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Kellystown Wind Farm, Drogheda, Co. Louth, Ireland

**Desktop Study and Walkover Survey for Preliminary
Determination of Ground Conditions**

Report No: 2200-23A **DRAFT**

4th April 2023

*This document has been prepared by Whiteford Geoservices Ltd
on behalf of*

EDF Renewables Ltd



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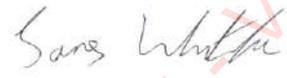
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Kellystown Wind Farm, Co. Louth

[SOILS AND GEOLOGY STUDY]

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Desktop Study and Walkover Survey – Kellystown Wind Farm, near Drogheda, County Louth, Ireland

Client: EDF Renewables

Date: 4th April 2023

Report No. 2200-23A

Statement of Authority

John Whiteford BSc (Hons) Geophys AMIOSH MEAGE FGS has more than 26 years of experience in the field of earth sciences, geotechnical engineering and management. His academic qualifications are a BSc with Honours in Geophysics from Edinburgh University, with memberships of The European Association of Geoscientists and Engineers and The Institute of Safety and Health.

Commencing work with Kirk McClure Morton (Consulting Engineers) in Belfast, he has been engaged in full-time consultancy for the past 22 years and since 1996 trading as Whiteford Geoservices Ltd. The company and its staff of professional and technical personnel and has completed in excess 2100 contracts for clients within the construction and mineral exploration sectors where they have built up a recognised level of specialist experience, particularly in the field of Wind Energy. Working at home, in Europe and worldwide the company has been involved in more than 100 wind power projects where our services have been sought in relation to foundation design, peat slide risk assessment, geophysics, electrical earthing design and thermal resistivity analysis.

The following report contains an analysis of the soils and geology present at the target site and also assesses the risk presented by organic soils.

Assessment of the former draws from, 'Design Manual for Roads and Bridges ("DMRB") Volume 11, Section 3 (Environmental Assessment), Part 11: Geology and Soils, but also references, the current best practice guidance presented in the English Nature publication 'Geological conservation – a guide to good practice'.

Assessment of the latter employs guidance contained within the Scottish Executive's "*Peat Slide Hazard and Risk Assessment – Best Practice Guide for Proposed Electricity Generation Developments*", published as a Second Edition April 2017 (referred to as "the Scottish Guidance").

This Best Practice Guide was updated, in part, in April 2017, and for the purpose of clarity the protocols adopted to determine Peat Slide Hazard Ranking are consistent with the version of the report, as published in 2017. Unless otherwise stated, all assessments and conclusions contained within this report are made with reference to either the 2006 or 2017 publication. Where variations from the guidance occur the reason for this is provided, either within the text or as a footnote.

This report details the works undertaken by Whiteford Geoservices Ltd at the site of the proposed Kellystown Wind Farm near Drogheda, Co. Louth

Dated: 4th April 2023

1.0 INTRODUCTION

1.1 Background and Purpose of Desk Study and Walkover Survey

This report relates to the first stage of an assessment into the Soils and Geology at Kellystown Wind Farm near Drogheda, Co. Louth.

In November 2022 Whiteford Geoservices Ltd was commissioned by EDF Renewables to undertake this assessment in order to the potential impact to, and from, the proposed wind farm development.

Reporting for the purposes of this Soils and Geology Assessment has been split into three (3) distinct elements, as follows:

1. Desktop Study and Walkover Survey Report 2200-23A. This report details the findings of desktop analysis and site scoping of the general area within which the proposed wind farm is to be constructed. This report identifies the existing site conditions, potential sensitive receptors, potential preconditions that increase the risk of peat instability and pre-failure indicators present at the site. The report includes with a preliminary screening assessment of the Hazard of Peat Slide occurrence.
2. Preliminary Site Investigation Works Report 2200-23B. This report presents the findings of supplementary field work undertaken following on from the preliminary assessment of hazard. These additional investigations have been employed to determine ground composition at the site of each proposed wind turbine generator, as well as to screen for the presence of “karst”.
3. Soils and Geology Report 2200-23C. This report takes the preliminary findings from Item 1 above and reviews the information in light of both the development layout plan and the site investigation works carried out and reported as Item 2. In this particular case the “Peat Stability and Hazard Assessment” element of this report. normally included in Report 2200-23C, is not required due to the absence of Peat soils.

The purpose of this reporting is to determine the potential hazards associated with the existing soils and geology environment directly attributable to the construction of new proposed turbines, tracks and infrastructure throughout the proposed lifetime of the scheme.

This portion of the soils and geology assessment consists of both a desktop review of available ground information and a walkover survey conducted at the proposed development site. Where organic or peat soils are present the report would also contain an assessment of peat stability (not applicable in this case).

The findings of the desktop study and walkover survey have been employed to obtain a baseline overview with respect to the soils and solid geology present within the boundary of the proposed development site.



Figure 1 – General Site Location
(Reproduced courtesy of Google maps 2023)

The purpose of this stage of the assessment is as follows:

- Undertake initial scoping of the existing geology, topography, ground stability and hydrology surrounding the site.
- Identify all potential soils and geology related factors that impact upon development at the site, such as “karst” rock instability, peat instability, weak soils, groundwater, contamination, seismic activity etc.

Environmental legislation that is relevant to the hydrological aspects of this study is as follows:

- Quality of Water Intended for Human Consumption (80/778/EEC) and Quality of Water Intended for Human Consumption Directives (98/83/EC).

The Water Framework Directive (WFD) which was passed by the European Union (EU) in 2000 is a wide-reaching legislation that will eventually replace a number of the previous water quality directives (for example, those on Water Abstraction) while implementation of others (for example,

The Integrated Pollution Prevention and Control and Habitats Directives) will form part of the 'basic measures' for the Water Framework Directive.

1.2 Timescale

Desktop based research and the scoping walkover surveys were carried out in January 2023 by Mr John Whiteford of Whiteford Geoservices Ltd.

2.0 EXISTING ENVIRONMENT

2.1 Topography

Analysis of coarse topographic information indicates that Kellystown Wind Farm occupies undulating lands, which slope generally in a southerly direction.

Ground surface level elevations vary between approximately 91m to 126m above Ordnance Datum (Malin Head).

2.2 Land Usage

2.2.1 Current

Land usage does not appear to vary significantly across the various land holdings which make up the Kellystown Wind Farm development; these being typified typically by pastureland and rough grazing for cattle.

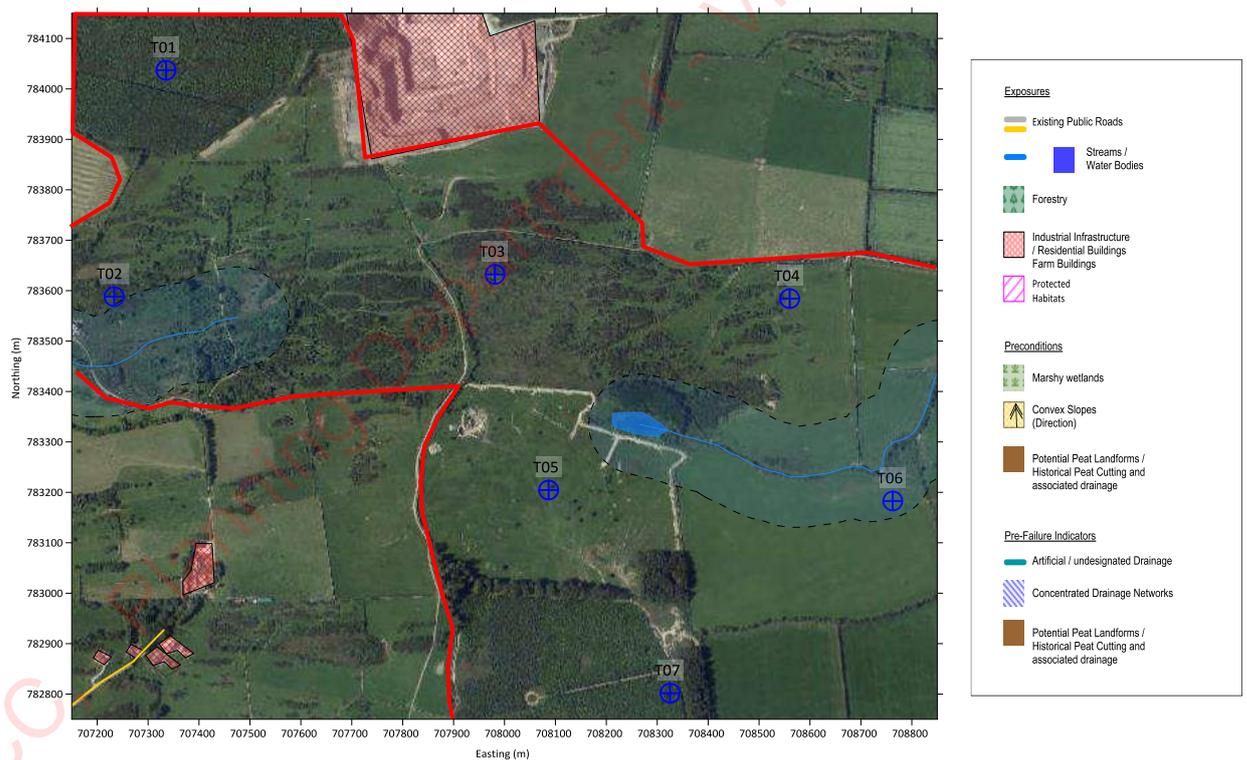


Figure 1A – General Site Location Annotated with Local Features
Reproduced courtesy of www.maps.google.co.uk

The closest active quarrying operations to the site, are at Gallstown Quarry operated by Kilsaran, immediately north of the proposed wind farm development.

Surface water flowing from Kellystown Wind Farm is split into two water local catchments.

Watercourses such as the Hammondstown Stream, within the north western portion of the site (in the vicinity of WTG01 and WTG02, initially flow westwards to join the River White and then northwards to merge with the River Dee before entering the Irish Sea at Annagassan Port, approximately 10km north of the site. Watercourses within the remainder of the site (in the vicinity of WTG03, 04, 05, 06 and WTG07, such as Piperstown Stream and Drumshallon Lough Stream flow eastwards to merge with the Termonfeckin Stream, which ultimately enters the Irish Sea at Termonfeckin.

Groundwater in the vicinity of WTG03, 04, 05, 06 and WTG07 can ultimately be expected to drain through the permeable subsoils and shallow fractured rock until it enters either the Piperstown Stream, Drumshallon Lough Stream. Groundwater in the vicinity of WTG01 and WTG02 will in a similar manner ultimately enter the Hammondstown Stream.

The Geological Survey of Ireland does not record the presence of “karst” features, nor subterranean groundwater flow was identified at Kellystown Wind Farm. However, the author has noted that the underlying rock formation is described as “calcareous” and as such has the potential to be soluble and to be associated with subterranean flow systems. Further investigation is recommended to determine whether the subsurface rock formations are soluble and therefore “karstic”.

There are no residential dwellings located within the site boundary, with the closest inhabited buildings being approximately at least 700m from the development area. However, there are some buildings associated with an agricultural land use present within the development area.

2.2.2 Historic

A review of historical mapping, courtesy of OSI, suggests that the site of Kellystown Farm has not changed significantly in land use from that recorded on the 6” Second Edition Mapping, dated 1842.

2.3 Services & Utilities

Overhead electricity services were not recorded within the site boundary, however these services were recorded along the edge of the Ballymakenry Road at the site entrance via Piperstown Livery and Equestrian Centre.

A gas transmission line runs south east to north west through the development area, and less than 300m distant from T4 and T6 at closest approach. No further underground services were identified within the site boundary, although it is anticipated that minor water services, telecoms and electricity

may serve existing farm buildings and facilities within the site boundary. These are similarly anticipated to be present within the highway or verge of the minor road, at the site entrance.

2.4 Geology

2.4.1 Soils and Sub-soils

A study was made of available geological information for the area (GSI Online Database). This study indicated that the following natural geology is predominately present across the site of Kellystown Wind Farm.

