



**323699 Shancloon Windfarm, County Galway:
Hydrogeological Review**

Client: An Coimisiún Pleanála

Dated: 13th July 2026

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1. Introduction

1.1 Background

As part of the examination and analysis of Chapters 11 (Soils, Geology and Hydrogeology) and 12 (Hydrology and Water Quality) of Environmental Impact Assessment Report (EIAR) received for this case, An Coimisiún Pleanála requires technical expertise in Water (Hydrology & Hydrogeology) to support the EIA and AA, if required, having regard to relevant legislation and best practice guidance.

1.2 Proposed Works

An Environmental Impact Assessment Report (EIAR) has been prepared by Fehily Timoney (TM) on behalf of RWE Renewables Ireland Ltd (RWE), who applied to An Bord Pleanála (now An Coimisiún Pleanála [ACP]) for planning permission to construct a renewable energy development which will comprise 11 No. wind turbines, and associated infrastructure in the townlands of Beagh, Beagh More, Cloonbar, Cloonweelaun, Cloonnaglasha, Cloonteen, Corillaun, Derrymore, Ironpool, Shancloon, Toberroe and Tonacooleen, County Galway, approximately 8.5km northwest of Tuam, Co. Galway, and approximately 4km northeast of Shrúle village, Co. Mayo, and an on-site substation and associated works, including underground cabling to connect to the National Grid. The general locality and the EIAR site boundary are shown on Figure 1.

ACP have requested a “request for examination and analysis” (review) of the following to inform the EIA and AA to be completed by ACP as part of their determination of the application:

1. Examination and analysis of the information presented by the applicant relating to Hydrology & Hydrogeology namely:
 - The relevant chapters in the EIAR (Chapters 2, 11 and 12) and associated appendices and other chapters within the EIAR which may be referenced within and may be of relevance.
 - The request for further information sought by An Bord Pleanála dated 15th May 2025
 - The response from the applicant to the further information request received on: 5th December 2025
2. Provide an independent professional appraisal of the information provided by the applicant in view of current best practice taking account of observations made by relevant prescribed body/public submissions.
3. This assessment should be proportional to the development proposed with a focus on the likely significant effects.
4. The examination and assessment should consider the following and highlight any departures from best practice: (in the EIAR as it relates to Hydrology & Hydrogeology and associated appendices and documents):
 - Approach and methodology
 - Field survey results and evaluation
 - Likely significant effects and cumulative effects with other windfarms
 - Likely effectiveness of mitigation measures, residual impacts
5. Provide an independent appraisal of the assessment presented in the relevant elements of Chapters 11 and 12 of the EIAR and associated appendices (and other chapters within the

EIAR which may be referenced within Chapter 11 & 12 and may be of relevance) and any submissions of relevance and the applicant's response to same.

6. Advise on any additional measures that could be conditioned as part of a planning permission (if necessary).

1.3 Scope of Report

As requested, this report relies on factual information presented by Fehily Timoney in their EIAR Chapter 1 (Introduction), Chapters 11 (Soils, Geology and Hydrogeology) and 12 (Hydrology and Water Quality), together with Appendix 2.1 and the Non-Technical Summary (NTS). The Response to third party submissions dated February 2026 (Ref. P25357-FT-XX-XX-RPT-PL-0001) has been reviewed, as have submissions from third parties, including those from Seamus Roche on behalf of Kilconly and Caherlistrane Community (which included chapters prepared by Dr Pamela Bartley and Prof. Paul Johnstone). The information submitted has been taken as true and accurate, notwithstanding any inconsistencies or limitations evidenced.

The scope of the review is limited to consideration of the information submitted within the context of questions posed by ACP as detailed in section 1.2 of this report. The objective of this report is to provide a technical narrative that ACP can use to assist them in their determination and preparation of an EIA (Environmental Impact Assessment) and AA (Appropriate Assessment) if required.

This report has been prepared by James Dodds BSc (Hons), DUC, MSc, CGeol, FGS, FIQ.

James Dodds has been identified on the list of technical experts as a suitable External Consultant to undertake this role. He was previously engaged on the Galway Bypass project in 2021 and 2025, and prepared and was the lead author of reports for the same. He is a UK-based independent hydrogeologist and natural water consultant who has been practicing since 1986 and has operated in many different countries and across a wide range of industries. He regularly acts in the planning and other regulated arenas across a wide range of industries.



James Dodds has no connection with any of the parties, witnesses or advisors that could lead to a conflict of interest with regard to the matters under consideration in this review. More specifically, he has had no direct contact with any parties in relation to this case prior to instruction.

James Dodds visited the Site and its environs on 20th May 2026 with Brid Maxwell and Jim Egan (ACP) to assist with understanding of the site context and the broader setting. This did not comprise any surveys, data collection, or any repetition of the Applicant's field survey programme.

1.4 Declarations

I (James Dodds) have prepared this report and confirm and it has been prepared and is given in accordance with the guidance of my professional institution namely The Geological Society of London.

I confirm that the contents of this Report are true to the best of my knowledge and belief and contain my own professional opinions.

I understand that my duty is to help the Inspector to achieve the overriding objective by giving independent assistance by way of objective, unbiased opinion on matters within my expertise. I confirm that I have complied with and will continue to comply with that duty.

