APPENDIX 9-1

FLOOD RISK ASSESSMENT

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LACKAREAGH WIND FARM, CO. CLARE

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

EDF RENEWABLES IRELAND

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO), on behalf of EDF Renewables Ireland (the Client), to undertake a Flood Risk Assessment (FRA) for the Proposed Project.

This FRA is written to accompany Chapter 9 of the Environmental Impact Assessment Report (EIAR) for the Lackareagh Wind Farm (hereafter referred to using the following terminology: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection Route', 'the site' as defined in Section 1.1.1 of Chapter 1 of the EIAR). The Proposed Project is described in full in Chapter 4 of the EIAR. For the purposes of this FRA, and consistent with the EIAR, the various components are described and assessed using the references outlined above.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

1.2 STATEMENT OF EXPERIENCE

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

HES's core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. HES routinely work on surface water monitoring and modelling, and prepare flood risk assessment reports.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Carrownagowan WF, Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with over 4 years' experience in environmental consultancy in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor has prepared the Land, Soils and Geology and Hydrology and Hydrogeology Chapters for numerous wind farm EIAR projects. Conor routinely competes Flood risk Assessments for a wide variety of projects including wind farms, quarries and proposed residential developments.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the Proposed Project;
- Section 3 outlines the hydrological and geological characteristics of the local area;
- Section 4 presents the initial flood risk identification undertaken for the Proposed Project based on desk studies and walkover surveys and a resultant Justification Test based on HES's findings;
- Section 5 presents the drainage design for the Proposed Project in terms of flood prevention; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

This section provides details on the topographical setting of the site along with a description of the Proposed Project.

2.1 SITE LOCATION AND TOPOGRAPHY

The Proposed Wind Farm is located immediately to the east of the village of Kilbane in east Co. Clare. The Proposed Wind Farm is located ~3.7km northwest of the village of Bridgetown, ~4.6km east of the village of Broadford, Co. Clare and ~14km north of Limerick City. The Proposed Wind Farm is located in the townlands of Shannaknock, Killeagy and Ballymoloney in the west and Magherareagh and Lackareagh Beg in the east. The site has a total area of 291 hectares (ha).

The Proposed Wind Farm is comprised of agricultural lands in the west and existing commercial forestry plantations, dominated by Sitka Spruce and Lodgepole Pine, in the east. The eastern section of the Proposed Wind Farm also contains areas which have been felled and are reverting naturally.

The Proposed Wind Farm is served by an existing network of local public and private roads. A local road (L7080), known as the Gap Road, bissects the Proposed Wind Farm and joins the village of Kilbane in the west with Garraunboy Cross in the east. This local road is located on a steep gradient in places and passes between Glennagalliagh Mountain to the north and Lackareagh Mountain to the south. Several small farm access tracks and forestry roads branch off from this local road and facilitate access to the Proposed Wind Farm.

Topography of the Proposed Wind Farm is highly variable, ranging from ~90 to 440mOD (metres above Ordnance Datum). The Proposed Wind Farm is located in the Slieve Bernagh Mountain Range. The east of is located on the western slopes of Glennagalliagh and Lackareagh mountains and contains some very steeply sloping ground. Meanwhile, the northwest of the Proposed Wind Farm is located on the southern slopes of Cragnamurragh Mountain.

The Proposed Grid Connection Route from the proposed onsite 38kV substation to the existing Ardnacrusha 110kV substation is ~14.7km in length. The Proposed Grid Connection Route is located within the carriageway of regional and local public roads (~14.4km) and ESB access tracks (~300m) on the approach to Ardnacrusha 110kV substation, as described fully within Chapter 4 of this EIAR.

Meanwhile along the Turbine Delivery Route (TDR) A temporary blade transition area will be constructed along the R466 in the townland of O'Briensbridge, ~1km southeast of the small village of Bridgetown in east Co. Clare.

A site location map is shown as **Figure A**.

2.2 PROPOSED PROJECT DETAILS

The Proposed Project is detailed in full in Chapter 4 of the EIAR.

In summary the Proposed Project includes 7 no. proposed wind turbines, an onsite 38kV substation, a battery storage compound, a temporary construction compound, a temporary set down area, a permanent meteorological mast, an onsite borrow pit, new site access roads, upgrades to existing site access roads, an underground 38kV grid connection to the existing Ardnacrusha 110kV substation and a temporary blade transition area along the TDR.

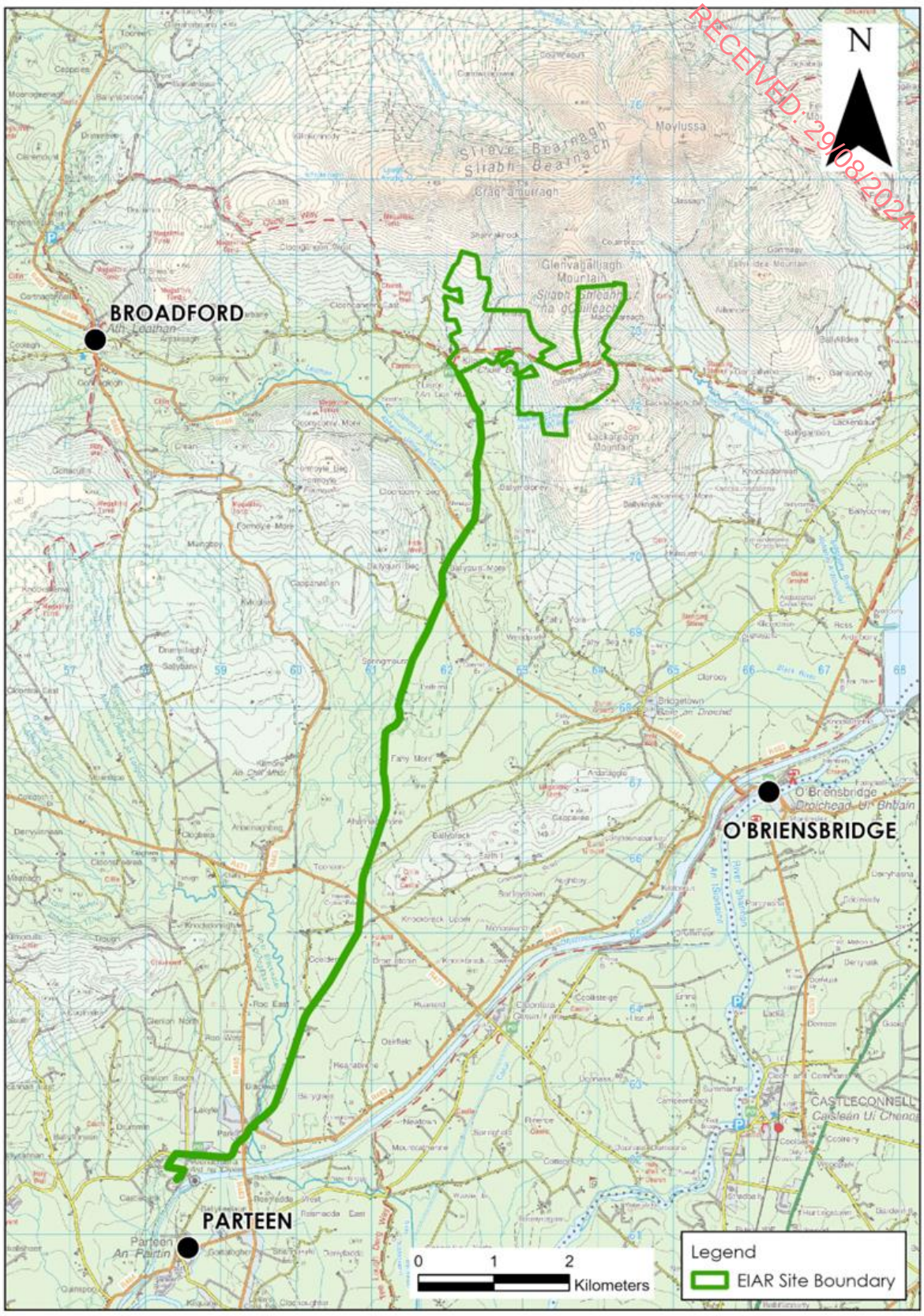

Figure A: Site Location Map

3. EXISTING ENVIRONMENT AND CACTHMENT CHARACTERISTICS

This section gives an overview of the hydrological and geological characteristics of the region and the Proposed Project site.