- Thickly bedded calcareous greywacke which outcrops within the western portion of the site
- Glacial Till (derived from Lower Palaeozoic sandstones and shales)
- Alluvium (present in river valley bottoms)
- Cutover Raised Bog (isolated discrete locations)

2.4.2 Solid Geology

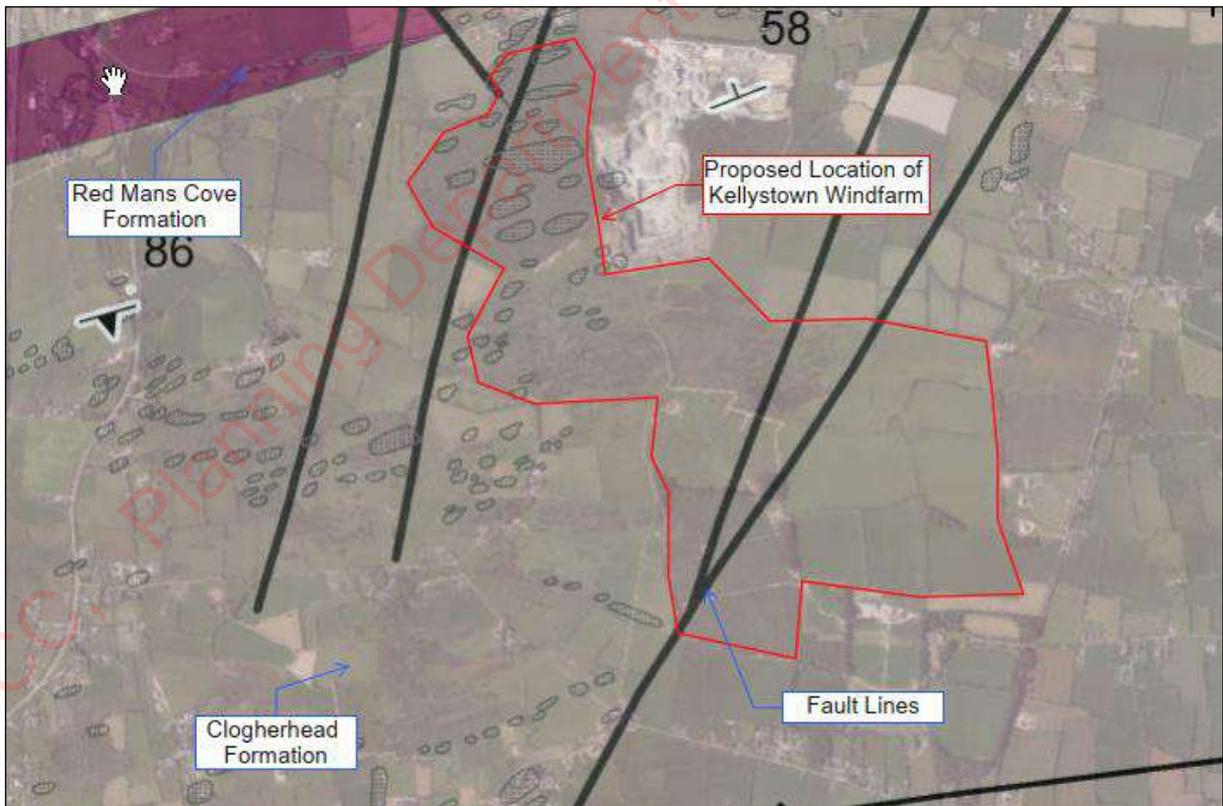


Figure 2A – Bedrock Solid Geology
Reproduced courtesy of GSI Datasets Public Viewer

According to the GSI online database, Kellystown Wind Farm the uppermost rock strata relates to the Clogherhead Formation which consists of, thickly bedded calcareous greywacke.

Also present just north east of the site boundary is the Red Mans Cove Formation which consists of, red, green, black mudstone

2.4.3 Superficial Geology

Superficial soils present within the wind farm largely consist of thin glacial till soils overlying shallow, often outcropping greywacke rock, or glacial tills derived from Lower Palaeozoic sandstones and shales.

Alluvium is present throughout the boundary and some isolated area of peat are also indicated to be within the site boundary.

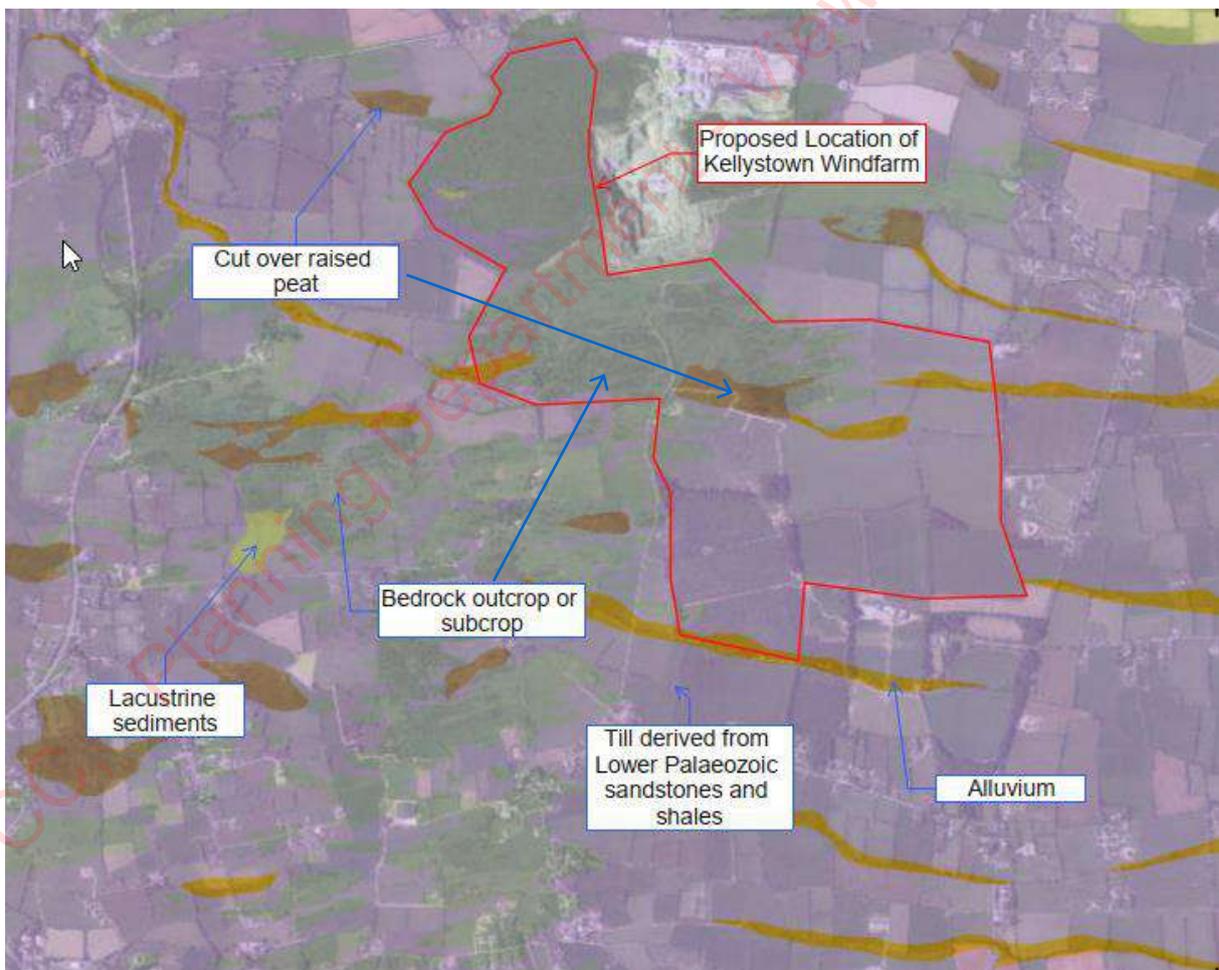


Figure 2B – Superficial Geology
Reproduced courtesy of GSI Datasets Public Viewer

2.5 Regional Hydrogeology

2.5.1 Aquifer Classification

A review of site hydrogeology was undertaken with respect to the Geological Survey of Ireland (GSI) Database's Aquifer Bedrock Potential, Superficial Aquifers and Groundwater Vulnerability Mapping.

Surface water is anticipated to enter the subsurface where the surface is permeable and can be expected to continue vertically downwards until it comes in contact with either an impermeable stratum or the water table. At this point the surface water will migrate in the same direction as the groundwater or according to the gradient of the impermeable stratum.

GSI database mapping indicates that the site is underlain by a poor bedrock aquifer which is generally unproductive.

Potential superficial aquifers have not been identified within the site boundary. GSI mapping considers the subsoils to be of low permeability.

2.5.2 Groundwater Vulnerability

The groundwater vulnerability within the site boundary of the development is predominantly "Extreme" to "High" where rock is either covered by thin permeable tills or outcrops at the surface.

2.5.3 Well Database

The GSI database records no water wells within the site boundary. The closest recorded water wells (BH1 & BH2) servicing the Grangebellew Group Supply Scheme are located north of the R170 and immediately west of the L2250 at Grangebellew, approximately 3.1km north of WTG04

The potential for adverse impact to this abstraction well, caused by the wind farm construction, is considered negligible.

2.6 Local Hydrology

2.6.1 Site Drainage

Across the proposed development site, a number of drainage channels and lake beds are evident. Most of these channels are generally less than 2m in width and depth and situated adjacent to field boundaries, access tracks or to effect removal of significant volumes of groundwater from fields.

Two ephemeral lakes have been identified;

1. Drumshallon Lough (practically dry at the time of the walkover survey)
2. An un-named lake (dry and vegetated at the time of the walkover survey) immediately north of WTG06.

A low impact on the current “natural hydrology”, as a result of the development, is anticipated following application of mitigation,

Please refer to the site walkover and reconnaissance section (Section 3.0) and Appendix 1, for details of site drainage features present within the site boundary.

2.6.2 Local Watercourses

For the purpose of defining watercourses as sensitive receptors these are deemed to fulfil the following criteria: -

1. Consistently contain flowing water / not ephemeral.
2. Be a natural watercourse with either a designated name or be a smaller tributary of a designated watercourse. i.e. Not man made in origin.
3. Flow underground through fissures, cavities or cave systems within limestone rock.

The development site for Kellystown Wind Farm has no major watercourses, however, there are several streams which run through the boundary and which discharge to the Irish Sea.

These are:

- Piperstown stream (Drains to the west)
- Drumshallon Lough Stream. (Drains to the east)
- Hammondstown Stream (Drains to the east)

2.6.3 Palaeo-Karst Features

Karst topography is defined as “An assemblage of topographic forms resulting from dissolution of the bedrock and consisting primarily of closely spaced sinkholes.” Karst topography can form in regions of exceptionally soluble rocks, including Limestone.

Soluble rocks generally mean the presence of limestone, chalk or evaporite deposits such as gypsum that contain carbonates. These carbonates are particularly susceptible to dissolution under

the action of acid rainfall, leaving to the development of cavities and deep weathering within the rock formation.

The presence of such features has, in some cases, resulted in structural instability. The walkover survey did confirm that landforms / features consistent with a “karst” landscape are present at Kellystown Wind Farm, particularly in the vicinity of turbines T04 and T05.

In order to effectively screen for the presence of “karst”, further sampling and assessment of the solid geology has been undertaken during the follow-on Site Investigation phase of the Soils and Geology study.

The results of this investigation are reporting on in Report 2200-23B/22.

GSI records do not record the presence of “karst” features within the site boundary and the closest GSI record of a “karst” features are shallow holes and enclosed depression located approximately 6km south west of site boundary.

In summary, the potential for “karstified rock” to affect the stability of installed structures and infrastructure is considered to be a Medium Hazard for the wind farm site at all Turbine locations.

Specific supplementary ground investigation is proposed prior to construction to confirm both the stability and competence of the underlying soils and rock formation and to select the most appropriate design for foundations.

2.7 Mining or Active Quarry Operations

A review of the GSI Online Database mapping indicates that there is one quarry adjunct to the northern site boundary and the next closest approximately 11km to the south of the site. These are as follows: -

1. Gallstown Quarry (Greywacke – Hard rock aggregate) immediately north of Kellystown Wind Farm. Operated by Kilsaran.
2. Mullaghcrone Quarry (Limestone – Hard rock aggregate): 11 km south of Kellystown Wind Farm. Operated by Roadstone Ltd.

No records of shafts or adits associated with mineral exploration were observed within 10km of the Kellystown Wind Farm site.

