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BRISKALAGH RENEWABLE ENERGY DEVELOPMENT
CO. KILKENNY

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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Disclaimer:

This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site specific and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by MKO Ireland 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 Proposed Project. 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 following references: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection', the 'Site' and the 'Proposed Wind Farm site'.

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 AUTHORITY

Hydro-Environmental Services (HES) are a specialist geological, 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.

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

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is a Civil/Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. In addition, he has substantial experience in geological characterisation, peatland morphology, and surface water drainage design and SUDs design and surface water/groundwater interactions. Michael has worked on the EIS/EIAR for Oweninny WF, Cloncreen WF, Derrinlough WF and over 100 other wind farm related projects across the country.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the hydrology and hydrogeology chapters of environmental impact assessment reports for wind farm developments. Conor has also prepared several flood risk assessments and Water Framework Directive compliance assessments for various renewable energy developments in Ireland.

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 Nore River Catchment in the vicinity of the Site;
- Section 4 presents our initial flood risk identification undertaken for the Proposed Project based on desk studies and walkover surveys and a resultant Justification Test based on our findings;

- Section 5 presents a detailed flood risk assessment and a Justification Test;
- Section 6 outlines the drainage design for the Proposed Project in terms of flood prevention,
- Section 7 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

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

2.2 SITE LOCATION AND TOPOGRAPHY

The Proposed Wind Farm site is located within a rural, agricultural setting in northwest Co. Kilkenny, approximately 8.5km west of Kilkenny City. The settlement of Kilmanagh is located approximately 1.2km south of the nearest proposed turbine, and the settlement of Tullaroan is located approximately 2.7km north of the nearest proposed turbine. The Proposed Wind Farm site is situated in Briskalagh and adjacent townlands listed in Table 1-1 of the EIAR. The Site has a total area of ~1,000hectares.

The R695 regional road runs immediately south of the Site in an east-west orientation entering Kilmanagh and then heading south from Kilmanagh towards Callan, passing within 1.3km of the nearest proposed turbine. Existing access is via farm entrances off the L5023 local road to the northwest, and temporary entrance from the L1009 to the south. A new entrance will also be constructed from the L5024 in the north of the Site. The Site is traversed by a number of existing agricultural roads and tracks.

Landuse within the Site currently comprises a mix of pastoral agriculture and small-scale, private forestry. The surrounding landuse predominantly comprises pastoral agriculture and residential within Kilmanagh and Tullaroan.

The Proposed Wind Farm is situated within the valley of the Tullaroan Stream, that runs southwards. Elevations across the Proposed Wind Farm site generally range between 110mOD and 200mOD, with the greatest elevations seen towards the north, in the area of the proposed borrow pit, and in the eastern portion of the Proposed Wind Farm site. Topography generally slopes towards the centre and the south of the Proposed Wind Farm site towards the Tullaroan Stream and the settlement of Kilmanagh.

The Proposed Grid Connection includes the proposed onsite 38kV substation and associated control buildings in the townland of Oldtown within the Proposed Wind Farm site. The proposed onsite 38kV substation is located in agricultural lands and will be accessed via Proposed Wind Farm access roads.

The Proposed Grid Connection underground cabling route will originate at the proposed onsite 38kV substation and run west for approximately 260m through an existing access track within the Proposed Wind Farm towards the L5023 local road. The Proposed Grid Connection underground cabling route continues underneath the local road network for approximately 12.3km before following the R694 north for 8.6km. The underground cabling route then follows the N77 national road north for ~1km before crossing the River Nore via directional drilling. On the eastern side of the River Nore, the proposed cable route then passes through several private agricultural fields, for approximately 360m, before travelling along a farm track for approximately 270m. The proposed cable route then joins the R432 for the remainder of the route, a stretch of approximately 140215m. From the R432 the cable route turns right into the existing 110kV Ballyragget Substation compound in the townland of Moatpark.

Much of the southern section of the Proposed Grid Connection underground cabling route is located at elevations in excess of 100mOD associated with the Slieve Ardagh Hills.

Topography rises rapidly to the north of the Brittas crossroads and the greatest elevations are recorded in the townland of Picketstown where ground elevations stand at ~240mOD. Further to the north in the vicinity of Freshford and Ballyragget, ground elevations are relatively flat and range from 70 to 80mOD.

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

2.3 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, temporary construction compounds, a permanent meteorological mast, spoil management areas, new site access roads, upgrades to existing site access roads, 38kV underground cabling to the existing Ballyragget 110kV substation and all associated works.

