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Peat Stability Risk Assessment (PSRA) for Carrig Renewables Wind Farm

Client	**MKO**
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REVISION SUMMARY

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00	29/05/2023	All	First issue
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EXECUTIVE SUMMARY

Gavin and Doherty Geosolutions (GDG) was commissioned by MKO to undertake a Peat Stability Risk Assessment (PSRA) for the proposed Carrig Renewables Wind Farm (the "Proposed Development"). In accordance with planning guidelines compiled by the Department of the Environment, Heritage and Local Government (DoEHLG), where peat is present on a proposed wind farm development, a peat stability assessment is required.

The purpose of this report is to outline the potential for peat instability at the proposed development, and to outline a quantitative peat stability risk assessment rating in line with the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (PLHRAG, Scottish Government, 2017) for the proposed permanent development footprint.

The findings of the peat stability risk assessment showed that the site has an acceptable margin of safety and low risk of peat failure and is suitable for the proposed renewable energy development.

Consultation with published GSI maps and the observations from site investigations indicate that a large proportion of the site consists of cut-over Raised Peat. Peat is mapped across the site, aside from small areas at the far eastern, southern and western site boundaries. Recorded peat thicknesses range from 0-4.5m across the site, with an average thickness of 1.6m recorded. In total, 40.8% of recorded peat thicknesses were under 1m, and 78.2% were under 2m. Areas of deep peat of >2m in thickness have been recorded near T01, T02, T06, northeast of T03, and between T05 and the proposed construction compound. An area of particularly deep peat between T05 and the construction compound has been avoided during the design process.

A desk study, site walkovers, ground investigation campaigns, stability analyses and a risk assessment were carried out to assess the risks posed by peat failures within the site of the Proposed Development. The risks were assessed following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2017).

The stability analysis aims to determine the stability, i.e., the Factor of Safety (FoS) of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a FoS between 1.0 and 1.29 indicates that a slope is stable but not safe, and an acceptable FoS for slopes is 1.3 or greater.

A risk assessment was carried out considering the FoS value calculated in the stability analysis and other factors that could influence peat stability, considering how damaging a peat slide would be to this particular site's environment.

The site was found to have both acceptable factors of safety and levels of risk against peat instability at all infrastructure locations. Twenty-three small areas, referred to as safety buffers (see Appendix L), have been highlighted and will have restricted construction activities; they should not be used for the placement of peat or spoil. The proposed permanent development footprint avoids these areas entirely.

1 INTRODUCTION

1.1 BACKGROUND

Gavin and Doherty Geosolutions (GDG) was commissioned by MKO to undertake a Peat Stability Risk Assessment (PSRA) for the Carrig Renewables Wind Farm site.

Gavin & Doherty Geosolutions Ltd. (GDG) is a specialist geotechnical and marine civil design consultancy, providing innovative engineering solutions to a broad infrastructure problem. Established in 2010, GDG has since grown to more than 200 people. Our aim is to provide an innovative, cost effective and reliable service tailored to meet and exceed our clients' requirements. We strive to attain the highest possible standards and are consistently looking to pioneer and develop new technologies and techniques while ensuring that all relevant design codes and practices are met.

GDG brings together state of the art research and direct industry experience and offers a bespoke engineering service, delivering the most progressive, reliable, and efficient designs across a wide variety of projects and technical areas, including offering forensic engineering and expert witness services to the Insurance and Legal sectors. Our clients include large civil engineering contractors, renewable energy developers, semi-state bodies and engineering and environmental consulting firms.

GDG has been involved in many wind farm developments in both Ireland and the UK at various stages of development, i.e. preliminary feasibility, planning, peat stability assessment, design and construction. In addition to this, the GDG team made up of engineering geologists, geomorphologists, geotechnical engineers and environmental scientists, has developed expertise in landslide hazard mapping, including leading a recent national landslide hazard mapping pilot study which included extensive landslide runout and hazard mapping and calculation in Irish blanket peat.

This Report was written by Alastair Lewis (GDG Head of Infrastructure, MEng (Hons) Civil Engineering) and Chris Engleman (GDG Graduate Geologist, MGeol Geological Sciences). Alastair is GDG's Head of Infrastructure and has twenty-five years' experience in civil engineering and ground engineering. Chris is a Graduate Geologist with GDG and has 4 years' experience in geotechnical engineering and geology. All onsite GDG site walkovers and ground investigation activities on this project have been led by Chris with remote supervision by Alastair.

GDG visited the proposed development on four occasions between July 2022 and March 2023 to conduct site walkovers and ground investigation.

1.2 PROPOSED DEVELOPMENT

The proposed Carrig Renewables Wind Farm is located in Co. Tipperary, approximately 7km southwest of Birr, Co. Offaly. It encompasses all or part of the townlands of Lissernane, Sharragh, Arragh More, Faddan More, Arragh Beg, Coolderry and Cloncorig. The site is approximately 544 hectares in size.

A site location map is provided in Figure A- 1 in Appendix A.

The Proposed Development infrastructure will comprise of the following:

- Construction of 7 wind turbines and associated hardstand areas with the following parameters:
  - a total tip height of 185m;
  - hub height 104m; and
  - the rotor diameter of 162m.
  - Each turbine will be capable of generating 6.2MW, with an overall installed capacity of 43.4MW;
- One 38kV permanent electrical substation including a control building with welfare facilities, all associated electrical plant and equipment, battery energy storage system, security fencing, all associated underground cabling, wastewater holding tank and all ancillary works;
- 1no. meteorological mast with a height of 104 metres, and associated foundation and hard-standing area;
- All associated underground electrical and communications cabling connecting the turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid via underground cabling to the existing Dallow substation;
- Upgrade of existing tracks and roads, provision of a new site access roads and hardstand areas;
- All works associated with the provision of a new site entrance off the L5040 local road;
- Six peat and spoil repository areas
- Two temporary construction compounds;
- Junction accommodation works to facilitate turbine delivery ;
- Spoil Management;
- Site Drainage;
- Tree Felling;
- Operational stage site signage; and
- All ancillary works and apparatus.

The Proposed Development has been designed with an operational life of 35 years, at the end of which it can be decommissioned. The Applicant is therefore seeking a ten-year permission and a 35-year operational life from the Proposed Development's commissioning date.

Refer to Chapter 4 of the EIAR for a detailed description of the development.

This report examines the conditions at the Proposed Development Site, located within the EIAR Site Boundary as defined in Chapter 1 of the EIAR and does not analyse the transport delivery route. The transport delivery route has not been included in this report as no peat stability risk is expected along the route. Works on the transport delivery route are not expected to be carried out in peat material and will not require the excavation or placement of significant amounts of material. Very little peat or soft ground has been identified on the grid connection route, as this is located entirely within existing roads and tracks, and therefore this has also not been included in the report. The "Proposed Development Site" or "Site" as referred to in this report is in reference to the core of the Proposed Development as defined in Chapter 4 of the EIAR.

1.3 OVERVIEW OF PEAT LANDSLIDES

1.3.1 PEAT LANDSLIDE TYPES

The literature typically refers to two general groups of peat landslides: peat slides and bog bursts. Some descriptions of each type are provided in Table 1-1.

Table 1-1: Peat landslide types.

Characteristics	Peat slide	Bog burst
Outstanding characteristic	Shallow translational failures	Particularly fluid failures without necessarily a clear scar margin. The liquefied basal material is expelled through surface tears followed by settlement of the overlying mass.
Mechanism	Shear failure along discrete shear surfaces, typically at the peat-substrate interface	Subsurface creep, swelling
Peat depth	≤ 2 m	≥ 1.5 m
Slope angle	5 – 15° (moderate)	2 – 10° (gentle), where deeper peat is more likely
Spatial distribution	Scotland, England and Wales	Ireland

The slope angle within the Proposed Development Site ranges from 0° to 16°. Evidence of past landslides has not been identified within the proposed wind farm site and the near surroundings on the available Google Earth imagery (available from 2010 onwards), nor during the fieldwork.

According to the GSI landslide inventory (GSI, 2022), the closest landslide is located around 10 km northeast of the closest turbine (T02) and around 9.7km from the site boundary. The area of the peat slide was not recorded, but it is recorded to have occurred around 1900 and resulted in "an old road (being) swallowed in the bog". Little other information is available, but this location appears to be a relatively flat, deep raised peat bog, and therefore the failure mechanism was likely a bog burst. Figure 1-1 shows the landslide event closest to the site boundary. The locations of the past landslide events identified in the GSI landslide archive are shown in Figure G- 1 in Appendix G.

Figure 1-1: Closest recorded landslide to the site boundary (GSI, 2022).

Although there is no evidence of landslides within the Proposed Development Site, this does not necessarily mean that landslides have never occurred at the proposed site location. It is noted that the geomorphological features associated with peat landslides (peat slides and bog bursts) are softened with time through erosion, drying and re-vegetation (Feldmeyer-Christe & Küchler, 2002; Mills, 2003). Additionally, the peat harvesting activities across the proposed site obscure the identification of possible historical landslides.

1.3.2 CONTROLS OF PEAT INSTABILITY

The spatial and temporal occurrence of landslides, including peat landslides, is controlled by *conditioning* and *triggering factors*.

The conditioning factors explain the spatial distribution of landslides and are related to the inherent properties of the terrain, such as soil type, slope angle, curvature (convex/concave) of the slopes and drainage.

The triggering factors explain the frequency of landslides. They can be distinguished between fast and slow triggers:

- Fast triggers:
    - Intense rainfall (the most frequent trigger);
    - Snowmelt (very frequent trigger; Warburton, 2022);

  - Rapid ground accelerations (e.g. from blasting rock);
  - Undercutting of peat by natural processes (e.g. fluvial) or man-made, or
  - Loading the peat.

- Slow triggers:
  - Low intensity but constant rainfall;
  - Afforestation / Deforestation (wildfires, pollution-induced vegetation change); or
  - Weathering (physical, chemical, biological).

Slow triggers can start landslides by themselves and can also act as *preparatory factors* for fast triggers by lowering their threshold to start landslides.

1.3.3 PRE-FAILURE INDICATORS

The presence of conditioning factors and low-pace triggers before failure is often indicated by ground conditions, features and morphologies that can be identified remotely or during the fieldwork by the geomorphologist or through basic monitoring techniques.

According to the updated guidelines provided by the Scottish-Executive (2017), the following critical features are indicative of the susceptibility or proneness to failure in peat environments:

- Presence of historical and recent failure scars and debris;
- Presence of features indicative of tension (e.g. cracks);
- Presence of features indicative of compression (e.g. ridges, thrusts, extrusion features);
- Evidence of peat creep (typically associated with tension and compression features);
- Presence of subsurface drainage networks or water bodies;
- Presence of seeps and springs;
- Presence of artificial drains or cuts down to substrate;
- Presence of drying and cracking features;
- The concentration of surface drainage networks;
- Presence of soft clay with organic staining at the peat and (weathered) bedrock interface; and
- Presence of iron pans or similar hardened layers in the upper part of the mineral substrate.

Other evidence of peat instability unrelated to landslides has been considered, namely quaking peat in horizontal areas with very low bearing capacity.

1.4 PEAT STABILITY RISK ASSESSMENT WORKFLOW

GDG has carried out the PSRA for the Proposed Development Site following the principles set out in the *Proposed electricity generation developments: peat landslide hazard best practice guide* (Scottish Executive, 2017). This guide has been used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks concerning consent applications for electricity generation projects.

Figure 1-2 shows a workflow diagram showing the general methodology for the PSRA. The methodology can be summarised into the following steps:

1. Completion of the desk study including:
    - Geology and Quaternary sediments (subsoils);
    - Soils;
    - Moisture;
    - Hydrogeology;
    - Multi-temporal aerial / Satellite imagery;
    - Topography;
    - Landslide inventories and landslide susceptibility;
    - Hydrology;
    - Land cover and land use;
2. Relevant academic literature and publications. Undertaking a walkover and fieldwork to:
    - Carry out geo-investigations especially concentrated at the proposed infrastructure areas, including peat probing, hand shear vane testing and trial pitting;
    - Record geological and geomorphological features, including exposures of the soil profile and evidence of peat instability; and
    - Record hydrologic and vegetation features.
3. Risk assessment, including:
    - Interpolation of the peat probe values and generation of the peat depth map;
    - Creation of the Factor of Safety (FoS) maps using a deterministic approach (Bromhead, 1986) for drained and undrained conditions;
    - Qualitative hazard assessment by combining the FoS with observations of the peat condition identified both on aerial imagery and during fieldwork.
    - Qualitative consequences assessment;
    - Calculation of the peat landslide risk by multiplying hazards and consequences;
    - Classification of the risk values into four classes:
        - Negligible;
        - Low;
        - Medium; and

- Serious.

4. Proposal of actions required for each infrastructure element.

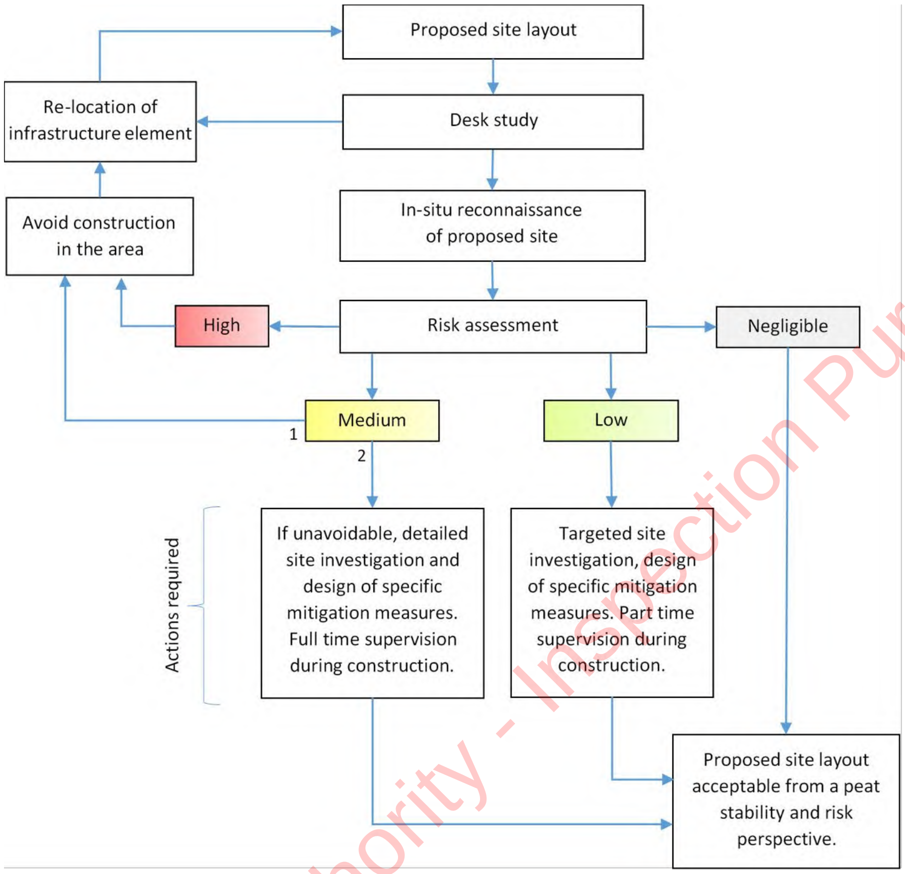

Figure 1-2: Workflow of the PSRA methodology for the acceptability of the proposed site layout (Scottish Executive, 2017).

2 DESK STUDY

For a preliminary site suitability analysis and background knowledge of local peat stability and ground conditions, the following areas have been considered:

1. Geology and Quaternary sediments (subsoils);
2. Soils;
3. Moisture;
4. Hydrogeology;
5. Multi-temporal aerial / Satellite imagery;
6. Topography;
7. Landslide inventories and landslide susceptibility;
8. Hydrology;
9. Land cover and land use;

10. Relevant academic literature and publications.

2.1 BEDROCK GEOLOGY

According to the GSI bedrock geological map of Ireland at 1:100,000 scale (Figure B- 1 in Appendix B) (GSI, 2018a), the bedrock underlying the proposed site is limestone of Carboniferous age. The north part of the site (including T06 and T02) is underlain by Waulsortian Limestone of lower Carboniferous (Tournasian-Visean) age. This lithology is characterised pale grey, crudely bedded or massive limestone.

T01, T03, T04 and T05, along with the eastern cable route, are underlain by grey calcarenitic and oolitic limestones of the Terryglass Formation, of Lower Carboniferous (Dinantian) age. The lithology is characterised by medium to pale grey, very well-sorted calcarenites, which are essentially oolitic. Grain size varies from fine to medium.

The southern part of the site is underlain by micritic limestones of the Lismaline Micrite Formation (Lower Carboniferous) and muddy limestones and calcareous shales of the Slevoir Formation (Lower Carboniferous). Bedrock is not mapped as outcropping at the surface within the site boundary.

As the underlying geology of the site is dominated by limestones, karstic features may be present and present additional risks. One karstic enclosed depression is mapped by the GSI (2015) roughly 900m north of the site boundary close to T06, within the Waulsortian Limestone. The presence of further karstic features unmapped by the GSI, obscured under the quaternary sediments, must not be discounted and should be taken into account in future site investigations.

2.2 QUATERNARY SEDIMENTS

The map of Quaternary sediments at 1:50,000 scale shown in Figure B- 2 in Appendix B (GSI, 2021) shows that the wind farm site is located primarily on cut-over raised peat. Cut-over raised peat consists of discreet, raised, dome-shaped masses of peat which have had part of their peat volume removed by anthropogenic peat harvesting methods.

Alluvium deposits are not mapped within the site boundary; however, it is expected that some form of alluvium would be present adjacent to most of the minor watercourses that cross the site.

Three pockets of Till derived from limestones are mapped along the southern boundary of the Proposed Development, largely corresponding with small ridge features mapped by the GSI as drumlins. An additional area in the eastern part of the site is also mapped as Till derived from limestones. A small patch of gravels derived from limestones is mapped near T04; however, a Trial Pit at this location identified cohesive Glacial Till.

2.3 SOIL COMPOSITION

The Irish soil map at a 1:250,000 scale is shown in Figure C- 1 in Appendix C (EPA, Teagasc, & Cranfield University, 2018). The Proposed Development Site is covered mainly by peat. The east of the Proposed Development Site contains some soils classified as Luvisols of the 1000a and 1000c associations: Luvisols associated with Surface-water Gleys, Stagnic Brown Earths and Calcareous

Brown Earths, on drift with limestones (1000a) and Luvisols associated with histic and humic Groundwater Gleys and calcareous Brown Earths, on drift with limestones and Basin Peat (1000c). It is noted that the presence or absence of peat cover in the regional scale maps (Figure B- 2 and Figure C- 1) must not be taken as exact. The depth and extent of peat deposits may vary over short distances as a function of local underlying geology, past and ongoing geomorphological activity, and management history. Therefore, these maps have been complemented by peat probes and field observations described in Section 3.

2.4 MOISTURE

Water reaching a slope can produce the following processes:

- Lubrication. It reduces the friction along discontinuities (joints or stratification) in rock or soil (Wu, 2003). In clay soils, lubrication is due to the presence of water that produces a repulsion or separation between the clay particles.

- Softening. It mainly affects the physical properties of filler materials in fractures and fault planes in rocks.

- Pore pressure. Water in soil pores exerts pressure on soil particles, changing the effective pressure and the shear strength. The negative impact of pore pressure changes is particularly evident in partially saturated or unsaturated soils, where the increase in moisture content causes the development of a wetting front that converts beneficial negative suction stresses within the capillary structure of the soil to a fully saturated positive pore pressure. When soil is saturated, capillary stresses and adhesion between particles diminish, and, as a result, soil shear strength decreases.

- Confined water pressures. The confined underground water acts as an uplifting pressure on the impermeable layers, decreasing the shear strength and producing hydrostatic pressures on the layers where permeability changes. These lifting stresses can cause material deformation or failure, and pore pressure decreases soil resistance.

- Fatigue failure due to fluctuations in the water table. Some landslides occur in episodes of rain with lower intensity than previous ones. This phenomenon is explained by Santos et al. (1997) as a case of soil fatigue due to cyclical pore pressures. In temperate climates, seasonal variations in temperature can lead to slight variations in the water table. These changes are much more significant in tropical climates (Xue & Gavin, 2008).

- Washing away of cement material. The groundwater flow can remove the soluble cement (e.g. calcium carbonate) from the soil and, thus, decreases the cohesion and the friction angle. This process is usually progressive.

- Density increase. The presence of water in soil pores increases the bulk density and weight of the materials in the slope. Therefore, shear stress increases, and the slope safety factor decreases.

- Internal hydraulic forces. The movement of groundwater currents creates hydrodynamic pressure on the ground in the direction of flow. This force acts as a destabilizing element on the groundmass and can appreciably decrease the safety factor of the slope. The hydrodynamic or seepage/flow force can also cause the movement of the particles and the destruction of the soil mass (piping).

- Collapse. Collapsible soils (alluvial soils deposited very rapidly and wind soils or loess) are very sensitive to changes in humidity. When water content increases, their volume decreases, and the microstructure collapses.

- Desiccation cracks. Changes in humidity can cause cracking, and these cracks can determine the extension and location of the surface of failure and have a very important effect on the safety factor or possibility of sliding.

- Piping in clays. Some clayey soils disperse and lose their cohesion when saturated. The result can be the total collapse of the soil structure and the activation of landslides.

- Chemical weathering: Processes of ion exchange, dissolution, hydration, hydrolysis, corrosion, oxidation, reduction and precipitation (Wu, 2003).

- Erosion. The detachment, dragging, and deposition of soil particles by water flows modifies the relief and the stresses on slopes and can produce the activation of a landslide, especially when erosion undercuts slopes.

The *Normalized Difference Moisture Index Colorized* GIS service or the United States Geological Survey (USGS) has been used to estimate levels of moisture in the soil across the Proposed Development site. This service is based on the analysis of multispectral Landsat 8[1] OLI images. Using data processing, the raw digital number (DN) values for each Landsat band are transformed to scaled (0 - 10000) apparent reflectance values, and then, the Normalised Difference Moisture Index is obtained using Equation 2.4-1 (Gao, 1996):

$$\text{NDMI} = (\text{Band } 5^{2} - \text{Band } 6^{3}) / (\text{Band } 5 + \text{Band } 6) \qquad \textbf{Equation 2.4-1}$$

Figure D- 1 in Appendix D illustrates the levels of estimated soil moisture across the Proposed Development Site as calculated by the above method. Wetlands and other vegetated areas with high levels of moisture appear as dark blue. Regions of lower values of moisture are represented as light blue and green. The map indicates that the proposed development site as a whole displays a high moisture content.

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[1] Landsat 8 includes 8-band multispectral scenes at 30-meter resolution which are typically used for mapping and change detection of agriculture, soils, moisture, vegetation health, water-land features and boundary studies.

[2] Near Infrared (NIR)

[3] Short Wave Infrared 1 (SWIR1)

2.5 MULTI-TEMPORAL AERIAL / SATELLITE IMAGERY

The aerial / satellite imagery used for this report is the ESRI orthophoto (OTF) and the Google Earth multi-temporal imagery (2010 onwards). This imagery has been used to:

- Identify any evidence of peat failures;
- Identify pre-conditioning factors for failure (where visible at the resolution of the imagery);
- Observe, where possible, vegetation cover, drainage regime and dominant drainage pathways; and
- Identify evidence for land management practices with the potential to influence ground conditions (e.g. burning, artificial drainage, peat cutting and forestry). The advancing peat cutting from 2010 to 2022 onsite can be seen in Figure 2-1 to Figure 2-3.

It is noted that the time-lapse of the available imagery is too short to identify old peat instability evidence that may have been eroded or re-vegetated with time or changes in land management.

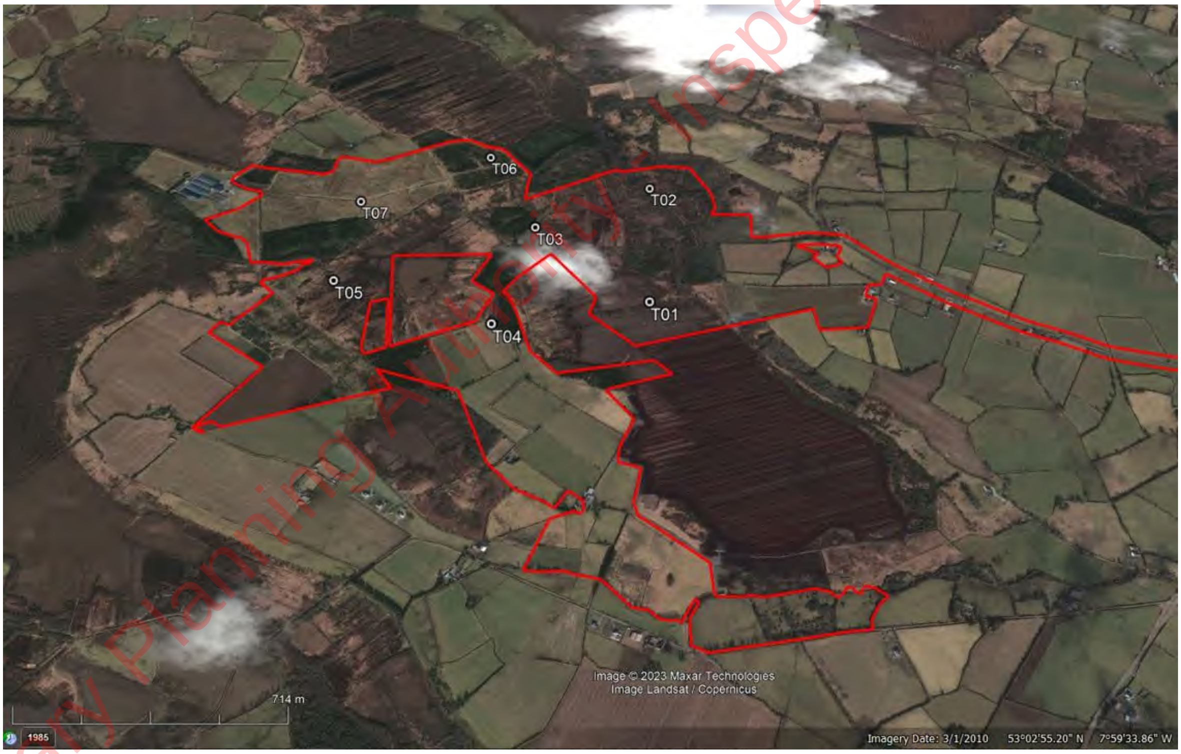

Figure 2-1: Multitemporal Satellite Imagery (Google Earth, 2010). White dots indicate the proposed WTG layout.

Figure 2-2: Multitemporal Satellite Imagery (Google Earth, 2017). White dots indicate the proposed WTG layout.

Figure 2-3: Multitemporal Satellite Imagery (Google Earth, 2022). White dots indicate the proposed WTG layout.

2.6 HYDROGEOLOGY

According to the GSI Bedrock Aquifer map (2018), shown in Figure E- 1 in Appendix E, much of the site is underlain by a Regionally Important Aquifer – Karstified (diffuse). This aquifer corresponds with the Terryglass Formation and is classed as capable of supporting large public water supplies sufficient to support a large town. The northern and southern boundary areas of the site are mapped as being Locally Important Aquifers which are either generally moderately productive or productive only in local zones. These are classed as aquifers which are capable of supporting smaller public water supplies or group schemes.

The GSI Subsoil Permeability map (2018), shown in Figure E- 2 in Appendix E, indicates that almost the entirety of the site is of medium permeability. A small area close to T04 is mapped as being of high permeability.

A topographic low identified to the west of T02 appears from site reconnaissance and aerial imagery to be persistently waterlogged, indicating high water tables in this area.

2.7 TOPOGRAPHY

A Digital Terrain Model derived from Bluesky (2018) orthophoto data was used for the topographical analysis and is shown in Figure 2-4 and in Figure F- 1 in Appendix F.

The topography of the site is largely low-lying and flat, with low NW-SE oriented ridges mapped by the GSI as drumlins located around the site boundary. The peat bogs on site occupy low-lying, generally flat depressions between the drumlins. The topography of the site can be described as flat to undulating raised bog plain. The elevation varies between 52 m to 85 mOD (meters above ordnance datum). A topographically low area of <60mOD is identified to the west of T02, which remains persistently waterlogged, based on site observations and aerial imagery.

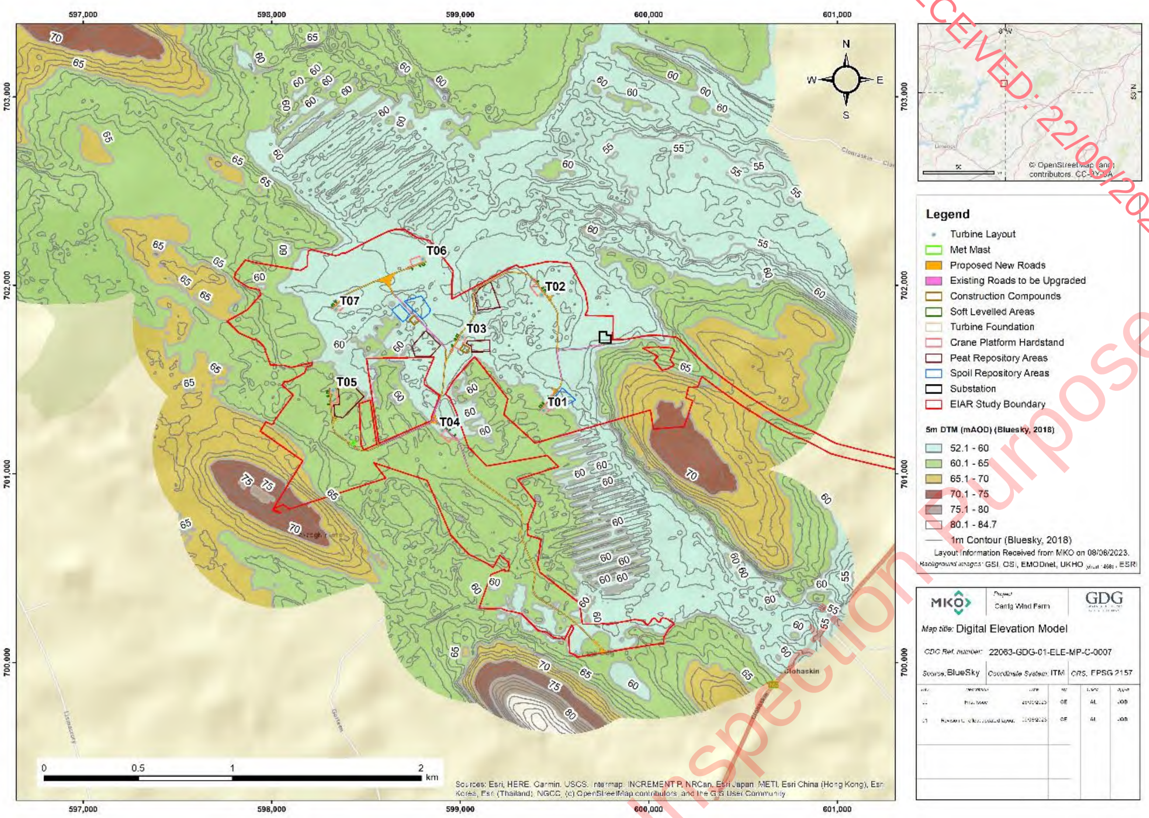

Figure 2-4: Digital Elevation Model for the proposed development, showing the low lying, generally flat topography (Bluesky, 2018).