2.8 Peat Disturbance and Soil Removal

At the site of Kellystown Wind Farm there are isolated areas of peat, which were initially identified from GSI mapping and confirmed during the walk over survey.

A total of three such areas of Cut-over Raised Bog are present in the development area (refer to Appendix 1, "GSI Superficial Geology"), as follows: -

- Depression associated with Drumshallon Lough, centred on E=708135, N=783401 – 240m south west of WTG04, 150m north of WTG05 and 170msouth of WTG03.
- Isolated depression centred on E=707668, N=782900 – 480m south west of WTG05 and 580m south west of WTG04.
- Area centred on E=708695, N=784040 – 420m north of WTG04.

Only one such area of cut-over raised peat bog, extending to c. 5.27ha, is located within the wind farm development area. This area of peat is associated with Drumshallon Lough and occupies a locally low portion of land, just north west of WTG05.

All turbine infrastructure is considered to be sufficiently distant from these fragments of bog, so as to render any negative impact to the construction works negligible.

2.8.1 Historic Landslides and Landslide Susceptibility

Records indicate no significant historic soils and rock movement within the site boundary or within 6km of the site.

GSI landslide susceptibility mapping also indicates that the site generally has a low to moderately low landslide susceptibility, although there does appear to isolated areas of Moderately High landslide susceptibility indicated by the mapping database midway between WTG03 and WTG04. A review of local ground slopes within the landholding indicates that the isolated moderately high susceptibility coincides with steeper slopes associated with outcropping rock.

The isolated area of cut-over Peat Bog coincides with slope gradients of <5 degrees to the horizontal and landslide susceptibility of Low / Moderately Low.

The Geological Survey of Ireland (GSI) records show that the closest recorded landslide event was approximately 6km, south west of the site and not related to peat instability.

Please refer to Appendix 1 for further details.

2.9 Potential Contamination

2.9.1 Land Contamination

Other than agriculture, the site has not been subject to the action of industrial activities that would have the potential to contaminate the soils at the site, although it is adjacent to established quarrying operations.

No significant areas of filled ground have been identified within the site boundary, although some local areas of filling are present to the south of WTG05, where this extends to approximately 0.2ha. Such areas of infill can result in a negative impact on natural soils, as a result of exposure to unknown historic contamination within the fill material. Areas of imported fill material should be further analysed to determine their significance with respect to site users and potential off-site disposal.

2.9.2 Contaminated Watercourses

There is no visual or olfactory evidence to suggest that any potential contaminants have significantly affected existing watercourses at the Kellystown Wind Farm site.

An assessment of baseline surface and groundwater should be included within the contaminated land investigations.

2.10 Analysis of Existing SI Information

A search for existing site investigation information within the immediate vicinity of the proposed new development has not yielded any useful data.

3.0 SUMMARY OF DESK STUDY

The following section summarises the findings of the desktop study carried out to determine local conditions at the site of Kellystown Wind Farm.

- The lands are classed as agricultural with no recorded significant industrial heritage associated with the site. Apart from the construction of small sections of metalled tracks, the proposed development of the wind farm will take place on natural soils, small areas of infilled ground and weak rock formations. For the purpose of construction these lands would be mainly classified as “greenfield”, although isolated portions of infill are present in the vicinity of WTG05.
- Geological studies indicate that the uppermost rock formation applicable to the majority of the site is Greywacke of the Clogherhead Formation, which is in turn mantled by superficial soils consisting of sandstone and shale derived tills. This rock may be at or very close to the surface.
- Greywacke rock pertaining to Clogherhead Formation appears to outcrop within the site boundary. GSI described this rock formation as “calcareous”. Where “calcareous” rocks are present typical “karst” features, such as sinkholes and subterranean chambers can potentially be present. Such features are associated with ground instability and are a recognised geo-hazard when encountered close to the surface. The landforms associated with the lake bed north of WTG05 show similarities to that exhibited by “Karst” landscape.
- The apparent absence of peat and presence of low slope gradients suggests that a peat stability assessment may not be required. Preliminary / scoping assessment of peat stability hazard carried out at Walkover Phase has confirmed this to be the case. No detailed peat assessment is anticipated to be necessary.
- Records indicate that the closest active quarrying operations are; hard rock extraction at Gallstown Quarry immediately north of the site.
- Hard rock aggregate quarries often have a requirement for rock blasting, resulting in the transmission of sonic and vibrational energy. Impacts to the proposed wind farm structures in relation to blasting at either of the closest quarries should be considered.
- No significant watercourses are present within the site boundary (refer to the Appendix for relevant mapping), although minor watercourses are present that connects with external significant watercourses. Care should be taken to ensure that any possible environmental impact caused by the construction process is minimised by implementing effective mitigation controls. There is also potential for subterranean flow to be present

within the site and as a result further fieldwork is recommended to assess these features on site. Supplementary investigations will be presented in Report 2200-23B that accompanies this report.

- Direct impact by peat debris flow on other more significant receptors, by either construction works or operations has been ruled out. The risk of soil debris flow, given the shallow ground slopes is low. In the event of a debris flow reaching a watercourse, there is potential for the wider environment to be impacted. The mechanisms for this impact would be by:
 - siltation pollution of watercourses and those into which they flow.
 - deterioration in river water quality and that of waterways into which they flow.
 - impact to water borne flora and fauna.
 - damage to highways and third-party structures.
 - damage to overhead and underground services.
 - damage to bridge or culvert structure crossing the affected watercourse.

For these reasons, impact on designated watercourses, or subterranean flow networks, is considered critical and directly related to the potential for impact of other sensitive receptors downstream. Once a debris flow reaches a water body its impact can be transmitted far from its initial point of entry. Consideration of designated watercourses and subterranean networks as sensitive receptors thus includes for the potential impacts detailed above. Refer to the Preliminary Risk Plot¹ for an initial screening assessment of the Hazard of Peat Instability with respect to all receptors.

- The majority of the site is of high to extreme groundwater vulnerability, where highly bedrock is close to the surface. Care must therefore be taken when carrying out works in these areas to avoid any possible contamination entering the groundwater aquifer.

¹ Finalised following walk over survey fieldwork and testing

4.0 SITE WALKOVER SURVEY

4.1 Introduction

A reconnaissance / walk over survey was undertaken by Whiteford Geoservices Ltd at the proposed site of Kellystown Wind Farm following completion of the desk-based study. This had the general objective of identifying and assessing on-site features, which could affect both the construction and / or operation of the wind energy development.

This walkover survey (see section 4.0) has taken into account the findings of the initial desktop study and includes a preliminary investigation of the potential receptors, preconditions and failure mechanisms. Following the walkover survey further ground investigations have also been recommended (see follow on Report, 2200-23B); specified in order to aid further understanding of the subsurface in order to determine preliminary geotechnical parameters ahead of final design. The final report 2200-23C, will contain an amalgamated of the desktop study, walkover and site investigation phases.

4.2 Survey Date

The site walkover survey was carried out by John Whiteford of Whiteford Geoservices Ltd on 24th January 2022.

Weather conditions consisting of generally mild temperatures were experienced during the site walkover survey.

4.3 Survey Strategy

The site walkover survey was carried out in order to record the following general on-site information in the vicinity of the main infrastructure, and to act as a confirmatory method to the desk-based study:

- “Spot” check for presence of peat soils and thickness
- Nature of superficial deposits
- Existing bedrock geology (where exposed)
- Presence of significant landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note.
- Topography – significant slopes
- Relative position of potential receptors such as buildings, roads, watercourses, etc.
- Location of any services / utilities
- Identification of any regions of sensitive ground

Practically, this analysis was made at a series of positions in the vicinity of the proposed turbine infrastructure, in order to gain a preliminary geotechnical understanding of ground conditions that might affect the stability of lands at and immediately surrounding the wind energy development.

5.0 PREVAILING SITE CONDITIONS

(As determined from the Desk Study)

The proposed development site has an agricultural land use where these lands consists of grazing land, semi improved grass land and coniferous forestry.

The following section details the various soils and geology characteristics encountered during the walkover survey carried out at Kellystown Wind Farm.

5.1 Superficial Deposits

Desk study analysis indicates that the superficial soils consist of thin glacial tills mantled by organic topsoil. Isolated areas of weak cut over raised peat bog are present, but considered sufficiently distant to the planned infrastructure so as to have no impact on stability.

The walkover survey generally confirms this to be the case.

5.2 Solid Geology

During the site reconnaissance survey, it was not possible to determine the depth that bedrock will be encountered across the development site, nor the rock type, as exploratory hole data collected on site terminated without reaching the bedrock level.

Regions of outcropping weathered rock were identified within the proposed development site during the desktop study, where they were restricted to the north and west of the site. In particular outcropping rock was recorded in the vicinity of WTG01, WTG02, WTG03 and WTG04.

The Author believes that the solid geology of the site is not dissimilar to what has been published by the GSI.

No further information with respect to the solid geology was added following the walkover.

5.3 Existing Slopes

An analysis of OSI topographic data was undertaken to identify the variation in gradient applicable to the existing slopes within the vicinity of the proposed wind farm infrastructure. This was primarily used to determine the susceptibility of peat soils to movement and is applied here for the propose of providing a preliminary determination of hazard with respect to peat stability.

Both Evans and Warburton (2007) and Boylan et al. (2008) found from their analysis of recorded failures in blanket bog, that failures were often recorded for slopes of typically 4 – 8 degrees to the horizontal. In such cases the mechanism of failure is almost certainly, exclusively, by tear induced “bog burst” (i.e. peat, on average, greater than 2.5m thick) with very little to do with the surface slope gradient, where the cause is a build-up of excessive hydrostatic pressure in the peat mass.

Peat residing on slopes in excess of 8 degrees is generally thin and unlikely to accumulate to the thickness required for “bog burst” to occur. Gravity as opposed to hydrostatic pressure is the main precondition for landslide in this case.

In thick peat the peat failure mechanism is normally internal and not due to a detaching of the peat soils from the underlying mineral substrate or as a result of activation along on surface tear, as would be the case on steeper slopes and shallower peat.

A common mechanism for internal failure is increased hydrostatic pressure which occurs when significant rainfall falls on peat soils. This both increases the weight of the peat bog and can cause any minor weaknesses in the bog structure to be activated as the system attempts to reduce the internal pressure. Such internal failure is then likely to cause detachment to occur below the failure point, which in turn results in the peat mass moving under gravity along the water-lubricated basal plane; where the peat – mineral soil friction may never have been exceeded.

Friction at the base of the peat is nonetheless important and thus it is important to consider the existing slope gradient as a potential trigger and precondition for a peat slide. This is especially the case where thinner peat thicknesses are present for which “bog burst” is much less likely to occur.

For these reasons, a banded factor-based approach is advocated for the purpose of apportioning risk. The following bands are used for this purpose and are based on our experience with accidently triggered peat slides at over 100 different wind farm sites.

Existing Slope Angle (<i>Measured at Surface of Peat, Angle to Horizontal</i>)	Risk Factor Assigned (<i>Using Factor Based Probabilistic Analysis</i>)	Remarks
0 - ≤5	0	Negligible influence
5 - ≤ 10	1	Low
10 - ≤ 22.5	2	Medium
>22.5	3	High

The additional risk of internal failure relating to “bog burst”, is allowed for by apportioning an additional risk factors based on peat thickness.

5.4 Observations

The following is an appraisal of ground conditions at the site of the approved Kellystown Wind Farm. Mapping is provided which indicates the point survey locations which have informed this assessment.

Point 1 - Turbine WTG01

Nature of Assessment	Observations
Position (ITM)	E=530662.7, N=648685.3
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	No outcropping rock
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None evident
Topography	0 - 5 degrees to horizontal at Turbine centre; up to 10 degrees area within the anticipated construction zone. Topography is generally irregular and probably the result of shallow or frequently outcropping bedrock.
Sensitive Receptors	Within coniferous forestry. No sensitive receptors recorded within the relevant buffer
Utilities: Underground or overhead	None recorded within relevant buffer
Any other observations	Badger sett or fox den in the immediate vicinity. Borehole Standpipe identified within 200m of the Turbine

Point 2 - Turbine WTG02

Nature of Assessment	Observations
Position (ITM)	E=530315.0, N=648361.9
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	No outcropping rock recorded at turbine centre. Undulating surface topography suggests rock is shallow.
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None evident

Topography	0 - 5 degrees to horizontal. Irregular surface topography – probable thin soils overlying rock.
Sensitive Receptors	Within coniferous forestry. No sensitive receptors recorded within the relevant buffer
Utilities: Underground or overhead	None recorded within relevant buffer
Any other observations	Unable to reach the centre of the turbine due to thick vegetation.

