White Hill Wind Farm Electricity Substation & Electricity Line

Environmental Impact Assessment Report

Chapter 6: Land & Soil

White Hill Wind Limited

Galetech Energy Services
Clondargan, Stradone, Co. Cavan Ireland
Telephone +353 (0)49 555 5050
www.galetechenergyservices.com

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6.1 Introduction

6.1.1 Background and Objectives

This chapter provides an assessment of the likely effects of the project on the land, soil and geological environment.

This chapter provides a baseline assessment of the environmental setting of the project in terms of land, soils and geology and identifies the likely and significant effects that the construction, operation and decommissioning of the project will have. Where required, appropriate mitigation measures to avoid any identified significant effects to land, soils and geology are recommended and the residual effects of the project post-mitigation are assessed.

6.1.2 Project Description

The project site is located in rural County Kilkenny and County Carlow, approximately 11 kilometres (km) northeast of Kilkenny City, c. 15km southwest of Carlow Town, c. 3km west of Muine Bheag and c. 1km north of Paulstown. In summary, the project comprises the following main components as described in full at **Chapter 3**:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 320 metres (m) of 110kV underground electricity line between the electricity substation and the Kellis-Kilkenny overhead transmission line and the provision of 2 no. interface masts;
- An electrical control unit at the permitted White Hill Wind Farm site;
- Approximately 8.8km of underground electricity line between the electricity substation and the electrical control unit; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The project site traverses the administrative boundary between counties Kilkenny and Carlow; with the electricity substation and c. 3.3km of the underground electricity line located in County Kilkenny and c. 5.5km of the underground electricity line and the electrical control unit located in County Carlow. Electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide.

6.1.3 Statement of Authority

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

Our core areas of expertise and experience include upland hydrology and wind farm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types, including wind farms and associated grid connections.

This chapter was prepared by Michael Gill and David Broderick, who also prepared the Land & Soil and Water chapters for the White Hill Wind Farm EIAR.

Michael Gill (P. Geo., B.A.I., MSc, Dip. Geol., MIEI) is an Environmental Engineer with over 23-years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms in Ireland. He has also managed EIAR assessments for infrastructure projects and private residential and commercial developments. In addition, he has substantial experience in wastewater engineering and site suitability assessments, contaminated land investigation and assessment, wetland hydrology/hydrogeology, water resource assessments, surface water drainage design and SUDs design, and surface water/groundwater interactions. For example, Michael was involved in the Environmental Impact Statement/Environmental Report (EIS/EIAR) for Seven Hills Wind Farm, Oweninny Wind Farm, Cloncreen Wind Farm, and Yellow River Wind Farm, and over 100 no. other wind farm related projects.

David Broderick (P. Geo., BSc, H. Dip Env Eng, MSc) is a Hydrogeologist/Environmental Engineer with over 17-years' experience in both the public and private sectors. Having spent 2-years working in the Geological Survey of Ireland, working mainly on groundwater and source protection studies, David moved into the private sector. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has also completed numerous geological and hydrological EIAR assessments for a range of commercial developments. David has been involved in the preparation of numerous EIS/EIAR for energy developments including Oweninny Wind Farm, Cloncreen Wind Farm, White Hill Wind Farm, Arderroo Wind Farm and Yellow River Wind Farm and over 80 no. other wind farm related projects across the country.

6.1.4 Relevant Legislation

This chapter has been prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

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

- *Planning and Development Act 2000 (as amended);*
- *Planning and Development Regulations 2001 (as amended);*
- *S.I. No. 349/1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84/1995, S.I. No. 352/1998, S.I. No. 93/1999, S.I. No. 450/2000 and S.I. No. 538/2001), S.I. No. 30/2000, the Planning and Development Act, and S.I. 600/2001 Planning and Development Regulations and subsequent Amendments. These instruments implement EU Directive 85/373/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;*
- *Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment ('the EIA Directive'); and,*
- *S.I. No 296/2018: S.I. No. 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.*

6.1.5 Relevant Guidance

This chapter has been prepared in accordance with the EIA Directive and having regard, where relevant, to guidance contained in the following documents:-

- *Guidance Document on Wind Energy Developments and EU Nature Legislation* (European Commission, 2020);
- Environmental Protection Agency (2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*;
- Institute of Geologists Ireland (2013) *Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements*;
- National Roads Authority (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*;
- Department of Housing, Planning & Local Government (2018) *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*;
- Department of the Environment, Heritage, and Local Government (2006) *Wind Energy Development Guidelines for Planning Authorities 2006*;
- European Union (2017) Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU);
- Institute of Environmental Management (IEMA) (2022) A New Perspective on Land and Soil in Environmental Impact Assessment;
- Forestry Commission (2004) *Forests and Water Guidelines*, Fourth Edition. Publ. Forestry Commission, Edinburgh; and,
- COFORD (2004) *Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads*.

6.2 Methodology

6.2.1 Desk Study

A desk study of the project site, and its environs, was completed in advance of undertaking the walkover survey and site investigations (see below). This desk study involved collecting all relevant land and geological information for the project site and the nearby permitted White Hill Wind Farm site. The desk study involved consultation with and a review of the following data sources:-

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 19 (Geology of Carlow - Wexford); Geological Survey of Ireland (GSI, 1994);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 16 (Geology of Kildare - Wicklow); Geological Survey of Ireland (GSI, 1994);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie);
- Teagasc soils map (www.gsi.ie);
- Aerial Photography, 1:5,000 and 6" base mapping; and,
- White Hill Wind Farm EIAR Land & Soil and Water chapters (Galetech Energy Services, 2022).

6.2.2 Baseline Surveys & Site Investigations

As part of the EIAR for the White Hill Wind Farm, geological mapping and soil probing exercises were undertaken by HES on 31 August 2021 and 10 and 30 March 2022. In

addition, trial pits were undertaken at the wind farm site on 6 October 2021, including 2 no. at the location of the electrical control unit.

A walkover of the off-road sections of the electricity line route was undertaken in addition to a driven/windshield survey of the in-road sections of the route was undertaken on 24 October 2024. A trial pit investigation was also undertaken at the electricity substation on 24 October 2024.

6.2.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees and other bodies with environmental responsibility.

