Appendix 9-3 – Flood Risk Assessment

FuturEnergy Scart Mountain Designated Activity Company

Proposed Scart Mountain Wind Farm, Co. Waterford

Stage 2 Flood Risk Assessment

Document Control Sheet	
Document Reference	Stage 2 Flood Risk Assessment
Client:	FuturEnergy Scart Mountain Designated Activity Company
Project Reference	11303

Rev	Description	Author	Date	Reviewer	Date	Approval	Date
A	Draft Issue	FOC	10/10/2023	ST	10/10/2023	ML	13/10/2023
B	Added GCR & TDR	FOC	24/09/2024	ST	26/09/2024	KD	10/10/2024

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1. INTRODUCTION

Tobin were appointed by FuturEnergy Scart Mountain Designated Activity Company in to undertake a Flood Risk Assessment (FRA) for their lands (Figure 1-1) and proposed wind farm project including proposed turbine delivery route (TDR) and grid connection route (GCR) (see Figure 1-2) in Scart Mountain , Co. Waterford.

The proposed wind farm site infrastructure includes the development of one substation, 15 wind turbines and associated hardstanding areas, met mast, temporary construction compounds; access roads, and borrow pits.

The topography of the proposed wind farm site is mountainous and ranges from 140mOD at the lowest point up to two mountain peaks that have maximum elevations of approximately 486mOD and 425mOD. The site consists of two mountain peaks to the north of the site with a much gentler slope noted at the south of the site. Given the mountainous terrain of the proposed wind farm site, the headwaters of a number of watercourses are located within the boundary of the proposed site. The number and nature of these watercourses, together with the steep profile of the upper elevations of the site, indicates that runoff from the site is 'flashy' and quite rapid.

There are three hydraulic features which flow through the proposed wind farm site: the Glenshelane River, a minor tributary of the Glenshelane River, and the Boherawillin River, with headwaters originating within or immediately north of the wind farm site (See Figure 1-2). There are three further rivers which flow along the boundary of the wind farm site, identified by the EPA as: Farnane 18, Toor 18, and Knocknasheegan rivers. All rivers within and bordering the wind farm site flow towards the Blackwater River before draining into Caliso Bay, Co. Waterford.

Three additional watercourses flow through the proposed GCR, the Finisk river, Ballykerin stream, and the Colligan river. The Finisk and Ballykerin streams flow towards the Blackwater River before draining into Caliso Bay, Co. Waterford. The Colligan river drains into Dungarvan Harbour.

The purpose of this Stage 2 FRA is to identify, quantify, and communicate the risks of flooding, if any, to the proposed project.