Point 3 - Turbine WTG03

Nature of Assessment	Observations
Position (ITM)	E=530176.2, 647991.3
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	Outcropping rock in vicinity of the turbine
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	None evident
Topography	5 - 10 degrees to horizontal in the vicinity of the turbine. Very undulating topography suggesting thin soil cover over rock
Sensitive Receptors	None recorded within relevant buffer
Utilities: Underground or overhead	None recorded within relevant buffer
Any other observations	Quarry face within 265m of turbine centre

Point 4 - Turbine WTG04

Nature of Assessment	Observations
Position (ITM)	E=530195.9, N=648747.1
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	Outcropping rock exposed to the west of the turbine
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	5 - 10 degrees to horizontal in the vicinity of the turbine. Very undulating topography on the western side suggests thin soil cover over rock. Lands to the east of the turbine are uniform in gradient, lacking the undulating form evident to the west.
Topography	5 - 10 degrees to horizontal
Sensitive Receptors	None recorded within relevant buffer

Utilities: Underground or overhead	Major underground Gas Transmission Line within 300m of infrastructure. Minor underground water supply anticipated along the edge of the access track to the north of the turbine location.
Any other observations	Raised water trough evident immediately to the north west of turbine location.

Point 5 - Turbine WTG05

Nature of Assessment	Observations
Position (ITM)	E=529689.8, N=648511.6
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content. There is evidence to suggest that portions of the within which WTG05 is sited, have been filled with imported material.
Solid Geology	No outcropping rock
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	A depression approximately 1540m to the north of WTG05 is the source for a small watercourse, Drumshallon Stream that flows east towards
Topography	5-10 degrees to horizontal Filled ground has been recorded within the south eastern corner of the field within which WTG05 is sited. Historic aerial photography suggests more extensive infilling between 1985 and present day
Sensitive Receptors	A small lake bed, Drumshallon Lough, is present approximately 180m to the north east, within locally low-lying lands. At the time of the site visit this lake bed was dry.
Utilities: Underground or overhead	None evident
Any other observations	A track constructed on a raised "causeway skirts the southern perimeter of Drumshallon Lough and could indicate a potential flood risk within the northern and eastern portions of the field.

Point 6 - Turbine WTG06

Nature of Assessment	Observations
Position (ITM)	E=529581.6, N=648917.0
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	No outcropping rock
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	The site of WTG06 is relatively low-lying and as just could indicate a potential flood risk
Topography	0 - 5 degrees to horizontal but some areas up to 10 degrees area is very undulating
Sensitive Receptors	Turbine centre is 55m south of Drumshallon Stream and another dry lake bed, identified on historic mapping, but now thickly vegetated.

Utilities: Underground or overhead	Major underground Gas Transmission Line within 300m of infrastructure.
Any other observations	None.

Point 7 - Turbine WTG07

Nature of Assessment	Observations
Position (ITM)	E=529324.7, N=648643.8
Peat Depth	No peat was encountered
Superficial Soils	Slightly sandy, slightly gravelly SILT / CLAY with low cobble content
Solid Geology	No outcropping rock within immediate vicinity
Presence of peat landforms, evidence of past ground movement, hydrological features, other watercourses or other features of note	Turbine centre is within coniferous forestry, approximately 25m west of stoned access track.
Topography	Lands relatively flat and sloping at < 5 degrees to horizontal
Sensitive Receptors	Less than 100m north west of commercial building / agricultural shed
Utilities: Underground or overhead	None evident
Any other observations	None

5.5 Existing Mining Activities

The walkover survey confirms that there are no current licensed quarrying operations evident within the site boundary. Aerial photography suggests that local extraction of soils may have taken place in the north west corner of the field (c. 185m distant) occupied by WTG05.

The closest quarrying operations about the northern boundary of the wind farm site, with turbines T03 being approximately 300m from quarry workings.

5.6 Existing Services / Utilities

The main hazard at Kellystown wind farm from utilities is the underground transmission Gas Main that traverses the site. Please refer to mapping contained in Appendix 1 for details of its position within the proposed wind farm landholding.

No additional information regarding existing services / utilities was determined from the walkover survey. However, given the area the site covers, underground services should be expected in the vicinity of local and regional roads

Minor utilities are potentially present along any of the site tracks within the site, where these provide water to service water troughs.

5.7 Potential Sensitive Receptors

Analysis of desk study resources and follow up walkover survey have identified the following receptors with the potential to be susceptible to peat instability generated by activity related to the proposed wind farm construction and / or operation.

Receptor	Minimum distance to Development Boundary	Exposure Factor (Factor Based Probabilistic Analysis)	Remarks
Peatlands / Bog	Some evident in Isolated area	1	Two areas are bog are recorded: - 1. Depression associated with Drumshallon Lough, centred on E=708135, N=783401 2. Isolated depression centred on E=707668, N=782900 3. Area centred on E=708695, N=784040
Agricultural Lands	0m (within site)	1	The majority of the site with the exception of areas of coniferous forestry at WTG01, WTG02 and WTG07.
Minor Utilities	0m (within site)	2	Water / Telecom within site boundary and assumed to be potentially present in the vicinity of tracks traversing the site to service agricultural structures.
Designated Minor Watercourses / Water Bodies	0m (within site)	2	Drumshallon Lough Drumshallon Lough Stream Minor Lake Bed north of WTG06 Piperstown Stream Hammondstown Stream
Designated Major Watercourses / Water Bodies	c. 7km to south	3	River Boyne

Undesignated Watercourses / Drainage	0m (within site)	1 / 2	Ditches and man-made watercourses, ephemeral run-off channels and possible subterranean flow networks have been recorded within the wind farm site.
Minor Public Roads	c. 0m (at site entrance)	3	The wind farm is accessed from Ballymackenry Road. Hamlinstown Lane / Harewood Cottages runs along the south side of the land holding and is used to access turbine WTG02, via another unpaved public road.
Moderately to highly trafficked Public Road	c.1600m	4	M1 north west of site
Dwellings	<100m from site entrance	4	There are approximately thirty-five dwellings within 800m of the indicated viable development area boundary. All remaining identified residential dwellings are sited 700 metres or more from the closest sited turbine locations
Commercial Property	0m (within site)	3	Agricultural buildings within site boundary. WTG07 is < 100m north west of an existing agricultural building. No other consented nor operational wind farms within 2km of the site development area;
Significant Utilities (Overhead) / Underground	C 300m (within site boundary)	3	Underground gas transmission main. within 300m of WTG04 and WTG06 ² .
Population centre / Urban area	c. 4.5km (Dunleer) c.5.5km (Drogheda)	5	Dunleer – Population 1.822 (2016). Drogheda – Greater area population 83,000 (2016) ³

² Source: Wikipedia: <https://en.wikipedia.org/wiki/Dunleer>

³ Source: Wikipedia: <https://en.wikipedia.org/wiki/Drogheda>

5.8 Potential Preconditions Identified within the immediate vicinity of the proposed development

Analysis of desk study resources and follow up walkover survey have identified the following static or inherited factors that could potentially act as preconditions to slope instability, especially in weak/organic soils and bog land habitats.

Precondition	Minimum distance to Development (m)	Remarks
Concentrated drainage network / presence of standing water / area of flush / springs, or rises	Identified within wind farm	In vicinity of WTG05 and WTG06
Significant slopes	Not at assessed infrastructure	Some steep slopes evident just east of WTG03 only
Presence of sensitive organic soils or peat	0m	Two small regions of raised bog are present within the development area. One area extending to
Significant peat thickness	No peat encountered	No significant peat thickness present at proposed infrastructure
Very highly decomposed peat	N/A	N/A
Very weak peat and underlying mineral soils	0m	Very weak mineral soils anticipated in vicinity of WTG06.
Potential sonic vibration or ground accelerations	<200m.	Vibrationally induced energy, e.g. from quarry blasting potentially <300m north of WTG03

5.9 Pre-Failure Indicators within the immediate vicinity of the proposed development

Pre-failure indicators are physical landforms that are “tell-tale” signs of stress within the soils and peatland environment.

The following pre-failure indicators have been considered for the proposed development at Kellystown Wind Farm: -

- Historical evidence of previous movement / Peat cutting
- Tension or compression features
- Soil creep
- Cracking / desiccation

- Other⁴

The following pre-failure indicators are present within the immediate vicinity of the proposed development.

Pre-Failure Indicator	Minimum distance to Development (m)	Remarks
Historic peat cutting	None recorded	None evident
Evidence of historical peat / soil movement	Not at assessed infrastructure	
Evidence of tension cracking or compression features	Not at assessed infrastructure	
Evidence of soil creep	Not at assessed infrastructure	
Cracking / desiccation	Not at assessed infrastructure	

5.10 Summary of Prevailing Site Conditions

Analysis of Desk Study and Walkover Survey data allows the following preliminary geotechnical appraisal for the Kellystown Wind Farm site: -

1. Superficial soils are anticipated to be variable in thickness and composed of organic topsoils overlying tills derived from sandstones and shales. Although peat is present as cutover raised bog in isolated locations, for practical purposes any negative impact from peat can be considered absent for the purpose of the proposed development. Specific detailed Peat Stability and Landslide Hazard Assessment is not required.

Weak, waterlogged mineral soils are anticipated within the locally low central portion of the site around WTG06 and Drumshallon Lough, where traditional gravity base foundations are unlikely to be suitable and piled foundations more so. Specific guidance regarding safe methods of construction within this area would be appropriate.

Moderate thicknesses of soils are anticipated at WTG05 and WTG07, where there is risk that these soils may be considered of marginal competence where gravity base foundations are considered.

2. Rock outcrops at the surface within the west and north of the development area, but is considered to be extremely weak to weak in terms of local weathering and competence. Rock

⁴ The Scottish Guidance notes other potential pre failure indicators such as artificial drainage, concentrated drainage networks, seeps, springs, soft clays and iron pans. The author considers these to be preconditions and not pre failure indicators.

extraction is highly likely to be necessary to construct infrastructure in the vicinity of WTG01, WTG02, WTG03, WTG04, WTG. The hazard that this represents to construction is Medium.

3. The dominant underlying rock formation is Greywacke and is potentially "karstic" because of its calcareous content. "Karst" landscapes features such as sinkholes, cavities or subterranean drainage networks and have the ability to affect the stability of turbine infrastructure. Features typical of a "karst" landscape have been observed during the walkover surface and therefore the hazard that this represents to construction of wind turbine foundations is currently considered to be Medium, without further investigation. Supplementary investigations are required prior to construction to assess this item further.
4. Construction of the access track network, turbine hardstands and other associated infrastructure are expected to follow traditional principles, where the weak shallow soils will be removed to expose a competent formation upon which construction can commence. An allowance for excavation within rock should be made particularly when constructing within the west of the site.

The exception to this rule may occur in the vicinity of turbine WTG06 and Drumshallon Lough where a significant thickness of weak surface soils is expected.

5. Groundwater is anticipated to be a feature of construction design at WTG06 and to a lesser extent at WTG05 and WTG07. Groundwater is anticipated to be of minimal significance at turbines WTG01, WTG02, WTG03 and WTG04.