3.1 BASELINE HYDROLOGY

3.1.1 Regional and Local Hydrology

The Proposed Wind Farm site is located across 2 no. regional surface water catchments. The east of the Proposed Wind Farm site is located in the Lower Shannon surface water catchment and Hydrometric Area 25D. Meanwhile, the west of the Proposed Wind Farm site is located in the Shannon Estuary North surface water catchment and Hydrometric Area 27. Both regional surface water catchments are located in the Shannon River Basin District.

Within the Lower Shannon surface water catchment, the Proposed Wind Farm site is located in the Shannon[Lower]_SC_080 sub-catchment. More locally this section of the Proposed Wind Farm site lies within the catchment of the Ardcloony River. This river rises near the summit of Moylussa and flows to the southeast, ~1km east of the Proposed Wind Farm site. The Ardcloony River discharges into Lough Derg ~5km to the southeast. In terms of WFD river sub-basins, this area of the Proposed Wind Farm site is mapped in the Ardcloony_010 river sub-basin.

Within the Shannon Estuary North surface water catchment, the Proposed Wind Farm site is located in the Owenogarney_SC_010 sub-catchment. More locally, this area of the Proposed Wind Farm site is drained by the Glenomra River and is mapped in the Broadford_010 WFD river sub-basin. The Glenomra River flows to the northwest, ~1km southwest of the Proposed Wind Farm site. Several mountain streams rise on the slopes of Lackareagh and Glennagalliagh mountains and flow to the southwest, through the site, before discharging into the Glenomra River. Many of these mountain streams are locally unnamed, with the exception of the Ailleenagommaun Stream which flows ~200m north of T7 and ~250 south of T6. Many of these streams have been assigned names in the EPA blueline database. The Ailleenagommaun Stream is referred to as the Clonconry Beg Stream, while a stream referred to as the Kilbane Stream flows to the south ~220m east of T2. Downstream of the Proposed Wind Farm site, the Glenomra River flows to the west, through the village of Broadford. Downstream of Broadford, this watercourse is referred to as the Broadford River. This river discharges into Doon Lough, ~6.7km west of the Proposed Wind Farm site and outfalls from this lake as part of the Owenogarney River.

With regards to the Proposed Grid Connection Route, the northern section is mapped in the Shannon Estuary North surface water catchment. There are a total of 5 no. watercourse crossings over EPA mapped rivers and streams in this area (1 no. of which is located within the Proposed Wind Farm site). These crossings are located within the Proposed Wind Farm site along the Gap Road over a tributary of the Ailleenagommaun Stream, along the L3022-8 over the Ailleenagommaun Stream (referred to by the EPA as the Cloonconry Beg Stream), over the Glenomra River at Ahnagor Bridge and over a small locally unnamed tributary of the Glenomra Stream referred to by the EPA as the Ballquin Beg Stream. Meanwhile, the vast majority of the Proposed Grid Connection Route is mapped in the Lower Shannon surface water catchment and Hydrometric Area 25D. There is 1 no. crossings over the EPA mapped Blackwater River near Barry's Cross.

The proposed blade transition area long the TDR is located in the Lower Shannon regional surface water catchment. More locally this area is within the Shannon[Lower]_SC_080 sub-catchment and the Bridgetown (Clare)_010 WFD river sub-basin. There are no EPA mapped watercourses in the immediate vicinity of the temporary blade transition area along the TDR.

A local hydrology map is attached as **Figure B**.

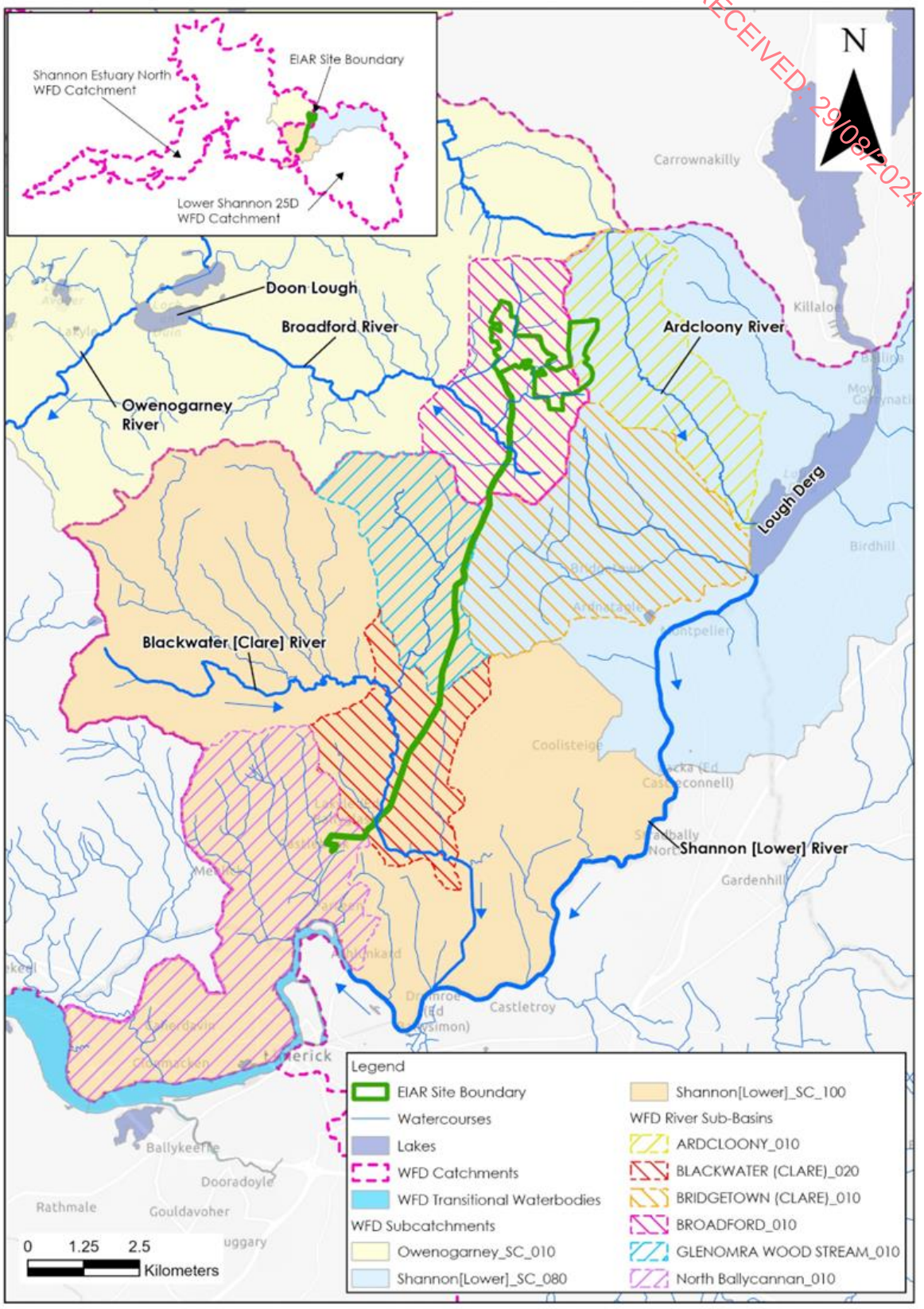

Figure B: Local Hydrology Map

3.1.2 Proposed Wind Farm Site Drainage

The Proposed Wind Farm site is drained by several 1st and 2nd order streams. These natural watercourses originate within the EIAR Site Boundary and flow downslope before discharging into the Ardcloony River to the east and the Glenomra River to the southwest.