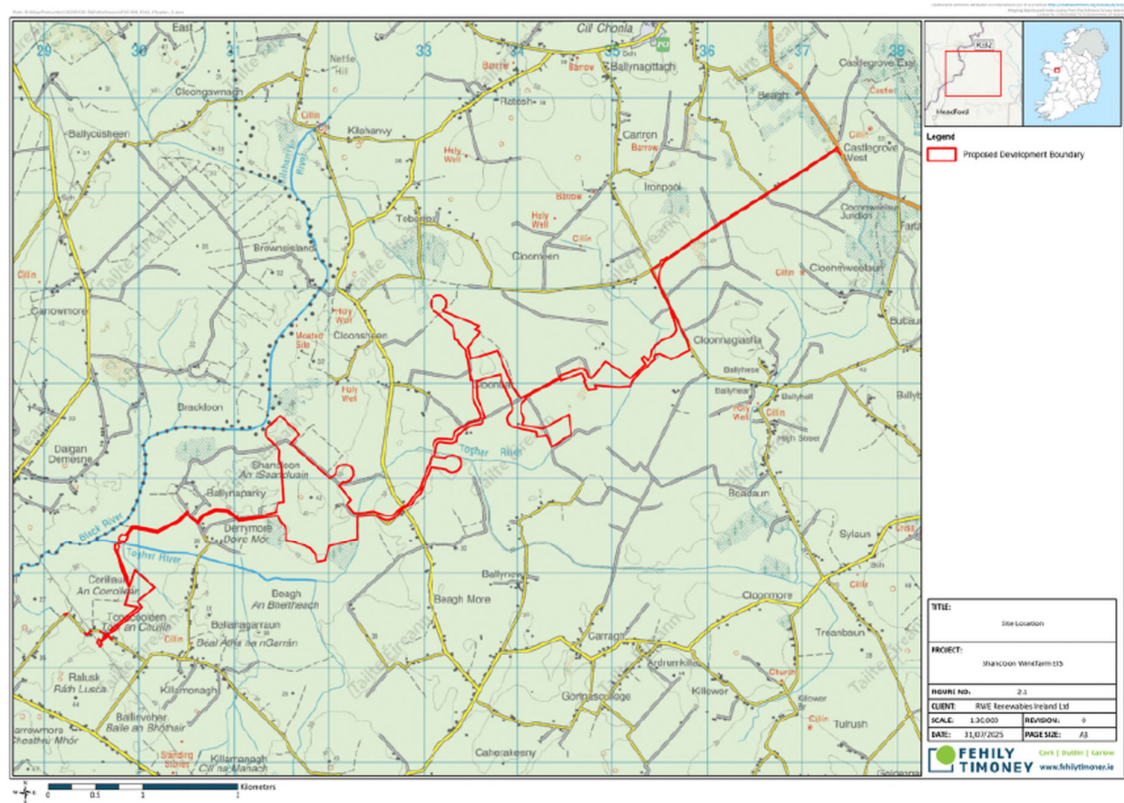


Figure 1 Location

2. Hydrological & Hydrogeological Setting

In reviewing the documentation the following nomenclature has been used. Where 'the Site' is referred to, this relates to the primary study area for the Proposed Project EIAR, as delineated by the EIAR Site Boundary (Figure 1) and includes both the Wind Farm site and Grid Connection. Where the 'Wind Farm site' is referred to, this refers to the 11 no. wind turbine generators, a 110 m meteorological mast, and 1 no. 110kV substation along with ancillary civil, drainage and electrical infrastructure (including loop-in connection to the National Electricity Grid) and all associated works related to the construction of the wind farm as well as measures designed to protect and enhance existing habitats.

2.1 Baseline & Site Investigation

The site investigations to inform Chapter 11 (Soils, Geology and Hydrogeology) of the EIAR included the following:

- Walkover inspections of the Site with recording of salient geomorphological features at proposed infrastructure locations.
- Peat depth probing and slope stability assessment at proposed infrastructure locations and where peat deposits were encountered.
- Recording of GPS co-ordinates of site investigation locations using a hand-held GPS.
- In addition to the site walkover and peat probing surveys, a project specific non-intrusive and intrusive ground investigation was carried out to inform the soils, geology and hydrogeology assessment of the Site between 26th May and 1st June 2022. The investigation comprised:
 - 26 no. Electrical Resistivity Tomography (ERT) profiles
 - Accompanying soft ground (peat) probing along each ERT profile
- Intrusive ground investigation comprised:
 - 22 no. trial pits
 - 22 no. rotary cored boreholes with groundwater monitoring well installations at the turbine locations
 - Geotechnical and geo-environmental testing

Based on Chapter 1 of the EIAR the proposed development application area encompasses a land area of 154 ha (1.54km²), and the development footprint within the application area 19.6 ha (0.196 km²).

The site comprises a rural landscape characterised by agricultural land, with areas of peatland, forestry, and watercourses. The site consists of a gently rolling drumlin topography, with ground elevations ranging from approximately 28 m to 40 m above Ordnance Datum (OD). The 30mOD contour¹, describes the Site with gradients from across the Site generally falling to the south west. The central part of the Site has very low gradients.

¹ Ordnance Survey Ireland 1:50 000 6th Edition sheet 39

2.2 Hydrology

Figure 12.1 (Chapter 12) shows the general drainage directions local to the Site.

Regionally, the drainage from the Site to the south west via the Togher River which confluent with the Black (Shrute) River, which itself flows to the south west and drains into Loch Corrib at Gortbrack some 13km (flow length) downstream from the confluence. The Site thus falls within the Lough Corrib catchment, which supports salmonid species. While the Togher and Black Rivers are not classified at SACs, the Lough Corrib SAC boundary lies c. 1km downstream from the Site boundary.

2.3 Geology

The majority of the Site is underlain by cutover raised peat which in turn is surrounded and underlain predominately by limestone Tills. A small areas of Esker is present in the middle of the Site, and alluvial deposits associated with the Black River are present in the south western end of the Site. Below the limestone Tills lies a mid Carboniferous limestone sequence. The Site is predominantly underlain by the Ardnasillagh Formation comprising dark cherty limestone and thin shales. The Ardnasillagh Formation is underlain by the Illaunagappul Formation (Limestone with thin shale partings), and that by the Oakport Limestone Formation (Pale grey massive limestone)². The northern extent of the Site, at the location of turbine T10, is underlain by the thick bedded pure limestone of the Cong Limestone Formation, which stratigraphically lies above the Ardnasillagh Formation. The juxtaposition of the Cong Limestone Formation and the Ardnasillagh Formation is caused by a NE – SW striking fault zone which trends along the north west extent of the Site. T2 lies on the mapped fault zone, T10 lies on the northern (downthrow) side, and the Togher River crossing lies on the mapped trend. The geology south of the fault strikes in a north east – south west direction with a shallow dip (c. 2°) to the south east, while north of the fault the structure is more complicated, but with a local north - south strike and a steeper dip toward the east.

The limestone Tills comprise predominantly clays and silts, but may contain sand and/or gravel lenses and/or clasts of limestone.