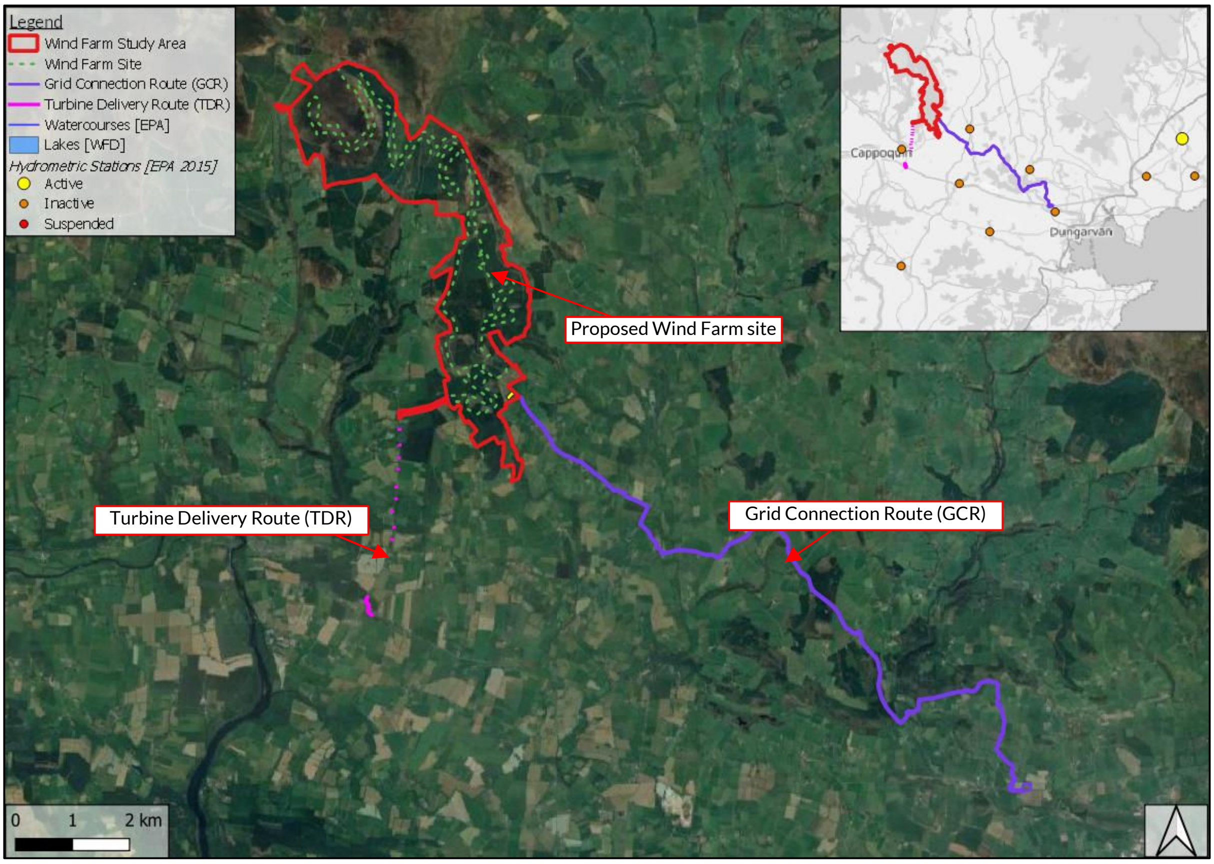

Figure 1-1 Site Location

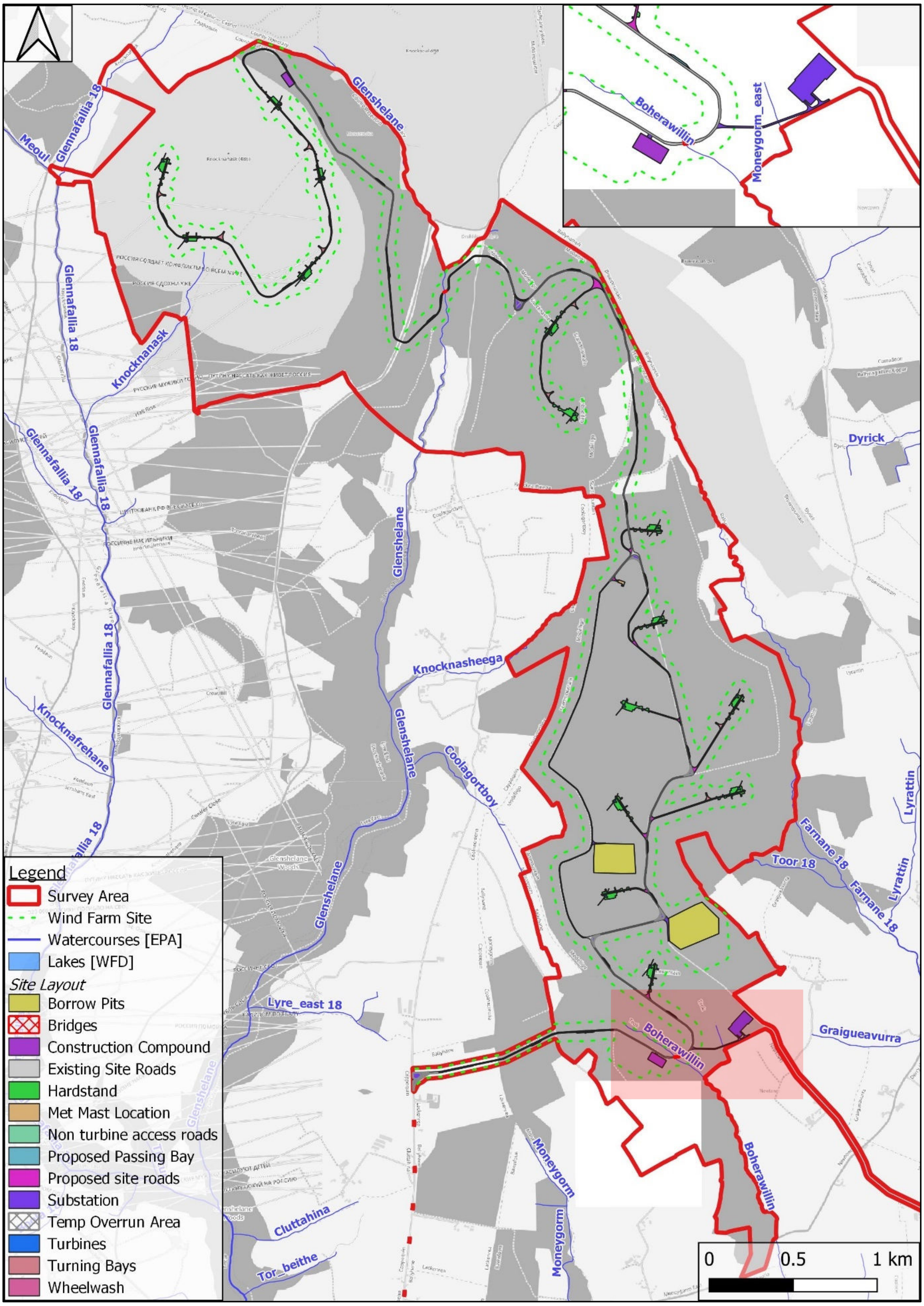

Figure 1-2 Proposed wind farm site layout

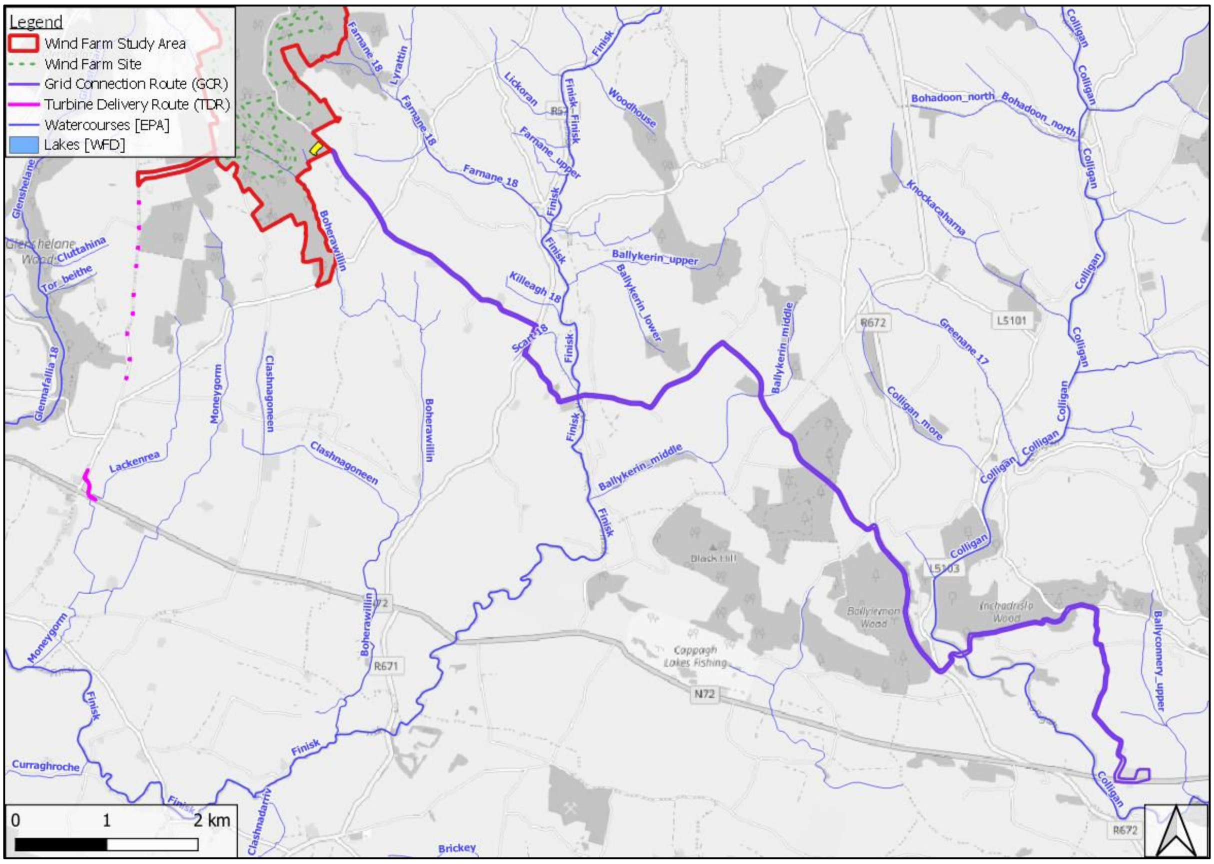

Figure 1-3 Proposed Turbine Delivery Route (TDR) and Grid Connection Route (GCR)

2. FLOOD RISK MANAGEMENT GUIDANCE

This Stage 2 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 (OPW and DoEHLG 2009)
- Flood Risk Management Climate Change Sectoral Adaptation Plan (DCCAE, 2018)
- Waterford County Development Plan 2022-2028

2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management Guidelines for Planning Authorities (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 three 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.

Table 2-1 shows a decision matrix that indicates which types of development are appropriate in each flood zone and when the Justification Test (see Section 2.1.2) must be satisfied. The annual exceedance probabilities used to define each flood zone are also provided.

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

Flood Zone: (Probability)	Annual Exceedance Probability (AEP)	Highly Vulnerable Infrastructure	Less Vulnerable Infrastructure	Water Compatible Infrastructure
A (High)	Fluvial & Pluvial Flooding More frequent than 1% AEP Coastal Flooding More frequent than 0.5% AEP	Justification Test Required	Justification Test Required	Appropriate
B (Medium)	Fluvial & Pluvial Flooding 0.1% to 1% AEP Coastal Flooding 0.1% to 0.5% AEP	Justification Test Required	Appropriate	Appropriate
C (Low)	Fluvial, Pluvial & Coastal Flooding Less frequent than 0.1% AEP	Appropriate	Appropriate	Appropriate

The PSFRM Guidelines state that electricity generating power stations and substations are classified as "essential infrastructure". The proposed project contains essential infrastructure such as an electrical substation and wind turbines which has been assessed against a 1-in-1,000-year flood event (0.1% AEP).

2.1.2 The Justification Test

Any proposed development being considered in an inappropriate flood zone (as determined by Table 2-1) must satisfy the criteria of the Justification Test outlined in Figure 2-1 (taken 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 Criteria of the Justification Test

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 2-1 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

2.3 WATERFORD COUNTY DEVELOPMENT PLAN 2022-2028

Waterford City and County Development Plan 2022-2028 came into effect on Tuesday 19th July 2022. The Plan is a unitary Development Plan for the amalgamated Waterford City and County administrative area, and supersedes the previous separate City, County and Dungarvan Town Development Plans and relevant Local Area Plans

The current County Development Plan provides a strategic framework for land use planning for 2022 to 2028. Section 9.2 outlines the Waterford Council approach to flooding, incorporating the PSFRM Guidelines. The Development Plan sets out two key Flood Management Policy Objectives, two Utility, Energy & Communication Policy Objectives, and one Regulatory Framework and Climate Change Policy Objective:

FM 01 Waterford City & Council will work with the OPW, LAWPRO and other agencies at a catchment-level to identify any measures, such as natural water retention measures, that can have benefits for, water quality, flood risk management and biodiversity objectives.

FM 02 Waterford City & Council will protect floodplains of river catchments in the County and retain them for their flood protection and natural heritage values.

CA 01 To support and implement the policies of the Waterford Climate Adaptation Strategy in collaboration with Waterford Climate Action Team the Climate Action Regional Office (CARO), and review/replace the strategy pursuant to the provisions of the Climate Action Plan 2021 and Low Carbon Development Act. We will vary the Development Plan as necessary following the review/replacement of the strategy.

UTL 10 <u>Flooding SFRA</u>

To reduce the risk of new development being affected by possible future flooding by:

- Avoiding development in areas at risk of flooding,
- Where possible, reducing the causes of flooding to and from existing and future development,
- Increase the application of SuDS such as permeable paving, bioretention/infiltration ponds, swales and Natural Water Retention Measures, and the identification of existing areas which may be suitable for temporary storage/overflow of water during heavy storms,
- Where development in floodplains cannot be avoided, taking a sequential approach to flood risk management based on avoidance, reduction, and adaptation to the risk; and,
- Ensuring that all proposals for development falling within Flood Zones A or B are consistent with the "The Planning System and Flood Risk Management –Guidelines for Planning Authorities 2009", "Climate Action and Low Carbon Development Act" (2021), and any amendment thereof, and the "Waterford Strategic Flood Risk Assessment" (2021) as included in Appendix 13.
- To support the making of Local Area Plan for larger urban centres we will prepare surface water management plans where adequate data exists to support their preparation. Where data is lacking, we will carry out a data

review gap analysis and prepare conceptual surface water management plans as an initial step.
- We will support the development of new flood relief schemes by the OPW, in particular those at Aglish, Ballyduff and Dungarvan & Environs while protecting public investment in flood relief schemes as detailed in Section 4.4.3 of the SFRA (Appendix 13).

UTL 11 Flood Plains

To contribute towards the improvement and/or restoration of the natural flood risk management functions of flood plains subject to compliance with the environmental legislation and availability of resources and ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management applicable at the time.

3. INITIAL FLOOD RISK ASSESSMENT

3.1 PAST FLOOD EVENTS

The OPW's National Flood Information Portal[1] provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data. Based on the flood map shown in Figure 3-1 , there is one past flood event recorded 220m east of the proposed GCR (Flood ID-3812).

- The flood event is recurring and as a result of the River Colligan
- Meeting minutes state that "A combination of heavy rain and high tides causes overbank flow from the Colligan on a recurring basis."
- A factory and the N72 road are flooded periodically.

All other flood extents recorded in the vicinity are at minimum 1.6km away from the proposed wind farm site, GCR, and TDR. It is estimated that the flood events will not have any effect on the proposed development due to the large distance between them and the proposed project.

