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Proposed Wind Farm at Castlebanny, County Kilkenny

Flood Risk Assessment

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Flood Risk Assessment

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TOBIN Consulting Engineers

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1.0 INTRODUCTION

TOBIN Consulting Engineers were appointed by Springfield Renewables Limited to undertake a Flood Risk Assessment (FRA) for a proposed 21 turbine wind farm on their lands at Castlebanny, County Kilkenny. The purpose of this report is to communicate any potential flood risks to vulnerable receptors, such as people, property, the economy or the environment.

The study area for the purposes of the Flood Risk Assessment is shown in Figure 1-1 of this EIAR. The proposed wind farm site (as shown in Figure 1-2 of this EIAR) is located within an agricultural and forested landscape, between Mullinavat, Inistioge and Ballyhale, in Co. Kilkenny. The site of the proposed wind farm extends to approximately 1,434 ha, the majority (approximately 1,200 ha) of which is commercial forest owned by Coillte, while the remaining areas are third-party lands and comprise a mix of agricultural grassland, arable crops and forestry. Coillte forestry within the site comprises different stages of coniferous plantation forestry. The Arrigle River runs south-north to the east of the site area and the Derrylacky River (Ballytarsna River) runs to the west of the site. There are a number of residential properties near the boundary of the site. The entire proposed project is described in detail in Chapter 2 (Description of the Proposed Development) of the EIAR.

The topography of the site is generally hilly with high points at its centre and sloping downward in all directions (towards its boundaries).

Tributary streams of the Derrylacky and Arrigle Rivers rise within the site boundaries, near the proposed locations for turbines T5, T9, and T8 (see Figure 1-1). The Jerpoint Church Stream occurs to the north of the site.