The mid Carboniferous limestone sequence is classified by GSI as a regionally important aquifer – karstified (conduit), with areas classified as locally important aquifer – karstified. While impure and shaley limestones are less susceptible to karst development, both the structural and stratigraphic boundaries can be important in the formation and control of karst development (a process whereby fissures, faults and joints are enlarged by dissolution). There are no exposures of bedrock at the Site, as the area is covered by peat and/or limestone Till.

2.4 Hydrogeology

The hydrogeological setting comprises four important layers. The top layer comprises the peat and mineral soils, the second layer the limestone Till, the third layer any karstified/weathered limestone (and any epikarst³ if it is present), and the fourth layer is the unweathered limestone. The base of the active hydrogeological zone would be the base of layer 3, layer 4 being of very low or effectively no permeability (layer 3 is taken to include any karst conduit structures).

The important aspect of the hydrogeological setting is the connectivity between the different layers, and the connectivity with streams, rivers, loughs and turloughs at the surface.

² Interpretation of Geological Survey of Ireland Public Data Viewer Bedrock Geology Datasets 100k

³ the highly weathered, porous upper layer of karst limestone

Groundwater actively flows to the 'hydrological base', that is rivers that have a strong sustained flow during dry weather (baseflow), strong permanent springs and turloughs (in karst settings) and the sea. In this setting the hydrological base will be the Black (Shrule) River to the west and possibly the Togher River locally, and the turloughs, with an overall south westward control toward the Lough Corrib. Examination of the Ordnance Survey Ireland 1:50,000 scale map suggests a hydrological base at about 25mOD locally (the approximate elevation of the Black and Tougher Rivers confluence).

The local groundwater flow within the Carboniferous limestone will be controlled by geology of the mid Carboniferous limestone sequence and degree of karstification. As the strike and structural trend is toward the SW, and that karstification will generally follow this trend, then it would be expected that the regional groundwater flow would be toward the south west generally, but will be modified locally depending on connectivity with springs and streams, and changes in bulk permeability of the limestone associated with stratigraphic and structural boundaries, particularly. Groundwater heads (levels) in the peat and limestone Till may be different from that in the Carboniferous limestone and will be controlled by local drainage to drains and streams that may hydraulically isolated from the Carboniferous limestone.

2.5 Karst

Appendix 11.2 presents a karst assessment and is supported by:

- FT undertook a desk study to identify mapped karst features on or adjacent to the Site. This study also incorporated a review of available aerial photographs, orthorectified photographs and digital terrain models to identify surface anomalies that may be attributed to karst features.
- FT undertook site reconnaissance to ground truth findings from the desk study and to inform the need for further investigation.
- Apex Geophysics undertook 26 no. geophysical surveys (ERT profiles) at 13 no. possible turbine locations.
- Ground Investigations Ireland (GII) dug no. 22 trial pits and drilled 22 no. boreholes to characterise ground and groundwater conditions and to target potential karst features.

At page 22 of Appendix 11.2 it is stated that *"Collapse dolines usually occur very suddenly where the bedrock or subsoil material collapse into and underlying void. Cover collapse dolines, sometimes known as dropout dolines are very common in Ireland. They occur in karst areas covered by unconsolidated material, such as glacial till. They form by the sudden downward movement of the overburden and usually form in areas where the overburden is somewhat cohesive. They occur in a process called 'piping', where a soil or subsoil arch, which has formed due to removal of material at the bottom of a layer of overburden, suddenly gives way (White, 1988). **Although there must be a highly efficient pathway established for sediment transportation in order for the soil arch to form and grow, a large bedrock hollow is not necessary for their development**⁴. Cover collapse dolines are characterised by vertical or steep-sided collapses, with a very sharp break in slope and often have stepped sides, where soil is exposed. Over time, however, their slopes may degrade and infilling sediment may build up giving these dolines the morphology of solution dolines."*

GSI classify the underlying limestone as karstified, and FT have identified 35 karst features in their analysis. It must be recognised that this will not represent the total extent of karstification,

⁴ My emphasis

but is a clear sign that karst process have been or are active and therefore buried karst features should be expected. Cover collapse dolines are an indication that sufficient void space of sufficient size, exists in the underlying solution weathered limestone for overlying sediment to move into.

Figure 2-1 of Appendix 11.2 provides a map of the distribution of the karst features that have been identified. It is important to note the linear distribution of the features and the association with the north east trending fault. The north south trending distributions that cross the Site may be associated with unmapped faults or other structural features. It is common in settings where the limestone is impure, that karstification concentrates along structural features. It is also possible that the Ardnasillagh Formation is thin (<20m) and that the north south trends represent connection to underlying pure limestone formations.

Table 2-3 of Appendix 11.2 presents 32 karst features mapped by GSI within 5km of the Site. Figure 2 below provides a map showing the location of mapped karst features. The red line represents the approximate area of the Site and the blue circles highlight features that may be considered close and downgradient. These features include turloughs. The Black River down stream of the confluence with the Togher River and Shule town should also be considered surface water systems probably connected to the karst limestone aquifer, down gradient of the Site.