This consultation process is outlined in **Chapter 1** of this EIAR. Matters raised and recommendations highlighted by the responses relevant to land, soils and geology are summarised in **Table 6.1** below. The full response from each of the below consultees are provided in **Annex 1.7.**

Consultee	Summary of Response	Addressed in Section
Geological Survey of Ireland (GSI)	GSI records show that there are no County Geological Sites in the vicinity of the project.	**Section 6.3.6**
Carlow County Council	The EIAR must address the direct effects and short, medium and long term, permanent and temporary, positive and negative, secondary cumulative and transboundary effects of the whole project, i.e. the wind energy development, electricity substation & electricity line.	**Sections 6.4, 6.5 & 6.6**

Table 6.1: Summary of Relevant Land & Soil Scoping Responses

6.2.4 Receptor Importance/Sensitivity Criteria

In addition to the utilisation of sensitivity and receptor importance criteria outline within the abovementioned EPA Guidance (EPA, 2022), this assessment, in accordance with National Roads Authority (NRA, 2009) guidance, quantifies the importance of the land, soil and geology environments within the project site by applying the criteria set out in **Table 6.2**, with the impact/effect magnitude and impact/effect rating/significance subsequently assessed using **Table 6.3.**

Importance	Criteria	Typical Example
Very High	• Attribute has a high quality, significance or value on a regional or national scale. • Degree or extent of soil contamination is significant on a national or regional scale. • Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	• Geological feature rare on a regional or national scale (NHA). • 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	• Contaminated soil on site with previous heavy industrial usage. • Large recent landfill site for mixed wastes. • Geological feature of high value on a local scale (County Geological Site). • Well drained and/or high fertility soils.

	organic soil underlying site is significant on a local scale.	• Moderately sized existing quarry or pit. • Marginally economic extractable mineral resource.
Medium	• Attribute has a medium quality, significance or value on a local scale. • Degree or extent of soil contamination is moderate on a local scale. • Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	• Contaminated soil on site with previous light industrial usage. • Small recent landfill site for mixed Wastes. • Moderately drained and/or moderate fertility soils. • Small existing quarry or pit. • Sub-economic extractable mineral resource.
Low	• Attribute has a low quality, significance or value on a local scale. • Degree or extent of soil contamination is minor on a local scale. • Volume of peat and/or soft organic soil underlying site is small on a local scale.	• Large historical and/or recent site for construction and demolition wastes. • Small historical and/or recent landfill site for construction and demolition wastes. • Poorly drained and/or low fertility soils. • Uneconomically extractable mineral resource.

Table 6.2: Estimation of Importance of Soil and Geology Criteria (NRA, 2009)

The assessment of effects follows the description of the baseline environment and is Stage 6 of 7 of the information which must be included in an EIAR (EPA, 2022). The guideline criteria for the assessment of effects states that the purpose of an EIAR is to identify, describe and present an assessment of the likely significant effects. The likely effects are described with respect to their quality (positive, neutral or negative), significance (imperceptible to profound), extent (i.e. size of area or number of sites effected), context (is the effect unique of being increasingly experienced), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The descriptors used in this chapter are those set out in the EPA (2022) glossary of effects as shown at **Chapter 1** of this EIAR.

In order to provide an understanding of this descriptive system in terms of the geological environment, elements of this system of description of effects are related to examples of likely significant effects on the geology and morphology of the existing environment, as listed at **Table 6.3**.

Effect Characteristics		Geological/Hydrological Effects
Quality	**Significance**	

Negative only	Profound	• Widespread permanent effect on:-
		  ○ The extent or morphology of a SAC.
		  ○ Regionally important aquifers.
		  ○ Extents of floodplains.
		• Mitigation measures are unlikely to remove such effects.

Positive or Negative	Significant	• Local or widespread time dependent effects on:-
		  ○ The extent or morphology of a SAC/ecologically important area.
		  ○ A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features).
		  ○ Extent of floodplains.
		• Widespread permanent effects on the extent or morphology of a NHA/ecologically important area,
		• Mitigation measures (to design) will reduce but not completely remove the effect – residual effects will occur.

Positive or Negative	Moderate	• Local time dependent effects on:- o The extent or morphology of a SAC/NHA/ecologically important area. o A minor hydrogeological feature. o Extent of floodplains. • Mitigation measures can mitigate the effect OR residual effects occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	• Local perceptible time dependent effects not requiring mitigation.
Neutral	Imperceptible	• No effects, or effects which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

Table 6.3: Additional Impact/Effect Characteristics (NRA, 2009)

6.2.5 Study Area

The study area for the land, soils and geological environment is limited to within the project site boundary. There is no likelihood of the project affecting the land, soils and geological environment outside of the project site.

6.2.6 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of this chapter.

6.3 Description of the Existing Environment

6.3.1 Site Location & Description

The project site is located at the southern fringes of the Castlecomer Plateau. The Castlecomer Plateau is an elevated plateau located in south County Laois, northwest County Carlow and northeast County Kilkenny. The Castlecomer Plateau is characterised by undulating hills and steep escarpments at its fringes.

The lowlands to the south of the Castlecomer Plateau (route of the electricity line and substation location) are a mixture of pasture and tillage with fields typically bordered by mature broadleaf tree lines and hedgerows.

The electricity substation site is located in the townland of Shankill, Paulstown, County Kilkenny. The substation is situated within agricultural grasslands, adjacent to the M9 motorway (to the east).

Topography at the substation location is mapped as relatively flat, with lands sloping slightly southeasterly. Overall site elevations range between approximately 68m and 73m OD (Ordnance Datum).

The electrical control unit is located to the south of the permitted White Hill Wind Farm, within the townland of Baunreagh, County Carlow. The location is also situated in agricultural lands. Forest and semi-natural areas surround the location to the north and east. The electrical control unit is in an upland setting where topography in the area is hilly. The elevation of the electrical control unit site is approximately 280m OD.

The underground electricity line will comprise c. 5,925m (c. 5.9km) located within private agricultural lands/forestry and c. 2,850m (c. 2.9km) with the carriageways of the L6673, L6738, L7117 and L71172 local roads.

The ground elevations along the electricity line generally decreases from c. 280m OD at the electrical control unit to c. 68m OD at the electricity substation. However, due to the hilly nature of the topography along the route, the highest elevation reaches c. 310m OD.

6.3.2 Land and Land Use

Corine land cover maps (2018) illustrate that the project site is largely mapped by Agricultural Areas and Forestry and Semi-Natural Areas. Historic Corine land cover maps (1990-2018) do not record any significant land cover changes in the local area. Based on the Corine (2018) mapping, the Forestry and Semi-Natural Areas predominately comprise coniferous forests while the Agricultural Areas largely comprise pastures. All public roads located within the project site are classed as local roads.