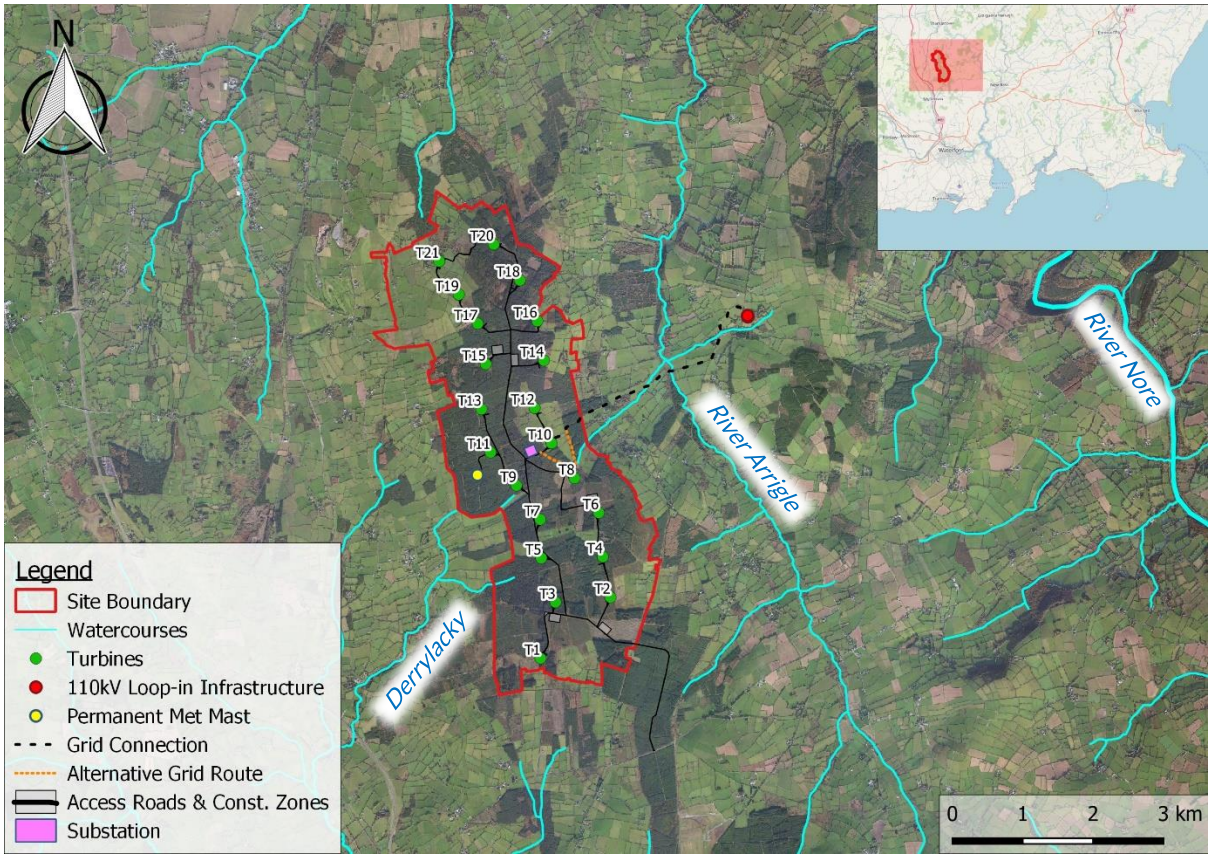

Figure 1-1 Site Location and Proposed Layout

2.0 FLOOD RISK MANAGEMENT GUIDANCE

This Strategic Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Kilkenny County Development Plan 2014-2020

2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management (PSFRM) Guidelines were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of flood zones A, B, and C, which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The flood zones, vulnerability classes and requirement for the Justification Test is summarised in Table 2-1.

Table 2-1 Decision Matrix for Determining the Appropriateness of a Development

Flood Zone (Probability)	Annual Exceedance Probability (AEP)	Recommendation based on Vulnerability of Development		
		Highly Vulnerable / Essential Infrastructure	Less Vulnerable	Water Compatible
A (High)	Fluvial & Pluvial Flooding More frequent than 1% AEP	Justification Test	Justification Test	Appropriate
B (Medium)	Fluvial & Pluvial Flooding 0.1% to 1% AEP	Justification Test	Appropriate	Appropriate
C (Low)	Fluvial & Pluvial Flooding Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate
Note: Given that coastal flooding is not a potential source of risk to the proposed development, the probabilities for coastal flooding have been omitted from this table.				

The PSFRM Guidelines classifies electricity generating stations as “essential infrastructure”. The proposed windfarm has therefore been assessed against the 1,000-year flood event.

2.1.2 The Justification Test

As noted in Table 2-1, developments being considered in an inappropriate flood zone must satisfy the criteria of the Justification Test outlined in Figure 2-1 (extract from the PSFRM Guidelines).

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: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 2-1 Justification Test Criteria

2.2 The Flood Risk Management Climate Change Adaptation Plan

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW's approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2-2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

For the purpose of this flood risk assessment, we have assessed the proposed development against the Mid-Range Future Scenario as it represents what the OPW call a "likely" future scenario

2.3 Kilkenny County Development Plan 2014-2020

The Kilkenny County Development Plan provides a strategic framework for land use planning for 2014 to 2020. Chapter 9 relates to Infrastructure and Environment and outlines Kilkenny County Council's strategic approach to flood risk management.

It sets out Flood Management Objective 9G, which is to adopt a comprehensive risk-based planning approach to flood management to prevent or minimise future flood risk. In accordance with the Planning System and Flood Risk Management Guidelines, the avoidance of development in areas where flood risk has been identified shall be the primary response. The aim of this objective is to facilitate sustainable development through the reduction of future flood damage, and hence to reduce the associated potential economic and social costs.

The Development Management Standard set out in Section 9.2.9.2 states that where flood risk may be an issue for any proposed development, a flood risk assessment that is appropriate to the scale and nature of the development and the risks shall be carried out. Proposals for mitigation and management of flood risk will only be considered where avoidance is not possible and where development can be clearly justified with the Justification Test.

In relation to surface water drainage, the following Development Management Standards are set out in Section 9.2.11:

- Developments must, so far as is reasonably practicable, incorporate the maximum provision to reduce the rate and quantity of runoff.
- For greenfield developments in general, the limitation of surface water runoff to pre-development levels will be required. Where a developer can clearly demonstrate that capacity exists to accommodate runoff levels in excess of greenfield levels, the planning authority shall consider such proposals on a case-by-case basis.
- In line with the above, Kilkenny County Council will consider all drainage proposals consistent with Sustainable Drainage Systems (SuDS).
- For developments adjacent to watercourses of a significant conveyance capacity, any structures (including hard landscaping) must be set back a minimum of 5-10 m from the edge of the watercourse to allow access for channel clearing and maintenance.
- To give adequate allowance for climate change in designing surface water proposals, a multiplication factor of 1.2 shall be applied to all river return periods up to 100 years except in circumstances where the OPW have provided advice specifying the particular multiplication factor for return periods up to 100 years. In the case of rainfall, a multiplication factor of 1.1 shall be applied to rainfall intensities to make allowance for climate change requirements.