This report has been prepared on behalf of EDF Renewables and Jennings O'Donovan Ltd.

by

Whiteford Geoservices Ltd



John Whiteford BSc (Hons) Geophys AMIOSH MEAGE FGS
Technical Director

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Appendices

RECEIVED: 04/12/2024

Louth CC, Planning Department - Viewing Purposes Only

RECEIVED: 04/12/2024

Appendix 1

General Site Location Plans – P1 / P2
Kellystown Wind Farm Site Layout Plan P3

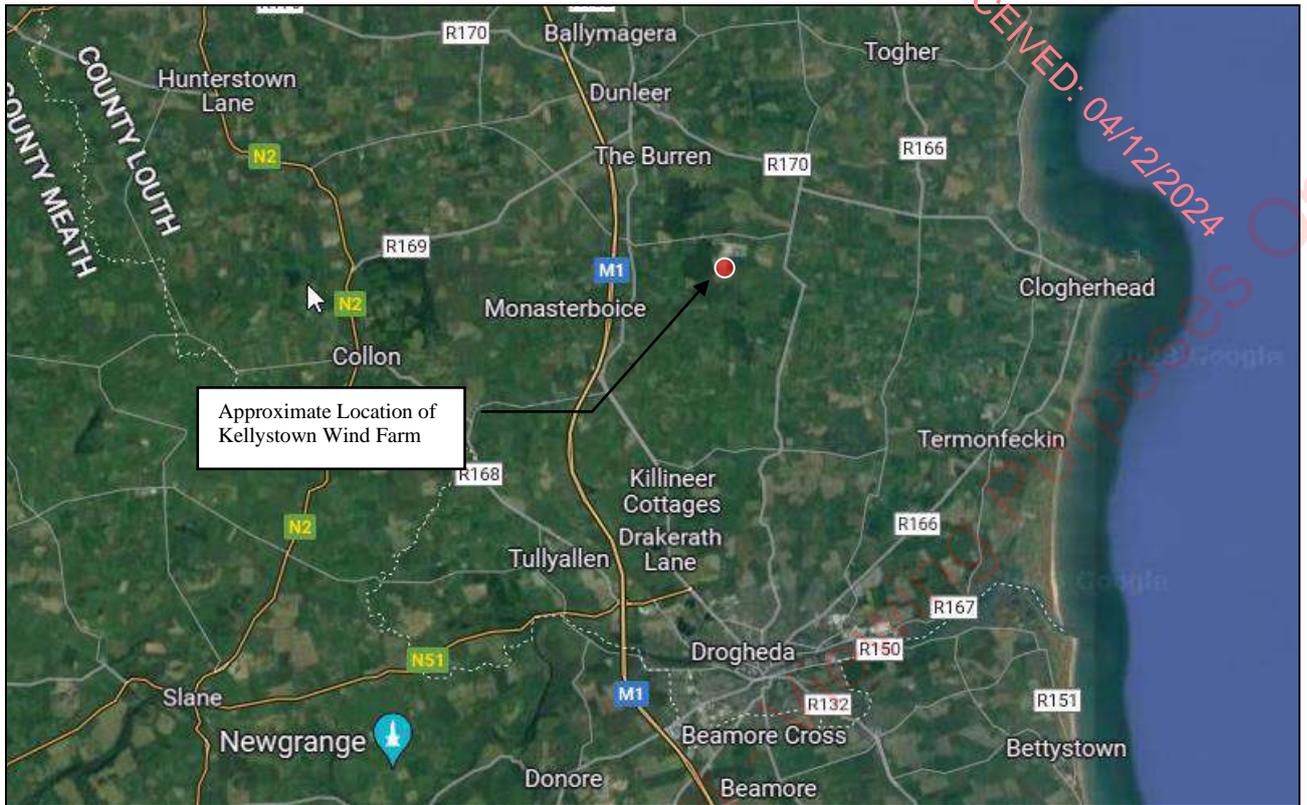
Priority Habitat Mapping – Local (EPA Online Environment Viewer)

Plot Depicting location of sensitive receptors, as well as identified preconditions and pre-failure indicators in the immediate vicinity of the wind farm development [2200-23A-PE]

Geological Survey of Ireland Public Viewer Data – Solid and Structural Geology
Geological Survey of Ireland Public Viewer Data – Superficial Soils and Landforms

Geological Survey of Ireland Public Viewer Data – Groundwater Resources
Geological Survey of Ireland Public Viewer Data – Groundwater Vulnerability
Geological Survey of Ireland Public Viewer Data – Karst Groundwater Data
Geological Survey of Ireland Public Viewer Data – Active Quarries

Geological Survey of Ireland Public Viewer Data – Landslide Susceptibility
Geological Survey of Ireland Public Viewer Data – Historic Landslide Events



P1 - General Location Plan (Aerial view)
(© google maps 2021)



P2 - Local Location Plan (Aerial view)
(© google maps 2021)

Kellystown Wind Farm

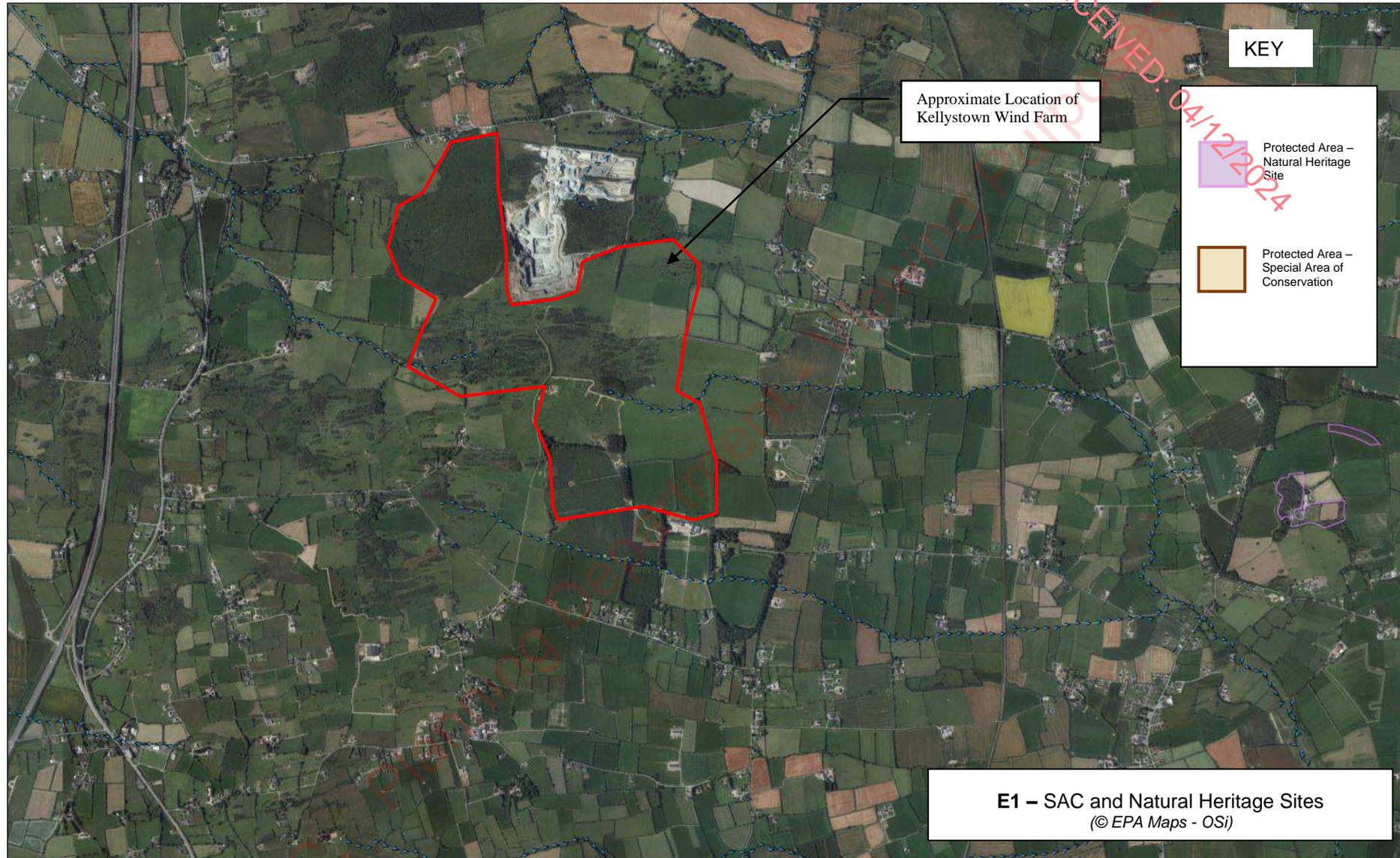
Soils and Geology Study

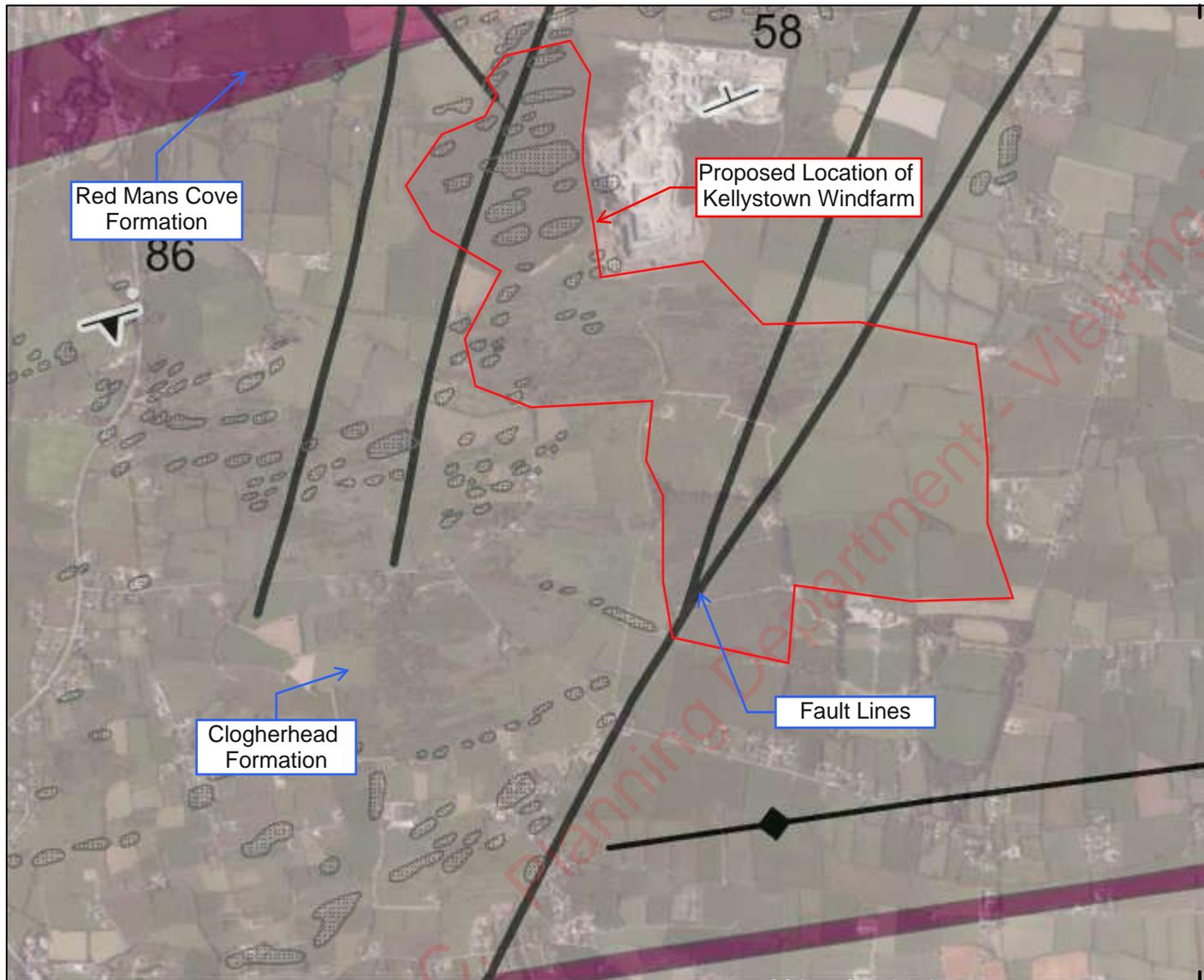
Layout Plan - Proposed Wind Turbine Locations



Key

WTG01 ● Proposed Wind Turbine Generator





Legend Structural Symbols 100K ITM 2018

- ◀ GSI data
- ↗ First foliation parallel to bedding
- ↖ Foliation trend, Thorr and Rosses Granites
- ⊕ Horizontal Bedding
- ↘ Strike and dip of bedding, right way up
- ↙ Strike and dip of bedding, way up unknown
- ↗ Strike and dip of first foliation
- ↖ Strike and dip of overturned bedding
- ↘ Strike and dip of second foliation
- ↙ Strike and dip of third foliation
- ↗ Strike and plunge of first generation fold axis
- ↖ Strike and plunge of second generation fold axis
- ↘ Strike and plunge of third generation fold axis
- ⊕ Strike of vertical bedding/foliation
- ↘ Strike of vertical first foliation
- <all other values>

