FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COOM GREEN ENERGY PARK, COUNTY CORK

VOLUME 2 – MAIN REPORT – CHAPTER 9 – LAND, SOIL AND GEOLOGY

Prepared for: Coom Green Energy Park Limited

coom green energy

Date: November 2020

Core House, Pouladuff Road, Cork T12 D773, Ireland

T: +353 21 4964 133 | E: info@ftco.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

Page

LIST OF TABLES

9. LAND, SOIL AND GEOLOGY

9.1 Introduction

This chapter has been prepared to examine the potential impacts of the proposed Coom Green Energy Park (CGEP), associated grid connection and turbine delivery route on existing geological conditions within the study area. The effects of the proposed CGEP are considered, taking account of mitigation measures to reduce or eliminate any residual impacts on land, soils and geology. The assessment also considers the cumulative impacts associated with other nearby developments.

The proposed CGEP is defined in Chapter 1 - Introduction and a detailed description of the proposed CGEP is set out in Chapter 3 - Description of the Proposed Development.

9.1 Assessment Methodology

In summary the methodology adopted for this assessment includes:

- Review of appropriate guidance and legislation;
- Characterisation of the receiving environment;
- Review of the proposed development;
- Assessment of potential effects;
- Identification of mitigation measures; and
- Assessment of residual impacts.

The assessment methodology and criteria are outlined in Section 9.1.4.

9.1.1 Relevant Guidance

The general EIA guidelines are listed in Chapter 1, other topic specific reference documents used in the preparation of this section include the following:

- NRA (2009), Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- IGI (2013), Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Scottish Executive (2017) Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments, 2nd Edition.
- European Union (2000/60/EC) Water Framework Directive
- European Union (2006/188/EC) Groundwater Directive
- Government of Ireland (2010) European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010)
- Government of Ireland (2003) European Communities (Water Policy) Regulations (S.I. No. 722 of 2003)
- EPA (2003), Towards Setting Guideline Values for the Protection of Groundwater in Ireland.

9.1.2 Water Framework & Groundwater Directives, Status and Risk Assessment

The Water Framework Directive (WFD) provides for the protection, improvement and sustainable use of waters, including rivers, lakes, coastal waters, estuaries and groundwater within the EU Member States. It aims to prevent deterioration of these water bodies and enhance the status of aquatic ecosystems; promote sustainable water use; reduce pollution; and contribute to the mitigation of floods and droughts.

Under the Water Framework Directive large geographical areas of aquifer have been subdivided into smaller groundwater bodies (GWB) for them to be effectively managed.

The overriding purpose of the WFD is to achieve at least "good status" in all European waters and ensure that no further deterioration occurs in these waters. European waters are classified as groundwaters, rivers, lakes, transitional and coastal waters. The first cycle of river basin management planning, which covered the period 2009-2015, developed plans and associated programmes of measures based on eight River Basin Districts (RBDs) within the island of Ireland. These plans set ambitious targets that envisaged that most water bodies would achieve good status by 2015.

The Groundwater Directive establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that take account of local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. The directive thus represents a proportionate and scientifically sound response to the requirements of the Water Framework Directive (WFD) as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations in groundwater.

9.1.3 Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Chapter 5 – Scoping, Consultation and Key Issues. Responses from the consultees identified a range of observations which have been taken into consideration in the preparation of the respective chapters of this EIAR. Specific issues raised during the scoping process with respect to Land, Soils and Geology were as follows:

Department of Agriculture, Food and the Marine

The Department advised that if felling of trees is required, a Felling Licence must be obtained before the trees are felled or removed. The Department advised that the contents of *Felling and Reforestation Policy* document be taken note of. When the Forest Service is considering an application to fell trees, the following applies:

- The interaction of the proposed works with the environment locally and more widely, in addition to potential direct and indirect impacts on designated sites and water, is assessed. Consultation with relevant environmental and planning authorities may be required where specific sensitivities arise;
- Where a tree felling licence application is received, the Department will publish a notice of the application before making a decision on the matter.
- Third parties that make a submission or observation will be informed of the decision to grant or refuse the licence.

The Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) set out the provisions for licensing for afforestation, forest road applications, aerial fertilisation licensing and felling licences.

As outlined in Section 9.3.2.1 of this chapter, it is proposed to fell approximately 61ha of coniferous forestry for the proposed CGEP development. As such, replant lands of the same area are required. The replacement replanting of forestry can occur anywhere in the State subject to licence. Potential replanting sites have been identified at Moneygorm, Co. Cork and Ballard, Co. Wicklow. The replant lands and associated impacts are assessed in Appendix 3.3 of this EIAR and potential cumulative impacts summarised in Section 9.2.9 and 9.4.5 of this chapter.

9.1.4 Impact Appraisal Methodology

As outlined in Section 9.1, the aim of this is to identify the impacts of the construction, operation and decommissioning of the proposed CGEP and associated works on the existing land, soils and geology of the study area. The assessment also identifies appropriate mitigation measures to minimise these impacts.

The following elements were examined to determine the potential impacts of the proposed CGEP on the Land, Soils and Geology within the study area:

- characterisation of the land, soils and geology underlying the study area,
- evaluation of the potential impacts of the proposed development.

The baseline geological and hydrogeological conditions within the study area were determined following a desktop review of publicly available information including aerial photography and EPA and GSI online databases. Site walkovers and intrusive investigations were also carried out.

Following the assessment of the existing environment, the unmitigated impacts of the proposed development during the construction, operational and decommissioning phases on sensitive receptors identified were determined. The evaluation of the significance of the impacts was undertaken in accordance with the IGI guidance (2013).

Where potential impacts were identified, mitigation measures were recommended to minimise impacts on the environment to acceptable levels of significance. The residual impact from the proposed CGEP was then re-appraised taking into account the recommended remedial measures. The residual impacts from the proposed development are presented in Section 9.5 of this chapter.

9.1.5 Evaluation Criteria

During each phase (construction, operation, maintenance and decommissioning) of the proposed development, several activities will take place on site, some of which will have the potential to cause impacts on the geological regime at the proposed site and the associated Land, Soil and Geology. These potential impacts are discussed throughout this chapter. Mitigation measures where required are presented in Section 9.4.

9.1.5.1 Assessment of Magnitude and Significance of Impact on Land, Soils and Geology

An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. In line with the IGI Guidance, the receiving environment (Geological Features) was first identified.

Using the NRA rating criteria in Appendix C of the IGI Guidance, the importance of the geological and hydrogeological features are rated (Tables 9.1 and 9.2) followed by an estimation of the magnitude of the impacts on geological and hydrogeological features (Tables 9.3 and 9.4).

This determines the significance of the impact prior to application of mitigation measures as set out in Table 9.1:

Table 9-1: Criteria Rating Site Importance of Geological Features (NRA, 2009)

Magnitude	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	• Geological feature 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 the site is significant on a local scale	• Contaminated soil on site with previous heavy industrial usage • Large recent landfill site for mixed wastes • Geological feature of high value on a local scale (County Geological Site) • Well drained and/or high fertility soils • Moderately sized existing quarry or pit • Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying the 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 the 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 • Uneconomic extractable mineral resource

Table 9-2: Criteria Rating Site Importance of Hydrogeological Features (NRA, 2009)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. NHA status. Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for impact on Geological and Hydrogeological features are outlined in Tables 9.3 and 9.4 respectively.

Table 9-3: Estimation of Magnitude of Impact on Geological Features (NRA, 2009)

Magnitude	Criterion	Description and Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site

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

Table 9-4: Estimation of Magnitude of Impact on Hydrogeological Features (NRA, 2009)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Removal of moderate proportion of aquifer. Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Calculated risk of serious pollution incident <0.5% annually.

The matrix in Table 9.5 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Tables 9.1 to 9.4.

Table 9-5: Ratings of Significance of Impacts for Geology/Hydrogeology (NRA, 2009)

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

The determination of the significance of each impact for this site is discussed in Section 9.4.

9.1.6 Desk Study

Prior to undertaking the site walkovers and intrusive site investigations, a desk study was undertaken to help determine the baseline conditions within the study area and planning boundary to provide relevant background information. The desk top study involved an examination of the following sources of information:

- OSI (2020), Current and historic Ordnance Survey Ireland mapping and ortho-photography.
- Taluntas (1980), General Soil Map of Ireland
- Geological Survey of Ireland (2020) GSI Public Data Viewer (www.spatial.dcenr.gov.ie)
- Environmental Protection Agency (2020) Review of the EPA online mapping (http://gis.epa.ie/Envision).
- Study of the proposed layout of the development.

To determine the existing hydrogeological regime within the study area the following EPA and GSI online datasets and mapping from the sources outlined above were reviewed:

- Catchment & Management Units;
- Groundwater Bodies Status and Risk;
- Drinking Water Protection Areas;
- Groundwater Resources (Aquifers);
- Groundwater Wells and Springs;
- Karst Features; and
- Groundwater Vulnerability.

9.1.7 Site Investigations and Field Assessments

Site walkovers and peat stability assessments were undertaken by an Engineering Geologist working for Fehily Timoney and Company (FT) during June and July 2019 and during August 2020 to determine the baseline characteristics of the proposed development site.

The site assessment works undertaken comprised the following:

- Walk over inspections of the study area with recording of salient geomorphological features at proposed infrastructure locations (see Figure 9.11).
- Peat depth probing and slope stability assessment at proposed infrastructure locations and where peat deposits were encountered.
- Recording of GPS co-ordinates of site investigation locations using a hand-held GPS.

Intrusive and non-intrusive site investigations were undertaken by Irish Drilling Ltd (IDL) and Minerex Environmental Ltd under the supervision of an Engineering Geologist from FT June to October 2019 and also in October 2020.

The scope of the site investigations is summarised below with the information obtained referenced in this chapter:

- Advancement of 18 No. trial pits to a maximum depth of 4.4m below ground level (BGL) at proposed borrow pit locations and selected turbine locations.
- Advancement of 3 No. cable percussive/rotary boreholes to a maximum depth of 15m BGL at proposed horizontal directional drilling (HDD) locations at water crossings locations W06, W08 and W19 along the proposed grid connection route.
- Collection of samples for environmental and geotechnical testing.
- Seismic Refraction Profiling, 2D Electrical Resistivity (ERT) surveying and Seismic Refraction (P-Wave) along pre-designated transects at proposed turbine locations

9.2 Receiving Environment

The receiving environment is described hereunder. This includes descriptions of the underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination. This section also includes a summary of site-specific information obtained during site walkovers and intrusive site investigations undertaken as part of the baseline assessment works.

9.2.1 Quaternary Deposits

The Quaternary Geology underlying the proposed CGEP is discussed below and presented in Figure 9.1. The subsoils present within the development site and wider study area were taken from the Geological Survey of Ireland (GSI) online mapping - Quaternary Geology of Ireland (1:50,000 scale) and comprise:

- Till derived from Devonian sandstones (TDSs);
- Bedrock outcrop or sub-crop (Rck);
- Limited extent of blanket peat (BktPt) and Cut Peat (Cut).

As shown in Figure 9.1 the majority of turbine location and associated infrastructure are located within areas classified as Till derived from Devonian Sandstones. Areas of bedrock outcrop or sub crop are identified at locations T2, T5, T14, T20 and T21.

The majority of the proposed grid connection route is underlain by Till derived from Devonian Sandstones with limited areas of bedrock sub-crop or outcrop indicated along the proposed route.

During site walkovers limited areas of shallow Peat/Peaty Topsoil deposits were noted to be limited in extent and thin with typical thicknesses of between 0.1 – 0.4m.

9.2.2 Solid Geology

The Geological Survey of Ireland (GSI) 1:100,000 scale bedrock geology map shows that the proposed wind farm development site of the CGEP is underlain by the Devonian Ballytrasna Formation.

The Ballytrasna Formation is described as comprising dusky-red mudstone with subordinate pale-red sandstones occurring throughout the formation.

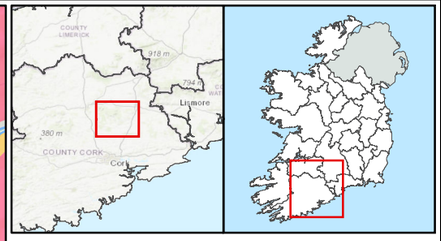
The bedrock geology that is within the proposed wind farm site forms an anticlinal feature as it is part of the regional folding in the Devonian rocks between the Mallow and Cork anticline. There is one main unnamed fault close to the proposed development site running in a northeast – southwest direction. Other faults in the surrounding area either follow this trend or run in a north – south direction.

The proposed grid connection route traverses the Ballytrasna Formation, as described above for the majority of the route. The eastern extent of the grid connection is underlain by the Gyleen and Waulsortian Formations. The Upper Devonian Gyleen Formation is described by the GSI as comprising of fining upwards sequences of red Sandstones with thinly bedded alternations of green and red Sandstones, Siltstones and Mudstones. The Carboniferous Waulsortian Formation is described by the GSI as comprising massive un-bedded lime-mudstone.

The bedrock geology of the proposed CGEP and surrounding area is presented in Figure 9.2.

During site investigations weathered bedrock was encountered at depths ranging from 1.3m to 3.0m BGL, with intact bedrock encountered at between 3.4m to 10.8m BGL. Where intact bedrock was encountered it was generally described as *medium strong to strong thinly bedded SILTSTONE.*

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-1_QuaternaryGeology_A3.mxd



- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation

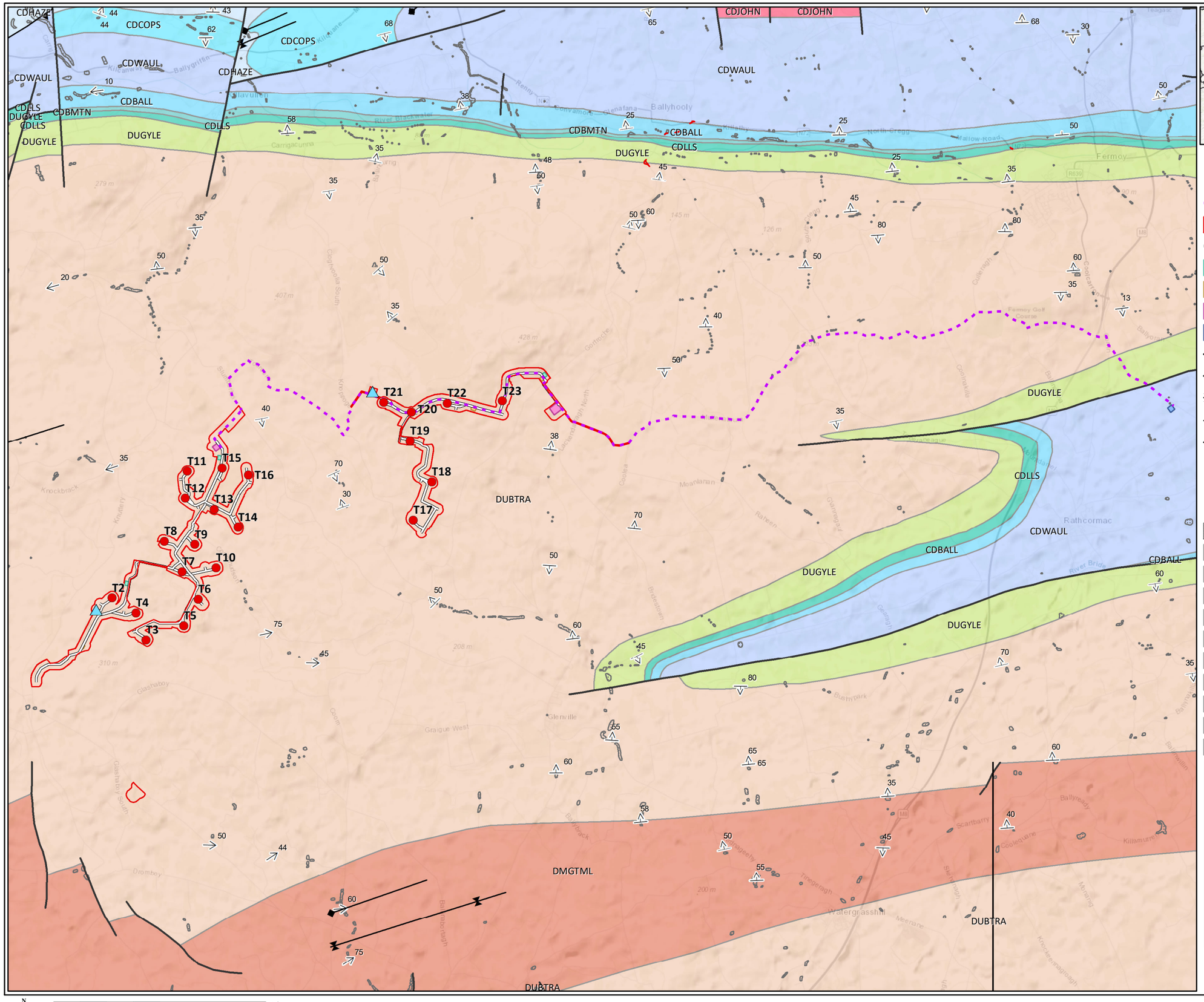
Quaternary Sediments

- A, Alluvium
- BktPt, Blanket Peat
- Cut, Cut over raised peat
- GDSs, Gravels derived from Devonian sandstones
- KaRck, Kartsified bedrock outcrop or subcrop
- L, Lacustrine sediments
- Rck, Bedrock outcrop or subcrop
- TDSs, Till derived from Devonian sandstones
- TNSSs, Till derived from Namurian sandstones and shales
- Urban
- Water

TITLE:	Quaternary Geology		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.1		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-2_BedrockGeology_A3.mxd



- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation
- Anticlinal Axis
- Fault
- Synclinal Axis
- Thrust, barbs on hanging-wall side
- X-Section
- Dip of bedding or main foliation, old GSI data
- Strike and dip of bedding, right way up
- Strike and dip of bedding, way up unknown
- Bedrock Outcrop
- Ballysteen Formation
- Ballymartin Formation
- Copstown Limestone Formation
- Hazelwood Limestone Formation
- Johnstown Red Marble Formation
- Lower Limestone Shale
- Waulsortian Limestones
- Gortanimill Formation
- Ballytrasna Formation
- Gyleen Formation

TITLE: Bedrock Geology

PROJECT: Coom Green Energy Park, Co. Cork

FIGURE NO:	9.2		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S

0 1 2 4 Kilometers

9.2.3 Hydrogeology

9.2.3.1 Groundwater Vulnerability

The Groundwater Vulnerability within the proposed CGEP boundary is classified by the GSI as ranging from 'High' to 'Extreme' with areas of exposed bedrock (X – Rock Near Surface) also present within the proposed development site. At the eastern extent of the proposed grid connection the vulnerability classification is reduced to 'Moderate'. The GSI distribution of groundwater vulnerability for the site area is shown in Figure 9.5.