One additional map has been derived from the digital terrain model (DTM):

- The slope angle map shown in Figure F- 2 in Appendix F shows the slope angles range between 0° and 16.

2.8 LANDSLIDE MAPPING

The GSI landslide inventory (GSI, 2022a), the multi-temporal aerial / satellite imagery, the DEM, the landslide susceptibility map (GSI, 2016), and the rainfall information of Met Éireann data 1981-2010 have been used for this part of the desk study.

Figure G- 1 in Appendix G depicts the spatial relationship between records of previous landslide events (GSI, 2022a, 2022b) and rainfall across Ireland from the Met Éireann (2018) average annual rainfall dataset. The study area is in a region of high rainfall and relatively flat topography, and there is no record of past landslide events from the national landslide database nor from the desk study and fieldwork for this project. However, there is one landslide event in the database within 10km of the eastern boundary of the site, with the closest landslide according to the GSI database occurring on flat, heavily worked peat bog around 10km from the Proposed Development red line boundary. The likely cause of the landslide instabilities is from the extraction of peat from the raised bog.

Figure G- 2 in Appendix G illustrates the landslide susceptibility (GSI, 2016) across the Proposed Development Site. This map was obtained by using an empiric probabilistic method at a regional scale and did provide input into site-specific scale engineering studies. The entirety of the site is mapped as having low susceptibility due to the low slope angles encountered. The field visits of the geotechnical team support that the site is stable.

2.9 HYDROLOGY

According to the Ordnance Survey Ireland (OSi) shapefile of rivers, lakes and catchments/basins (Figure H- 1 in Appendix H), the site is located within the watershed of the Little Brosna River – a tributary of the River Shannon. One minor watercourse, labelled Faddan Beg by the OSI, crosses the site to the south of T06.

Further details are outlined in the Chapter 9: Hydrology and Hydrogeology of the EIAR.

2.10 LAND COVER AND LAND USE

According to the Corine Land cover map shown in Figure I- 1 in Appendix I, the surrounding landscape of the proposed site comprises mixed forest, peat bog and pastures. Land use within the site is mixed, with peat cutting and pastoral agriculture dominating.

3 SITE RECONNAISSANCE AND GROUND INVESTIGATION

GDG conducted a site reconnaissance as part of the assessment. This comprised four site visits (July 2022, August 2022, November 2022 and March 2023) to record geomorphological features concerning the Proposed Development, peat depths and peat strength. An indication of the site conditions (harvested peat, peat bogs, wetlands and forestry) with flat topography are shown in Figure 3-1 and Figure 3-2.

Figure 3-1: Harvested peat close to T05.

Figure 3-2: Waterlogged cut-over peat bog 200m to the west of T02.

Four ground investigations (GI) were carried out on the site:

1. MKO (June 2022): 67 peat probes
2. GDG (July 2022): 32 peat probes and 6 hand shear vanes.
3. GDG (August 2022): 25 peat probes.
4. GDG (November 2022): 9 trial pits.
5. MKO (February 2023): 34 peat probes.
6. GDG (March 2023): 27 peat probes and 6 trial pits.

In summary, intrusive ground investigations were carried out at a total of 206 locations.

The site investigation locations (Figure J- 1 and Figure J- 2 in Appendix J) considered the following criteria:

- Spatial distribution of the proposed infrastructure;
- Distance between probe points to avoid interpolation of peat depths across large distances;
- Changes in slope angle, as peat depths are likely to be shallower on steeper slopes;
- Changes in vegetation, which can reflect changes in peat condition;
- Changes in hydrological conditions; and
- Changes in land use.

No evidence of any previous landslides or peat instability indicators as described in section 1.3.3 were identified during the walkovers.

A raster map was created in GIS software presenting the interpolated peat depth across a site from the peat probe points using the Inverse Distance Weighted (IDW) method. This interpolated raster of peat depth is represented in Figure J- 3 to Figure J- 4 in Appendix J.

Table J- 1 to Table J- 10 in Appendix J present the observations made at the proposed infrastructure. The trial pit logs can be seen in Appendix A.1.1.1(a)J.1.

3.1 GROUND INVESTIGATION SUMMARY

The ground investigations indicate that the ground conditions at the site comprise predominantly of areas of cut-over raised peat of up to 4.5m in depth, with areas of glacial till to the south, east and west of the site. Trial pit locations (Appendix A.1.1.1(a)J.1) suggest that the peat material is sometimes underlain by granular or cohesive glacial material or weathered rock, or by soft lacustrine silt, or directly on limestone bedrock.

Peat thickness encountered by intrusive investigations across the site varies from 0m to a maximum of 4.5m, with an average of 1.68m recorded. The frequency of different peat thicknesses are shown in Figure 3-3. In total, 40.8% of recorded peat thicknesses were under 1m, and 78.2% were under 2m. Laterally extensive regions of >2m in depth were encountered, particularly in the vicinity of T01, T02, T06, northeast of T03, and between T05 and the proposed construction compound. The depths encountered are considered moderate to deep in places: with probes identifying peat thicknesses of up to 4.5m.

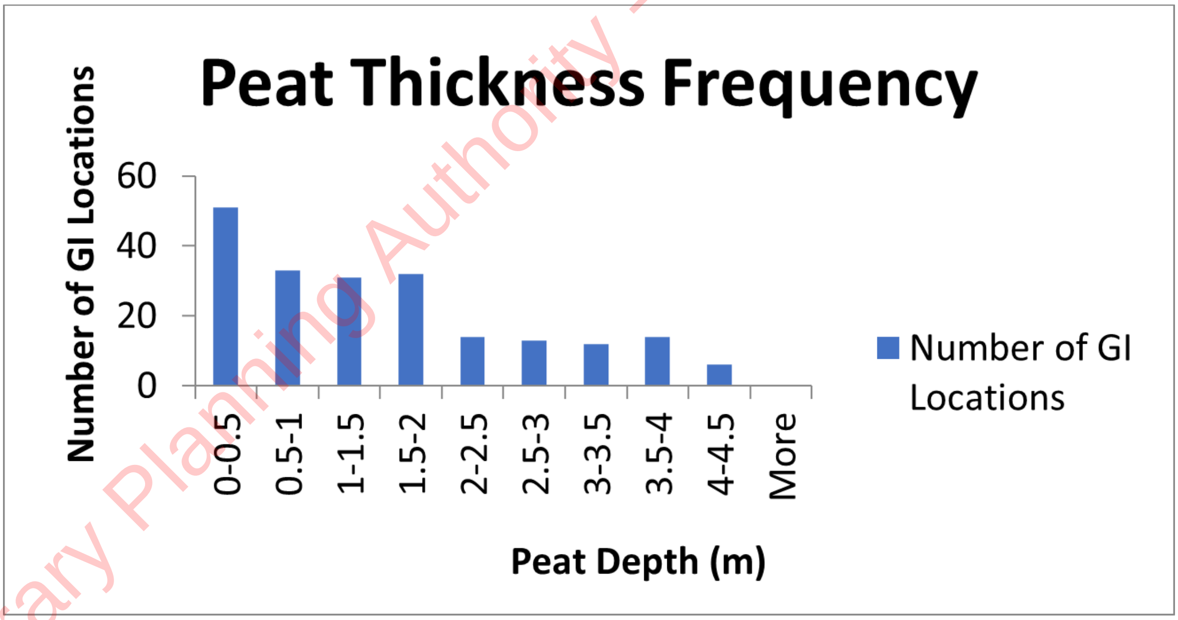

Figure 3-3: Histogram of peat thickness results across the site.

The walkover indicated that the peat is being cut in several areas and has drained significantly, with the observed peat classified as the catotelm. The surface condition of the peat can be described as being varied, with some areas having bare peat at the surface where cutting is active as shown in Figure 3-1, and other areas are vegetated with grass/rushes or forestry, as shown in Figure 3-2.

4 PEAT STABILITY ASSESSMENT

The peat stability assessment is one of the inputs required for the peat hazard assessment and risk calculation. This section presents:

- A review of the general approaches to assess peat stability;
- The concept of Factor of Safety (FoS);
- The methodology adopted for this report and the parameters required; and
- The resulting FoS delineates safety buffers and peat stockpile restricted areas.

The eastern cable route is not included in this analysis.

4.1 MAIN APPROACHES TO ASSESS PEAT STABILITY

The main approaches for assessing peat stability for wind farm developments include the following:

1. Qualitative geomorphological judgement; and
2. Quantitative assessment:
    a. Empirical probabilistic approach.
    b. Physically based deterministic approach (Factor of Safety - FoS).

Approach 1 is subjective and thus not adopted for this study. Approach 2a is objective and quantitative but is more appropriate for land planning and decisions making studies at a regional scale. Additionally, the method does not provide an engineering indication of physical stability as Approach 2b does. In this report, the peat stability assessment is carried out by using Approach 2b: deterministic (FoS) approach (Bromhead, 1986).

4.2 THE FACTOR OF SAFETY (FOS) CONCEPT

The factor of safety is a measure of the stability of a slope. For any slope, the degree of stability depends on the balance between the landslide driving forces (weight of the slope) and its inherent shear strength, illustrated in Figure 4-1.

Figure 4-1: Balance of forces in a slope (Scottish Executive, 2017).

Therefore, the factor of safety provides a direct measure of the degree of stability of a slope by the ratio of the shear resistance along a potential surface of failure and the landslide driving forces acting on such surface. Multiple potential surfaces of failure are possible, but the FoS assigned to a slope is that of the surface of failure with the lowest value of FoS.

- FoS < 1 indicates a slope is unstable and prone to fail.
- FoS = 1 indicates a slope is theoretically stable but not safe.
- FoS ≥ 1.3 indicates the acceptable safety threshold. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981) provided advice on the design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation, the design FoS should be greater than 1.3. This way, the slope is stable and safe.

As a general guide, the FoS limits for peat slopes assumed in this report are summarised in Table 4-1.

Table 4-1: Factor of Safety limits assumed in this report.

Factor of Safety limits	Slope stability
FoS < 1	Unstable
1 ≤ FoS <1.3	Stable but not safe
FoS ≥ 1.3	Stable and safe

Eurocode 7 (EC7) (IS EN 1997-1:2005) now serves as the reference document and basis for design geotechnical engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances. Unlike the traditional FoS approach, EC7 does not provide a direct measure of stability, as global factors of safety are not used.

Therefore, to provide a direct measure of the peat stability across the site, the previous FoS method has been used for this assessment, rather than EC7 partial factors.

4.3 METHODOLOGY ADOPTED AND PARAMETERS

The stability of a peat slope is dependent on several factors working in combination, namely the slope angle, the shear strength of the peat, the depth of the peat, the pore water pressure and the loading conditions. An adverse combination of these factors could potentially result in peat failure. An adverse value of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding in the study area. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To determine the stability of the peat slopes in the study area, undrained (short-term stability during construction) and drained (long-term stability during operation) analyses have been carried out.

4.3.1 UNDRAINED CONDITIONS

The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the Derrybrien failure, undrained loading during construction was found to be the critical failure mechanism.

Among the shear strength values obtained by GDG by using the hand shear vane tests in the proposed site, the lowest registered value was 8 kPa. However, based on GDG's experience in the assessment of similar blanket peats and values reviewed in the literature, a more conservative value of 5 kPa has been adopted for the undrained shear strength (C_u). The shear vane testing was carried out in summer and is not considered to be representative of winter undrained conditions.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z sin\alpha cos\alpha} \quad \text{Equation 4.3-1}$$

Where,

F = Factor of Safety;

c_u = Undrained strength 5 kPa in the study area);

γ = Bulk unit weight of the material (assumed 10 kN/m^3);

z = Depth to failure plane assumed as the depth of peat (this is the interpolated raster of peat depth); and

α = Slope angle (in each pixel of 1 m. This is obtained from the 1-m DEM provided by the Client).

4.3.2 DRAINED CONDITIONS

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

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of the disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values, a review of published information on peat was undertaken. Table 4-2 shows a summary of the drained parameters used is published literature. Based on GDG's experience in the assessment of similar raised peats, and the values reviewed in the literature, it was considered appropriately conservative to use design values below the averages, namely c' = 4 kPa and ø' = 25°.

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha} \quad \text{Equation 4.3-2}$$

Where,

F = Factor of Safety;

c' = Effective cohesion (4 kPa);

γ = Bulk unit weight of the material (10 kN/m^3);

z = Depth to failure plane assumed as the depth of peat (this is the interpolated peat depth);

γ_w = Unit weight of water (9.81 kN/m^3);

h_w = Height of the water table above the failure plane (= z i.e.at surface level);

α = Slope angle (in each pixel. This is obtained from the 1-m contour lines provided by the Client);

ø' = Effective friction angle (25°).

Table 4-2: Effective cohesion and friction angle values from the literature

Reference	Cohesion, c' (kPa)	Friction Angle, ø'
Hanrahan et al. (1967)	5 to 7	36 to 43
Rowe and Mylleville (1996)	2.5	28
Landva (1980)	2 to 4	27.1 to 32.5
Landva (1980)	5 to 6	-
Carling (1986)	6.5	0
Farrell and Hebib (1998)	0	38
Farrell and Hebib (1998)	0.61	31
Rowe, Maclean and Soderman (1984)	3	27
McGreever and Farrel (1988)	6	38
McGreever and Farrel (1988)	6	31
Hungr and Evans (1985)	3.3	-
Madison et al. (1996)	10	23
Dykes and Kirk (2006)	3.2	30.4
Dykes and Kirk (2006)	4	28.8
Warburton et al (2003)	5	23.9
Warburton et al (2003)	8.74	21
Entec (2008)	3.8	36.8
Komatsu et al (2011)	8	34
Zhang and O'Kelly (2014)	0	28.9 to 30.3

Several general assumptions were made as part of the analysis:

1. Peat depths are based on the maximum peat depths recorded in each probe from the walkover surveys.
2. The slope angles derived from the DEM, as outlined in Section 2.7, accurately represent slope angles on site.
3. The surface of failure is assumed to be parallel to the ground surface.

4. The peat stability is calculated in pixels of 1 m across the fringe containing information of peat depth and the proposed infrastructure.

Two surcharging conditions are considered for the stability analysis:

- No surcharging load; and
- Surcharging load of 10 kPa, equivalent to 1 m of stockpiled or side-cast peat.

4.4 FOS RESULTS

The factors of safety obtained for the two different conditions (undrained and drained) and for the two surcharge scenarios (no surcharge and 1 m of peat surcharge) are presented in both in table format and map format.

Table K- 1 and Table K- 2 in Appendix K show the FoS calculation process in the proposed turbine sites only for undrained and drained conditions, respectively. The FoS calculation for the rest of the sites, i.e. the proposed substation, temporary construction compound, existing and upgraded access roads, borrow pits and met mast (more than 5000 pixels of 5 m), has been carried out semi-automatically in GIS by implementing Equation 4.3-1 and Equation 4.3-2 in the GIS raster calculator.

4.4.1 FoS FOR UNDRAINED CONDITIONS

The spatial distribution of the FoS values calculated for undrained conditions (no surcharge) is shown in Figure K- 1 and Figure K- 2 in Appendix K. At each turbine location, the construction compound, the substation and met mast location, the pixels exhibit a FoS > 1.3 (green: stable and safe).

4.4.2 FoS FOR UNDRAINED CONDITION AND SURCHARGE OF 10 KPA

Figure K- 3 and Figure K- 4 in Appendix K depict the spatial distribution of the FoS values calculated for undrained conditions and with a 10 kPa surcharge. The 10kPa simulated the placement of 1m of peat material on the ground surface. In terms of factor of safety results, the undrained condition with the 10kPa surcharge is considered to be the critical stability scenario. Almost all of the pixels are shown to be stable and safe (FoS > 1.3, green), including the entirety of the proposed permanent development footprint. Several additional areas of factor of safety >1 but <1.3 (yellow: stable but not safe), and one area of factor of safety <1 (red: not stable) are identified. These occur away from site infrastructure and are associated with steep turf banks at recent peat cut faces and are not considered to present a significant peat landslide risk.

4.4.3 FoS FOR DRAINED CONDITIONS

The spatial distribution of the FoS values calculated for undrained conditions (no surcharge) is shown in Figure K- 5 and Figure K- 6 in Appendix K. Each of the pixels exhibits a FoS > 1.3 (green: stable and safe).

4.4.4 FoS FOR DRAINED CONDITION AND SURCHARGE OF 10 KPA

The spatial distribution of the FoS values calculated for undrained conditions (no surcharge) is shown in Figure K- 7 and Figure K- 8 in Appendix K. At all permanent hardstanding infrastructure location, the pixels exhibit a FoS > 1.3 (green: stable and safe).

4.5 ASSESSMENT AND INTERPRETATION OF FoS RESULTS

The interpretation of the factor of safety analysis and accurate assessment of the peat stability conditions is a semi-automated approach which combines the developed polygon areas of the FoS results, areas of risk identified during the site walkovers and potential risk areas identified from the examination of peat depths and site topography. It is noted that the results from all FoS analyses (drained/undrained, with and without surcharge) are used, highlighting any areas indicative as having a FoS of less than 1.3 in the worst-case surcharged condition with 10kPa. These areas were then cross examined with the observations from the site visits and topographic models.

This analysis was used throughout the development process to aid in the siting and design of the proposed development layout including turbines, hardstands, and other key infrastructure locations.

The undrained scenario with a 1m peat surcharge has been considered as the critical scenario, however, the FoS of all elements of the site was examined in both the drained and undrained conditions.

None of the proposed infrastructure locations overlap with any of the areas identified as being low factor of safety (<1.3), aside from PRA 2. In PRA 2, one 5m x 5m pixel was identified as having a FoS of 1.288. This is likely related to a very localised slope caused by a relict turf bank and is not considered to present a peat stability risk. It is recommended that this area, along with all other peat and spoil repository areas, be levelled prior to construction.

Much of the Proposed Development Site contains flat lying, deep peat with active peat cutting. Steep peat cuttings of <1m generate low factors of safety but are considered to be generally of low landslide risk. Raised bog environments such as this site may be susceptible to bog burst type failures, which can occur at very low slope angles and which may not be fully quantified by the FoS calculation, as they are driven by hydrological factors rather than being slope driven. For this reason, the locations need to be assessed on-site and 'ground truthed' to identify true hazards. GDG site walkovers identified no evidence of bog burst features, however this does not preclude the possibility that these may occur. Further inspection will be required during the detail design and construction stage to inspect for peat instabilities, including bog burst features. This will be carried out by the detail designer and Contractors team. The design team shall develop their own inspection and testing criteria to satisfy and de-risk the possibility peat landslides at these locations.

4.6 SAFETY BUFFER ZONES

From the site reconnaissance and the calculations of the FoS for the peat slopes, a series of safety buffer zones and peat stockpile restriction (PSR) areas are proposed and presented in Figure L- 1 and Figure L- 2 in Appendix L.

Safety Buffer zones are areas identified during the development phase of the wind farm which are highlighted as possessing a potential instability risk. The development of the safety buffer zones is a semi-automated approach which combines the developed polygon areas of the FoS results, areas of risk identified during the site walkovers and potential risk areas identified from the examination of peat depths and site topography. It is noted that the results from all FoS analyses (drained/undrained, with and without surcharge) are used, highlighting areas indicative as having a FoS < 1.3 in the worst-case surcharged condition with 10kPa. This analysis was used throughout the development process to aid in the siting and design of the proposed development layout including turbine, hardstands, and other key infrastructure locations.

The proposed development layout and the safety buffer zone do not overlap, and as construction is not required as part of the proposed development the safety buffer areas should be treated as peat storage and plant restriction areas and construction activities should not be carried out here without further assessment.

Safety buffer zones are outlined in Appendix L, Figure L- 1 to Figure L- 2.

5 PEAT STABILITY RISK ASSESSMENT (PSRA)

A peat stability risk assessment (PSRA) has been carried out at each of the proposed structures taking into consideration the landslide hazard probability and potential consequences at each location. The peat stability factor of safety is the most significant factor in generating a risk rating. The production of a PSRA risk rating for the site access tracks is not possible as they are linear structures which cover significant distances, but the same considerations were used in the design and assessment of the stability of the access road alignment.

5.1 RISK DEFINITION

Risk is the potential or probability of adverse consequences, including economic losses, environmental or social harm or detriment. Risk is expressed as the product of a hazard (e.g. peat landslide) and its adverse consequences (Lee & Jones, 2004; Corominas et al., 2014) (Equation 5.1-1). Some use approximate synonyms and refer to risk as the product of the likelihood and the impact or the product of susceptibility and the exposure.

$$\text{Risk} = (\text{Hazard}) \times (\text{Adverse Consequences}) \qquad \text{Equation 5.1-1}$$

5.2 GENERAL METHODS FOR RISK ASSESSMENT

There are various levels of risk assessment, ranging between:

- Detailed quantitative risk assessments (QRA) where the objective is to generate more precise measures of the risks (e.g. expressing risk as a specific probability of loss). These require a large amount of quantitative input and time; and
- High-level qualitative assessments where the objective is to develop an approximate estimate of the risks, particularly in relative terms (e.g. low, medium and high levels of risk).

Qualitative risk assessments are typically used for PSRA reports, given the availability of information and the time frame. To apply Equation 5.1-1, the quantitative information (e.g. FoS) and the qualitative information (e.g. geomorphic observations relevant to the stability of peat) that determine the hazard and the consequences need to be transformed into subjective ratings. The following sections address the calculation of the two risk components: hazard and consequence.

5.3 HAZARD ASSESSMENT

Landslide hazard is the likelihood or probability of landslide occurrence in each location and a given period. The likelihood or hazard of peat landslides has been determined according to the guidelines for geotechnical risk management given by Clayton (2001), taking into account the approach of MacCulloch (2005) and using the available data from the desk study, site reconnaissance and site investigations.

The hazard is calculated from a variety of weighted factors, including the FoS and thirteen secondary factors related to geomorphic observations, topography, hydrology, vegetation, peat workings, existing loads and slide history (Appendix M). These secondary factors are difficult to quantify in a stability calculation but may contribute to peat instability.

In accordance with the Scottish Guidance (2017), each hazard factor has been reclassified into one of four classes with rating values ranging from 0 to 3 (Appendix M). A rating of 0 indicates that the hazard factor is not relevant; ratings 1, 2 and 3 indicate low, moderate and high correlation to peat slide hazard, respectively.

Weighting values have been assigned to these factors to reflect their relative importance in peat stability. Both the rating and the weighting values have been assigned according to the expert criteria of the project team and are presented in Appendix M. The hazard score of each factor is the multiplication of its rating value and weight value. These factors and their corresponding weightings are presented in Table 5-1.

The hazard values for a given wind farm element are the sum of the scores of all the hazard factors divided by the maximum hazard value possible to obtain a normalised hazard value ranging from 0 to 1 (see tables in Appendix M). Hazard is grouped into four categories: Negligible, low, medium and high.

Table 5-1: Factors affecting peat stability and hazard.

Hazard factors			Role in peat stability	Weight
Factor of Safety			This is the most critical factor, including the slope angle, the peat depth, the peat density, the peat cohesion in the drained and undrained conditions, as well as the effective friction angle. This is the complete factor. See Section 4 for further details.	10
Secondary factors	Topography	Curvature Plan (across the slope)	This represents the curvature across the slope and the funnelling / dispersion of the runoff.	1
		Curvature Profile (downslope)	This represents the curvature down-slope and, therefore, the capacity of water retention and infiltration. Convex slopes are typically more prone to landslides.	
	Hydrology	Distance from watercourse (m)	This tends to affect the likelihood of landslides, especially in sectors where this distance is short.	
		Moisture index (NDMI)	This Landsat-derived factor indicates the water content or moisture of the vegetation, which can be considered as a proxy of the terrain moisture.	
		Evidence of piping	The presence of piping is clear evidence of potential peat instability.	
		The direction of existing drainage ditches	Drainage ditches that are aligned cross slope can affect the overall stability of a slope face.	
	Vegetation	Bush	This is an indicator of the type of peat at the site and the hydrological nature of the site.	

Hazard factors			Role in peat stability	Weight
		Forestry	The vigour of forestry is another indicator of peat stability, with stunted trees more frequent in unstable sectors.	
	Peat workings	Peat cuts presence	This factor evaluates the effect of various peat workings on the stability of the peat.	
		Peat cuts vs contour lines	Where the peat cuts parallel the contour lines, the potential instability increases.	
	Existing loads	Roads	Side-cast of solid roads and floating roads pose a load to the peat blanket.	
	Slide history	Distance to previous slides (km)	This suggests that landslides at the site are likely if a peat slide has occurred at the site or within a 10-kilometre radius. The weight assigned is doubled the weights for the other secondary factors	2
		Evidence of peat movement (e.g. tension cracks, compression features).	This factor evaluates the effect of any existing peat movement indicators on-site, such as tension cracks. The weight assigned is doubled the weights for the other secondary factors	

5.4 ADVERSE CONSEQUENCES ASSESSMENT

The impacts of peat landslides on the wind farm elements, surrounding environment, and existing assets may typically generate a variety of adverse consequences. This report assessed these consequences qualitatively following the Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish-Executive, 2017).

Table 5-2 summarises the consequences considered for the PSRA of the development.

Table 5-2: Consequences considered for the PSRA

Consequence factors	Description	Weight
Volume of potential peat flow (function of distance from the nearest watercourse and peat depth in the area)	This is the second most heavily weighted factor. It is estimated based on the distance from the nearest defined watercourse and the depth of peat in the area. The longer the distance and the deepest the peat depth, the larger landslide.	3
Downslope features	This factor accounts for the type/shape of downslope features that may hamper or favour the propagation downhill of the peat flow.	1
Proximity from the defined valley (m)	This is the distance from the site to the nearest defined river valley. Rivers close to potential landslide sectors are more vulnerable to a landslide event.	

Consequence factors	Description	Weight
Downhill slope angle	This factor accounts for the runout distance as a matter of slope angle.	
Downstream aquatic environment	Reflects the severity of a peat slide event's impact on the receiving aquatic environment.	
Public roads in the potential peat flow path	Rates the impact of a peat slide striking a public road.	
Overhead lines in the potential peat flow path	Rates the impact of a peat slide striking a service line.	
Buildings in the potential peat flow path	Rates the impact of a peat slide striking a habitable structure.	
Capability to respond (access and resources)	Rates the capability of the site staff to respond to a peat instability event.	

The nine consequence factors considered have been reclassified in the same fashion the hazard factors were reclassified (Appendix M). A rating of 0 indicates that the consequence factor is not relevant and a rating of 3 indicates high consequences.

'Volume of potential landslide' has been assigned a weight of 3 to reflect its relative importance in the potential consequences. The rest of the factors have been assigned a weight of 1. Both the rating and the weighting values have been assigned according to the expert criteria of the project team. The score of each consequence factor is the multiplication of its rating value and its weight value (Appendix M).

The consequences value for a given wind farm element is the sum of the nine consequences scores. This total value is then divided by the maximum consequence value possible to obtain a normalised consequence value ranging from 0 to 1 (see tables in Appendix M). Consequences are grouped into four categories: Negligible, low, medium and high.

5.5 RISK CALCULATION

Risk in each wind farm infrastructure element is calculated with Equation 5.1-1, i.e. multiplying the scores of the hazard and the scores of the consequences. The risk rating ranges between 0 and 1, and the following levels of risk rating have been distinguished (Table 5-1 and Table 5-2):

- High (0.6 to 1): Avoid project development at these locations. Mitigation is generally not feasible.
- Medium (0.4 to 0.6): Project should not proceed unless risk can be avoided or mitigated at these locations without significant environmental impact to reduce risk ranking to low or negligible.
- Low (0.2 to 0.4): Project may proceed pending further investigation to refine assessment and mitigate hazard through relocation or re-design at these locations.
- Negligible (0 to 0.2): Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

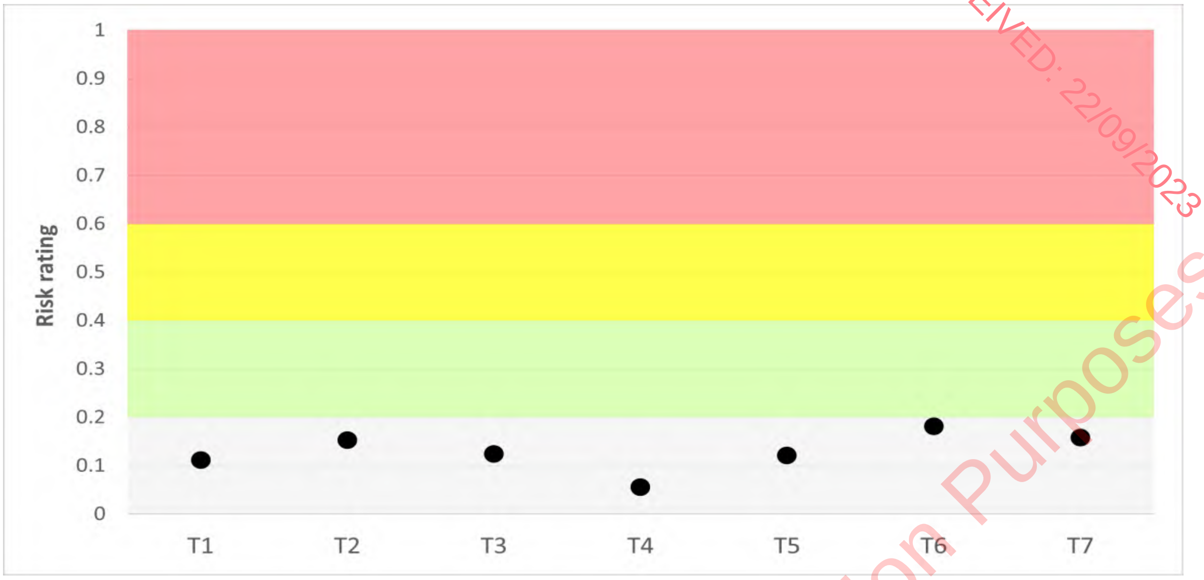

Figure 5-1: Risk ratings at the proposed turbine locations.