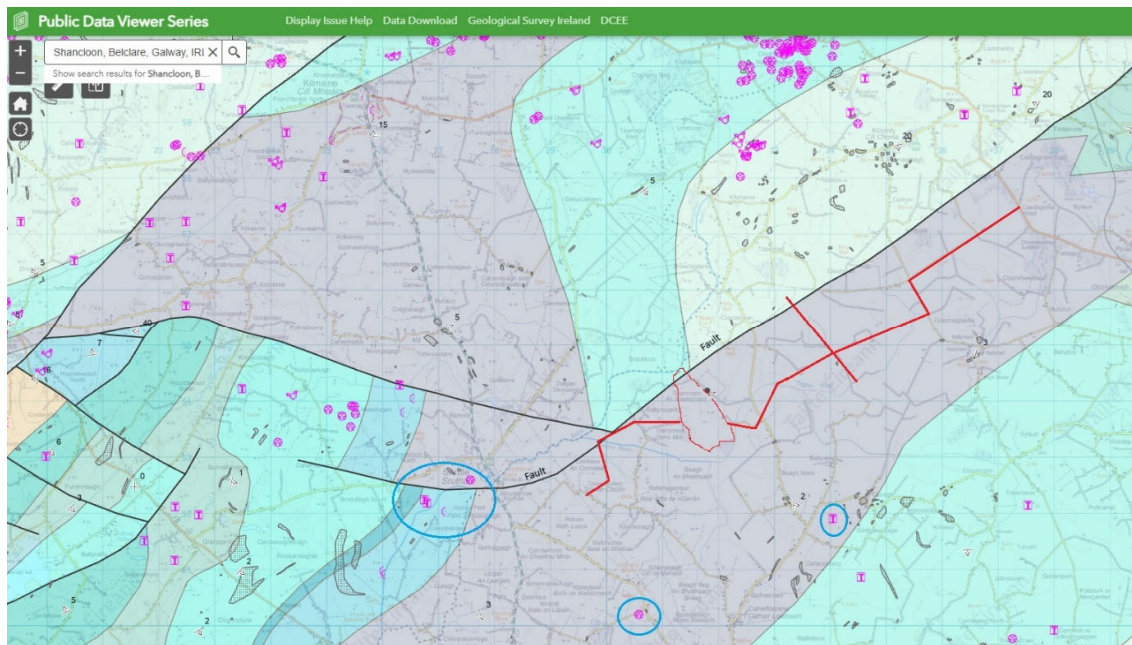


Figure 2 Bedrock geology, structure and mapped karst

Figure 3 below reproduces Figure 2-1 of Appendix 11.2 and adds to and complements Figure 2 above. The two figures demonstrate that karst features link the Site and the wider environment.

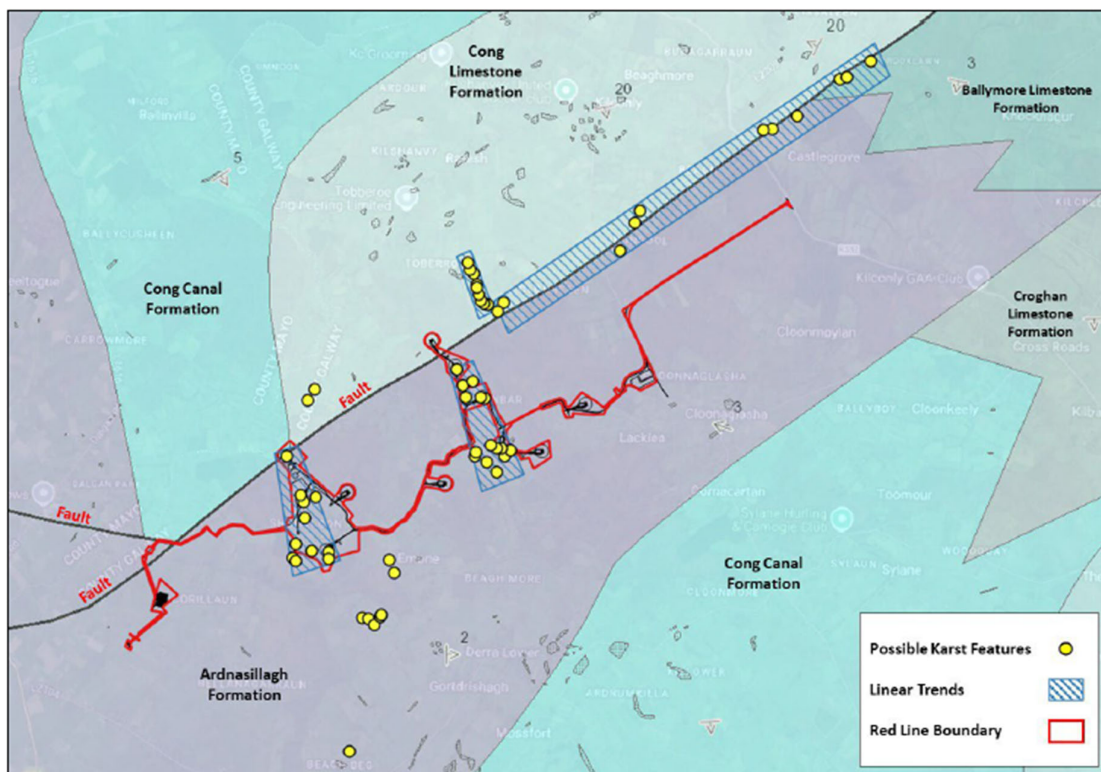


Figure 2-1: Distribution of possible karst features observed on aerial photography and DTM mapping

Figure 3 Figure 2-1 from Appendix 11.2 of EIAR

In terms of interaction between the water environment and the development, the important aspect is the connectivity of the surface with the karst system. If there is connectivity, then the karst system provides a very fast pathway for contaminants to reach the surface water system and any private borehole that are down gradient of the Site.

2.6 Conceptual Hydrogeological Model

The basic conceptual model is straight forward. There are three active hydrogeological layers (hydrostratigraphic layers): 1) Peat (including cutaway areas and 'virgin' areas) 2) The limestone Till (of varying thickness and composition) 3) Weathered / karstified Carboniferous limestone which regional evidence indicates has long fast flow pathways. The regional hydrological base locally is at c. 25mOD. The Site lies at an elevation close to this and therefore the local Carboniferous limestone water table (piezometric surface) is likely to be close to, at, or above the ground surface in the lower, and cut away areas of the Site. The groundwater level in the Peat and limestone Till may be at a different level from that in the Carboniferous limestone and will be controlled by local drainage to drains and streams.

Regional horizontal groundwater flow directions in the Carboniferous limestone are likely to be generally south-westward, but due to the nature of karst systems local variations to flow directions, including reversal of flow directions, should be expected.

Vertical groundwater flow through the layers is conceptually likely to be downward toward the eastern end of the Site due to the position in the upper part of local and regional catchments, but is likely to reverse toward the eastern end as groundwater discharges to the Black River.

Discharge to the Togher River may also induce vertically upward gradients. The extent of cutaway bog may also induce an upward gradient.

Recharge comes from incident rainfall, and while there is an extensive till layer, the presence of sinkholes and other enclosed depressions shows that active recharge to the limestone is occurring, with discharge via the principal rivers and turloughs.