The proposed project will contribute towards achieving National and EU targets for renewable energy production and CO_2 emission reductions.

3.0 INITIAL FLOOD RISK ASESSMENT

3.1 Site Topography

Based on the Ordnance Survey Ireland (OSI) elevation contours map shown in Figure 3-1, the topography of the proposed wind farm site is generally hilly, sloping downward in all directions (towards its boundaries) from high points at its centre. The highest points are approximately 250 mOD in the north and 265 mOD in the south, descending to approximately 145 mOD in the west and 160 mOD in the east. Water arising at the site would therefore naturally flow away from the site towards lands at lower elevations.

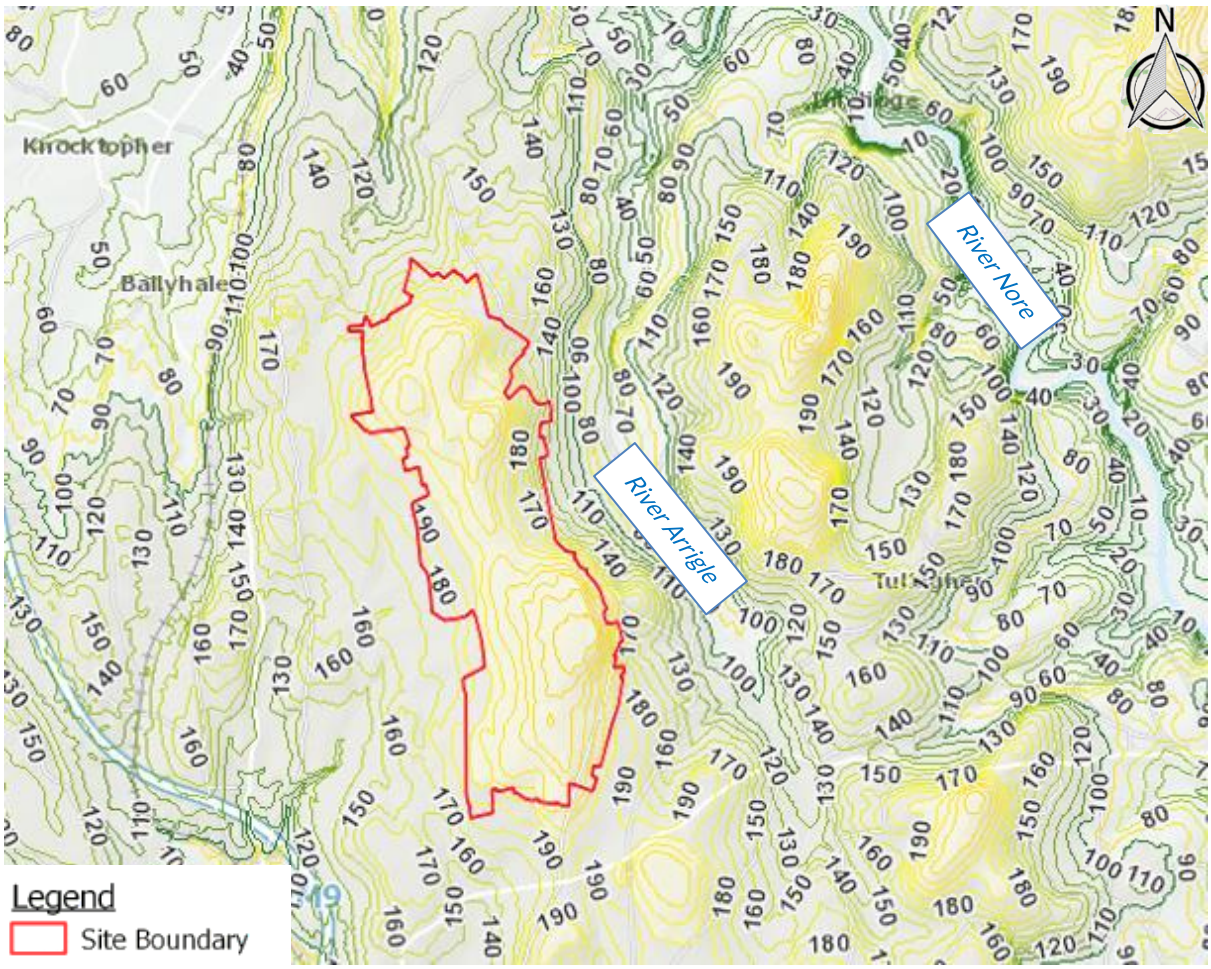

Figure 3-1 OSI Elevation Contours Map

3.2 Past Flood Events

The OPW's National Flood Information Portal[1] provides mapping of past flood events with records of flood reports, meeting minutes, press articles, photos, and/or hydrometric data.