6.3.3 Superficial Geology

6.3.3.1 Soils and Subsoils

Based on the GSI/Teagasc soils mapping (www.epa.ie), the location of the electricity substation is overlain by poorly drained, mainly basic mineral soils (BminPD). The location of the electrical control unit is mapped as shallow acid poorly drained mineral soils (AminSP).

The mapped soil types along the underground electricity line chiefly consist of a mixture of acidic natured soils such as shallow well drained mineral soils (AminSW), poorly drained mineral soils (AminPD), deep well drained mineral soils (AminDW), Shallow, rocky, peaty/non-peaty mineral complexes (AminSRPT) and poorly drained mineral soils (AminSP). Alluvium soils are mapped briefly (~400m section) along route where the Shankill Stream nears the local road towards the southern section of the route.

A map of the local subsoil cover is provided at **Figure 6.1** (www.gsi.ie) and illustrates that Till derived from limestones (TLs) is mapped to underly the electricity substation. There is little subsoil coverage in the more upland areas of the project site underlying the electrical control unit, as bedrock outcrop/subcrop (Rck) is mapped here by the GSI.

Similarly, there is little subsoil coverage mapped to underly much of the electricity line route as bedrock outcrop/subcrop (Rck) is dominant throughout. Any subsoils that are mapped along the route are chiefly Till derived from Namurian sandstones and shales (TNSSs). Alluvium subsoils are also mapped briefly along the southern section of the route near the Shankill Stream. As the route progresses nearer to the electricity substation, the subsoils are mapped as Till derived from limestones (TLs).

As part of the EIAR for the White Hill Wind Farm, 2 no. trial pits (referred to herein as TP1/CU and TP2/CU) were carried out at the location of the electrical control unit on 6 October 2021.

In addition, 3 no. trial pits were carried out at the location of the electricity substation (TP1/ST – TP3/ST) on 24 October 2024.

A summary of the investigation findings is provided at **Table 6.4** below. The locations of the trial pits are illustrated at **Figure 6.2**. Trial pit logs are provided at **Annex 6.1** (**Volume II**).

The subsoils encountered at electrical control unit consist mainly of SILT with

increasing gravel/stone content with depth due to the underling shallow weathered bedrock. Depth to bedrock at electrical control unit ranged from 0.5m to 1m.

The subsoils encountered at the electricity substation comprise a layer of SILT above gravelly CLAY. Bedrock was not encountered at the substation site at the maximum trial pit depth of 2.5m.

No ground stability issues were identified by the trial pit investigation and all subsoils were found to be firm to very firm and cohesive which is generally typical of shale, sandstone and limestone tills.

A walkover survey of the off-road sections of the underground electricity line confirmed the presence of mineral soils/subsoils and generally firm under foot ground conditions.