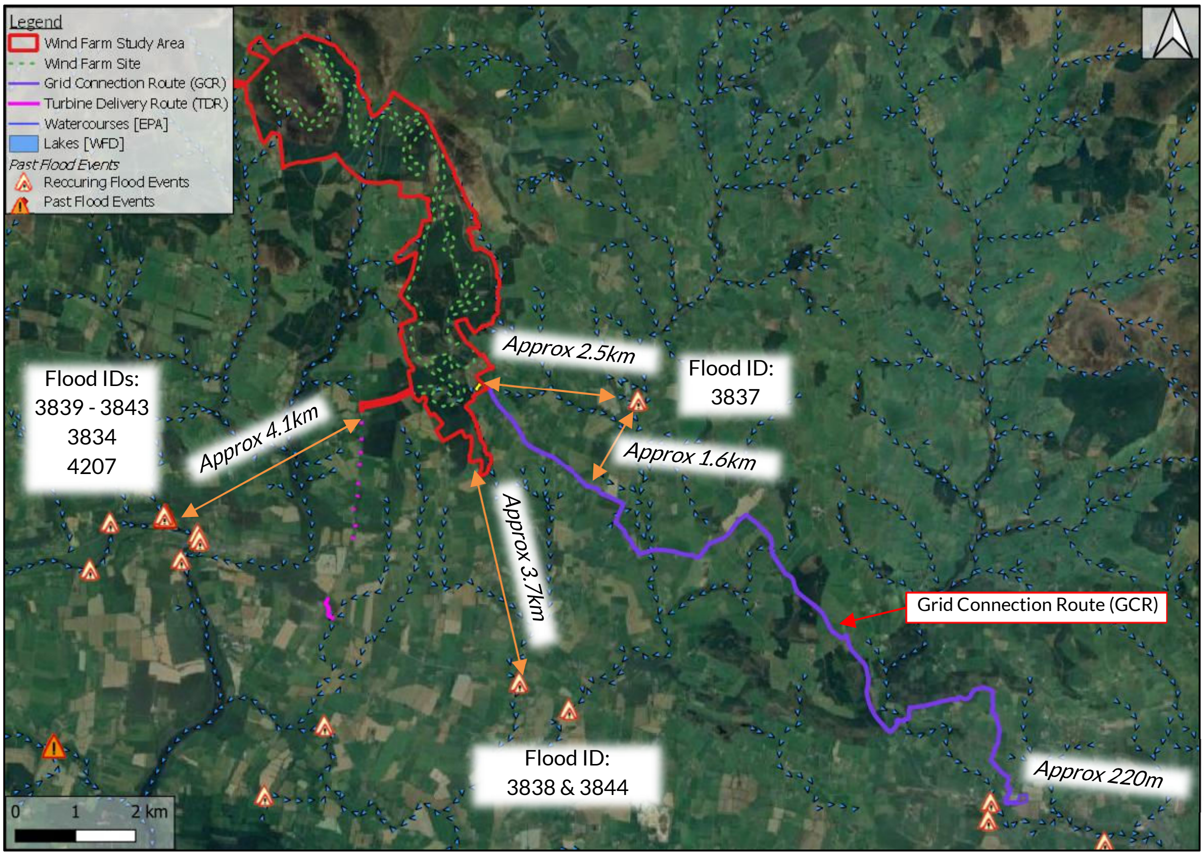

Figure 3-1 OPW Flood Map of Past Flood Events[2]

[1] floodinfo.ie

[2] https://www.floodinfo.ie/map/floodmaps/

3.2 OPW Preliminary Flood Risk Assessment (PFRA) Study

In 2009, the OPW produced a series of maps to assist in the development of a broad-scale FRA throughout Ireland. These maps were produced from several sources.

The OPW's National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 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".*

Figure 3-2 provides an overview of the fluvial, coastal, pluvial, and groundwater indicative flood extents in the vicinity of the proposed wind farm site.

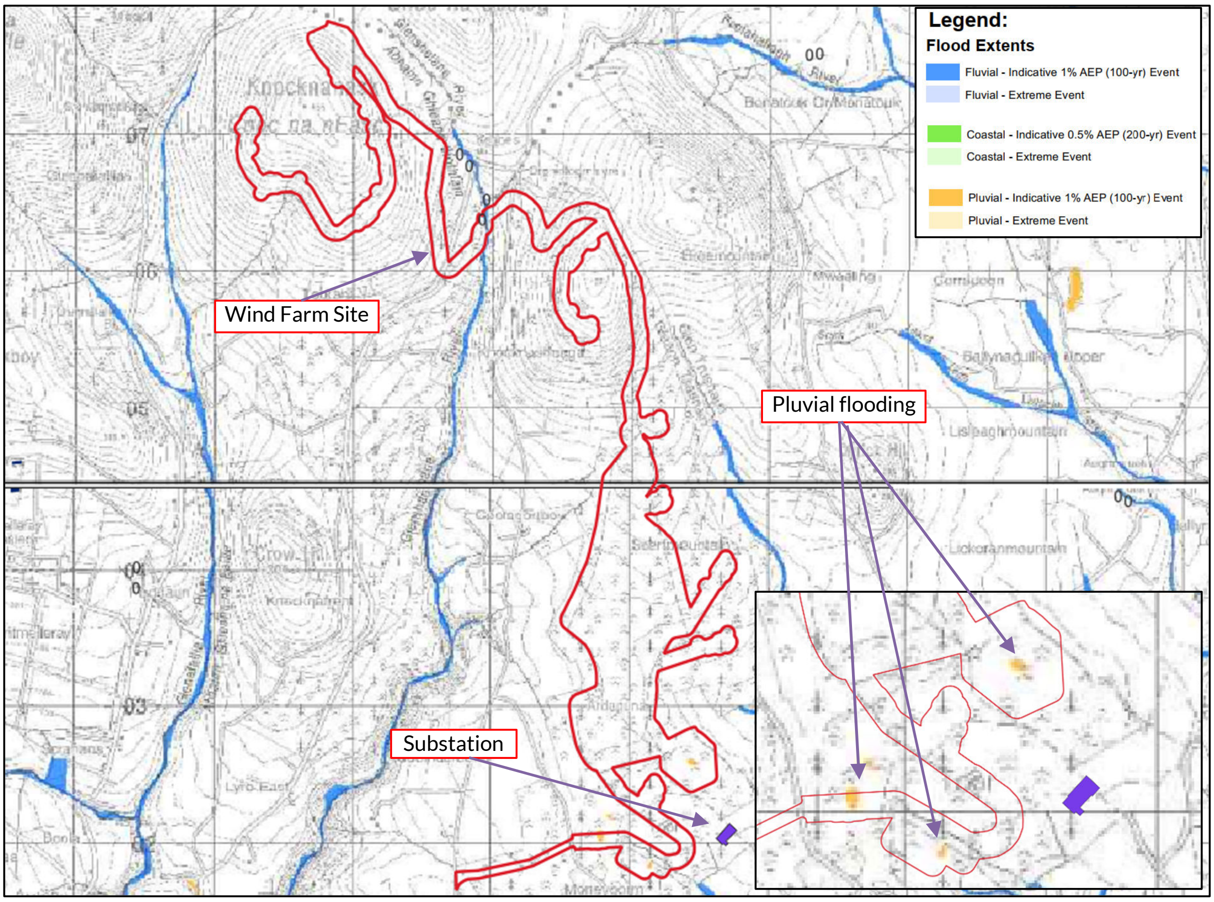

Figure 3-2 Indicative Flood Mapping [extract from PFRA Map 67 & 86]

Wind Farm site

The Glenshelane River, Colligan River, Finisk River, and Ballykerin Stream are all mapped by the PFRA study. The PFRA mapping shows that one area of the proposed wind farm site is liable to fluvial flooding along the proposed bridge at the north end of the site (see inset in Figure 3-3) The other watercourses in the vicinity of the proposed wind farm site are unmapped due to the proximity of the stream's headwaters.

The proposed wind farm site is not identified as being at risk of groundwater or coastal flooding.

Several areas of the proposed wind farm site are identified as being at risk of pluvial flooding due to localised topographical depressions. One small area corresponds to the vicinity of the construction compound, and the other at a proposed borrow pit. The proposed substation is not liable to pluvial flooding. The proposed substation is approximately 300m northeast of the PFRA flood extents.

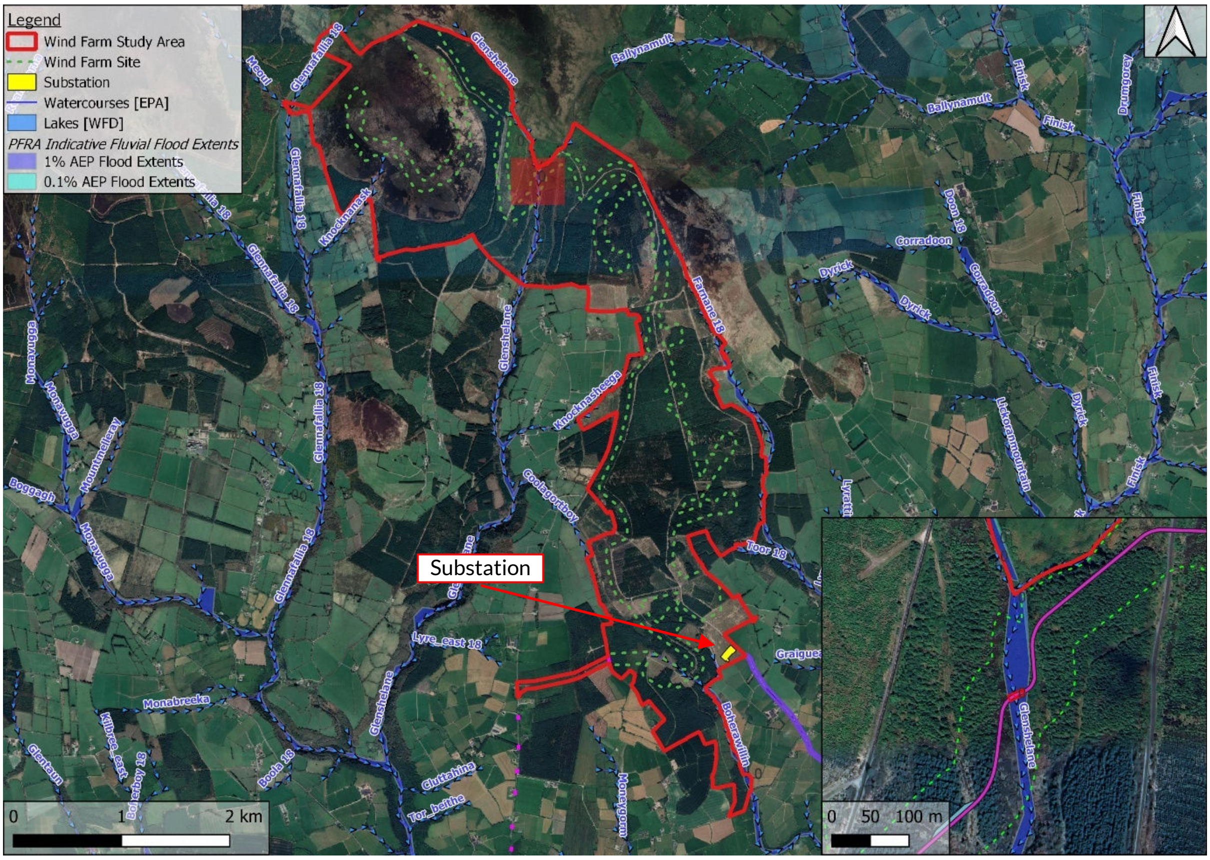

Figure 3-3 PFRA Indicative Flood Mapping – Wind Farm Site

Grid Connection Route (GCR)

Four areas along the GCR are liable to fluvial flooding (see insets in Figure 3-4).

The proposed GCR is not identified as being risk of groundwater of coastal flooding.