Based on the map shown in Figure 3-2, no past flood events have been reported within 1.5 km of the proposed wind farm site. Kilkenny County Council records from 2005 or earlier indicate that the River Arrigle floods the R704, making it impassable, several times a year after sustained periods of heavy rainfall. There is also evidence of roads and rural lands at Ballyhale and Knockwilliam flooding when the local watercourse bursts its banks.

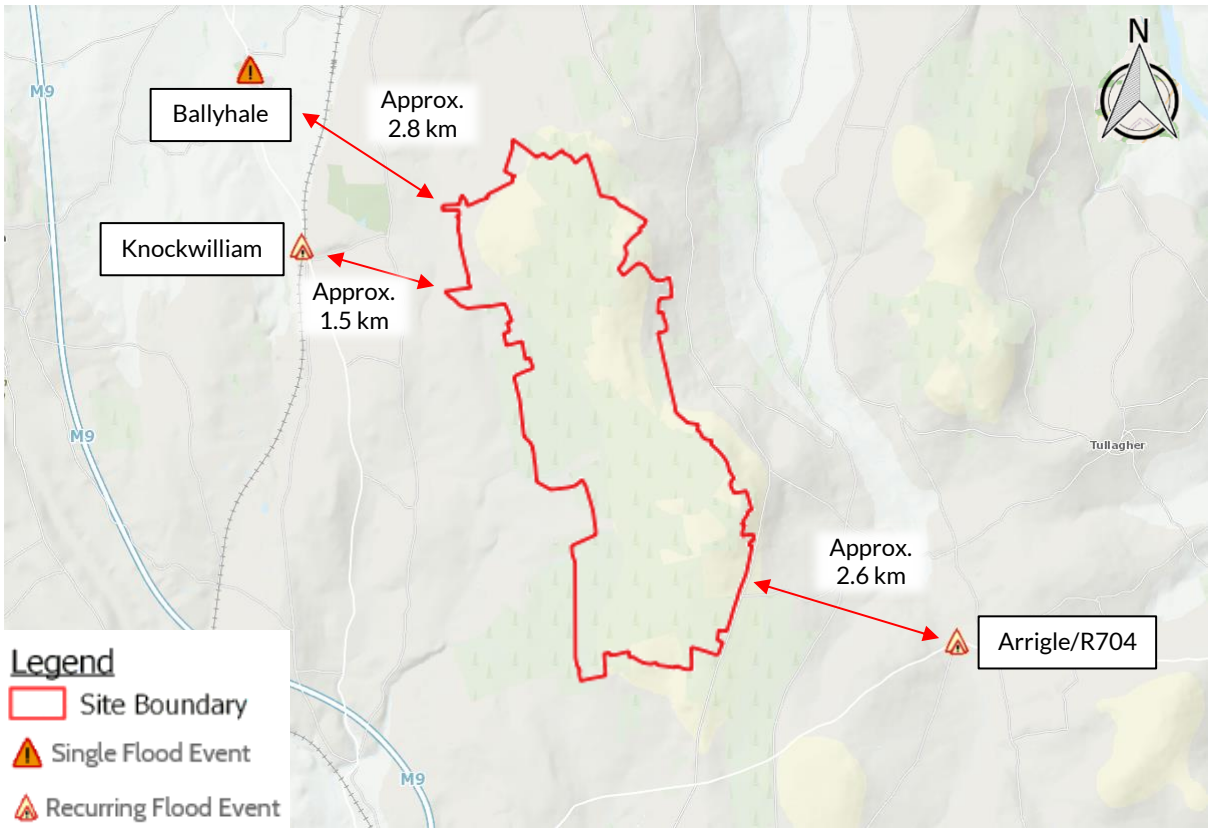

Figure 3-2 OPW Map of Past Flood Events

[1] floodinfo.ie

3.3 National Preliminary Flood Risk Assessment

In 2009, the OPW produced indicative flood maps as part of a National Preliminary Flood Risk Assessment (PFRA). It should be noted that "*the flood extents shown on these maps are based on broad-scale, simple analysis and may not be accurate for a specific location.*" [2] Additionally, the likely effects of climate change were not considered for the PFRA.