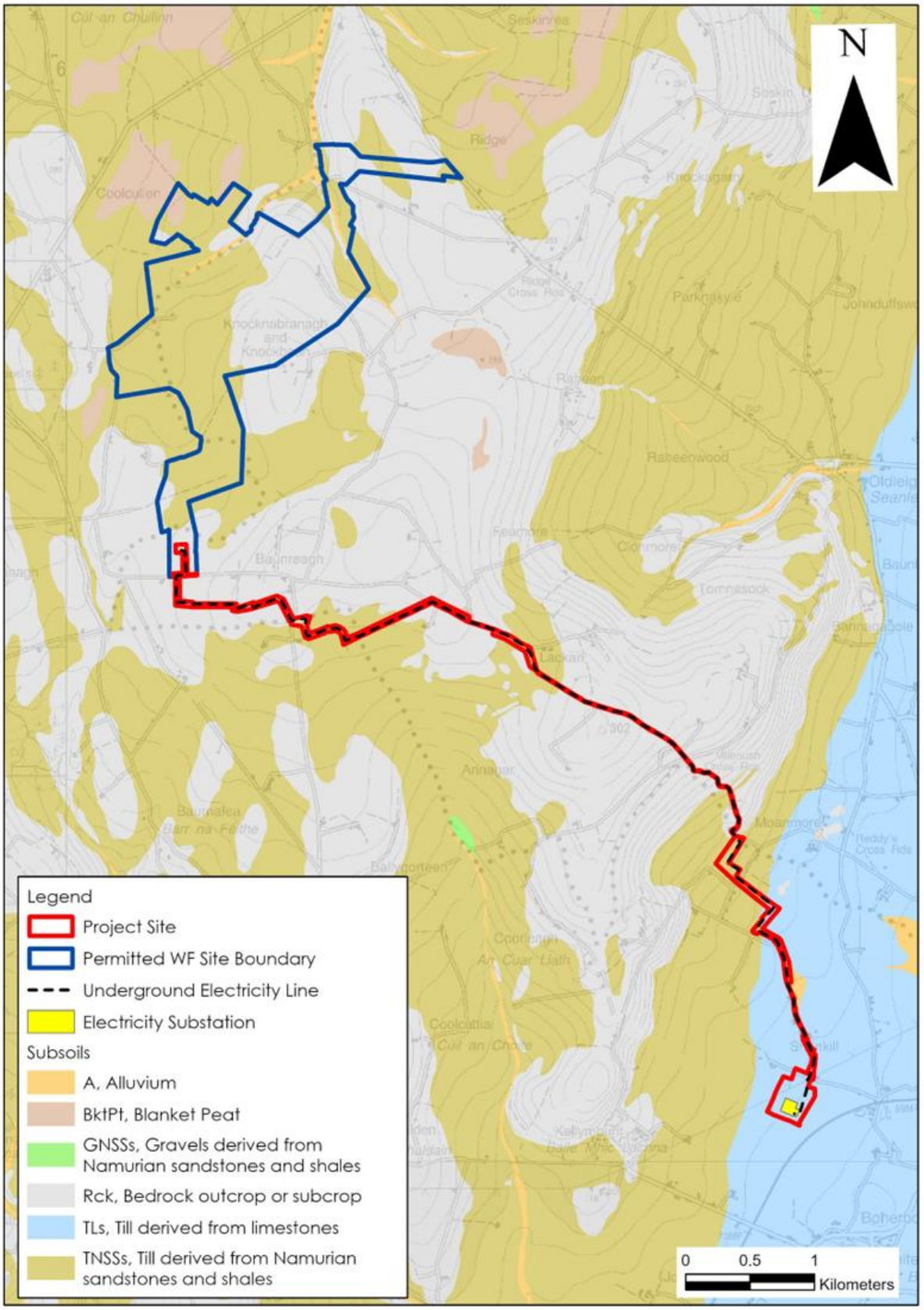

Figure 6.1: Local Subsoil Geology Mapping

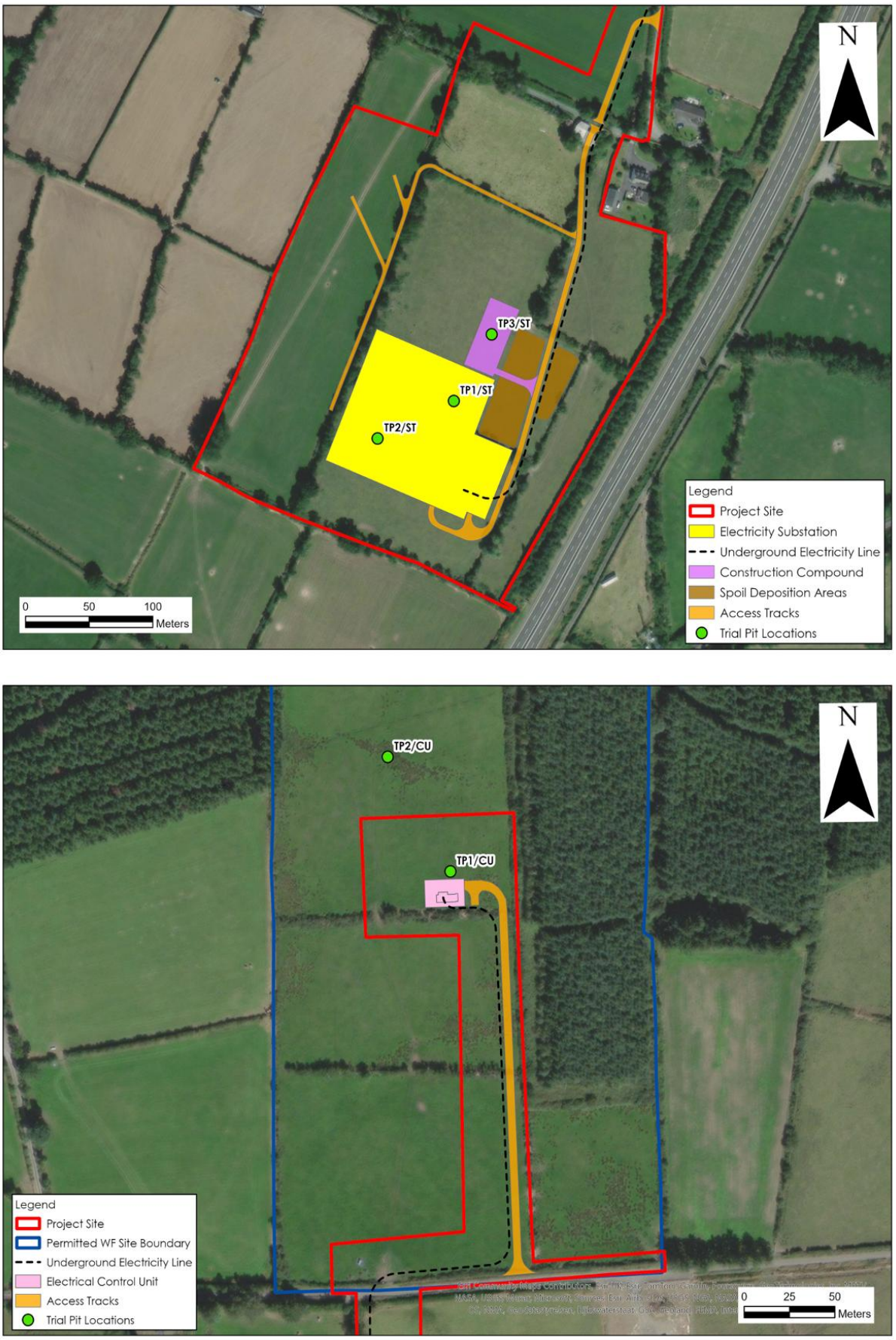

Figure 6.2: Site Investigation Maps

Location	Total Depth of TP (m)	Primary Subsoil Lithology	Depth to Bedrock (m)
TP1/CU	1.1	Firm SILT getting gravelly with depth	0.5
TP2/CU	1.1	Firm SILT getting gravelly with depth	1
TP1/ST	2.5	Firm SILT over very firm gravelly CLAY	>2.5
TP2/ST	2.5	Firm SILT over very firm gravelly CLAY	>2.5
TP3/ST	2.5	Firm SILT over very firm gravelly CLAY	>2.5

Note: CU – Electrical Control Unit, ST – Electricity Substation

Table 6.4: Summary of Trial Pit Investigations

6.3.3.2 Soil Contamination

There are no known areas of soil contamination within the project site or in the surrounding lands. During the site walkovers and site investigations, no areas of contamination concern were identified.

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

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

6.3.4 Bedrock Geology

Based on the GSI bedrock mapping (www.gsi.ie), the location of the electricity substation is underlain by Dinantian aged Limestones, and more specifically by the Ballyadams Formation. The Ballyadams Formation is known to consist of crinoidal wackestone/packstone limestones.

The electrical control unit is mapped to be underlain by Westphalian aged shales of the Coolbaun Formation, which is described by the GSI as consisting of shales and sandstone with thin coals. The bedrock encountered during the trial pitting at the electrical control unit (i.e. soft weathered SHALE) is consistent with the GSI mapping.

The route of the electricity line crosses a series of mapped non-calcareous and then calcareous bedrock lithologies as it progresses south-eastwards from the electrical control unit towards the electricity substation.

There are no mapped faults within the electricity substation site or the location of the electrical control unit. However, there is 1 no. fault that is mapped to intercept the electricity line route. This fault line is likely to have no consequence for the project due to the shallow nature of the works associated with the electricity line.

A bedrock geology map of the area is illustrated at **Figure 6.3**.