The GCR is not expected to be at risk of pluvial flooding due to its route being located along a route of an existing road, which are expected to be raised above the surrounding lands with no localised depressions along them. The landscaping and topography of the existing roads will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event.

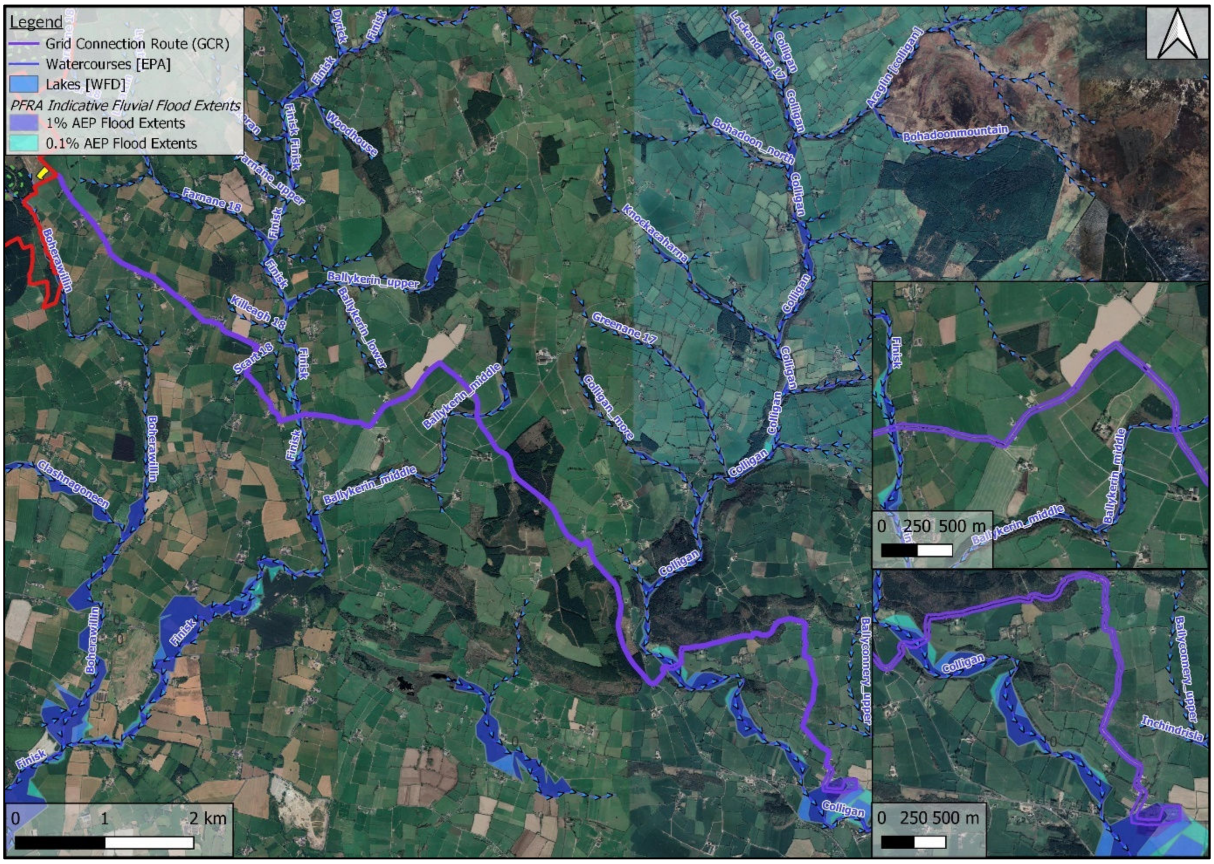

Figure 3-4 PFRA Indicative Flood Mapping – GCR

<u>Turbine Delivery Route (TDR)</u>

One area along the TDR is liable to fluvial flooding (see insets in Figure 3-5).

The proposed TDR is not identified as being risk of groundwater of coastal flooding.

The TDR is not expected to be at risk of pluvial flooding due to its route being located along a route of an existing road, which are expected to be raised above the surrounding lands with no localised depressions along them. The landscaping and topography of the existing roads will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event.

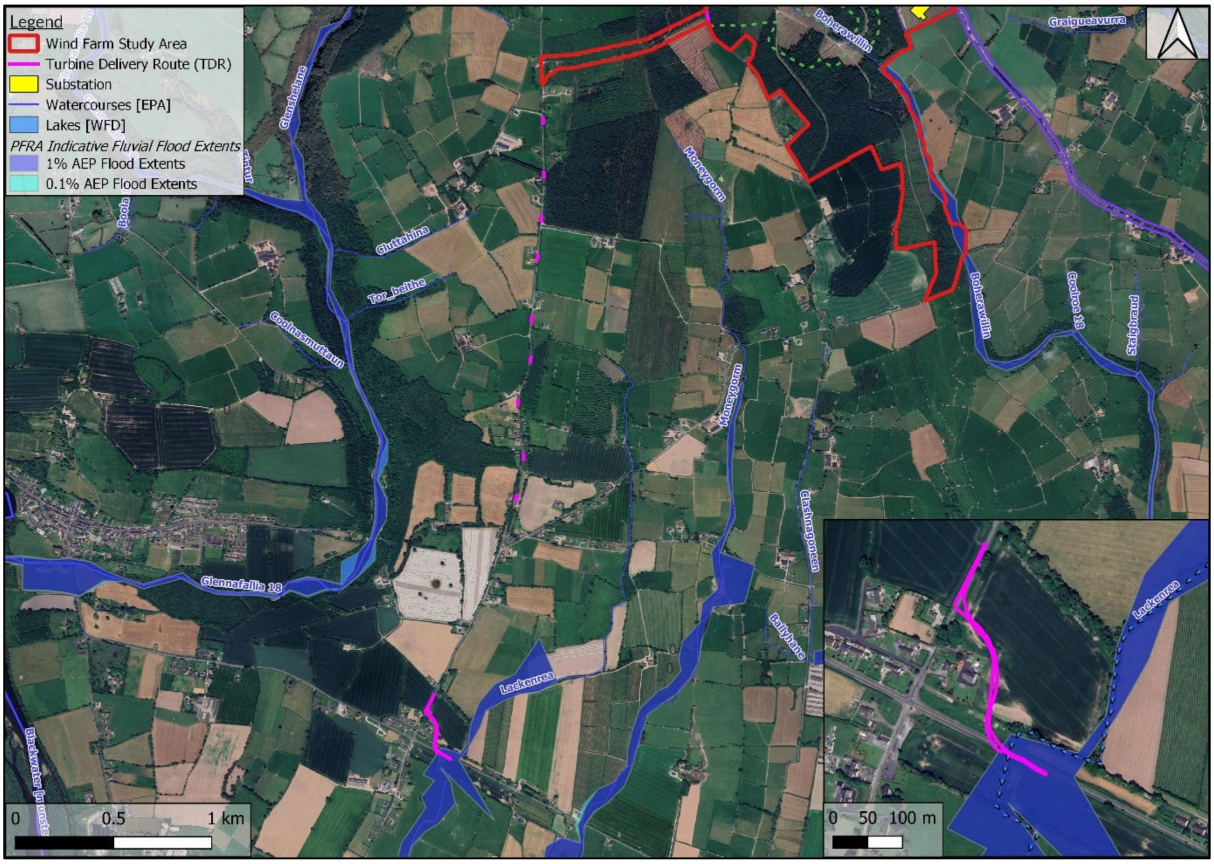

Figure 3-5: PFRA Indicative Mapping - TDR

Limitations on potential sources of error associated with the PFRA maps include:

- Assumed channel capacity (due to absence of channel survey information)
- Absence of flood defences and other drainage improvements and channel structures (bridges, weirs, culverts)
- Local errors in the national Digital Terrain Model (DTM)
- Lack of detailed hydrology and hydraulic assessment

3.2.1 National Indicative Fluvial Mapping[3] (NIFM)

In 2020, the OPW produced second-generation indicative fluvial flood mapping, improving upon the first generation PFRA and producing higher quality flood maps.

The NIFM Flood Mapping Technical Data notes that "Cross sectional surveys have not been used to define the dimensions of river channels and structures within the 2D model. Channels have been represented in the 2D model by assuming their channel capacity is equivalent to the estimation of [the index flood flow]". The 2D model uses a Digital Terrain Model with a grid scale of 5m.

<u>Wind Farm Site</u>

Figure 3-6 provides an overview of the 1 in 100-year and 1 in 1,000-year indicative fluvial flood mapping for the Proposed wind farm site. The section of the Glenshelane River within the wind far site is not modelled by the NIFM.