Permanent flow in the Togher and Black Rivers, suggests connection to the limestone system and/or continuous drainage from the peat and/or till.

3. Appraisal

The appraisal has considered the information that has been presented in the EIAR in the context of the following three questions:

1. Does it provide a data set against which receptors can be identified?
2. Does it provide a data set against which affects and impacts can be measured?
3. Does it provide a data set against which a hydrogeological conceptual model can be developed, which allows hazards and risks to be identified and evaluated?

With respect to the hydrogeology the key components are described below, in general terms. Weaknesses in the data gathering are described where appropriate.

Guidance on the preparation of EIAR chapters on soils, geology and hydrogeology has been prepared by the Institute of Geologists Ireland⁵ which is referenced in section 11.3.1 of the EIAR.

Figure 2 of that guidance is presented in Appendix A of this report. This development falls into Environment types B, D and E and includes the following activities:

- Earthworks
- Storage / transmission of leachable and/or hazardous materials
- Lowering of groundwater levels by pumping or drainage
- Discharges to ground
- Excavation of materials above the water table
- Excavation of materials below the water table

Thus, it can be considered that the Site is in a sensitive hydrogeological setting and the details setting out the investigation works as laid out in Appendix A of this report are appropriate.

3.1 Geology

The geology of the Site has been evaluated based on a desk study covering a range of sources, a site investigation which has focused on the shallow peat deposits through probing, trial pits, borehole drilling, peat gouge coring and geophysics. However, the results of these investigations have only been presented in summary tables and figures. No interpretation of the geological information gathered from the desk study, and collected at the turbine bases has been interpreted and extrapolated across the Site. Thus, the geology related to risks associated with roads/tracks and wider potential pathways (eg. Faults and karst features) is poorly defined.

Twenty two (22) boreholes have been drilled to depths varying from 10m to 23m on or near the turbine locations, at the substation location with one 10m deep borehole at the Black River Crossing. Figures or plans showing the distribution of the investigation boreholes and the results in the wider geological context are not presented.

The findings from the investigation described at 11.4.11 of the EIAR suggests that fault rock was found in PBH-13 and PBH-16, and karst was recorded in only PBH-3A and PBH-18. Examination of borehole logs in the Karst Assessment Report (EIAR Appendix 11.2) suggests that features that might be attributed to karst or faulting are present in PBH-08 (15.35m), PBH-09 (17m),

⁵ Institute of Geologists Ireland (2013): Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements

PBH-10 (16.9m), PBH-11 (15.95m), PBH-12 (14.8m) all on T8; PBH-13 (16.7m) at T9; PBH-16 (15m) at T12; PBH-17 (11m) at T13; PBH-18 (8.5m – 14.8m). Thus weak, permeable and possibly karst effected ground may be under reported.

Geophysical surveys comprises two orthogonal lines of ERT at each turbine location with a target investigation depth of c. 20m The geophysics was designed to investigate the shallow founding geology. It was not designed to examine deeper geological or karst structures. Geophysical surveys were not undertaken at the connector compound or the HDD river crossing.

It is important to note that although there has been peat probing and gouge coring at the turbine locations and along the roads/tracks, there has been very little investigation of peat thickness and type across the wider site.

In summary, the geological data has focussed on the turbine foundations but has not been extrapolated to the wider environment. There is no interpretation of the geological setting with respect to formation thicknesses or fault movements. The distribution of mapped karst features has not been used to inform the geological interpretation. There has been no investigation of peat type of thickness across the wider site. Impact measurement, hazard and risk identification, and impact evaluation are discussed in the hydrogeology section below.

The does provide a data set against which receptors can be identified, but because it does not extend across the whole site and does not consider the wider environment, it does not provide a data set against which affects and impacts can be measured.

The site investigation does provide a data set against which a hydrogeological conceptual model could be developed, which would allow hazards and risks to be identified and evaluated, with appropriate mitigation and protocols to take account of low risk unknowns or unknowables.

3.2 Hydrology

The hydrology within the EIAR is covered by Chapter 12 – Hydrology and Water Quality. Appendices 12.2 and 12.3 present a surface water management plan and flood risk assessment respectively.

Section 12.8.6 describes water dependent protected areas as Shrle Turlough SAC (2.5km west of the western boundary of the Site and Lough Corrib SAC the boundary of which on the Black River is 1km downstream from the Site boundary.

The flood risk assessment at section 4.1 (of Appendix 12.3) does not recognise the areas of groundwater flooding adjacent to the Site and particular in the vicinity of the sub-station compound and Turbines 1 to 4. The flood risk assessment follows a logical process and using the National Indicative Flood Mapping Dataset identifies T7 as falling within an indicative present day scenario 1% AEP (1 in 100 year) flood zone. The report does not highlight that the road/track north of the sub-station is also within a 1%AEP flood zone and that the sub-station compound abuts a 1% AEP flood zone. The access road east of T11 is also effected by a 1% AEP flood zone.

The mid range future climate change adjusted scenarios, increase the extents of the areas affected by the current scenario.

The flood risk assessment includes a modelling exercise to assess the flood risk at a site level. The results are in agreement with National Indicative Flood Mapping Dataset and also provide flood levels and recommend construction levels which are above the flood level.

The flood risk assessment is based on OPW's River Flood Extents Mapping, National Indicative Fluvial Mapping, Past Flood Event mapping, historical mapping and GSI Groundwater/Surface Water Flood Maps, together with walk over surveys and site specific modelling.

The level of assessment is appropriate for the flood risk, and it provides a data set against which receptors can be identified, and affects/impacts can be measured. However, while it does provide a data set against which could be used to inform a hydrogeological conceptual model, the hydrological setting has not been used to inform the hydrogeological setting. The interaction between surface water systems, including groundwater flooding and turloughs, have not been considered within a geological or hydrogeological context.

3.3 Karst

The presence of karst below and in the local and regional setting is an important part of the setting of the Site and is fundamental to the EIAR process. While this is recognised in section 11.6 (of Chapter 11), section 11.4.6.3 (Groundwater Vulnerability) does not recognise the importance of karst pathways in this context.