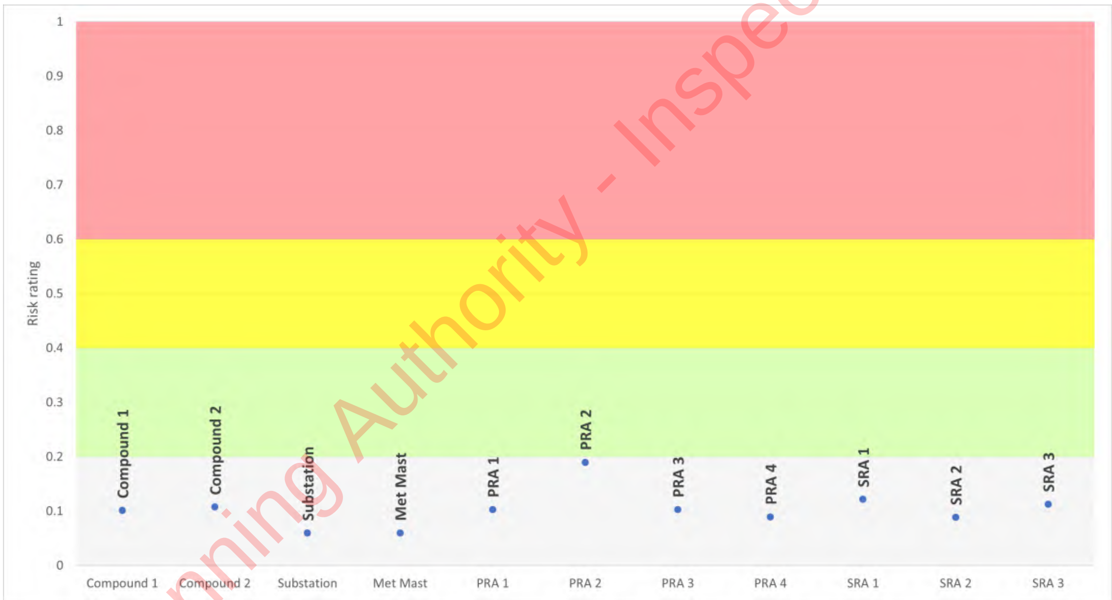

Figure 5-2: Risk ratings at the proposed infrastructure element sites.

Appendix M gathers the risk calculation process at each turbine considering the four scenarios of hazard: Undrained; undrained with a surcharge of 1 m; drained; and drained with a surcharge of 1 m (Table M- 1 to Table M- 11). Figure 5-1 and Figure 5-2 summarise the risk rating obtained at the turbines and compound locations. All the turbines and infrastructure elements are located in sectors of negligible to low risk.

It is stressed that the resulting risk rating does not indicate a probability of landslide occurring; it simply expresses a rating of the potential risk.

6 GEOTECHNICAL RISK REGISTER

This register lists significant potential peat geotechnical hazards and associated risks with respect to construction and operation of the proposed development, and recommended mitigations.

Table 6-1: Geotechnical risk register

Ref.	Risk	Contributing factor	Mitigation
1	The collapse of the dried peat berm/ peat slippage	Overestimation of soil strength parameters	The soil parameters are based on the hand shear vane test carried out by GDG at each turbine location. Shear vane testing was carried out at 0.5m intervals through the peat to assess variation within the peat body. The interpreted undrained shear strength values take into account a conservative reduction factor for the influence of the fibres within the peat. Extensive sampling ground investigation at infrastructure location including trial pitting to assess the composition and strength of the peat and collect samples for testing. The derived values were compared with a literature review of the most common general drained and undrained parameters for each type of soil and on the descriptions. The GI completed to date is considered to be thorough and robust for the purposes of the EIAR, however it is expected that further testing and assessment of the peat during further ground investigation campaigns will be required before construction. This will allow for a robust understanding of the ground conditions and the detail design of access roads and structures. An extensive testing protocol shall be developed by Construction stage contractor and the design team. These tests shall be observed by a suitably qualified engineer and reported to the owner's engineer. It would be expected that an observational approach will be required when constructing on peat due to the limitations associated with testing and verifying its strength and the contractor is required to frequently inspect the peat material and providing proof of inspection.

Ref.	Risk	Contributing factor	Mitigation
2	The collapse of berm/peat slippage	Underestimation of peat depth	Extensive ground investigation including trial pitting and peat probing has been carried out across the site. GI locations have been carried out at location where access was possible. Access was limited to some areas of the site with restriction relating to forestry and terrain limiting coverage. Further GI will be required at these locations during the detail and construction stage to assess peat depths. This will be carried out by the detail designer and Contractors team. The design team shall develop their own testing criteria to satisfy and de-risk the possibility of larger peat depth occurring at these locations.
3	Failure of peat slope due to loading or agitation of existing instability	Failure to identify existing instability/ peat deformation at the site	Assessment of satellite imagery and topographical data for evidence of past landslide events was carried out as part of the desk study, finding no evidence of past instabilities or landslide events within the site area. The Geological Survey of Ireland (GSI) landslide database was examined identifying no landslide events in the local region within 5km of the site, the closest approx. 9.7km from the site boundary and 10km from the nearest turbine, T02. During the site walkovers the site GDG engineers examined the landscape and the areas surrounding the proposed infrastructure of evidence of instability or past landslide events. No past landslide or instability events was identified. Although there is no evidence of landslides within the Proposed Development Site, this does not necessarily mean that landslides have never occurred at the proposed site location. It is noted that the geomorphological features associated to peat landslides (peat slides and bog bursts) are softened with time through erosion, drying and re-vegetation, particularly given the forestry and peat harvesting activities which have taken place at this site. Access was limited to some areas of the site with restriction relating to dense forestry and terrain limiting visibility and inspection areas – particularly in the vicinity of T2. Further inspection will be required during the detail design and construction stage to inspect for peat instabilities. This will be carried out

Ref.	Risk	Contributing factor	Mitigation
			by the detail designer and Contractors team. The design team shall develop their own inspection and testing criteria to satisfy and de-risk the possibility of larger peat depth occurring at these locations.
4	The collapse of peat berm/peat slippage	Failure due of excessive loading of peat	The peat stability analysis factor of safety exercise examines the peat in the drained and undrained condition both without and with the addition of a surcharge equating to 1m of peat loading. Areas indicative of a low or moderate FoS result with the 1m peat surcharge within or adjacent to the proposed site infrastructure have been designated as safety buffer zones as outlined in Section 4.6. Requirements for the safe and sustainable storage of peat and spoil material are outlined in the associated Peat and Spoil Management Plan (PSMP) document (GDG, 2023). The requirements and restrictions for peat and spoil management outlined in this document must be adhered to during the constriction stage.
5	Instability of peat slippage	Variation in the ground water conditions at the site	The ground water conditions were examined during the walkovers and within the trial pit locations. Areas of saturated surface peat were identified during the walkovers as outlined in Section 3 and these have been considered in the risk assessment and findings of the report. Water strikes, peat water content and groundwater conditions are noted in the trial pit locations (GDG, 2022). The groundwater conditions and peat moisture content way vary seasonally and/or more frequently with the immediate weather conditions. Long term groundwater monitoring across the site should be considered in further design stage ground investigations and further lab testing of the peat in its in-situ condition will need to be assessed for the construction design. Hydrology of the area should be maintained as far as possible by implementing and maintaining an appropriate drainage system.
6	Instability due to unmapped subsurface	Voids and subsidence due to karstic weathering of the	The existing geological mapping and GI indicate the proposed development sits on limestone bedrock, which may be susceptible to karstic weathering. One karstic feature (an enclosed depression) is mapped

Ref.	Risk	Contributing factor	Mitigation
	karst features	underlying limestone bedrock.	900m from the site boundary. It is possible that additional karstic features occur within the site boundary but are obscured by overlying quaternary sediments. Confirmatory ground investigations to investigate the presence and extent of any karstic features in proximity to the infrastructure locations should be undertaken at design stage.

7 CONCLUSIONS AND RECOMMENDATIONS

Following the guidance of the Scottish-Executive (2017), a review of the published thematic geographic information (e.g. geology, soils, protected areas) and relevant background literature was undertaken for the proposed development. Site reconnaissance and site investigations were carried out to validate and enhance the desk study information. Based on the available data, the fieldwork and GDG's professional judgement, it is concluded that significant peat slides are unlikely on the site with diligent peat management and careful consideration of the peat conditions at the site at the design and construction stage.

A deterministic Factor of Safety was calculated across the proposed element locations, and from this, a robust peat stability risk assessment (PSRA) was performed. The findings of the peat assessment showed that the site has an acceptable margin of safety and is suitable for the proposed development, provided appropriate mitigation measures, as outlined below, are implemented:

- All earthworks shall be designed by a competent geotechnical designer, informed by;
- Detailed ground investigation to confirm peat, mineral soil and bedrock condition and properties.
- Detailed site investigation to be conducted by experienced geotechnical staff.
- Maintain hydrology of area as far as possible by implementing and maintaining an appropriate drainage system.
- Use of experienced contractors and trained operators to carry out the work.

The peat stability risk for the proposed infrastructure is negligible. However, the results of the factor of safety deterministic calculation and the site walkover allowed for the identification of safety buffer areas outlined in Section 4.6 and shown in Appendix L. These must be adhered to in future stages of the proposed development.

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMSs) for the project will implement in full, but not be limited to, the recommendations above.

Construction works shall follow the recommendations of the peat and spoil management plan: Peat and spoil management plan (GDG, 2023). During construction, it is strongly recommended to carry out frequent monitoring works, especially after heavy rainfall events or prolonged rainfall.

7.1 CONTINGENCY MEASURES

Due to the high factors of safety and negligible risk of peat landslides identified on site, it is not anticipated that peat failure will occur on site. However, in the event of peat failure (e.g. tension cracking, surface rippling, sliding), the following measures should be implemented:

1. All activities within the affected area shall cease immediately.
2. Where possible action shall be taken to prevent a potential peat slide from reaching any watercourse. In this instance, priority should be given to the one watercourse which crosses the site (>100m to the south of T06 and T07). This will usually take the form of the construction of check barrages on land if this is possible after due consideration of the speed of the failure and accessibility of the terrain.
3. All relevant authorities should be notified if a peat slide event occurs on site.
4. Localised peat slides which do not present a risk to watercourses shall be stabilised where possible by rock infill and granular material. The area shall then be assessed by competent engineers and further stabilisation measures implemented where necessary.
5. In the event of a peat slide which presents a risk to watercourses, a check barrage shall be installed within the watercourse, downstream of the likely point of entry. This shall consist of the placement of granular fill across the watercourse to prevent the passage of peat debris while allowing water flow.

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Appendix A LOCATION AND ADMINISTRATIVE LIMITS

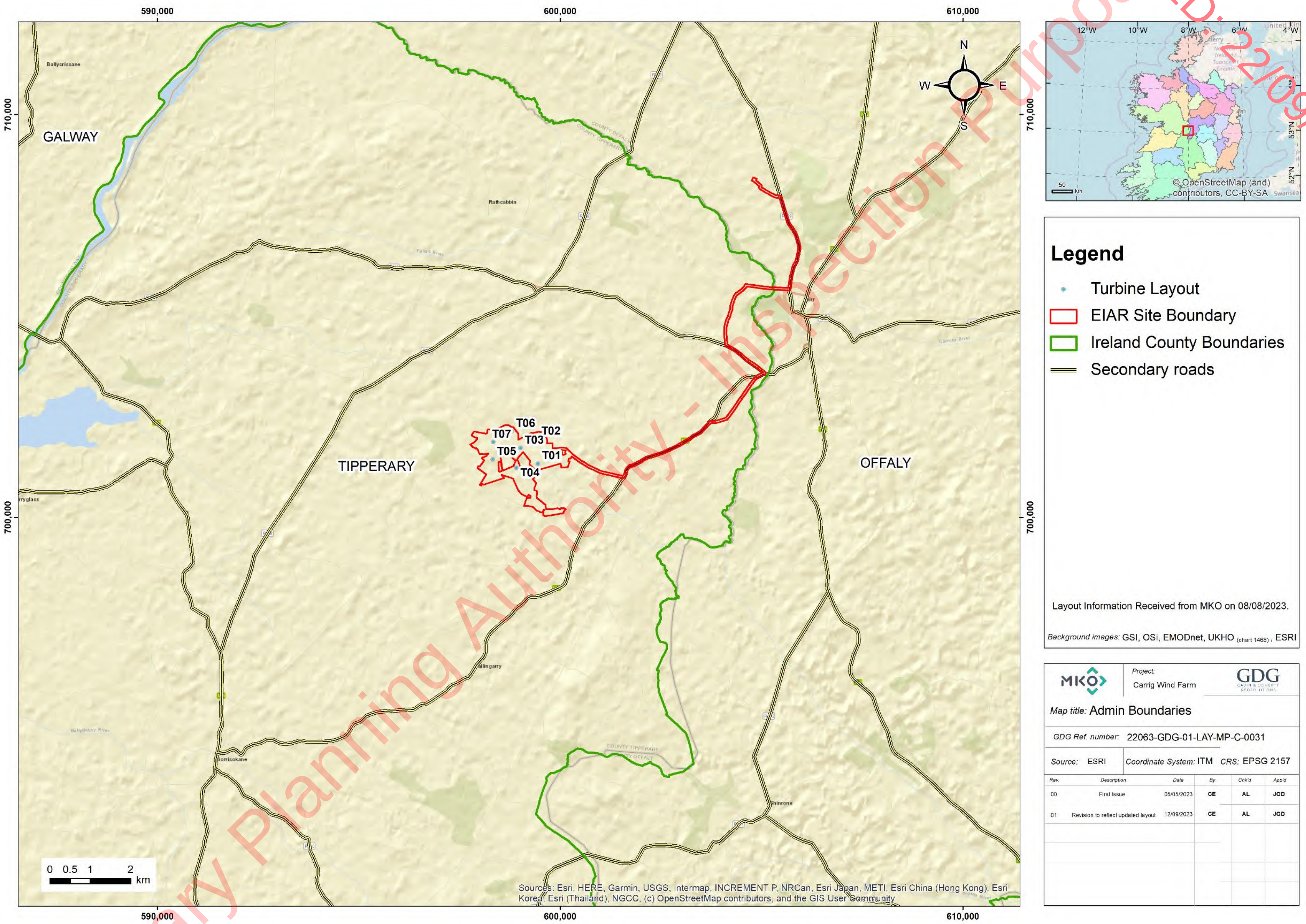
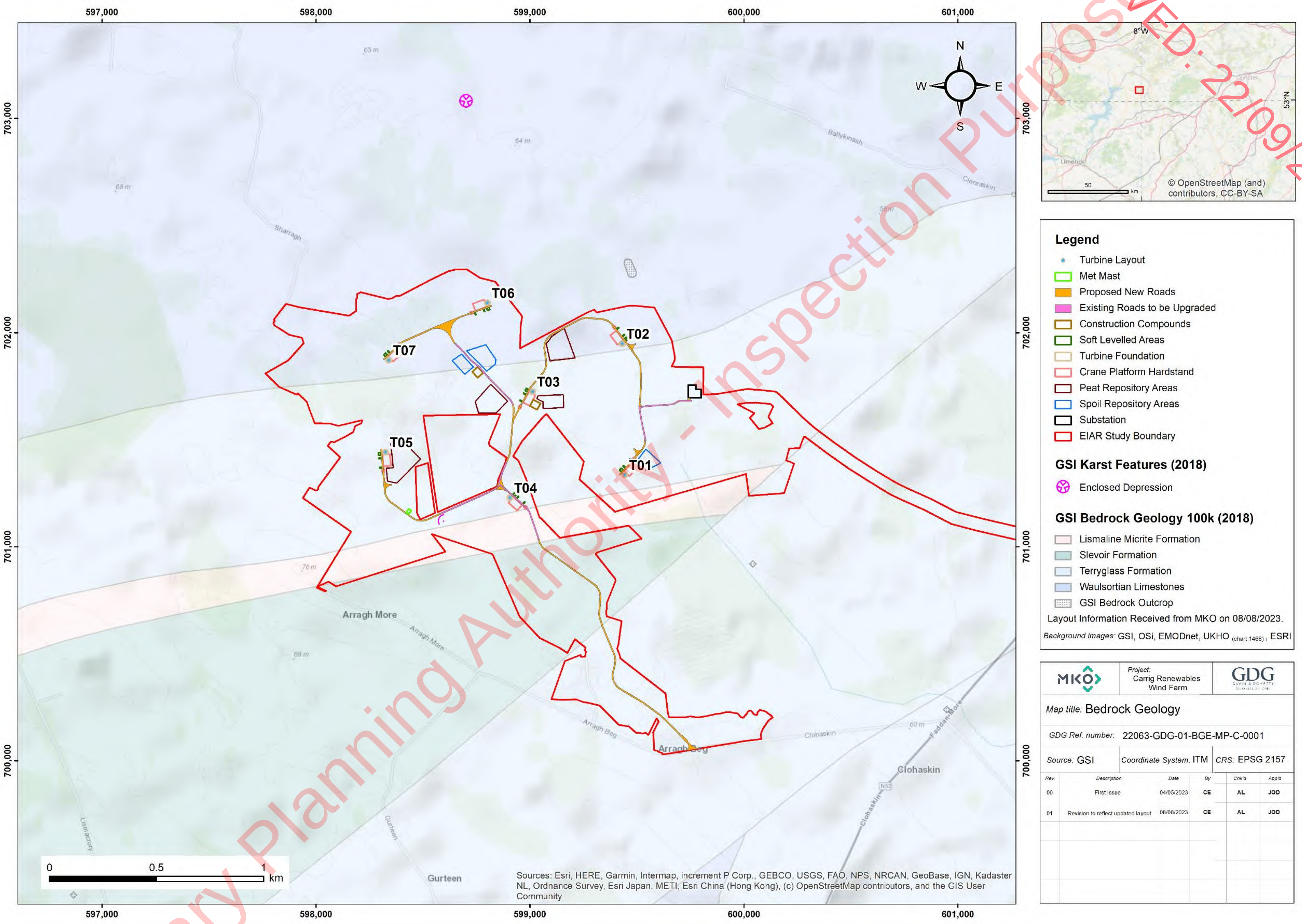


Figure A- 1: Location of the proposed site and administrative limits.

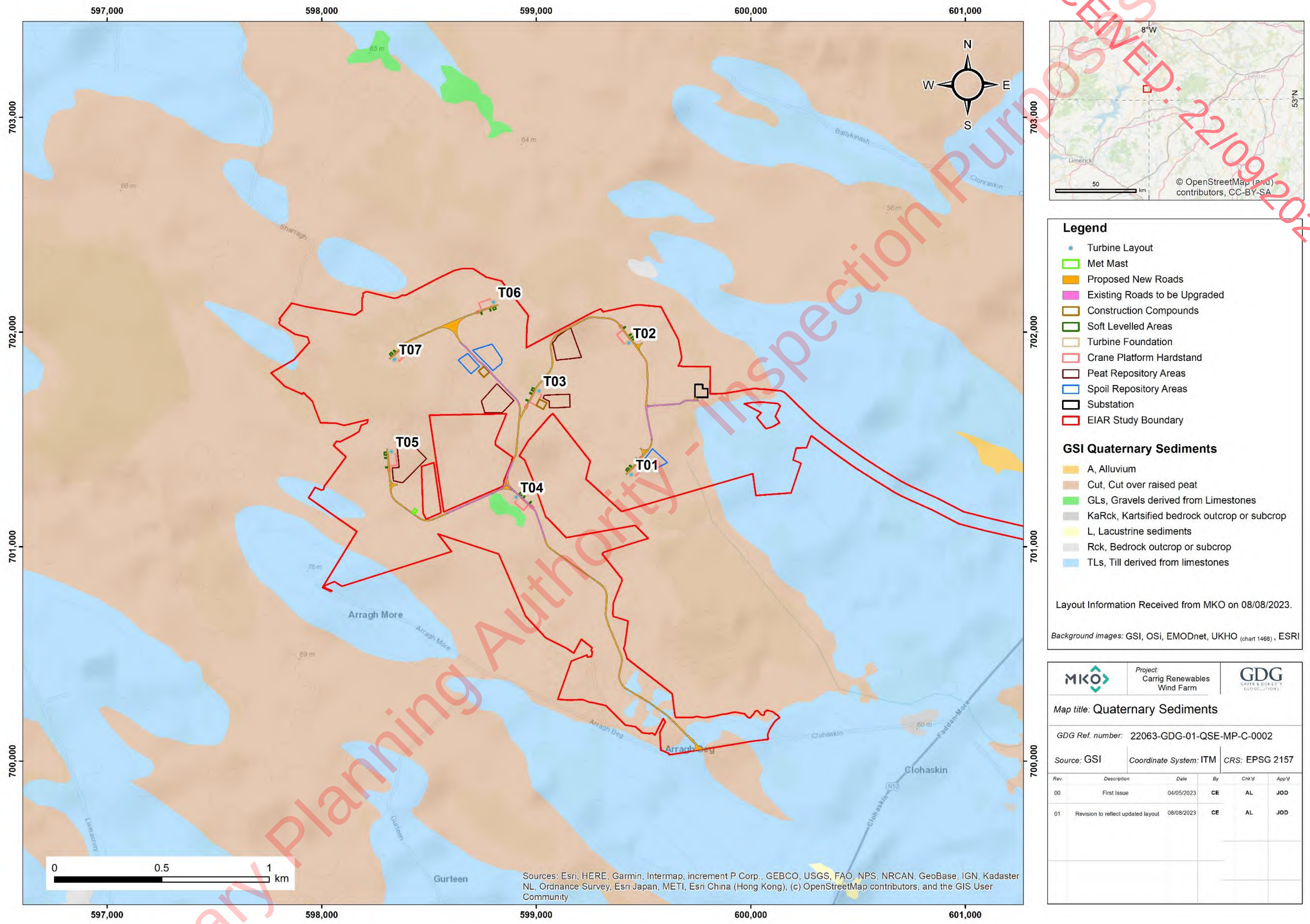
Appendix B GEOLOGY



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

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

Figure B- 1: Bedrock geology 100k (GSI).



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

Figure B- 2: Quaternary sediments (GSI).

Appendix C Soils

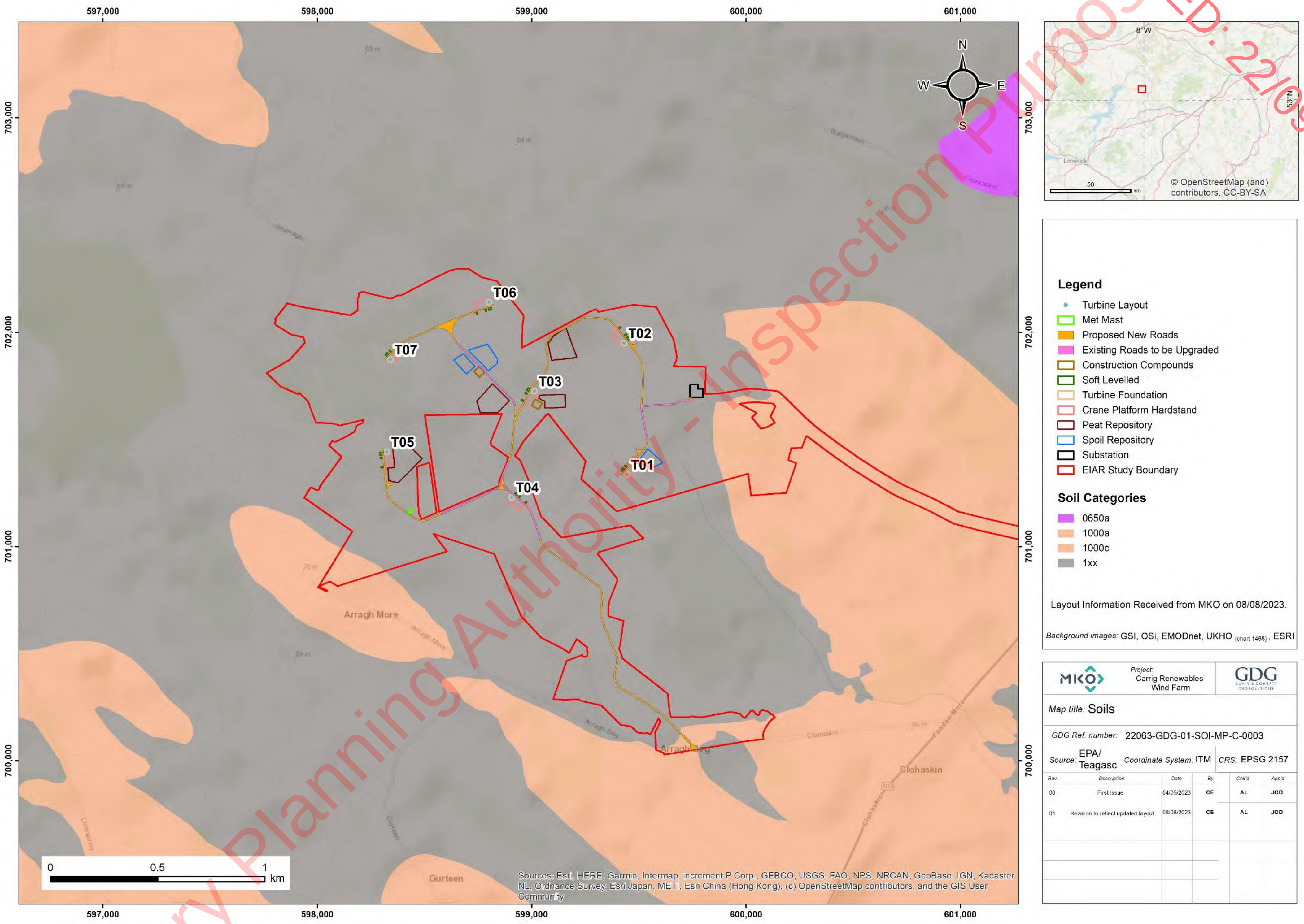
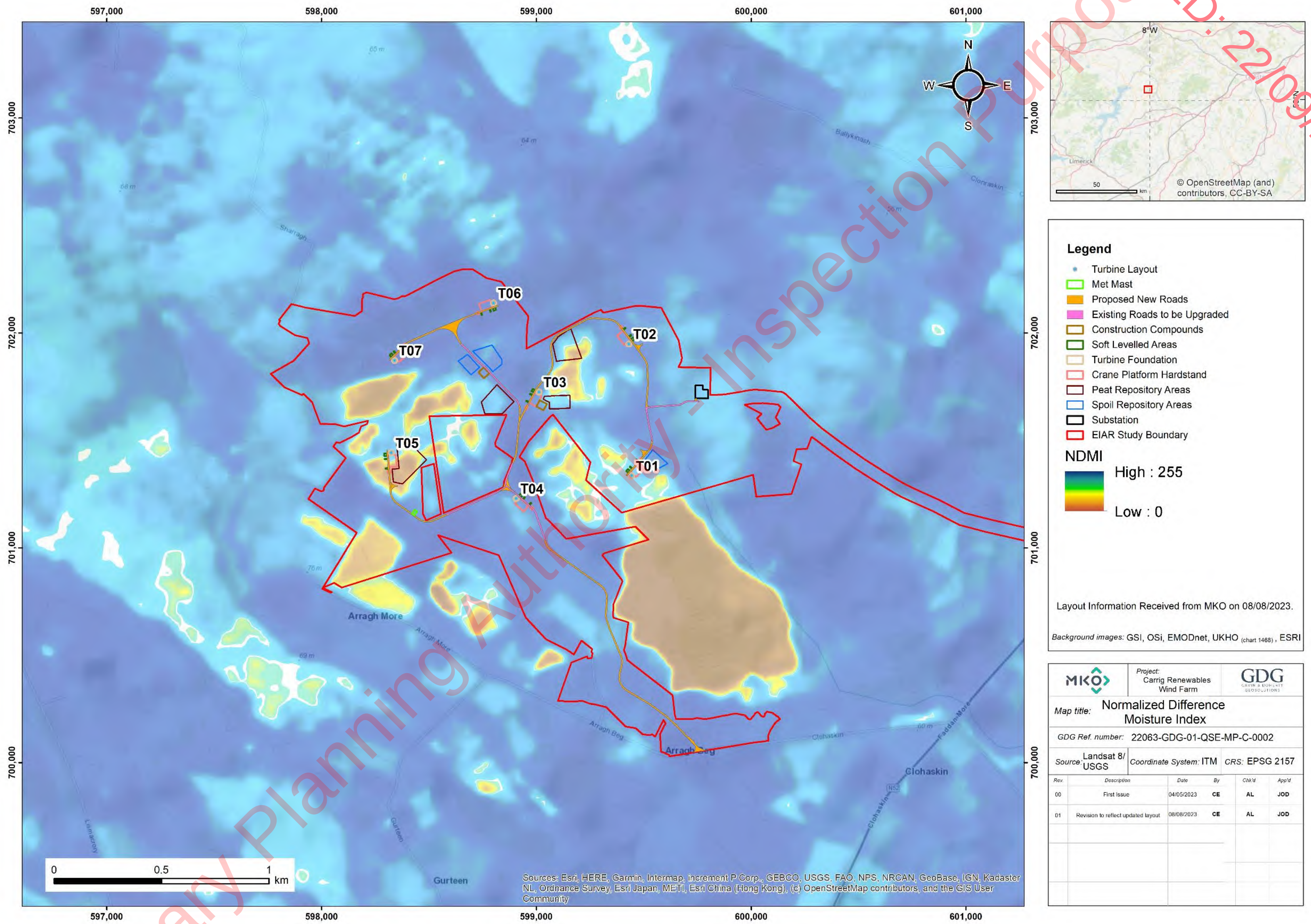


Figure C- 1: Soils.

Appendix D MOISTURE



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

Figure D- 1: Moisture Index developed from Landsat 8 and the USGS.