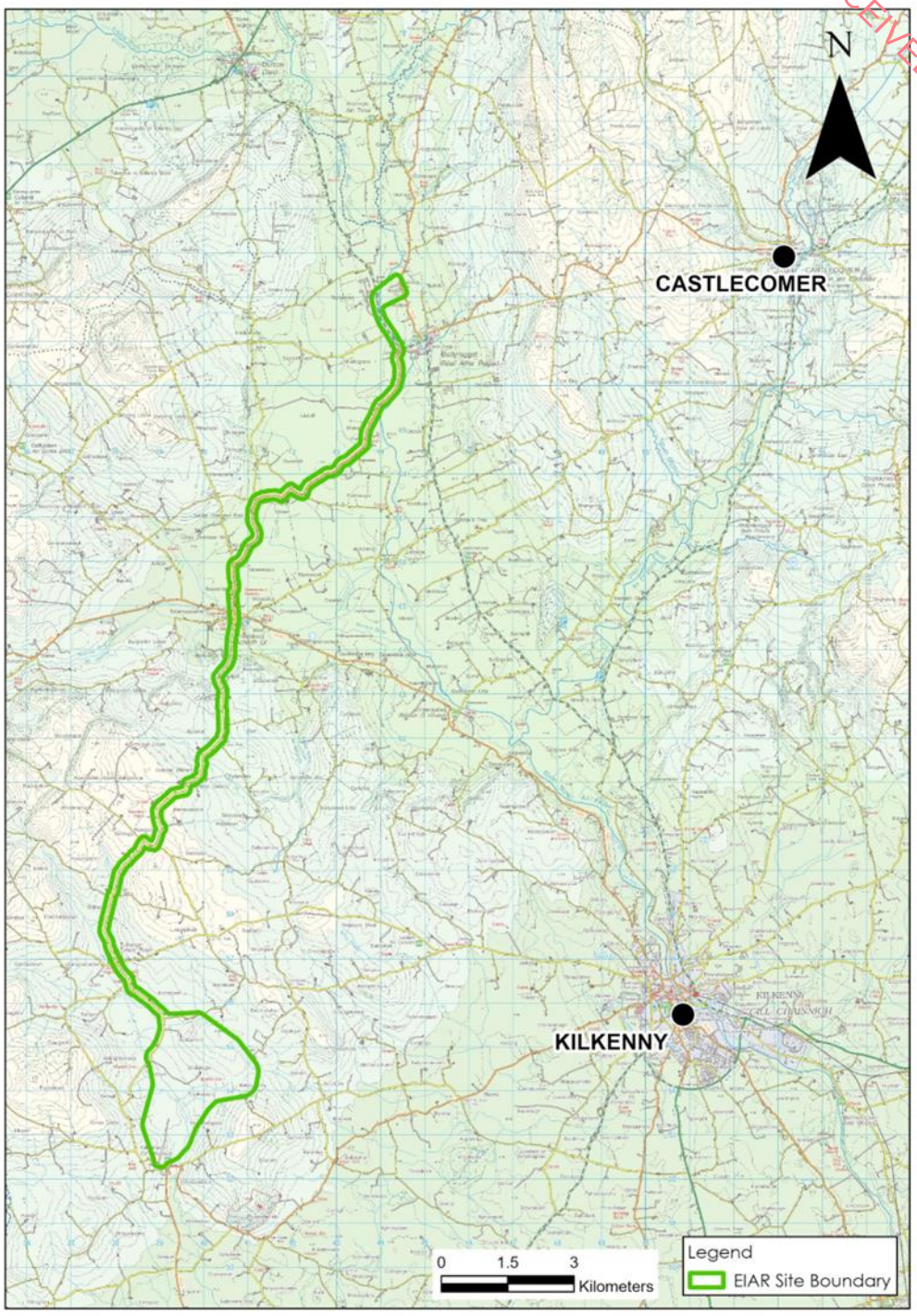

Figure A: Site Location Map

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the Site and the surrounding area.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

Regionally, the Proposed Wind Farm site is located in the River Nore surface water catchment within Hydrometric Area 15 of the South Eastern River Basin District. More locally, the Proposed Wind Farm is located within 2 no. WFD river sub-catchments. The vast majority of the Proposed Wind Farm is located in the Munster River sub-catchment (Munster_SC_010) whilst a small area in the northeast is mapped in the Nore_SC_090 sub-catchment.

Within the Munster River sub-catchment the Proposed Wind Farm is mapped in 2 no. WFD river sub-basins. The north is located in the Tullaroan Stream_020 river sub-basin whilst the majority of the Proposed Wind Farm site is mapped in the Tullaroan Stream_030 river sub-basin. The Tullaroan Stream flows to the south, dissecting the Proposed Wind Farm site, and continues southwards before discharging into the Munster River ~5.7km to the south. Further downstream the Munster River discharges into the King's River to the northwest of Callan (~7.7km from the Proposed Wind Farm site). The King's River discharges into the River Nore ~17km to the southeast.

More locally the Proposed Wind Farm site is drained by several tributaries of the Tullaroan Stream. These streams originate within the Proposed Wind Farm site and downslope from the valley sides towards the Tullaroan Stream. These watercourses are locally unnamed but some have been assigned names by the EPA (www.epa.ie).

Within the Nore_SC_090 sub-catchment the Site is mapped in the Breagh(Kilkenny)_010 WFD river sub-basin. This area is drained by the Bregagh River, however no infrastructure associated with the Proposed Wind Farm is located in this WFD river sub-basin.

The Proposed Grid Connection underground cabling route is also located in the River Nore surface water catchment. There are a total of 13 no. watercourse crossings along the Proposed Grid Connection underground cabling route (10 no. crossings over EPA mapped watercourses). 12 no. crossings are at existing bridge and culvert crossings with 1 no. new crossing proposed under the River Nore to the southwest of Ballyragget substation.

A local hydrology map is shown as **Figure B** below.

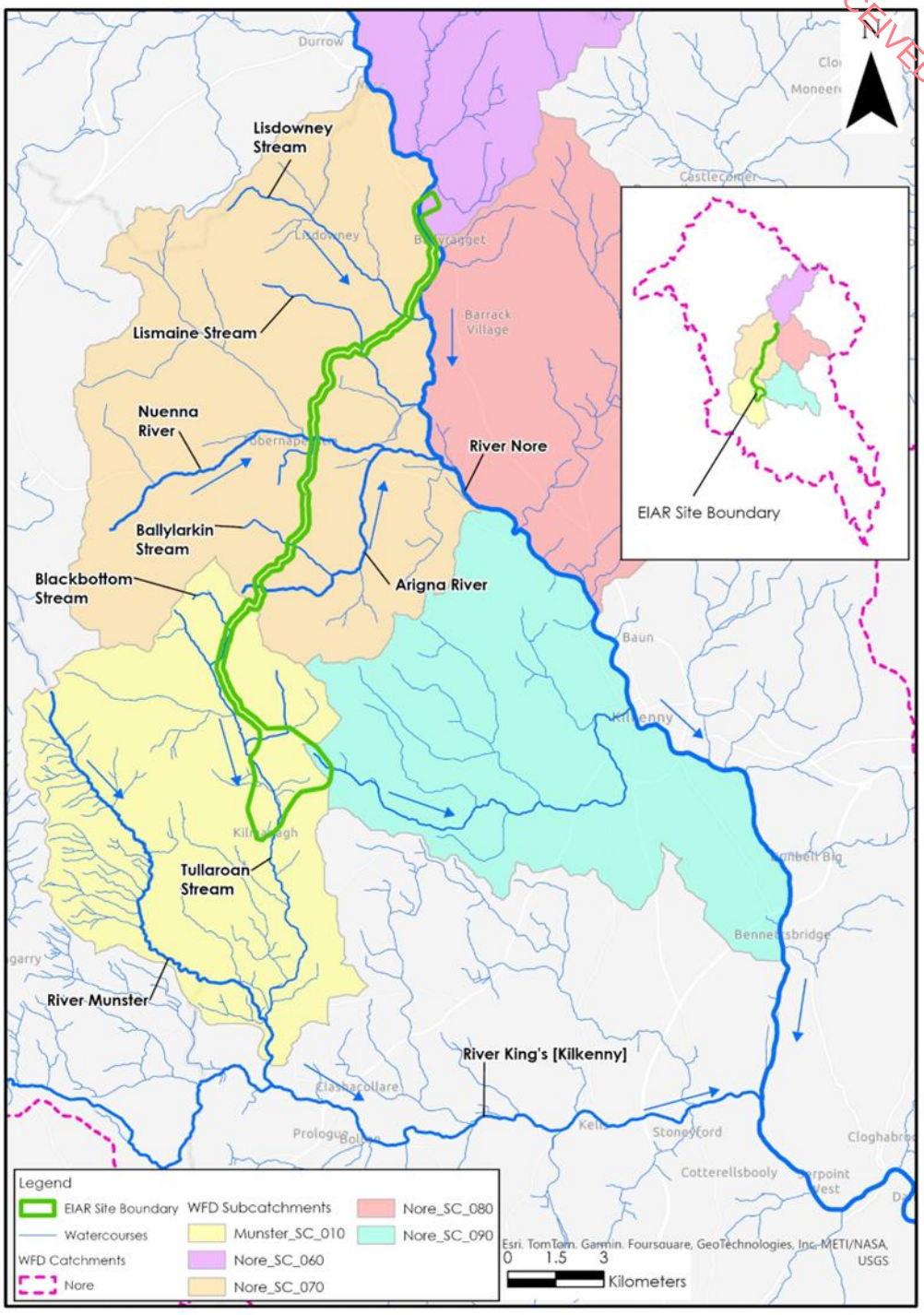

Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

Long term rainfall and evaporation data were sourced from Met Éireann. The 30-year annual average rainfall (1981-2010) recorded at Kilkenny rainfall station, located ~8.6km east of the Proposed Wind Farm site, is ~871mm/year.