Two tributaries of the River Derrylacky and one tributary of the River Arrigle rise within the site boundaries, near the proposed locations for turbines T5, T9 and T8.

Based on the indicative flood map shown in Figure 3-3, it is estimated that the proposed wind farm site is not at risk of fluvial flooding.

The natural topography of the site is such that flood waters would flow away from the site towards lands further downstream that are at lower elevations (see Section 3.1).

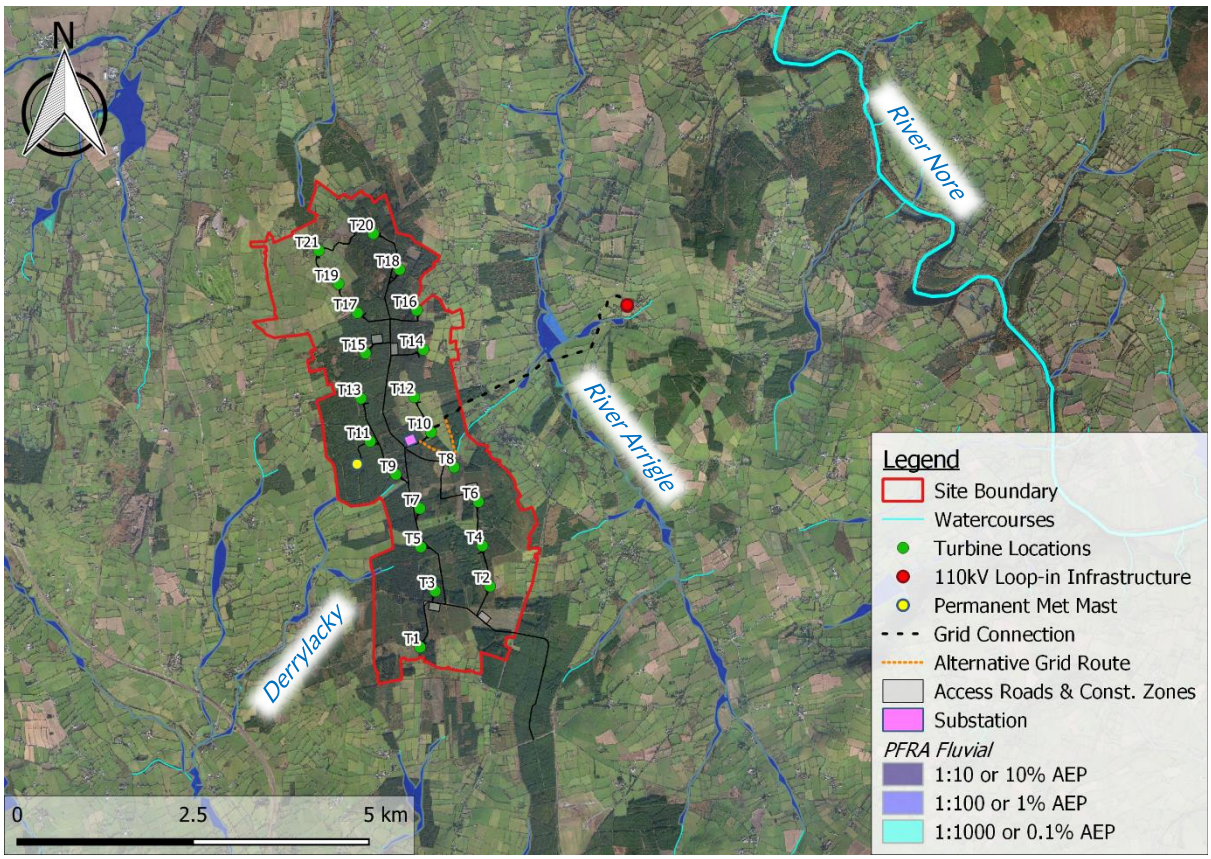

Figure 3-3 PFRA Indicative Fluvial Flood Map

[2] The National Preliminary Flood Risk Assessment (PFRA) Overview Report (OPW, March 2012)

3.4 Catchment Flood Risk Assessment and Management Study

In 2015, the OPW produced flood maps[3] as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study. The flood extents in these maps are based on detailed modelling of Areas for Further Assessment (AFA) identified by the National PFRA.