Appendix E HYDROGEOLOGY

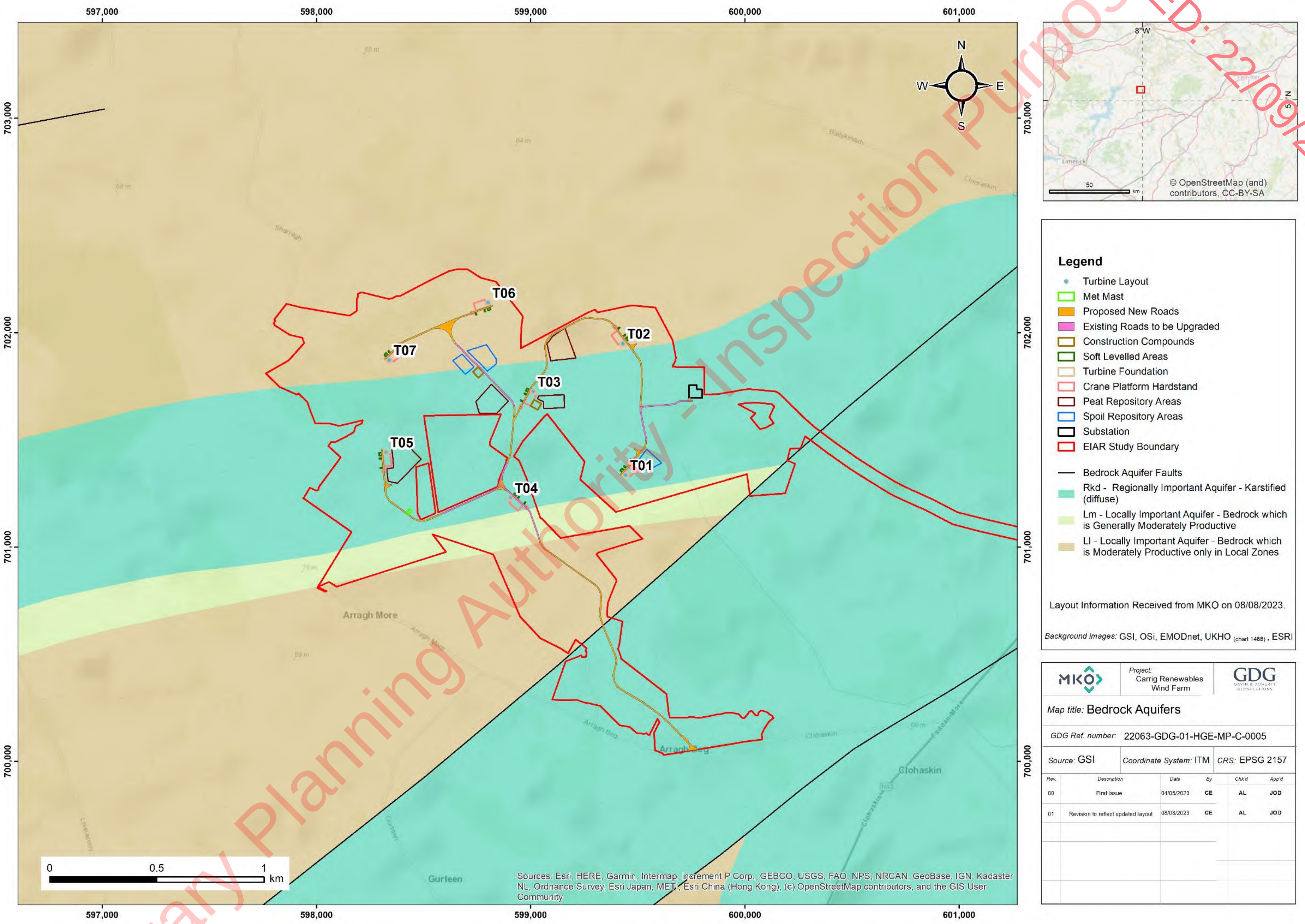


Figure E- 1: Bedrock Aquifers (GSI).

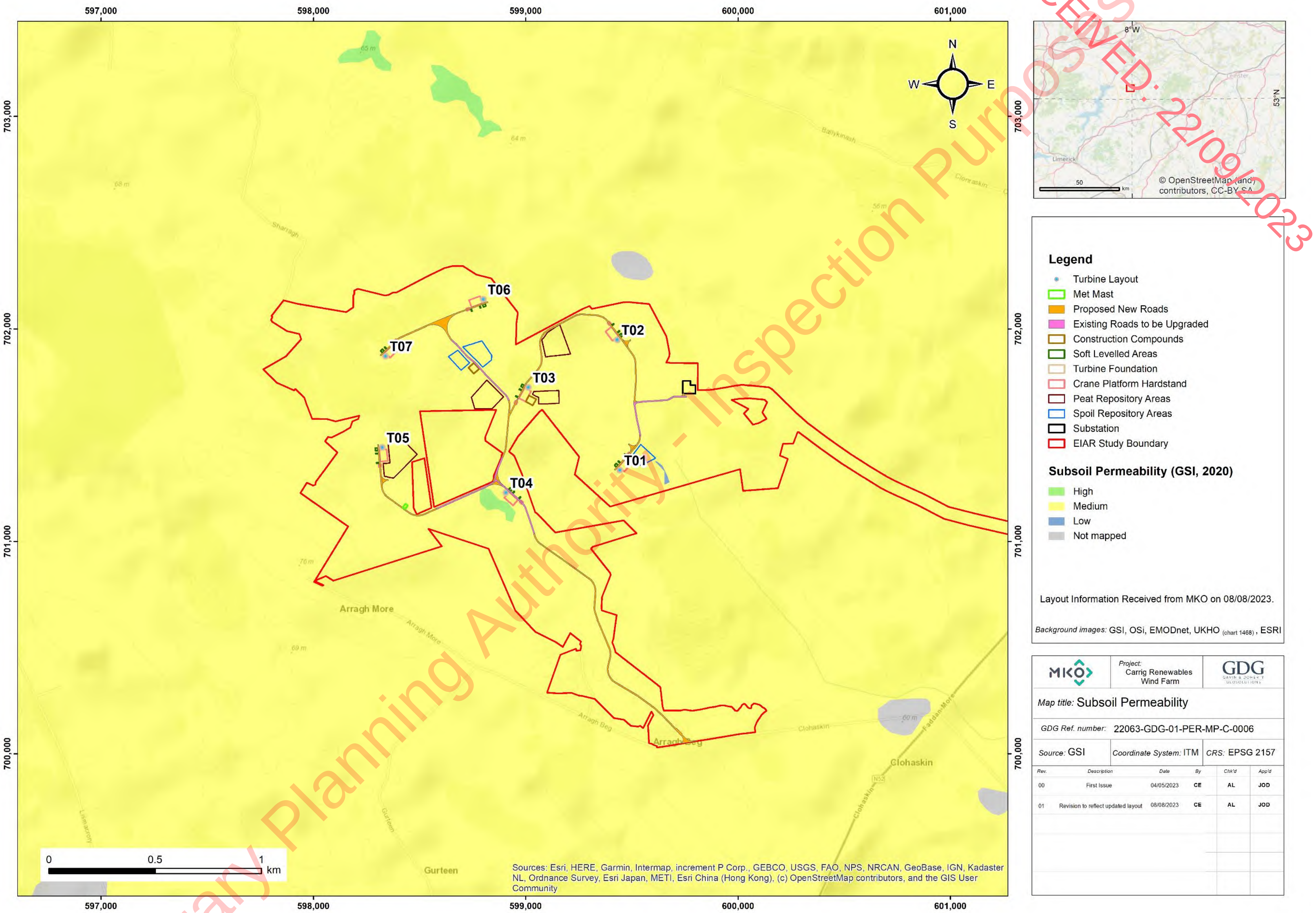


Figure E- 2: Subsoil Permeability (GSI).

Appendix F TOPOGRAPHY

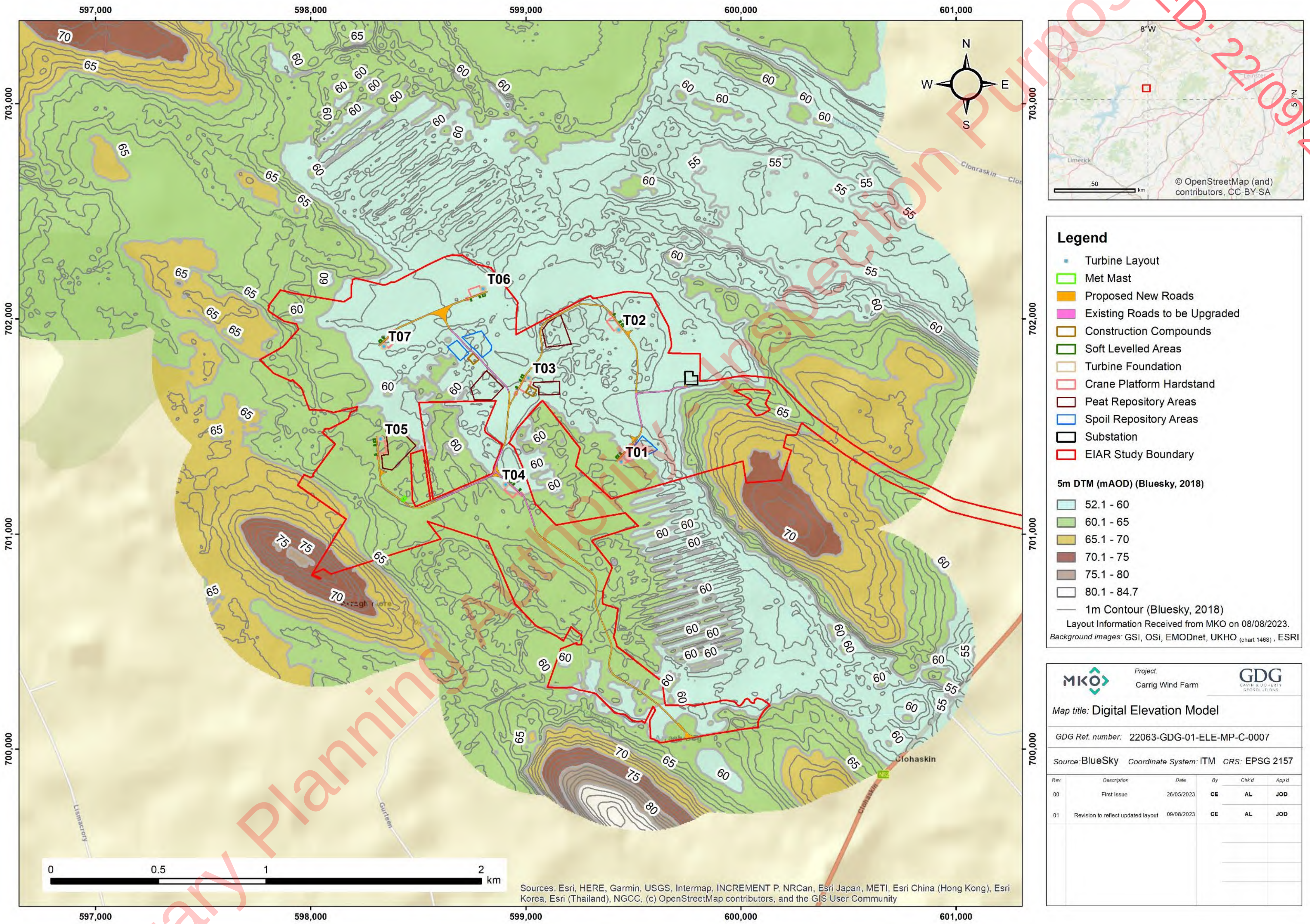


Figure F- 1: 5-meter Digital Elevation Model and 1m Contours sourced from BlueSky (2018).

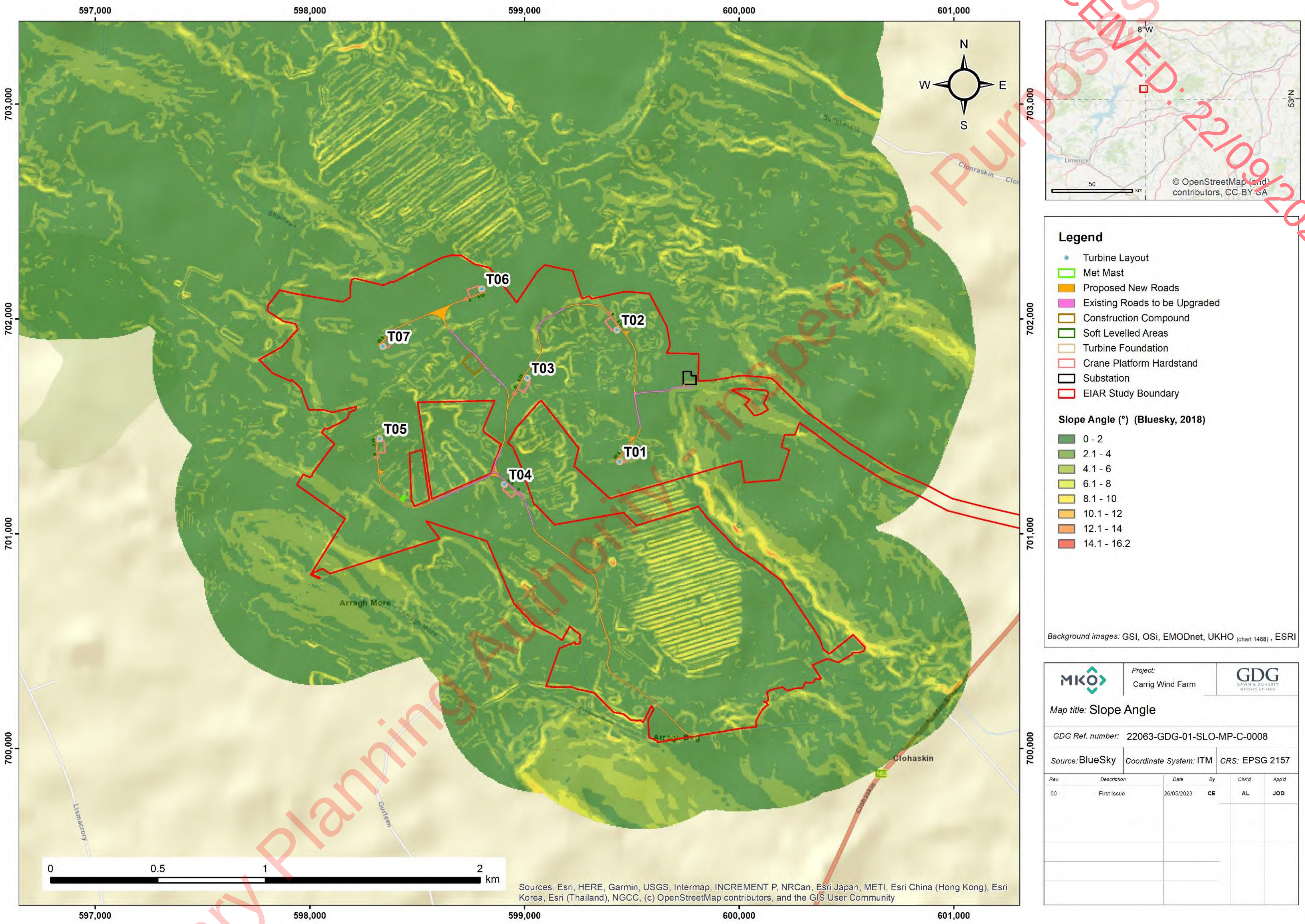
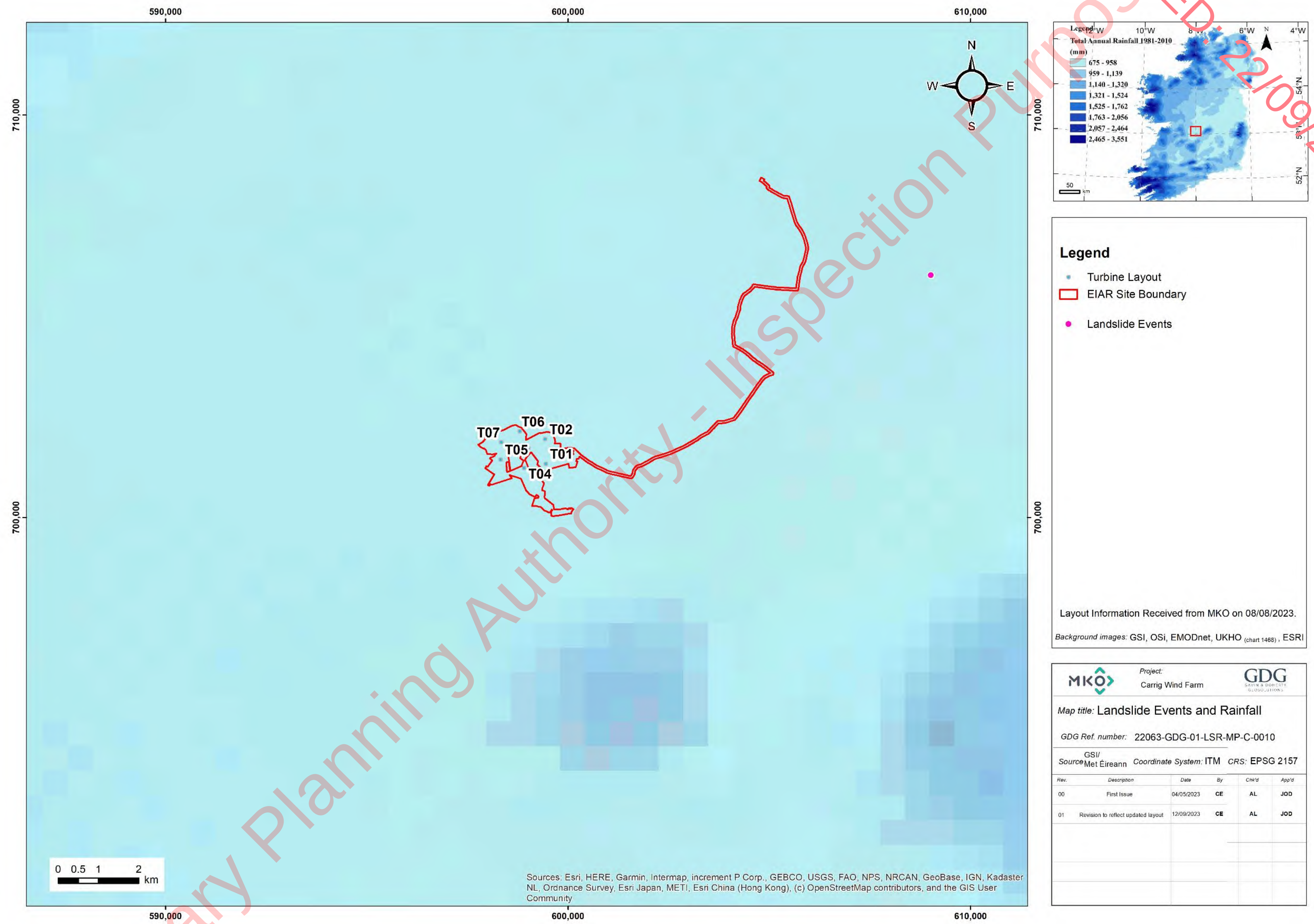


Figure F- 2: Slope Angle (°) sourced from BlueSky (2018).

Appendix G SLOPE INSTABILITY MAPPING



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

Layout Information Received from MKO on 08/08/2023.

Background images: GSI, OSi, EMODnet, UKHO (chart 1468) , ESRI

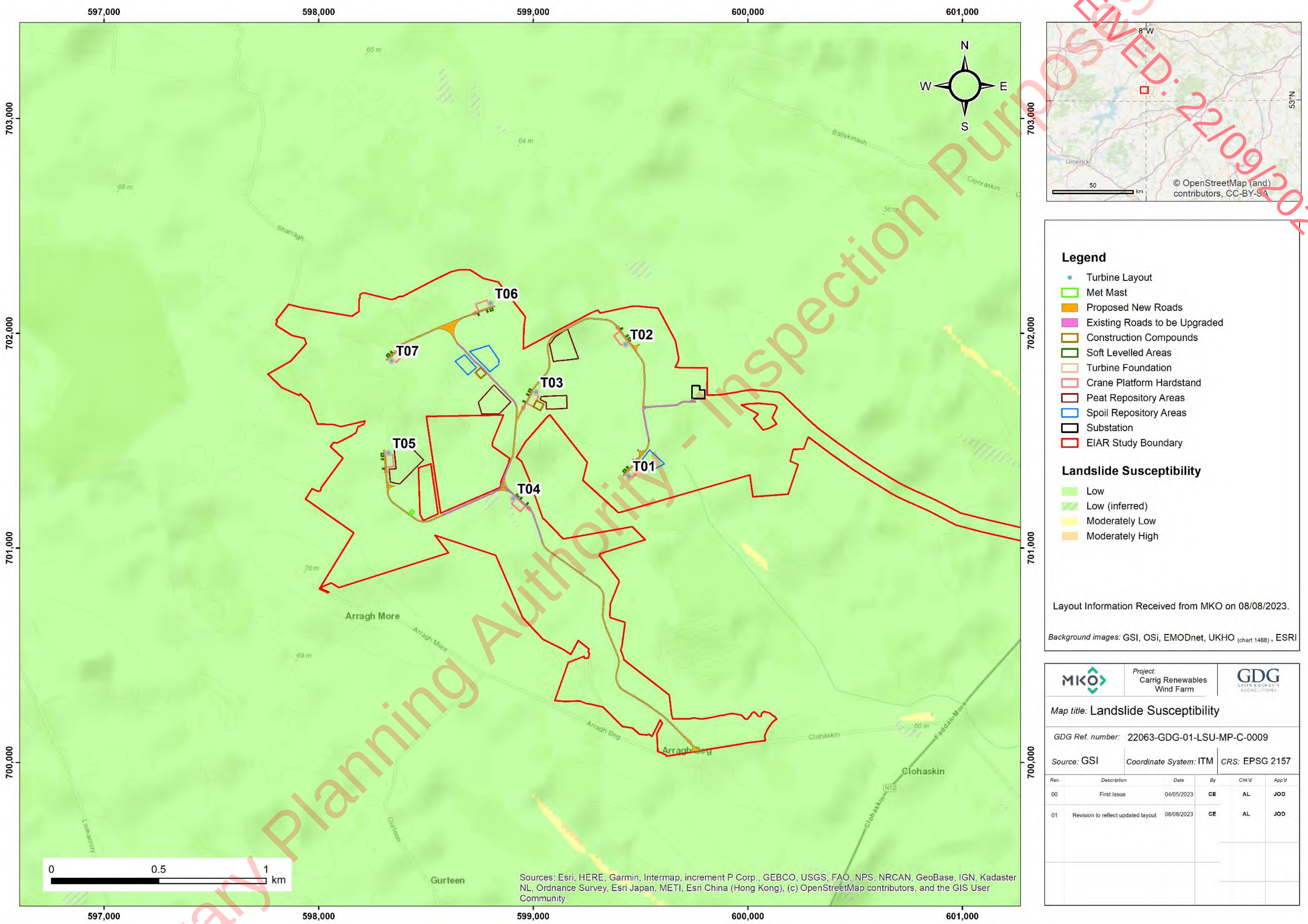
Map title: Landslide Events and Rainfall

GDG Ref. number: 22063-GDG-01-LSR-MP-C-0010

Source: GSI/ Met Éireann *Coordinate System:* ITM *CRS:* EPSG 2157

Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	12/09/2023	CE	AL	JOD

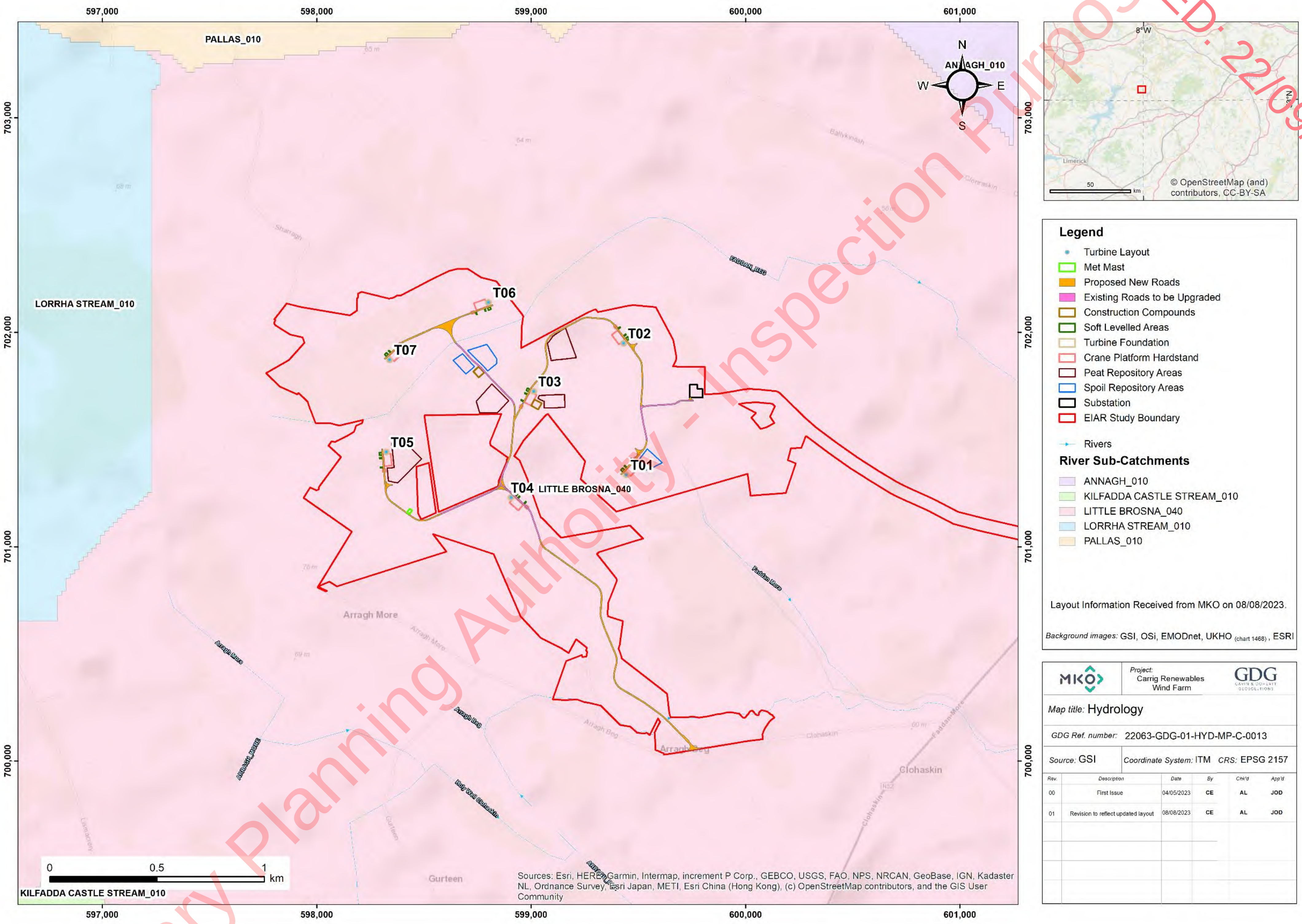
Figure G- 1: Landslide from national database (GSI) and rainfall (Met Éireann, 2018)



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

Figure G- 2: Landslide Susceptibility (GSI).

Appendix H HYDROLOGY



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

Layout Information Received from MKO on 08/08/2023.

Background images: GSI, OSi, EMODnet, UKHO (chart 1468) , ESRI

Project: Carrig Renewables Wind Farm

Map title: Hydrology

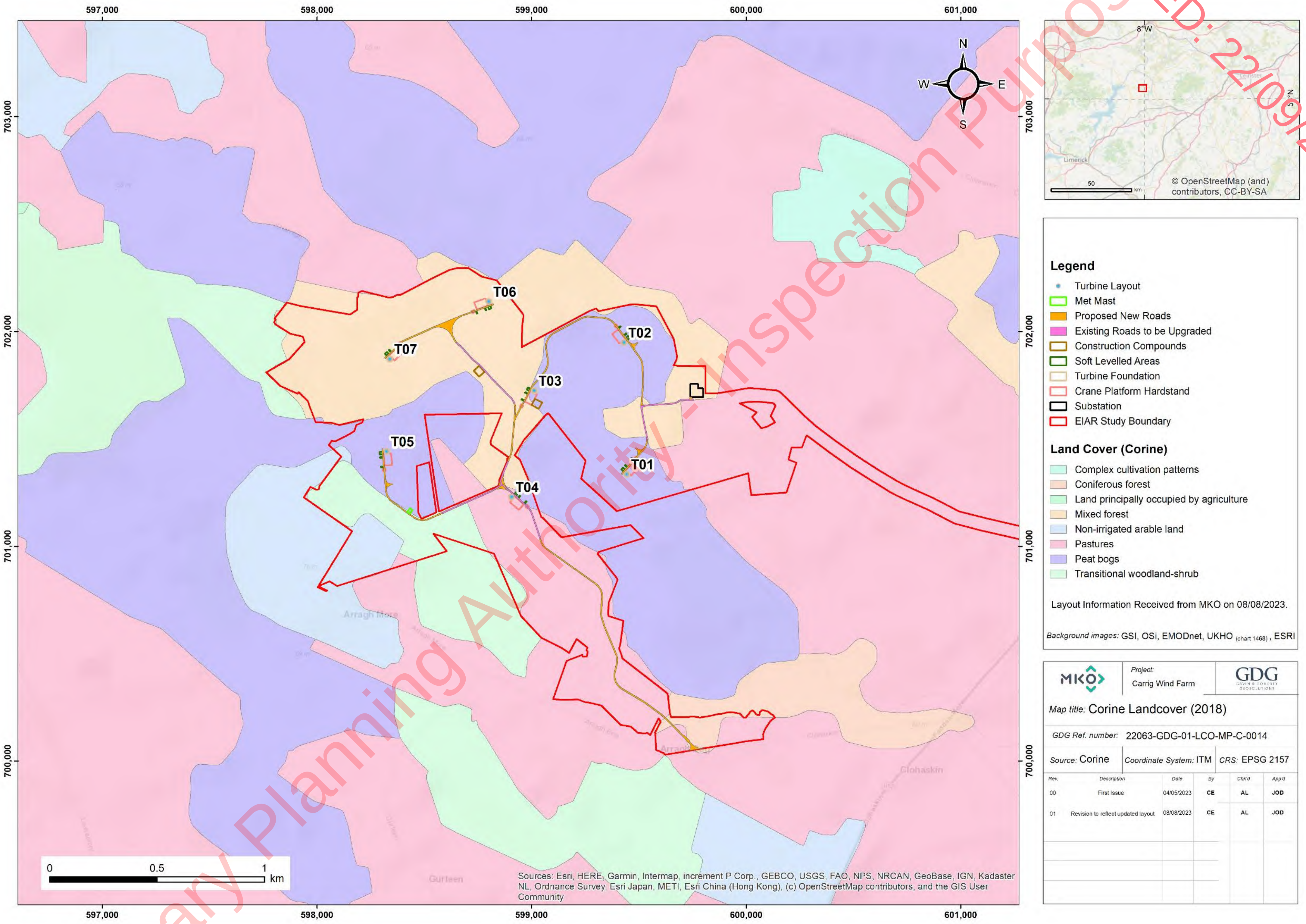
GDG Ref. number: 22063-GDG-01-HYD-MP-C-0013

Source: GSI *Coordinate System:* ITM *CRS:* EPSG 2157

Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

Figure H- 1: Hydrology.

Appendix I LAND COVER AND LAND USE



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	04/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	08/08/2023	CE	AL	JOD

Figure I- 1: Land cover map (Corine, 2018).