However, the Average Annual Rainfall (AAR) at Kilkenny rainfall station may underestimate the actual AAR at the Proposed Wind Farm site due to the elevation difference (the highest elevations at the Proposed Wind Farm site (~190mOD) are ~125m higher than the elevation of Kilkenny rainfall station (~66mOD).

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 1,027 to 1,046mm/year with an average of 1,036mm/yr. This AAR is considered to be the most accurate estimate of AAR from the available sources.

The average Potential Evapotranspiration (PE) at Kilkenny is taken to be 458.8mm (www.met.ie). The Actual Evapotranspiration (AE) is calculated to be 435.9mm (95% PE). Using the above figures, the Effective Rainfall (ER)[1] for the area is calculated to be (ER = AAR – AE) ~600mm/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 area of 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: Briskalagh – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.6	5.6	9.0	11.9
15 mins	5.9	9.2	14.7	19.6
30 mins	7.7	11.8	18.3	24.1
1 hours	10.0	15.1	22.9	29.8
6 hours	19.9	28.4	40.8	51.1
12 hours	25.9	36.2	51.0	63.1
24 hours	33.9	46.3	63.8	77.8
2 days	41.0	54.5	73.0	87.5

3.3 GEOLOGY

The published Teagasc soils map (www.gsi.ie) shows that the north of the Proposed Wind Farm site is predominantly overlain by poorly drained acidic mineral soils (AminPD). There is some bedrock at the surface – non calcareous (RckNCa) at the north of the Proposed Wind Farm site also where the elevations are greatest. The areas that have bedrock at or near the surface are deemed to have well drained acidic mineral shallow soils (AminSW). Towards the south of the Proposed Wind Farm site, near the Tullaroan Stream, soils are mapped as well drained basic mineral soils (BminSW) and well drained acidic mineral soils (AminDW). Mineral alluvium is also mapped along the Tullaroan Stream.

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

The GSI subsoils map (www.gsi.ie) shows that the Proposed Wind Farm site is largely mapped to be underlain by till derived from Namurian shales and sandstones (TNSSs). The till is located on the sides of the valley of the Tullaroan Stream. Meanwhile an area of sand and gravels derived from Carboniferous limestone are mapped towards the centre and southern area of the Proposed Wind Farm site, whilst alluvium subsoils are mapped along the Tullaroan Stream. The sands and gravels are mapped along a thin strip along the banks of the Tullaroan Stream.

Based on site investigations (trial pits and boreholes) supervised by HES, the subsoils at the Proposed Wind Farm site comprise of thin glacial till deposits on the valley sides with some thick glaciofluvial sands and gravels encountered along the banks of the Tullaroan Stream.

Based on the GSI bedrock mapping (www.gsi.ie) the Proposed Wind Farm site is underlain by the Killeshin Siltstone Formation. During the site investigations rock was encountered at depths of 0.4 to 3.3m on the valley sides and at depths of 13.4 to 18.7m where the thick glaciofluvial deposits are present along the Tullaroan Stream.

3.4 DESIGNATED SITES & HABITATS

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

The Proposed Wind Farm site is not located within any designated conservation site, however there are downstream hydrological connections with some of the Natura 2000 sites in the region as described below:

- The River Barrow and River Nore SAC (Site Code: 002162) is located ~4.6km south of the Proposed Wind Farm site and includes the lower reaches of the Tullaroan Stream. This SAC is hydrologically connected to the Proposed Wind Farm site via the Tullaroan Stream. This SAC consists of the freshwater stretches of the Barrow and River Nore catchment as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary.
- The River Nore SPA (Site Code: 004233) is located ~10km (straight line distance) southeast of the Proposed Wind Farm site and is hydrologically connected via the Tullaroan Stream, Munster River and King's River. This SPA includes the King's River downstream of Callan.

Other designated sites in close proximity to the Proposed Wind Farm site include:

- Ballykeefe Wood pNHA (Site Code: 000400) is located ~1.8km southeast of the Proposed Wind Farm site. There are no hydrological connections between the Proposed Wind Farm site and this pNHA.

The new proposed crossing along the Proposed Grid Connection underground cable route over the River Nore also crosses the River Barrow and River Nore SAC and the River Nore SPA. All other watercourses draining the Proposed Grid Connection also eventually discharge into these designated sites.

Other designated sites in close proximity to the Proposed Grid Connection underground cable route include:

- River Nore / Abbeyleix Woods Complex pNHA (Site Code: 002076) which is located ~300m west of the Proposed Grid Connection to the north of Ballyragget.
- Inchbeg pNHA (Site Code: 000836) is also located downstream of the Proposed Grid Connection along the River Nore.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

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 Wind Farm site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DoEHLG, 2009), 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 Flood Risk Management 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. For example, application of Development Management Justification Test would be required at a site specific level, such as for this FRA, if a Justification Test is required.

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 the area and the vicinity of the Proposed Wind Farm site.

Meanwhile, the local 6" Casini basemap records an area which is liable to flood on the eastern banks of the River Nore immediately to the south of Ballyragget town. In this area the Proposed Grid Connection underground cable route is located to the west of the River Nore along the R694. There are no other areas identified as "liable to flooding" along the Proposed Grid Connection underground cable route.

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the 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, mineral alluvium is mapped along the course of the Tullaroan Stream within the Proposed Wind Farm site. No infrastructure is mapped in this area of the Site with the exception of the new proposed crossing over the Tullaroan Stream. A small area of mineral alluvium is also mapped ~300m southwest of T07 and immediately to the west of the southern temporary construction compound.

With regards to the Proposed Grid Connection, the proposed onsite substation location is not mapped to be overlain by mineral alluvium. Meanwhile, alluvial soils are mapped at 4 no. locations along the Proposed Grid Connection underground cable route. Alluvium soils are mapped at 3 no. existing crossings over the EPA mapped Blackbottom Stream, the Ballylarkin Upper Stream and the Lisdowney Stream -also referred to as the Grange River). Extensive alluvium soils are recorded along the River Nore adjacent to the route along the R694. The new proposed crossing under the River Nore is mapped in an area of alluvial soils.

4.3.3 OPW Past Flood Events Map

To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood maps (www.viewer.myplan.ie) were consulted.

No recurring or historic flood incidents are recorded within the Proposed Wind Farm site. The closest recurring flood event is mapped at Kilmanagh (Flood ID: 2548). In relation to this flood event the local area engineer's report states that recurring flooding occurs along the R695. Several recurring flood events are also recorded further downstream along the Tullaroan Stream at Cooleeshal Graigue (Flood ID: 2549) and at Killaloe Bridge on the R695 (Flood ID 2550). Recurring flood events are also recorded downstream of the Proposed Wind Farm site on the Munster River and on the King's River at Callan.

The OPW Past Flood Events map records recurring flood events along the Proposed Grid Connection underground cabling route at Freshford (associated with the Nuenna River – Flood ID: 2814) and at Ballyragget (associated with flood along the River Nore – Flood ID: 2813).

Additionally, no areas within the Site are mapped as an OPW Drainage District, i.e. an area where drainage schemes to improve land for agricultural purposes were constructed or as Benefiting Lands, i.e. land identified by the OPW as potentially benefitting from the implementation of Arterial (Major) Drainage Schemes and an indicator of land subject to flooding and poor drainage.

Historic and recurring flood events in the vicinity and downstream of the Site are shown on **Figure C** below.