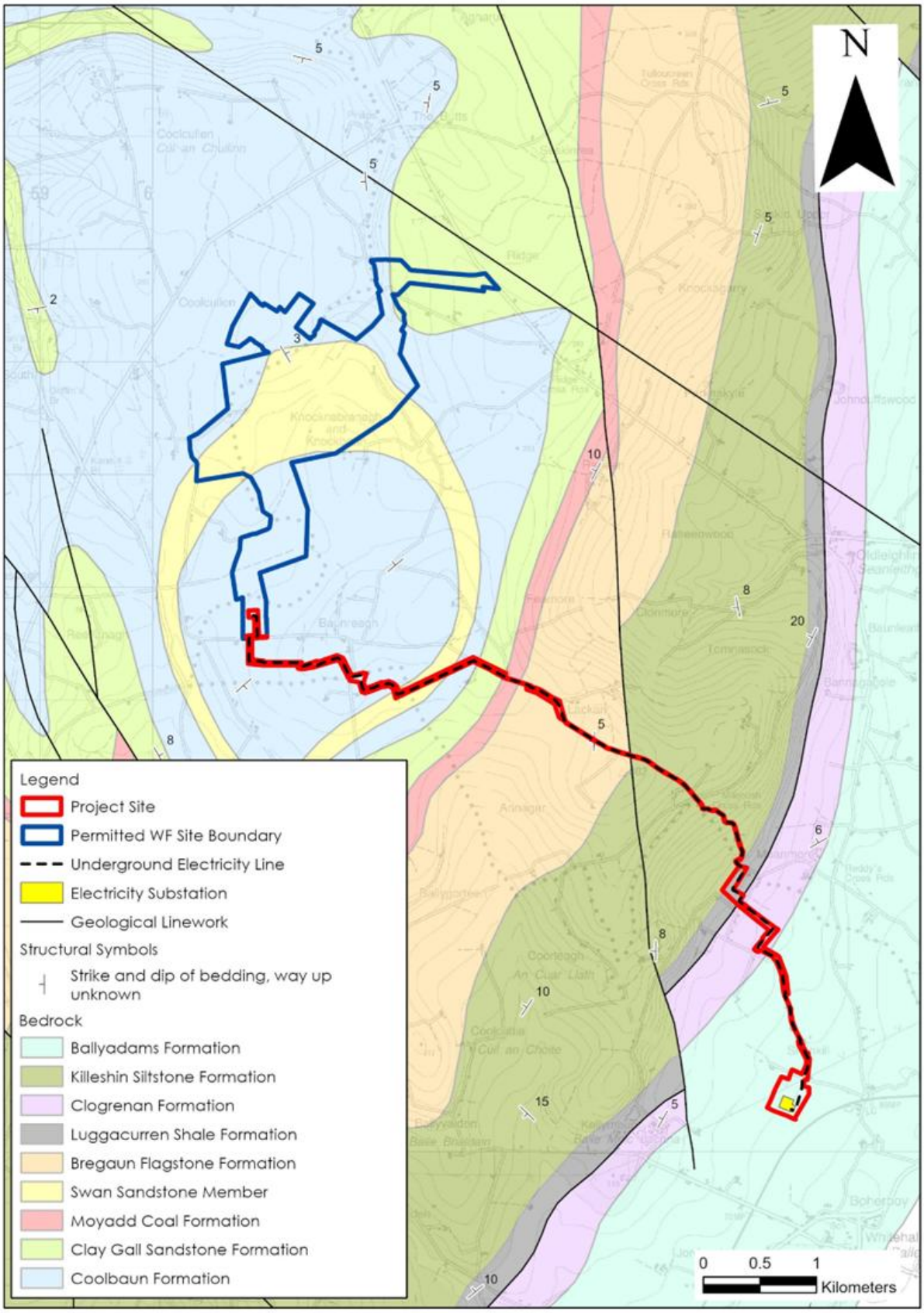

Figure 6.3: Local Bedrock Geology Mapping

6.3.5 Geological Resource Importance

Soils and subsoil at the project site can be classified as 'high to moderate' importance with the former relating to agricultural land and the latter to forestry.

According to the GSI natural resource mapping database, the electricity substation site and the electrical control unit site have a 'moderate' crushed aggregate potential and neither area is mapped as having any potential for granular aggregate.

The bedrock underlying the majority of the electricity line route has similar aggregate potential as described above, however, there are smaller sections along each of the routes that are mapped to have 'high to very high' crushed aggregate potential.

Based on criteria at **Table 6.2** above and the GSI aggregate potential, the local bedrock underlying the project site is of 'medium to high' importance.

6.3.6 Geological Heritage & Designated Sites

No elements of the project are mapped within a geological heritage site or designated site.

The closest geological heritage project site to the project is Bannagagole Quarry (Site Code CW004), a large and deep working quarry in the limestones of the Ballyadams Formation, which is located approximately 2km northeast of the underground electricity line at its nearest point.

Ballyellin Quarry (Site Code: CW001), is a large working quarry located approximately 6.5km to the southeast of the electricity substation.

Another geological heritage site, Ballyfoyle Channels (Site Code: KK005), consisting of a series of deeply incised channels, is located approximately 7km to the west of the electrical control unit.

Within the Republic of Ireland, designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SAC), candidate Special Areas of Conservation (cSAC)and Special Protection Areas (SPAs). The project is not located within or adjacent to any designated site.

The closest designated site is Whitehall Quarries pNHA (Site Code: 000855) which is situated c. 500m to the southwest of electricity line at its nearest point and is c. 1.5km northwest of the substation.

In addition, all of the surface waterbodies draining the project site drain into the River Barrow and River Nore cSAC (Site Code: 002162). Further details of the assessment of hydrological effects, including on the River Barrow and River Nore cSAC, can be found at **Chapter 7**.

Based on criteria at **Table 6.2** above, geological heritage sites have a 'high' importance while designated sites have a 'high to very high' importance.

6.4 Description of Likely Effects

6.4.1 Characteristics of the Project

The project comprises a 110kV electricity substation; including all associated development works to accommodate its construction, operation, maintenance and the export of electricity to the national grid via the existing Kellis-Kilkenny overhead

electricity transmission line; an electrical control unit and c. 8.8km of underground electricity line.

During the construction phase, earthworks will arise from the excavation of topsoil, subsoil and bedrock (where present) in order to achieve the required levels for the electricity substation, electrical control unit, control buildings, electrical equipment, and access tracks.

A 'cut and fill' exercise will be implemented whereby material at higher elevations (i.e. topsoil and subsoil) will be excavated and imported material (i.e. aggregates) used to make up levels at areas of lower elevation. This process, which accords with best practice construction techniques, will avoid the excavation of significant volumes of soil or the importation of significant volumes of stone aggregates in order to provide a level surface.

Due to the generally shallow nature of excavations, substantial volumes of spoil are not predicted to be generated. It is proposed that excavated material (topsoil, subsoil, etc.) will, insofar as possible, be utilised in the post-construction reinstatement of the project (e.g. at the electricity substation site, interface mast foundations, electrical control unit, access track and electricity line trenches).

The electricity line will be installed within ducting in an excavated trench of c. 1.2m deep and c. 2m wide. 12 no. jointing plinths will be required along with Horizontal Directional Drilling (HDD) at 5 no. watercourse crossing locations.