Based on the GSI aquifer vulnerability mapping, overburden deposits are generally between 3 and 10m deep in the central portion of the site; generally, 3 to 5m deep in the north, east and south-east of the site; and <3m deep in the extreme west and north east of the site.

A summary of the groundwater vulnerability for the site is presented in Table 9.6. This table outlines the standard ratings of vulnerability used by the GSI, with the existing site conditions highlighted based on the findings of the site investigations.

Table 9-6: Groundwater Vulnerability

Vulnerability Rating	Hydrogeological Conditions		
	Subsoil Permeability (Type) and Thickness		
	High Permeability (sand/gravel)	Moderate Permeability (sandy soil)	Low Permeability (clayey subsoil, clay, peat)
extreme (E)	0 - 3.0m	0 - 3.0m	**0 - 3.0m**
high (H)	> 3.0m	3.0 -10.0m	**3.0 - 5.0m**
moderate (M)	N/A	>10.0 m	**5.0 - 10.0m**
low (L)	N/A	N/A	>10 m

9.2.3.2 Groundwater Bodies Description

The proposed wind farm site and the majority of the proposed gird connection of the CGEP is located within the Glenville Groundwater Body (GWB). The eastern extremity of the proposed grid connection route traverses the Tallow GWB as shown in Figure 9.3.

The descriptions of the GWBs within the study area have been taken from the 'Summary of Initial Characterisation' draft reports for each defined GWB published by the GSI in accordance with the Groundwater Working Group Publication: Guidance Document GW2 (2003). The GWB Characterisation Reports are available from the GSI Public Data Viewer. Site specific data including depth to bedrock and subsoil type encountered during intrusive investigations has been used to supplement and validate the published information.

Ballinhassig GWB

The Ballinhassig GWB which underlies the access road to the Bottlehill landfill site adjacent to the CGEP development covers the upland areas of the River Lee catchments and its tributaries. This GWB is bounded to the north by the Glenville GWB which is discussed in the following section. The dominant bedrock units of this GWB comprise the Devonian Old Red Sandstones which includes the Ballytrasna Formation which underlies much of the study area.

The GSI indicates that permeability within the GWB generally decreases rapidly with depth in all aquifers within this GWB. Aquifer categories within the Ballinhassig GWB are either Locally Important or Poor Aquifers. General transmissivities are reported by the GSI to be 'Low'.

However, 'Excellent' yielding wells known in some of the Old Red Sandstone units – these yields are usually associated with boreholes being situated on fault zones.

Diffuse recharge will occur via rainfall percolating through the subsoil or areas of outcropping rock. The generally Low permeability of the aquifer and the sloping topography in the north of the GWB indicate that a high proportion of recharge to the aquifer will discharge rapidly to surface water features. Groundwater flows within the GWB are relatively short from 30-300 m, with groundwater discharging to springs, or to the streams that traverse the aquifer.

Glenville GWB

Due to the general absence of intergranular permeability within the underlying Ballytrasna Formation, groundwater flow generally occurs in faults and joints within this GWB. The majority of the groundwater flow generally occurs in an upper, shallow weathered zone. This is due to the lesser frequency and connectivity of water-bearing fractures and fissures at depth within the GWB.

The main recharge mechanism for the GWB is via diffuse recharge from rainwater percolating through the subsoils. According the GSI, groundwater within this GWB is generally unconfined with local groundwater flow towards the rivers and streams, and flow paths will not usually exceed a few hundred metres in length.

Tallow GWB

The Tallow GWB is classified as a Regionally Important Karstified Aquifer (Rkd) dominated by diffuse flow, underlying the eastern extent of the proposed grid connection route. The main aquifer lithology in this GWB is Dinantian Pure Unbedded Limestones (Waulsortian Limestone Formation) as shown in Figure 9.2. The bedrock aquifer is generally devoid of intergranular permeability with groundwater flow occurring in faults and joints, enlarged by karstification. Due to the high frequency of fissures in this GWB, overall groundwater flow is thought to be of a diffuse nature.

Sandstone ridges within the adjacent Glenview GWB provide surface water runoff which recharges the aquifer lithologies within the Tallow GWB. According to the GSI a small volume of groundwater may cross as throughflow from the sandstones in the Glenview GWB. Recharge within the Tallow GWB is via point and diffuse recharge. Karst features such as swallow holes and collapse features provide the means for point recharge to the underlying aquifer. Diffuse recharge occurs across the entire GWB via rainfall percolating through the subsoil.

The GSI classifications for the aquifer in the study area, including the principal aquifer characteristics are summarised in Table 9.7, and shown on Figure 9.3. All aquifers in the study area are bedrock aquifers; there are no gravel aquifers within the study area (i.e. a gravel deposit of greater than 1km^2 with a saturated thickness of greater than 5m).

Table 9-7: Summary of Aquifer Classifications & Characteristics

Groundwater Body	European Code	Aquifer Name	GSI Aquifer Classification	Status	Transmissivity (m^2/day)
Ballinhassig	IE_SW_G_004	Unnamed	Locally important aquifer- bedrock which is moderately productive only in local zones	Good	Typically, 2- 20 m^2/d
Glenville	IE_SW_G_037	Unnamed	Locally important aquifer- bedrock which is moderately productive only in local zones	Good	2- 20 m^2/d
Tallow	IE_SW_G_074	Unnamed	Regionally Important Karstified Aquifer	Good	270 – 1820 m^2/d

According to interim classification work carried out as part of the Water Framework Directive and published by the EPA, the Ballinhassig, Glenville and Tallow GWBs are classified as having *'Good'* status in terms of quality and quantity. The overall risk for both GWBs is under review by the EPA with regards to groundwater quality.

9.2.3.3 Groundwater Supply Sources

A review of published information on groundwater supply sources within the study area was undertaken to identify potential groundwater dependant receptors at potential risk from the proposed development. These include group water schemes (GWS), source protection zones and private supply wells with information on these features obtained from the GSI Groundwater database and site walkovers.

9.2.3.4 Source Protection Zones

The GSI maintains a database of Public Supply Source Protection Areas. From a review of the database there are no Public Supply Source Protection Areas within the proposed development site boundary.

There are however 3 No. Source Protection Areas for public water supply schemes in the vicinity of the proposed development site, and these are:

- Carrignavar, approximately 10km south of the proposed development boundary,
- Grenagh, approximately 7km west of the proposed development boundary,
- Coolroe, approximately 2.3km north of the proposed grid connection route.

These Public Supply Source Protection Areas are presented in Figure 9.4.

9.2.3.5 Public Water Supplies and Group Water Schemes

Based on a review of the Cork County Council Report: *Aquifer Protection for Water Supplies in the Northern Division (1998*) and the current EPA and GSI groundwater databases, there are no Public Water Supplies (PWS's) or Group Water Schemes (GWS) within the boundary of the proposed CGEP. However, there are a number of PWS's and GWS's within the vicinity of the proposed development and in the wider study area. These are:

- Coolroe (Fermoy) PWS
- Bottlehill GWS
- Grenagh GWS
- Burnfort GWS
- Knockbrack GWS
- Glenville GWS
- Whitechurch/Ryefield GWS
- Carrignavar GWS

The locations of each of the GWS's referenced above are presented in Figure 9.4. Where available water quality and monitoring data is available for the GWS's a summary is provided in the following sections.

Coolroe (Fermoy) PWS

According to the GSI Report: *Fermoy Water Supply Scheme*, the Fermoy Water Supply is situated in the townland of Coolroe, about 3km west of Fermoy town in North Cork. The water supply comes from an infiltration gallery constructed in 1968. The gallery is 350 metres long and is aligned approximately east-west, some 15 to 30 metres south of the bank of the Blackwater River. There is also a Production Borehole (PW 1) drilled in December 1999, and an observation borehole (trial well, TW 4) drilled in March 1996.

The GSI reports that the water quality at both the sources is generally good, apart from elevated nitrate levels.

Grenagh GWS

According the GSI Report: *Grenaghy Water Supply Scheme*, the Grenagh Water Supply is spread across the townlands of Grenagh North and Grenagh South (at Quarryhall Cross, which is located approximately 1km south of Grenagh village).

The water supply comprises 2 No. bored wells in the village, located at the edge of a green field area beside the council houses (one borehole in the pumphouse and the other approximately 25m away, outside) and the bored well at Quarryhall Cross.

The GSI reports that the water quality at both the sources is generally good, although there have been recorded instances of the exceedance of the Maximum Admissible Concentrations (MAC) for coliforms during historical monitoring undertaken. The GSI recommended that the supply be chlorinated.

Carrignavar GWS

The reference material for the Carrignavar Water Supply is taken from the EPA Report: *Establishment of Groundwater Source Protection Zones, Carrignavar Group Water Supply Scheme.* The supply is provided by two boreholes situated approximately 50m apart. BH-1 was installed in 1994. Due to increasing demand the borehole was unable to meet the supply required and therefore in 2004, BH-2 was installed and added to the Carrignavar Water Supply.

Groundwater analysis undertaken indicates a medium hard calcium bicarbonate hydro-chemical signature (average 105mg/l CaCO3). The average conductivity is 251µS/cm and pH is around 6.5 which is indicative of siliceous bedrock material. According to the OCM Report there was only one reported incident of Faecal Coliforms in the water supply. This was found to be an isolated occurrence. Other parameters monitored at the supply are generally reported to be below the MAC Values.

9.2.3.6 Groundwater Wells and Springs

Based on a review of the GSI Groundwater Wells and Springs database there are 6 No. Groundwater Wells recorded (500m to 1km accuracy) within 1km of the proposed development site. Following discussions with local residents and site walkovers during July and August 2019 a further 1 No. groundwater supply well and 1 No. spring used for private water supply was identified.

Figure 9.4 shows the location of groundwater wells within the vicinity of the proposed development included in the GSI dataset. Table 9.8 below outlines details of groundwater wells and springs held within the GSI dataset and those identified during site assessments within 1km of the proposed development.

Table 9-8: Summary of Wells within 1km of the Proposed Development

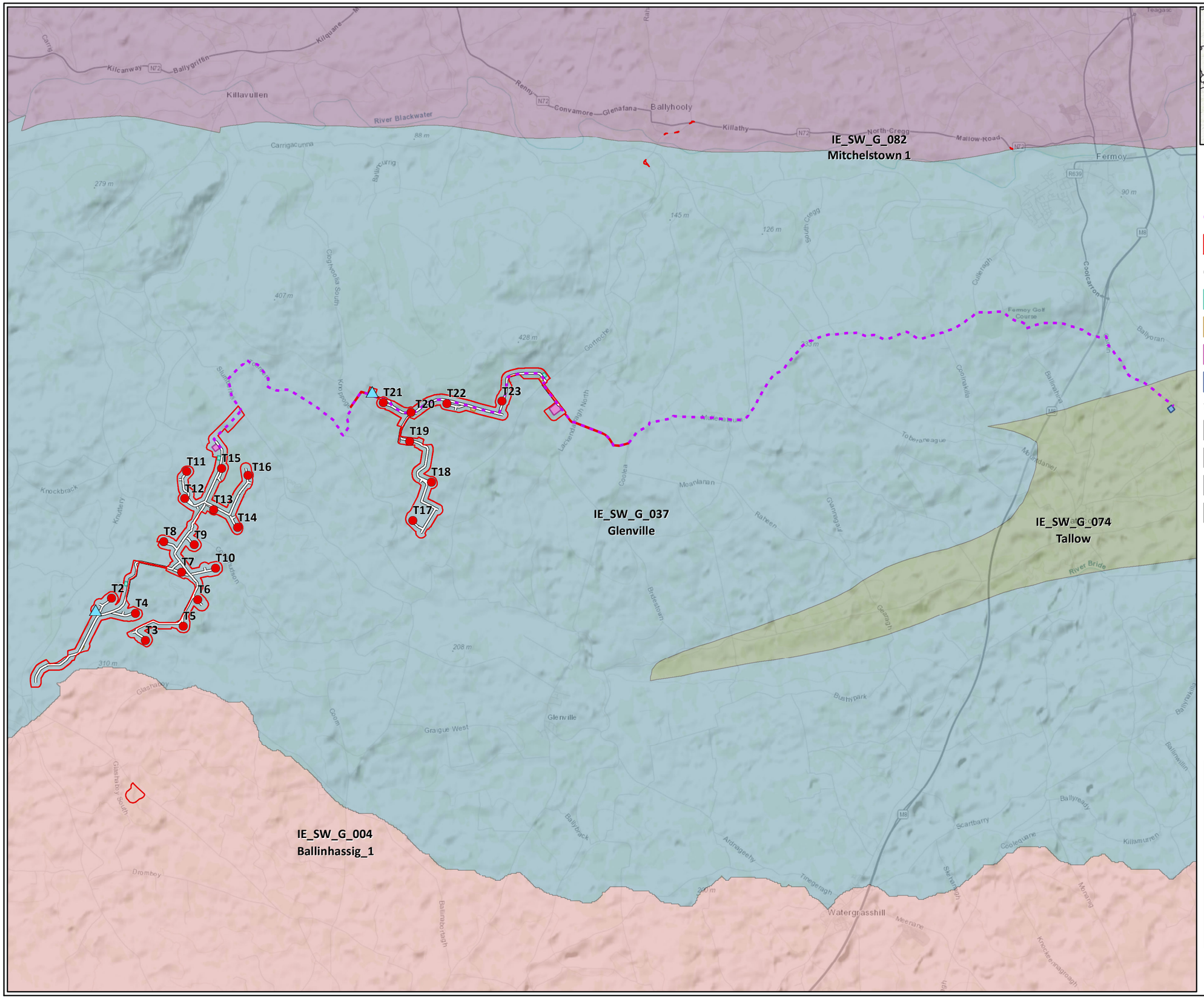
Location ID	Easting (ITM)	Northing (ITM)	Type	Total Depth (m BGL)	Current Use	Yield Class	GSI Location Accuracy (m)	Nearest Infrastructure ID
1409SEW014	165070	93710	Borehole	4.5	Unknown	Unknown	10-50m	Grid Connection
1709SWW004	180300	94500	Borehole	22.9	Agricultural use only	Poor	10-50m	Grid Connection
1709SWW006	173250	93600	Borehole	38.1	Agricultural & domestic use	Poor	10-50m	Grid Connection

Location ID	Easting (ITM)	Northing (ITM)	Type	Total Depth (m BGL)	Current Use	Yield Class	GSI Location Accuracy (m)	Nearest Infrastructure ID
1409SEW040	162760	91660	Borehole	86.9	Agricultural & domestic use	Poor	200-500m	Turbine 8
1409SEW001	165160	91740	Borehole	45.7	Unknown	Poor	500-1km	Turbine 14
GWS001	162511	88641	Borehole	36.0	Agricultural & domestic use	Unknown	<10	BP01
GWS002	169907	93370	Spring	0	Agricultural & domestic use	Unknown	<10	T23

9.2.3.7 Karst Features

The underlying bedrock (Waulsortian Formation) at the eastern extent of the proposed grid connection is prone to karstification. However, according to the GSI datasets, there are no karst features recorded within the proposed site. The nearest karst feature is Killavull Cave (564693E 596814N) which is located approximately 1km to the north of the proposed site.