The assessment of karst is based on a detailed walk over, the GSI karst database, geophysical surveys and borehole drilling. However, there is inconsistency in the karst interpretation and links to the conceptual model and risk assessment. There is a strong reliance placed the low carbonate content of the Ardnasillagh Formation and the low potential for karst development. However, this formation may not be very thick (<30m) based on interpretation of its low dip and the low topographic range.

The EIAR recognises the presence of many dolines and the relationship between these and the geological setting is presented. For collapse dolines to occur there must be a mechanism for the material in the superficial deposits to be washed somewhere. There must be sufficient volume of void space for the material to fill or a pathway for the material to be flushed away. This has to be a deeper karst system. Figure 6-2 (Appendix 11.2) does not work conceptually. Figure 6.1 (Appendix 11.2) clearly shows the need for pathways in the underlying limestone. It is more likely that a combination of thin Ardnasillagh Formation and fault zones or other structural features leads to a karst inception zone in the pure limestone underlying the Ardnasillagh Formation which links to the superficial deposits and the development of dolines. Whatever the mechanism, the presence of a large number of dolines, particularly those in close proximity and aligned with known structural features should be taken as an indication of karst pathways. The site investigation borehole drilling and geophysics was not designed to investigate such pathways away from the turbine bases. The unpredictability of karst structures within the subsurface means that they are difficult to intercept with boreholes and the lack of interception should not be interpreted as a lack of features. In this case, it would seem that karst features in the borehole logs are under reported.

Section 7.1 of Appendix 11.2 states *"Results from the combined desktop study, site reconnaissance and ground investigations suggest that, with the exception of PBH-18, karst within the Site is confined to the Quaternary deposits overlying the limestone."* This conclusion is fundamentally flawed. Karst cannot be confined to the Quaternary deposits. The presence of karst features within the Quaternary deposits is evidence of karst process and features in the underlying Carboniferous limestone.

In summary, the conclusions drawn regarding karst are inconsistent with the evidence and the recommendations relate only to foundation design and do not take account of the link between karst and hydrogeological (pollution) risks.

The resulting concern is that the assessment dismisses karst as an issue and therefore no protection against contamination entering karst fast flow pathways is offered. As recommended by Apex (the geophysics contractor to the Applicant) *“such as sealed drainage, and foundations capable of spanning voids that may come to the surface, should therefore be incorporated into any works.”*

The site investigation does provide a data set against which receptors can be identified, and provides a data set against which affects and impacts can be measured. However, the interpretation of the data (or lack thereof) means that it does not appropriately inform a hydrogeological conceptual which allows hazards and risks to be identified and evaluated.

3.4 Hydrogeology

The hydrogeology of the Site is evidenced by the site investigation data. The GSI vulnerability rating of ‘Low’ to ‘High’ with localised areas mapped as having ‘Extreme’ to ‘X – Rock at or near Surface’, has been modified to ‘Moderate’ to ‘Low’, based on the site investigation information.

The critical aspect of the hydrogeology is the connection through the hydrogeological layers and the pathways between the Site and the wider environment. The EIAR presents conclusions that there are not pathways from the surface to fast flow karst features. There is no assessment of, and therefore conclusions related to water movement through the Peat.

While there is a large amount of site investigation data, the data has not been used to develop a conceptual hydrogeological model which provides a consistent interpretation of the data within a three dimensional geological and hydrological context, linking the Site to the wider environment and receptors. For example, the geological setting has not been considered in three dimensions, and the desk study geological information has not been interpreted to consider the thickness of the geological layers. As a result, the site investigation surveys including the geophysics and the borehole drilling have not considered the deeper potential for karst pathways and the risks that they may pose. Equally, the data collected on the Peat has not been considered within the context of the site wide peat environment and the impacts that construction may have on the peatlands dependent on it.

Groundwater level data related to the Carboniferous limestone has been collected, but this has not been considered within the context of a conceptual model, has not been used to generate groundwater contours which may give insight into the local interaction with rivers and karst systems. Rather an inappropriate reference to a general south westerly ground water flow direction, based on surface catchments has been relied upon. Neither have transient groundwater level responses been considered together with the borehole response zones to understand different hydrostratigraphic or compartmentalisation settings. No information on Peat water or limestone Till water levels has been collected.

No boreholes or samples from boreholes have been tested to provide values of permeability or other hydraulic properties of the hydrogeological layers. No field based evidence is presented on the vertical hydraulic gradients between the hydrostratigraphic layers.

The interaction between groundwater heads (levels) and the construction of the turbine foundations, has been largely dismissed based on an assumed low permeability of the limestone Till and or the Ardnasillagh Formation. No consideration of basal heave or evidence of the permeability has been presented.

Extrapolation of a conceptual model across the site, which incorporates all the data has not been presented. Thus, the relationship between nearby groundwater flooding and the above ground groundwater heads (levels) (artesian water levels) at the sub-station site have no context and

therefore construction and water management risks have not been considered. No assessment of development, floating roads and sheet piling on peat drainage has been undertaken.

Further, the lack of a unified conceptual hydrogeological model means that the evidence base for the conclusion that there is no risk to protected groundwater dependent features such as SAC rivers and turloughs is very poor.

The summary while the site investigation is wide ranging it does not present a consistent and robust interpretation of the data within a hydrogeological setting at either the Site or local level. As such it does not provide a data set against which receptors can be identified or a data set against which affects and impacts can be measured. A hydrogeological conceptual model has not been developed, which allows hazards and risks to be identified and evaluated.

3.5 Receptors

The principal receptors are:

- Lough Corrib SAC (Site Code: 000297) which includes sections of the Black (Shule) River. There are surface water connections (pathways) to the SAC. There may be groundwater pathways to the SAC.
- Shrule Turlough SAC. There are no surface water pathways to this SAC, but there may be groundwater pathways.
- Other turloughs and springs. The lack of the development of a unified conceptual hydrogeological model and groundwater contours means that the risk of development on these receptors cannot be assessed.
- Clare Corrib groundwater body. There may be groundwater pathways.
- 4 No private wells and 1 x spring identified on GSI data base and numerous dwellings within 2km of the Site boundary. If dwellings are reliant on shallow wells, seepage pits or similar they could be affected by surface water pathways. No census of private water supplies is presented. The lack of the development of groundwater contours means that the risk of development on these receptors cannot be assessed.
- Kilmaine and Dunmore Glenamaddy PWSSs are not considered at risk due to their distance and direction from the Site which is appropriate.
- The GWS listed in 11.4.6.7 are not considered at risk due to their distance and/or direction from the Site which is appropriate.