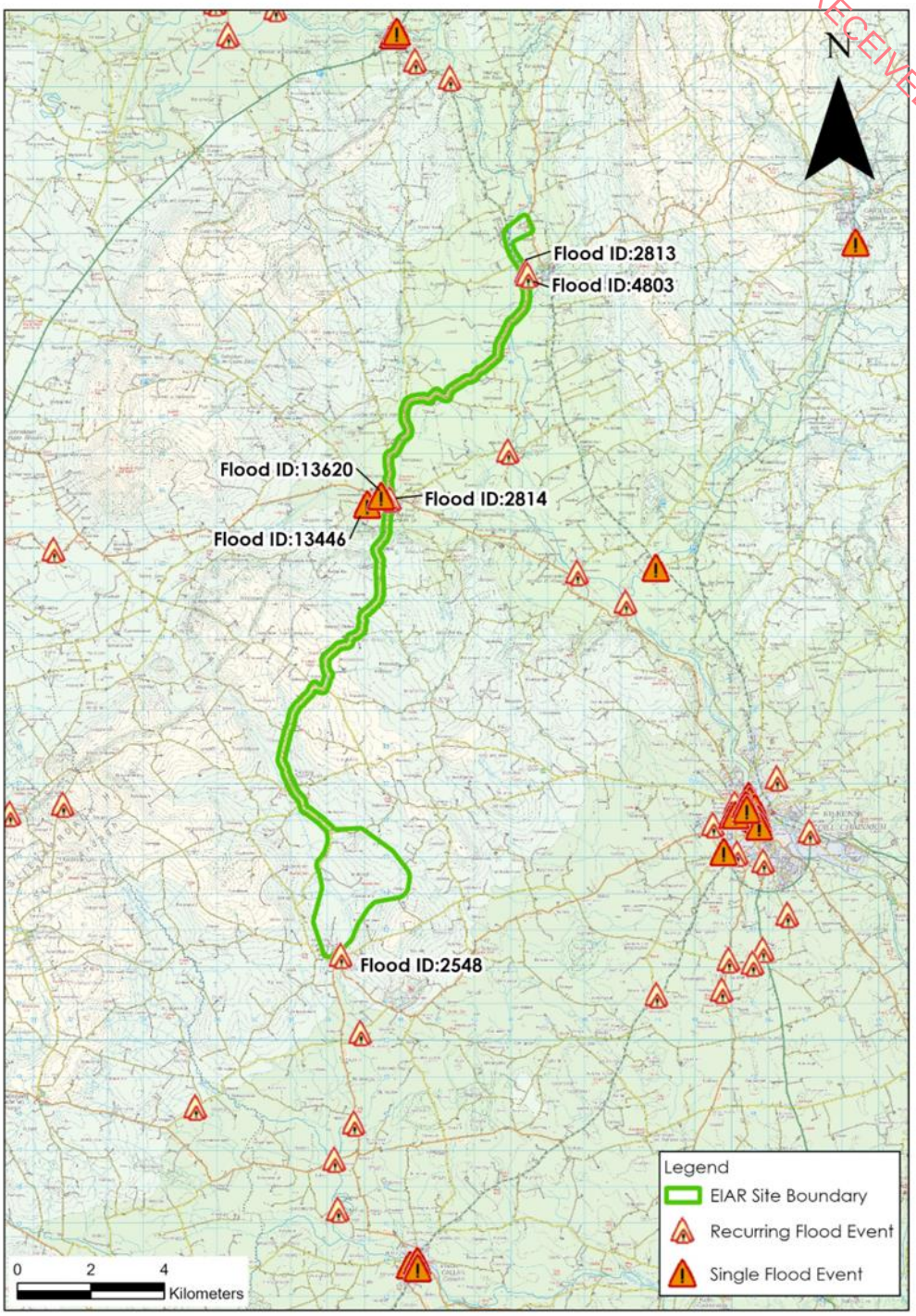

Figure C: OPW Past Flood Events Map

4.3.4 GSI Winter 2015/2016 Surface Water Flood Mapping

The GSI Winter 2015/2016 Surface Water Flooding map shows fluvial (rivers) and pluvial (rain) floods, excluding urban areas, during the winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available at www.floodinfo.ie.

The GSI do not record any historic flood zones in the area of the Proposed Wind Farm site. The nearest Winter 2015/2016 Surface Water Flooding mapped areas from the Proposed Wind Farm site are located ~2.8km to the southeast.

The GSI's Winter 2015/2016 Surface Water Flood Map records surface water flood zones in the area where the Proposed Grid Connection underground cable route crosses the River Nore. Historic flood zones are also mapped downstream of the route along the length of the River Nore. However, no other flood zones are mapped in the immediate vicinity of the route.