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-3_GroundwaterBodies_A3.mxd



Proposed Turbine Layout

Proposed Permanent Met Masts

Proposed Cable Route

Proposed Development Boundary

Proposed Internal Roads

Proposed Borrow Pit

Proposed Temporary Compound

Proposed Substation

Existing Barrymore 110kV Substation

WFD Ground Water Bodies

IE_SW_G_004, Ballinhassig_1

IE_SW_G_037, Glenville

IE_SW_G_074, Tallow

IE_SW_G_082, Mitchelstown 1

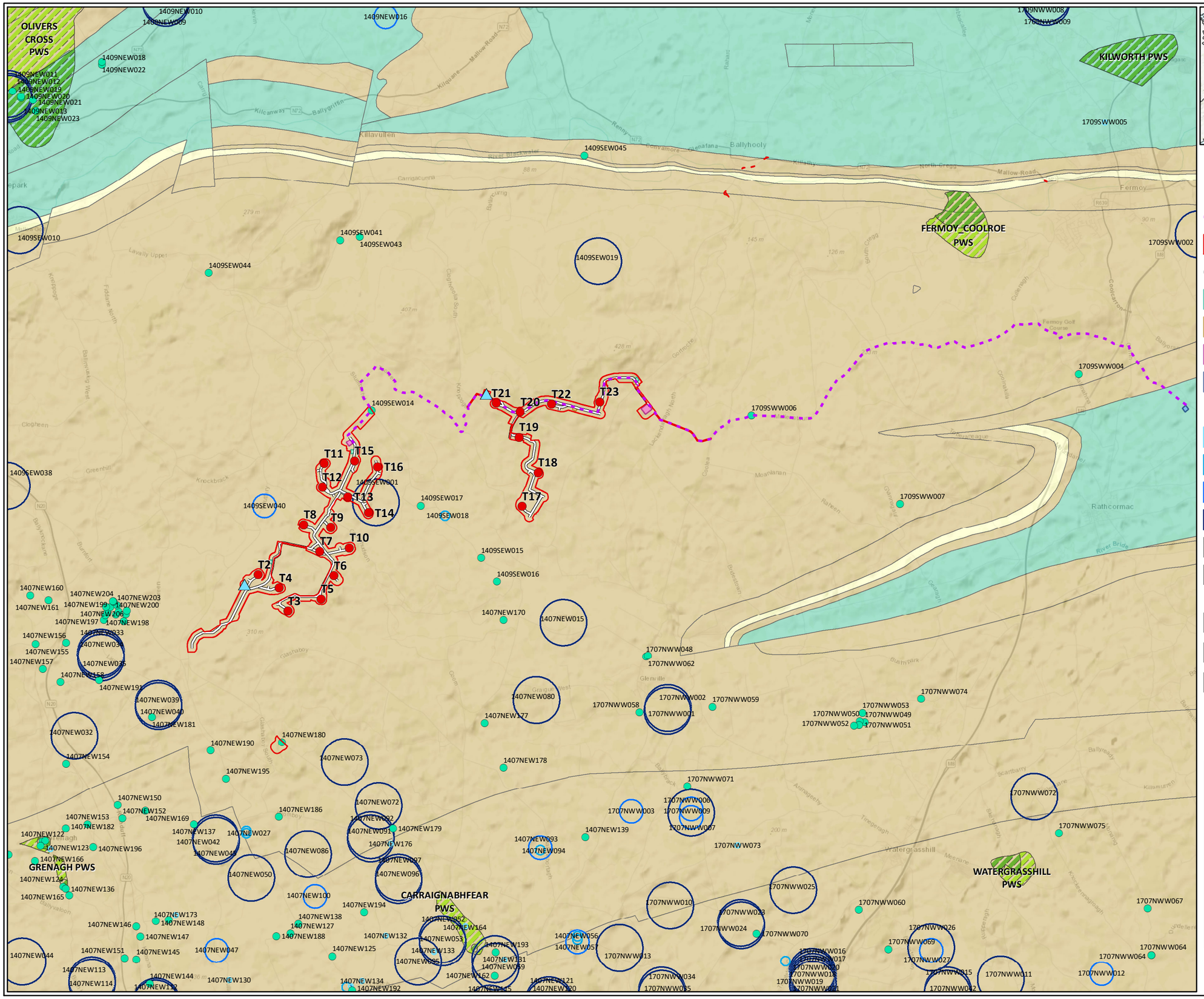
N W E S

0 1 2 4 Kilometers

TITLE:	Groundwater Bodies		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.3		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-4_AquiferClassification_A3.mxd



N W E S

0 1 2 4 Kilometers

TITLE: Aquifer Classification

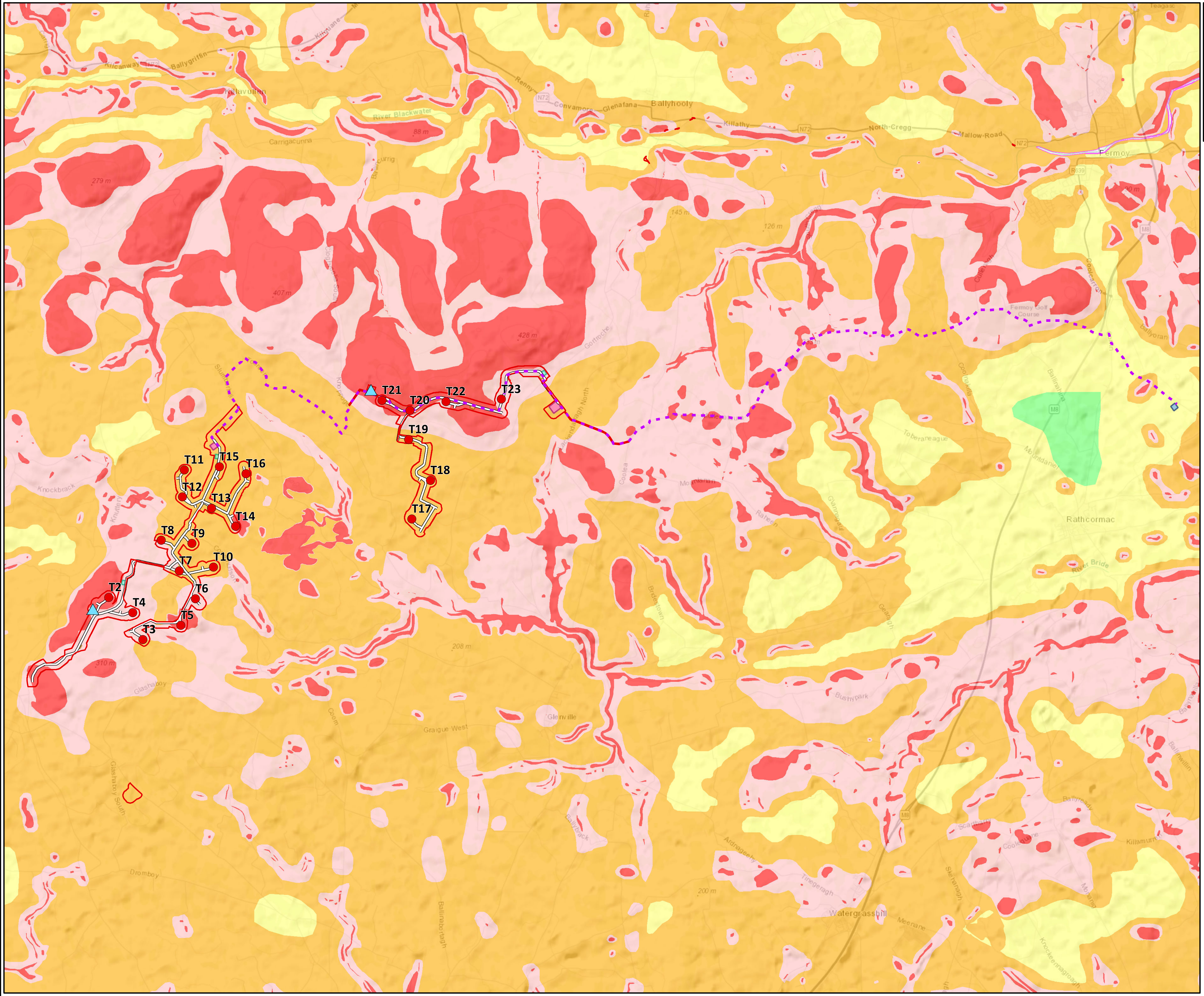
PROJECT: Coom Green Energy Park, Co. Cork

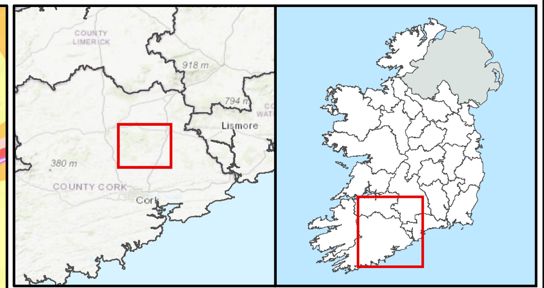
FIGURE NO:	9.4		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:80000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-5_GroundwaterVulnerability_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation

Groundwater Vulnerability

- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X - Rock Near Surface or Karst

N W E S

0 1 2 4 Kilometers

TITLE:	Groundwater Vulnerability		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.5		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	REVISION:	0
DATE:	28/09/2020	PAGE SIZE:	A3

FEHILY TIMONEY Cork | Dublin | Carlow www.fehilytimoney.ie

9.2.4 Geological Heritage

The GSI - Irish Geological Heritage Section (IGH) and NPWS (National Parks and Wildlife Service) have undertaken a programme to identify and select important geological and geomorphological sites throughout the country for designation as NHAs (Natural Heritage Areas) – the Irish Geological Heritage Programme. This is being addressed under 16 different geological themes. For each theme, a larger number of sites (from which to make the NHA selection) are being examined, to identify the most scientifically significant. The criterion of designating the minimum number of sites to exemplify the theme means that many sites of national importance are not selected as the very best examples. However, a second tier of County Geological Sites (CGS) (as per the National Heritage Plan) means that many of these can be included in County Development Plans and receive a measure of recognition and protection through inclusion in the planning system.

The GSI Online Irish Geological Heritage database indicates that the proposed development area is not located in an area of specific geological heritage interest. The nearest site of significant geological heritage features to the study area is located approximately 9km to the west of the proposed development at Carrigcleena. The feature is described by the GSI as comprising an outcrop of Devonian volcanics in a working quarry.

The distribution of Geological Heritage sites is shown on Figure 9.6.

9.2.5 Economic Geology

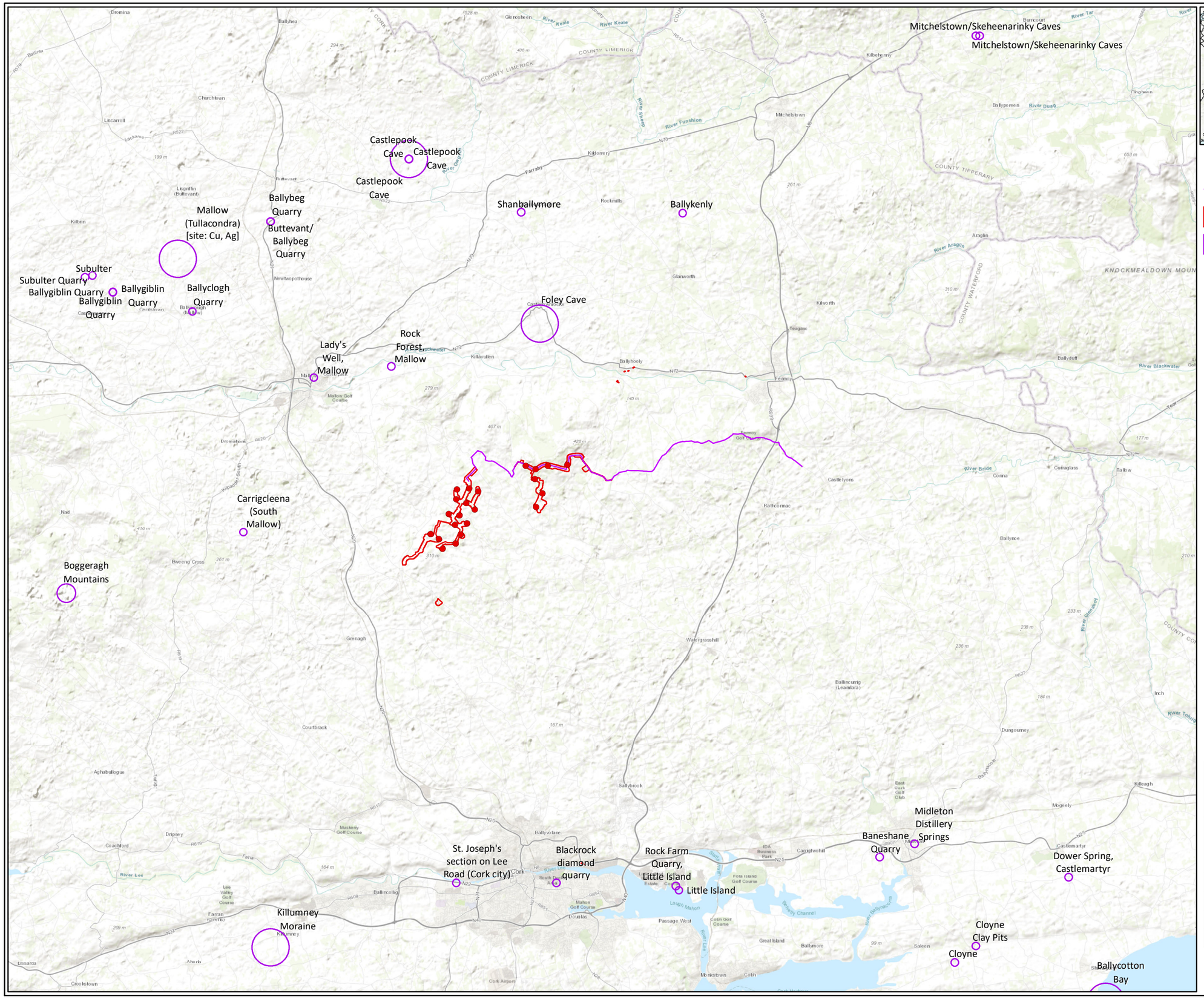
The GSI Online Minerals Database accessed via the Public Data Viewer shows a number of active and historic quarries and mineral occurrences surrounding the study area. Their distribution is shown on Figure 9.7. These consist of rock quarries, a sand and gravel quarry and recorded mineral occurrences none of which are located within the site boundary.

There is a historic borrow pit associated with the construction of the existing Bottlehill Landfill located to the south west of the landfill site. This borrow pit is not currently active. The site of the existing borrow pit was visited during the Site Walkovers conducted by FT. The borrow pit comprises of exposed slopes of Glacial Till which were typically noted to comprise light brown/red sandy gravelly CLAY with Cobbles.

The nearest quarry is identified as Finbarr O'Neill Ltd. at Lyrevarrig, Glenville. This is a Sand & Gravel quarry to the north-east of the Bottlehill cluster.

The GSI Aggregates database indicates that there is a very low to moderate potential for crushed rock aggregate across much of the site as shown in Figure 9.8.

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-6_GeologicalHeritage_A3.mxd



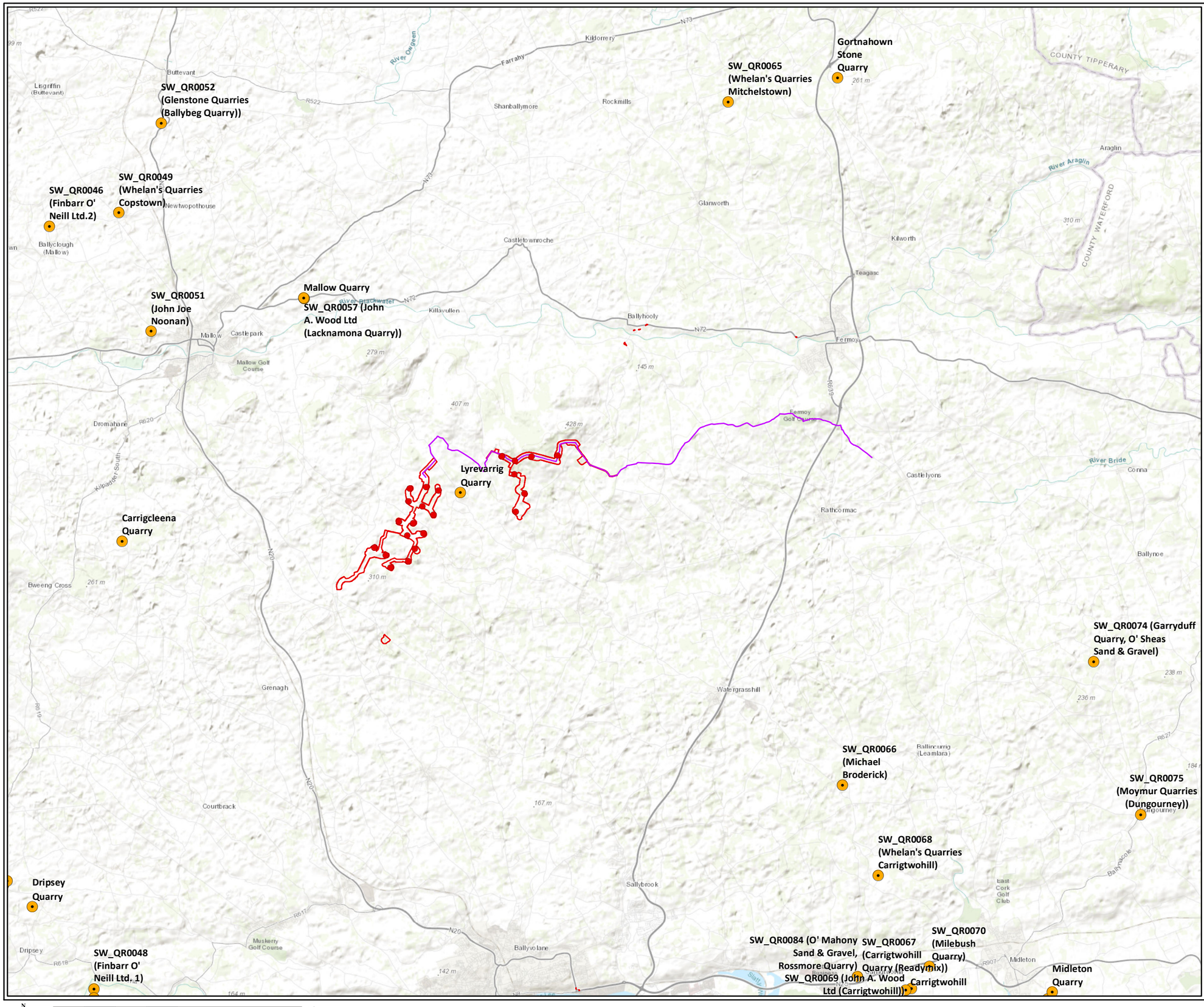
N
W E
S

0 2.5 5 10 Kilometers

TITLE:	Geological Heritage		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.6		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:200000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-7_EconomicGeography_A3.mxd