Appendix J GEO-INVESTIGATIONS

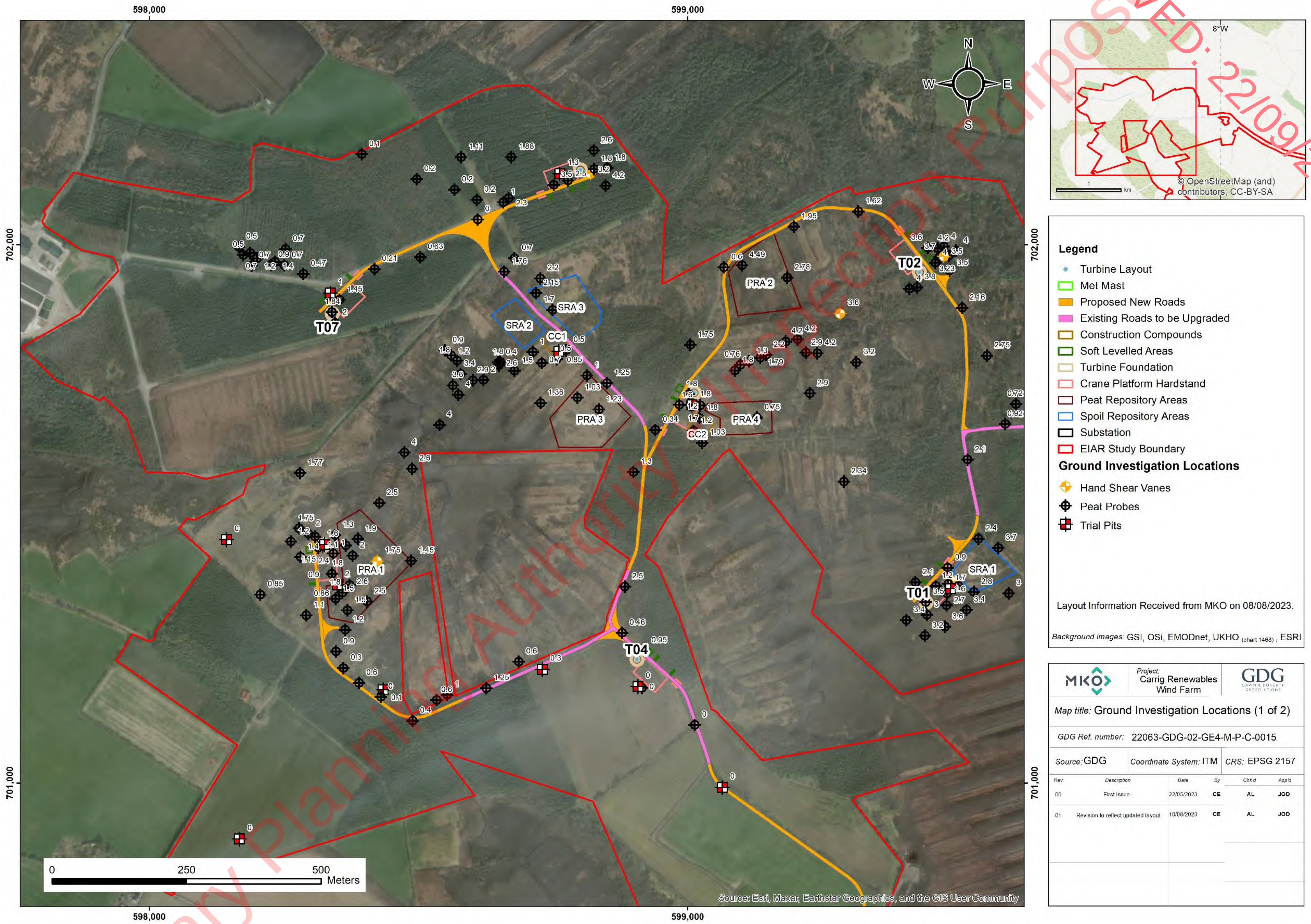


Figure J- 1: Geo-investigation map (1 of 2).

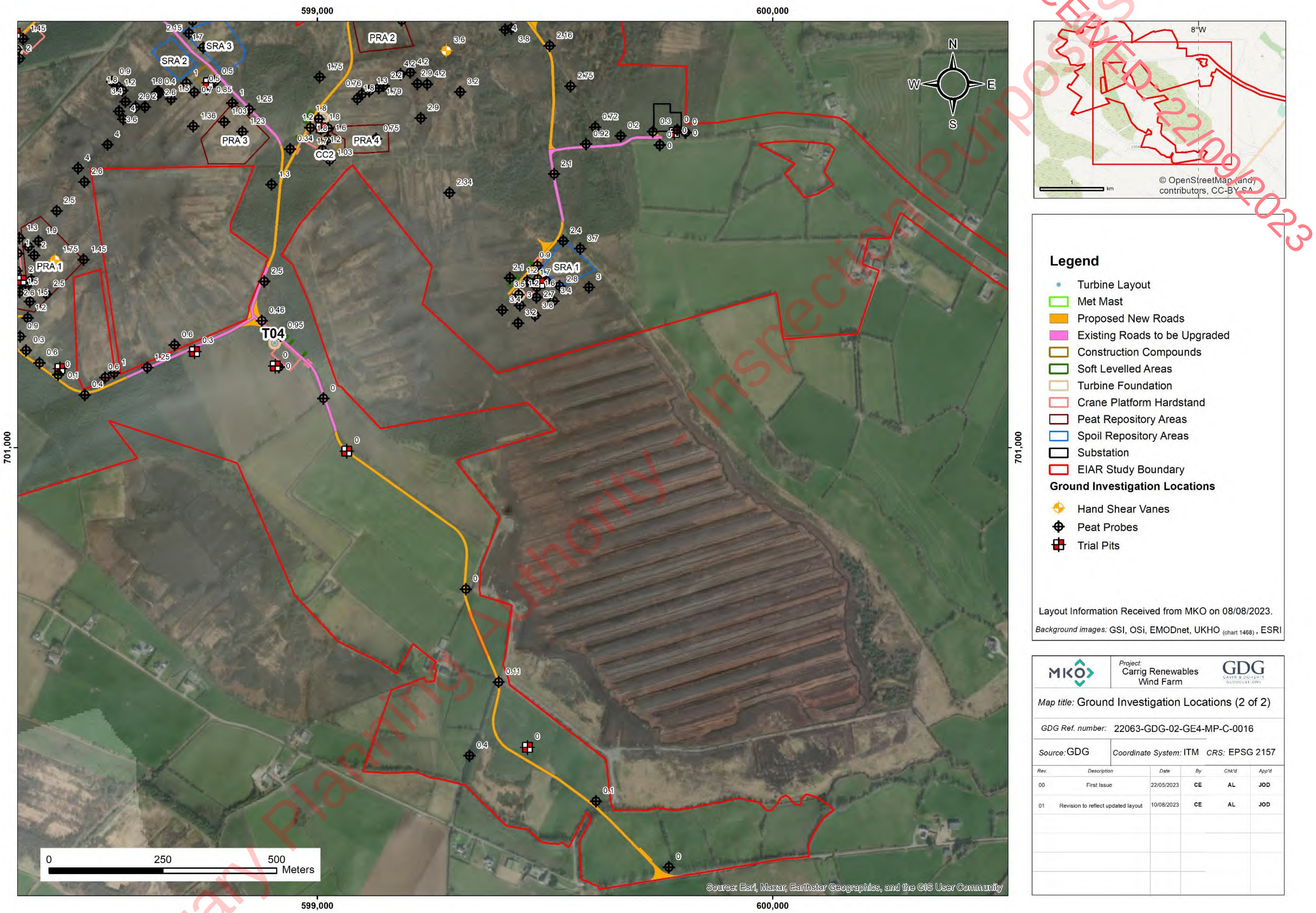
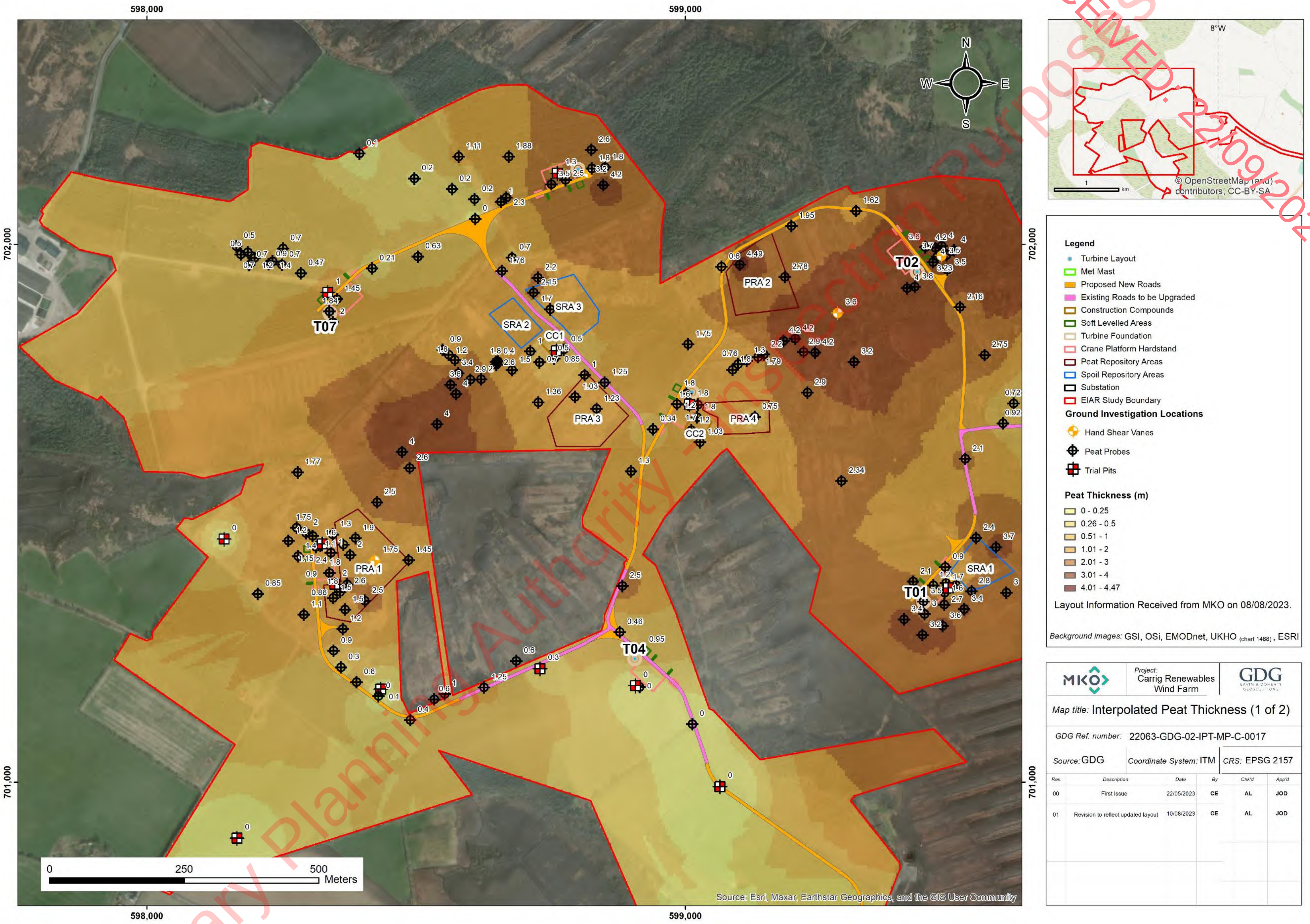


Figure J- 2: Geo-investigation map (2 of 2)



Layout Information Received from MKO on 08/08/2023.

Background images: GSI, OSi, EMODnet, UKHO (chart 1468), ESRI

Project: Carrig Renewables Wind Farm

Map title: Interpolated Peat Thickness (1 of 2)

GDG Ref. number: 22063-GDG-02-IPT-MP-C-0017

Source: GDG
Coordinate System: ITM
CRS: EPSG 2157

Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	10/08/2023	CE	AL	JOD

Figure J- 3: Interpolated peat depth map (1 of 2).

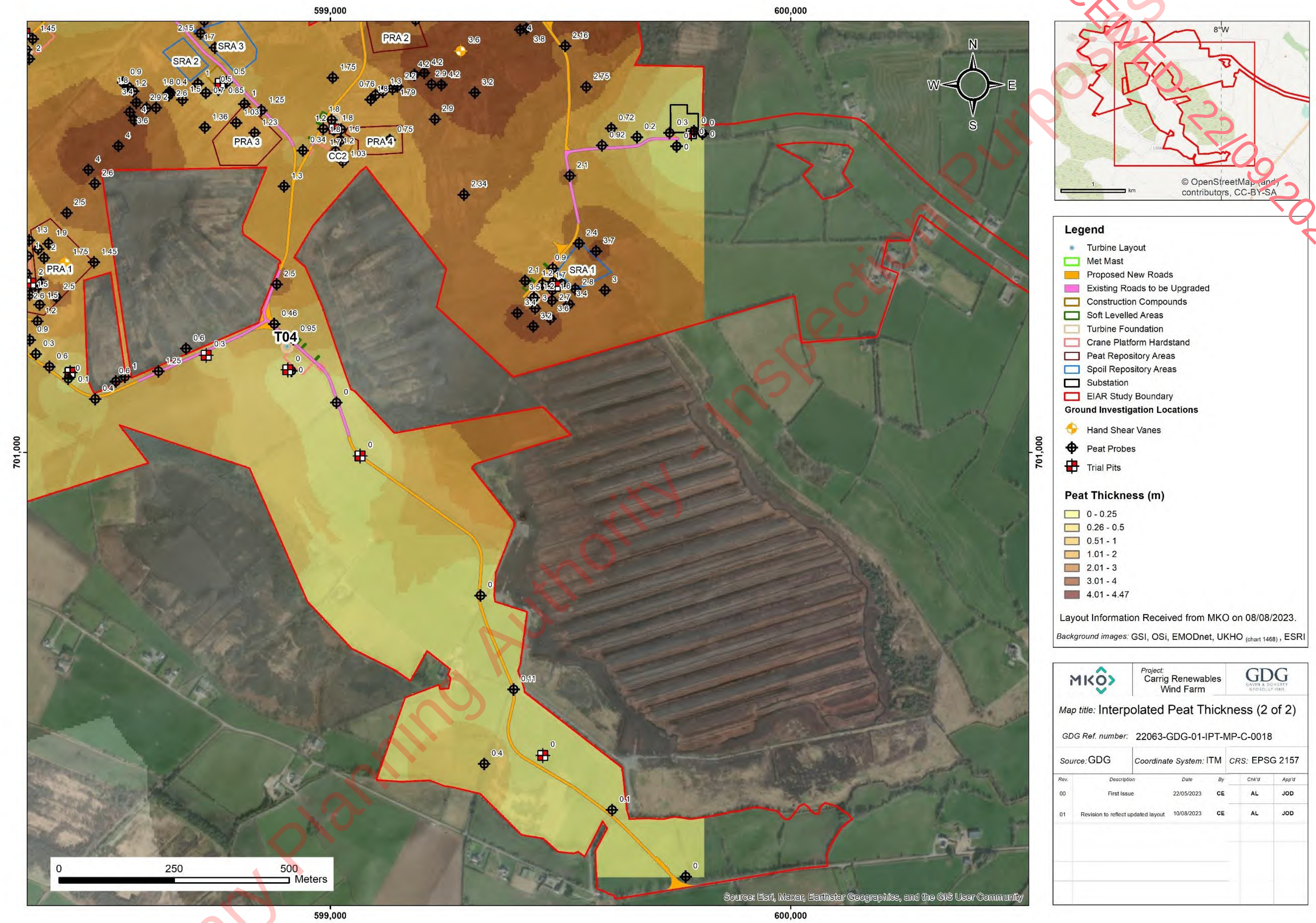


Figure J- 4: Interpolated peat depth map (2 of 2).

Table J- 1: Site reconnaissance of the Turbine 1 site.

Imagery

Peat geo-investigation

22063 Sharragh TP02a 221122.JPG

Shared legend

Legend
— 2m Contour
📷 GDG_Photos_PP_22063_Merged_230425
⌖ GI Locations

Updated FINAL layout 31.03.23
🟦 Proposed New Roads - 2023.03.31
🟪 Existing Roads to be Upgraded - 2023.03.31
● Turbine Layout - 2023.02.22
🟩 Turbine Foundation - 2023.03.03
🟧 Crane Platform Hardstand - 2023.03.03
🟥 Red Line Boundary - 2023.03.08
⬜ Substation - 2023.03.08
🟨 Construction Compound- 2023.03.03
🟪 Met Mast- 2023.03.03

Peat Depth (m)
-
🟨 <= 0.50
🟨 0.50 - 1.00
🟨 1.00 - 2.00
🟧 2.00 - 3.00
🟧 3.00 - 4.00
🟫 > 4.00

22063 Sharragh TP02 Site.JPG

Description

Date of the satellite images: March 2022. [Maxar/Esri].

Date of the ground-based pictures: 18th of August, 22nd of November 2022 and 29th of March 2023 [GDG].

Geomorphology: T1 is located on a raised peat bog. Topography is flat.

Peat: The peat depth at T1 is 3.43 m and slope angle of 2 degrees.

Instability evidence: No.

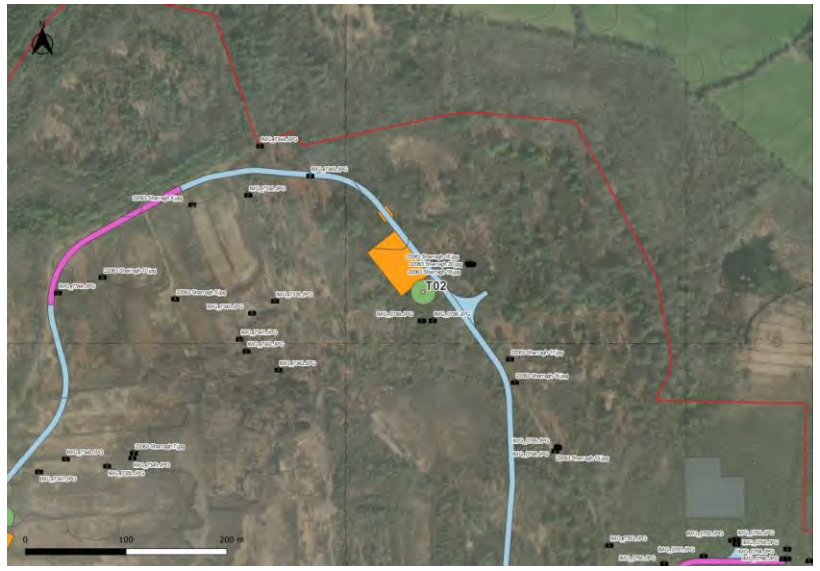
22063 Sharragh 12.JPG

22063 TP02 Soil b.JPG

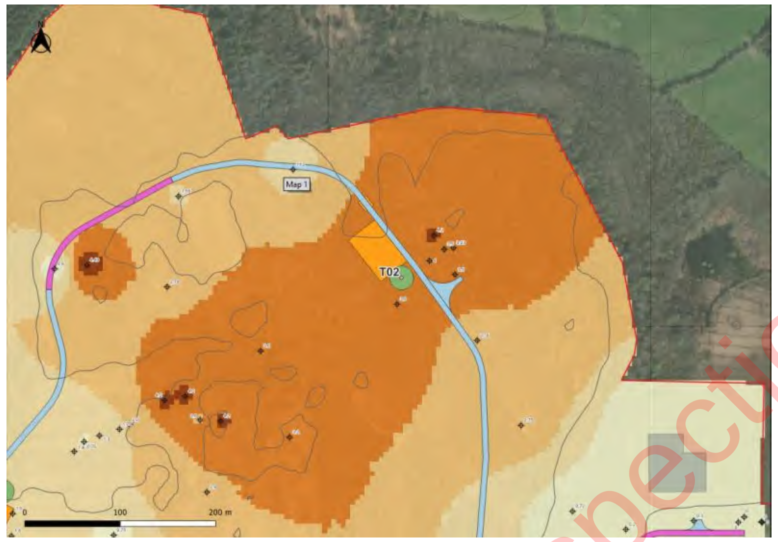
0782.JPG

Table J- 2: Site reconnaissance of the Turbine 2 site.

Imagery



Peat geo-investigation



22063 Sharragh 19.JPG

Shared legend

Legend

— 2m Contour

📷 GDG_Photos_PP_22063_Merged_230425

⌖ GI Locations

Updated FINAL layout 31.03.23

- ▭ Proposed New Roads - 2023.03.31
- ▭ Existing Roads to be Upgraded - 2023.03.31
- ● Turbine Layout - 2023.02.22
- ▭ Turbine Foundation - 2023.03.03
- ▭ Crane Platform Hardstand - 2023.03.03
- ▭ Red Line Boundary - 2023.03.08

- ▭ Substation - 2023.03.08
- ▭ Construction Compound- 2023.03.03
- ▭ Met Mast- 2023.03.03

Peat Depth (m)

-
- ▭ <= 0.50
- ▭ 0.50 - 1.00
- ▭ 1.00 - 2.00
- ▭ 2.00 - 3.00
- ▭ 3.00 - 4.00
- ▭ > 4.00

Description

Date of the satellite images: March 2022. [Maxar/Esri].

Date of the ground-based pictures: 18th of August 2022 [GDG].

Geomorphology: The topography is flat, with mixed forestry and thick undergrowth.

Peat: The peat depth at T2 is 3.7m with a slope angle of 0.22 degrees

Instability evidence: No.

22063 Sharragh 18.JPG

22063 Sharragh 20.JPG

Table J- 3: Site reconnaissance of the Turbine 3 site.

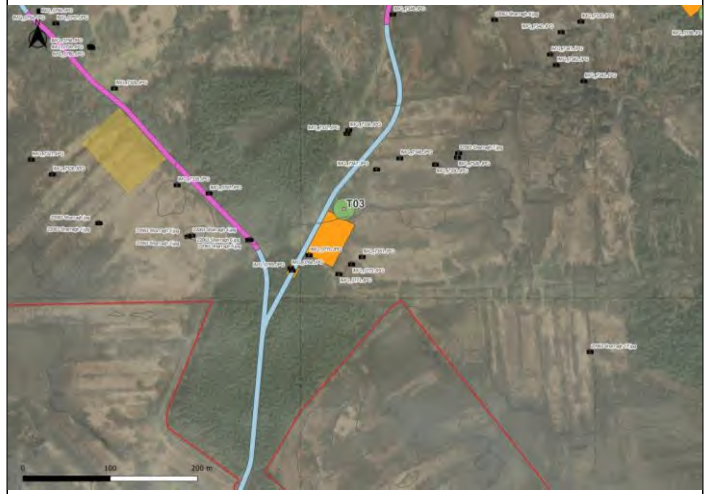
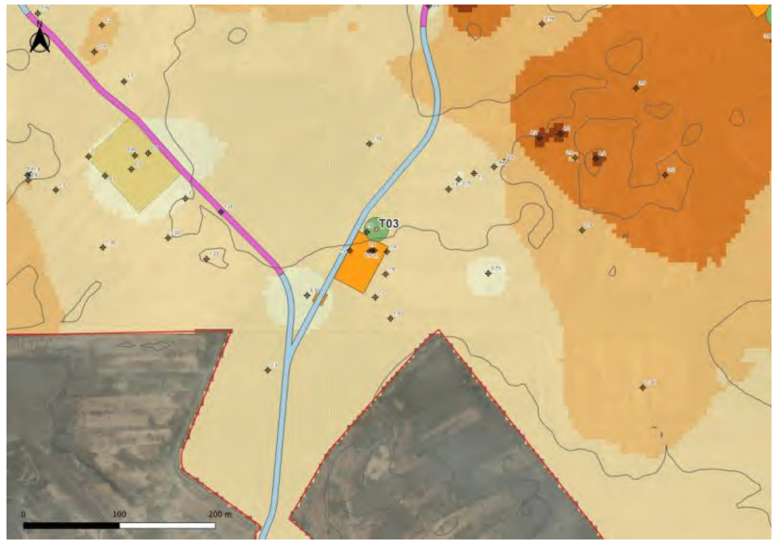
Imagery	Peat geo-investigation	22063 Sharragh TP03 Site a 221122.JPG
		
Shared legend **Legend** — 2m Contour 📷 GDG_Photos_PP_22063_Merged_230425 ⌖ GI Locations **Updated FINAL layout 31.03.23** ▭ Proposed New Roads - 2023.03.31 ▭ Existing Roads to be Upgraded - 2023.03.31 ● Turbine Layout - 2023.02.22 🟩 Turbine Foundation - 2023.03.03 🟧 Crane Platform Hardstand - 2023.03.03 🟥 Red Line Boundary - 2023.03.08 ▭ Substation - 2023.03.08 ▭ Construction Compound- 2023.03.03 ▭ Met Mast- 2023.03.03 **Peat Depth (m)** - ▭ <= 0.50 ▭ 0.50 - 1.00 ▭ 1.00 - 2.00 ▭ 2.00 - 3.00 🟧 3.00 - 4.00 🟫 > 4.00		
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures:** 22nd of November 2022 [GDG]. Geomorphology: T03 is located on a cut over peat bog. The topography is mostly flat. Peat: The peat depth varies form 0.9-1.8m at the T03 location. The slope angle is 1.3 degrees. Instability evidence: No.	22063 Sharragh TP03 Site c 221122.JPG 	22063 Sharragh TP03 d 221122.JPG 

Table J- 4: Site reconnaissance of the Turbine 4 site.

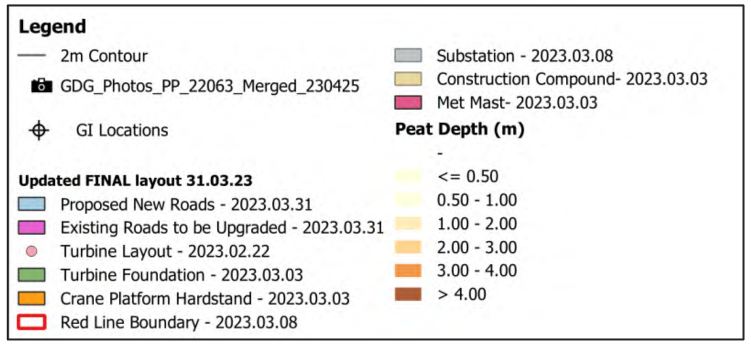
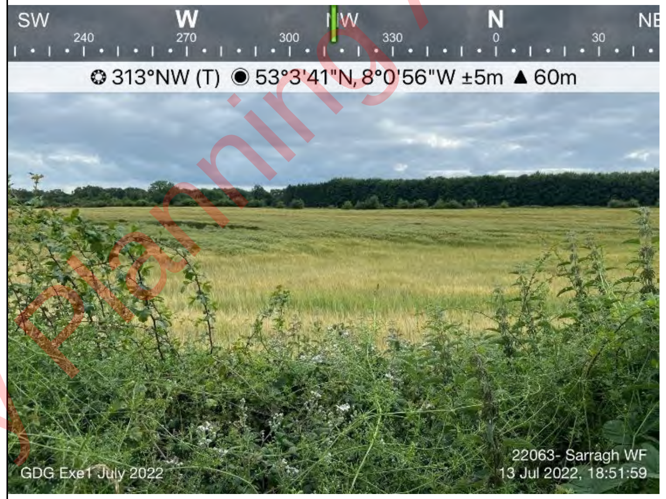
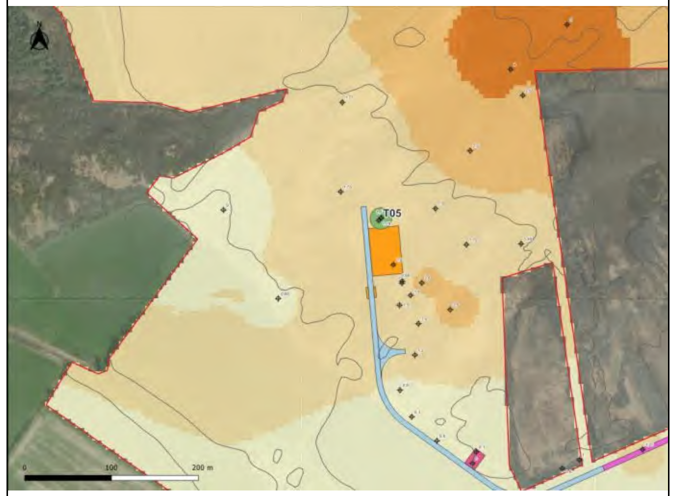
Imagery	Peat geo-investigation	Sharragh TP08 Site 21122.JPG	
		 	
Shared legend  **Legend** — 2m Contour 📷 GDG_Photos_PP_22063_Merged_230425 ⌖ GI Locations **Updated FINAL layout 31.03.23** 🟦 Proposed New Roads - 2023.03.31 🟪 Existing Roads to be Upgraded - 2023.03.31 ● Turbine Layout - 2023.02.22 🟩 Turbine Foundation - 2023.03.03 🟧 Crane Platform Hardstand - 2023.03.03 🟥 Red Line Boundary - 2023.03.08 ⬜ Substation - 2023.03.08 🟨 Construction Compound- 2023.03.03 🟥 Met Mast- 2023.03.03 **Peat Depth (m)** - 🟨 <= 0.50 🟨 0.50 - 1.00 🟨 1.00 - 2.00 🟧 2.00 - 3.00 🟧 3.00 - 4.00 🟫 > 4.00			
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures:** 13th of July and 22nd of November 2022 [GDG]. **Geomorphology**: The topography is generally flat glacial till. **Peat**: The peat depth in this sector is 0.6m. Trial pit is at previous T4 location, 50m to south, in area of no peat. **Instability evidence**: No.	IMG_7359.JGP  	IMG_0929.JPG  	IMG_0934.JPG 

Table J- 5: Site reconnaissance of the Turbine 5 site.

Imagery

Peat geo-investigation



22063 Sharragh TP06 Backfill 221122.JPG

Shared legend

Legend
— 2m Contour
📷 GDG_Photos_PP_22063_Merged_230425
⌖ GI Locations

Updated FINAL layout 31.03.23
▭ Proposed New Roads - 2023.03.31
▭ Existing Roads to be Upgraded - 2023.03.31
● Turbine Layout - 2023.02.22
🟩 Turbine Foundation - 2023.03.03
🟧 Crane Platform Hardstand - 2023.03.03
🟥 Red Line Boundary - 2023.03.08

▭ Substation - 2023.03.08
▭ Construction Compound- 2023.03.03
▭ Met Mast- 2023.03.03

Peat Depth (m)
-
▭ <= 0.50
▭ 0.50 - 1.00
▭ 1.00 - 2.00
▭ 2.00 - 3.00
🟧 3.00 - 4.00
🟫 > 4.00

Description

Date of the satellite images: March 2022. [Maxar/Esri].

Date of the ground-based pictures: 13th of July, 22nd of November 2022 and 24th of March 2023 [GDG].