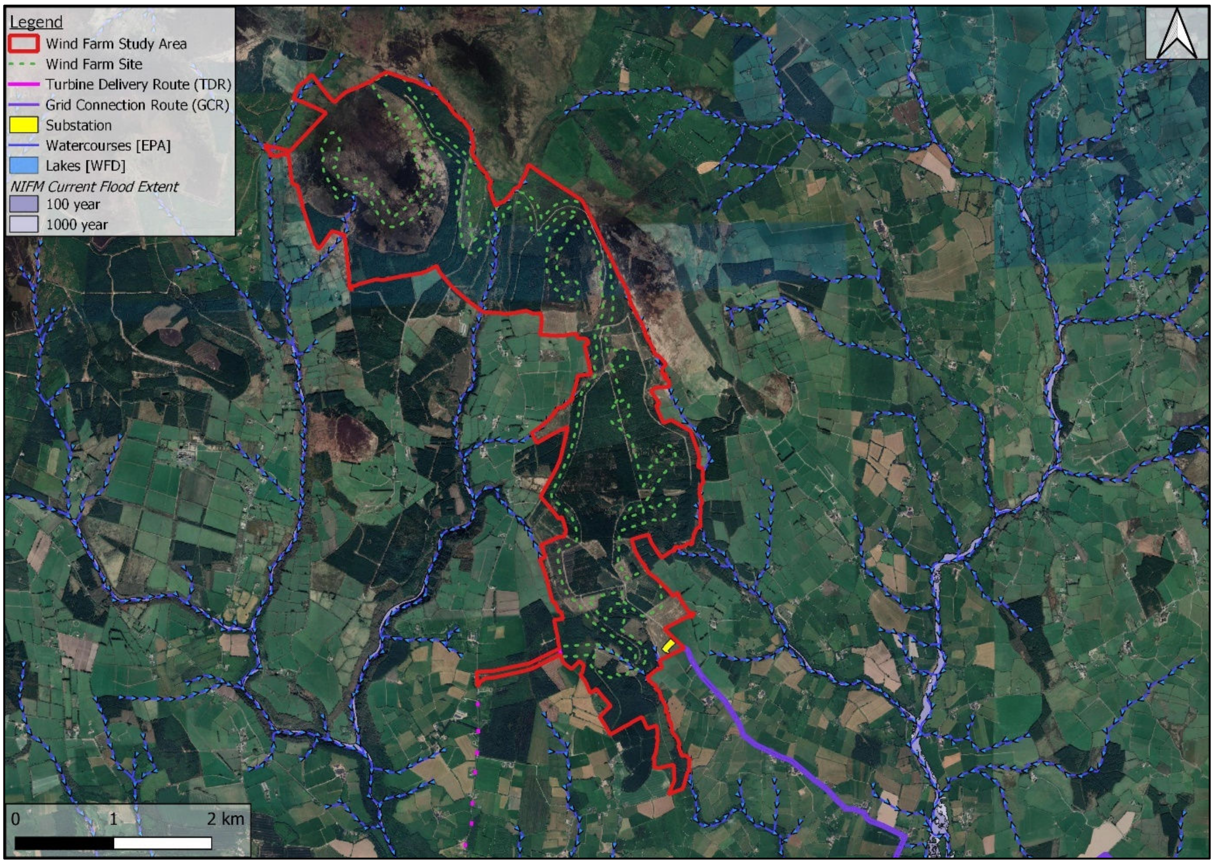

Figure 3-6 NIFM Current Flood Extents – Wind Farm Site

<u>Turbine Delivery Route (TDR)</u>

Figure 3-7 provides an overview of the 1 in 100-year and 1 in 1,000-year indicative fluvial flood mapping for the Proposed wind farm site and TDR. The section of the Glenshelane River within

[3] National Indicative Fluvial Mapping: Applying and Updating FSU Data to Support Revised Flood Risk Mapping for Ireland, Brown et al., Irish National Hydrology Conference 2019

the proposed site is not modelled by the NIFM. The closest extents are approximately 600m from the proposed TDR.

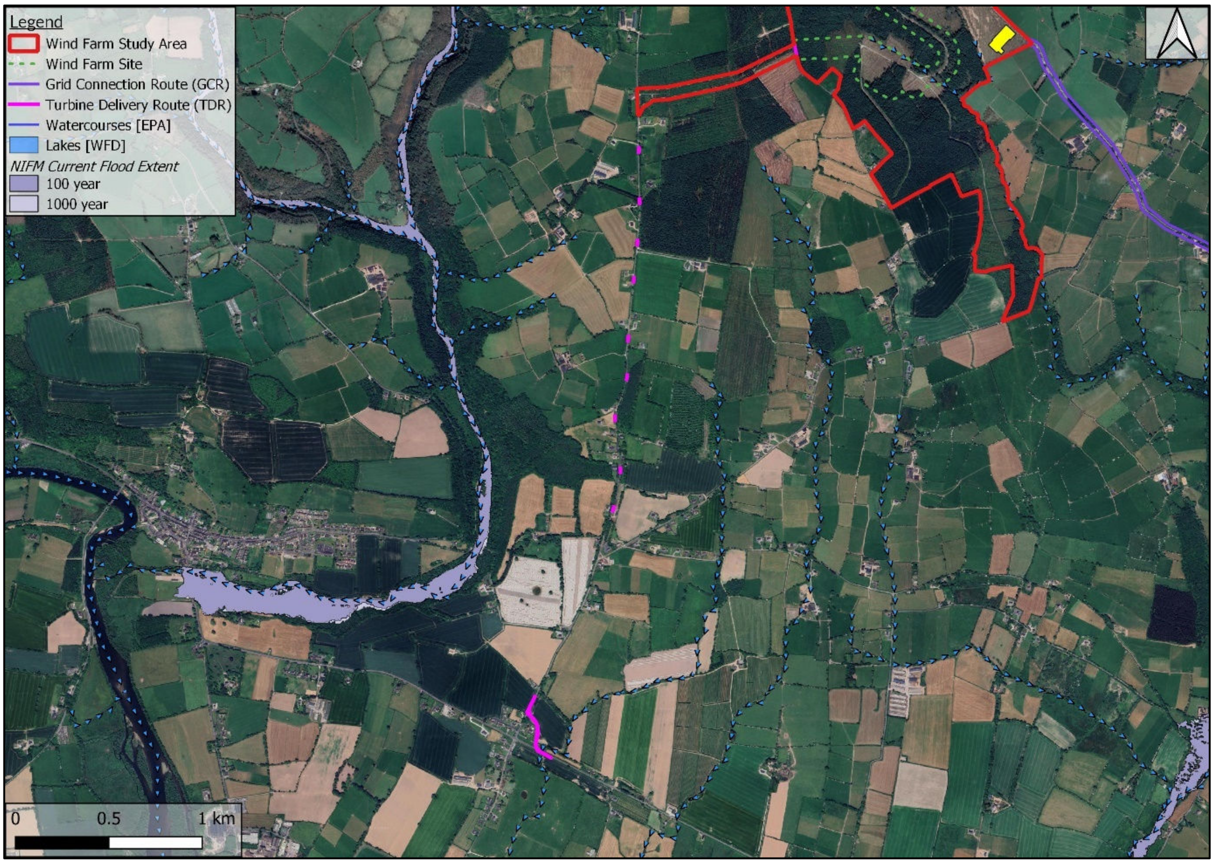

Figure 3-7 NIFM Current Flood Extents - TDR

<u>Grid Connection Route (GCR)</u>

The Colligan River and Finisk River were both modelled as part of the NIFM study. Figure 3-8 provides an overview of the 1 in 100-year and 1 in 1,000-year indicative fluvial flood mapping for the Proposed GCR, with Figure 3-9 showing the same with climate change included. The mapping shows two locations along the proposed GCR that are at risk of fluvial flooding.