- Ghost Line
- Goniatite marine band (R1-R4)
- Lithological boundary offshore
- Metadolerite sheet, mainly sills
- Paleogene/ Tertiary
- Dyke
- Synclinal Axis
- Synformal axis
- Tectonic Slide, barbs on hanging-wall
- Thin stratigraphical unit, diagrammatic
- Thrust, barbs on hanging-wall side
- Tuff band
- Unconformity, dots on younger side
- X-Section

- ### Bedrock Geology
- Clogherhead Formation
 - Red Mans Cove Formation

- Bedrock Outcrops 100 ITM 2018

Bedrock Linework 100k ITM 2018

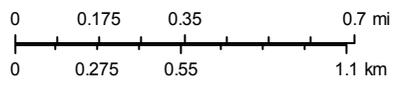
- ◆ Anticlinal Axis
- ◆ Antiformal axis
- Aquifer Boundary
- Area
- Coal seam
- Dyke
- Fault

Scale: 1:25,000

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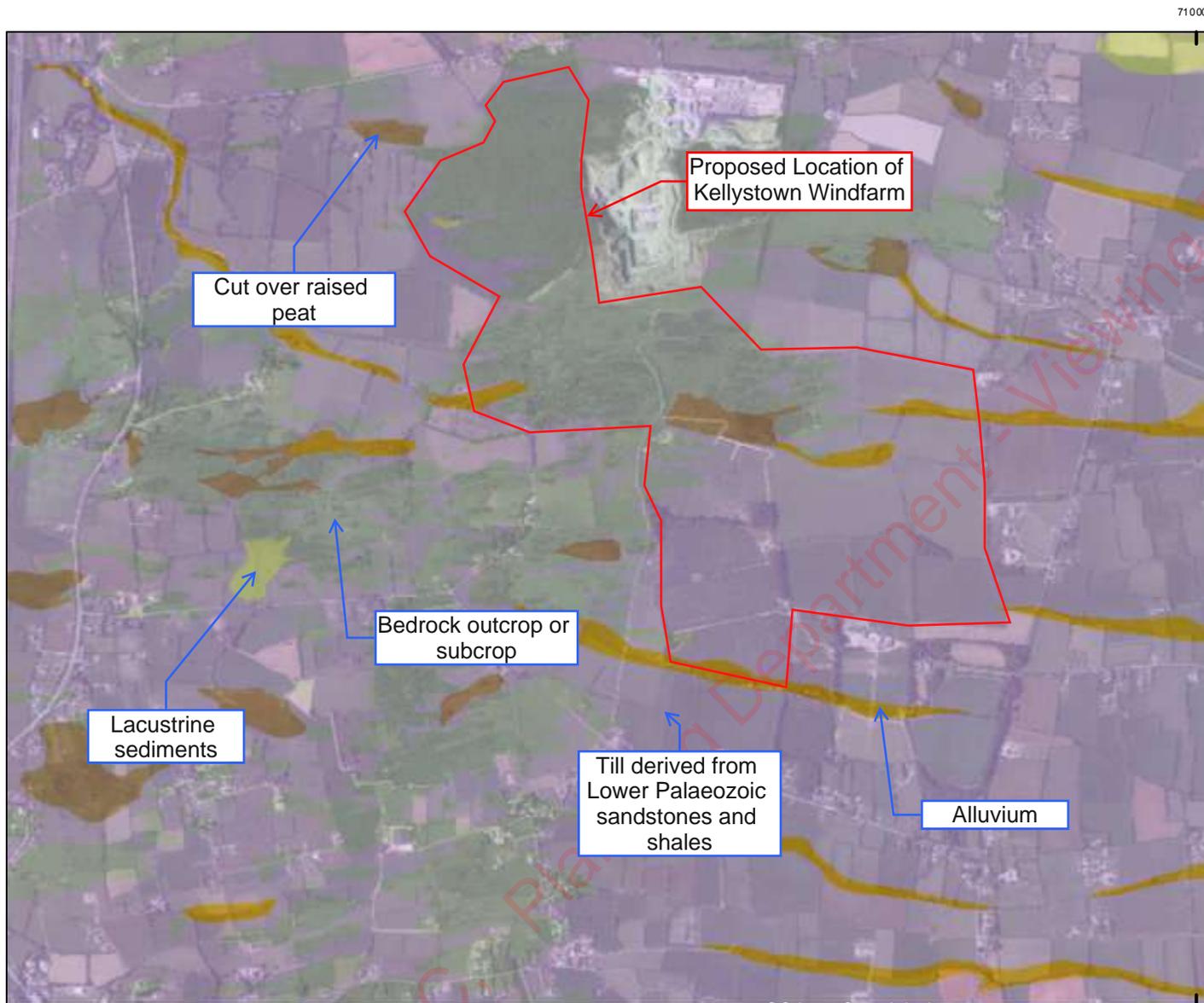


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Quaternary Sediments

- Alluvium
- Cut over raised peat
- Lacustrine sediments
- Till derived from Lower Palaeozoic sandstones and shales
- Bedrock outcrop or subcrop

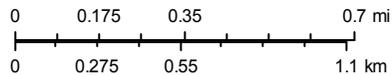


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Proposed Location of
Kellystown Windfarm

710000

Legend

Gravel Aquifer

- Regionally important gravel aquifer
- Locally important gravel aquifer

- Bedrock Aquifer
- Faults

Bedrock Aquifer

- Rkc - Regionally Important Aquifer - Karstified (conduit)
- Rkd - Regionally Important Aquifer - Karstified (diffuse)
- Rk - Regionally Important Aquifer - Karstified
- Rf - Regionally Important Aquifer - Fissured bedrock
- Rf/Rk - Regionally Important Aquifer - Fissured bedrock/Regionally Important Aquifer - Karstified
- Lm - Locally Important Aquifer - Karstified
- Bedrock which is Generally Moderately Productive
- Lk - Locally Important Aquifer - Karstified
- LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- PI - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive

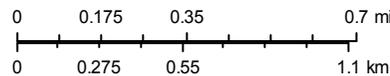
- Lake
- Unclassified

Scale: 1:25,000

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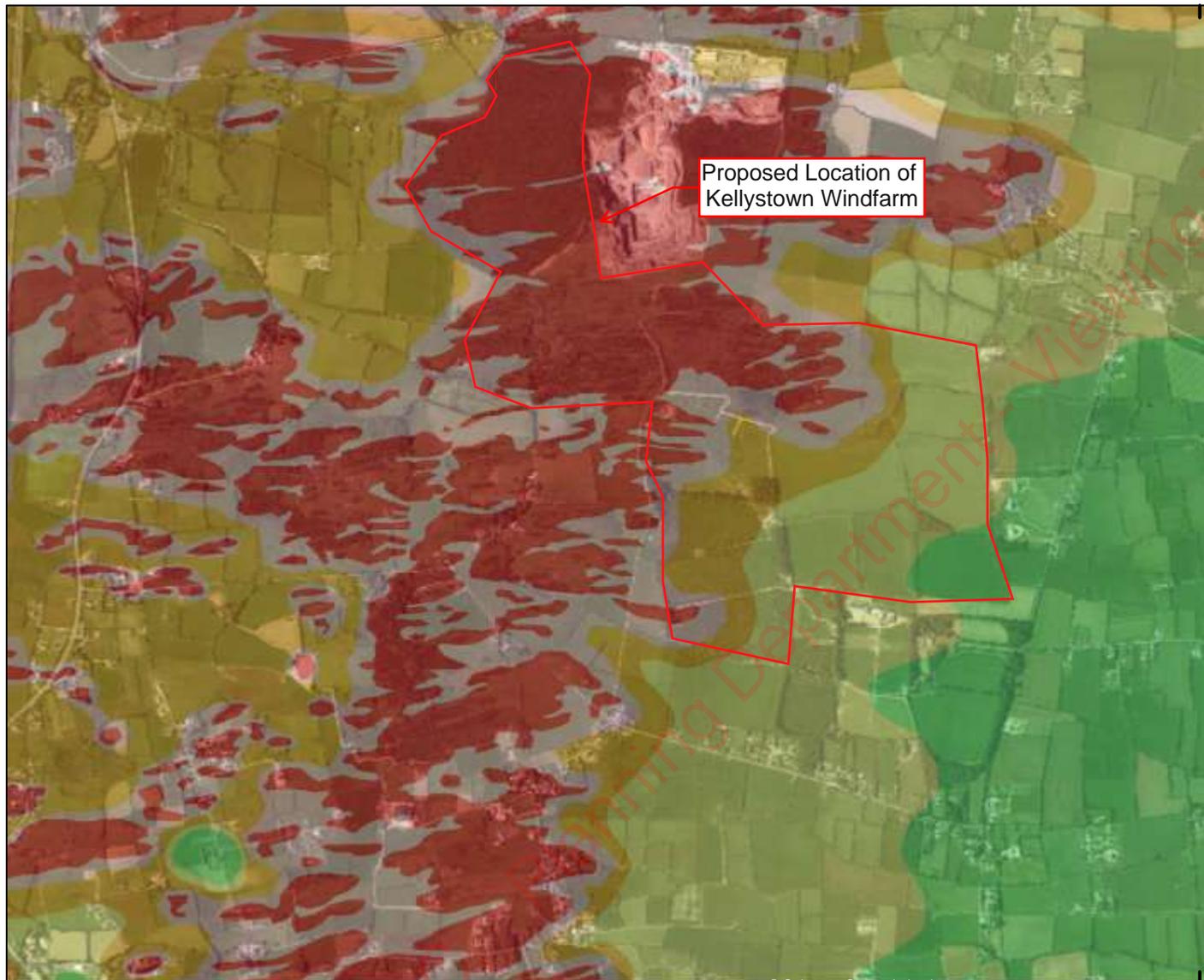
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GSI - Groundwater Vulnerability

Legend

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low
- Water

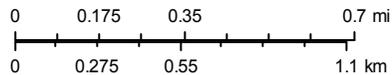


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710000

Legend

Karst Landforms

-  Borehole
-  Cave
-  Dry Valley
-  Enclosed Depression
-  Spring
-  Superficial Solution Features
-  Swallow Hole
-  Turlough
-  Traced Underground Connections
-  Groundwater Wells and Springs