In places the natural drainage is further facilitated by a network of manmade drains. The nature of these drains depends on the local land use. In agricultural areas of the Proposed Wind Farm site, manmade field drains are located along many of the local field boundaries and hedgerows and connect to downstream natural watercourses. Manmade drains are also located along sections of the existing roads. Meanwhile, the forestry plantations are generally drained by a network of mound and ribbon drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantations.

3.1.3 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Killaloe, the closest rainfall station to the Proposed Wind Farm site with long term SAAR data, is 1,357mm (www.met.ie). Killaloe rainfall station is located ~6km east of the Proposed Wind Farm site. However, the SAAR at Killaloe is likely to underestimate rainfall at the Proposed Wind Farm site due to elevation differences whereby the Proposed Wind Farm site stands at elevations of 90-440mOD and Killaloe rainfall station is at ~40mOD.

Met Éireann also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Proposed Wind Farm site ranges from 1,385 to 1,499mm/year. The average annual rainfall is 1,442mm/yr (this is considered to be the most accurate estimate of average annual rainfall from the available sources).

The average potential evapotranspiration (PE) at Shannon Airport (~25km southwest of the Proposed Wind Farm site) is taken to be 543.2mm (www.met.ie). The actual evapotranspiration (AE) is calculated to be 516mm (95% PE). Using the above figures, the effective rainfall (ER)[1] for the area is calculated to be (ER = SAAR – AE) 926mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table A** below presents return period rainfall depths for the Proposed Wind Farm site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table A. Proposed Wind Farm site – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.6	6.0	10.2	14.0
15 mins	6.0	9.9	16.6	23.0
30 mins	7.7	12.4	20.2	27.4
1 hours	10.1	15.7	24.7	32.7
6 hours	20.0	28.5	41.2	51.8
12 hours	26.0	36.0	50.3	61.8
24 hours	33.9	45.4	61.3	73.9
2 days	42.6	55.8	73.8	87.7

[1] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

3.2 GEOLOGY

The published Teagasc soils map (www.gsi.ie) for the local area shows that the Proposed Wind Farm site is overlain by a mosaic of soil types. Mapped soils within the Proposed Wind Farm site comprise of acid deep well drained mineral soils (AminDW) and acid shallow well drained mineral soils (AminSW) in the west. Meanwhile, acid, shallow, rocky, peaty mineral soils (AminSRPT) and peat are mapped in the east of the Proposed Wind Farm site.

The published subsoils map (www.gsi.ie) shows that much of the west of the Proposed Wind Farm site is underlain by till derived from Lower Palaeozoic sandstones and shales (TLPSsS). A small area in the southwest is underlain by Gravels derived from Lower Palaeozoic and Devonian sandstones (GLPDSs). Due to the elevated nature of the local area, much of the higher ground in the east in mapped to be underlain by Bedrock outcrop or subcrop (Rck). A small area of Blanket Peat is also mapped in the northeast of the Proposed Wind Farm site, near the summit of Glennagalliagh Mountain.

The soils and subsoils at the Proposed Wind Farm site have been verified by site investigations comprising of peat probes and trial pits. These site investigations have revealed that the site is overlain by a thin layer of peat or topsoil which is underlain by glacial till.

The GSI bedrock geology map shows the Proposed Wind Farm site to be underlain by the Broadford Formation which is comprised of fine to conglomeratic graded greywacke and greywacke sandstone. Based on the GSI mapping, there are several bedrock geological faults mapped within Proposed Wind Farm site. The bedrock geology is exposed within several watercourses channels within the Proposed Wind Farm site and was verified during walkover surveys.

3.3 DESIGNATED SITES & HABITATS

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The Proposed Wind Farm site is not located within a designated conservation site, however there are several designated sites in close proximity and downstream of the Proposed Wind Farm site.

Slieve Bernagh Bog SAC is located directly to the north of the Proposed Wind Farm site. However, this SAC is located upgradient of the Proposed Project. There is no potential for the Proposed Project to impact on the status of this SAC.

Within the Shannon Estuary North surface water catchment there are several designated sites which are located downstream of the Proposed Project. These include Doon Lough NHA, Danes Hole Poulnalecka SAC/pNHA, Castle Lake pNHA, Ratty River Cave SAC, the Lower Shannon SAC, the Fergus Estuary and Inner Shannon, North Shore pNHA and the River Shannon and Fergus Estuary SPA. The Proposed Wind Farm site is hydrologically connected to these designated sites via the Glenomra, Broadford and Owenogarney rivers.

Meanwhile, within the Lower Shannon surface water catchment, the Proposed Wind Farm site is hydrologically connected to the Lower River Shannon SAC via the Ardcloony River and its associated tributaries. The blade transition area along the TDR is located ~670m northwest of the Lower Shannon SAC. Furthermore, the Proposed Grid Connection Route is located upstream of this SAC in the Lower Shannon Catchment and also crosses the Glenomra Wood SAC.

4. FLOOD RISK IDENTIFICATION

4.1 INTRODUCTION

The following flood risk assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the Proposed Project site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the Proposed Project. As per the Guidelines, the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment – quantitative appraisal of potential risk to a proposed development*.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Due to its inland location, coastal flooding is not applicable to the site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.
- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent

low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.
- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.
- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and,

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the Guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.
- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the study area that would identify lands that are "liable to flood" within or in the vicinity of the Proposed Wind Farm site, along the Proposed Grid Connection Route or in the area of the blade transition area along the TDR.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the Proposed Wind Farm site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported silts/clays referred to as alluvium build up within the flood plain and hence the presence of these soils is a good indicator of potentially flood prone areas.

Based on the EPA/GSI soil map for the local area, no fluvial or lacustrine deposits are mapped within the Proposed Wind Farm site. There are no soils present that indicate areas where flooding may have occurred in the past. The closest mapped alluvium deposits within the Shannon Estuary North surface water catchment are located along the Glenomra River, ~2.5km west of the Proposed Wind Farm site. Meanwhile, within the Lower Shannon surface water catchment the closest alluvium deposits are mapped along the Ardcloony River, ~1km east of the Proposed Wind Farm site.