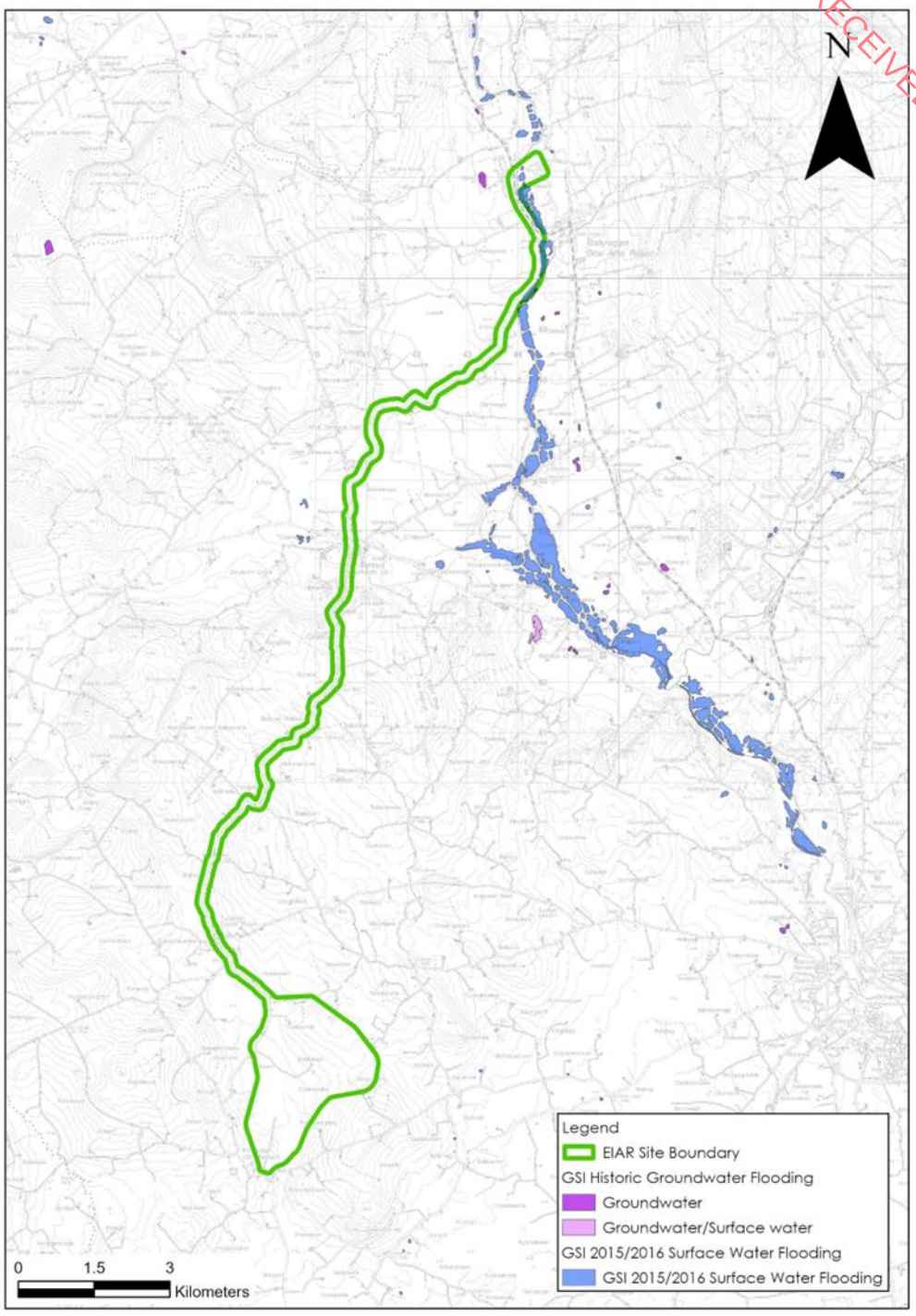

Figure D: GSI 2015/2016 Flood Mapping

4.3.5 CFRAM Mapping

Where complete, the 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.

CFRAM mapping has not been completed for the area of the Proposed Wind Farm site. The closest CFRAM flood zones are located on the Kings' River near Callan, ~8.3km south of the Proposed Wind Farm site.

Meanwhile, along the Proposed Grid Connection underground cable route CFRAM mapping has been completed along the Nuenna River in the vicinity of Freshford and along the River Nore at Ballyragget. Existing road and watercourse crossings exist at Freshford. Meanwhile, the new crossing over the River Nore will be completed using Horizontal Directional Drilling.

[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.*

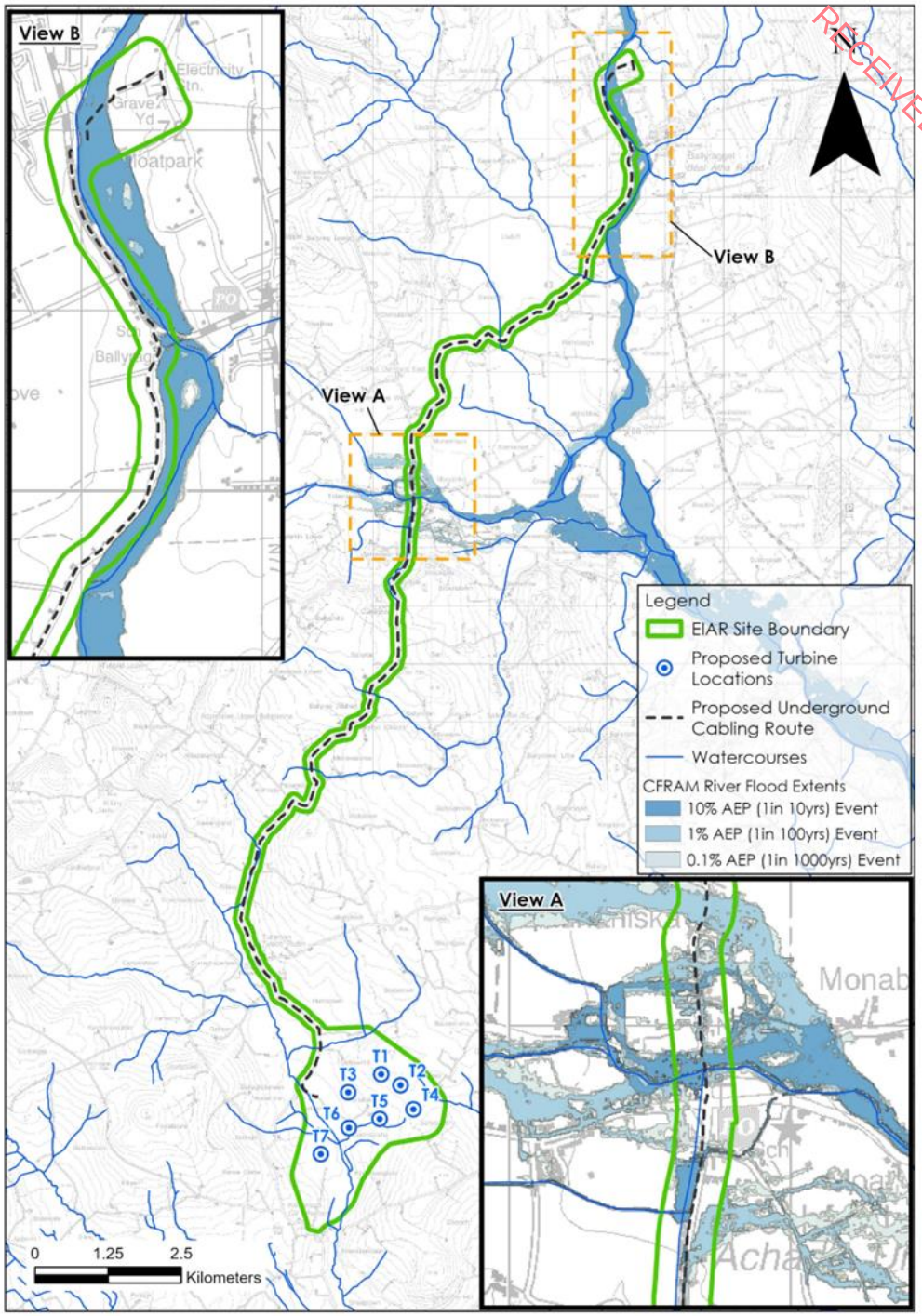

Figure E: CFRAM Fluvial Flood Mapping

4.3.6 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, low (1 in 1,000-year) and medium (1 in 100-year) probability fluvial flood zones are mapped along the length of the Tullaroan Stream within the Proposed Wind Farm site. With the exception of the new proposed crossing over the Tullaroan Stream, new proposed roads to the east and west of this crossing and ~240m of existing road to be upgraded in the northwest of the Site, all proposed infrastructure associated with the Proposed Wind Farm is located outside of the mapped low probability fluvial flood zone. With respect to proposed turbine locations, the low probability flood zone is mapped ~340m east of T7 and ~120m southwest of T6.

A fluvial map showing the National Indicative Fluvial Flood Mapping for the present day scenario at the Proposed Wind Farm site is included as **Figure F** below.

With regards to the Proposed Grid Connection, the low probability fluvial flood zones along the Tullaroan Stream are mapped immediately to the southwest of the proposed onsite 38kV substation but do not encroach upon the substation site. Elsewhere, NIFM flood zones are mapped at the following locations along the Proposed Grid Connection underground cable route.

- ~400m to the northwest of the proposed onsite substation is mapped in fluvial flood zones associated with the Tullaroan Stream. Existing site access roads and public roads are present in this section of the route.
- ~700m along the R694 to the north of Freshford.
- At the existing watercourse crossing over the Grange River.

A fluvial map showing the National Indicative Fluvial Flood Mapping for the present day scenario along the Proposed Grid Connection underground cabling route is included as **Figure G** below.