The proposed wind farm site was not identified as an AFA. The Derrylacky and Arrigle Rivers were therefore not considered as part of the CFRAM Study due to their small catchment sizes.

Based on the CFRAM flood map shown in Figure 3-4, the proposed wind farm site is far from the 0.1% AEP MRFS fluvial flood extents predicted for the River Nore and River Blackwater.

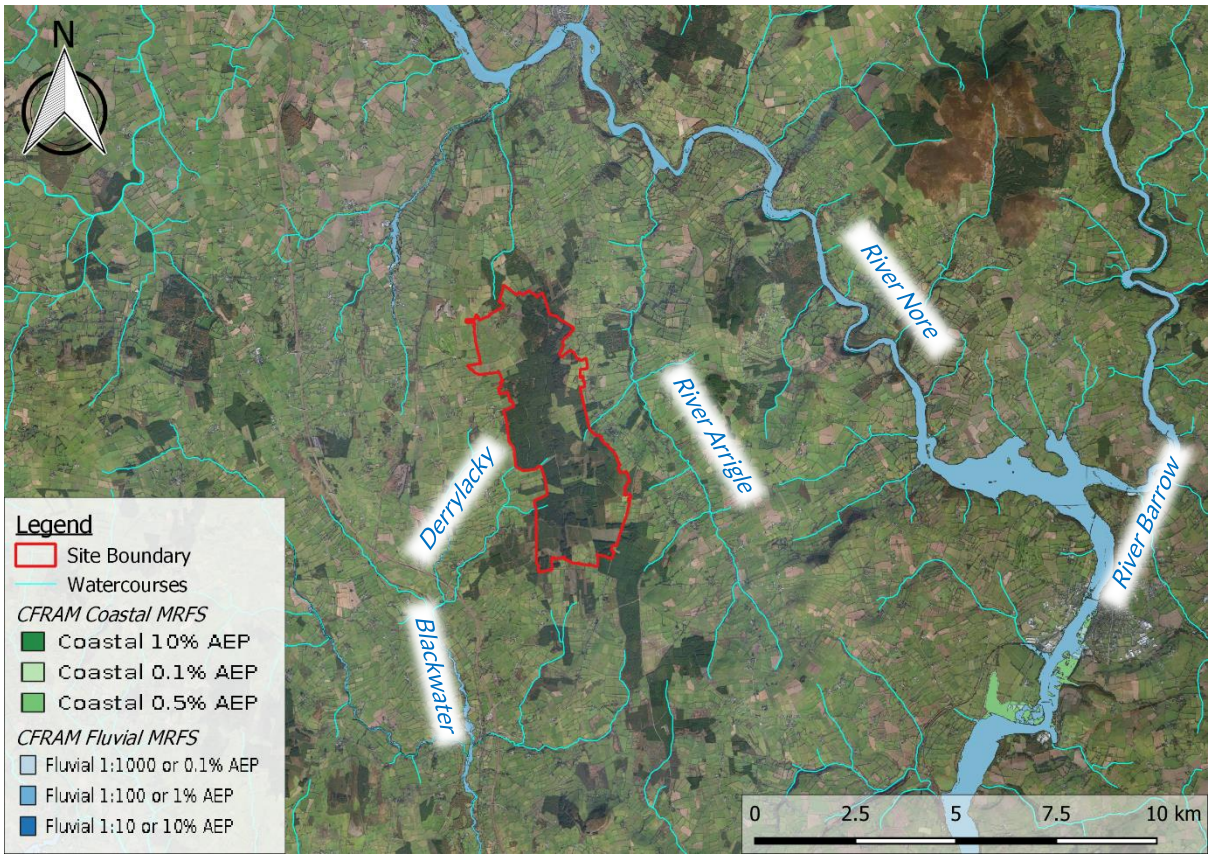

Figure 3-4 CFRAM Fluvial Flood Extents for a Mid-Range Future Scenario

[3] floodinfo.ie

3.5 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping[4] with data related to Ireland's subsurface and groundwater. Based on the map shown in Figure 3-5, there are no karst landforms in the vicinity of the site. There is therefore no evidence to suggest groundwater as a potential source of flood risk to the proposed wind farm site.