Geomorphology: Flat cut over peat bog.

Peat: Depths of 1.5 m at the turbine location. Slope angle is 0.37 degrees.

Instability evidence: No.

IMG_7367.JPG

IMG_7368.JPG

IMG_0867.JPG

Table J- 6: Site reconnaissance of the Turbine 6 site.

<table>
<tr>
<td>Imagery
 </td>
<td>Peat geo-investigation
 </td>
<td>IMG_7334.JPG
 </td>
</tr>
<tr>
<td colspan="2">Shared legend
Legend
— 2m Contour
GDG_Photos_PP_22063_Merged_230425
⌖ GI Locations
Updated FINAL layout 31.03.23
🟦 Proposed New Roads - 2023.03.31
🟪 Existing Roads to be Upgraded - 2023.03.31
● Turbine Layout - 2023.02.22
🟩 Turbine Foundation - 2023.03.03
🟧 Crane Platform Hardstand - 2023.03.03
🟥 Red Line Boundary - 2023.03.08
Substation - 2023.03.08
Construction Compound- 2023.03.03
Met Mast- 2023.03.03
Peat Depth (m)
-
<= 0.50
0.50 - 1.00
1.00 - 2.00
2.00 - 3.00
3.00 - 4.00
> 4.00</td>
<td>22063 Sharragh TP05 Site b 221123.JPG
 </td>
</tr>
<tr>
<td>Description

Date of the satellite images: March 2022. [Maxar/Esri].

Date of the ground-based pictures: 13th of July and 23rd of November 2022 [GDG]

Geomorphology: Topography is flat and forested. Peat is underlain by soft lacustrine silts.

Peat: Peat depth at TP06 is 2.54m, with a slope angle of 0.25 degrees.

Instability evidence: No.</td>
<td>22063 Sharragh TP05c 221123.JPG
 </td>
<td>22063 Sharragh TP05 Spoil C 221123.JPG
 </td>
</tr>
</table>

Table J- 7: Site reconnaissance of the Turbine 7 site.

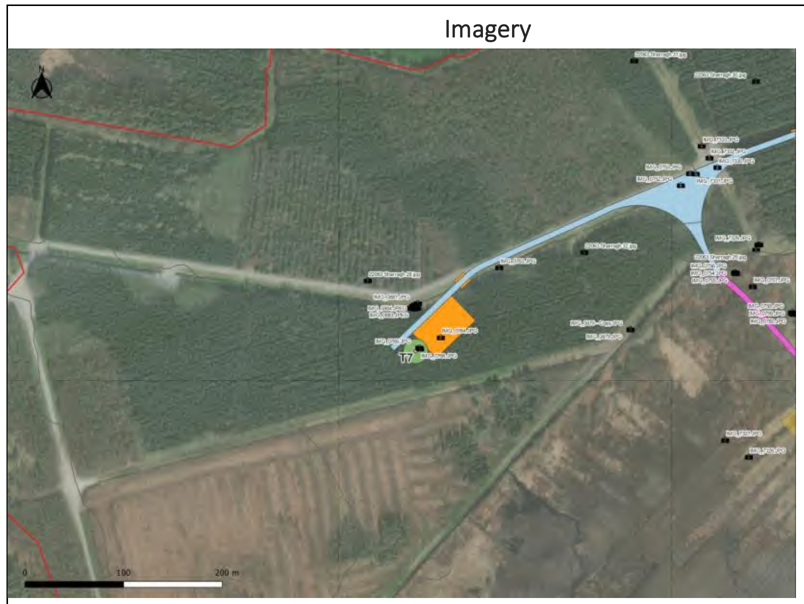
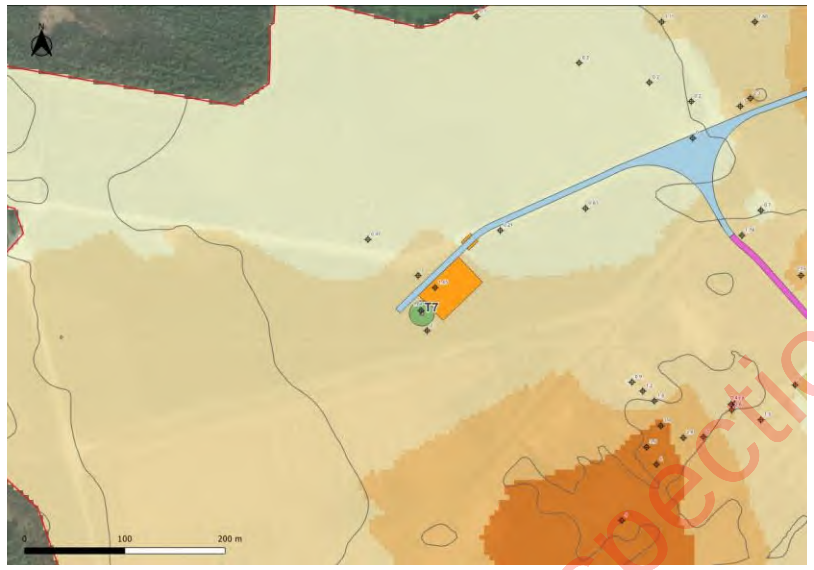
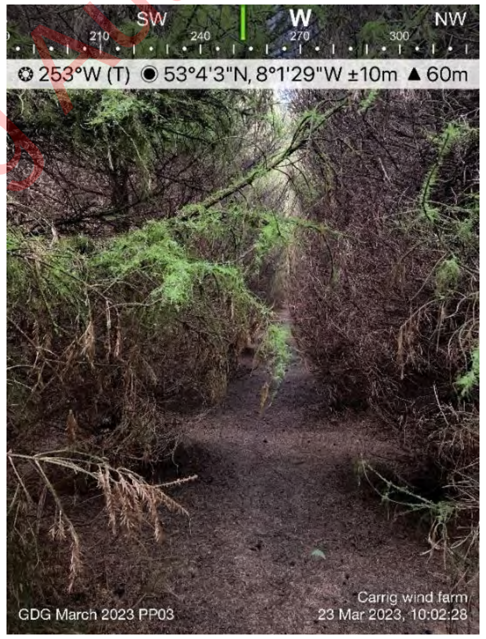
Imagery	Peat geo-investigation	IMG_0881.JPG
		
Shared legend **Legend** — 2m Contour 📷 GDG_Photos_PP_22063_Merged_230425 ⌖ GI Locations **Updated FINAL layout 31.03.23** ▭ Proposed New Roads - 2023.03.31 ▭ Existing Roads to be Upgraded - 2023.03.31 ● Turbine Layout - 2023.02.22 🟩 Turbine Foundation - 2023.03.03 🟧 Crane Platform Hardstand - 2023.03.03 🟥 Red Line Boundary - 2023.03.08 ▭ Substation - 2023.03.08 ▭ Construction Compound- 2023.03.03 ▭ Met Mast- 2023.03.03 **Peat Depth (m)** - ▭ <= 0.50 ▭ 0.50 - 1.00 ▭ 1.00 - 2.00 ▭ 2.00 - 3.00 🟧 3.00 - 4.00 ▭ > 4.00		22063 Sharragh TP05 Site b 221123.JPG
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures:** 13th of July and 23rd of November 2022 [GDG] **Geomorphology**: Topography is flat and forested. Peat is underlain by soft lacustrine silts. **Peat**: Peat depth at T7 is 1.8m, with a slope angle of 0.4 degrees. **Instability evidence**: No.	IMG_0765.JPG 	IMG_0766.JPG 

Table J- 8: Site reconnaissance of the Construction Compound site.

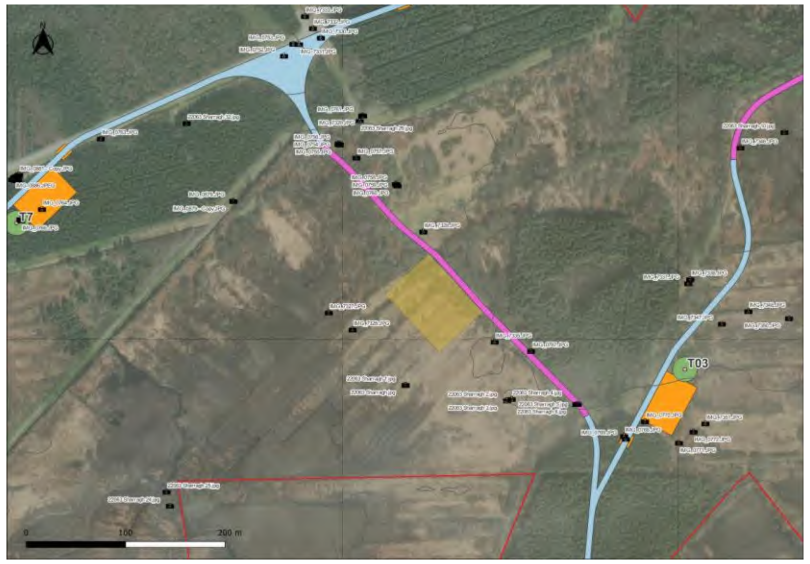
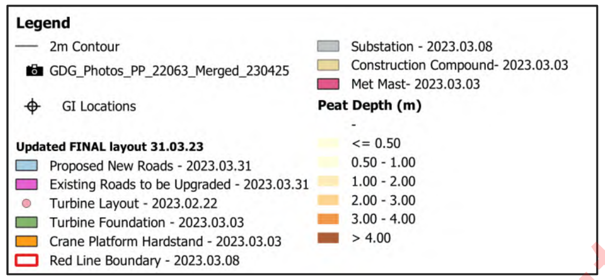
Imagery	Peat geo-investigation	22063 Sharragh TP04 Backfill.JPG
		
Shared legend 		
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures**18th of August and 22nd of November 2022 [GDG]. **Geomorphology**: Topography at site is mostly flat cut over peat bog. **Peat**: Peat depth is 0.85m, with a slope angle of 1.15 degrees. **Instability evidence**: No.	IMG_0939.JPG 	IMG_0942.JPG 

Table J- 9: Site reconnaissance of substation site.

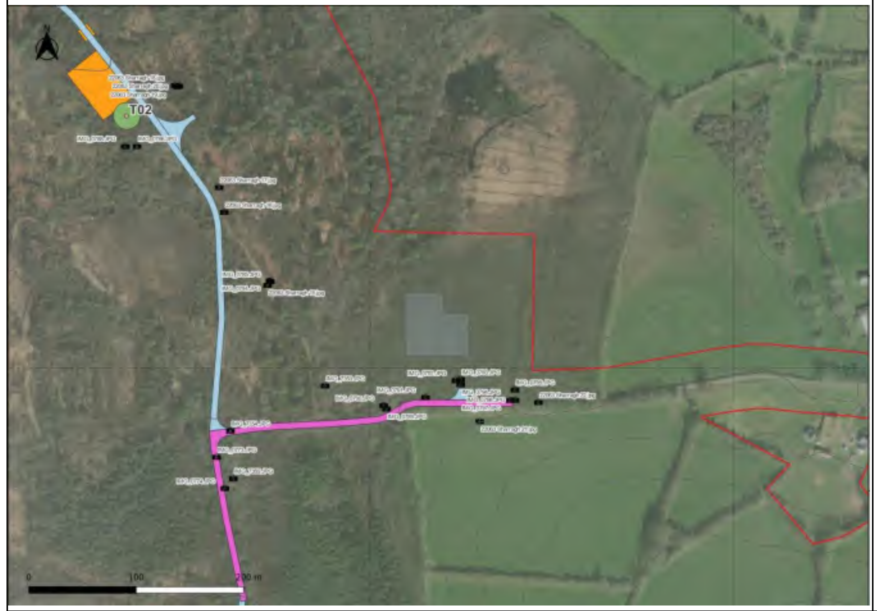
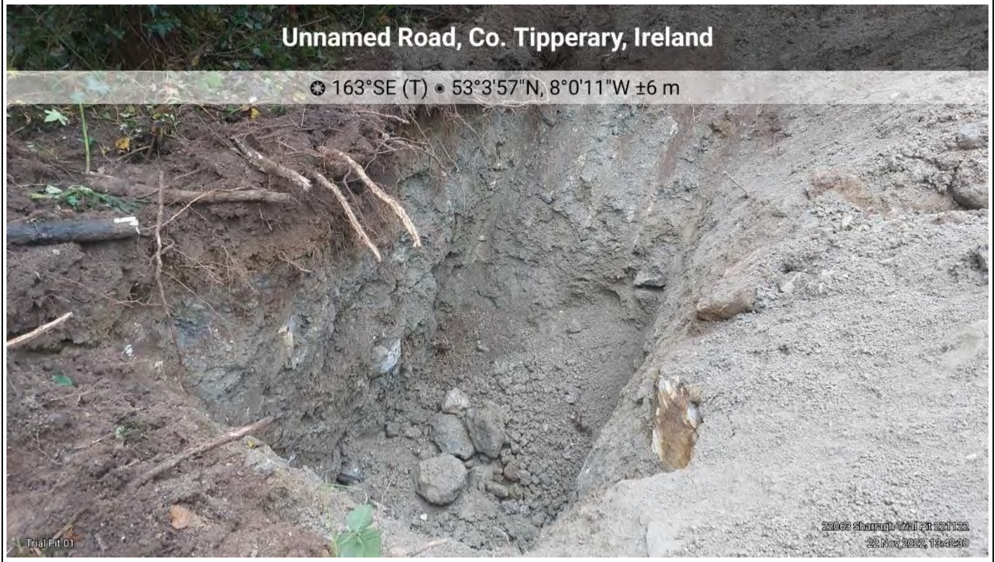
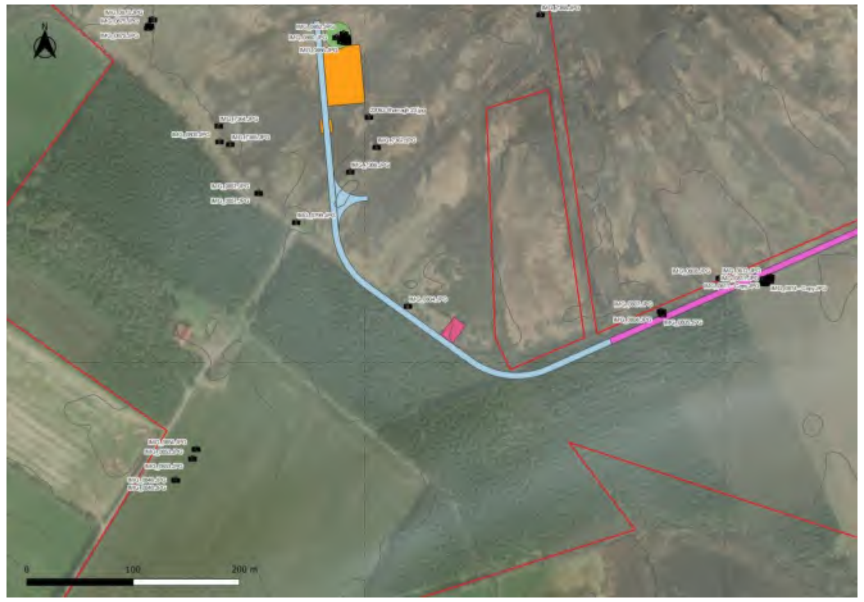
Imagery	Peat geo-investigation	22063 Sharragh TP01 Site 221122.JPG
 	 	
Shared legend **Legend** — 2m Contour 📷 GDG_Photos_PP_22063_Merged_230425 ⌖ GI Locations **Updated FINAL layout 31.03.23** 🟦 Proposed New Roads - 2023.03.31 🟪 Existing Roads to be Upgraded - 2023.03.31 ● Turbine Layout - 2023.02.22 🟩 Turbine Foundation - 2023.03.03 🟧 Crane Platform Hardstand - 2023.03.03 🟥 Red Line Boundary - 2023.03.08 ⬜ Substation - 2023.03.08 🟨 Construction Compound- 2023.03.03 🟥 Met Mast- 2023.03.03 **Peat Depth (m)** - 🟨 <= 0.50 🟨 0.50 - 1.00 🟨 1.00 - 2.00 🟧 2.00 - 3.00 🟧 3.00 - 4.00 🟫 > 4.00		
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures:** 22nd of November 2022 [GDG]. Geomorphology: Flat forestry, with no peat present. Peat: No peat. Instability evidence: No.	22063 Sharragh TP01 Backfill b 221122.JPG  	22063 Sharragh TP01c 221122.JPG 

Table J- 10: Site reconnaissance of the Met mast site.

Imagery	Peat geo-investigation	
		22063 Sharragh TP07 Site.JPG 
Shared legend **Legend** — 2m Contour 📷 GDG_Photos_PP_22063_Merged_230425 ⌖ GI Locations **Updated FINAL layout 31.03.23** ▭ Proposed New Roads - 2023.03.31 ▭ Existing Roads to be Upgraded - 2023.03.31 ● Turbine Layout - 2023.02.22 🟩 Turbine Foundation - 2023.03.03 🟧 Crane Platform Hardstand - 2023.03.03 🟥 Red Line Boundary - 2023.03.08 ▭ Substation - 2023.03.08 ▭ Construction Compound- 2023.03.03 ▭ Met Mast- 2023.03.03 **Peat Depth (m)** - ▭ <= 0.50 ▭ 0.50 - 1.00 ▭ 1.00 - 2.00 ▭ 2.00 - 3.00 ▭ 3.00 - 4.00 ▭ > 4.00		
Description **Date of the satellite images:** March 2022. [Maxar/Esri]. **Date of the ground-based pictures:** November 22nd, 2022 (of TP07, at Met Mast) [GDG]. **Geomorphology**: Flat topography. **Peat**: Interpolated peat depth 0.1m, slope angle of 0.51 degrees. **Instability evidence**: No.	22063 Sharragh TP07c 221122.JPG 	22063 Sharragh TP07 Spoil 221122.JPG 

J.1 TRIAL PIT LOGS

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Trial Pit Log

TrialPit No
TP01
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 599783.90 - 701692.49 Level: 58.80	Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 2.60 × 1.40 Depth 2.30	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40	58.40	▨	Light brown silty TOPSOIL with high root and wood content.
				2.30	56.50	░	Firm light grey slightly sandy slightly gravelly CLAY with moderate cobble content. Sand and gravel are fine to coarse, gravel is angular to subrounded. Cobbles are subrounded of limestone.
							End of Pit at 2.30m

Remarks: No water encountered. Terminated due to confined space in forested area - limited space for excavator to move and to store spoil. Elevation taken from DEM.

Stability: Stable.

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Trial Pit Log

TrialPit No
TP02
Sheet 1 of 1

Project Name: Sharragh Wind Farm
Project No. 22063
Co-ords: 599488.37 - 701360.83
Level: 59.60
Date 22/11/2022

Location: Sharragh, Co. Tipperary
Dimensions (m): 4.50 × 2.20
Depth 4.00
Scale 1:25

Client: McCarthy Keville O'Sullivan Ltd. (MKO)
Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Spongy black slightly decomposed PEAT (H4) with moderate wood and coarse fibre content.
				0.50	59.10		Plastic black pseudofibrous decomposed PEAT (H7) with strong organic odour.
				1.70	57.90		Firm grey slightly sandy slightly gravelly CLAY with moderate cobble and low boulder content. Sand and gravel are fine to coarse, gravel is angular to subangular. Cobbles and boulders are subangular to subrounded of limestone.
				4.00	55.60		End of Pit at 4.00m

Remarks: No water encountered. Terminated at target depth. Elevation taken from DEM.

Stability: Stable.

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Trial Pit Log

TrialPit No
TP03
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 599007.56 - 701702.47 Level: 58.30	Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 4.00 × 1.40 Depth 1.80	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged CE

Water Strike	Samples & In Situ Testing Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	58.10		Spongy dark brown pseudofibrous PEAT (H3) with moderate coarse fibre and high wood content. Moderate odour.
▼				0.90	57.40		Plastic dark brown oxidising to black amorphous PEAT (H6) with low coarse fibre content. Strong odour.
				1.80	56.50		Plastic black decomposed amorphous PEAT (H8) with strong odour.
				1.80	56.50		Weathered LIMESTONE bedrock.

End of Pit at 1.80m

Remarks: Rapid water ingress at 0.9m bgl. Terminated as bedrock encountered. Elevation taken from DEM.

Stability: Poor.

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Trial Pit Log

TrialPit No
TP04
Sheet 1 of 1

Project Name: Sharragh Wind Farm
Project No. 22063
Co-ords: 598760.37 - 701801.88
Level: 59.10
Date 22/11/2022

Location: Sharragh, Co. Tipperary
Dimensions (m): 4.00 × 1.40
Depth 2.80
Scale 1:25

Client: McCarthy Keville O'Sullivan Ltd. (MKO)
Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Spongy dark brown fibrous PEAT (H3) with moderate fine and coarse fibre content.
				0.20	58.90		Plastic black pseudofibrous PEAT (H5) with low coarse fibre content. Moderate organic odour.
▼				0.85	58.25		Stiff bluish grey gravelly CLAY with moderate cobble content. Gravel is fine to coarse, angular to subrounded. Cobbles are angular of limestone.
				2.80 2.80	56.30 56.30		LIMESTONE bedrock. End of Pit at 2.80m

Remarks: Moderate water ingress at 1m bgl. Pit terminated as bedrock encountered. Elevation taken from DEM.

Stability: Poor.

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Trial Pit Log

TrialPit No
TP05
Sheet 1 of 1

Project Name:	Sharragh Wind Farm	Project No. 22063	Co-ords: 598762.41 - 702132.11 Level: 57.20		Date 23/11/2022
Location:	Sharragh, Co. Tipperary		Dimensions (m): 4.00 2.10		Scale 1:25
Client:	McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.60		Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	56.90		Plastic black pseudofibrous PEAT (H5) with strong organic odour.
▼				1.30	55.90		Plastic black highly decomposed PEAT (H8) with strong organic odour.
				2.60	54.60		Very soft damp light grey slightly sandy SILT with occasional rootlets. Sand is fine.
							End of Pit at 2.60m

Remarks: Water seepage at base of PEAT at 1.3m bgl. Pit terminated due to walls collapsing. Elevation taken from DEM.

Stability: Poor.

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Trial Pit Log

TrialPit No
TP06
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598348.71 - 701367.84 Level: 61.60	Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 4.00 × 1.40 Depth 3.70	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.40	61.20	▨	Spongy dark brown oxidising to black fibrous PEAT (H4) with moderate coarse fibres and wood fragments. Slight organic odour.
				2.00	59.60	▨	Spongy black H6 pseudofibrous PEAT (H6) with low wood content. Moderate organic odour.
▼				3.70	57.90	▨	Soft damp grey slightly sandy slightly gravelly CLAY with moderate cobble and boulder content. Sand is fine to coarse, gravel is fine to coarse, angular to subangular. Cobbles and boulders are subangular of limestone. One boulder is 70cm.
							End of Pit at 3.70m

Remarks: Terminated due to moderate water ingress at 3.6m bgl and unstable sides. Elevation taken from DEM.

Stability: Poor

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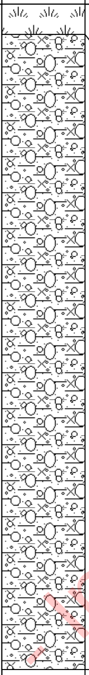
Trial Pit Log

TrialPit No
TP07
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598434.31 - 701173.31 Level: 62.20	Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 4.00 2.20	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.20	Logged CE



Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10	62.10		Spongy black fibrous PEAT (H3) with moderate coarse fibre content.
				2.20	60.00		Soft grey slightly sandy slightly gravelly slightly silty CLAY with high cobble and boulder content. Sand and gravel are fine to coarse, gravel is angular to subrounded. Cobbles and boulders are subrounded of limestone.
							End of Pit at 2.20m

Remarks: No water encountered. Terminated due to pit walls collapsing. Elevation taken from DEM.

Stability: Poor

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Trial Pit Log

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598907.34 - 701179.10 Level: 60.60	TrialPit No TP08 Sheet 1 of 1 Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 3.50 × 1.30 Depth 2.50	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10	60.50	▨	Black organic rich TOPSOIL.
▼				2.50	58.10	▨	Firm grey mottled orange slightly sandy slightly gravelly CLAY with moderate cobble and low boulder content. Sand and gravel are fine to coarse, gravel is subangular to subrounded. Cobbles and boulders are subrounded of limestone.
							End of Pit at 2.50m

1
2
3
4
5

Remarks: Slight water seepage at 2.5m bgl. Pit terminated due to collapsing sides. Elevation taken from DEM.

Stability: Poor

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Trial Pit Log

TrialPit No
TP09
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 599064.09 - 700991.90 Level: 61.50	Date 22/11/2022
Location: Sharragh, Co. Tipperary		Dimensions (m): 4.00 × 1.40	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.10	Logged CE

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	61.30	▨	TOPSOIL.
				2.10	59.40		Firm grey mottled orange slightly sandy slightly gravelly CLAY with moderate cobble and boulder content. Sand and gravel are fine to coarse, gravel is subangular to subrounded. Cobbles and boulders are subrounded of limestone. One boulder is 80cm.
							End of Pit at 2.10m

Remarks: No water encountered. Terminated due to pit walls collapsing. Elevation taken from DEM.

Stability: Poor

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Trial Pit Log

TrialPit No
TP101
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 599461.00 - 700341.00 Level: 60.00	Date 24/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 3.50	Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	59.70	▨	Dark brown slight sandy clay with presence of cobbles [TOPSOIL]
				1.00	59.00	○	Large rounded boulders in a granular matrix
				1.60	58.40	⁘	Grey slightly gravelly sandy CLAY. Sand is fine to coarse, subangular to subrounded. Presence of rounded cobbles.
▼				3.50	56.50	⁙	Gery very gravelly CLAY. Gravel is medium to coarse, angular to subrounded. Presence of rounded cobbles
							End of Pit at 3.50m

Remarks: Elevation extracted from Google Earth. Groundwater encountered at 2.2 mBGL

Stability: Stable.

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Trial Pit Log

TrialPit No
TP102
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598730.00 - 701211.00 Level: 61.00	Date 23/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m): Depth 2.05	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	60.70		Spongy black pseudofibrous PEAT (H3) with moderate coarse fibre and high wood content. Moderate odour.
				0.35	60.65		Grey mottled orange slightly sandy CLAY. Sand is fine to medium, subangular to subrounded.
▼				2.05	58.95		Grey very gravelly sandy CLAY. Gravel is fine to coarse, subangular to subrounded. Sand is fine to coarse, subangular to subrounded. High presence of cobbles and boulders

End of Pit at 2.05m

Remarks: Elevation extracted from Google Earth. Groundwater encountered at 1.8 mBGL

Stability: Stable.

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Trial Pit Log

TrialPit No
TP103
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598336.00 - 701910.00 Level: 59.00	Date 24/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.70	Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.80	58.20		Black psudo-fibrous PEAT (H3). High content of wood at the bottom of the layer.
▼ (2.00)				2.70	56.30		Grey very gravelly very sandy CLAY. Sand is fine to coarse, angular to subrounded. Gravel is fine to coarse, angular to subrounded.
							End of Pit at 2.70m

1
2
3
4
5

Remarks: Elevation extracted from Google Earth. Groundwater encountered at 2 mBGL

Stability: Unstable .

AGS

Trial Pit Log

GDG GAVIN & DOHERTY GEOSOLUTIONS			TrialPit No TP104 Sheet 1 of 1
Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598325.00 - 701443.00 Level: 60.00	Date 24/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m): Depth 3.50	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼				1.60	58.40		Soft to firm spongy dark brown pseudofibrous PEAT (H3) with moderate coarse fibre and high wood content. Moderate odour. Stiffness increase with depth.
▼				3.50	56.50		Light grey sandy CLAY [MARL]. Sand if fine to medium, subangular to subrounded. Presence of cobbles (15-30cm). Presence of white loose fine to medium sand.
							End of Pit at 3.50m

Depth scale: 1, 2, 3, 4, 5

Remarks: Elevation extracted from Google Earth. Groundwater encountered at 0.3 mBGL (based of Peat layer) related to percolation from the surface; and, at 3.5 mBGL.

Stability: Unstable.

AGS

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Trial Pit Log

TrialPit No
TP105
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598167.00 - 700896.00 Level: 68.00	Date 24/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m):	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)		Depth 2.60	Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.60	67.40	▨	Brown slightly gravelly CLAY [TOPSOIL]. Presence of black organic material at the bottom of the layer.
				1.50	66.50	○	Large subangular to rounded boulders (>1m)
				2.60	65.40	▦	Very gravelly sandy CLAY. Gravel is fine to coarse, angular to subrounded. Sand is fine to coarse, angular to subrounded.

End of Pit at 2.60m

Remarks: Elevation extracted from Google Earth.

Stability: Stable.

AGS

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Trial Pit Log

TrialPit No
TP106
Sheet 1 of 1

Project Name: Sharragh Wind Farm	Project No. 22063	Co-ords: 598143.00 - 701452.00 Level: 60.00	Date 24/03/2023
Location: Sharragh, Co. Tipperary		Dimensions (m): Depth 2.10	Scale 1:25
Client: McCarthy Keville O'Sullivan Ltd. (MKO)			Logged IPP

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.10	59.90	▨	Black organic CLAY [TOPSOIL]
				0.40	59.60		Orangeish brown CLAY
▼				2.10	57.90		Light grey slightly sandy gravelly CLAY. Sand is fine to medium, subangular to subrounded. Gravel is coarse, subangular to subrounded. Presence of cobbles and boulders.

End of Pit at 2.10m

Remarks: Elevation extracted from Google Earth. Groundwater encountered at 1.6 mBGL

Stability: Unstable.

AGS

Appendix K FACTOR OF SAFETY

Table K- 1: Example of calculation of Factor of Safety for undrained conditions (with and without surcharge).