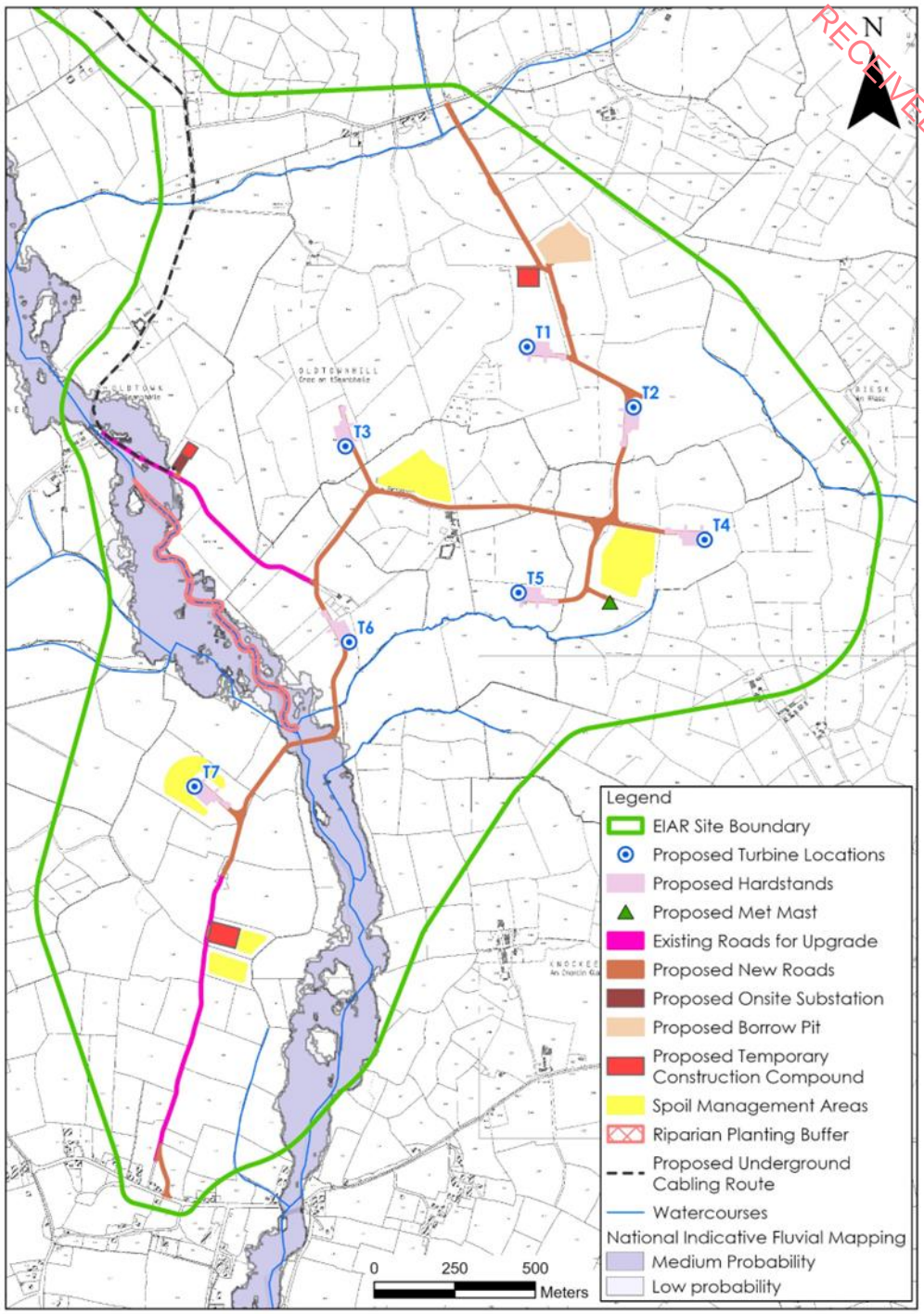

Figure F: OPW National Indicative Flood Mapping at Proposed Wind Farm site

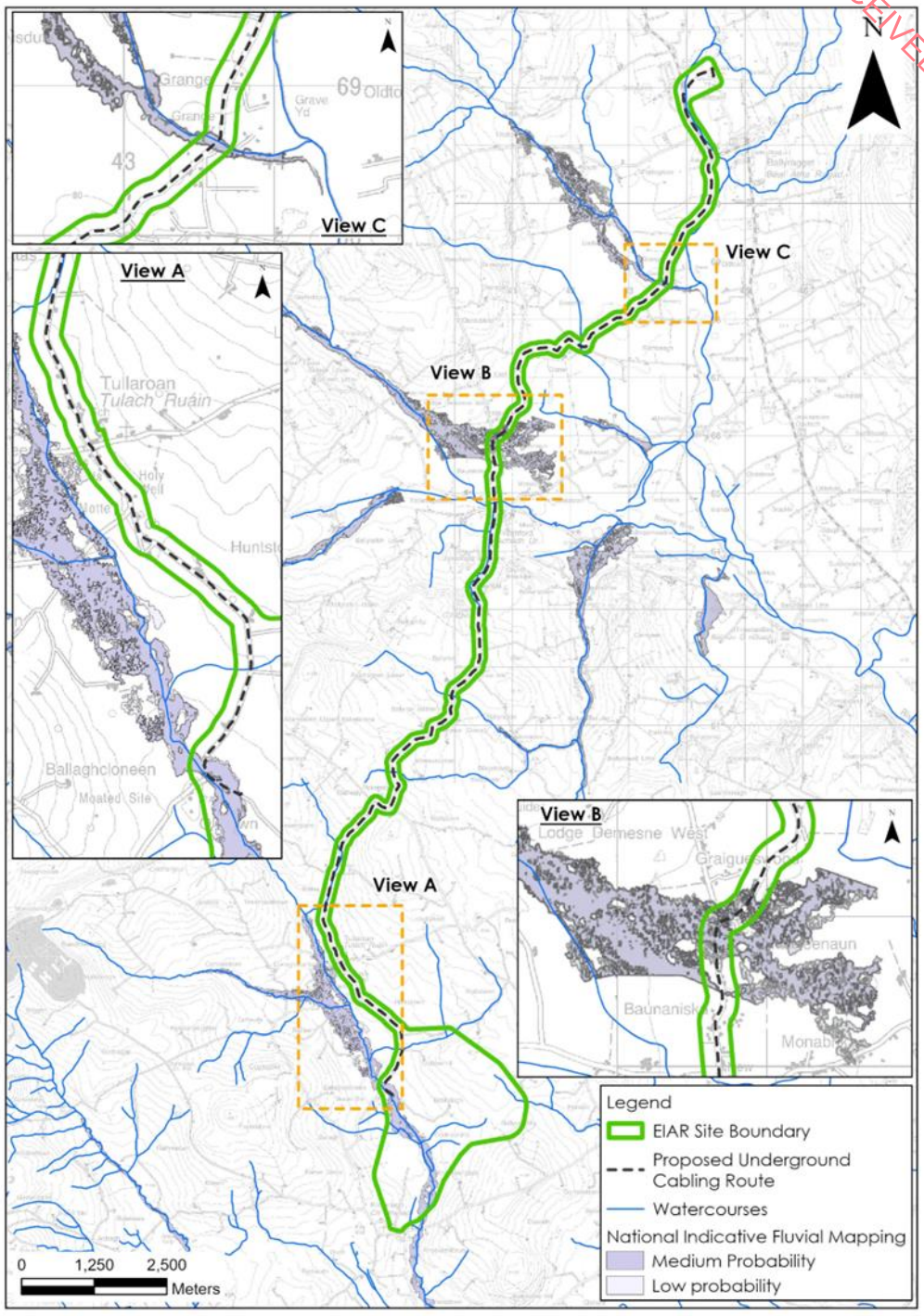

Figure G: OPW National Indicative Flood Mapping along the Proposed Grid Connection

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 Site.

