

8.5.2.5.2 Mitigation by Reduction

As discussed previously, careful design of the Wind Farm has reduced the amount of site traffic required onsite by reducing access tracks lengths, excavation volumes and double handling. Similarly, good site practice and a robust CEMP will also result in less traffic and a lower potential for fuel spills and leakages.

8.5.2.5.3 Emergency Response

Procedures and contingency plans will be set up to deal with an emergency accidents or spills. In particular an emergency spill kit with oil boom and absorbers will be kept onsite in the event of an accidental spill. All site operatives will be trained in its use.

8.5.2.6 Material and Waste Management

All materials used onsite, and wastes generated onsite will be reduced by good site practice and attention to the CEMP. A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from site for recycling. Any waste which is not recyclable or compostable will be properly disposed of landfill. Whenever possible, excavated materials will be re-used close to the area of excavation. Careful design will result in minimal excess soil and rock.

8.5.2.7 Construction Phase Residual Effects

The residual effects after implementation of all mitigation measures for the construction phase of the Proposed Development are presented in **Table 8.13**.

Table 8.13: Residual Effect Summary

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Subsoil and bedrock removal	Direct	Negative	Moderate	Moderate	Localised	Conforms to baseline	Unavoidable	Permanent
Storage of stockpiles (general)	Direct	Negative	Slight	Slight	Localised	Conforms to baseline	Likely	Temporary
Compaction, erosion and degradation of peat arising from vehicular movement	Direct	Negative	Slight	Slight	Localised	Conforms to baseline	Avoidable	Long term / permanent
Stability issues and slope failure arising from vehicular movement (Localised/ regional displacement)	Direct or Indirect / Secondary	Negative	Moderate	Moderate	Localised / Potentially Regional	Contrast to baseline	Avoidable	Long term / permanent
Subsidence and settlement of newly established and enhanced Site tracks	Direct	Neutral	Slight	Slight	Localised	Conforms to baseline.	Likely	Permanent
Localised stability issues arising during construction activities (Localised displacement)	Direct or Indirect / Secondary	Negative	Slight	Slight	Localised	Conforms to baseline	Avoidable	Long term / Permanent
Hydrocarbon contamination	Direct	Negative	Slight	Slight	Localised*	Contrast to baseline	Avoidable	Long term / Permanent

Effect Description	Type	Quality	Significance	Weighted Significance	Extent	Context	Probability	Duration / Frequency
Construction Material contamination	Direct	Negative	Slight	Slight	Localised*	Contrast to baseline	Avoidable	Long term / Permanent
General Waste contamination	Direct	Negative	Slight	Slight	Localised*	Contrast to baseline	Avoidable	Long term / Permanent
Note: * Contamination of soils / peat by hydrocarbons is considered a localised effect, however if hydrocarbon contamination is intercepted by surface water features the effect is potentially regional								

8.5.2.8 Operational Phase

All wastes from the control building and ancillary facilities will be removed by the appropriate contractor. The operational team will carry out maintenance works (to Site Access Tracks, 110 kV Onsite Substation and turbines) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the windfarm. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

The potential effects are limited by the size of the fuel tank of vehicles used on the site. There are no other mitigation measures proposed relating to soils and geology during the operational phase of the Proposed Development.

8.5.2.9 Operational Phase Residual Effects

The potential effects on the soil and geological environment during the operational phase of the work will be mitigated through good site practice; vehicular movements, hydrocarbon controls, sustainable use of natural resources, human health etc. as discussed previously. Overall, the residual effects from these aspects will have a not significant, permanent, negative effect on the site.

8.5.3 Development Decommissioning and Restoration Phases

8.5.3.1 Decommissioning of Infrastructure

Following the permitted lifespan of the wind farm, decommissioning of the infrastructure will occur or the site may be repowered with more modern turbines, subject to a separate planning application. All physical infrastructure (turbines, substation, mast etc.) will be removed, re-used or recycled as appropriate or upgraded if the site is to be repowered.

8.5.3.2 *Decommissioning Phase Residual Effects*

The residual effects associated with decommissioning includes waste generation, hydrocarbon leakage and erosion of soil and rock. In general, effects will be similar to those at construction and operation, but of a greatly reduced magnitude.

8.5.3.3 *Reinstatement of Redundant Access Track and Hardstand Areas*

Where possible, redundant Site Access Tracks, turbine bases and hardstand areas will be reinstated. Some of the Site Access Tracks and hardstanding areas, if not required during operation, will be reinstated. Areas of excess soil and rock will be reused in order to match the surrounding land as near as possible. Drainage and slopes will be restored as close to the original ground as possible if it is geotechnically and environmentally beneficial to do so.

After decommissioning of the wind farm, all Site Access Tracks and areas of hardstanding will be returned to as close to their natural state as possible, again if it is geotechnically and environmentally feasible.

8.5.3.4 *Reinstatement Phase Residual Effects*

On completion of reinstatement works, it is expected that the wind farm will be returned as close to its present condition as possible. In particular, areas of peat and current drainage regimes should be reinstated. It is expected that the long-term residual effects associated with the Proposed Development will therefore be slight.

8.6 SUMMARY OF SIGNIFICANT EFFECTS

Providing the mitigation measures outlined in this report are fully implemented and best practice is followed on site, it is expected that effects associated with the development of the Wind Farm Site will not be significant. It is recommended that suitable monitoring programmes are implemented in order to ensure that there is rigid adherence both to the CEMP and to the mitigation measures outlined here during construction, operation and decommissioning of the Wind Farm.

8.7 REFERENCES

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