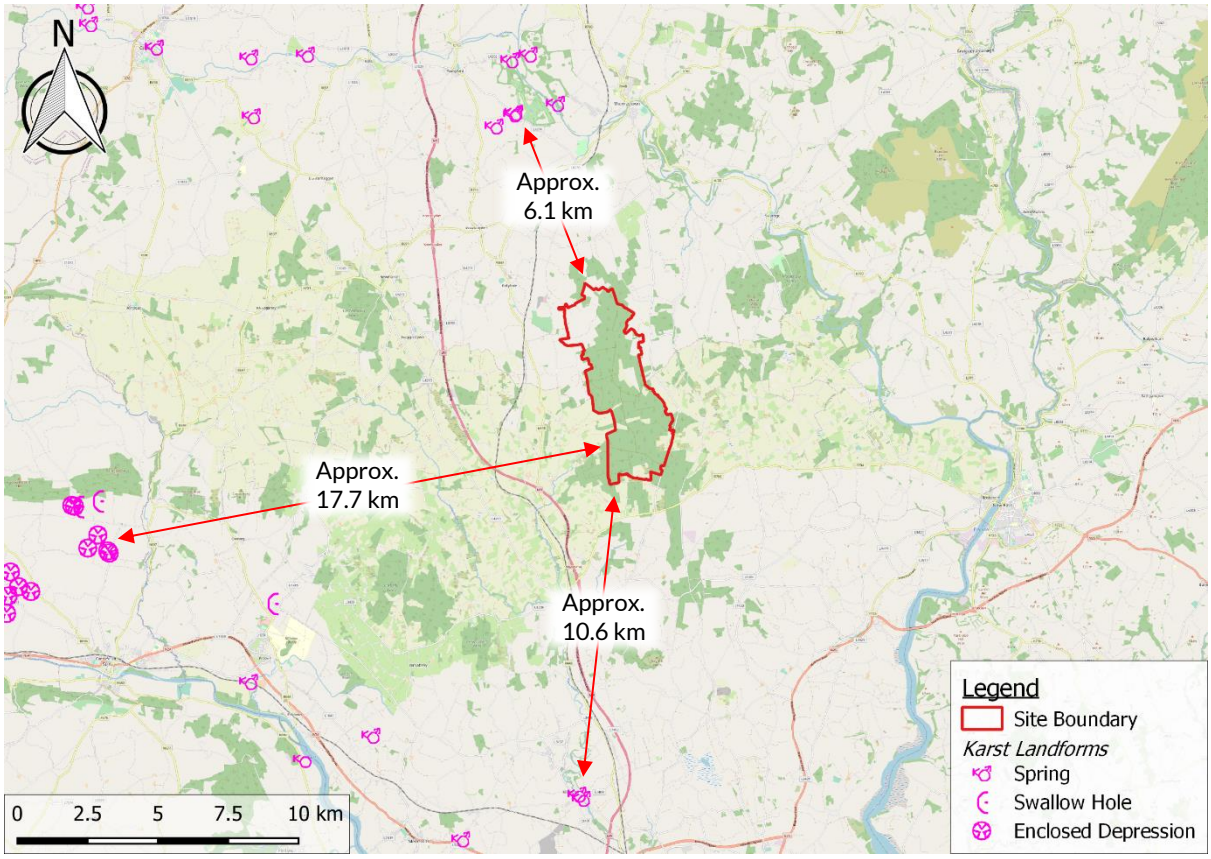

Figure 3-5 GSI Mapping of Karst Features

[4] https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx

4.0 DETAILED FLOOD RISK ASESSMENT

The PSFRM Guidelines (OPW/DoEHLG, 2009) classify electricity generation infrastructure as "essential infrastructure" which is considered appropriate in Flood Zone C. The proposed wind farm has therefore been assessed against a 0.1% AEP MRFS flood.

4.1 Pluvial Flooding

There is no record of pluvial flooding or surface water ponding at the proposed wind farm site.

Surface water arising at developed areas of the site will be managed by a dedicated stormwater drainage system designed in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

It is estimated that the natural landscaping and topography of the site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked. Regular inspections and maintenance will be undertaken on the stormwater drainage system to minimise any risk associated with this.

On this basis, it is estimated that the proposed wind farm is not at risk of pluvial flooding and it is determined that there will be no cumulative effects on flood risk elsewhere.

4.2 Fluvial Flooding

Two tributaries of the River Derrylacky and one tributary of the River Arrigle rise within the site, near the proposed locations for turbines T5, T9, and T8 (see Figure 1-1).

It was noted that due to the size of these streams (catchment area <1km^2), they were not surveyed/modelled as part of the OPW's CFRAM programme.