Meanwhile, the GSI's Maximum Historic Groundwater Flood Map records a small area of groundwater flooding ~800m to the north of the new proposed crossing over the River Nore along the Proposed Grid Connection underground cable route. Some areas of historic groundwater flooding are also mapped on the opposite side of the River Nore, ~750m east of the Proposed Grid Connection underground cabling route along the R694.

4.3.8 Coastal Flooding

The Proposed Wind Farm site is located approximately ~28km northwest (straight line distance) of where the River Nore becomes tidal near Inistioge and at elevations of between ~110mOD and ~200mOD.

As such, there is no risk of coastal flooding at the Proposed Wind Farm site, along the Proposed Grid Connection.

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. These CFRAM flood zones have 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.

However as stated above no CFRAM modelling has been completed in the vicinity of the Proposed Wind farm site. CFRAM River flood extents show similar flood zones along the Nuenna and Nore rivers along the Proposed Grid Connection underground cabling as described above in **Section 4.3.5**.

Similarly, there are NIFM flood zones have also been modelled for the 2 no. potential future climate change scenarios. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.6**. Therefore, flood zones at the Proposed Wind Farm site, along the Proposed Grid Connection underground cabling route 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 majority of Proposed Wind Farm site, including all proposed turbine locations, is located in Fluvial Flood Zone C and is at a low risk of fluvial flooding. Fluvial flood zones are mapped in the vicinity of the Tullaroan Stream but do not extend any significant distance from the Proposed Wind Farm site. The only infrastructure mapped in the flood zone is a proposed watercourse crossing and existing roads for upgrade.

Much of the Proposed Grid Connection underground cabling route is located in Flood Zone C. However, some sections of the route, in the vicinity of local watercourses are mapped in fluvial flood zones. Due to the nature of the underground cabling, this will have no effect during the operational phase of the Proposed Project. During the construction phase, works

along the work may have to be postponed following heavy rainfall events which may cause flooding at these locations.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Survey and Drainage

Detailed walkover surveys of the Proposed Wind Farm site and the Proposed Grid Connection underground cable route were undertaken by HES on 29th September 2023, 13th June and 10th July 2024.

The Proposed Wind Farm site was noted to comprise predominantly of agricultural land with some forestry in the vicinity of T7. An existing network of manmade drains were noted within the Proposed Wind Farm site. The nature of these drains depends on the local land use. As discussed above, several natural watercourses are also present in the Proposed Wind Farm site and flow downslope before discharging into the Tullaroan Stream. Due to the permeable nature of the sand and gravels along the banks of the Tullaroan Stream some of these watercourses also recharge to ground in this area.

During the walkover surveys and flow monitoring there was little evidence of previous out of bank flow from within the various watercourse channels. During targeted visits following considerable rainfall in the prior days, high flows were observed within the local streams, 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 underground cabling route was undertaken on 3 no. occasions at 4 no. monitoring locations (SW1-SW4). The data are presented in Table B. The measured flows vary depending on the nature of the waterbody being monitored. The smallest recorded flow volumes were noted within the Briskalagh Stream (tributary of the Tullaroan Stream) while larger flows being recorded in the Tullaroan Stream itself. Meanwhile, the flow volumes measured along the Grange River, referred to by the EPA as the Lisdowney Stream, ranged from ~10 - ~15l/s.

Table B: Surface Water Flow Monitoring

Location/Date	Easting (ITM)	Northing (ITM)	Watercourse – EPA Name	Flow Volume (l/s) Range
SW1	238806	154700	Tullaroan Stream	~20 – 25
SW2	239528	153851	Briskalagh Stream	~1 – 2
SW3	239426	152305	Tullaroan Stream	~25 – 30
SW4	243624	168637	Grange River (Lisdowney Stream)	~10 – 15

4.4.2 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Proposed Wind Farm site, along the Proposed Grid Connection underground cabling route can be described using the Source – Pathway – Receptor Model ("S-P-R"). Given the typical 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 Tullaroan stream which drains the Proposed Wind Farm site during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

The Proposed Grid Connection underground cabling 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 underground cabling, this will have no impact during the operational phase of the Proposed Project. During the construction phase, works in these areas may have to be postponed following heavy rainfall events which could cause flooding in this area.

4.4.3 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 Site or downstream of the Site. The potential sources of flood risk for the Site are outlined and assessed in **Table C**.

Table C: S-P-R Assessment of Flood Sources

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to some of the wind farm infrastructures and the rivers and streams that flow throughout the site	Land & infrastructure	Based on National Indicative Fluvial Flood Mapping, the majority of the Proposed Wind Farm site is located in Fluvial Flood Zone C where there is a low risk of fluvial flooding. Due to the slope of the land on the sides of the valley, water flows rapidly downslope in the numerous 1st and 2nd order streams which drain the Proposed Wind Farm site. There is little risk of fluvial flooding in these areas of the Proposed Wind Farm site. Meanwhile, NIFM fluvial flood zones are mapped along the Tullaroan Stream. A new proposed crossing and a section of existing roads to be upgraded are the only infrastructure which are mapped in the flood zone. The majority of the Proposed Grid Connection underground cabling route is mapped in Fluvial Flood Zone C and is at low risk of flooding. Some existing and proposed watercourse crossings are mapped in fluvial flood zones.
Pluvial	Ponding of rainwater on site	Land & infrastructure	Within the Proposed Wind Farm site there is very little risk of pluvial flooding on the valley sides as drainage moves relatively freely due to the sloping topography and the high density of drainage features. Meanwhile, the sand and gravel aquifer which is present along the banks of the Tullaroan Stream will accept groundwater recharge in this low-lying area and

			there will be no potential for pluvial flooding.
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	There are no historic or modelled groundwater flood zones located within the Proposed Wind Farm site. The risk of groundwater flooding is low.
Coastal/tidal	Overbank flooding	Land, People, property	The Site is inland and stands at a significant elevation above sea level. Therefore, there is no risk of coastal/tidal flooding.

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. 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, some elements of the Proposed Wind Farm, comprising a new crossing over the Tullaroan Stream, new access roads to the east and west of this new proposed crossing and ~240m of upgrades to existing site roads are located in Fluvial flood Zone A.

Furthermore, new and proposed watercourse crossings along the Proposed Grid Connection underground cabling route are located in mapped fluvial flood zones. These elements of the Proposed Project can be considered to be "Less Vulnerable Developments".

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.*

[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).*

5. DETAILED FLOOD RISK ASSESSMENT

5.1 INTRODUCTION

This section assesses the flood risk of the Proposed Project with regard to Section 5.28 of the Flood Risk Management Guidelines. The assessment is made based on the NIFM flood zone mapping as this has modelled flood zones within which some areas of the Proposed Wind Farm site are located.