As part of the design process, considerable attention has been given to the extent of excavations required to construct the project in order to minimise the generation of spoil and, subsequently, to the management of excavated material. **Table 6.5**, below, provides a breakdown of the spoil volumes predicted to be generated and proposals regarding the reuse or disposal of this material.

Where excess material is generated at the electricity substation site or along the route of the underground electricity line which cannot be utilised for reinstatement or landscaping purposes, it is proposed to develop 2 no. dedicated spoil deposition areas immediately northeast of the electricity substation where excess material will be stored permanently. It is estimated that c. 10,385m^3 of excess material will be stored within these proposed deposition areas. The location of the deposition areas was selected due to the general absence of environmental constraints, available separation distances to watercourses, generally flat or gently sloping gradient and close proximity thus avoiding traffic movements on the public road network.

Excess spoil generated at the site of the electrical control unit will be deposited at the spoil deposition areas permitted under An Bord Pleanála Reference ABP-315365-22 (White Hill Wind Farm).

Spoil will be transported to the deposition areas where it will be placed in layers in accordance with best-practice methods. Appropriate drainage management measures will be implemented to ensure that the deposited spoil does not become waterlogged. Following the completion of construction, the spoil deposition areas will be covered with the vegetative topsoil layer removed from the footprint of the deposition areas or covered with topsoil and allowed to vegetate. Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified geotechnical engineer.

Due to potential for soil contamination, all road pavement material (tar & chips, etc.) will be disposed of at an approved off-site waste facility.

A Planning-Stage Spoil Management Plan (enclosed within the Planning-Stage Construction & Environmental Management Plan [CEMP] at **Annex 3.5**, **Volume II**) has been prepared to detail proposals regarding the appropriate management of material which may arise from the construction of the project.

Project Element	Volume of Material to be Excavated (m^3)	Volume of Material to be utilised for reinstatement/ landscaping (m^3)	Volume of Material to be disposed of in deposition area (m^3)	Volume to be disposed of off-site (m^3)
Electricity Substation (incl. substation compound, access track, site entrance, interface masts)	7,965	200	7,755	10
Temporary Construction Compound	685	685	0	0
Underground Electricity Line	17,330	14,045	2,630	655
Electrical Control Unit (incl. compound, access track and site entrance)	950	100	850	0

Table 6.5: Spoil Generation and Management

6.4.2 'Do Nothing' Effects

In the event that the project is not progressed, the site will continue to be used for agricultural/forestry/public transport purposes and there will be no alteration to the land, soil or geological environment.

6.4.3 Construction Phase

6.4.3.1 Land and Land Use

The construction of the electrical control unit and electricity substation will result in the loss of c. 1.6ha of agricultural land. The loss of c. 1.6ha of agricultural land is not significant in the context of the project site or the wider environs.

While the construction of the electricity substation and electrical control unit will result in a loss of land from agricultural production, existing agricultural operations can readily continue within the remainder of the relevant landholdings and there will be no perceptible effect on these activities.

The presence of the electricity line will not, being entirely sub-surface, result in any alteration to land or land-use.

The overall (final) effect on land and land-use is summarised at **Table 6.6** below.

Attribute	Description
Receptor	Land & Land Use
Pathway	Infrastructure construction
Final Effect	Negative, slight, direct, likely, permanent/long-term effect on land and land use.

Table 6.6: Land and Land Use

6.4.3.2 Soil, Subsoil and Bedrock Excavation

The excavation of soil, subsoil and bedrock will be required for the levelling of the site to the requisite gradient and for the installation of building foundations, concrete plinths for electrical apparatus, electricity line trench, horizontal directional drilling, the foundations of electricity end masts, and access tracks.

This will result in a permanent removal of topsoil and subsoil and at excavation locations. Estimated volumes of soil and subsoils to be excavated and relocated are discussed at **Section 6.4.1** above.

The overall effect magnitude is assessed to be slight-to-moderate and not likely to be significant due to the following:-

- The spread-out and linear nature of the project over a relatively large geographical area;
- The soil, subsoil and bedrock which will be removed during the construction phase will be localised to the footprint of the project;
- A minimal volume of soil, subsoil and bedrock, in comparison to the total resource present in the overall project site and wider area will be removed to allow for infrastructural work to take place;
- No infrastructure will be constructed within or near any protected sites for the protection of geological features such as NHAs, cSACs and geological heritage sites; and,
- Due to the shallow nature of the works along the electricity line (1.2m) which is distributed over c. 8.8km, effects on soils, subsoil and bedrock will not be significant.

The overall (final) soil and subsoil excavation effect is summarised at **Table 6.7** below.

Attribute	Description
Receptor	Soils, subsoils and bedrock
Pathway/Mechanism	Excavations and extraction
Final Effect	Negative, slight to moderate (moderate-slight), direct, likely, permanent effect on soil, subsoil and bedrock.

Table 6.7: Soil and Subsoil Excavation

6.4.3.3 Erosion of Exposed Soil and Subsoil

The exposure of soil and subsoils at locations of excavation (at the electricity substation site, the electrical control unit site and along the underground electricity line) and spoil storage (at the electricity substation site) will increase the likelihood of soil erosion resulting in a direct physical effect on land and soil. However, given the small footprint of the proposed excavations and spoil storage areas in the context of the overall project site and the wider area, the pre-mitigation effect is not assessed

as likely to be significant.

The pre-mitigation soil and subsoil erosion effect is summarised in **Table 6.8** below.

Attribute	Description
Receptor	Soil and subsoils
Pathway/Mechanism	Vehicle movement, surface water erosion, and wind action.
Pre-mitigation Effect	Negative, direct, imperceptible to slight (not significant), likely effect on soil and subsoils.

Table 6.8: Soil and Subsoil Erosion

6.4.3.4 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

The contamination of soils and subsoils at the electricity substation site, the electrical control unit site and along the underground electricity line presents as a risk of direct effects on the soils and geology of the project site. Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk. Hydrocarbon has a high toxicity to humans and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks are likely to result in significant effects (i.e. contamination of soils and subsoil on the geological environment.

The pre-mitigation soil contamination effect is summarised in **Table 6.9** below.

Attribute	Description
Receptor	Soil, subsoil and bedrock
Pathway	Soil, subsoil and bedrock pore space
Pre-mitigation Effect	Negative, direct, slight, short term, unlikely effect on soils, subsoils and bedrock.