There are no alluvium deposits mapped along the Proposed Grid Connection Route. However, alluvium deposits are mapped along a tributary of the Bridgetown River ~350m east of the Proposed Grid Connection Route in the townland of Fahy More South. Alluvium deposits are also mapped ~450m west of this section of the Proposed Grid Connection Route along the Glenomra Wood Stream. Further south, alluvium deposits are mapped ~50m east of the Proposed Grid Connection Route in the townland of Coolderry along the EPA mapped Oakfield stream. Meanwhile, marine and estuarine sediments are mapped where the Proposed Grid Connection Route crosses the Blackwater Bridge near Barry's Cross.

There are no fluvial or lacustrine deposits mapped in the area of the blade transition area along the TDR. Meanwhile, estuarine silts and clays are mapped to the southwest.

4.3.3 OPW Past Flood Events Mapping

To identify those areas as being at risk of flooding, OPW's Past Flood Events Map was consulted (www.floodinfo.ie).

No recurring or historic flood incidents are recorded within the Proposed Wind Farm site. However, several flood events have been recorded downstream.

Within the Shannon Estuary North surface water catchment, the closest mapped recurring flood event is located ~1.5km west of the Proposed Wind Farm site along the Glenomra River (Flood ID: 4695). In relation to this recurring flood event, the local area engineers report states that "*land on North side of R466 floods over an extensive area on average twice per year. The cause is rainfall/runoff causes stream running by road to overflow*" (www.floodinfo.ie). A recurring flood event is also mapped downstream of Doon Lough along the Owenogarney River (Flood ID: 4699). Further downstream several recurring flood events (Flood ID: 4485, 4479, 4498) are also located downstream of Sixmilebridge where roads are noted to flood in the vicinity of the Owenogarney River due to heavy rainfall and/or tidal backup.

Within the Lower Shannon surface water catchment, there are no historic or recurring flood events mapped along the Ardcloony River. Several historic flood events, dating from 2009 and 2015, are mapped further downstream on the River Shannon near O'Briensbridge. With respect to mapped recurring flood events, the nearest recurring flood event (Flood ID: 13690) downstream of the Proposed Wind Farm site is mapped at Parteen Weir, ~6km to the southeast.

The OPW Past Flood Events map does not record any historic or recurring flood events in the vicinity of the Proposed Grid Connection Route. The closest recurring flood event is mapped along the Bridgetown River in the townland of Fahy More South, ~1.4km southeast of the Proposed Grid Connection Route. Several historic flood events are recorded downstream along the River Shannon in the vicinity of Limerick City.

No historic or recurring flood events are mapped in the area of the blade transition area along the TDR.

The OPW Past Flood Events Map is presented as **Figure C** below.

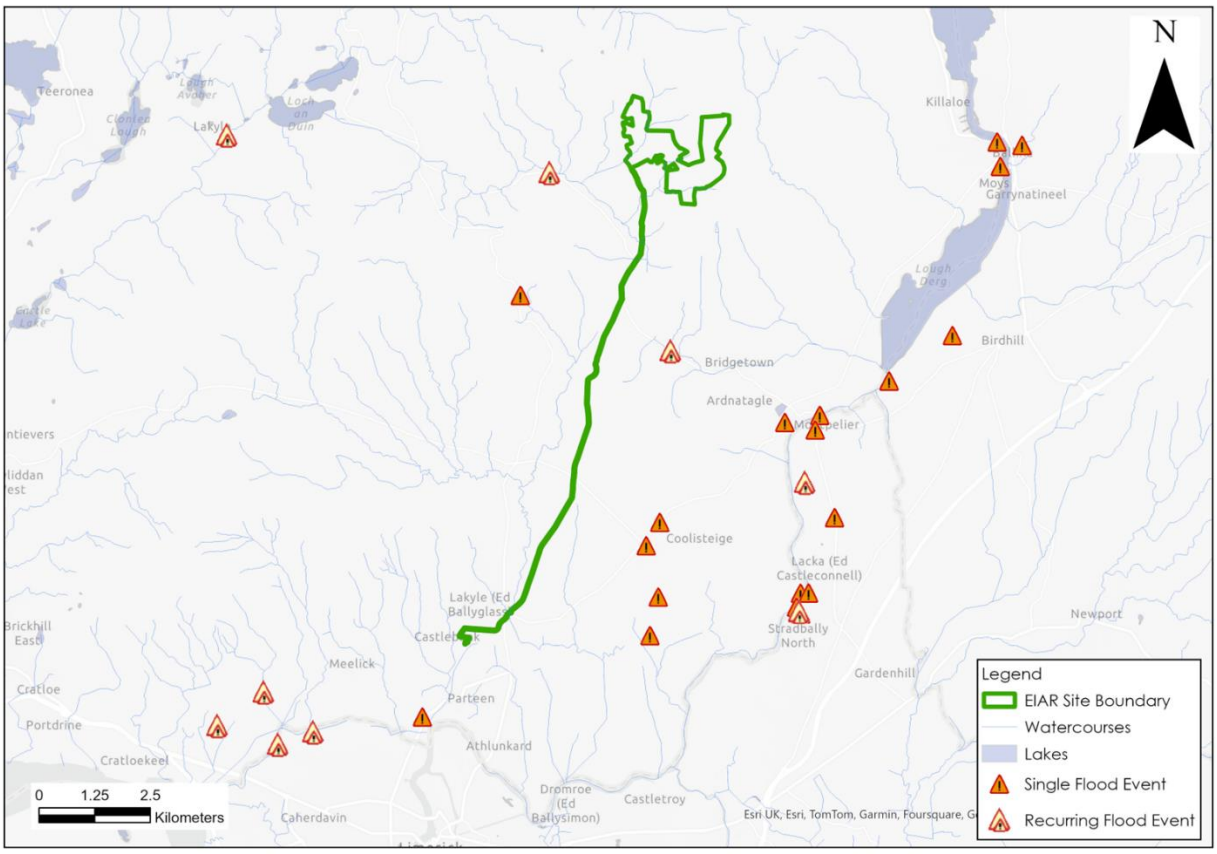

Figure C: OPW Past Flood Events Map (www.floodinfo.ie)

4.3.4 GSI Historic Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding map shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available to view at www.floodinfo.ie.

The flood map for this event does not record any flood zones along the streams and watercourses which drain the Proposed Wind Farm site. Downstream of the site within the Shannon Estuary North surface water catchment, some flooding was recorded at Doon Lough. Within the Shannon Lower surface water catchment, flooding was recorded along Lough Derg and the River Shannon.

The GSI do not record any historic flood zones along the Proposed Grid Connection Route. Surface water flooding was recorded along Ardnacrusha canal.

No historic surface water flood zones are mapped in the vicinity of the blade transition area along the TDR. The closest flooding was recorded ~120m to the southeast of the proposed blade transition area, corresponding to the location of McNamara's Lake.

4.3.5 CFRAM Mapping – Fluvial and Pluvial Flooding

Catchment Flood Risk Assessment and Management (CFRAM)[2] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA maps. CFRAM mapping of river flood extents are available at www.floodinfo.ie.

No CFRAM mapping has been completed for the area of the Proposed Wind Farm site. The closest mapped low-probability (1 in 1,000-year) CFRAM fluvial flood zones within the Lower Shannon surface water catchment are located at Lough Derg, ~4.7km to the southeast of the Proposed Wind Farm site. Meanwhile, the closest low probability CFRAM fluvial flood zones in the Shannon Estuary North catchment are located on the Owenogarney river downstream of Castle Lake, approximately 15km southwest of the Proposed Wind Farm site.