This detailed flood risk assessment addresses potential flood concerns at the new proposed watercourse crossing over the Tullaroan Stream, the new proposed site access roads to the east and west of this crossing and the upgrade of ~240m of existing access roads.

In relation to the Proposed Grid Connection underground cabling route, the sections of the route which are mapped in fluvial flood zones are located at existing bridge/culvert crossings, along existing public roads and at the location of a new proposed crossing under the River Nore. There will be no in-stream works at any of the existing crossing locations or along existing public roads. Furthermore, the new proposed crossing over the River Nore will be achieved by Horizontal Directional Drilling. Therefore, there is no potential for the displacement of floodwaters or an increase in flood risk at this location. The potential effect of the Proposed Grid Connection underground cabling route is not considered further.

5.2 PROPOSED RIVER CROSSING

The new proposed watercourse crossing over the Tullaroan Stream will be achieved through the use a clear span crossing. The construction methodology for this crossing has been designed to eliminate the requirement for in-stream works at this location. This watercourse crossing will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. The crossing will be designed cater for the 100-year flood level plus a 300mm freeboard plus climate change. There will be no displacement of floodwaters.

5.3 REDUCTION IN FLOODPLAIN STORAGE AND FLOOD LEVEL IMPACTS (PROPOSED WIND FARM SITE)

Construction of new above-ground structures within floodplains have the potential to reduce the storage capacity of the floodplain and increase flood risk locally or downstream. In this scenario, the downstream receiving water is the floodplain associated with the EPA mapped Tullaroan Stream.

The Proposed Wind Farm infrastructure located within the mapped flood zone consists of a new crossing over the Tullaroan Stream (flood risk described in **Section 5.2** above), associated new roads and ~240m of existing roads to be upgraded.

The upgrade of the existing road will include widening, grading, and capping. This will be completed at existing ground level, so there will be no change in flood risk associated with this existing track.

The proposed infrastructure within the mapped flood zones has a limited footprint of ~0.226ha (0.112ha of existing roads to be upgraded and 0.114ha of new proposed roads). This area is negligible compared to the total area of the low probability NIFM flood zone within the Site which is ~48ha. Therefore, the proposed footprint within the flood zone represents <0.5% of the flood zone within the Site.

Nevertheless, to mitigate the risk of the new proposed access road flooding, the sections of access road within the modelled flood zones will have the track surface raised at least 500mm above the 100-year fluvial flood level. In addition, in order to maintain flowpaths in the floodplain during flooding events, culverts will be placed at 25m intervals in these sections of the access roads to maintain the hydrological regime and to prevent a damming effect occurring during flood events. The access tacks will also be constructed of porous stone, so they will not fully prevent the flow of water. Culverts will be inspected and maintained annually to ensure ongoing functionality.

5.4 JUSTIFICATION TEST

Box 5.1 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. 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:

The section of the new proposed access roads to the east and west of the new proposed crossing over the Tullaroan Stream and the ~240m of existing access roads which are proposed for upgrade which are located in the mapped flood zones provide access between the proposed turbines and ancillary infrastructure. The closest downstream third-party sensitive receptor to these proposed infrastructure located in the mapped flood zones is approximately 1.3km to the south (in Kilmanagh village). During the site selection process, one of the criteria considered was the identification of an area that can maintain an appropriate set-back from third-party sensitive receptors. Having reviewed the settlement patterns in the vicinity, along with a number of other criteria, the Proposed Wind Farm site was identified as a suitable location for the provision of a renewable energy development of the scale proposed.

1. The Proposed Project has been the subject of a flood risk assessment (this report) and the following has been determined:

    i. Due to the relatively small footprint of the Proposed Project within the NIFM flood zones, the Proposed Project is predicted to have an imperceptible

impact on flood water levels downstream of the Proposed Wind Farm site. No increase in downstream flood risk is anticipated.

- The new proposed crossing over the Tullaroan Stream will be completed in accordance with OPW guidelines and subject to Section 50 consent. There will be no instream works and no displacement of floodwaters.
- The upgrades on the existing road will be completed at existing ground level and therefore will not increase local or downstream flood risk.
- The new proposed access road (east and west of the river crossing, will have a small infill, but will include permeable stone fill, and regular culverting to ensure drainage pathways are maintained. As a result, the increase in flood risk will be minimal.

ii. The design of the Proposed Wind Farm site has undergone an iterative process which included moving proposed turbines and all other site infrastructure (aside from the new and proposed roads sections) outside of the modelled flood zones. These measures will mitigate against any potential disruption to the natural hydrology of the Proposed Wind Farm site. No increase in flood risk to people, property, the economy or the environment during extreme flood events as a result of the Proposed Project is predicted due to the appropriate design measures which will result in imperceptible upstream and downstream effects; and,

iii. The Proposed Project is compatible with the wider planning objectives of the area, including the provision of wind energy developments at appropriate locations and the proper planning and sustainable development of the area.

6. FLOOD IMPACT PREVENTION AND DRAINAGE MANAGEMENT

6.1 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 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 on the sides of the valley 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.

6.2 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.

7. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Proposed Project at Briskalagh, Co. Kilkenny. From this study:
    - No instances of historical flooding were identified in historic OS maps;
    - No instances of recurring or historic flooding were identified on OPW maps within the Proposed Wind Farm site;
    - The GSI Historical 2015/2016 flood map does not record any historic flood zones in the area of the Proposed Wind Farm site;
    - The Proposed Wind Farm site is not mapped within any historic or predictive groundwater flood zone;
    - The Proposed Wind Farm site is not identified as being within CFRAM Flood Zones; and,
    - The National Indicative Fluvial Food Mapping does show some fluvial flood zones along the Tullaroan Stream within the Proposed Wind Farm site.
- 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 risk of pluvial flooding at the Proposed Wind Farm site is predominantly very low due to the elevated and sloping nature of the site and the high density of streams and drains which flow rapidly downslope;
- However, there is a higher risk of flooding along the lower ground adjacent to the Tullaroan Stream. NIFM fluvial flood zones are mapped along the length of the Tullaroan Stream. However, all highly vulnerable development infrastructure, including the proposed onsite substation and the proposed 7 no. turbines, are located in Flood Zone C;
- The infrastructure located in the flood zones within the Proposed Wind Farm site comprise of existing roads to be upgraded, a new proposed crossing over the Tullaroan Stream and new proposed access roads to the east and west of the new proposed crossing. The new proposed crossing will be constructed in accordance with OPW guidelines/requirements and will be subject to Section 50 consent. The crossing will be a clear span crossing and there will be no instream works. The new proposed access roads will include permeable stone fill, and regular culverting to ensure drainage pathways are maintained. As a result, the increase in flood risk will be minimal;
- The Proposed Grid Connection is also largely located in Flood Zone C (including the proposed on-site 38kV substation). However, some sections of the Proposed Grid Connection underground cabling route are located in mapped fluvial flood zones at existing and proposed watercourse crossings. No instream works are proposed at any of the existing bridge or culvert crossings. Furthermore, the new proposed crossing under the River Nore will be completed by directional drilling. Therefore, there will be no potential for the displacement of floodwaters associated with the Proposed Grid Connection; and,
- 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.

8. REFERENCES

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