Table 6.9: Soil and Subsoil Contamination

6.4.4 Operational Phase

Very few likely direct effects are envisaged during the operational phase of the project. These may include:-

- Some construction vehicles or plant may be necessary for routine maintenance. On average, the site will be visited 1-2 times a week which could result in minor accidental leaks or spills of fuel/oil;
- Emergency repair works to the underground electricity line, which are highly unlikely, could result in future excavation of soils and subsoils; and,
- The transformer in the electricity substation is oil cooled. There is a risk for spills/leaks of oils from this equipment resulting in contamination of soils and groundwater.

In relation to indirect effects, a small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

6.4.5 Decommissioning Phase

As set out at **Chapter 3** (**Sections 3.2** and **3.7**), the electricity substation will form part

of the national electricity network and decommissioning will not occur. The underground electricity line will be decommissioned upon decommissioning of the White Hill Wind Farm. The electricity line will be removed from its ducting and transported to an approved waste handling facility for re-use or recycling. The electrical control unit will be decommissioned and removed from site for re-use or recycling.

The likely effects associated with the decommissioning of the project will be similar to those associated with construction but of a much-reduced magnitude due to minimal excavation requirements.

During decommissioning, it will be possible to reverse or reduce some of the likely effects resulting from the construction phase by rehabilitating construction areas such as areas of hardstanding at the electrical control unit and returning them to grassland.

Other likely effects, such as erosion and contamination by fuel leaks, will remain but will be of reduced magnitude.

6.4.6 Cumulative Effects

Given the small construction footprint and localised and near-surface earthworks proposed at the electricity substation, electrical control unit and electricity line; it is assessed that significant cumulative effects on land, soils and geology are unlikely to arise in-combination with other off-site developments and any effects are assessed as likely to be not significant.

The White Hill Wind Farm EIAR land and soil impact/effect assessment concluded that significant effects are unlikely to arise predominately due to the localised and near surface nature of the construction works and the absence of likely significant effects during the operation and decommissioning phases.

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

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

6.4.7 Assessment of Likely Health Effects

The likelihood of adverse health effects, albeit low, arises mainly from the possibility of soil and ground contamination during construction. A development, such as that proposed, is not a recognised source of land or soil pollution and so the likelihood for effects during the construction or operational phases are assessed as negligible.

Hydrocarbons will be used onsite during construction; however, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with best practice measures. The likely residual effects associated with soil or ground contamination and subsequent health effects are assessed to be imperceptible.

6.4.8 Risk of Major Accidents or Disasters

Due to the nature of the electricity substation site; i.e. generally flat or gently sloping terrain; there is no risk of a landslide occurring.

The walkover surveys and inspection of the underground electricity line identified no peat stability issues. The underground electricity line comprises of a 1.2m deep trench and there is assessed to be a negligible likelihood of ground instability.

6.5 Mitigation & Monitoring

6.5.1 Construction Phase

6.5.1.1 Land and Land Use

The loss of agricultural land in the context of project study area is minimal and therefore the effects are assessed to be not significant. The loss of land from agricultural production is assessed to be an acceptable part of the project and therefore no mitigation is proposed.

6.5.1.2 Soil, Subsoil and Bedrock Excavation

The excavation of soil, subsoil and bedrock will have a direct effect on the geological environment.

Mitigation measures at the electricity substation site and electrical control unit site include:-

- Placement of infrastructure in areas of suitable ground conditions based on detailed site investigation data;
- The soil and subsoil which will be removed during the construction phase will be localised to the proposed infrastructure location;
- The project has been designed to avoid sensitive habitats;
- No unnecessary excavation of soil or subsoil will be undertaken;
- At the identified spoil deposition areas, the vegetative topsoil layer will be removed to allow for spoil to be placed and, upon reaching the recommended height, the vegetative topsoil layer will be reinstated over the spoil or the deposition areas will be covered in topsoil and allowed to vegetate;
- The spoil deposition areas will be developed in a phased approach, with the topsoil removed and temporarily stockpiled within the defined area while the spoil is being placed. The stockpiled topsoil will then be reinstated over the placed spoil, and the exercise will continue within the same spoil deposition area until the area is full;
- The placement of spoil will be restricted to a maximum height of 3.5m, subject to confirmation by the Geotechnical Engineer;
- Where practical, the surface of the placed spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the spoil will be carried out as placement of spoil within the area progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed spoil;
- Finished/shaped side slopes of the placed spoil will be not greater than 1(v):2(h) in the deposition areas and not greater than 1(v):1(h) alongside access tracks;
- Inspections of the spoil deposition areas will be made by a Geotechnical Engineer on a weekly basis during the construction phase and monthly for a 6-month period thereafter. The appointed contractor will review work practices

at the spoil deposition areas when periods of heavy rainfall are expected so as to prevent excessive dirty water runoff from being generated;
- An interceptor drain will be installed upslope of the spoil deposition areas to divert any surface water away from these areas;
- The surface of the deposited spoil will be profiled to a gradient to be agreed with the Geotechnical Engineer and vegetated or allowed to vegetate naturally;
- All the above-mentioned general guidelines and requirements will be confirmed by the Geotechnical Engineer prior to construction; and,
- Spoil deposition areas are at a minimal distance from excavation areas to avoid excessive transport of excavated materials.

Mitigation measures along the underground electricity line include:-

- Soils and subsoils excavated along the underground electricity line will be temporarily stored in covered stockpiles along the edge of the trench or immediately removed from site to a licensed waste management facility, as appropriate; and,
- The tarmacadam road surface will be replaced with the same design standard as the surrounding carriageway.

6.5.1.3 Erosion of Exposed Soil and Subsoil

The following mitigation measures are proposed to prevent the erosion of soil and subsoil:-

- Excavated soil will be side cast and stored temporarily adjacent to excavation areas for use during reinstatement and landscaping;
- Silt fences will be installed around all temporary stockpiles and excavated areas to limit movement of entrained sediment in surface water runoff;
- In order to minimise runoff during the construction phase, works will not take place during periods of intense or prolonged rainfall (to prevent increased silt laden runoff). Drainage systems, as outlined in **Chapter 7**, will be implemented to limit runoff effects during the construction phase;
- Bog mats will be used, as necessary, to support construction plant and machinery on soft ground, thus reducing the likelihood for soil and subsoil erosion and avoiding the formation of rutted areas. This will substantially reduce the likelihood for surface water ponding to occur;
- Following the completion of construction, the spoil deposition areas will be covered with the vegetative topsoil layer removed from the footprint of the deposition areas or covered with topsoil and allowed to vegetate;
- The underground electricity line will be constructed in a stepwise manner along its length. This will minimise the time any particular section of the underground electricity line trench is open before being reinstated;
- A detailed Spoil Management Plan will be prepared as part of the Construction & Environmental Management Plan prior to the commencement of development; and,
- Works at the spoil deposition areas will be monitored, on a weekly basis during the construction phase and monthly for a 6-month period thereafter, by an appropriately qualified Geotechnical Engineer.