Similarly, there are no CFRAM food zones mapped along the watercourses which drain the northern sections of the Proposed Grid Connection Route. However, CFRAM fluvial flood mapping has been completed on the West Roo stream (EPA name) to the southwest of the existing Ardnacrusha 110kV substation. The low probability (1 in 1,000-year) flood zone along this watercourse is mapped ~100m west of the existing Ardnacrusha 110kV substation and ~100m south of the Proposed Grid Connection Route. In this area CFRAM Flood Zones are also mapped along the Ardnacrusha canal, these are located approximately 60m to the south of the Proposed Grid Connection Route. CFRAM Flood Extents Mapping (Present Day) in the vicinity of the Proposed Grid Connection Route at Ardnacrusha are shown in **Figure D** below.

There are no CFRAM fluvial flood zones located in the area of the blade transition area along the TDR. The closest mapped flood zones are located along Ardnacrusha canal, ~400m to the southeast of the blade transition area.

[2] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

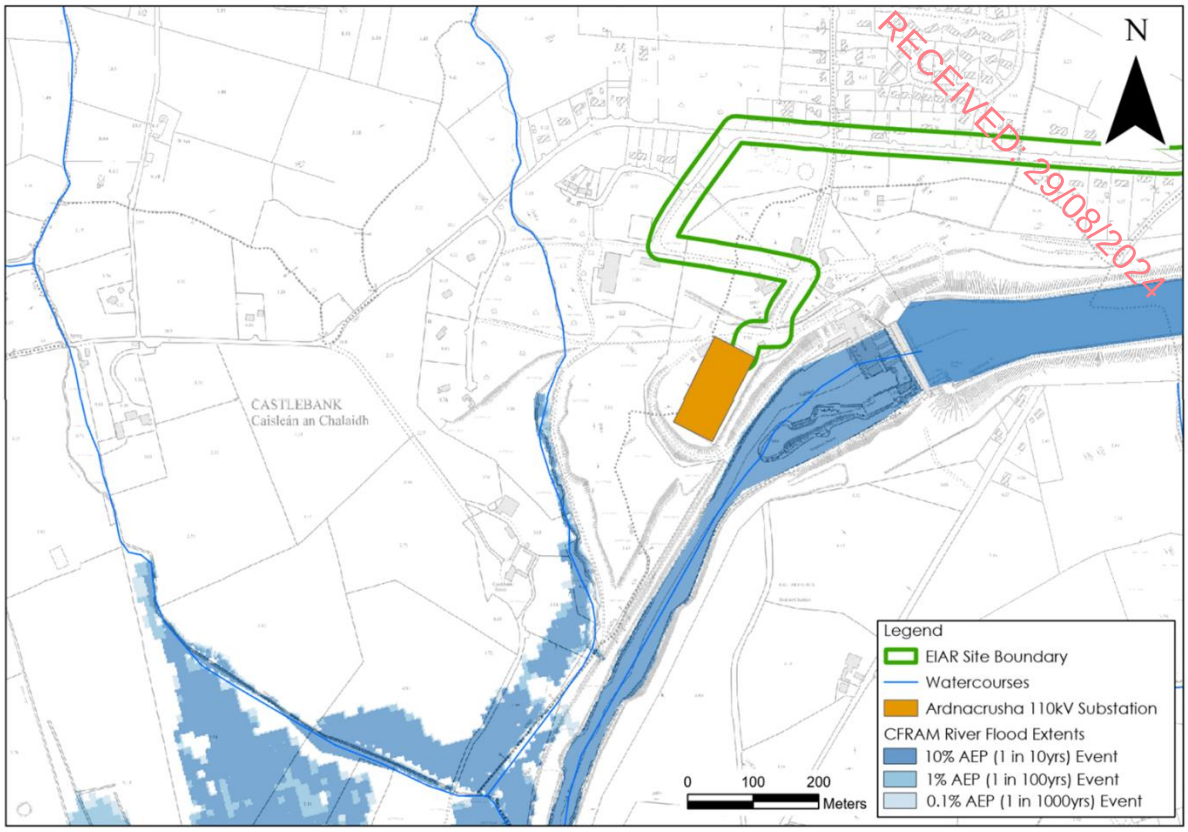

Figure D: CFRAM Fluvial Flood Mapping at Ardnacrusha (www.floodinfo.ie)

4.3.6 OPW National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Flood Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.9** below.)

For the Present Day Scenario, no high probability (1 in 10-year), medium probability (1 in 100-year) or low probability (1 in 1,000-year) fluvial flood zones have been mapped within the Proposed Wind Farm site. Within the Shannon Estuary North surface water catchment, fluvial flood zones are mapped along the Glenomra and Broadford rivers from Kilbane to Doon Lough with the nearest flood zones situated ~900m southwest of the Proposed Wind Farm site. Meanwhile, within the Lower Shannon Catchment, fluvial flood zones are mapped along the Ardcloony River, ~1km to the east of the Proposed Wind Farm site.

The Proposed Grid Connection Route crosses a modelled fluvial flood zone along the Blackwater River at Blackwater Bridge near Barry's Cross. There is an existing bridge at this location. The remainder of the route is located in Fluvial Flood Zone C and is at low risk of flooding.

There are no NIFM flood zones in the area of the blade transition area along the TDR.

Local NIFM flood zones are shown on **Figure E** below.