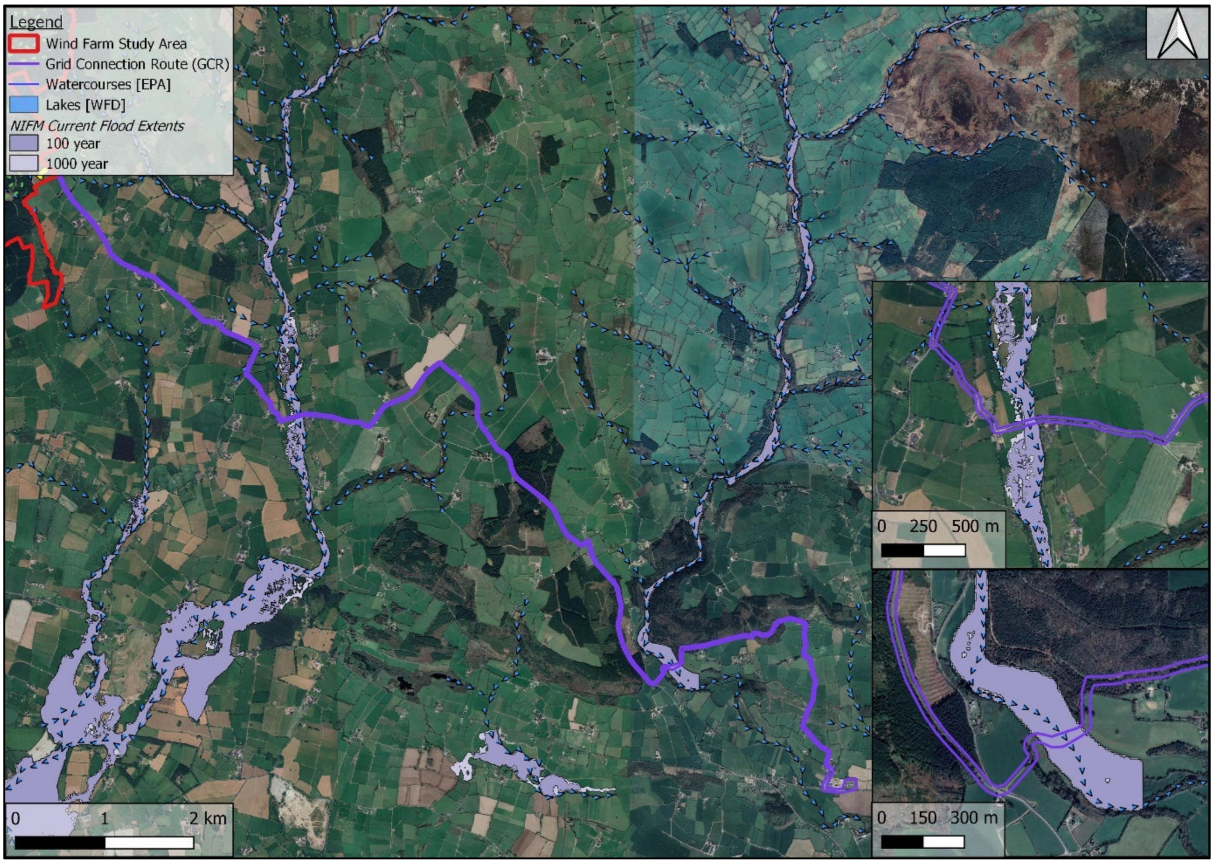

Figure 3-8 NIFM Current Flood Extents – GCR

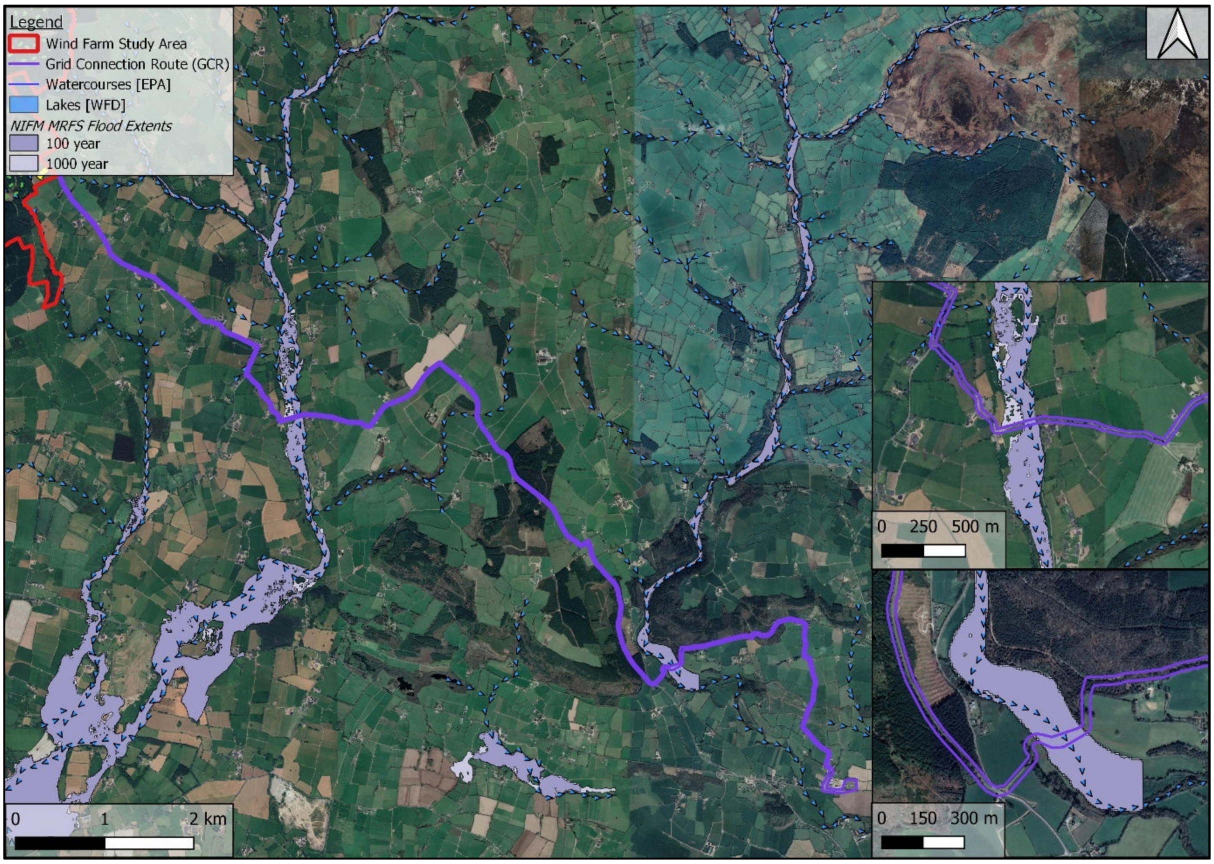

Figure 3-9 NIFM MRFS Flood Extents – GCR

3.3 CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

3.3.1 Fluvial Flooding

In 2015, the OPW produced flood maps 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 identified by the National Preliminary Flood Risk Assessment.[4].

Wind Farm Site

The watercourses in the vicinity of the wind farm site were not modelled as part of the CFRAM study and were not identified as areas for further development assessment. The Blackwater River is the closest CFRAM modelled river to the wind farm site. The CFRAM extents are located approximately 3.4km southwest of the wind farm site. The extents are shown in Figure 3-10 below.

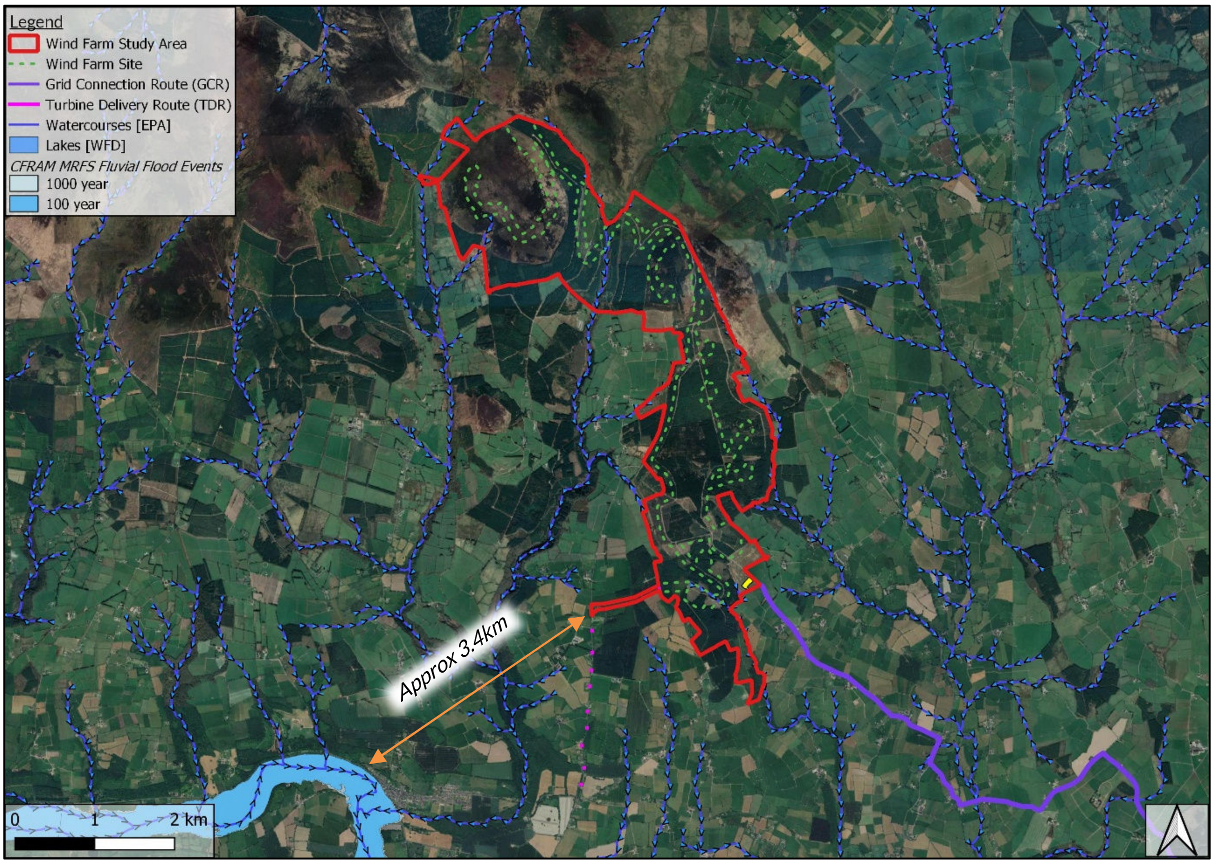

Figure 3-10 CFRAM MRFS Fluvial Flood Extents – Wind Farm Site

Turbine Delivery Route (TDR)

The Blackwater River is the closest CFRAM modelled river to the TDR. The CFRAM extents are located approximately 1.8km west of the TDR. The extents are shown in *Figure 3-11* below.

[4] https://www.floodinfo.ie/about_frm/

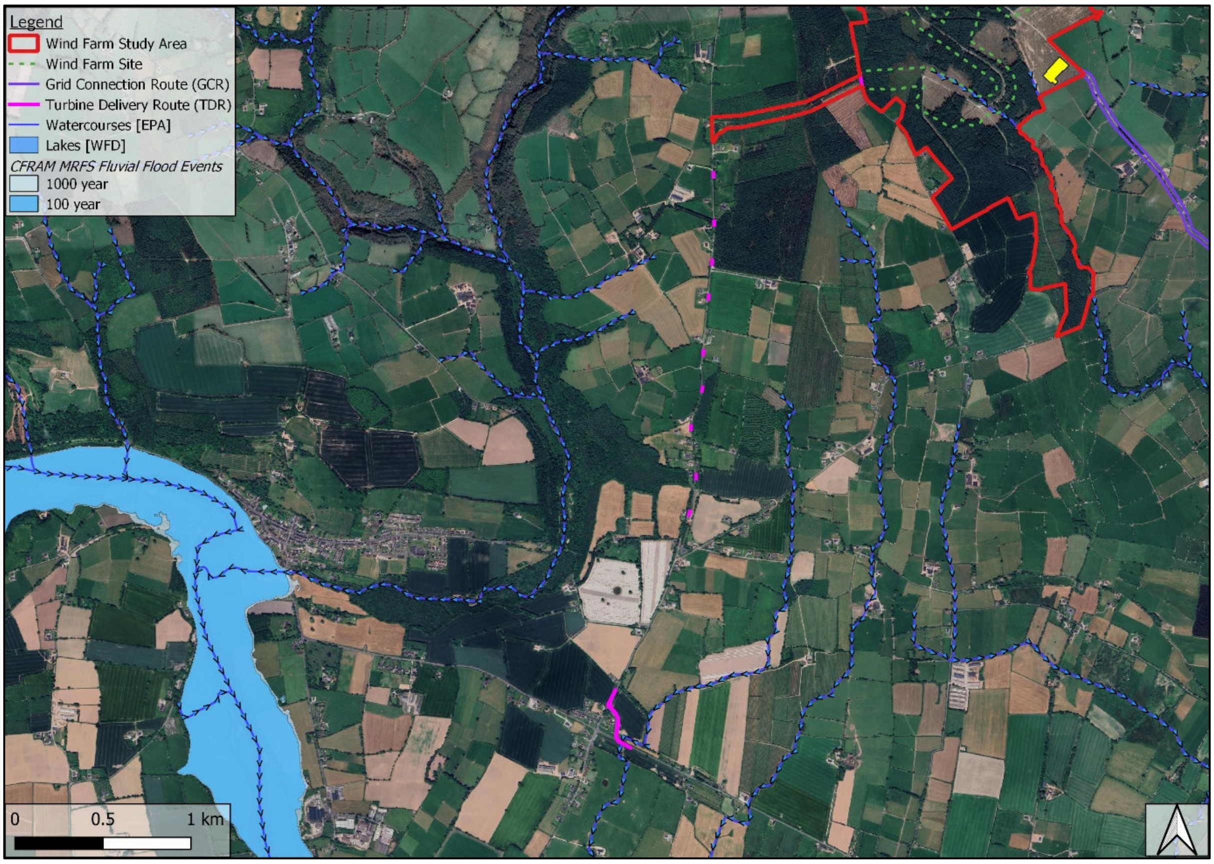

Figure 3-11 CFRAM MRFS Fluvial Flood Extents - TDR

<u>**Grid Connection Route (GCR)**</u>

The watercourses in the vicinity of the GCR were not modelled as part of the CFRAM study and were not identified as areas for further development assessment. The Corrigan River is the closest CFRAM modelled river to the GCR. The Corrigan River flows through the GCR, however no flood extents are shown to inundate the GCR. The closest CFRAM modelled flood extents to the GCR are located 15m away. The extents are shown in *Figure 3-12* below.