Based on the indicative flood mapping produced as part of the National PFRA Study (Figure 3-3), it is estimated that the proposed wind farm is not at risk of fluvial flooding from watercourses in the area.

The landscaping and topography of the site also provides a natural overland flow path to convey water away from the essential infrastructure.

While the R704 at the River Arrigle and local roads at Ballyhale and Knockwilliam are known to flood after heavy rainfall, there are no OPW records of past flooding within 1.5 km of the proposed wind farm site.

The stormwater management system proposed as part of the development is designed to limit runoff from the site to greenfield runoff rates, therefore mitigating against an increase in flood risk elsewhere.

4.3 Groundwater Flooding

Based on Geological Survey Ireland (GSI) subsurface and groundwater mapping, there are no karst landforms (springs, swallow holes, enclosed depressions, etc.) in the vicinity of the proposed wind farm (see Figure 3-5).

There is therefore no evidence to suggest groundwater as a potential source of flood risk to the proposed wind farm site.

4.4 Coastal Flooding

Given the elevated nature of the proposed wind farm site (145 mOD to 265 mOD), it is estimated that there is no risk of coastal flooding.

4.5 The Justification Test

The proposed wind farm has been assessed against the criteria of the Justification Test (see Figure 2-1):

1. The proposed wind farm site is located in an area 'open to consideration' for wind energy development based on the 2014-2020 County Development Plan. See Chapter 4 of the Castlebanny Wind Farm EIAR for further discussion on this point.
2. The site has been subject to this detailed FRA, which demonstrates:
    (i) Due to the inclusion of a dedicated stormwater management system, it is estimated that the proposed wind farm will not impact flood risk elsewhere in the catchment.
    (ii) The proposed wind farm will not impede the flow of surface water during extreme flood events.
    (iii) Residual risks to vulnerable receptors and essential infrastructure (substations, turbines, access tracks etc.) can be managed to an acceptable level during an extreme flood event.
    (iv) The proposed wind farm is compatible with the wider planning objectives of the area, which promote sustainable growth and development.

5.0 CONCLUSIONS

TOBIN Consulting Engineers were appointed by Coillte to undertake a Flood Risk Assessment for a proposed 21 turbine wind farm at Castlebanny, County Kilkenny. The location and proposed layout of the approximately 1,434 ha site is shown in Figure 1-1. The Planning System and Flood Risk Management Guidelines (OPW/DoEHLG, 2009) classify electricity generating stations as "essential infrastructure" which is considered appropriate in Flood Zone C. The proposed wind farm has therefore been assessed against a 0.1% AEP MRFS flood (i.e., a 1000-year flood and likely climate change scenario).

The results of this Flood Risk Assessment are as follows:

Pluvial Flooding:

There is no record of pluvial flooding or surface water ponding at the proposed wind farm site.

Surface water arising at developed areas of the site will be managed by a dedicated stormwater drainage system designed in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

It is estimated that the natural landscaping and topography of the site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

On this basis, it is calculated that the proposed wind farm is not at risk of pluvial flooding and it is determined that there will be no cumulative effects on flood risk elsewhere.

Fluvial Flooding:

Two tributaries of the River Derrylacky and one tributary of the River Arrigle rise within the subject site. Due to the size of these streams (catchment area < 1km^2), they were not surveyed/modelled as part of the OPW's CFRAM programme.

Based on the indicative flood mapping produced as part of the National PFRA Study (Figure 3-3), it is indicated that the proposed wind farm is not at risk of fluvial flooding from watercourses in the area.

The landscaping and topography of the site also provides a natural overland flow path to convey water away from the essential infrastructure.

While the R704 at the River Arrigle and local roads at Ballyhale and Knockwilliam are known to flood after heavy rainfall, there are no OPW records of past flooding within 1.5 km of the proposed wind farm site.

The stormwater management system proposed as part of the development is designed to limit runoff from the site to greenfield runoff rates, therefore mitigating against an increase in flood risk elsewhere.

Groundwater Flooding:

There is no evidence to suggest groundwater as a potential source of flood risk to the proposed wind farm site.

Coastal Flooding:

Given the elevated nature of the proposed wind farm site (145 mOD to 265 mOD), it is estimated that there is no risk of coastal flooding.

Based on the results of this FRA, it is estimated that the risk of flooding associated with the proposed development will be minimal, and it is predicted that the development will not increase the risk of flooding elsewhere.

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