6.5.1.4 Contamination of Soil by Leakages and Spillages and Alteration of Soil/Subsoil Geochemistry

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

- The volume of fuels or oils stored on site will be minimised;
- All fuel and oil will be stored in an appropriately bunded area of sufficient capacity within the temporary construction compound. Only an appropriate volume of fuel will be stored at any given time. The bunded area will be roofed to avoid the ingress of rainfall and will be fitted with a storm drainage system and an appropriate oil interceptor;
- All bunded areas will have 110% capacity of the volume to be stored;
- An oil interceptor will be installed within the surface water drainage system at the electricity substation site during the construction phase to intercept any accidental hydrocarbon spillages;
- From the construction compound, fuel will be transported to the works area by a 4x4, in a double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled at the temporary compound and will be towed around the site by a 4x4 jeep to where plant and machinery is located. The bowser/4x4 jeep will also be fully stocked with fuel absorbent material, pads and spill kits in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations to avoid any accidental leakages;
- All plant and machinery used during construction will be regularly inspected for leaks and fitness for purpose;
- Spill kits will be available to deal with any accidental spillages within the temporary construction compound and during refuelling;
- All waste tar material arising from road cuttings (from trenching in public roads) will be removed off-site and disposed of at a licensed waste facility. Due to the potential for contamination of soils and subsoils, it is not proposed to utilise this material for any reinstatement works; and,
- An emergency plan for the construction phase to deal with accidental spillages is contained within the Planning-Stage Construction and Environmental Management Plan (**Annex 3.5**). This emergency plan will be further developed by the contractor prior to the commencement of construction.

6.5.2 Operational Phase

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

Oil used in transformers (and other electrical apparatus) and storage of hydrocarbons could result in leakages during the operational phase and result in effects on soil and subsoils. Any hydrocarbon storage areas will be located in a concrete bund capable of holding 110% of the stored oil volume. The electrical transformer will also be bunded and capable of holding 110% of the stored oil volume. The bunded areas will prevent leakage of any hydrocarbons or chemicals to groundwater or surface water. The storm drainage system will be fitted with an appropriate oil interceptor to ensure that no contaminants are discharged from the project site.

In the event that access track maintenance is required; aggregates will only be

sourced from authorised quarries.

6.5.3 Decommissioning Phase

Mitigation measures applied during decommissioning activities will be similar to those applied during construction, where relevant. Some of the effects will be avoided by leaving elements of the project in place such as the electricity substation and underground electricity line ducts.

The electrical control unit hardstanding areas will be rehabilitated by covering with local topsoil/subsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects. Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures.

6.5.4 Monitoring Measures

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

6.6 Residual Effects

6.6.1 Construction Phase

6.6.1.1 Land and Land Use

The project will result in the loss of agricultural lands which will be replaced by the electricity substation, access tracks and associated compound. This will result in a permanent change to land at these locations. However, due to the relatively small footprint of the project infrastructure on a site scale, and even more so on a local scale, the residual effect is assessed as likely to be negative, direct, slight, permanent, likely effect on land (land-take).

For the reasons outlined above (small development footprint), no significant effects on land (land use) are likely to occur.

6.6.1.2 Soil, Subsoil and Bedrock Excavation

The importance of the soil at the site can be classified as of 'High to Medium' but not designated or unique in any way. The residual effect on the land, soil and geological environment is the disturbance and relocation of c. 26,930m^3 of soil and subsoil during construction, however, no likely significant effects on the geological environment are likely to arise from these excavations. Therefore, the residual effect will be negative, slight to moderate (moderate-slight), direct, permanent, likely effect.

Following the excavation and construction of the underground electricity line, the area excavated will be reinstated with a comparable ground cover. The residual effect is assessed as likely to be a negative, imperceptible, direct, likely, permanent effect.

For the reasons outlined above, no significant residual effects on soil, subsoil and bedrock are assessed as likely to occur.

6.6.1.3 Erosion of Exposed Subsoils During Construction Work

Spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works will be completed in accordance with a detailed Spoil Management Plan (to be prepared prior to the commencement of development). Material excavated for the construction of the electricity substation will remain within the project site and will be used as fill or stored within designated spoil management areas. The material excavated along the underground electricity line will either be used for reinstatement or, where material is unsuitable for this purpose, will be transported to licensed waste facility for disposal. Following implementation of these measures, the residual effects will be negative, imperceptible, direct, likely, permanent effect on soil and subsoils.

No significant residual effects on soils, subsoils or bedrock are assessed as likely.

6.6.1.4 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor. The residual effect will be negative, imperceptible, direct, short term, unlikely effect.

For the reasons outlined above, and with the implementation of the listed mitigation, no significant effects are assessed as likely to occur.

6.6.2 Operational Phase

With the implementation of mitigation measures as described above, no significant residual effects are assessed as likely to occur during the operational phase.

6.6.3 Decommissioning Phase

With the implementation of mitigation measures as described above, no significant residual effects are assessed as likely to occur during the decommissioning phase.

6.7 Summary

Excavations will be required for electricity line trenching, site levelling and for the installation of building foundations, hardstands and access tracks. This will result in a permanent removal of soil and subsoil at the locations of the electricity substation and electrical control unit and along the route of the underground electricity line. Excavated soil and subsoil will be used for reinstatement and landscaping and where excess material arises, this will largely be disposed of at the dedicated spoil disposal areas.

Due to small scale and geographically spread-out nature of the project, it is not assessed as likely to result in a significant cumulative effect with the permitted White Hill Wind Farm.

Furthermore, all other existing, permitted and proposed developments in the vicinity of the project have been assessed to determine their likelihood to act in combination with the proposed project; however, it is concluded that there is no likelihood of significant cumulative effects.

In conclusion, this assessment has determined that the project will not result in any likely significant effects on land and soil. Where effects are likely to occur, such as soil

contamination and erosion, the implementation of appropriate mitigation measures will ensure that any effects are imperceptible. Where it is not possible to implement mitigation measures to minimise the effects of the project, such as in respect of the loss of land and direct excavation of soil/subsoil, the level of effect is assessed as likely to be moderate-slight to imperceptible and not likely to be significant.