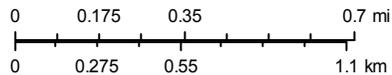


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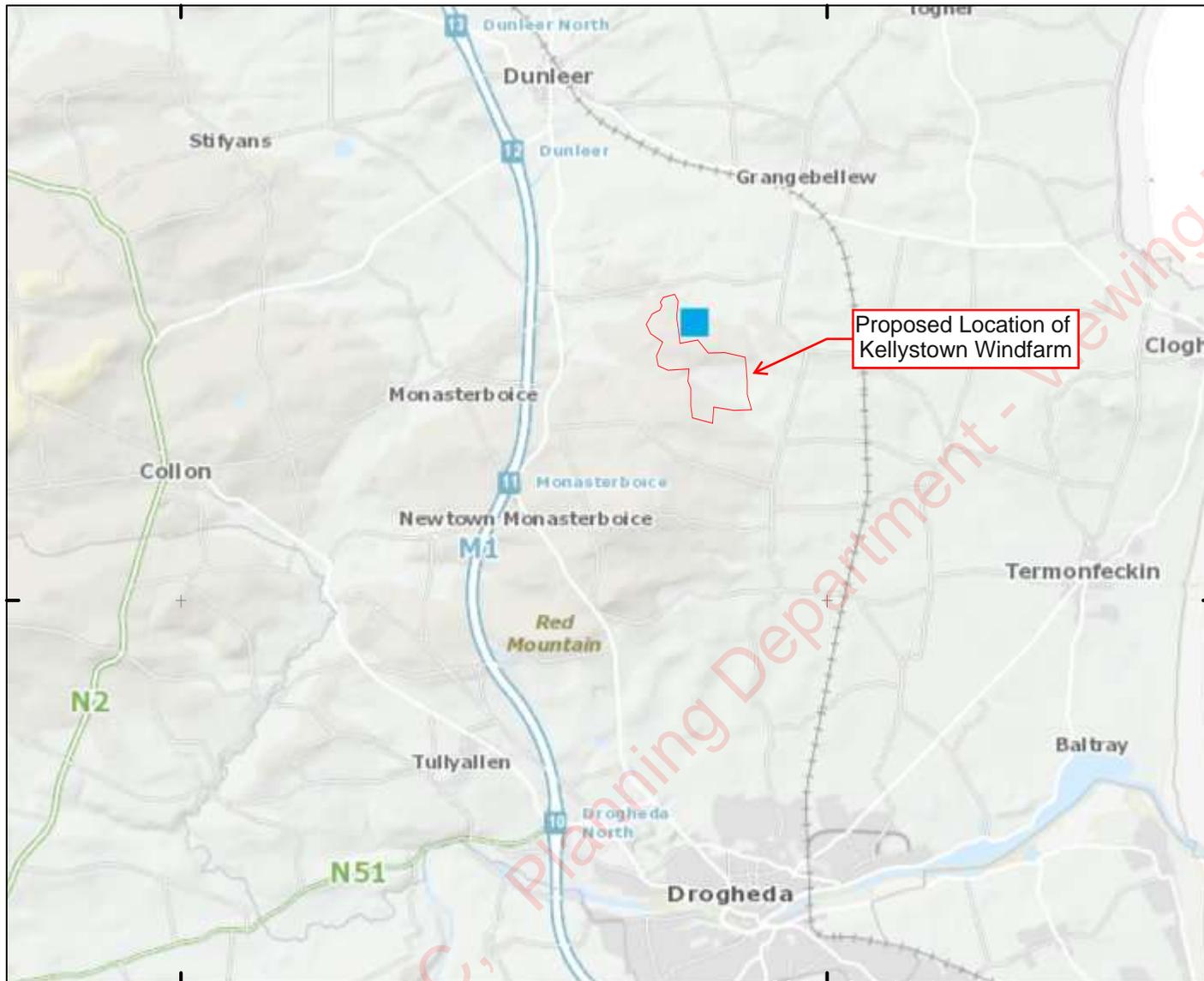
Map Centre Coordinates (ITM) 707,715 783,016
16/02/2023, 11:33:10

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Legend

Active Quarries and Pits

- Crushed Rock
- ▲ Dimension Stone
- Sand and Gravel

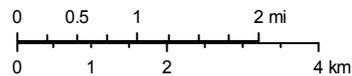


Scale: 1:100,000

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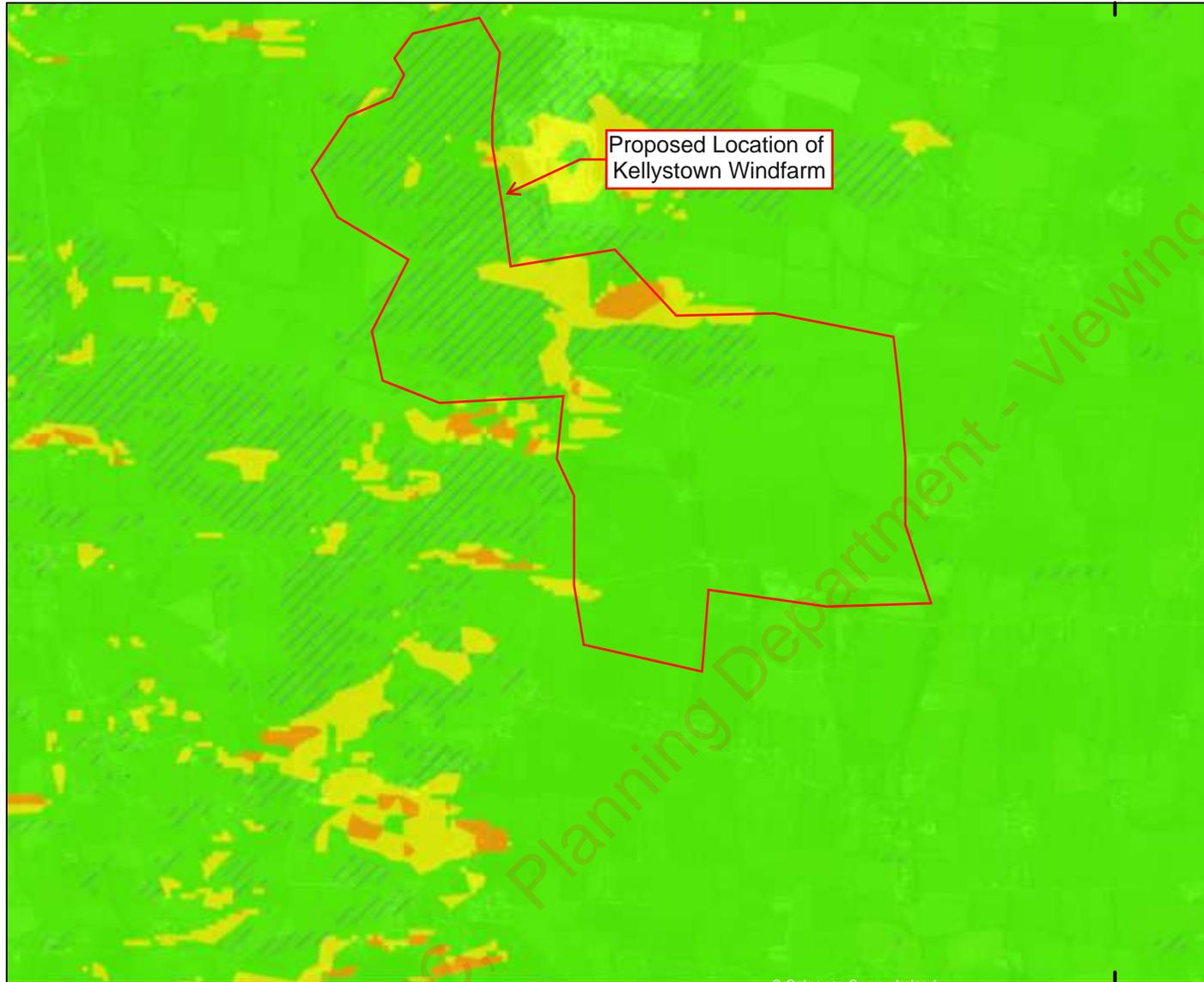
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GSI - Landslide Susceptibility Map

Legend

Landslide Susceptibility Classification

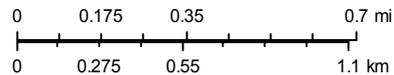
- Unclassified
- Low
- Low (inferred)
- Moderately Low
- Moderately Low (inferred)
- Moderately High
- Moderately High (inferred)
- High
- High (inferred)
- Made
- Water



Scale: 1:25,000
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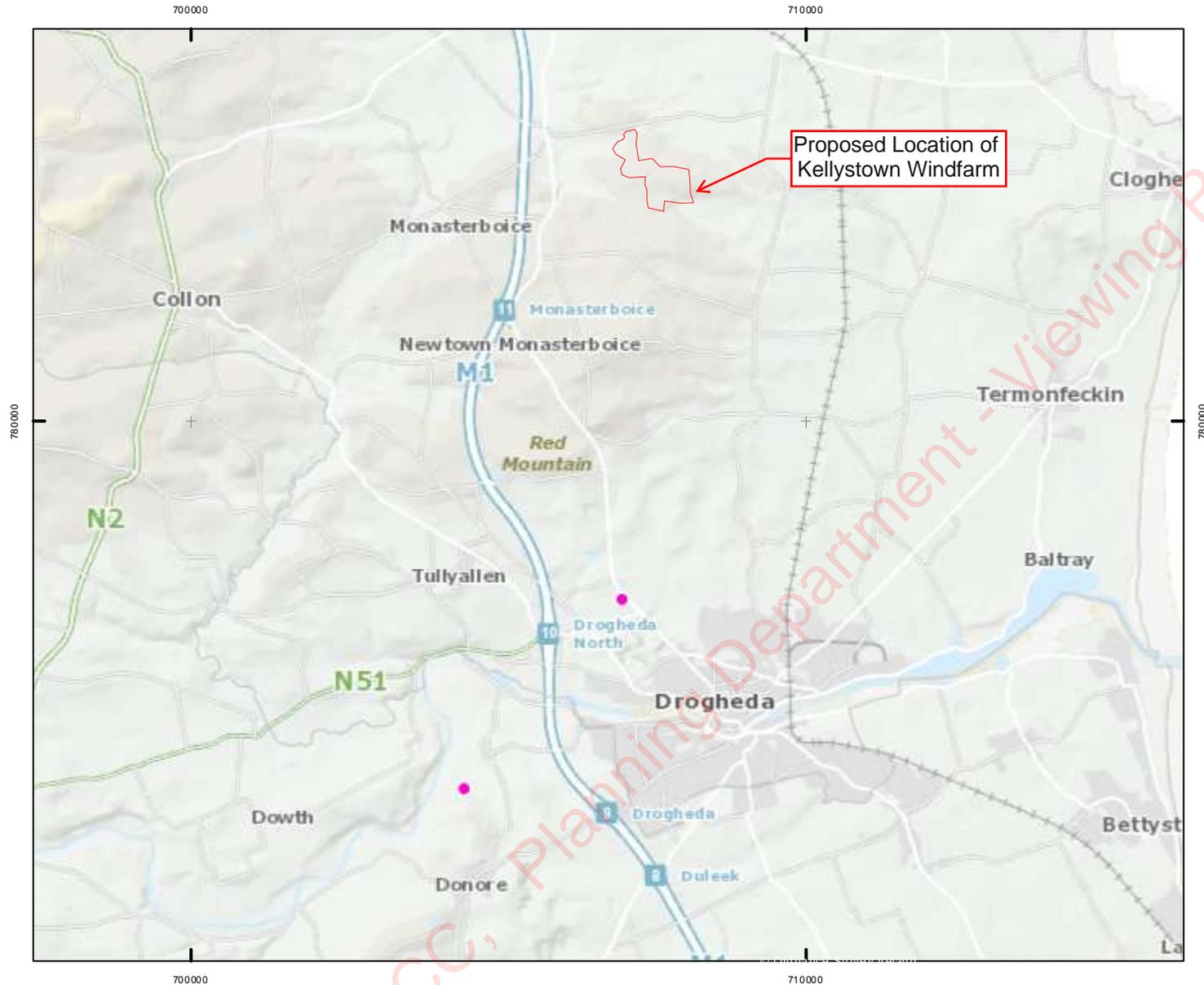
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 16/02/2023, 11:42:59

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GSI - Landslide Events Map - Regional

Legend

- Landslide Locations Ireland ITM
- Landslide Extents Ireland ITM

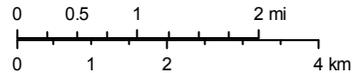


Scale: 1:100,000

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16/02/2023, 11:40:03

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 REVISED: 04/12/2024

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Appendix 2

Preliminary Peat Depth Data
Classed Plot of Peat Depth 2200-23A-D1

2200-23 - Kellystown Wind Farm
Preliminary Data of Peat Depth at Turbines

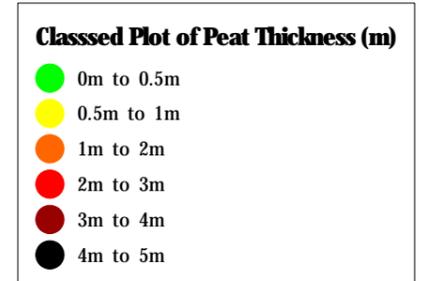
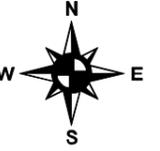
Location	Easting	Northing	Depth
T2	707234	783588	0
T7	708325	782802	0
T5	708087	783205	0
T6	708763	783183	0
T4	708560	783584	0
T3	707981	783632	0
T1	Not accessible - within forestry. Peat depth expected to be negligible.		