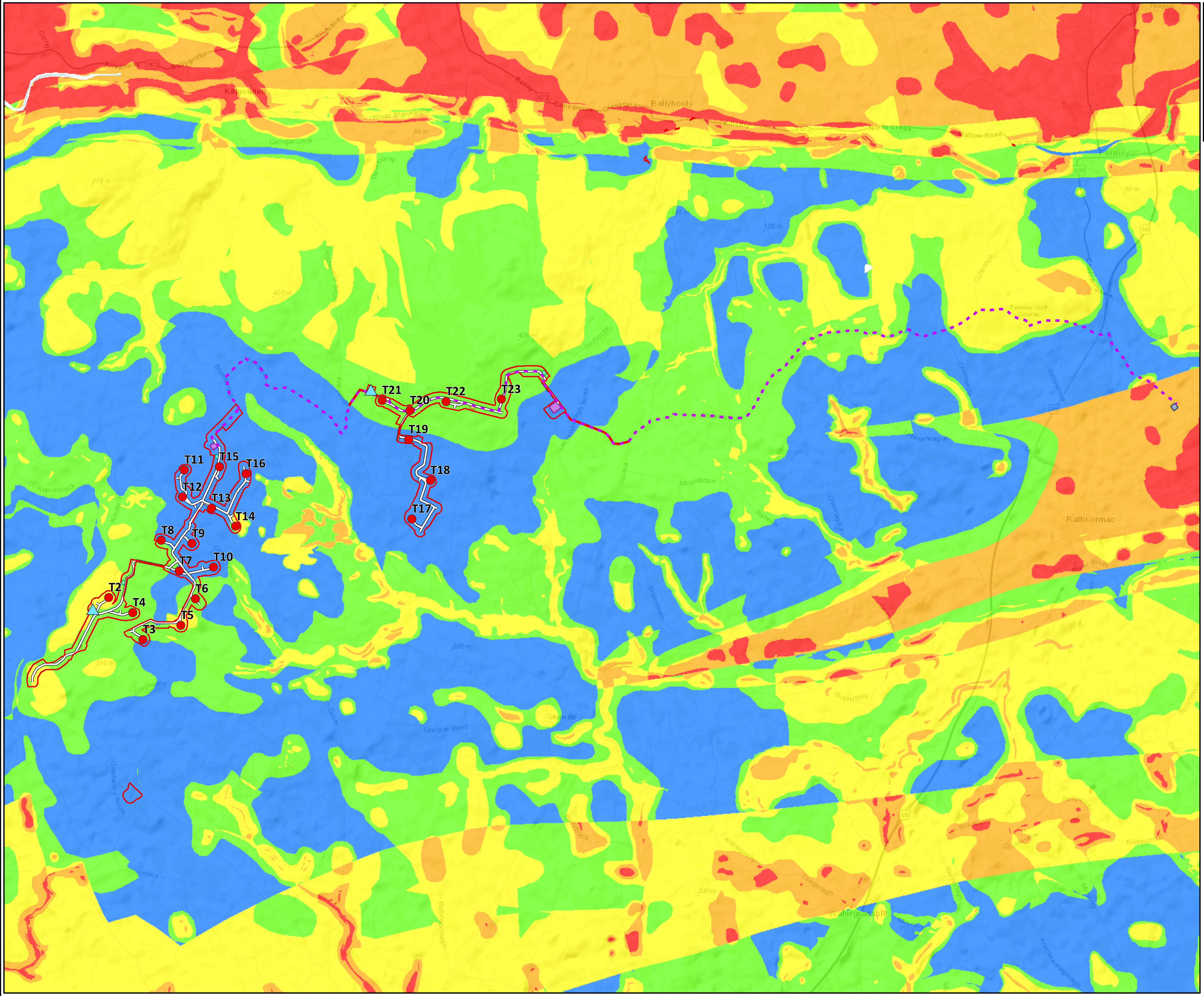
TITLE:	Economic Geography
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	9.7
CLIENT:	Coom Green Energy Park Ltd.
SCALE:	1:150000
REVISION:	0
DATE:	28/09/2020
PAGE SIZE:	A3

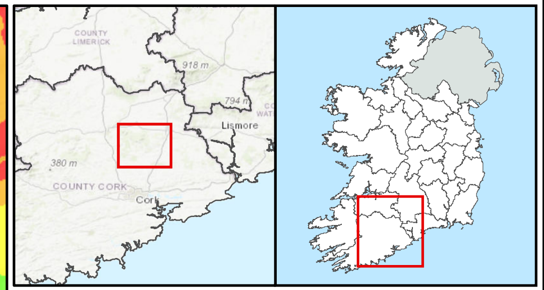
FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S
0 2.5 5 10 Kilometers

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-8_CrushedRockPotential_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Lally, GSI
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





Proposed Turbine Layout
Proposed Permanent Met Masts
Proposed Cable Route
Proposed Development Boundary
Proposed Internal Roads
Proposed Borrow Pit
Proposed Temporary Compound
Proposed Substation
Existing Barrymore 110kV Substation

Crushed Rock Aggregate Potential

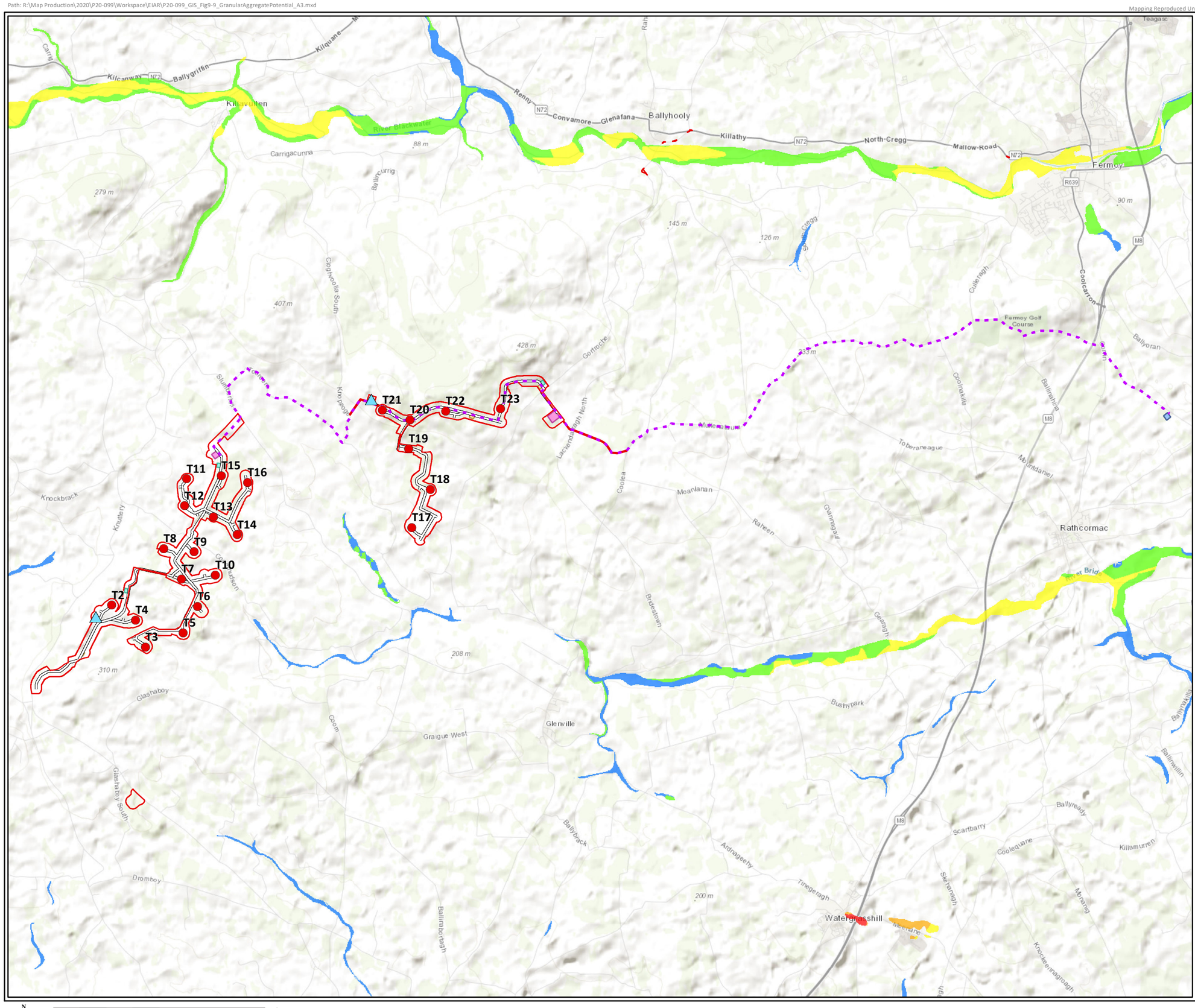
Very High potential
High potential
Moderate potential
Low potential
Very Low potential

TITLE: Crushed Rock Potential	
PROJECT: Coom Green Energy Park, Co. Cork	
FIGURE NO: 9.8	
CLIENT: Coom Green Energy Park Ltd.	
SCALE: 1:70000	**REVISION:** 0
DATE: 28/09/2020	**PAGE SIZE:** A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

0 1 2 4 Kilometers

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-9_GranularAggregatePotential_A3.mxd



- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation

Granular Aggregate Potential

- Very High potential
- High potential
- Moderate potential
- Low potential
- Very Low potential

TITLE:	Granular Aggregate Potential		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.9		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S

0 1 2 4 Kilometers

9.2.6 Site Investigations

As outlined in Section 9.2.7 site walkovers and peat stability assessments were undertaken by an Engineering Geologist working for Fehily Timoney and Company (FT) during June and July 2019 and August 2020 to determine the baseline characteristics of the proposed development site. Intrusive and non-intrusive site investigations were undertaken by Irish Drilling Ltd (IDL) and Minerex Environmental Ltd under the supervision of an Engineering Geologist from FT from June to October 2019 and during October and November 2020.

Intrusive investigations were undertaken at the proposed borrow pit locations, at selected proposed turbine locations and at each of the 3 No. proposed HDD water crossing locations along the proposed grid connection route. The purpose of the intrusive works was to confirm the geological succession underlying the site. The site investigations comprised the excavation of 18 no. trial pits to a maximum depth of 4.4m BGL and 3 No. cable percussive/rotary boreholes to a maximum depth of 15m BGL.

Topsoil was encountered across the site and at each infrastructure location during the site walkover and intrusive investigations. The Topsoil ranged from *soft, peaty Topsoil* to *loose loamy Topsoil* with *peaty SILT* and *gravelly SILT* deposits also encountered to a maximum depth of 0.6m BGL. Localised and thin *amorphous Peat* deposits were also noted at some locations as outlined below in Table 9.10.

Peat deposits were generally noted to be limited in extent and thin with typical thicknesses of between 0.1 – 0.6m.

The Topsoil and Peat deposits described above were found to overlie Glacial Till deposits either cohesive or granular in nature. Cohesive deposits encountered typically comprised *Soft to Stiff sandy gravelly SILT* or *Firm to stiff slightly sandy slightly gravelly CLAY* to a maximum depth of investigation of 4.3m BGL in trial pit TP23. The granular Glacial Till deposits encountered typically comprised *Clayey gravelly fine to coarse SAND with Cobbles* or *Silty sandy fine to coarse sub-angular to angular GRAVEL with Cobbles and/or Boulders.* Granular deposits were encountered to the maximum depth of investigation in borehole RC03 at 15.0m BGL.

Weathered Bedrock of the Ballytransa Formation was encountered during site investigations at depths of between 1.3 to 3.0m BGL where is was typically described as comprising *Weathered SILTSTONE or SILTSTONE/MUDSTONE*. Competent Bedrock was encountered in trial pits and boreholes at depths of between 2.7m to 10.8m BGL. Bedrock cores retrieved from the site investigation boreholes were typically described as *Medium strong thinly bedded greenish brown slightly sandy fine-grained SILTSTONE.*

In conjunction with the intrusive site investigations outlined above Minerex Geophysics Ltd. undertook a geophysical survey to determine ground conditions at proposed turbine locations. This included an estimate of the depth to bedrock and overburden thickness, to estimate the strength/stiffness of overburden deposits and an estimate of the rock quality. The geophysical survey was also utilised to identify lateral change or variations in geological conditions at each proposed turbine location and identify any potential faults and fracture zones.

The geophysical survey comprised of continuous 2D Electrical Resistivity (ERT) and Seismic Refraction (P-Wave) Profiling along pre-designated transects at proposed turbine location.

Groundwater was encountered in all boreholes advanced at the proposed HDD water crossing locations. Groundwater strikes in boreholes RC02 and RC03 were encountered within the gravel or silt deposits encountered at these locations between 2.5m BGL and 6.0m BGL. In borehole RC01 groundwater was encountered at the interface with the weathered bedrock at approximately 2.5m BGL.

During trial pit excavations minor shallow (perched) groundwater seepage at moderate ingress was noted in certain trial pits. Table 9.9 shows the groundwater strikes encountered during the intrusive site investigations. The remainder of site investigation location were noted as being dry during the works.

Table 9-9: Summary of Groundwater Encountered

Borehole ID	Groundwater Strike (m BGL)
RC01	6.0m
RC02	4.0m
RC03	2.5m
BP-TP01 (at BP01)	Seepage at 2.0m
BP2-TP04	Seepage at 3.0m
BP3-TP03	Seepage at 3.0m
TP-T03	Seepage at 1.2m
TP-T07	Seepage at 3.0m
TP-T13	Seepage at 2.0m
TP-T20	Seepage at 3.5m
TP-T22	Moderate Ingress at 2.0m

The detailed findings and conclusions of the site walkovers and site investigation works is provided in Appendix 9.1 – Geotechnical Assessment Report. A brief description of the ground conditions encountered during the site walkovers and site investigations completed during the assessment of the receiving environment is provided in the following section with a summary provided below in Table 9.10.

Table 9-10: Site Assessment Summary

Proposed Infrastructure	Land use	Quaternary Deposits (GSI Online Mapping)	Ground conditions encountered	Average Peat Depth (m)	Slope (degrees)	Depth to Bedrock (m) from Site Investigations	Groundwater Vulnerability (GSI Online Mapping
T02	Mature Forestry	Bedrock outcrop or sub-crop	Soft Peaty Topsoil with gentle to level topography	0.3m	2	4.5m	X – Rock Near Surface
T03	Immature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil overlying stiff cohesive glacial deposits, with gentle topography	0.3m (Peaty Topsoil)	4	2.5m	High to Extreme
T04	Mature Forestry	Till derived from Devonian sandstones	Soft Peaty Topsoil with gentle topography	0.3m	2	6.4 - 12.5m	Extreme
T05	Mature Forestry	Till derived from Devonian sandstones	Soft Peaty Topsoil with gentle to level topography	0.4m	3	5.0 - 7.5m	Extreme to X – Rock Near Surface
T06	Mature Forestry	Till derived from Devonian sandstones	Made Ground overlying stiff cohesive glacial deposits, with gentle to level topography	0.3m (Peaty Topsoil)	4	3.0 - 4.5m	Extreme
T07	Mature Forestry	Till derived from Devonian sandstones	Soft Peaty Topsoil overlying granular glacial deposits, with gentle to level topography	0.6m (Amorphous peat with silt laminations)	2	3.0 - 5.0m	High to Extreme
T08	Agricultural Land (Grassland)	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle to level topography	-	2.2	6.0m	High to Extreme

Proposed Infrastructure	Land use	Quaternary Deposits (GSI Online Mapping)	Ground conditions encountered	Average Peat Depth (m)	Slope (degrees)	Depth to Bedrock (m) from Site Investigations	Groundwater Vulnerability (GSI Online Mapping
T09	Felled forestry lands	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle topography	-	3.4	2.5m	High
T10	Edge of mature forestry and agricultural land	Till derived from Devonian sandstones	Grassland with Loamy Topsoil, level topography	-	1.7	3.4 - 7.0m	High
T11	Agricultural Land (Grassland)	Till derived from Devonian sandstones	Grassland with Loamy Topsoil, level topography	-	1.7	2.4m	High
T12	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle topography	-	1.1	5.0m	High
T13	Felled forestry lands	Till derived from Devonian sandstones	Soft Peaty Topsoil with gentle to level topography	0.2m (Peaty Topsoil)	1.7	2.7m	High
T14	Mature Forestry	Bedrock outcrop or sub-crop	Soft Organic Topsoil with gentle topography	-	2.2	4.8m	X – Rock Near Surface
T15	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle topography	-	3.4	4.0 - 10.0m	High
T16	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle topography	-	3.4	4.5	High
T17	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle to moderately sloping topography	-	3.4	2.0 - 4.5m	High

Proposed Infrastructure	Land use	Quaternary Deposits (GSI Online Mapping)	Ground conditions encountered	Average Peat Depth (m)	Slope (degrees)	Depth to Bedrock (m) from Site Investigations	Groundwater Vulnerability (GSI Online Mapping
T18	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle to moderately sloping topography	-	4	8.0m	High
T19	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle to moderately sloping topography	-	5	5.6m	High
T20	Mature Forestry	Bedrock outcrop or sub-crop	Soft Organic Topsoil with gentle to moderately sloping topography	-	10.2	3.4 - 10.0m	X – Rock Near Surface
T21	Mature Forestry	Bedrock outcrop or sub-crop	Soft Organic Topsoil with gentle to moderate to steep slopes	-	14.5	10.0m	X – Rock Near Surface
T22	Mature Forestry	Bedrock outcrop or sub-crop	Soft Organic Topsoil with gentle to moderate to steep slopes	-	10.2	4.0m	Extreme to X – Rock Near Surface
T23	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle to moderate slopes	-	5	8.6m	Extreme
BP1	Young Forestry	Till derived from Devonian sandstones	Soft Peaty Topsoil with gentle slopes	0.2m (Peaty Topsoil)	2	2.5 - 2.7m	Extreme
BP2	Mature Forestry	Till derived from Devonian sandstones	Exposed Mineral Soil with gentle slopes	-	3	2.0 – 2.8m	High
BP3	Mature Forestry	Bedrock outcrop or sub-crop	Exposed Mineral Soil with moderate slopes	-	6	NP	Extreme

Proposed Infrastructure	Land use	Quaternary Deposits (GSI Online Mapping)	Ground conditions encountered	Average Peat Depth (m)	Slope (degrees)	Depth to Bedrock (m) from Site Investigations	Groundwater Vulnerability (GSI Online Mapping
Lackendarragh North Substation	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle slopes	-	3	-	High
Temporary Compound (South)	Young Forestry	Till derived from Devonian sandstones	Soft Peaty Topsoil with gentle slopes	0.2m (Peaty Topsoil)	3	-	Extreme
Temporary Compound (North)	Mature Forestry	Till derived from Devonian sandstones	Soft Organic Topsoil with gentle slopes	-	3	-	Extreme

9.2.7 Existing Slope Stability

During the site walkovers a series of hand-held probes were undertaken to determine the presence/depth of peat and/or soft soils within the proposed CGEP site. From a desk top review of the proposed grid connection route, the majority of the proposed route is situated within existing public highway. As such and given the limited extent of lateral and vertical excavations it was not considered a risk was posed to slope stability along the grid connection route. A summary of the general topography and slopes at the proposed development are summarised below.