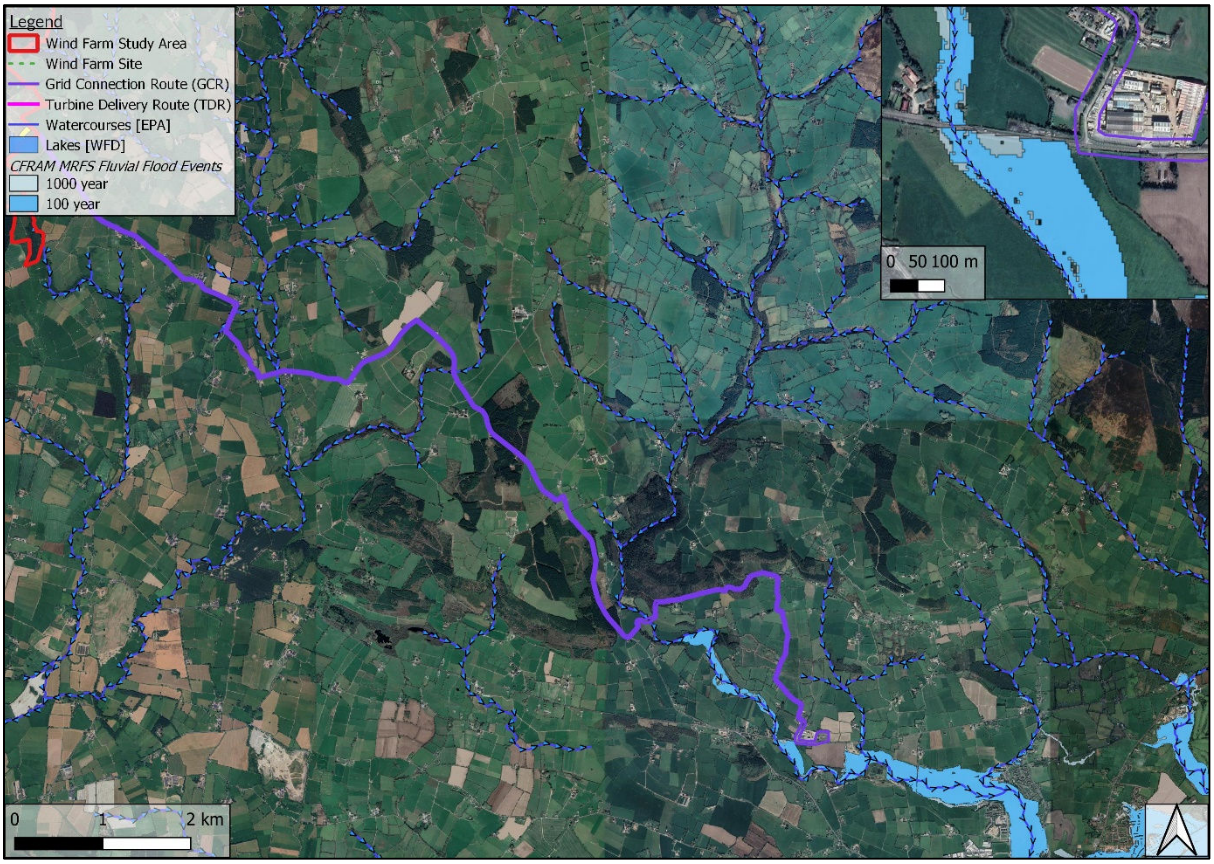

Figure 3-12 CFRAM MRFS Fluvial Flood Extents – GCR

3.3.2 Coastal Flooding

The coastal flood extents are in line with the fluvial flood extents as discussed in Section 3.3.1. None of the subject sites are liable to coastal flooding as indicated by the CFRAM Coastal Flood Extents.

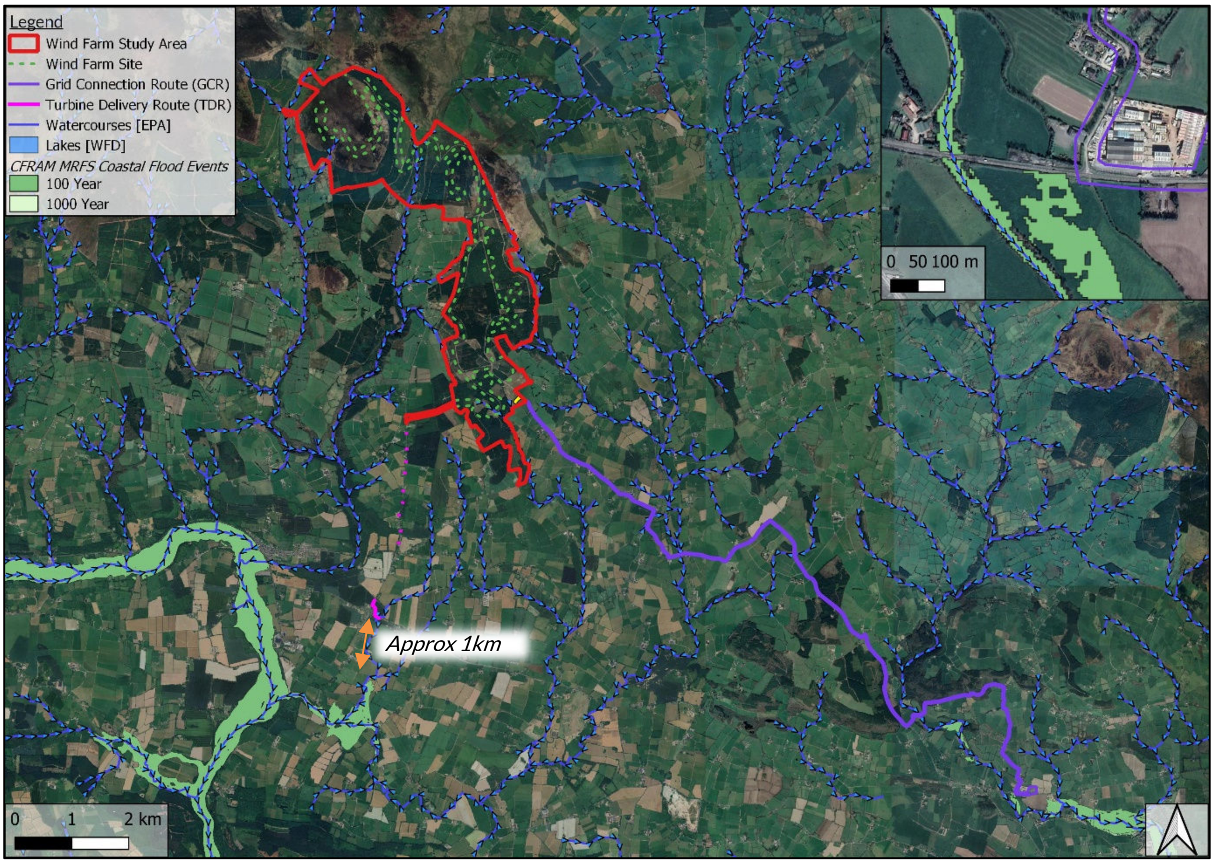

Figure 3-13 CFRAM MRFS Coastal Flood Extents

3.4 NATIONAL COASTAL FLOOD HAZARD MAPPING (NCHFM)

The National Coastal Flood Hazard Mapping (NCFHM) was completed in 2021. The aim of the project is to produce updated national scale coastal flood extent and depth maps for the 50%, 20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% Annual Exceedance Probabilities (AEPs) for the present day scenario and for the Mid-Range Future Scenario (MRFS), High End Future Scenario (HEFS), High+ End Future Scenario (H+EFS), and High++ End Future Scenario (H++EFS) which represent a 0.5m, 1.0m, 1.5m and 2.0m increase in sea level respectively. The mapping is based on the extreme levels calculated in the Irish Coastal Wave and Water Level Modelling Study (ICWWS).

The Irish Coastal Wave and Water Level Modelling Study (ICWWS) was undertaken in 2018. The study provides an update to the Extreme Coastal Water Levels for the coast of Ireland. The study provides an update to the water levels presented in the ICPSS undertaken between 2004 and 2013.

Table 3-1 below outlines the extreme water levels at node S31 which is the closest ICWWS node to the proposed project. Figure 3-14 details point S31's location in relation to the proposed project

Table 3-1 ICWWS modelled extreme water levels

Return Period	Existing Scenario Water Level (mOD)	Mid-Range Future Scenario (MRFS) Water Level (mOD)
1 in 200-Year (0.5% AEP) Event	2.84	3.34
1 in 1000-Year (0.1% AEP) Event	3.01	3.51

Figure 3-14 National Coastal Extreme water estimation point S31

The minimum level of the wind farm site is approximately 140mOD. The MRFS for water level at South Point S31 is 3.51mOD, therefore it can be expected that coastal flood events will not affect the proposed project.

3.5 OPW Drainage Districts

The OPW Drainage Districts were carried out by the commissioners of Public Works under a number of drainage and navigation acts from 1842 to the 1930s to improve land for agriculture and to mitigate flooding.[5] The local authorities are charged with the responsibility to maintain Drainage Districts.

The watercourses in the vicinity of the proposed project were not identified as having benefitted from the scheme.

3.6 Arterial Drainage Schemes

The OPW carried out a number of Arterial Drainage Schemes on catchments under the Arterial Drainage Act, 1945. Under section 37 of the 1945 Act, the OPW is required to maintain drainage works in proper repair and effective condition. The works are organised on a regional basis and to date there are 647,050 Acres of Benefiting lands across Ireland. Benefited lands are areas that were previously subject to poor drainage and/or flooding but that have benefited from the implementation of Arterial Drainage Schemes carried out under the Arterial Drainage Act 1945.