3.6 Hazards (Sources) and Pathways

The principal hazard is associated with water quality. The proposed development does not depend on the abstraction of water (other than possible short term dewatering during construction), and while it has not been specifically assessed, there is likely to be a negligible effect on the quantity of recharge to groundwater or the volume of runoff to surface water. However, alteration of peat groundwater flow through increased drainage, compaction or damming, represents a hazard to features dependent on peat groundwater.

Specific risks associated with water quantity are associated with construction. Although not anticipated, dewatering of gravity foundation pits may be required. If so, this would lead to increased discharge to surface water and could lead to a decrease in flows in local ditches and/or a fall in water level in saturated peat. This risk has not been assessed and is associated with the risk of basal heave in the gravity foundation and piling pits.

Interception of groundwater in cable trenches could divert flows and effect shallow wells and or springs. This risk has not been assessed, but is likely to be low. Mitigation could be included in the design by placing clay plugs within the trench backfill.

Surface water pathways directly connected to the SAC features exist. Groundwater pathways that could connect to the SAC features may exist, as evidence shows that pathways within the karst system have been proven but an integrated conceptual model including groundwater contours to evidence the local groundwater flow regime in the Carboniferous limestone has not been provided.

The fact that the Site has direct pathways to SAC features means that there must be a very high level of confidence in the impact assessment.

In general, the water quality hazards are those normally associated with construction activities such as mobilisation of suspended solids, release of high pH water and cement effluent during concrete placement in piles and foundation pits grouting, fuel, oils and greases from plant and machinery. There is also a source associated with the movement and stockpiling of peat, and the generation of Dissolved Organic Carbon (DOC) in runoff. This can lead to "browning" of surface water systems, restricting light penetration, increase biochemical oxygen demand (BOD) and reducing dissolved oxygen, which harms aquatic organisms. High DOC levels in drinking water sources can react with disinfectants to form hazardous disinfection byproducts (DBPs), such as trihalomethanes. The risk of DOC has not been considered, although background drainage from the peatlands will be contributing to the back ground levels, this has not been assessed in the baseline data collection.

The likely significant effects analysis, relating to groundwater, is largely based on the conclusion that there is a disconnect between the construction activities and the karst limestone system, due to an inappropriate interpretation of the karst setting. The data on karst and the conclusions drawn are in conflict. It is considered that there is not a high level of confidence in this position due to the lack of an integrated and consistent conceptual hydrogeological model.

The likely significant effects analysis for the earthworks is based on controlling runoff as a result of rainfall. Discharge of runoff will be via a treatment train, and ultimately infiltration back into the peat. Direct discharge of runoff is not proposed. It is proposed that work will be suspended if high rainfall is anticipated by monitoring of weather forecasts.

Runoff from the peat and spoil repository areas will be managed by placement outwith a 50m buffer zone, and routing of runoff via a swales and stilling ponds to the on-site drains.

The design of the hard standings does not prevent infiltration through them into the underlying strata. Neither does the design allow for preventing infiltration or release of contaminated water from settlement ponds.

3.7 Summary

The site investigation data presented in Chapter 11 of the EIAR is reasonable, however it is considered that the lack of an integrated evidence based conceptual hydrogeological model that considers the relationship between the Site and local geology and hydrology in three dimensions as well as the transient response of the groundwater means that there is insufficient evidence to provide high confidence in the conclusions, particularly with respect to the SAC features. This is demonstrated by consideration of Figure 2 of Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements, Institute of Geologists of Ireland 2013.

The information presented relating to karst is considered to be flawed.

While conceptually the effectiveness of the proposed mitigation measures, and residual impacts related to groundwater are possibly correct, the low level of confidence in the field data analysis means that the mitigation measures and therefore residual impacts cannot be supported.

The effectiveness of the proposed mitigation measures, and residual impacts related to surface water are appropriate on the basis that rainfall runoff is considered. However, no account is made of groundwater related risks during construction which could impact on the surface water management system. Therefore the mitigation measures and therefore residual impacts cannot be supported.

Permanent compounds and related drainage arrangements should be designed to prevent the infiltration of water to the ground and to allow discharge to be prevented in the event of a pollution event.

4. Responses

Submissions were received from prescribed bodies and third parties, including those, with reference to hydrogeological issues, from Seamus Roche, Emone, Caherlistrane Co Galway H54 N127 on behalf of concerned members of the Kilconly and Caherlistrane Community, Inland Fisheries Ireland, North East Galway Environmental Protection CLC, and Shancloon Windfarm Action Group. These submissions have been considered, as have other submissions from individuals and many present the same topics with respect to water. The submission from Seamus Rochae includes reports prepared by Prof. Paul Johnson and Dr Pamela Bartley (Hydro-G) cover the principal concerns and therefore these have been considered in more detail. The key points made are summarised in the sections below.

4.1 Inland Fisheries Ireland

- Impact on water quality and effect on fisheries, with salmonids referenced in particular.

4.2 Prof Paul Johnston (professional hydrogeologist & Professor of Environmental Engineering)

- The hydrogeological regime is not well understood.
- Turbine foundation construction will create a pathway for contaminants into the underlying limestone aquifer.
- High groundwater heads support saturation of overlying peatlands and piled foundations would likely affect the role of the regional karst groundwater in supporting any restored bog hydrology.
- The drainage design is generic and does not take account of local and site specific conditions.
- The EIAR does not include a water balance that takes account of recharge to groundwater and the flood modelling is not supported by field based stream flow measurements.