Topography of the Proposed Development Site

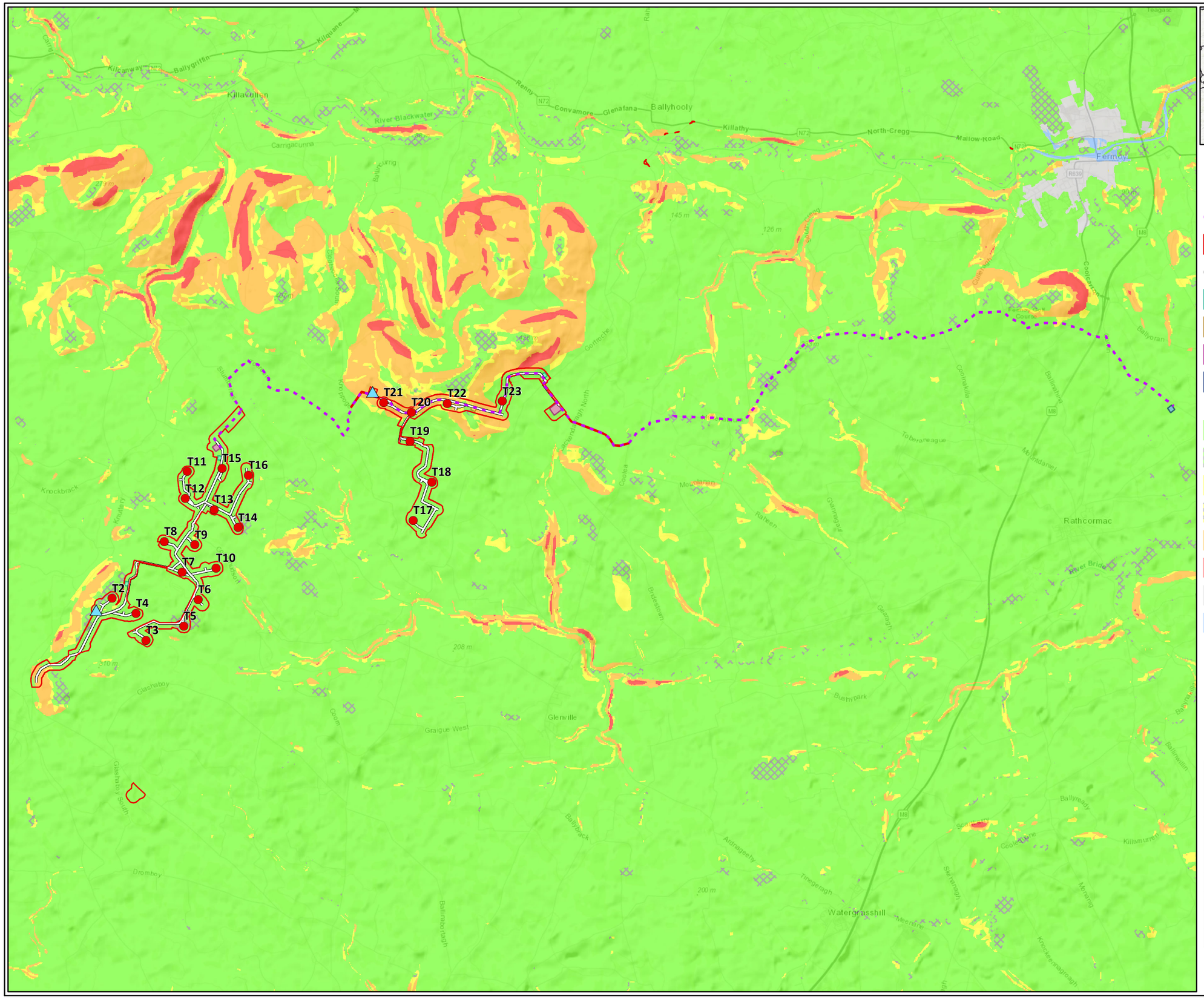
The slopes of the southern portion of the proposed development site (Bottlehill) is characterised by elevated lands with typical elevations of between 270m to 290m AOD with steep to moderate slopes to the west of the site boundary. Slopes within the proposed development and at proposed infrastructure locations generally comprise gentle slopes of between 1.7 to 3.4 degrees.

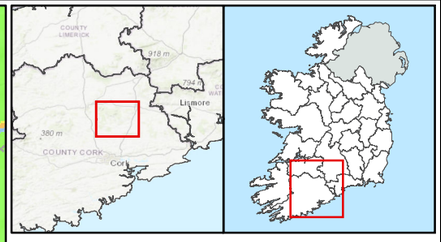
The central portion of the site (Mullenaboree) is also characterised by elevated lands with gentle slopes within the proposed development boundary of between 1.7 to 3.4 degrees.at turbine locations T11 to T16. Elevations at this portion of the proposed development are generally lower than those at the south with typical elevations of between 220m to 260m AOD.

The northern portion of the proposed development (Knockdoorty) which includes turbine locations T17 to T23, proposed borrow pit BP03 and the proposed Lackendarragh North sub-station comprises elevated lands sloping steeply to the south. A ridge feature at the extreme northern boundary of the proposed development trends east-west and reaches maximum elevations of between 424m and 428m AOD to the north of turbines T21 and T23 respectively.

Slopes at proposed turbine locations in this portion of the development range from gentle (3.4 degrees) to moderate to steep with maximum slope angles of 10.2 degrees at turbines T20 and T22 and 14.5 degrees at T21. These turbines are located along the east-west ridge at the north of the proposed development. Slopes at the proposed borrow pit BP03 are typically in the order of 6 degrees sloping the south-east.

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-10_LandslideSusceptibility_A3.mxd





- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Internal Roads
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation
- Existing Barrymore 110kV Substation

Landslide Susceptibility

- Low
- Low (inferred)
- Moderately Low
- Moderately Low (inferred)
- Moderately High
- High
- Made
- Water

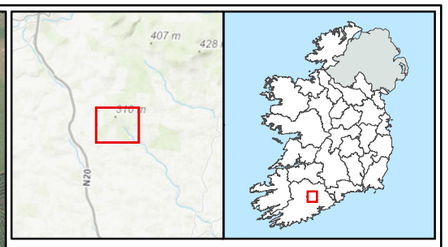
TITLE:	Landslide Susceptibility		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.10		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:70000	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S

0 1 2 4 Kilometers

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-11_GeomorphologicalFeatures_A3.mxd



- Proposed Turbine Layout
- Proposed Development Boundary
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding Area
- Proposed Temporary Compound

Geomorphological Features

- Peaty Topsoil
- Drainage Ditch

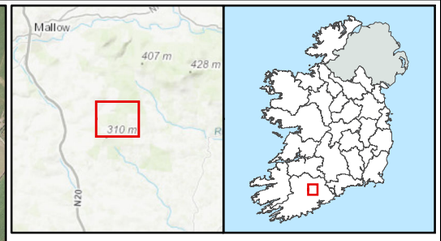
N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Geomorphological Features Area 1
PROJECT:	Coom Green Energy Park, Co. Cork
FIGURE NO:	9.11.1
CLIENT:	Coom Green Energy Park Ltd.
SCALE: 1:12500	**REVISION:** 0
DATE: 28/09/2020	**PAGE SIZE:** A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-11_GeomorphologicalFeatures_A3.mxd



- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding Area
- Proposed Borrow Pit
- Proposed Temporary Compound

Geomorphological Features

- Peaty Topsoil
- Thin Blanket Peat
- Drainage Ditch

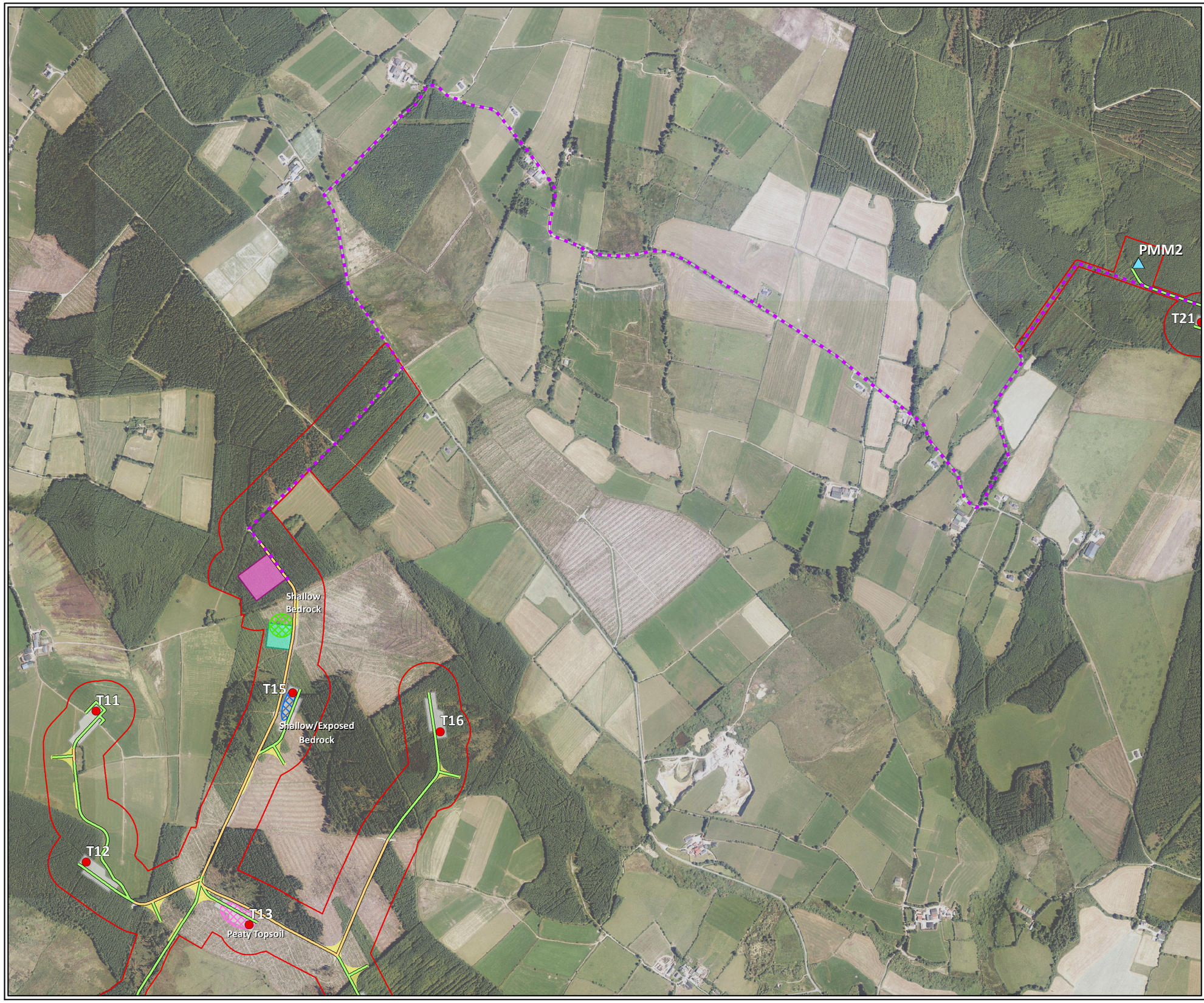
N W E S

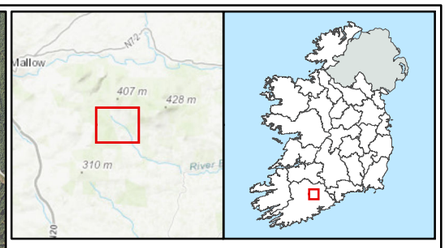
0 0.25 0.5 1 Kilometers

TITLE:	Geomorphological Features Area 2		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.11.2		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-11_GeomorphologicalFeatures_A3.mxd





- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding Area
- Proposed Borrow Pit
- Proposed Substation

Geomorphological Features

- Peaty Topsoil
- Shallow Bedrock
- Shallow/Exposed Bedrock

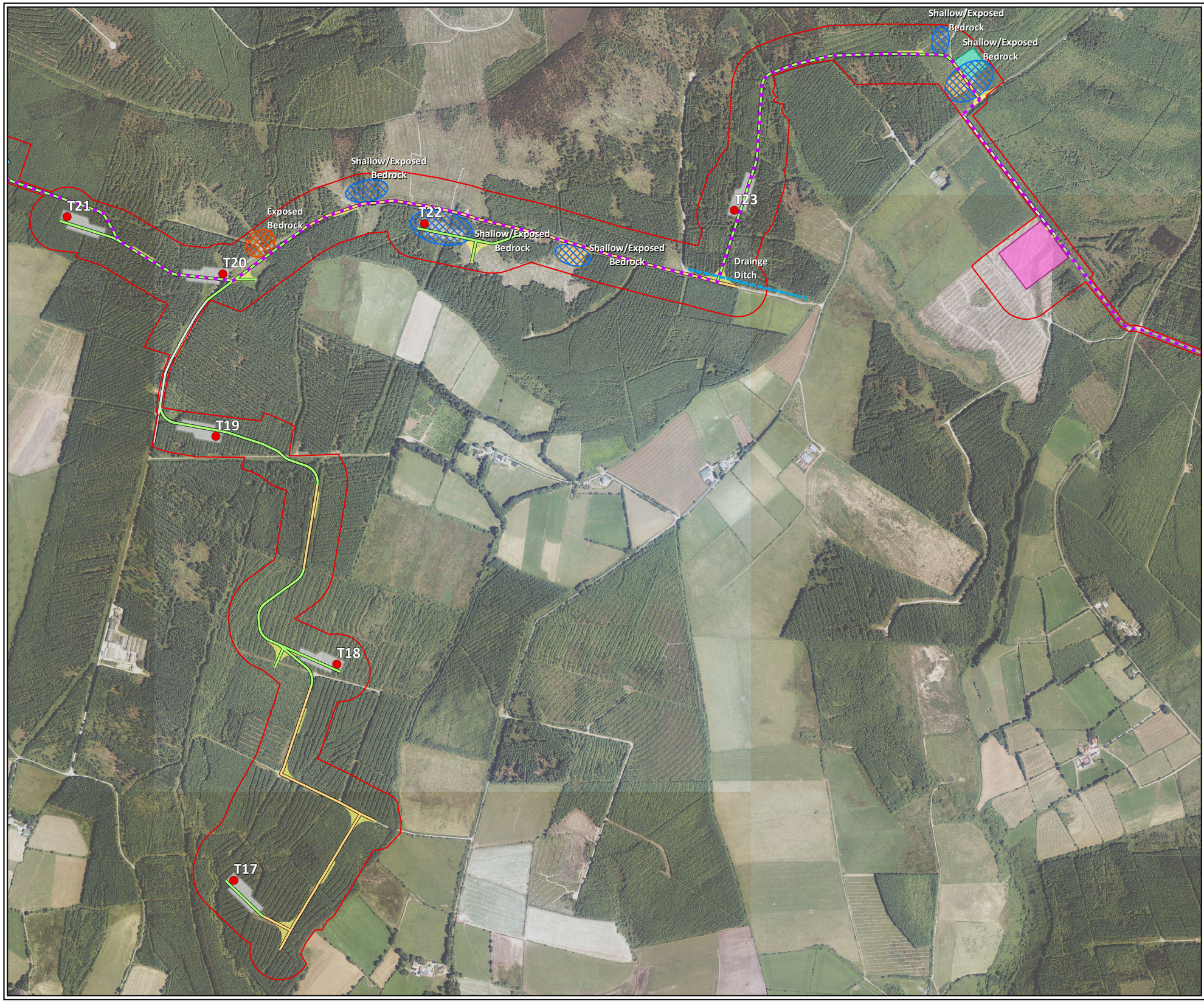
N W E S

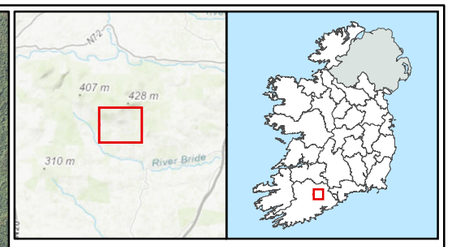
0 0.25 0.5 1 Kilometers

TITLE:	Geomorphological Features Area 3		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.11.3		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2020\P20-099\Workspace\EIAR\P20-099_GIS_Fig9-11_GeomorphologicalFeatures_A3.mxd





- Proposed Turbine Layout
- Proposed Permanent Met Masts
- Proposed Cable Route
- Proposed Development Boundary
- Existing Road
- Proposed Existing Road Upgrade
- Proposed New Road
- Proposed Turning Heads and Passing Bays
- Proposed Turbine Hardstanding Area
- Proposed Borrow Pit
- Proposed Temporary Compound
- Proposed Substation

Geomorphological Features

- Exposed Bedrock
- Shallow/Exposed Bedrock
- Drainage Ditch

TITLE:	Geomorphological Features Area 4		
PROJECT:	Coom Green Energy Park, Co. Cork		
FIGURE NO:	9.11.4		
CLIENT:	Coom Green Energy Park Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	28/09/2020	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Slope Stability Assessment

From a review of the GSI Landslide Susceptibility database, the proposed development and proposed infrastructure locations are generally located within areas of 'Low' susceptibility. The exceptions are T20 and T21 (Moderately High) and T22 (Low to Moderately Low). A summary of the GSI landslide susceptibility with respect to the proposed development is provided in Figure 9.10.

These turbines are all located in the northern portion of the proposed development. No evidence of slope instability was observed at the site and there are no historical records of landslide activity within or close to the site, on the GSI database.

Site investigations completed at proposed turbine locations T20 and T22 comprised the advancement of a trial pit to a maximum depth of 4.0m BGL at each location. At proposed turbine T20 Weathered Bedrock was encountered at 1.3m BGL which was described as angular flat and tabular gravel and cobbles of SHALE/MUDSTONE. The trial pit was terminated at 4.0m BGL where obstruction due to competent bedrock was encountered.

At proposed turbine location T22 trial pit TP-T22 was advanced to a maximum depth of 4.0m BGL where an obstruction was encountered from the presence of SHALE/MUDSTONE Bedrock at this depth. Weathered Bedrock at 1.9m BGL which was described as SHALE/MUDSTONE and recovered from the trial pit as flat and angular Cobbles of SHALE/MUDSTONE.