Proposed infrastructure	Slope	Cos Slope	Sin Slope	Undrained shear strength	Bulk unit weight of Peat	Peat depth	Factor of Safety	Surcharge	FoS surcharge	Slope
	(º)			Cu (kPa)	Y (kN/m^3)	(m)		(m)		Rad
T1	2.0	0.999	0.035	5	10	3.42667	**4.14**	1	**3.21**	0.03526
T2	0.2	1.000	0.004	5	10	3.70744	**34.39**	1	**27.09**	0.003921
T3	1.3	1.000	0.022	5	10	1.67289	**13.56**	1	**8.48**	0.022056
T4	0.8	1.000	0.014	5	10	0.677805	**51.29**	1	**20.72**	0.014384
T5	0.4	1.000	0.006	5	10	1.58833	**48.70**	1	**29.89**	0.006464
T6	0.3	1.000	0.004	5	10	2.54301	**44.27**	1	**31.77**	0.004442
T7	0.4	1.000	0.007	5	10	1.83752	**37.60**	1	**24.35**	0.007237
CC 1	1.2	1.000	0.020	5	10	0.85	**29.32**	1	**13.47**	0.020071
CC 2	2.4	0.999	0.042	5	10	1.5	**7.97**	1	**4.78**	0.041888
Substation	2.8	0.999	0.049	5	10	0.0002	**51605.94**	1	**10.32**	0.04852
Met Mast	2.6	0.999	0.045	5	10	0.1	**110.34**	1	**10.03**	0.045379
PRA 1	2	0.999	0.035	5	10	1.8	**7.96**	1	**5.12**	0.034907
PRA 2	5	0.996	0.087	5	10	3.5	**1.65**	1	1.28	0.087266
PRA 3	1.5	1.000	0.026	5	10	1.1	**17.37**	1	**9.10**	0.02618
PRA 4	2.2	0.999	0.038	5	10	0.75	**17.38**	1	**7.45**	0.038397
SRA 1	6	0.995	0.105	5	10	2.4	**2.00**	1	**1.41**	0.10472
SRA 2	2	0.999	0.035	5	10	1	**14.34**	1	**7.17**	0.034907
SRA 3	2	0.999	0.035	5	10	2.5	**5.73**	1	**4.10**	0.034907

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Undrained conditions

Where,

F = Factor of Safety
c_u = Undrained strength
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
α = Slope angle

Table K- 2: Example of calculation of Factor of Safety for drained conditions (with and without surcharge).

Proposed infrastructure	Drained shear strength	Bulk unit weight of Peat	Peat depth	Bulk unit weight of water	Height of water table above failure surface	Slope	Cos Slope	$\cos^2$ Slope	Sin Slope	ϕ'	Tan ϕ'	**FoS**	Surcharge (m)	**FoS Surcharge**
	C' (kPa)	Υ (kN/m^3)	(m)	Υ (kN/m^3)	(m)	(º)								
T1	4	10	3.42667	9.8	3.42667	2.0	0.999	0.999	0.035	25	0.466	**3.58**	1	**5.76**
T2	4	10	3.70744	9.8	3.70744	0.2	1.000	1.000	0.004	25	0.466	**29.89**	1	**11.27**
T3	4	10	1.67289	9.8	1.67289	1.3	1.000	1.000	0.022	25	0.466	**11.27**	1	**14.96**
T4	4	10	0.677805	9.8	0.677805	0.8	1.000	1.000	0.014	25	0.466	**41.68**	1	**36.16**
T5	4	10	1.58833	9.8	1.58833	0.4	1.000	1.000	0.006	25	0.466	**40.40**	1	**52.67**
T6	4	10	2.54301	9.8	2.54301	0.3	1.000	1.000	0.004	25	0.466	**37.51**	1	**56.55**
T7	4	10	1.83752	9.8	1.83752	0.4	1.000	1.000	0.007	25	0.466	**31.37**	1	**43.02**
CC 1	4	10	0.85	9.8	0.85	1.2	1.000	1.000	0.020	25	0.466	**23.92**	1	**23.55**
CC 2	4	10	1.5	9.8	1.5	2.4	0.999	0.998	0.042	25	0.466	**6.60**	1	**8.41**
Substation	4	10	0.0002	9.8	0.0002	2.8	0.999	0.998	0.049	25	0.466	**41284.94**	1	**17.86**
Met Mast	4	10	0.1	9.8	0.1	2.6	0.999	0.998	0.045	25	0.466	**88.47**	1	**17.38**
PRA 1	4	10	1.8	9.8	1.8	2	0.999	0.999	0.035	25	0.466	**6.64**	1	**9.04**
PRA 2	4	10	3.5	9.8	3.5	5	0.996	0.992	0.087	25	0.466	**1.42**	1	**2.29**
PRA 3	4	10	1.1	9.8	1.1	1.5	1.000	0.999	0.026	25	0.466	**14.25**	1	**15.95**
PRA 4	4	10	0.75	9.8	0.75	2.2	0.999	0.999	0.038	25	0.466	**14.15**	1	**13.00**
SRA 1	4	10	2.4	9.8	2.4	6	0.995	0.989	0.105	25	0.466	**1.69**	1	**2.50**
SRA 2	4	10	1	9.8	1	2	0.999	0.999	0.035	25	0.466	**11.74**	1	**12.54**
SRA 3	4	10	2.5	9.8	2.5	2	0.999	0.999	0.035	25	0.466	**4.85**	1	**7.28**

Drained Conditions

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha}$$

Where,

F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

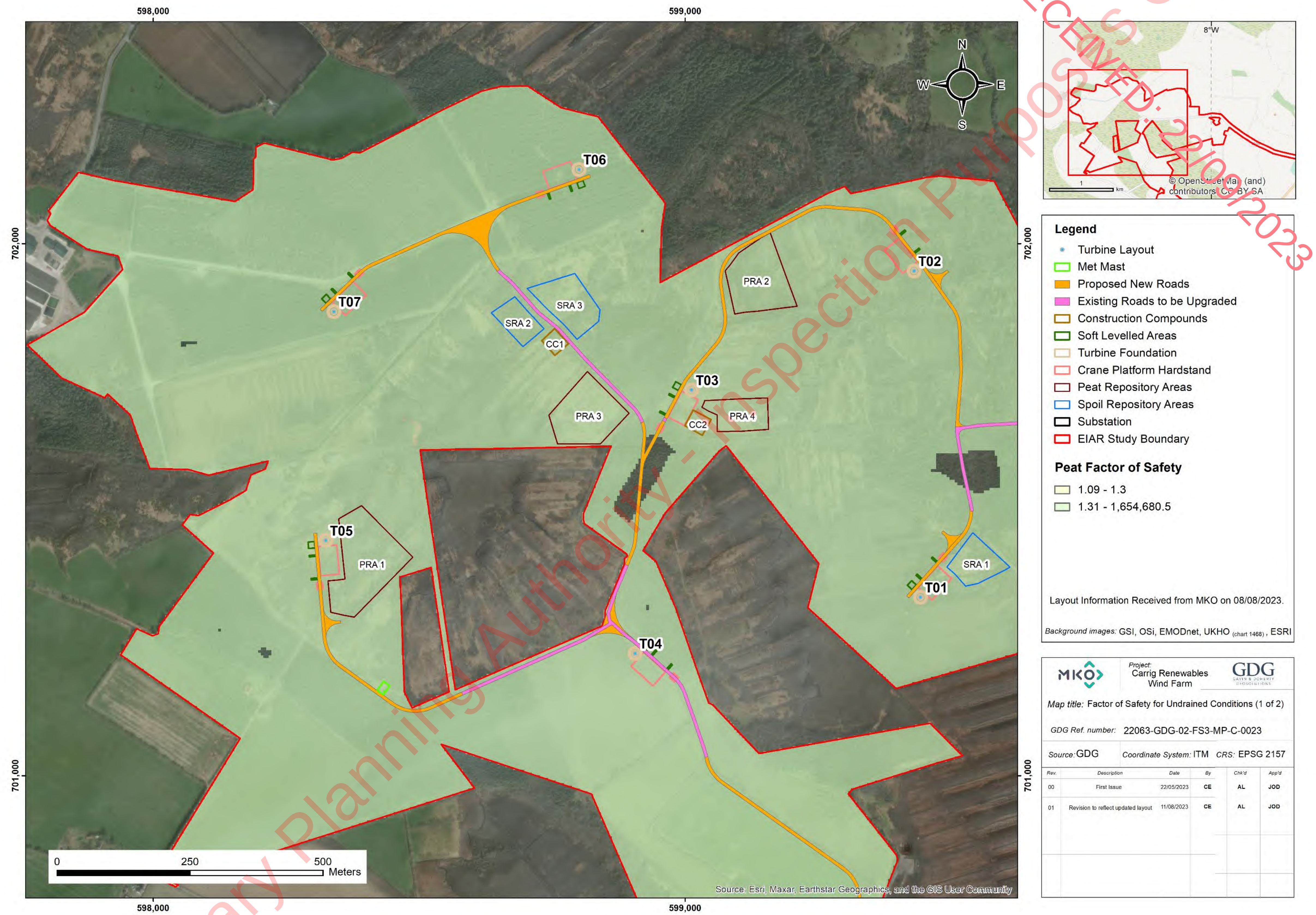
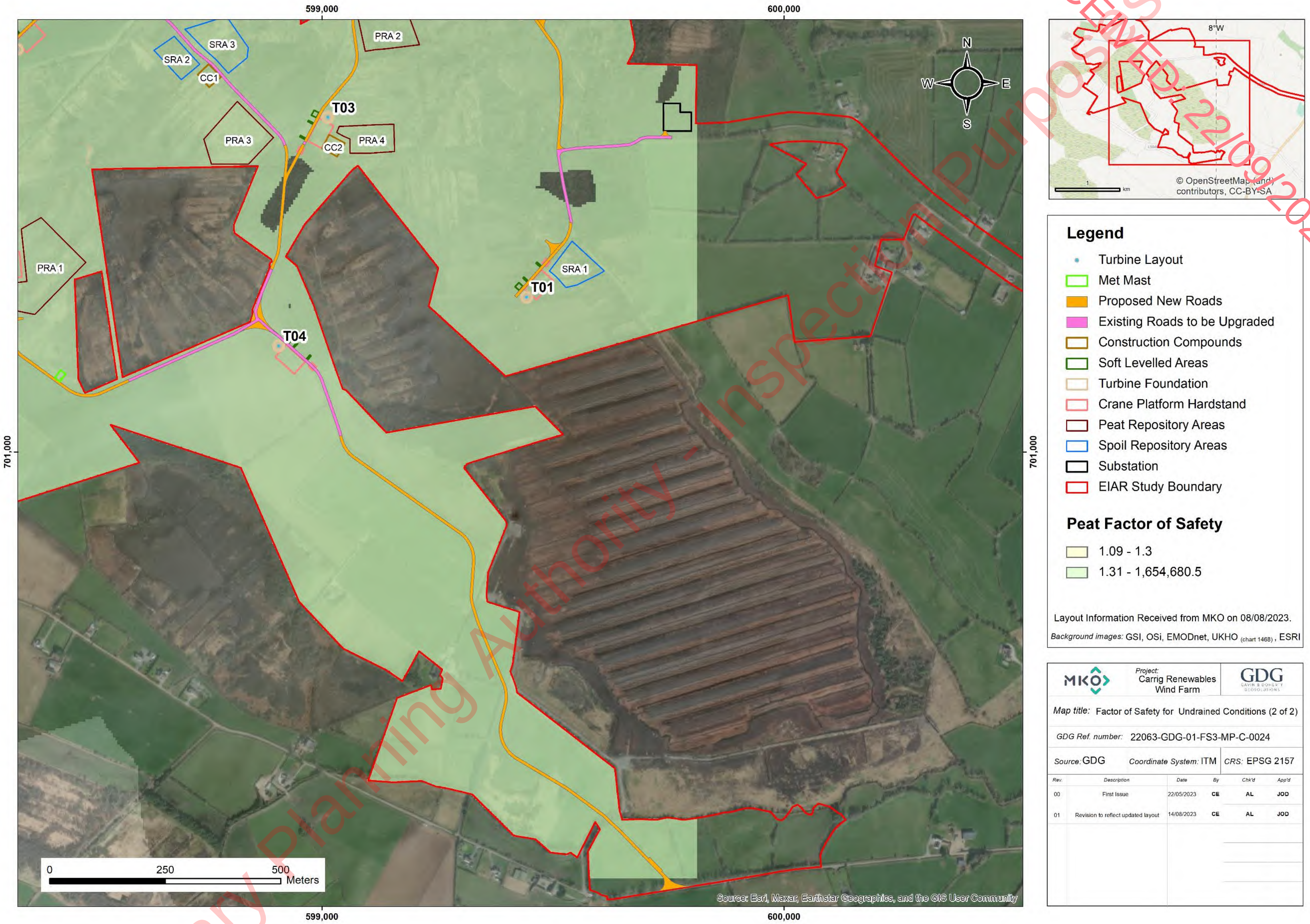


Figure K- 1: FoS for undrained conditions (1 of 2).



Layout Information Received from MKO on 08/08/2023.

Background images: GSI, OSi, EMODnet, UKHO (chart 1468), ESRI

Project: Carrig Renewables Wind Farm

Map title: Factor of Safety for Undrained Conditions (2 of 2)

GDG Ref. number: 22063-GDG-01-FS3-MP-C-0024

Source: GDG *Coordinate System:* ITM *CRS:* EPSG 2157

Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	14/08/2023	CE	AL	JOD

Figure K- 2: FoS for undrained conditions (2 of 2).

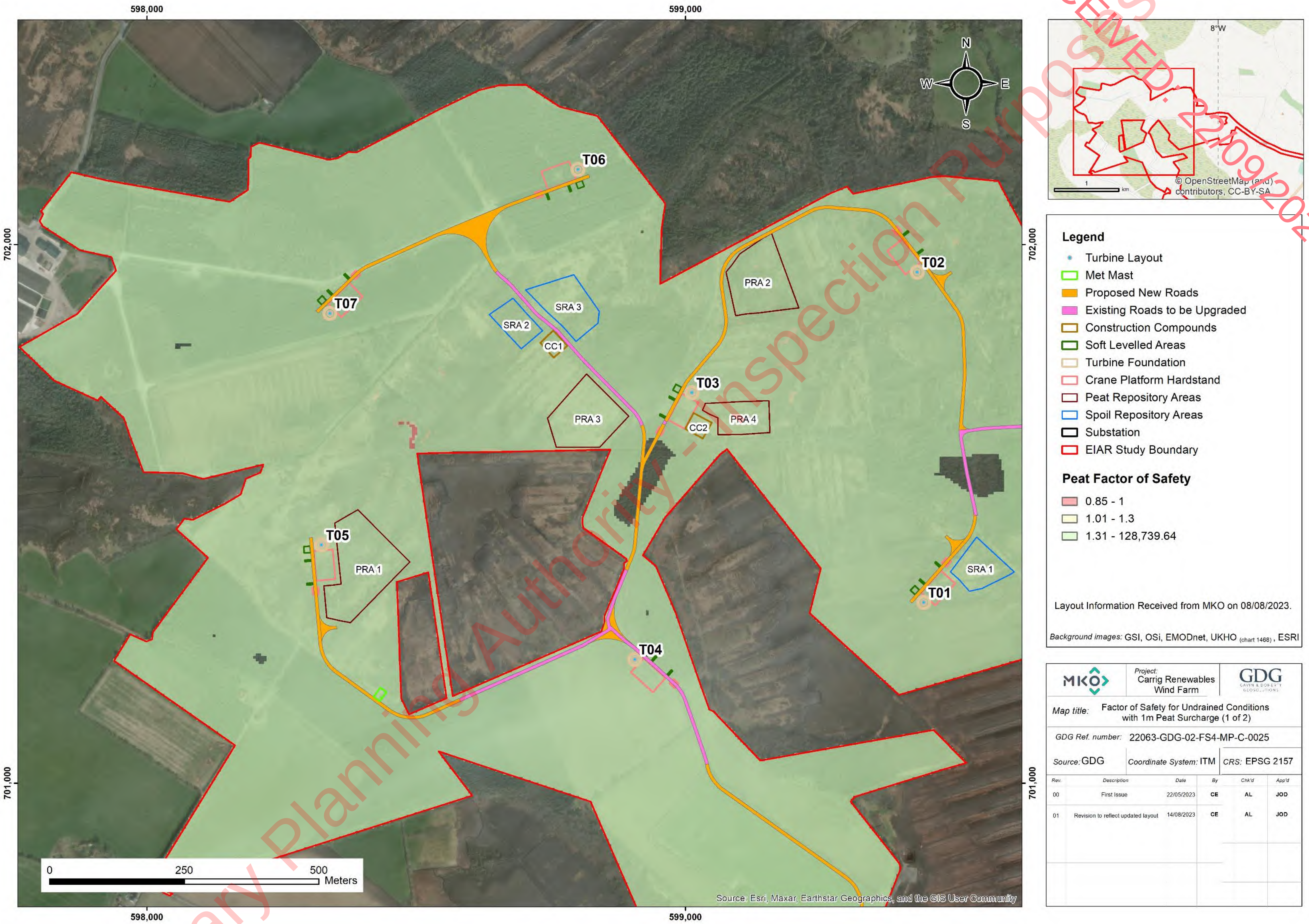


Figure K- 3: FoS for undrained conditions and surcharge of 1 m (i.e. 10 kPa) (1 of 2).

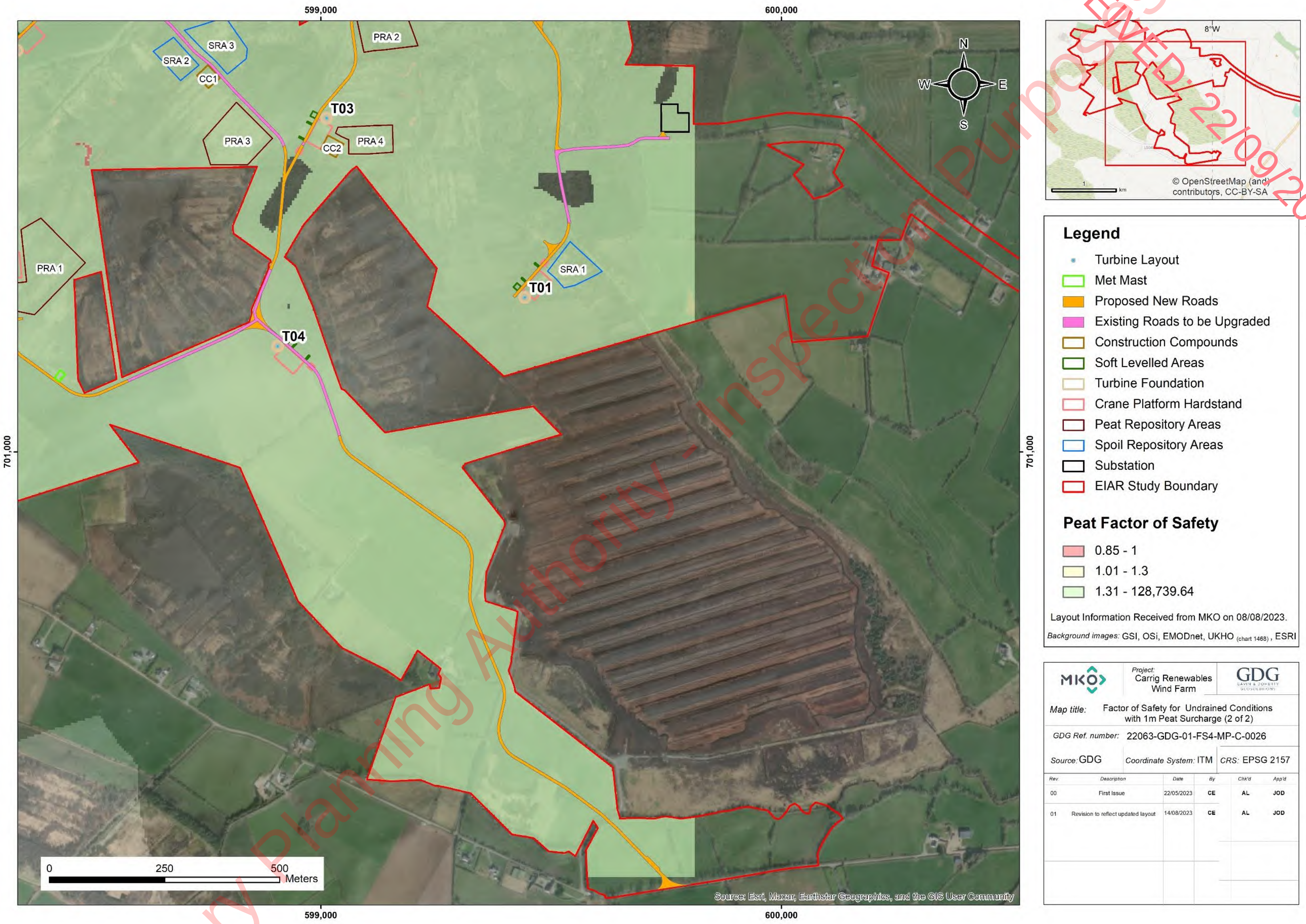
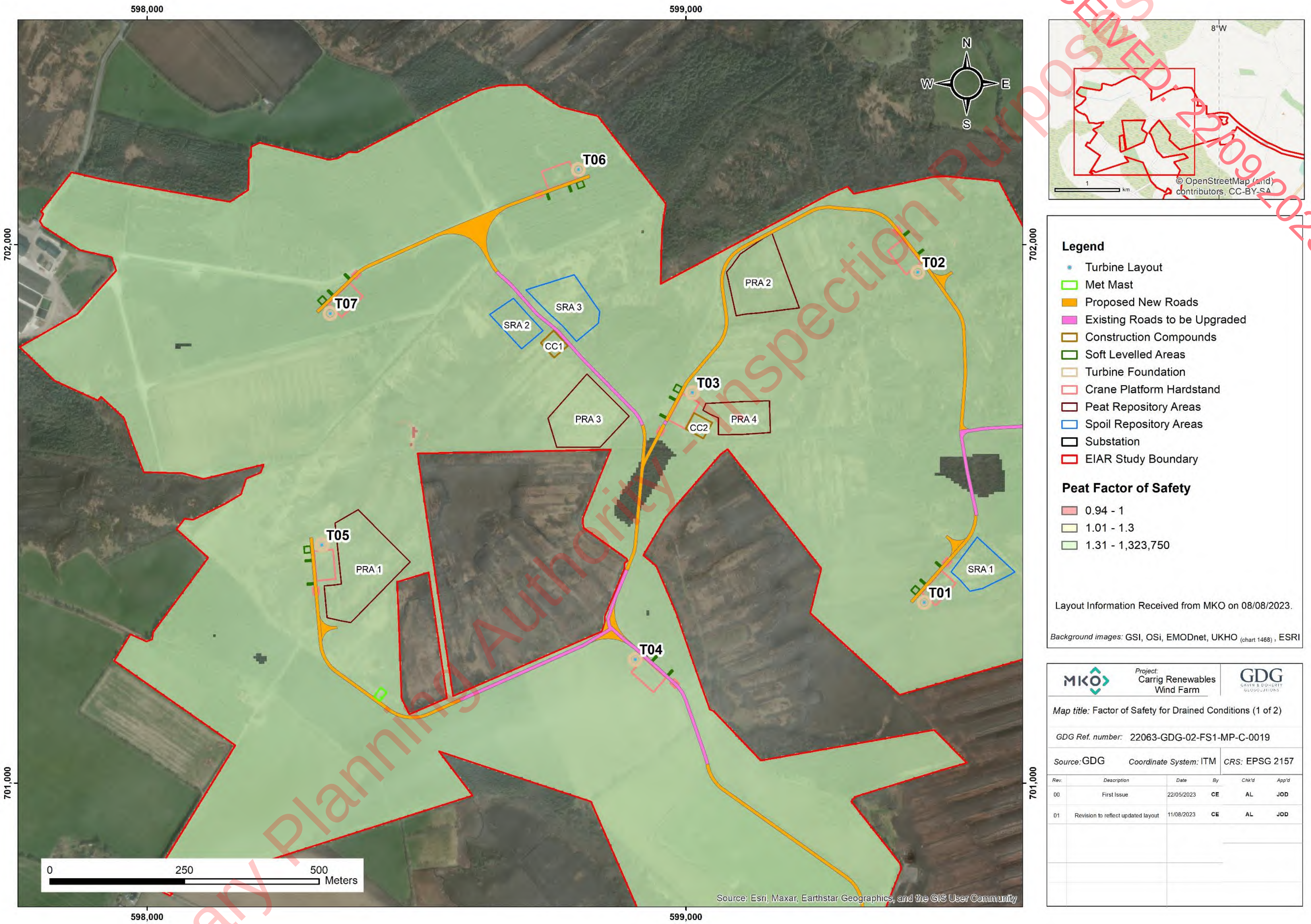
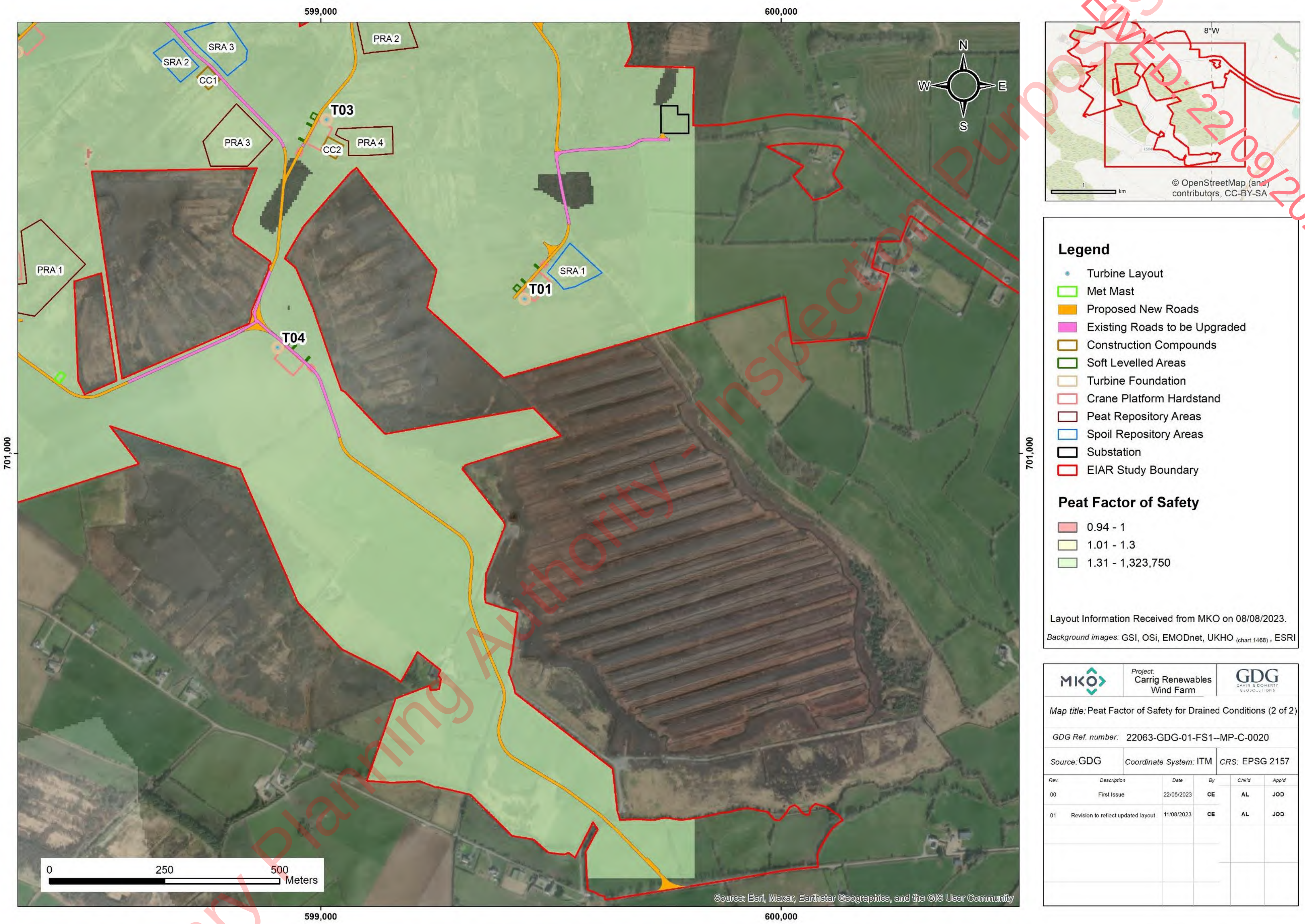


Figure K- 4: FoS for undrained conditions and surcharge of 1 m (i.e. 10 kPa) (2 of 2)



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	11/08/2023	CE	AL	JOD

Figure K- 5: FoS for drained conditions (1 of 2).



Legend

- ● Turbine Layout
- 🟩 Met Mast
- 🟧 Proposed New Roads
- 🟪 Existing Roads to be Upgraded
- ☐ Construction Compounds
- ☐ Soft Levelled Areas
- ☐ Turbine Foundation
- ☐ Crane Platform Hardstand
- ☐ Peat Repository Areas
- ☐ Spoil Repository Areas
- ☐ Substation
- 🟥 EIAR Study Boundary

Peat Factor of Safety

- 🟥 0.94 - 1
- 🟨 1.01 - 1.3
- 🟩 1.31 - 1,323,750

Layout Information Received from MKO on 08/08/2023.