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2200-23 - Kellystown Wind Farm
Classed Plot of Peat Depth - Preliminary Data

4th April 2023



Notes:

1. All depths are relative to ground level existing at the time of the survey / investigation.
2. All positions relate to the ITM coordinate system.
3. Where no depth / thickness is indicated access was not possible at time of walkover survey

DRAFT

Designed by J. S.	Checked by J. W.	Approved by - date 04/04/2023	Drawing No. 2200-23 D1-P	Date 04/04/2023	Scale NTS
Whiteford Geoservices Ltd Straid House 2 Main Street, Straid, BALLYCLARE, Co. Antrim, UK BT39 9 NE			Classed Plot of Peat Depth - Preliminary Data Kellystown Wind Farm		
Edition 0			Sheet A3		

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Appendix 3

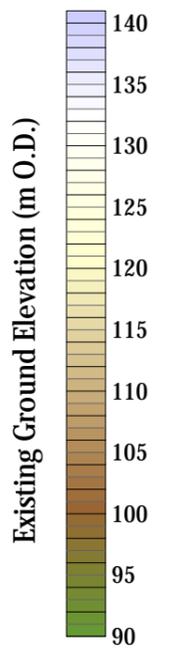
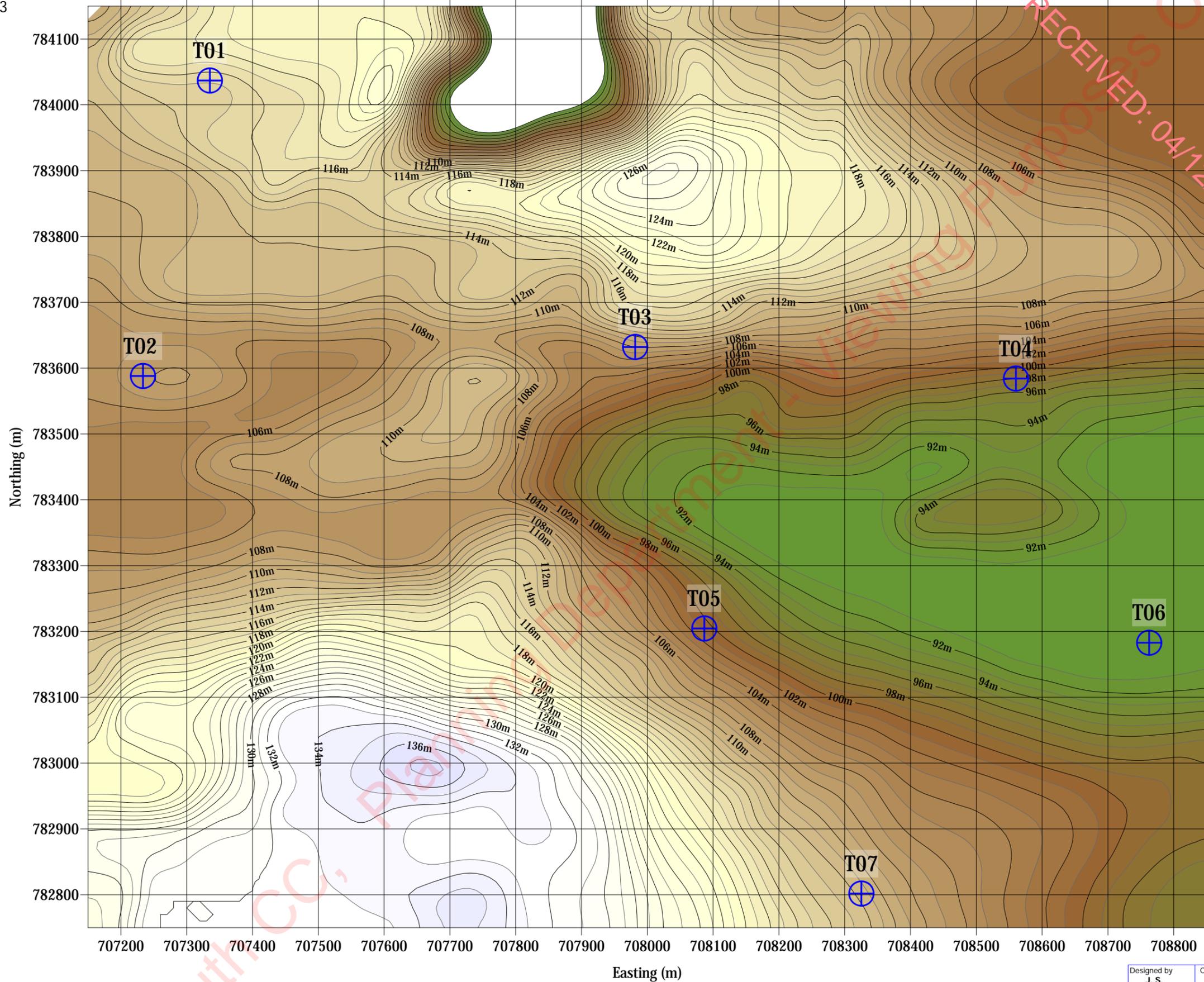
Preliminary Plot of Ground Elevation 2200-23A-D3

(10mx 10m data compiled using OSI DTM elevation data)

2200-23 - Kellystown Wind Farm

Contoured Plot of Elevation

4th April 2023



Notes:

1. All positions relate to the ITM coordinate system.
2. Any elevations are provided relative to Ordnance Datum Malin Head

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Designed by J. S.	Checked by J. W.	Approved by - date 04/04/2023	Drawing No. 2200-23 D3	Date 04/04/2023	Scale 1:6,000
Whiteford Geoservices Ltd Straid House, 2 Main Street, Straid, BALLYCLARE, Co. Antrim, UK BT39 9 NE			Contoured Plot of Elevation		
Kellystown Wind Farm			Edition 0	Sheet A3	

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Appendix 4

Preliminary Plot of Ground Slopes 2200-23A-D4

(Calculus applied to determine Gradient of 10m x 10m Data used to compile Ground elevation Plot – Appendix 3)

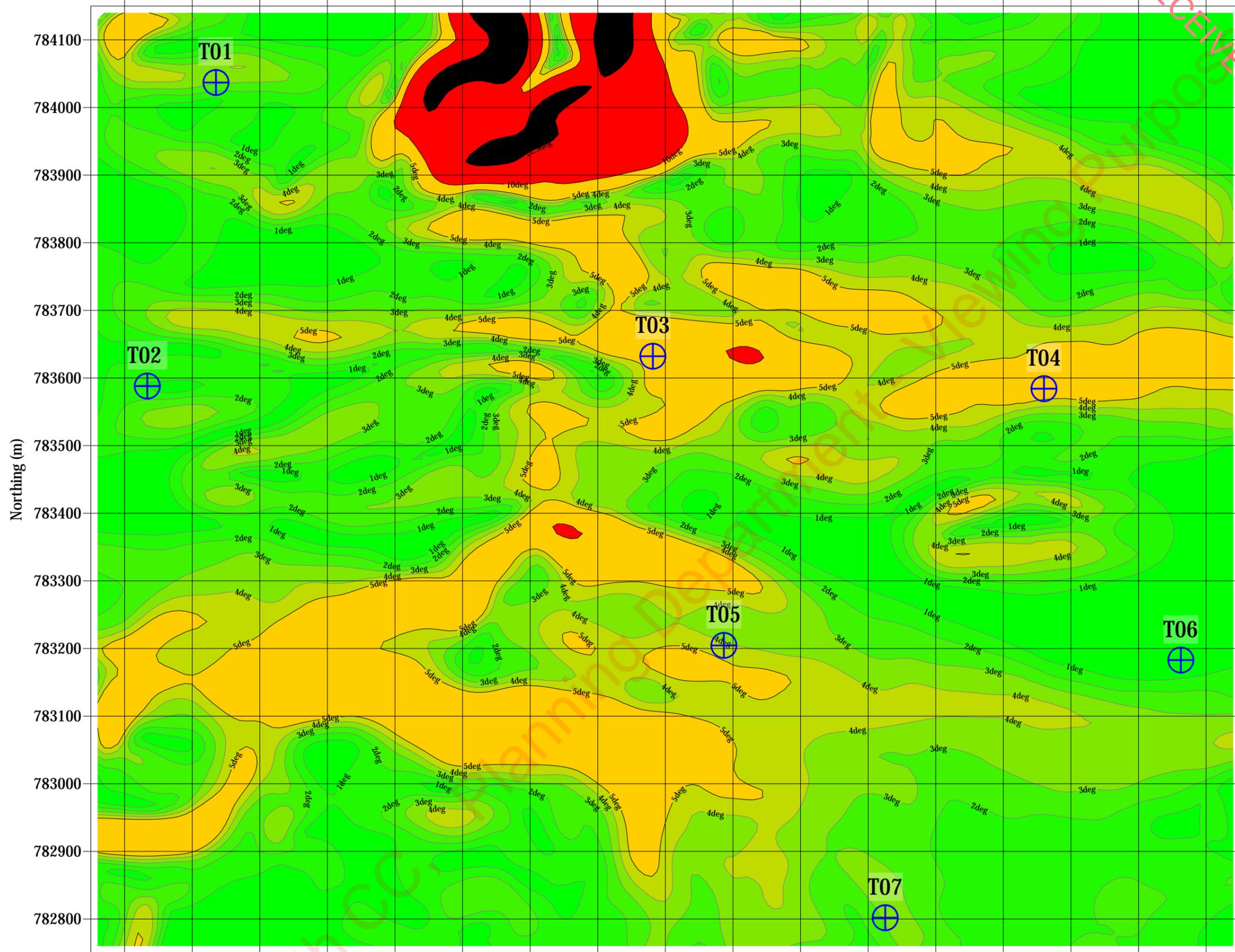
2200-23 - Kellystown Wind Farm

Contoured Plot of Slope Angle

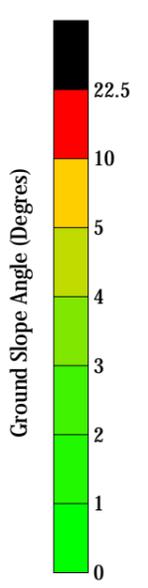
4th April 2023



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Key
Wind Turbine Generator



Notes:

1. All angles are relative to the horizontal.
2. All positions relate to the ITM coordinate system.

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Whiteford Geoservices Ltd Strait House 2 Main Street, Strait, BALLYCLARE, Co. Antrim, UK BT39 9 NE			Contoured Plot of Slope Angle		
Kellystown Wind Farm			Edition 0	Sheet A3	

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Appendix 5

Preliminary Screening for Peat Stability Hazard

(Compiled following analysis of site conditions and potential receptors)

2200-23 - Kellystown Wind Farm
Screening Assessment for Peat Stability and Landslide Hazard

4th April 2023



Peat Stability - Hazard Ranking & Classification		
■	HR = 0 to HR = 5	Negligible
■	HR = 5 to HR = 11	Significant
■	HR = 11 to HR = 17	Substantial
■	HR = 17 to HR = 25	Serious

Notes:

1. HR represents Peat Stability HAZARD RANKING
2. All positions relate to the ITM coordinate system.
3. Where Hazard Ranking is indicated access was not possible at time of walkover survey

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Designed by J. S.	Checked by J. W.	Approved by - date 04/04/2023	Drawing No. 2200-23A D7-P	Date 04/04/2023	Scale NTS
Whiteford Geoservices Ltd Straid House 2 Main Street, Straid, BALLYCLARE, Co. Antrim, UK BT39 9 NE			Classed Plot of Peat Depth - Preliminary Data Kellystown Wind Farm		
			Edition 0	Sheet A3	

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Appendix 6

Walkover Survey Photographic Record



Plate 1—View back to farm buildings and gate accessing T4 / T3



Plate 2—View towards the west. Access track to T4 / T3



Plate 3—Typical conditions around T4, just inside gate off track



Plate 4—View towards T4, c. 50m distant



Plate 5—View towards T6 on far side of scrub zone mid frame. No accessible from this point



Plate 6—Accessing T5, T6? and T7 from Piperstown Livery Stables



Plate 7—Laneway through Livery Stables to access T7



Plate 8—Track towards T7 (which is in forestry)
Ground Conditions assessed at closest accessible position



Plate 9—T7 within trees. Exploratory hole at edge of lane



Plate 10—View towards T5



Plate 11— Humocky ground on way to T5. Possible area of filled ground.



Plate 12—View towards T5



Plate 13— View towards T5



Plate 14—Looking towards T6 in distance from T5. T6 not accessed at time, although anticipate possible from this location



Plate 15— View towards T2



Plate 16—Lands on route to T2,; site should be accessible using the track
around edge of lake



Plate 17— View towards T2, within juvenile forestry