A more detailed summary of the site investigations completed at these locations and the results of the slope stability assessment are included the Geotechnical Assessment Report in Appendix 9.1 of the EIAR. In summary, given the absence of significant deposits of soft ground and the shallow depth of bedrock, safety ratios for potential slope failures for drained conditions ranged from 2.735 to 3.558 at proposed turbine locations T20, T21 and T22. A safety ratio of greater than 1.0 indicates that the slope is considered stable in the long-term drained conditions.

Peaty Stability Assessment

Following the site walkover and given the presence of small areas of Peat deposits and peaty Topsoil within the proposed development boundary, a review of the published checklist for peat landslide hazard and risk assessment was carried out. This was undertaken in accordance with the following best practice guidance: Scottish Executive – Peat Landslide Hazard and Risk Assessments (2017).

The potential for a landslide risk is defined in the Scottish Executive "Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments" (2017) as the following:

- *Peat is present at the development site in excess of 0.5m depth, and;*
- *There is evidence of current or historical landslide activity at the site, or;*
- *Slopes > 2° are present on-site, or;*
- *The works will impinge on the peat covered areas and cannot be relocated to avoid peat covered areas.*

A peat survey was carried out by an FTC Engineering Geologist during June and July 2019 and during August 2020. Thin Blanket Peat deposits were encountered in localised areas during site walkovers. The peat deposits were generally relatively thin (maximum 0.6m thick, average thickness 0.3m) and limited in aerial extent.

Soft Peaty Topsoil deposits were noted at proposed infrastructure locations, but these were generally very thin (0.1 to 0.6m thick) and were not considered to constitute Peat Deposits but rather a highly organic Topsoil with Peaty appearance.

As such and in accordance with the Scottish Executive Best Practice Guide for Proposed Electricity Generation Developments (2017) where peat deposits <0.5m were encountered a peat stability assessment was not undertaken.

9.2.8 Soil Contamination

There are no known areas of soil contamination on the proposed development site or the grid connection route. No evidence of soil contamination was noted during site walkovers. As agricultural/forestry equipment is used across much of the proposed development site it is possible that minor fuel spills and leaks have occurred locally in the past.

Further, due to the presence of local roads within the study area and along the proposed grid connection route there is a risk of fuel leakages and other highway related contamination in the upper soils.

According to the EPA online mapping (http://gis.epa.ie/Envision) with regards to licenced waste facilities and IPPC licenced facilities, the Bottlehill Residual Landfill Facility (563587E 590270N) is situated within the immediate environs of the proposed CGEP development.

The construction of the landfill site commenced in 2005 and was completed in 2006. The facility comprises leachate collection infrastructure, engineered landfill cells (Phase 1 – 8), weighbridge facilities and administration and maintenance buildings. The site is currently in-active and maintained by Cork County Council. The facility had not been opened for waste acceptance at the time of writing of this EIAR.

The nearest active EPA Licenced Waste Facility is McGill Environmental Systems Ltd. (EPA Licence W0180-01), located approximately 5km to the south-east of the study area (567384E 588643N).

9.2.9 Replant Lands

Moneygorm, Co. Cork

The proposed replant lands are made up of a large (c.40 Ha) open expanse of Improved Agricultural Grassland in the townland of Moneygorm on the southern side of Nagle's Mountains on a flat spur overlooking the Bride valley, accessed via the R614, un-named local roads, and farm/forestry access tracks. The site is located approximately 1.07km west of the proposed CGEP.

The surrounding landscape is both mountainous and rural in character, with pasture and commercial forestry being the dominant land uses; the replant lands site is surrounded to the west and north-east by conifer plantations, and to the north, south and south-east by agricultural land.

The underlying bedrock geology comprises the purple mudstone and sandstone of the Ballytrasna Formation; with the Quaternary deposits comprising of Glacial Till derived from Devonian sandstones.

The groundwater vulnerability is classed by the GSI as being 'High' across the site. The underlying groundwater aquifer is classed by the GSI as a 'Locally Important Aquifer' – bedrock that is moderately productive in local zones.

Ballard, Co. Wicklow

The proposed replant lands at Ballard, Co. Wicklow are made up of two large sections (c.23.7 and 12.8 Ha) divided by a private road.

The surrounding landscape is both mountainous and rural in character, with pasture and commercial forestry being the dominant land uses; the replant lands site is surrounded to the west and south by conifer plantations, and to the north, by semi-natural woodland, rivers and then further to agricultural land. Both sites are at elevations of 160-207m OD.

The underlying bedrock geology is described by the GSI as comprising 'Grey meta-greywacke psammites and semi-pelitic schists interbedded with dark blue-grey pelitic schists and phyllites' of the Ballybeg Member (Ordovician).

The Quaternary deposits across the sites predominantly comprise Till derived from Lower Palaeozoic sandstones and shale with areas of bedrock outcrop and shallow bedrock (sub-crop) also recorded by the GSI.

The groundwater vulnerability is classed by the GSI as being 'High' across the central portions of the sites with the vulnerability increasing to 'Extreme' at the northern and southern extremities of the sites. The underlying groundwater aquifer is classed by the GSI as a 'Locally Important Aquifer' - Bedrock which is Moderately Productive only in Local Zones

9.3 Potential Effects

The potential effects on the underlying land, soils and geology at the site are assessed in the following sections for the activities associated within each phase (construction, operation and decommissioning) for the proposed CGEP as described in Chapter 3.

The potential impacts are assessed in accordance with the evaluation criteria outlined in Section 9.1. The unmitigated potential impacts are summarised in Tables 9.8 and 9.9. The proposed mitigation measures are then considered to reduce or eliminate potential impacts.

9.3.1 Do Nothing Impact

If the proposed CGEP were not constructed, it is likely that the current land uses will continue for the foreseeable future. The impact on the Land, Soils and Geology would remain largely unaltered as a result.

9.3.2 Construction Phase

The following on-site activities have been identified as the sources of potential impacts on the existing geological and hydrogeological conditions during the construction phase of the proposed development:

9.3.2.1 Tree Felling

An area of the proposed development site comprises of commercial coniferous forestry.

Felling of approximately 62.8ha of coniferous forestry is required within and around the wind farm infrastructure to accommodate the construction of some turbines, hardstands, crane pads, access tracks, onsite substation, borrow pits, grid connection, temporary compounds and permanent met masts. A total of 15 No. turbines are located within forestry and consequently tree felling will be required as part of the project.

These works will be the subject of a Felling Licence Application to the Forest Service prior to construction as per the Forest Service's policy on granting felling licenses for wind farm developments.

Proposed tree felling will involve the use of heavy felling machinery and exposure of underlying soils to surface water runoff, which could result in soil erosion. This also could lead to an increase in sediment and nutrient concentrations in the surface water run-off which may in turn impact groundwater in the Locally Important Aquifer beneath the proposed development site.

The use of plant and machinery during tree felling works will require the storage and use of fuels and oils. Their storage and use present potential for spills and leaks which could contaminate underlying exposed soils and groundwater.

Further assessment of potential impacts to surface water discharges from felling activities are discussed in Chapter 10 of the EIAR.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

9.3.2.2 Earthworks

The proposed CGEP development will require construction phase earthworks associated with the excavation of turbine bases, removal of overburden deposits for the construction of turbine foundations, temporary site compounds, sub-stations, grid connection trenches, turbine hard standings, borrow pits, internal access roads and permanent met masts. Temporary accommodation works will also be required along the proposed turbine delivery route such as hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and local road widening.

As such there is the potential for impact to Land, Soils and Geology from the excavation and movement of existing Glacial Till deposits during the construction phase of the proposed development.

The following earthworks excavations will be required:

- Excavation of Topsoil and Peaty Topsoil deposits
- Excavation of Glacial Till to bedrock (as required).

The following filling and material deposition operations will be required:

- Deposition of surplus topsoil, peaty topsoil and Glacial Till deposits in berms for reinstatement proposes around turbine bases, hardstands and borrow pits.
- Importation and Filling of site won and imported General Fill and Engineering Aggregates

Turbines of the size proposed for the Coom Wind Farm have foundation depths in the order of 3m and diameters in the order of 21m, depending on the manufacturer and ground conditions.

Ideally, a suitable bearing stratum is encountered within 3m from ground surface so that the turbine foundation can be finished at / near existing ground level. Where deeper excavations (3-5m) are required to reach a suitable bearing stratum, soil replacement (engineered fill) is used to bring up the excavation so that the turbine foundation is finished at / near existing ground level. Flexibility of $^{+}/_{-}$ 1.5m in the finished levels is required to allow for sloping topography and ground conditions.

Some temporary stockpiles of material may be necessary prior to reinstatement; however, no permanent stockpiles of material will remain after construction.

It is proposed that all onsite materials excavated shall be retained on site and re-used where suitable as part of the construction phase to minimise the import materials requirements.

Surplus Topsoil, Peaty Topsoil and Glacial Till recovered from excavations will be used for the reinstatement of the proposed borrow pits and for reinstatement proposed around turbine bases and hardstands.

Direct impacts to the existing geological regime associated with the construction phase of the proposed development are:

- Soil compaction may occur due to movement of construction traffic. This will occur particularly within areas of highly compressible soft deposits which are left in-situ during the construction phase. This could lead to an increase in surface water runoff due to reduced infiltration of rainfall and subsequently to an increase in erosion of overburden deposits left in-situ.
- The use of plant and machinery during construction will require the storage and use of fuels and oils. Their storage and use present potential for spills and leaks which could contaminate underlying exposed soils.
- During construction, imported engineering fill and excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could deposit silt in streams with an indirect impact on surface water quality.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

Direct impacts to the existing hydrogeological regime associated with earthworks associated with the construction phase of the proposed development are:

- Potential for groundwater pollution from the removal of overburden deposits particularly at proposed turbine and borrow pit locations. The aquifer underlying the proposed wind farm site and the majority of the proposed grid connection route is classified by the GSI as ranging from 'High' to 'Extreme' with areas of exposed bedrock also present in these areas. At the eastern extent of the proposed grid connection the vulnerability classification is reduced to 'Moderate'. It is proposed to remove the overlying soft ground and Glacial Till deposits as outlined in the proposed design. The vulnerability of the aquifer to groundwater pollution particularly during construction stage will be increased as overburden is removed thus reducing the level of protection from groundwater pollution.
- Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer. Soil erosion as a result of exposure of soils in open excavations and temporary storage of excavated materials represents a potential impact to the underlying groundwater aquifer.
- Reduction in groundwater levels from dewatering of excavations as required during the construction stage if high groundwater is encountered. This impact is most likely during the excavation of turbine foundations.

There are no groundwater supply wells recorded in the immediate vicinity of proposed turbine or borrow pit locations. It is considered that other excavations associated with substation, temporary compound and grid connection trenches will not extend into the underlying bedrock aquifers. It is possible however that perched groundwater may exist locally within overburden deposits or weathered bedrock. Moderate groundwater ingress was noted in the trial pit advanced at turbine T22 at 2.0m BGL. Upon completion of the construction phase, it is considered that groundwater levels will revert to the pre-construction situation when there is no longer a requirement to control groundwater levels.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

9.3.2.3 Borrow Pits

Three proposed borrow pit locations (BP01, BP02 and BP03) have been identified as a potential source of site won general FILL for construction activities. The 3 No. locations were selected as potential sources of general FILL for the proposed development using the criteria of no peat deposits, gentle to moderate slopes, low landslide susceptibility and proximity to existing access tracks and proposed infrastructure.

The location of the proposed borrow pit is underlain by the Ballytrasna Formation which is classified by the GSI as being of 'Low' potential for crushed rock aggregate. However, intrusive site investigations undertaken at the proposed borrow pit locations identified overburden deposits comprising Gravels and Sands and Weathered Bedrock potentially suitable for use as General FILL for the construction of the proposed development. Bedrock excavated from the borrow pits will be suitable for reuse as a Class 1 fill material in hardstands and access roads.

The proposed borrow pits will each have a footprint area of approximately 6,400 m^2. This will provide a potential volume of approximately 12,800m^3 of site won General FILL based on an aggregate resource thickness of 2.0m at borrow pits BP01 and BP02. At borrow pit BP03 an aggregate resource thickness of 3.0m will provide a potential volume of 19,200m^3 of General FILL.

At each borrow pit location approximately 1.0m of overburden material will be required to be stripped to access the underlying deposits. This material will be temporarily stockpiled prior to re-use in the reinstatement of the borrow pits. No permanent stockpiles of material will remain after construction.

Direct impacts to the existing environment associated with the proposed borrow pits include:

- Potential for groundwater pollution from the removal of overburden deposits particularly at proposed borrow pit locations. The aquifer underlying the proposed wind farm site and the majority of the proposed grid connection route is classified by the GSI as ranging from 'High' to 'Extreme' with areas of exposed bedrock also present in these areas. At the eastern extent of the proposed grid connection the vulnerability classification is reduced to 'Moderate'. It is proposed to remove the overlying Peat and Glacial Till deposits as outlined in the proposed design.

  The vulnerability of the aquifer to groundwater pollution particularly during the construction stage will be increased as overburden is removed thus reducing the level of protection from groundwater pollution.

- Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer. Soil erosion as a result of exposure of soils in open excavations and temporary storage of excavated materials represents a potential impact to the underlying groundwater aquifer.

- Reduction in groundwater levels from dewatering of excavations as required during the construction stage if high groundwater is encountered. This impact is most likely during the excavation of turbine foundations and proposed borrow pits. There are no groundwater supply wells recorded in the immediate vicinity of proposed borrow pit locations. It is possible however that perched groundwater may exist locally within overburden deposits or weathered bedrock. However, trial pits advanced at proposed borrow pit locations did not encounter any significant groundwater ingress.

- The extraction of rock from the borrow pits will represent a reduction in the availability of an exhaustible resource. The crushed rock potential across the site is classified as 'very low' to 'moderate', indicating that the bedrock in the area is not considered to be of high quality, and is not readily available due to the lack of bedrock exposures at the surface.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate** significance.

9.3.2.4 Slope Stability

The proposed development and proposed infrastructure locations are generally located within areas of 'Low' susceptibility. However, locations T20 and T21 are classified as having a 'Moderately High' susceptibility to landslide. As such it is considered construction activities at these locations pose a potential risk to sensitive receptors from potential landslide/slope failures.

Slopes at locations T20 and T21 were selected for slope stability assessment in accordance with the principals of Eurocode 7 (IS EN 1997-1). The results of those analyses are summarised in the Geotechnical Assessment Report in Appendix 9.1 of the EIAR. In summary, safety ratios for potential slope failures indicates that the slopes are considered stable in the long-term drained conditions.

Following the site walkover, a review of the published checklist for peat landslide hazard and risk assessment was carried out, as outlined in Figure 1.1 of the Scottish Executive – Peat Landslide Hazard and Risk Assessments (2017). As <0.5m of peat has been recorded on the site, a peat stability assessment is not considered to be relevant for the proposed development.

Direct impacts to the existing environment associated with potential slope instability and failure include:

- Slope failures have the potential to impact the existing geological conditions from the removal and deposition of landslide/slope failure material and the exposure of underlying overburden deposits and bedrock to an increase in surface water runoff and subsequent increase in erosion. Slope failure also has the potential to have an impact on the safety of construction workers and forestry workers that could be in the vicinity of a landslide/slope failure event, existing infrastructure (roads, access tracks) and nearby urban areas.

- The impact of a slope failure could potentially result in the influx of acidic waters into downgradient surface water features resulting in a decrease in the receiving water's pH values. This may impact groundwater quality in the underlying Locally Important Aquifer and in any groundwater abstractions in the vicinity of a landslide event.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

9.3.2.5 Internal Access Roads and Hardstands

There will be approximately 25km of internal access tracks associated with the proposed wind farm development. This will be a combination of existing track upgrade and construction of new tracks; approximately 15km of new track construction and approximately 10km of existing track upgrade. Hardstand areas will be provided at each turbine location.

All access tracks will be approximately 4.5-5m wide along straight sections and wider at bends and as required. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks. Existing drainage infrastructure will be maintained and upgraded where necessary.

The need for floating roads is not expected at this site.

It is anticipated that the stone required for the construction of the internal access roads will be sourced from quarries in the vicinity and 3 no. on-site borrow pits.

As outlined in Chapter 13 of the EIAR the likely off-site, source quarries for the supply of imported aggregate during the construction phase of the development are located at:

- Danesfort, Co. Cork. Located 16km from Bottlehill and 35km from Knockdoorty entrance.
- Mallow, Co Cork. Located 20km from Bottlehill and 20km from Knockdoorty.
- Lyravarrig, Co. Cork. Located between the two site entrances, 13km to the Bottlehill entrance and 9km to the Knockdoorty site entrance.

Access track formation will consist of a minimum 500mm hardcore on geo-textile membrane. The likely construction methodology for newly constructed tracks will be as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500mm depth.
- A drainage ditch will be formed, within the excavated width and along the sides of the track.
- Surplus excavated material will be placed along the side of sections of the tracks and dressed to blend in with surrounding landscaping and partially obscure sight of the track.

Direct impacts to the existing geological regime associated with the construction of proposed access tracks and hardstands are:

- Soil compaction may occur due to movement of construction traffic. This will occur particularly within areas of highly compressible soft deposits which are left in-situ during the construction phase. This could lead to an increase in surface water runoff due to reduced infiltration of rainfall and subsequently to an increase in erosion of overburden deposits left in-situ.
- The use of plant and machinery during construction will require the storage and use of fuels and oils. Their storage and use present potential for spills and leaks which could contaminate underlying exposed soils.
- During construction, imported engineering fill and excavated soils will be exposed in excavations and in temporary stockpiles. These soils will be subject to erosion by wind and rain which could deposit silt in streams with an indirect impact on surface water quality.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

9.3.2.6 Internal Cabling and Grid Connection

As outlined in Chapter 3 of this EIAR, electricity generated from wind turbines at the Bottlehill and Mullenaboree parts of the site shall be collected at medium voltage (20/33kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall be terminated at a proposed onsite substation at Knockacullata in the Mullanboree part of the site.