4.3 Dr Pamela Bartley (Hydro-G)

- The EIAR has not considered groundwater flooding risk.
- Drainage of the substation will not work due to high groundwater heads and winter water logging.
- Construction is proposed in an area within Flood Zone A.
- The drainage design and construction design does not take sufficient account of the presence of dolines and potentially unstable ground.
- The groundwater risks do not take sufficient account of the mapped presence of karst features (dolines) on and close to the Site.
- The EIAR fails to appropriately consider the significance, impact, mitigation or residual impacts in the context of the site specific Statutory Instruments.
- Errors in the calculation of grout/concrete volumes for the foundations, which overstate the volumes.

4.4 Applicant's Response

The Applicant provided a response to the submissions dated February 2026 (FT Document No. P25357-FT-XX-XX-RPT-PL-000).

The response to the Inland Fisheries Ireland comments are covered in section 3.2. The responses relating to karst, hydrology and flooding, water pollution, and groundwater and wells are covered in sections 5.13 to 5.16 inclusive.

The responses are summarised as follows:

- The Applicant acknowledges IFI's statutory responsibility under the provisions of the Fisheries Acts for the management, conservation and protection of Ireland's fishery resource. The Applicant states that the wind farm design, construction methodology and mitigation set out in the EIAR has been devised to ensure no deterioration in the ecological and hydromorphological condition of the Togher River, the Black River and Lough Corrib and accord with the IFI (2016) publication 'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites'. The Applicant makes reference to the various parts of EIAR that demonstrate this with a particular emphasis on the SWMP, the CEMP, and the Peat and Spoil Management Plan. It should be noted that none of these documents provides quantitative design of the water protection measures including settlement ponds and does not provide a quantitative model of piped drainage networks.
- Karst related issues were raised by North East Galway Environmental Protection CLC, Shancloon Windfarm Action Group and others. Particular reference was made to the interaction with turloughs, to which the Applicant has responded that the turloughs were assessed as being outside of the zone of influence. With reference to other karst features the Applicant states *"Only dolines were observed (which are voids within the superficial fine-grained till deposits as opposed to bedrock, caused by washing out of material within the overlying Quaternary deposits through underlying fractured fault rock of the proposed development.)"* and *"The EIAR includes extensive ground investigation and groundwater monitoring which indicates a predictable subterranean flow given the geology of the proposed development lands, and as such potential pollutant pathways have been fully called out in the EIAR and mitigated for accordingly."*
- With respect to flood risk the Applicant justifies that the development of turbines in flood zone A is acceptable, and proposes finished floor levels above the flood level.
- With respect to water quality the Applicant re-states the conclusion of the EIAR and makes the following statement:
"However, it is important to note that the proposed development does not rely only on such "standard mitigation"; rather these mitigation measures are a secondary line of defence. The constraints-led design is the major factor in preventing potential impacts on surface waters, with all turbine foundations and hardstandings located a minimum of 50 m away from all watercourses. Section 2.12 of the EIAR includes full details on the mitigation proposed for the protection of surface waters, which far exceeds the standard mitigation being called into question."
- With respect to impacts on groundwater the Applicant restates the conclusions of the EIAR.

In summary the response document largely re-states the conclusions drawn in the EIAR. No additional information is presented and the comments made in the submissions are dismissed.

5. Conclusions

Chapters 11 &12 of the EIAR and associated documents present a desk based review of the hydrogeological and hydrological setting of the proposed development.

The desk based review is supported by a site investigation including amongst other activities, walk over surveys, peat probing, trial pitting and borehole drilling.

Interpretation of the site investigation data within a geological and hydrogeological local and site level context has not been presented.

An overarching, three dimensional and transient, consistent conceptual hydrogeological model that links the local and site level geology and hydrology is not presented.

The hydrogeology of the Peat has not been considered.

An appropriate flood risk assessment has been undertaken, which is supported by site level modelling.

Mitigation measures to prevent the discharge of contaminated water have been described, but have not been quantitatively designed, as such they do not take account of site level details.

The lack of an evidence based conceptual hydrogeological model means that the connectivity between the Site and development and local groundwater linked receptors including turloughs, streams and rivers and private wells/boreholes cannot be established.

The risk assessment associated with the construction of the turbine foundations is based on a flawed understanding of the relationship between mapped surface expressions of karst and the underlying geology.

An Appropriate Assessment Screening Report and Natura Impact Statement (NIS) accompanies the EIAR. These reports have been prepared to provide the competent authorities with the information necessary to complete an Appropriate Assessment screening and an Appropriate Assessment for the Proposed Project in compliance with Article 6(3) of the Habitats Directive. The Appropriate Assessment Screening Report identified the potential for significant effect on Lough Corrib SAC and Shule Turlough SAC. As such there is a high burden of proof required in ensuring that the Proposed Project, individually or in-combination with other plans or projects, will not adversely affect the integrity of any European Site.

The evidence presented does not robustly support the lack of potential effects on Shrule Turlough SAC and Lough Corrib SAC due to the lack of an overarching, three dimensional and transient, consistent conceptual hydrogeological model that links the local and site level geology and hydrology.

Therefore it cannot be assumed beyond reasonable scientific doubt that the Proposed Project, individually or in-combination with other plans or projects, will not adversely affect the integrity of any European Site.

6. Conditions

If it is considered that planning permission can be granted, then it is important that suitable conditions covering (but not limited to) the following aspects are included:

- A quantitative water management plan is submitted and approved prior to commencement, covering but not limited to:
 - Design of piped drainage systems
 - Design of runoff storage and settlement systems
 - Design of permanent hard standings preventing downward migration of infiltrating rainfall
 - Details of foundation construction which prevents the creation of hydrogeological pathways to the underlying limestone aquifer
 - Details of heave / breakthrough risk due to high groundwater heads below the limestone Till at the gravity foundation pit locations and permanent hardstandings
- Full details of the water level and water quality monitoring covering pre-construction (base line), construction, operation and restoration phases of development, including quality control procedures, based on an overarching, three dimensional and transient, consistent conceptual hydrogeological model that links the local and site level geology and hydrology.
- A karst protection protocol is submitted and approved prior to commencement.
- A piling protocol is submitted and approved prior to commencement.

Appendix A

Figure 2

Guidelines for the Preparation of
Soils, Geology and Hydrogeology Chapters of
Environmental Impact Statements
Institute of Geologists of Ireland, April 2013

Figure 2 Activities /Environments Matrix

[illegible]