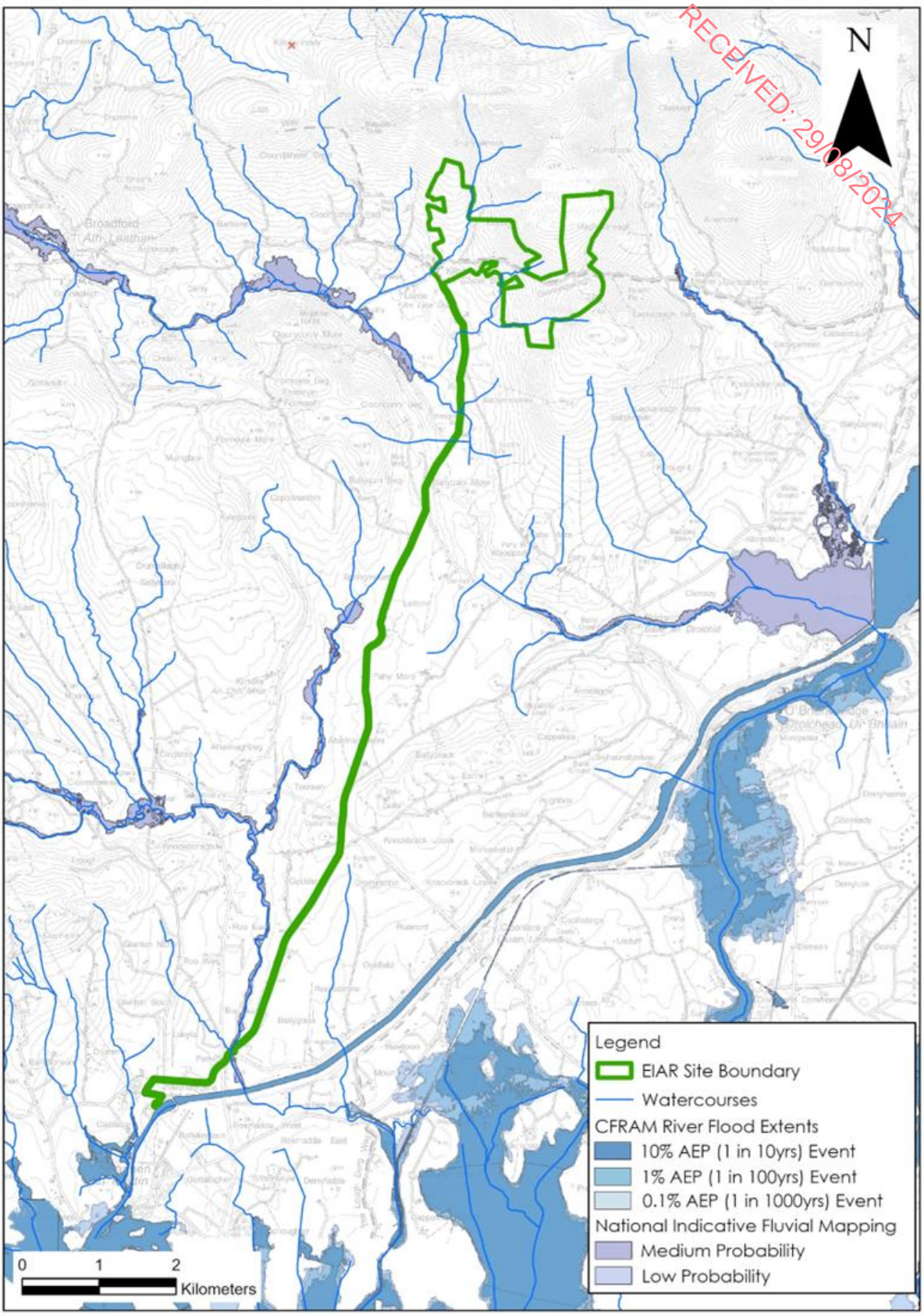

Figure E: OPW National Indicative Flood Mapping

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Proposed Wind Farm site, along the Proposed Grid Connection Route or in the vicinity of the blade transition area along the TDR.

4.3.8 Coastal Flooding

The Proposed Wind Farm site is located ~13km (straight line distance) from the Upper Shannon Estuary and stands at a significant elevation above sea level (~90 - 440mOD). The closest mapped CFRAM coastal flood zones are mapped ~13km to the south. Therefore, the Proposed Wind Farm is not at risk of coastal (tidal) flooding.

Similarly, no CFRAM tidal flood zones are mapped in the vicinity of the Proposed Grid Connection Route. The closest tidal flood zones are located near Parteen, ~1.3km south of the existing Ardnacrusha 110kV substation.

There are no coastal flood zones mapped in the area of the blade set down area along the TDR.

4.3.9 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall. The CFRAM Programme has modelled flooding associated with potential future climate change scenarios. However as stated above no CFRAM modelling has been completed in the vicinity of the Proposed Wind Farm site.

National Indicative Fluvial Mapping has been completed for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme. These flood zones have also been modelled for 2 no. potential future climate change scenarios, with the Mid-Range and High-End Future Scenario flood extents generated using an increase in rainfall of 20% and 30% respectively.

Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.6**. Therefore, the NIFM flood zones in the vicinity of the Proposed Wind Farm site and along the Proposed Grid Connection Route are unlikely to be significantly impacted by future climate change.

CFRAM fluvial flood mapping has also been completed for the Mid-Range and High-End Future Scenario. The modelled flood zones in the vicinity of the Proposed Grid Connection Route at Ardnacrusha and along Ardnacrusha Canal to the southeast of the blade transition area show similar flood zones to the Present Day Scenario ad described in **Section 4.3.5**. Therefore, flood zones along the Proposed Grid Connection Route and in the vicinity of the blade transition area are unlikely to be significantly impacted by future climate change.

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, the Proposed Wind Farm site is not constrained by coastal, fluvial or groundwater flooding. The entire Proposed Wind Farm site, including all proposed infrastructure locations, is located in Fluvial Flood Zone C and is at a low risk of flooding.

Much of the Proposed Grid Connection Route is located in Flood Zone C. However, a small section of the route is mapped in Fluvial Flood Zone A due to its proximity to the Blackwater

River. Due to the nature of the underground electrical cable, this will have no effect during the operational phase of the Proposed Project. During the construction phase, works along the Proposed Grid Connection Route may have to be postponed following heavy rainfall events which may cause flooding at the Blackwater Bridge.

The blade transition area along the TDR is at low risk of flooding (Flood Zone C).

4.4 DETAILED FLOOD RISK ASSESSMENT

4.4.1 Site Surveys

Detailed walkover surveys of the Proposed Wind Farm site were undertaken by HES on 8th September 2022, 13th July 2023 and 10th October 2023.

The Proposed Wind Farm site was noted to comprise of a mixture agricultural areas in the west and forestry plantations in the east. Several watercourses have their upper reaches within the Proposed Wind Farm site and these flow rapidly downslope before discharging into the larger watercourses in the surrounding valleys.

During the walkover surveys and surface water flow monitoring there was little evidence of previous out of bank flow from within the various river and stream channels. During targeted visits following considerable rainfall in the prior days, high flows were observed within the rivers, with many estimated to be several multiples of the typical dry weather flow. No widespread or localized flooding was observed during these site visits, all flow was contained within the channels.

Monitoring of stream discharge in the main streams within and downstream of the Proposed Wind Farm site and Proposed Grid Connection Route was undertaken on 2 no. occasions at 6 no. monitoring locations on 13th July 2023 and 12th October 2023. The data is presented in **Table B**. HES note that the flow volumes are typical of mountainous streams which drain a forested peatland, with high flow volumes and a rapid response to rainfall events. Larger flow volumes were encountered at SW6 as this monitoring location is on the Blackwater River along the Proposed Grid Connection Route. The recorded flow volumes at SW6 are more typical of larger regional watercourse with a large upstream catchment area.

In summary, no areas of concern regarding flood risk were noted during the walkover surveys due to:

- The elevation of much of the Proposed Wind Farm site located at elevations in excess of 100mOD;
- The steeply sloping nature of the land with the Proposed Wind Farm site which is drained by numerous streams and rivers which flow rapidly downslope and have eroded deep channels into the subsoils and bedrock;
- The existing drainage regime in agricultural areas which comprises of field drains along hedgerows and field boundaries and transfers surface water runoff to downstream natural watercourses; and,
- The existing drainage regime within forested areas, which is comprised of regularly spaced mound and ribbon drains. These drains facilitate the movement of water downslope and into the existing natural drainage system and local streams/rivers.

Table B: Surface Water Flow Monitoring

Location	Easting (ITM)	Northing (ITM)	Watercourse – EPA Name	Flow Volume (m^3/s) Range across 2 no. monitoring rounds
SW1	560998	672116	Glenomra River	0.05 – 0.06
SW2	562191	672827	Kilbane Stream	0.02 – 0.025
SW3	564890	672673	Unnamed stream	0.008 – 0.01
SW4	562372	671855	Cloonconry Beg	0.008 – 0.012
SW5	565267	672503	Ardcloony	0.03 – 0.04
SW6	559376	662466	Blackwater River	~5

4.4.2 Existing Site Drainage

The Proposed Wind Farm site is drained by several 1st and 2nd order streams. These natural watercourses originate within the EIAR Site Boundary and flow downslope before discharging into the Ardcloony River to the east and the Glenomra River to the southwest.

In places the natural drainage is further facilitated by a network of manmade drains. The nature of these drains depends on the local land use. In agricultural areas, manmade field drains are located along many of the local field boundaries and hedgerows and connect to downstream natural watercourses. Manmade drains are also located along sections of the existing roads.