The power from this western part of the site shall be transferred to the onsite substation at Lackendarragh North via a buried 110kV cable through private lands and a section of public road. Electricity generated from wind turbines at the Knockdoorty part of the site shall also be collected at medium voltage (20/33kV) by an internal circuit of buried cables which will follow on-site access tracks and terminated directly into the on-site substation at Lackendarragh North before being exported to the grid via a 110kV buried cable to the existing Barrymore substation.

Connection works will involve the installation of ducting, joint bays, drainage and ancillary infrastructure and the subsequent running of cables along the existing road network and within forestry lands. For cable trenches located in public roads, the contractor will excavate cable trenches and then lay high density polyethylene (HDPE) ducting in the trench in a surround of cement bound material (CBM). Back-filling and reinstatement in public roads will be to a specification to be agreed with the road authority.

A similar construction methodology will apply for cable trenches laid within site access tracks. In this case the cable-ducts will generally be laid when the track is being constructed and will follow the edge of the site access tracks. The trenches within these locations will generally be backfilled using the excavated material.

Direct impacts to the existing environment associated with the proposed internal cabling and grid connection works include:

- The proposed gird connection, associated excavations and ducting may present a preferential pathway for the movement of groundwater and/or contamination in the subsurface.

  However, the subsoil at the proposed development is predominantly Glacial Till which has a low permeability throughout the majority of the proposed grid connection route.
- The excavations for the grid connection trenches and joint bays can have a direct impact on the exposed soils and rock in the form of increased erosion from surface water ingress.
- Where the material excavated from the proposed grid connection excavations are not suitable for reuse as backfill or deposition on site this material will be disposed of at a facility licenced (subject to environmental testing and classification) to accept this waste type.

Given that the open sections of the trench will be backfilled following the installation of each section of ducting the magnitude of these potential impacts, prior to mitigation, is of **Slight** Significance.

9.3.2.7 Horizontal Directional Drilling (HDD) Under Existing Structure

HDD will be employed at up to 4 No. locations along the proposed grid connection route as part of the development as shown in Chapter 10, Figure 10.5. 3 No. of these locations will be for the crossing of existing watercourses.

The operation shall take place from one side of the watercourse within the public road corridor or verge and will be carried out by an experienced HDD specialist. Each crossing is expected to take place in a single day under one mobilisation.

The process will involve setting up a small tracked drilling rig on one side of the watercourse, within the public road corridor, and at least 10m back from the stream bank. A shallow starter pit will be excavated at the point of entry and shall be located at a sufficient distance from the watercourse to achieve a minimum clearance depth below the bed of the watercourse.

A pilot hole will be bored as per the agreed alignment and shall be tracked and controlled using a transmitter in the drill head. By tracking the depth, position and pitch of the drill head the operator can accurately steer the line of the drilling operation. The drilling operation is lubricated using a fluid. When the pilot hole has been drilled to the correct profile, its diameter is increased if necessary, to match the external diameter if the cable duct. The flexible plastic ducting is then pulled through the pre-drilled hole and sealed at each end until required for cable installation.

The depth of the bore shall be at least 3m below the level of the public road and stream bed. A pre-construction survey of buried services within the public road will be carried out by the contractor prior to commencement of the operation to confirm the conditions predicted in this EIAR.

Direct impacts to the existing environment associated with the proposed HDD works include:

- Potential for contamination to groundwater from spills/leakages during construction phase earthworks and HDD operations. The use of construction plant and associated refuelling and storage of fuels and hydrocarbons with potential for spills or leaks could result in contamination of the underlying aquifers.
- Potential for overburden collapse at the proposed HDD locations at water crossings W06, W08 and W19 during the advancement of the HDD bore.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Moderate significance.**

9.3.2.8 Turbine Delivery Route (TDR)

The proposed turbine delivery route (TDR) will be from Ringaskiddy and will comprise two distinct routes as described in Chapter 13 of this EIAR. One route to the west of the site, servicing the Bottlehill and Mullenaboree parts of the site and a second route servicing the Knockdoorty part of the site.

The following accommodation works are required along the TDR at the following locations:

- Local widening at Junction 14 of the M8;
- Widening at the junction of the N72 and the R639 in Fermoy Town;
- Local widening near Castlehyde along the N72 between Fermoy and Ballyhooly;
- Local widening at the junction of the N72 and the Ballyhooly North Road at Ballyhooly;

- Local widening at the approach road to the Blackwater Bridge in Ballyhooly;
- Local widening along the road from Ballyhooly to the site entrance at Knockdoorty;
- Widening at Silverspings transitioning from the N8 to the R635;
- Widening of existing forestry access, tree felling and construction of an off-site turning area at Glashaboy South (Offsite turning and transfer area);
- Local widening through the laying of hardcore to road verges, removal of street furniture at Junction between L-1217 and L-1219.

The accommodation works associated with the TDR route will include the excavation of existing overburden deposits. The potential impact would be from the exposure of the over burden and underlying bedrock to erosion via surface water ingress during the works.

Given the limited extent of excavations associated with these works the magnitude of these potential impacts, prior to mitigation, is considered to be of **Slight Significance.**

In summary, the overall magnitude of these potential direct impacts associated with the construction phase of the proposed development, prior to mitigation, is considered to be a Short Term, Negative Impact of **Slight** to **Moderate Significance.**

Following the identification of the potential direct impacts during the construction phase, as outlined above, mitigation measures to reduce the risk to an acceptable level are discussed in Section 9.5.2 of this Chapter.

Potential Indirect Impacts

As outlined in Section 9.3.9 potential replanting sites have been identified at Moneygorm, Co. Cork and Ballard, Co. Wicklow. These lands have been assessed in Appendix 3-3 of this EIAR in terms of potential to the existing geological and hydrogeological environment.

Quantities of granular material will be required for the proposed development. This will place a demand on local aggregate extraction facilities and at the proposed borrow pits BP01, BP02 and BP03.

Where the material excavated from the proposed grid connection excavations is not suitable for reuse as backfill or deposition on site this material will be disposed of at a facility licenced (subject to environmental testing and classification) to accept this waste type. This will take up available void space at licensed facilities if not recycled.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Slight Significance.**

9.3.3 Operational Phase

The potential impacts on land, soils and geology from the operation of the proposed development are outlined hereunder.

9.3.3.1 Potential Direct Impacts

Very few potential direct impacts are envisaged during the operational phase of the wind farm.

These include:

- Some construction traffic may be necessary for maintenance of turbines, hardstands and access tracks which could result in minor accidental leaks or spills of fuel/oil.
- The grid transformer in the substation and transformers in each turbine are oil cooled. A battery energy storage system along with ancillary civil and electrical infrastructure will also be located at the proposed substation at Lackendarragh North. There is potential for spills / leaks of oils/battery fluids from this equipment resulting in contamination of soils and groundwater.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Slight Significance.**

9.3.3.2 Potential Indirect Impacts

A small amount of granular material may be required to maintain access tracks during operation which will place intermittent minor demand on local quarries.

The magnitude of these potential impacts, prior to mitigation, is considered to be of **Slight Significance.**

9.3.4 Potential Impacts during Decommissioning

The potential impacts associated with decommissioning will be similar to those associated with construction but of reduced magnitude.

During decommissioning, it may be possible to reverse or at least reduce some of the impacts caused during construction by rehabilitating construction areas such as turbine bases, hardstanding areas and site compound. This will be done by covering with topsoil to encourage vegetation growth and reduce run-off and sedimentation.

Other impacts such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude. Nevertheless, as noted in the Scottish Natural Heritage guidance on restoration and decommissioning of onshore wind farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. It is therefore '*best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm*'.

Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

9.3.5 Potential Cumulative Impacts

Relevant projects in proximity to the proposed development are listed in Table 9.11:

Table 9-11: Potential Cumulative Impact from other developments

Development	Distance to Proposed Development (km)	Status	Interface	Potential Cumulative Impact
Bottlehill Landfill	0km	Constructed (Not Operational)	Potential for requirement of imported aggregate for maintenance of access tracks, landfill infrastructure	Imperceptible
			Potential cumulative impact on: Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Imperceptible
Replant Lands – Moneygorm, Co. Cork	1.04km	Proposed	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Slight
Replant Lands – Ballard, Co. Wicklow	170km	Proposed	N/A	N/A

The surrounding area predominantly comprises agricultural farmland and forestry with no other significant industries identified. Furthermore, given the resultant **Slight to Moderate** impact of the proposed development, it is considered there will be no cumulative impacts from other industrial developments on the geology and hydrogeology of the site.

It is considered given that the existing Bottlehill Landfill is not operational and has not received any waste the potential cumulative impact to groundwater receptors is considered to be **Imperceptible.** Should the facility become operational during the life of the proposed CGEP, the engineered landfill design and effective implementation and efficacy of the mitigation measures will prevent any significant, adverse cumulative impacts. In these circumstances, any effects on the receiving environment would be **Imperceptible.**

Potential replanting sites have been identified at Moneygorm, Co. Cork and Ballard, Co. Wicklow. These lands have been assessed in this EIAR in terms of potential impacts to the existing environment in Appendix 3-3 of this EIAR.

Given the proximity of the proposed replant sites at Moneygorm, Co. Cork to the CGEP it is considered there is a potential cumulative impact to the underlying hydrogeological environment should the replanting be undertaken in conjunction with the construction phase of the CGEP. The potential for impact will arise from drainage construction and associated works which may result in the exposure of the soil and subsoils. This has the potential to increase silt infiltration to groundwater as a result of increased surface water runoff.

Where plant and machinery is required for the drainage works the potential exists for minor accidental leaks or spills of fuel/oil.

Given the classification of the underlying aquifer and the limited depth and width of excavation associated with drainage works at the Moneygorm site the potential cumulative impact to groundwater receptors is considered to be **Slight.**

Given the distance to the proposed replant lands at Ballard, Co. Wicklow (approximately 170km) to the proposed development of the CGEP it is considered there are no cumulative impacts from these works on the existing geological or hydrogeological environments.

There may be indirect cumulative impacts in terms of demands placed on local quarries for aggregate and concrete required during the construction phase of the development.

9.3.6 Summary of Potential Impacts

A summary of unmitigated potential impacts on land, soils and geology attributes from the proposed development is provided in Table 9.12 with the potential impacts on hydrogeological attributes provided in Table 9.13.

Table 9-12: Summary of Potential Unmitigated Impact Significance on Land, Soils and Geology Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Earthworks	Removal of overburden material, open excavations and subsequent exposure underlying overburden and bedrock leading to increased erosion. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Excavation of bedrock from Borrow Pits will reduce the availability of this natural resource.	Local organic soils and Glacial Till deposits. Bedrock	Medium	Moderate Adverse	Moderate
Felling Activities	Exposure of underlying overburden leading to increased erosion. Felling machinery resulting soil compaction of soft deposits and an increase in surface water runoff resulting in increased erosion of exposed soils.	Local organic soils and Glacial Till deposits.	Medium	Moderate Adverse	Moderate
Construction of Internal Site Access Tracks, Hardstands and Temporary Compound	Open excavations, increased runoff causing erosion of underlying overburden and bedrock. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill	Local, organic soils and Glacial Till deposits. Bedrock Local quarries	Medium	Moderate Adverse	Moderate
Construction of Turbine and Substation Foundations	Open excavations, increased runoff causing erosion of underlying overburden and bedrock. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill and concrete products	Local organic soils and Glacial Till deposits. Bedrock Local quarries	Medium	Moderate Adverse	Moderate

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction of the Grid Connection and Internal Cabling	Removal of overburden material and exposure underlying Clay and Bedrock to erosion. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill and concrete products Disposal of surplus excavated material to licenced facility	Local, organic soils and Glacial Till deposits. Bedrock Local quarries Licenced Waste Facilities	Medium	Small Adverse	Slight
Earthworks associated with the construction of the proposed development and associated infrastructure	Slope Failure	Local organic soils and Glacial Till deposits. Bedrock	Medium	Moderate Adverse	Moderate
Accommodation works along TDR	Removal of overburden material and exposure of underlying Clay and Bedrock to erosion. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill Disposal of surplus excavated material to licenced facility	Local, organic soils and Glacial Till deposits. Bedrock Local quarries Licenced Waste Facilities	Medium	Small Adverse	Slight
Operational Phase					
Maintenance Traffic, Substation	Release of hydrocarbons or fuel spill	Local organic soils and Glacial Till deposits. Bedrock	Medium	Small Adverse	Slight
Maintenance of access tracks	Importation of engineering fill	Local quarries	Medium	Small Adverse	Slight

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Cumulative Impacts					
Construction of the proposed development and associated infrastructure Potential for requirement of imported aggregate to the Bottlehill Landfill for maintenance of access tracks, landfill infrastructure.	Cumulative impacts on local quarries from extraction of fill for proposed development	Local quarries	Medium	Negligible	Imperceptible

Table 9-13: Summary of Potential Unmitigated Impact Significance on Hydrogeology

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction Phase					
Earthworks	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks. Reduction in groundwater levels from dewatering of excavation as required during the construction phase	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate Adverse	Moderate

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Felling Activities	Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages from felling machinery	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate Adverse	Moderate
Construction of Internal Site Access Tracks, Hardstands and Temporary Compound	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks. Potential for ground water pollution from the use of cement-based compounds during the construction phase	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate Adverse	Moderate
Construction of Turbine and Substation Foundations	Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks. Potential for ground water pollution from the use of cement-based compounds during the construction phase. Reduction in groundwater levels from dewatering of excavation as required during the construction phase	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate Adverse	Moderate

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Construction of the Grid Connection and Internal Cabling	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks.	Glenville GWBs Locally and Regionally Important Bedrock Aquifers Groundwater Wells and Springs	High	Small Adverse	Moderate/Slight
Earthworks associated with the construction of the proposed development and associated infrastructure	Slope Failure	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate Adverse	Moderate
Operation					
Operational traffic, refuelling of vehicles	Some operational traffic will be necessary for maintenance plus normal operational traffic which could result in minor accidental leaks or spills of fuel/oil.	Glenville GWB Bedrock Aquifer Groundwater Wells and Springs	Medium	Small Adverse	Slight
Cumulative Impacts					
Bottlehill Landfill	Potential for groundwater pollution from waste deposition activates at the Bottlehill Landfill	Potential cumulative impact on: Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation	
				Magnitude	Significance
Replant Lands, Moneygorm	Potential for silt infiltration to groundwater as a result of increased surface water runoff during drainage works Potential for contamination to groundwater from spills/leakages during drainage works	Potential cumulative impact on: Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Small Adverse	Slight

9.4 Mitigation Measures

The following section outlines appropriate mitigation measures by design and best practice to avoid or reduce the potential impact of the proposed development. Further details are given in the CEMP included in Section 4.3.4 of the CEMP which is contained in Appendix 3.1 of Volume 3.

9.4.1 Mitigation by Design and Best Practice

With regard to the proposed development, detailed design and best practice will be implemented as follows:

- The proposed development has been designed in accordance with best practice
- The works have been designed and checked by geotechnical and civil engineers, suitably qualified and experienced in excavation and earthworks design and construction methodologies.
- Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to evaluate risk levels for the construction, operation and maintenance of the works. Identified impacts will be minimised by the application of principles of avoidance, prevention and protection. Information on residual impacts will be recorded and relayed to appropriate parties
- A detailed method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions. Where such weather is forecast, suitable measures will be taken to secure the works.

9.4.2 Construction Phase

The following sections outline appropriate mitigation measures to avoid or reduce the potential impact of the proposed development.

The primary mitigation measure employed has been the design of the wind farm in terms of locating the turbines, access roads, borrow pits, material storage areas and other site infrastructure within an area of commercial forestry where the soils are extensively worked and drained. In order to reduce the impacts on geology, hydrogeology and slope stability, infrastructure has been primarily located within areas of thinner peat/soft ground and lower slope gradients. Extensive work has already been undertaken at the preliminary design stage to apply risk avoidance by design which included:

- Extensive peat probing to identify areas of peat deposits across the site.
- Excavation of trial pits and advancement of boreholes to establish overburden and bedrock characteristics.
- Shear vane testing to establish characteristic peat strengths where shallow peat deposits were identified.
- Relocation and micro-siting of turbines, hardstandings, borrow pits and access roads based on the site assessments and geotechnical assessments in order to reduce ground risk associated with the proposed development.

9.4.2.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared for the proposed development and is included in Volume 3, Appendix 3.1. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the proposed development.

The CEMP describes how the contractor for the main construction works will implement a site Environmental Management System (EMS) to meet the specified contractual, regulatory and statutory requirements including the requirements identified as part of the environmental impact assessment process.

The CEMP will be updated prior to construction to take account of any amendments arising during the consenting process and relevant conditions attached to the planning permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be reviewed and updated as required.

Reference to relevant sections of the CEMP with respect to the mitigation of potential impacts to Land, Soils and Geology from the proposed development are outlined below.

Tree Felling

As outlined in Section 9.3.2.1 potential impacts to the existing environment from the proposed tree felling works have been identified. The works will lead to the exposure of underlying soils to surface water runoff, which could result in soil erosion. This also could lead to an increase in sediment and nutrient concentrations in the surface water run-off which may in turn impact groundwater in the Locally Important Aquifer beneath the proposed development site.

One of the primary mitigation measures to be employed at the construction phase of the development is the management of silt laden runoff. The potential impact from silt laden surface water runoff from increased erosion of exposed overburden deposits will be assessed at site-specific locations particularly at new and existing drainage locations and where tree felling works are proposed.

Details of the proposed Surface Water Management System and mitigation measures is summarised below and are also outlined in Section 4.3.5 of the CEMP in Appendix 3.1 of Volume 3.

Best practices will be employed in the prevention of silt laden run-off from entering watercourses as discussed below.

To minimise the impact to surface water quality, existing forestry drainage will be maintained outside the immediate site area, and where appropriate additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in new and existing drainage and monitoring of water quality undertaken during the tree felling works.

The use of plant and machinery during tree felling works will require the storage and use of fuels and oils. Details of oil spill protection measures adjacent to sensitive receptors and emergency spill response procedures are outlined in Section 4.3.5. of the CEMP which is contained in Appendix 3.1 of Volume 3.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of felling plant and equipment will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.

9.4.2.2 Earthworks

The development will be constructed in a phased manner to reduce the potential impacts of the development on the Land, Soils and Geology at the site. Phased construction reduces the amount of open, exposed excavations at any one time. Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.