Background images: GSI, OSi, EMODnet, UKHO (chart 1468) , ESRI

MKO

Project: Carrig Renewables Wind Farm

GDG GAVIN & DOHERTY GEOSOLUTIONS

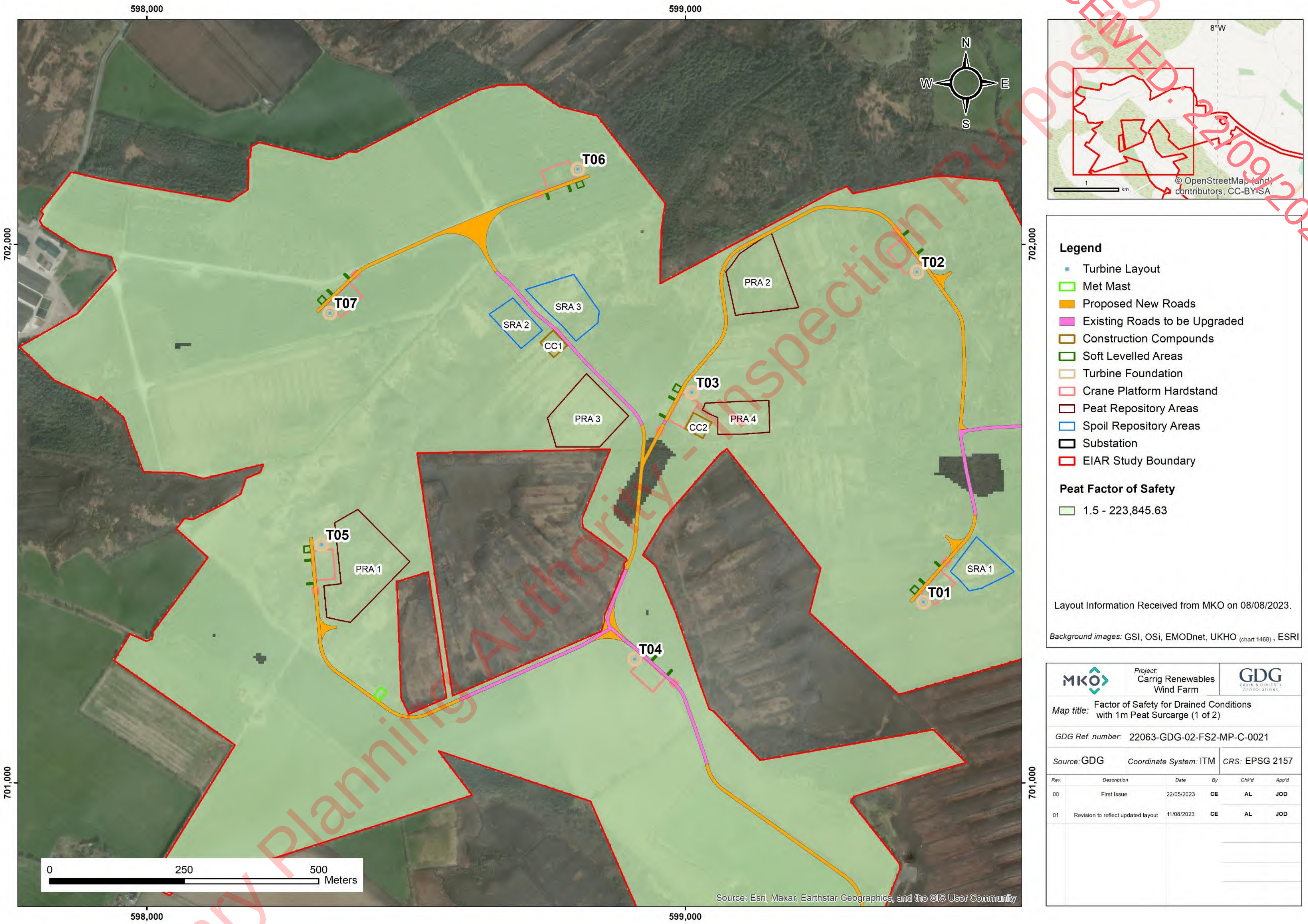
Map title: Peat Factor of Safety for Drained Conditions (2 of 2)

GDG Ref. number: 22063-GDG-01-FS1--MP-C-0020

Source: GDG | *Coordinate System:* ITM | *CRS:* EPSG 2157

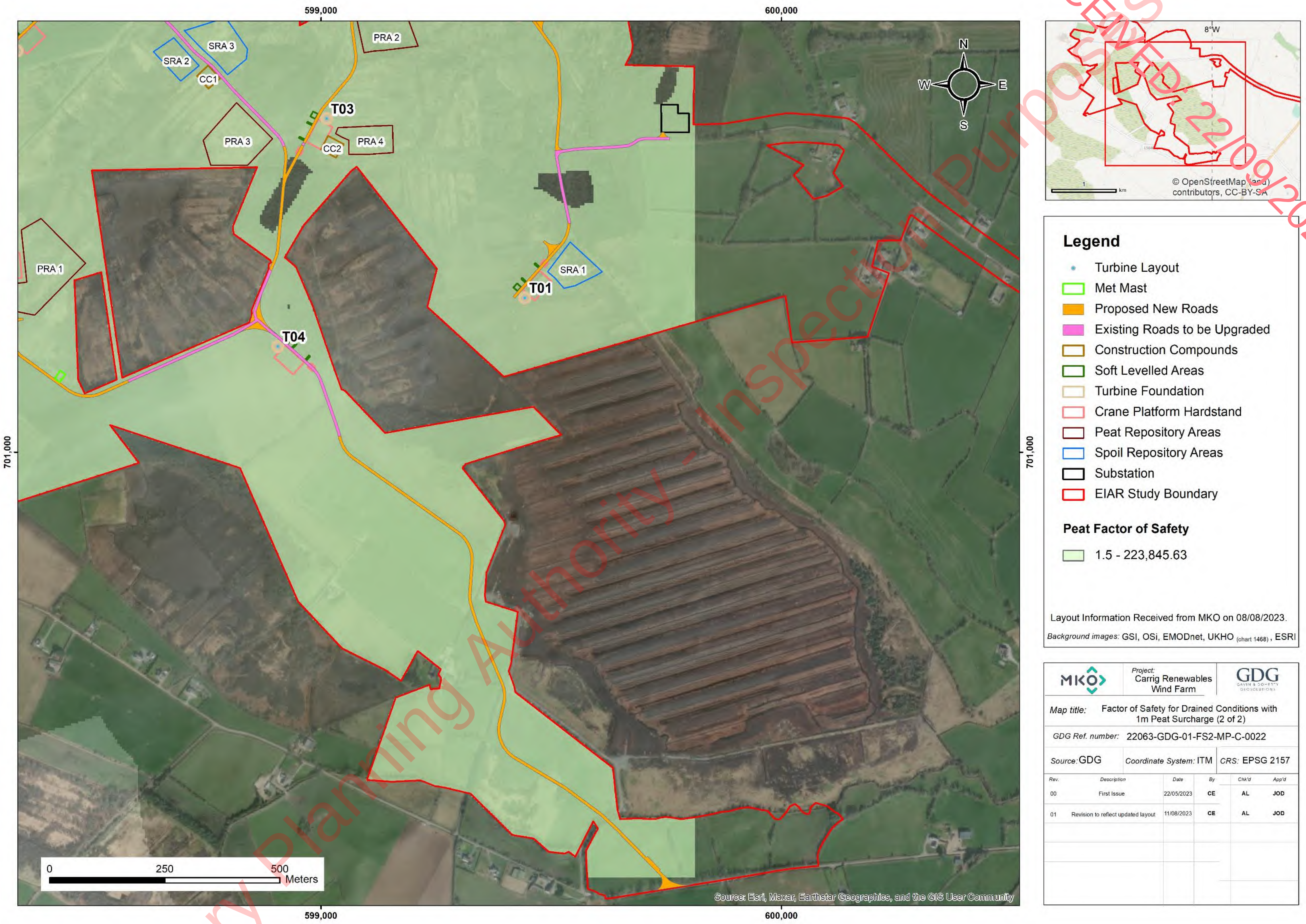
Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	11/08/2023	CE	AL	JOD

Figure K- 6: FoS for drained conditions (2 of 2).



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	11/08/2023	CE	AL	JOD

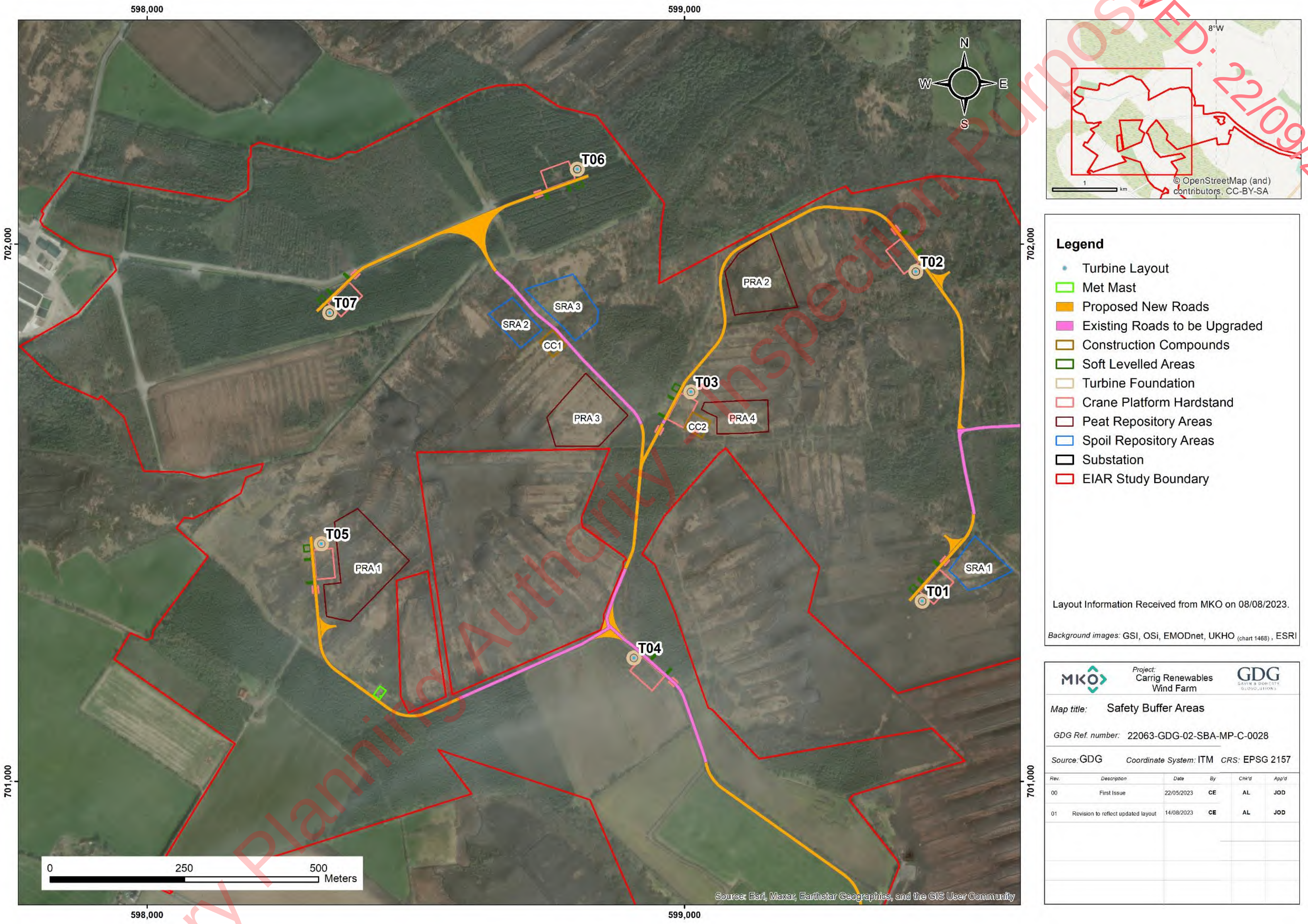
Figure K- 7: FoS for drained conditions and surcharge of 1 m (i.e. 10 kPa) (1 of 2).



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	11/08/2023	CE	AL	JOD

Figure K- 8: FoS for drained conditions and surcharge of 1 m (i.e. 10 kPa) (2 of 2).

Appendix L SAFETY BUFFERS



Rev.	Description	Date	By	Chk'd	App'd
00	First Issue	22/05/2023	CE	AL	JOD
01	Revision to reflect updated layout	14/08/2023	CE	AL	JOD

Figure L- 1 : Safety buffers (1 of 2).

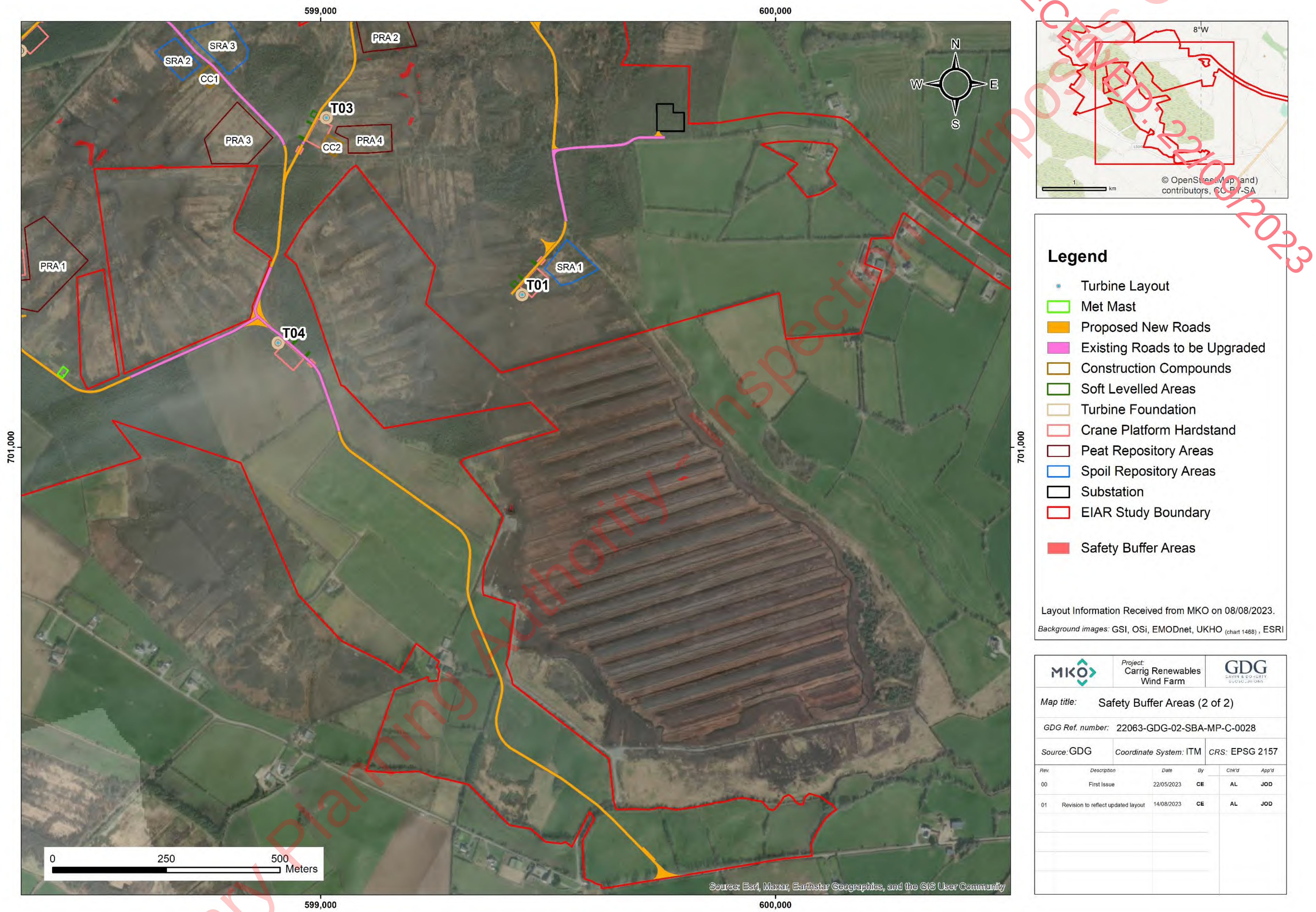


Figure L- 2: Safety buffers (2 of 2).

Appendix M PEAT STABILITY RISK CALCULATION

Table M- 1: Peat risk assessment at turbine 1.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Turbine 1**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Mar-23
Inspected by:	IPP
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			4.1	3.2	3.6	5.8	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~3.4m. Slope angle: 2.02º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP02) : Firm grey slightly sandy slightly gravelly CLAY with moderate cobble and low boulder content. Sand and gravel are fine to coarse, gravel is angular to subangular. Cobbles and boulders are subangular to subrounded of limestone.
		Peat fibres across transition to subsoil	No				NA	Yes	Partially	No	3	1	3	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	1	2	2	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	Flat topography.
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	Flat topography, but drains perpendicular to contours.
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	In very close proximity to turbary cutting
		Peat cuts vs contour lines	Oblique				NA	Perpendicular	Oblique	Parallel	2	1	2	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard total	34
Max. possible	102
Hazard 0-1	**0.33**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences total	11
Max. possible	33
Consequences 0-1	**0.33**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.33	0.33	=	**0.11**

Table M- 2: Peat risk assessment at turbine 2.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Turbine 2**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Aug-22
Inspected by:	CE
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			34.4	27.1	29.9	48.8	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~3.7m. Slope angle: 0.2º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	NA				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	0	1	0	No TP at location
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	No TP at location
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	No TP at location
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Floating				NA	Solid	-	Floating	3	1	3	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$	33.5
Max. possible	93
Hazard $_{0-1}$	**0.36**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	14
Max. possible	33
Consequences $_{0-1}$	**0.42**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.36	0.42	=	**0.15**

Table M- 3: Peat risk assessment at turbine 3.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Turbine 3**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			13.6	8.48	11.3	15.0	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~1.6 m. Slope angle: 1.3º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Smooth rock				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	2	1	2	Nearest TP (TP03) records: Bed rock.
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness	Slowly squeezing				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	2	2	4	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	Yes				NA	-	-	Yes	3	1	3	Rapid water ingress at 0.9m bgl - possible peat pipe.
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Down slope				NA	Down slope	Varied / Oblique	Across slope	1	1	1	Very low slope angle, but drains perpendicular to contours.
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{\text{total}}$ 38

Max. possible 102

Hazard $_{0\text{-}1}$ **0.37**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{\text{total}}$ 11

Max. possible 33

Consequences $_{0\text{-}1}$ **0.33**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.37 0.33 = **0.12**

Table M- 4: Peat risk assessment at turbine 4.

GAVIN & DOHERTY GEOSOLUTIONS

MKO

Carrig Wind Farm

Inspected on: Nov-22
Inspected by: CE
Completed by: CE
Date: Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			51.29	20.72	41.68	36.16	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~0.67 m. Slope angle: 0.8º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP08) records: Firm grey mottled orange slightly sandy slightly gravelly CLAY with moderate cobble and low boulder content. Sand and gravel are fine to coarse, gravel is subangular to subrounded. Cobbles and boulders are subrounded of limestone.
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Grassland				NA	Dry heather	Grassland	Wetlands	2	1	2	Agricultural tillage land
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$ 23

Max. possible 102

Hazard $_{0-1}$ **0.23**

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	**1**	**2**	**3**				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	No peat.
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 8

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 33

Consequences $_{0-1}$ **0.24**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.23 0.24 = **0.05**

Table M- 5: Peat risk assessment at turbine 5.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Turbine 5**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Mar-23
Inspected by:	IPP
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			48.7	29.9	40.4	52.7	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~ 1.5m. Slope angle: 0.37º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Soft sensitive clay				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	3	1	3	Nearest TP is TP104: Light grey sandy CLAY. Sand is fine to medium, subangular to subrounded. Presence of cobbles (15-30cm). Presence of white loose fine to medium sand. (TP06, also nearby records: Soft damp grey slightly sandy slightly gravelly CLAY with moderate cobble and boulder content. Sand is fine to coarse, gravel is fine to coarse, angular to subangular.) Cobbles and boulders are subangular of limestone. One boulder is 70cm.
		Peat fibres across transition to subsoil	Partially				NA	Yes	Partially	No	2	1	2	
		Peat wetness	Slowly squeezing				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	2	2	4	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	200 - 300				NA	> 300	200 - 300	< 200	2	1	2	
		Surface moisture index (NDMI)	0 - 96				NA	0 - 96	96 -135	135 - 174	1	1	1	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Down slope				NA	Down slope	Varied / Oblique	Across slope	1	1	1	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	37
Max. possible	102
Hazard $_{0-1}$	**0.36**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	Farm out-houses	NA	Farm out-houses	-	Dwelling	1	1	1	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	11
Max. possible	33
Consequences $_{0-1}$	**0.33**

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.36	0.33	=	**0.12**

Table M- 6: Peat risk assessment at turbine 6.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Turbine 6**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			44.3	31.77	37.51	48.60	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~2.5 m. Slope angle: 0.25°
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Soft sensitive clay				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	3	1	3	Nearest TP (TP05) records: Very soft damp light grey slightly sandy SILT with occasional rootlets. Sand is fine.
		Peat fibres across transition to subsoil	No				NA	Yes	Partially	No	3	1	3	Peat highly decomposed.
		Peat wetness	Extremely wet / Undiggable				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	3	2	6	Peat very wet.
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	Flat area.
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	Yes				NA	-	-	Yes	3	1	3	Rapid inflow of water in TP05
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	Very low slope angle, but large drain very near to turbine site.
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	No bush - forestry area.
		Forestry (if applicable)	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	No peat cuts.
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	40.5
Max. possible	102
Hazard $_{0\text{-}1}$	**0.40**

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	**1**	**2**	**3**				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	Farm out-houses	NA	Farm out-houses	-	Dwelling	1	1	1	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	15
Max. possible	33
Consequences $_{0\text{-}1}$	**0.45**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.40 0.45 = **0.18**

Table M- 7: Peat risk assessment at turbine 7.

GDG GAVIN & DOHERTY GEOSOLUTIONS

Peat Stability Risk Assessment (PSRA)

MKO

Carrig Wind Farm

Location:	**Turbine 7**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Mar-23
Inspected by:	IPP
Completed by:	CE
Date:	Apr-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			37.6	18.00	31.37	48.60	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~1.8 m. Slope angle: 0.4º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP103) records:Grey very gravelly very sandy CLAY. Sand is fine to coarse, angular to subrounded. Gravel is fine to coarse, angular to subrounded.
		Peat fibres across transition to subsoil	No				NA	Yes	Partially	No	3	1	3	Peat highly decomposed.
		Peat wetness	Slowly squeezing				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	3	2	6	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	Flat area.
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	Very low slope angle, but large drain fairly near to turbine site (<50m).
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	No bush - forestry area.
		Forestry (if applicable)	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	No peat cuts.
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$	35.5
Max. possible	102
Hazard $_{0-1}$	**0.35**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	Farm out-houses	NA	Farm out-houses	-	Dwelling	1	1	1	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	15
Max. possible	33
Consequences $_{0-1}$	**0.45**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.35 0.45 = **0.16**

Table M- 8: Peat risk assessment at Construction Compound 1.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Temporary compound site**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Jan-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			29.5	13.5	24	23	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 0.85, Slope angle: 1.15
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Smooth rock				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	2	1	2	Nearest TP (TP04) Records: Bedrock
		Peat fibres across transition to subsoil	Yes				NA	Yes	Partially	No	1	1	1	
		Peat wetness	Dry / Stands well				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	1	2	2	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	Flat
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Down slope				NA	Down slope	Varied / Oblique	Across slope	1	1	1	Very low slope angle, but drains perpendicular to contour lines.
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Dry heather				NA	Dry heather	Grassland	Wetlands	1	1	1	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	Peat cuts set back from site.
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	-				NA	Solid	-	Floating	2	1	2	Unsure if founded or floated.
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	34
Max. possible	102
Hazard $_{0-1}$	**0.33**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	10
Max. possible	33
Consequences $_{0-1}$	**0.30**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.33	0.30	=	**0.10**

Table M- 9: Peat risk assessment at Construction Compound 2.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Temporary compound site 2**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Jan-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			7.97	4.78	7	8.41	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 1.5, Slope angle: 2.4
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Smooth rock				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	2	1	2	Nearest TP (TP03) Records: Bedrock
		Peat fibres across transition to subsoil	Yes				NA	Yes	Partially	No	1	1	1	
		Peat wetness	Dry / Stands well				NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	1	2	2	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	Flat
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Down slope				NA	Down slope	Varied / Oblique	Across slope	1	1	1	Very low slope angle, but drains perpendicular to contour lines.
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Dry heather				NA	Dry heather	Grassland	Wetlands	1	1	1	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	Peat cuts set back from site.
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	-				NA	Solid	-	Floating	2	1	2	Unsure if founded or floated.
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	34
Max. possible	96
Hazard $_{0-1}$	**0.35**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	10
Max. possible	33
Consequences $_{0-1}$	**0.30**

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.35	0.30	=	**0.11**

Table M- 10: Peat risk assessment at the Substation.

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Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Substation**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Jan-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			51606	10.319	41284	17.86	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~0 m. Slope angle: 2.78º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (T1TP, 30m away from compound) records: Bed Rock.
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	No information given on log
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	No information given on log
	Topography	General curvature downslope	-				NA	-	Planar	Convex	1	1	1	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	NA				NA	Localised	Ponded in drains	Springs	0	1	0	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry (if applicable)	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	23.5
Max. possible	96
Hazard $_{0-1}$	**0.24**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	No peat.
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	8
Max. possible	33
Consequences $_{0-1}$	**0.24**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.24	0.24	=	**0.06**

Table M- 11: Peat risk assessment at the Met Mast.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**Met Mast**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Jan-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			562.00	51.07	450.5	88.57	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~0 m. Slope angle: 0.51°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g.	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP07) records: Soft grey slightly sandy slightly gravelly slightly silty CLAY with high cobble and boulder content. Sand and gravel are fine to coarse, gravel is angular to subrounded. Cobbles and boulders are subrounded of limestone.
		Peat fibres across transition to	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	23.5
Max. possible	96
Hazard $_{0-1}$	**0.24**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow	NA	NA	Small	Medium	Large	0	3	0	No peat.
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	8
Max. possible	33
Consequences $_{0-1}$	**0.24**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.24	0.24	=	**0.06**

Table M- 12: Peat risk assessment at PRA 1.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**PRA 1**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value U	Value US	Value D	Value DS	Rating criteria 0	Rating criteria 1	Rating criteria 2	Rating criteria 3	Rating value	Weighting	Score	Comment
Factor of Safety			8.0	5.1	6.6	9.0	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~1.8m. Slope angle: 2º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g.	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP is TP104: Light grey sandy CLAY. Sand is fine to medium, subangular to subrounded. Presence of cobbles (15-30cm). Presence of white loose fine to medium sand. (TP06, also nearby records: Soft damp grey slightly sandy slightly gravelly CLAY with moderate cobble and boulder content. Sand is fine to coarse, gravel is fine to coarse, angular to subangular.)
		Peat fibres across transition to	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	29.5
Max. possible	96
Hazard $_{0-1}$	**0.31**

Consequence factors	Value	Rating criteria 0	Rating criteria 1	Rating criteria 2	Rating criteria 3	Rating value	Weighting	Score	Comment
Volume of potential peat flow	NA	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	11
Max. possible	33
Consequences $_{0-1}$	**0.33**

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.31	0.33	=	**0.10**

Table M- 13: Peat risk assessment at PRA 2.

GDG GAVIN & DOHERTY GEOSOLUTIONS
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Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**PRA 2**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			1.6	1.3	1.4	2.3	-	≥ 1.3	1.3 - 1.0	≤ 1.0	2	10	20	Peat depth: ~3.5 m. Slope angle: 6º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	NA				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	0	1	0	No neaby trial pit
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	No neaby trial pit
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	No neaby trial pit
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$	41.5
Max. possible	93
Hazard $_{0-1}$	**0.45**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	**1**	**2**	**3**				
Volume of potential peat flow	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	14
Max. possible	33
Consequences $_{0-1}$	**0.42**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.45	0.42	=	**0.19**

Table M- 14: Peat risk assessment at PRA 3.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**PRA 3**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			17.4	9.1	14.3	15.9	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 1.5m. Slope angle: 1.1º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g.	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Smooth rock				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	2	1	2	Nearest TP (TP04) Records: Bedrock
		Peat fibres across transition to	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	200 - 300				NA	> 300	200 - 300	< 200	2	1	2	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Hazard $_{total}$	29.5
Max. possible	96
Hazard $_{0-1}$	**0.31**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow	Small	NA	Small	Medium	Large	1	3	3	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequences $_{total}$	11
Max. possible	33
Consequences $_{0-1}$	**0.33**

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.31 0.33 = **0.10**

Table M- 15: Peat risk assessment at PRA 4.

GDG GAVIN & DOHERTY GEOSOLUTIONS
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Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**PRA 4**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			17.4	7.4	14.1	13.0	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~0.75 m. Slope angle: 2.2º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP03) records: Bed rock.
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$ 23.5

Max. possible 96

Hazard $_{0-1}$ **0.24**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	1	2	3				
Volume of potential peat flow	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 12

Max. possible 33

Consequences $_{0-1}$ **0.36**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.24 0.36 = **0.09**

Table M- 16: Peat risk assessment at SRA 1.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**SRA 1**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			2.0	1.4	1.7	2.5	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~2.4 m. Slope angle: 6º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP02) : Firm grey slightly sandy slightly gravelly CLAY with moderate cobble and low boulder content. Sand and gravel are fine to coarse, gravel is angular to subangular. Cobbles and boulders are subangular to subrounded of limestone.
		Peat fibres across transition to subsoil	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	Parallel				NA	Perpendicular	Oblique	Parallel	3	1	3	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$	27.5
Max. possible	96
Hazard $_{0-1}$	**0.29**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	**1**	**2**	**3**				
Volume of potential peat flow	Medium	NA	Small	Medium	Large	2	3	6	
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	14
Max. possible	33
Consequences $_{0-1}$	**0.42**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.29	0.42	=	**0.12**

Table M- 17: Peat risk assessment at SRA 2.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**SRA 2**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			14.3	7.2	11.7	12.5	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~01m. Slope angle: 2º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g.	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP04) Records: Bedrock
		Peat fibres across transition to	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard $_{total}$ 25.5

Max. possible 96

Hazard $_{0-1}$ **0.27**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow	Small	NA	Small	Medium	Large	1	3	3	No peat.
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 11

Max. possible 33

Consequences $_{0-1}$ **0.33**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.27 0.33 = **0.09**

Table M- 18: Peat risk assessment at SRA 3.

Peat Stability Risk Assessment (PSRA)

Carrig Wind Farm

Location:	**SRA 3**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	Nov-22
Inspected by:	CE
Completed by:	CE
Date:	Aug-23

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			5.7	4.1	4.9	7.3	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~2.5m. Slope angle: 2º.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g.	NA				NA	-	-	Yes	0	2	0	
	Subsoil conditions (visible in trial pits)	Subsoil type	Gravel / Firm glacial till				NA	Gravel / Firm glacial till	Smooth rock	Soft sensitive clay	1	1	1	Nearest TP (TP04) Records: Bedrock
		Peat fibres across transition to	NA				NA	Yes	Partially	No	0	1	0	
		Peat wetness					NA	Dry / Stands well	Slowly squeezing	Extremely wet / Undiggable	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	< 200				NA	> 300	200 - 300	< 200	3	1	3	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	< 1000 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	1	1	1	
	Vegetation	Bush	NA				NA	Dry heather	Grassland	Wetlands	0	1	0	
		Forestry	Good growth				NA	Good growth	Fair	Stunted growth	1	1.5	1.5	
	Peat workings	Peat cuts presence	-				NA	-	Cutaway / Turbary	Machine cut	1	1	1	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Solid				NA	Solid	-	Floating	1	1	1	
	Time of year for construction		Late Summer, Autumn				NA	Spring	Winter, Early Summer	Late Summer, Autumn	3	1	3	Wost case estimate

Hazard	
0.0 - 0.3	Negligible
🟩 0.3 - 0.5	Low
🟨 0.5 - 0.7	Medium
🟥 0.7 - 1.0	High

Hazard $_{total}$	25.5
Max. possible	96
Hazard $_{0-1}$	**0.27**

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow	Medium	NA	Small	Medium	Large	2	3	6	No peat.
Downslope hydrology features	Minor undefined watercourse	NA	Bowl / contained	Minor undefined watercourse	Valley	2	1	2	
Proximity from defined valley (m)	> 500	NA	> 500	200 - 500	< 200	1	1	1	
Downhill slope angle	Horizontal	NA	Horizontal	Intermediate	Steep	1	1	1	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences	
0.0 - 0.3	Negligible
🟩 0.3 - 0.5	Low
🟨 0.5 - 0.7	Medium
🟥 0.7 - 1.0	High

Consequences $_{total}$	14
Max. possible	33
Consequences $_{0-1}$	**0.42**

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
🟩 0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
🟨 0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time
🟥 0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.27	0.42	=	**0.11**

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