The forestry plantations in the east of the Proposed Wind Farm site are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation. Mound drains and ploughed ribbon drains are generally spaced approximately every 15m and 2m respectively. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. Interceptor drains are also located up-gradient of forestry access roads. Culverts are generally located at stream crossings and at low points under access roads which drain runoff onto down-gradient forest plantations. A schematic of a typical standard forestry drainage network and one which is representative of the site drainage network is shown as **Figure F**. The forestry drains are the primary drainage routes towards the natural streams, but the flows in the higher elevated drains are generally very low or absent most of the time.

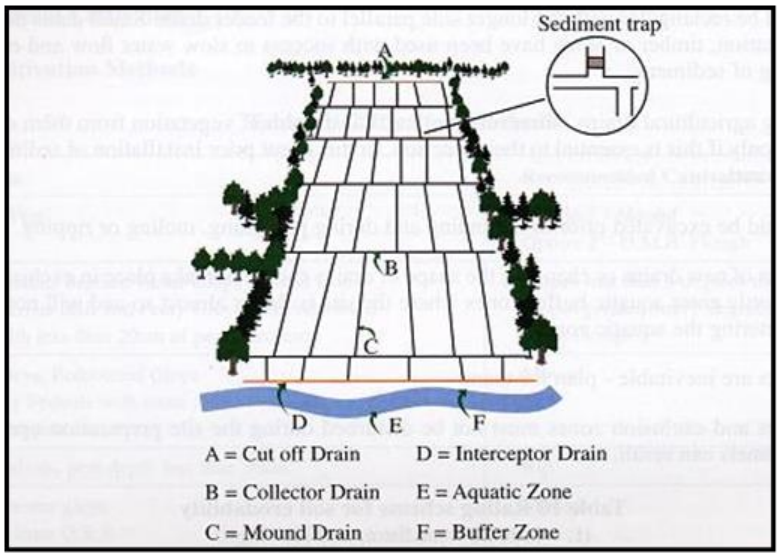

Figure F: Schematic of Typical Forestry Drainage Layout

4.4.3 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Proposed Wind Farm site, along the Proposed Grid Connection Route and in the blade transition area along the TDR can be described using the Source – Pathway – Receptor Model ("S-P-R"). Given the typical steeply sloping topography and ground elevations, the potential for pluvial flooding is generally low. The primary potential source of flooding in this area, and the one with most consequence for the Proposed Project, is fluvial flooding of the local streams which drain the Proposed Project site during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

There are no apparent sources of flooding at the Proposed Wind Farm site having considered tidal, fluvial and pluvial sources. The main risk of flooding is via pluvial flooding. This risk is limited to local flat areas due to the mountainous and sloping nature of the wider area. Surface water ponding/pluvial flooding may occur in some flat areas of the Proposed Wind Farm site due to the presence of low permeability peat/topsoil at the surface. However, mostly the risk of pluvial flooding is very low, due to the elevated and sloping nature of the Proposed Wind Farm site and the high density of streams and drains which flow rapidly downslope.

The Proposed Grid Connection Route also is at a low risk of flooding. However, there are areas which may be prone to flooding, principally at existing watercourse crossings. Due to the depth of the Proposed Grid Connection Route underground cabling, this will have no impact during the operational phase of the Proposed Project. During the construction phase, works along the Proposed Grid Connection Route may have to be postponed following heavy rainfall events which could cause flooding in this area.

There is no apparent flood risk at the location of the blade transition area along the TDR.

4.4.4 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and initial Flood Risk Assessment process it would appear that flooding is unlikely to be problematic at the Proposed Wind Farm site or along the Proposed Grid Connection Route. The potential sources of flood risk for the Proposed Project site are outlined and assessed in **Table C**.

Table C. S-P-R Assessment of Flood Sources for the Proposed Project

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to some of the wind farm infrastructure elements and the rivers and streams that flow throughout the site	Land & infrastructure	Based on CFRAM and NIFM, the Proposed Wind Farm site is location in Fluvial Flood Zone C where there is a low risk of fluvial flooding. Due to the slope of the land, water flows rapidly downslope in the numerous 1st and 2nd order streams which drain the site. There is little risk of fluvial flooding at the Proposed Wind Farm site. A small section of the Proposed Grid Connection Route is mapped in Fluvial Flood Zone A and B, associated with fluvial flooding along the Blackwater River. However, an existing crossing (Blackwater Bridge) already exists at this location. Therefore, the Proposed Project will have no effect on flooding in this area. There is no risk of fluvial flooding at the blade transition area along the TDR.
Pluvial	Ponding of rainwater on site	Land & infrastructure	There is very little risk of pluvial flooding within the Proposed Wind Farm site due to the steeply sloping nature of the land. Drainage moves relatively freely downslope due to the sloping topography; the existing agricultural and forestry drains and the high density of natural watercourses and streams. Therefore, there is little risk of pluvial flooding at the Proposed Wind Farm site.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	Based on local hydrogeological regime and GSI mapping, there is no risk of groundwater flooding at the Proposed Wind Farm site, along the Proposed Grid Connection Route or in the vicinity of the temporary compound and blade set down area along the TDR.
Coastal/tidal	Overbank flooding	Land, People, property	The Proposed Wind Farm site is located a significant distance from any estuary or tidal waterbody and at a significant elevation above sea level. Similarly, the Proposed Grid Connection Route and blade transition area along the TDR are distant from any coastal flood zone.

4.4.5 Requirement for a Justification Test

The matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test[3] is shown in **Table D** below.

It may be considered that the majority of the components of the Proposed Project can be categorised as "Highly Vulnerable Development" as they are electricity generating infrastructure (refer to Table 3.1 in DoEHLG, 2009). However, all "Highly Vulnerable Development" infrastructure, including the proposed onsite 38kV substation and 7 no. turbines are located in Flood Zone C (Low risk) and can therefore be considered as appropriate from a flood risk perspective.

However, an existing watercourse crossing (Blackwater Bridge) over the Blackwater River along the Proposed Grid Connection Route, is located in Fluvial Flood Zone A. The elements of the Proposed Project can be considered to be "Less Vulnerable Development". A justification test has been completed below for the Proposed Grid Connection Route crossing at Blackwater Bridge.

Table D: Matric of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	**Appropriate**
Less vulnerable development	**Justification test**	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

Box 5.1 (**Table E**) of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

Table E: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

[3] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: *this table has been adapted from Box 5.1 of "The Planning System and Flood Risk Management Guidelines" (2009).*

Referring to Point 1 and Points 2 (i) to (iv) inclusive:

An element of the Proposed Project is located in mapped fluvial flood zones along the Blackwater River at Blackwater Bridge near Barry's Cross along the Proposed Grid Connection Route. There are several dwellings located along local roads in the area of Blackwater Bridge which may be considered as being sensitive receptors. However, in this area the modelled NIFM flood zones are constrained to the immediate vicinity of the river channel. No dwellings in the surrounding lands are mapped in the modelled flood zones.

Furthermore, no displacement of floodwaters will result from the emplacement of the Proposed Grid Connection Route underground cable at Blackwater Bridge as the preferred option for crossing will be achieved by using a stainless steel pipe which will be strapped to the bridge exterior. There will be no in stream works or alteration of the existing hydromorphological regime.

During the construction phase, works at this location may be postponed in the event of flooding.