Details of the proposed methodology and mitigation measures is summarised below and are also outlined in Section 4.3.4 of the CEMP in Appendix 3.1 of Volume 3.

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of excavated overburden deposits to be exported off site. Excavated overburden will be retained on-site and reused as far as possible.

This will include:

- Use of suitable site won material (Glacial Till) as general fill in the construction of access tracks, hardstands and in reinstatement around turbine foundations.
- Surplus overburden will be re-used on site in the form of landscaping and for reinstatement purposes at the proposed borrow pits.

Surplus overburden deposits excavated during the course of the works will be temporarily stored in a level area adjacent to the construction phase excavations prior to reuse.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement, however no long-term stockpiles of material will remain after construction and no surplus/waste soil or rock will be removed from the proposed development site.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that peatland / soils outside the work area is not damaged. Excavations will then be carried out from access tracks, where possible, as they are constructed in order to reduce the compaction of soft ground.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events.

To mitigate against possible contamination of the exposed soils and bedrock, refuelling of machinery and plant will only occur at designated refuelling areas.

Soil excavated from trenches along the proposed grid connection route will be taken to a licenced facility for disposal or recycling where required. If feasible, the upper layers of tarmac and asphalt will be excavated separately to the lower engineered fill layers. The lower engineered fill layers will be reused. The tarmac / asphalt layers will be taken to a licenced facility for disposal or recycling.

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel fill will be used to provide additional support to temporary cuts/excavations where appropriate. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion.

Interceptor drains will be installed prior to any construction works commencing. Temporary settlement ponds and silt management measures will be installed to mitigate against sediment run-off as required. Further assessment of potential impacts to surface water discharges during the construction phase are discussed in Chapter 10 of this EIAR.

9.4.2.3 Control of Sediment Laden Runoff

The potential impact from silt laden surface water runoff from increased erosion of exposed overburden deposits will be assessed at site-specific locations particularly at new and existing drainage locations and where earthworks and tree felling are proposed.

Details of the proposed Surface Water Management System and mitigation measures is summarised below and are also outlined in Section 4.3.5 of the CEMP in Appendix 3.1 of Volume 3.

Best practices will be employed in the prevention of silt laden run-off from entering watercourses as discussed below.

To minimise the impact to surface water quality, existing forestry drainage will be maintained outside the immediate site area, and where appropriate additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in new and existing drainage and monitoring of water quality undertaken during the construction phase.

Final drainage will be constructed following the completion of these activities with silt fencing maintained until such time as a vegetation cover has become established. Chapter 10 of this EIAR discusses surface water issues in more detail.

9.4.2.4 Measures for Spills

Details of oil spill protection measures adjacent to sensitive receptors and emergency spill response procedures are outlined in Section 4.3.5 of the CEMP which is contained in Appendix 3.1 of Volume 3.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of construction vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas.

Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.

9.4.2.5 Slope Stability

With regard to slope stability issues, detailed design and construction phase best practice will be implemented as follows:

- The works will be designed and supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.
- Drainage infrastructure will be put in place in advance of turbine excavations. Drains will divert surface water and groundwater away from excavations into the proposed surface drainage network. Uncontrolled, direct and concentrated discharges of water onto the ground surface will be avoided.
- Loading or stockpiling on the surface of soft ground will be avoided. Loading or stockpiling on other deposits will not be undertaken without first establishing the adequacy of the ground to support loads by an appropriately qualified geotechnical engineer experienced in construction within upland conditions.
- Turbines located in areas adjacent to peat deposits will incorporate drainage measures such that surface water will be drained away from the peat and will not be allowed to collect adjacent to the peat mass.
- Excavation will be carried out from access roads or hardstanding areas to avoid tracking of construction plant across areas of soft ground/peat.
- A detailed assessment of the stability of conditions at proposed infrastructure locations will be undertaken by a suitably qualified and experienced geotechnical engineer prior to the commencement of all excavations to ensure these activities do not result in or contribute to slope failure.
- Blasting of rock will not be permitted.
- Excavations which could have the potential to undermine the up-slope component of an existing slope will be sufficiently supported to resist lateral slippage and careful attention will be given to the existing drainage.
- Where possible, earthworks will not be commenced when heavy or sustained rainfall is forecast. A rainfall gauge will be installed on site to provide a record of rainfall intensity. An inspection of site stability and drainage by the Geotechnical Engineer will be carried out on site when a daily rainfall of over 25mm is recorded on site, works will only recommence after heavy rain with the prior approval of the Geotechnical Engineer following their inspection.
- An emergency plan will be developed at pre-construction stage outlining the action plan which would be implemented in the unlikely event of a landslide/slope failure. Should a landslide/slope failure occur or if signs of instability/ground movement are observed, work will cease immediately.

Further details will be given in the CEMP included in Appendix 3.1 of Volume 3 of this EIAR.

Prior to the progression of the project to detailed design and to inform the detailed design of the proposed development, the developer will also ensure that:

- Additional and more extensive ground investigation works are undertaken, and these should be tailored to the engineering requirements of the project.
- The scheme will be developed to full detailed design prior to construction to minimise the risk of ground instability.
- Adequate time is afforded to any designers or contractors involved in the execution of the additional ground investigation works; detailed design and construction works.

9.4.2.6 Groundwater

To mitigate against the increased vulnerability of the underlying aquifer to groundwater pollution, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the underlying groundwater, refuelling of machinery and plant will only occur at designated refuelling areas. Details of mitigation measures related to spills and fuel storage are outlined above.

The dewatering of the foundation excavations is not expected to cause interference with domestic wells in the area, due to large offset distances to known wells, relatively shallow depths of excavation and temporary short-term nature of dewatering, if required. To monitor groundwater during the construction phase groundwater monitoring wells will be installed between areas of deeper excavations and sensitive groundwater receptors. The wells will be used to monitoring groundwater levels and quality to assess any potential impacts during the construction works.

The GSI database is however not complete; it is probable that there are other wells in addition to those in the GSI databases, but are generally associated with houses, the offset to which from the turbines is a minimum of 750m. Given the limited depth of the excavations during the construction phase and the distance to sensitive groundwater receptors the potential risk posed to groundwater supply wells is considered to be Imperceptible following the implementation of mitigation measures discussed above.

If, however, in the unlikely event of a previously unknown domestic well being impacted by the proposed development, an alternative supply will be provided – either a connection to mains water or a replacement well will be drilled.

The GSI holds records of groundwater wells in the vicinity of the proposed grid connection route. However, trenches are shallow (1.2m deep) and will only be open for a short period.

Depending on the ground conditions, presence of services, traffic management required, weather conditions, etc., the rate of installation of cable ducting would vary between 50m and 100m per day. Dewatering is therefore unlikely to be required and no impacts on wells is envisaged.

Grid connection and internal cable trenches could provide preferential pathways for groundwater and contaminant movement. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods, to avoid acting as a conduit for surface water flows. To further mitigate the risk of cable trenches becoming preferential pathways, clay plugs (or other low permeability material) will be installed at intervals along the trench to stop / inhibit water movement.

9.4.3 Mitigation Measures during Operation

It is not envisaged that the operation of the proposed development will result in significant impacts on the geological and hydrogeological regimes within the study area, as there will be no further disturbance of overburden post-construction.

The main potential residual impact during the operation phase would be the risk to groundwater from contamination from spills. Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of maintenance vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the refuelling areas and in each item of plant to deal with any accidental spillage.

Due to the reduced magnitude of the impacts, no additional mitigation measures are required for the maintenance and operation of the wind farm, over and above those incorporated into the design of the substation transformer, which will be bunded to protect soils against accidental leakages of oils and battery fluids.

9.4.4 Mitigation Measures during Decommissioning

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

Some of the impacts associated with reinstatement of the site (excavation of turbine bases, access tracks etc.) will be avoided by leaving these in place where possible.

The Irish Wind Energy Association (IWEA) (11) states that when decommissioning a wind farm "*the concrete bases could be removed, but it may be better to leave them under the ground, as this causes less disturbanc*e". It is proposed to leave the access tracks in-situ at the decommissioning stage. IWEA also state that "*it may be best*" to leave site tracks in-situ depending on the size and geography of the development.

It is considered that leaving the turbine foundations, access tracks and hardstanding areas in-situ will cause less environmental damage than removing and recycling them. It is proposed to retain these elements of the construction and cover with overburden material to allow for re-vegetation of the development site.

Removal of this infrastructure would result in considerable disruption to the local environment in terms of increased sedimentation, erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required by the respective local authority all infrastructure will be removed with mitigation measures similar to those during construction being employed.

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 outlined above.

9.4.5 Cumulative

During the construction of the proposed development there will be the requirement for the importation of engineered fill from source quarries and potential for disposal of materials unsuitable for reuse at licensed facilities. Should these coincide with demand for imported aggregate for maintenance works at the existing Bottlehill Landfill there would a cumulative impact in terms of demands placed on local quarries for aggregate.

Given the Bottlehill Landfill is already constructed and non-operational it is considered unlikely significant quantities of aggregate would be required. As such, it is considered there will be an **Imperceptible** cumulative impact during the construction phase of the development.

No significant, direct negative cumulative effects are envisaged during the operation or decommissioning phase of the proposed development. As such no mitigation measures are required with respect to potential cumulative impacts of the proposed development.

9.5 Residual Impacts

It can be observed from Tables 9.14 and 9.15 that, following the implementation of mitigation measures, the residual impact significance to the receiving environment would be imperceptible during the construction period and imperceptible during the operation of the proposed development. Mitigation measures will be monitored throughout the construction and operational phases.

The proposed development is not expected to contribute to any significant, negative cumulative effects of other existing or known developments in the vicinity. Slight residual cumulative effects from the excavation of fill material from local quarries and disposal of material deemed unsuitable for reuse are considered to result from the proposed development by placing demand on existing quarries and available void space at licensed facilities during the construction phase of the development.

Table 9-14: Residual Impact Significance for Sensitive Geological Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Earthworks	Removal of overburden material, open excavations and subsequent exposure underlying overburden and bedrock leading to increased erosion. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Extraction of bedrock from borrow pits resulting in the reduction in the availability of an exhaustible resource.	Local, organic Topsoil and Glacial Till deposits. Bedrock	Medium	Moderate	Moderate	Negligible	Imperceptible
Felling Activities	Exposure of underlying overburden leading to increased erosion. Felling machinery resulting soil compaction of soft deposits and an increase in surface water runoff resulting in increased erosion of exposed soils.	Local organic Topsoil and Glacial Till deposits.	Medium	Moderate	Moderate	Negligible	Imperceptible
Construction of Internal Site Access Tracks, Hardstands and Temporary Compound	Open excavations, increased runoff causing erosion of underlying overburden and bedrock. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill	Local organic Topsoil and Glacial Till deposits. Bedrock Local quarries	Medium	Moderate	Moderate	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction of Turbine and Substation Foundations	Open excavations, increased runoff causing erosion of underlying overburden and bedrock. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill and concrete products	Local organic Topsoil and Glacial Till deposits. Bedrock Local quarries	Medium	Moderate	Moderate	Negligible	Imperceptible
Construction of the Grid Connection and Internal Cabling	Removal of overburden material and exposure underlying Clay and Bedrock to erosion. Construction traffic resulting soil compaction and increase in surface water runoff resulting in increased erosion of exposed soils. Importation of engineering fill and concrete products Disposal of surplus excavated material to licenced facility	Local organic Topsoil and Glacial Till deposits. Bedrock Local quarries Licenced Waste Facilities	Medium	Small Adverse	Slight	Small Adverse	Imperceptible
Earthworks associated with the construction of the proposed development and associated infrastructure	Slope Failure	Local organic Topsoil and Glacial Till deposits.	Medium	Small Adverse	Slight	Negligible	Imperceptible
Accommodation works along TDR	Removal of overburden material and exposure underlying Clay and Bedrock to erosion. Construction traffic resulting soil compaction and increase in surface water	Local organic Topsoil and Glacial Till deposits. Bedrock Local quarries	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
	runoff resulting in increased erosion of exposed soils. Importation of engineering fill Disposal of surplus excavated material to licenced facility	Licenced Waste Facilities					
Operational Phase							
Maintenance Traffic	Release of hydrocarbons or fuel spill	Local organic Topsoil and Glacial Till deposits. Bedrock.	Medium	Small Adverse	Slight	Negligible	Imperceptible
Maintenance of access tracks	Importation of engineering fill	Local quarries	Medium	Small Adverse	Slight	Small Adverse	Imperceptible
Cumulative Impacts							
Construction of the proposed development and associated infrastructure	Cumulative impacts on local quarries from extraction of fill for proposed development	Local quarries	Medium	Negligible	Imperceptible	Negligible	Imperceptible

Table 9-15: Residual Impact Significance for Sensitive Hydrogeological Attributes

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Construction Phase							
Earthworks	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks. Reduction in groundwater levels from dewatering of excavation as required during the construction phase.	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate	Moderate	Negligible	Imperceptible
Felling Activities	Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages from felling machinery	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate	Moderate	Negligible	Imperceptible
Construction of Internal Site Access Tracks, Hardstands and Temporary Compound	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks.	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Moderate	Moderate	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
	Potential for ground water pollution from the use of cement-based compounds during the construction phase						
Construction of Turbine and Substation Foundations	Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks. Potential for ground water pollution from the use of cement-based compounds during the construction phase	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Medium	Moderate	Negligible	Imperceptible
Construction of the Grid Connection and Internal Cabling	Potential for ground water pollution from the removal of overburden deposits. Potential for silt infiltration to groundwater as a result of increased surface runoff and reduced protection of the aquifer Potential for contamination to groundwater from spills/leakages during construction phase earthworks.	Glenville, Bagnelstown & Cushina GWBs Locally and Regionally Important Bedrock Aquifers Groundwater Wells and Springs	High	Small Adverse	Moderate/Slight	Negligible	Imperceptible
Operation							
Maintenance Traffic	Some operational traffic will be necessary for maintenance plus normal operational traffic which could result in minor accidental leaks or spills of fuel/oil.	Glenville GWB Bedrock Aquifer Groundwater Wells and Springs	Medium	Small Adverse	Slight	Negligible	Imperceptible

Activity	Potential Impact	Receptor	Sensitivity	Prior to Mitigation		Post Mitigation	
				Magnitude	Significance	Magnitude	Significance
Cumulative Impacts							
Replant Lands, Moneygorm	Potential for silt infiltration to groundwater as a result of increased surface water runoff during drainage works Potential for contamination to groundwater from spills/leakages during drainage works	Glenville GWB Locally Important Bedrock Aquifer Groundwater Wells and Springs	Medium	Small Adverse	Slight	Negligible	Imperceptible

9.6 Conclusion

The assessment of Land, Soils & Geology has established a baseline for the receiving environment for the impact assessment. Potential impacts were considered for the construction, operational and decommissioning phases of the proposed development as well as potential residual and cumulative impacts. Mitigation measures have been proposed where relevant.

The proposed development site is not a sensitive site in terms of land, soils & geology.

A number of potential impacts have been identified associated with the excavation of soil and rock on the site. The significance of these potential impacts is assessed as being slight to moderate significance prior to mitigation.

The Coom Green Energy Park is not expected to contribute to any significant, negative cumulative effects with other existing or proposed developments in the vicinity.

With mitigation measures, outlined in Section 9.4, put in place during construction, operational and decommissioning stage the proposed development will have imperceptible significance on the Land, Soils & Geology.

9.8 References

BS8002:2015. (2015). *Code of practice for earth retaining structures.* British Standards Institute.

CIRIA, S. S. (1986). *Control of Groundwater for Temporary Works.* Construction Industry Research & Information Association (CIRIA).

Cork County Council. (1998). *Aquifer Protection for Water Supplies in the Northern Division (1998*)

EC. (2018). *Environmental Impact Assessment of Projects Guidance on the preparation of the Enviornmental Impact Assessment Report.*

Environmental Protection Agency. (2015). Retrieved Retrieved November 2019, from EPA Envision Map Viewer: http://gis.epa.ie/Envision

EPA. (2002). *Guidelines on the information to be contained in Environmental Impact Statements .*

EPA. (2003). *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements .*

EPA. (2015). *Advice Notes for Preparing Environmental Impact Statements Draft September 2015 .*

EPA. (2015). *Revised Guidelines on the Information to be Contained in Environmental Impact Statements, September 2015.*

EPA. (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports, Draft August 2017 .*

EPA. (2010). *Establishment of Groundwater Source Protection Zones Carraig na bhFear Group Water Supply Scheme 2010*

GSI. (2020). *Online Aggregate Potential Mapping Database*. (Geological Survey of Ireland) Retrieved September 2020 from http://spatial.dcenr.gov.ie/APM/index.html

GSI. (2020). *Online Heritage Database*. (Geological Survey of Ireland) Retrieved September 2020, from: http://spatial.dcenr.gov.ie

GSI. (2020). *Online Landslide Viewer* . (Geological Survey of Ireland) Retrieved September2020, from: http://spatial.dcenr.gov.ie/GeologicalSurvey/LandslidesViewer/index.html

GSI. (2020). *Public Data Viewer*. Retrieved September 2020, from: https://dcenr.maps.arcgis.com/apps/MapSeries/

GSI. (2000). *Fermoy Water Supply Scheme Coolroe Infiltration Gallery and Borehole Groundwater Source Protection Zones 2000*

GSI. (2000). *Grenagh Water Supply Scheme Groundwater Source Protection Zones, Draft 2000*

IGI. (2013). *Geology in Environmental Impact Statements.* Institute of Geologists of Ireland.

Ireland, O. S. (n.d.). Retrieved November 2019, from: http://maps.osi.ie/publicviewer

NRA. (2009). *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.* Transport Infrastructure Ireland.

Taluntais, F. (1980). *The General Soil Map of Ireland, second edition.* National Soil Survey of Ireland.

FEHILY TIMONEY

30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

www.fehilytimoney.ie

CORK OFFICE
Core House
Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6, Bagenalstown Industrial
Park, Royal Oak Road,
Muine Bheag,
Co. Carlow, R21 XA00,
Ireland
+353 59 972 3800