5. FLOOD IMPACT PREVENTION AND DRAINAGE MANAGEMENT

5.1.1 Planning Policy and the Clare County Development Plan

The following policies (**Table F**) are defined in the Clare County Development Plan (2023-2029), which was adopted in March 2023, in respect of flooding and we have outlined in the column to the right how these policies are provided for within the Proposed Project design.

Table F: Clare County Development Plan Objectives/Policies and Project Responses

CDP Policy Number:	Policy	Response
CDP 2.6	It is an objective of Clare County Council: To ensure development proposals have regard to the requirements of the SFRA and Flood Risk Management Guidelines; and where required are supported by an appropriately detailed hydrological assessment / flood risk assessment. To ensure that flood risk assessments include consideration of potential impacts of flooding arising from climate change including sea level rise and coastal erosion. To integrate sustainable water management solutions into development proposals.	This FRA has been prepared in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The potential effects associated with Climate Change are addressed in Section 4.3.9. The Proposed Wind Farm drainage system will ensure that runoff is attenuated and that volumes will be maintained at greenfield runoff rates.
CDP 2.8	It is an objective of Clare County Council: To support the implementation of the EU Floods Directive 2007/60/EC to manage flood risks; and, To implement the recommendation of the CFRAMS programme as it related to County Clare.	This FRA has been prepared in accordance with the EU Floods Directive 2007/6-/EC. The Proposed Project is not located within any mapped CFRAM Flood Zones.

5.1.2 Proposed Drainage

The site drainage system was designed integrally with the Proposed Project design layout as a measure to ensure that the proposal will not change the existing flow regime across the Proposed Project site, will not deteriorate water quality and will safeguard existing water quality status of the catchments from wind farm related sediment runoff.

Overland flow rates are likely to be significant and the drainage system must be designed and managed properly if it is to work effectively. A fundamental principle in the drainage design is that clean water flowing in the upstream catchment, including overland flow and flow in existing streams and drains, is allowed to bypass the works areas without being contaminated by silt from the works. The dirty water from the works areas is collected in a separate drainage system and treated by removing the suspended solids before discharging it to the downstream watercourse. This minimises the volume of dirty water requiring treatment.

Existing streams crossing the works area will be piped to isolate them from the works. New drains will be constructed to collect overland flow that is intercepted by the works areas or by new access roads. These will be constructed on the uphill side of the works and piped to the downhill side, bypassing the works areas. However, this will cause the normally dispersed flow to be concentrated at specific discharge points downstream of the works. In order to disperse this flow each clean water drain will be terminated in a discharge channel running parallel to the ground contours that will function as a weir to disperse the flow over a wider area of vegetation.

This will prevent erosion of the ground surface and will attenuate the flow rate to the downstream receiving waters.

The resultant diversion of clean water runoff will ensure that the treatment system will only need to deal with construction related runoff. The treatment system consists of a series of settlement ponds that are located at each works site and at intervals along the access roads. The outflow from the settlement ponds will be allowed to disperse across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering the downstream watercourses.

5.1.3 Proposed On-Site Runoff Attenuation

The creation of impermeable areas within a site has the effect of increasing rates of runoff into the downstream drainage system and this may increase flood risk and flood severity downstream. This applies particularly to urban areas that drain to closed pipe systems which do not have the capacity to cater for increased hydraulic loads. The Proposed Project is located within a large rural catchment with an open drainage system. The footprint of the impermeable areas and the associated increase in runoff rate is very small in the context of the catchment size and therefore represents a negligible increase in downstream flood risk. Notwithstanding the low increase in flood risk due to the Proposed Project, the drainage system has been designed to prevent any increase in discharge rates above that which already exist in the undeveloped site.

The volume of water requiring attenuation relates to direct precipitation on the roads and hard-standing footprint only. The aim of the storm water attenuation measures is to limit the flow rate from the developed area to that which prevails on the undeveloped site. This is achieved by limiting the flow rate to the downstream receiving waters and temporarily storing the excess water that accumulates as a result. The developed surfaces have some permeability and this reduces the attenuation requirement. Conventional attenuation systems use proprietary flow control units but these can become blocked with debris and vegetation and require regular maintenance. They are therefore not appropriate for use within a forestry environment or where routine maintenance would not be practical.

It is proposed to provide the temporary storage within the drainage channels by creating stone dams within them at regular intervals. The spacing of the dams is typically 100m but depends on the channel slope, with steeper channels requiring shorter intervals. The dams, which are constructed with small sized aggregate, also reduce the flow rate through the drainage system and are an effective means of providing flow control. Silt fence also provide storage and flow control.

All runoff from the developed areas will be routed through settlement ponds downstream. The outflow from the settlement ponds will be released in a controlled and diffuse manner. Therefore, the Proposed Project will not increase the magnitude of the hydrograph peak. The control measures are passive as opposed to mechanical and do not require maintenance to ensure their ongoing effectiveness.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Proposed Project. From this study:
  - No instances of historical flooding were identified in historic OS maps in the area of the Proposed Wind Farm site or along the Proposed Grid Connection Route;
  - No instances of recurring or historic flooding were identified on OPW maps within the Proposed Wind Farm site or along the Proposed Grid Connection Route;
  - The GSI Historical 2015/2016 flood map does not record any historic flood zones in the area of the Proposed Wind Farm site or along the Proposed Grid Connection Route;
  - The Proposed Wind Farm site or the Proposed Grid Connection Route are not mapped within any historic of predictive groundwater flood zones;
  - The Proposed Wind Farm site or the Proposed Grid Connection Route are not identified as being within CFRAM Flood Zones;
  - The National Indicative Fluvial Food Mapping does not show any fluvial flood zones along the local watercourses within the Proposed Wind Farm site;
  - The National Indicative Fluvial Flood Mapping shows that the majority of the Proposed Grid Connection Route is located in Flood Zone C, however flood zones are mapped at Blackwater Bridge over the Blackwater River; and,
  - No flood risks were identified in the vicinity of the blade transition area along the TDR.
- During the walkover surveys and flow monitoring at the Proposed Wind Farm site there was no evidence of out of bank flow from within the various stream/river channels. No widespread or even localized flooding was observed during these site visits;
- The Proposed Wind Farm site and all proposed infrastructure is mapped within Fluvial Flood Zone C and is at low risk of fluvial flooding;
- The Proposed Grid Connection Route is also largely located in Flood Zone C. However, a small section of the route is located in mapped fluvial flood zones along the Blackwater River. This flood zone is located at Blackwater Bridge. Therefore, a watercourse crossing already exists at this location. The Proposed Project will have no effect on flooding or mapped flood zones as no instream works are proposed. During construction works at this location may have to be postponed following heavy rainfall which could cause high flows in the river;
- The Proposed Wind Farm can be categorised as "Highly Vulnerable Development", however, the proposed infrastructure is located outside of areas mapped as Flood Zones and therefore the Proposed Project is appropriate from a flood risk perspective;
- The overall risk of flooding is estimated to be very low. A low risk would typically relate to the probability of being impacted by a 1,000-year flood (*i.e.* the entire area of the Proposed Wind Farm footprint is located in fluvial Flood Zone C). The flooding risk at the Proposed Wind Farm site has an estimated AEP of <0.1%.
- In addition, the risk of the Proposed Project contributing to downstream flooding is also very low, as the long-term plan for the site is to retain and slow down drainage water rates prior to release. Robust drainage measures on the site will include swales, silt traps, check dams, settlement ponds and buffered outfalls. Please refer to the hydrology Chapter of the EIAR for further details.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Clare County Council	2023	Clare County Council Development Plan 2023-2029