[5] www.floodinfo.ie

The watercourses in the vicinity of the proposed project were not identified as having benefitted from the scheme, the nearest Arterial drainage site is 4.5km Southwest, along the banks of the Blackwater River where there is regular flooding. The area around this Arterial Drainage Scheme is not classed as a benefitting land.

3.7 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping[3] with data related to Ireland's subsurface. Based on the map shown in Figure 3-15, there are no karst features in the vicinity of the study site. The closest karst features to the proposed project are a series of Swallow Holes, and enclosed depressions. Both are located either site of the proposed TDR, with both also located to the southeast of the GCR.

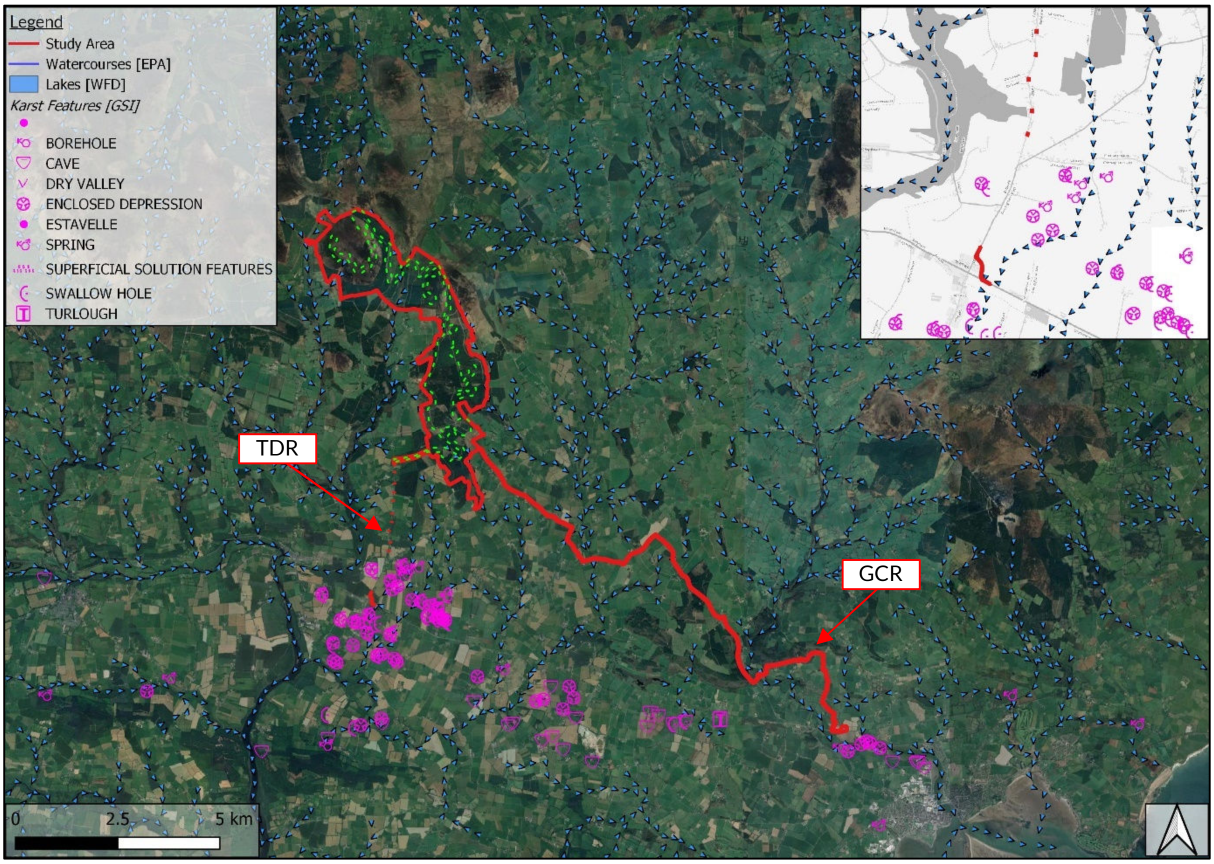

Figure 3-15 GSI Mapping of Karst Features

The GSI GW Flood Maps[4] of historic ground water and surface water flooding were also reviewed. These maps show both historic groundwater flooding during the winter 2015/16 event and the maximum historic groundwater flooding. Figure 3-16 below shows that there is no historic groundwater flooding within approximately 1.8km of the proposed project. The areas where groundwater flooding occurred are known Rivers, with the addition of some small

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

[4] Groundwater Flooding Data Viewer (arcgis.com)

areas and there is no hydraulic link between them and the proposed project. Figure 3-16 also shows no predicted groundwater flooding in the larger area surrounding the proposed project.

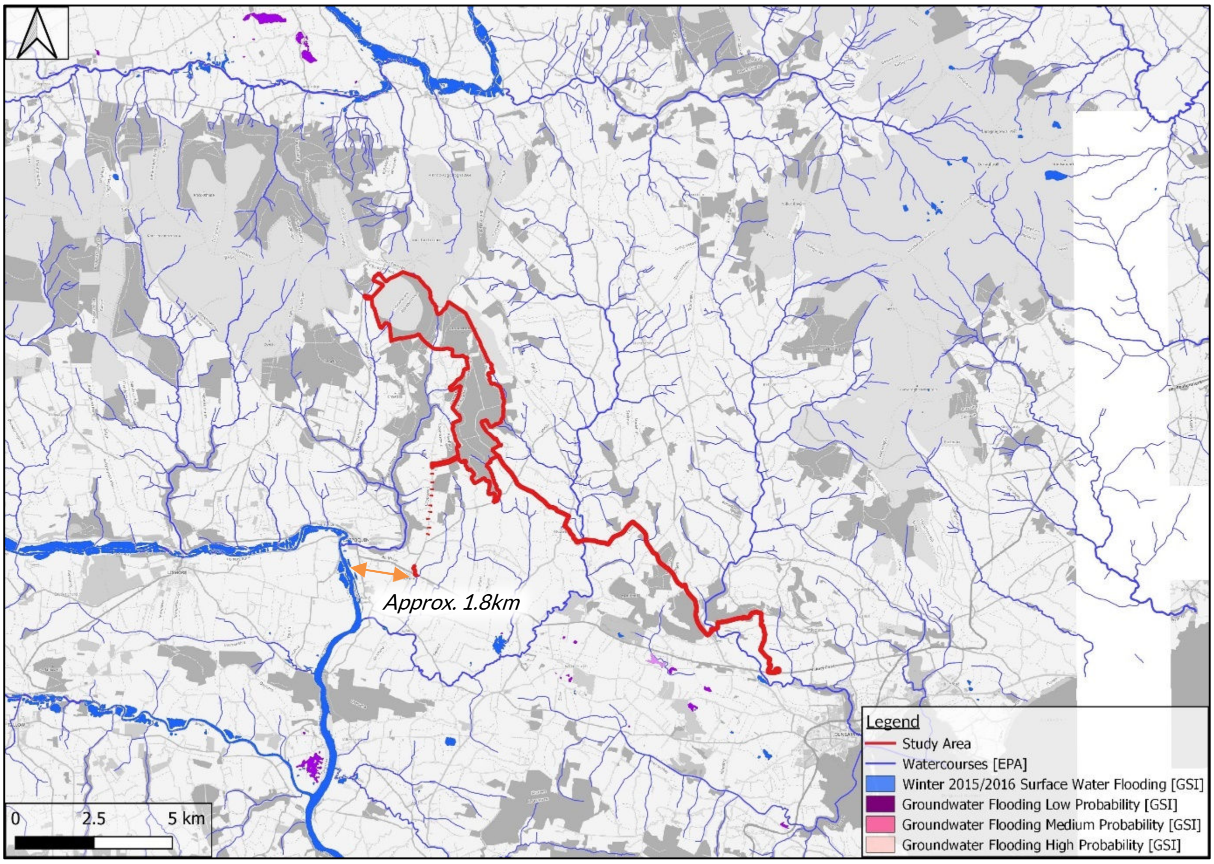

Figure 3-16 GSI Mapping of Historic and predicted Groundwater and Surface Water Flood Extents

4. DETAILED FLOOD RISK ASSESSMENT

As per Section 2.1.1, the PSFRM Guidelines classify essential infrastructure, such as electricity substations and wind turbines, as 'highly vulnerable' in terms of their sensitivity to flooding.

4.1 Fluvial Flooding

<u>Wind Farm site</u>

There are three hydraulic features which flow through the proposed wind farm site: the Glenshelane River, a minor tributary of the Glenshelane River, and the Boherawillin River, with headwaters originating within or immediately north of the wind farm site. There are three further rivers which flow along the boundary of the wind farm site, identified by the EPA as: Farnane 18, Toor 18, and Knocknasheegan rivers. All rivers within and bordering the wind farm site flow towards the Blackwater River before draining into Caliso Bay, Co. Waterford.

Given the mountainous terrain of the proposed wind farm site, the headwaters of a number of watercourses are located within the boundary of the proposed wind farm site 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.

Given the small nature of the catchments and associated watercourses within the proposed project, predicted flood mapping for the majority of streams has not been mapped by the National PFRA Study (Figure 3-2) and subsequent NIFM (Figure 3-6). This predicted flood mapping, produced as part of the National PFRA Study, indicates a small area of fluvial flooding along the banks of the Glenshelane River, there is no vulnerable infrastructure in this area and therefore, it is estimated that the proposed wind farm site is not at risk of fluvial flooding from the Glenshelane River.

The mountainous terrain and natural topography of the proposed wind farm site creates a dense stream network, providing a natural overland flow path to convey water away from the essential infrastructure and discourage flood storage at the proposed wind farm site. 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.

The risk of fluvial flooding to sensitive elements of the proposed wind farm site is estimated to be low due to the river's location between two mountain peaks. This section of the Glenshelane River is situated in a steep valley, making it increasingly difficult for floodwaters to extend laterally. *Figure 4-1* & *Figure 4-2* below show 5m contour mapping of the wind farm site, showing steep slope adjacent to watercourses.

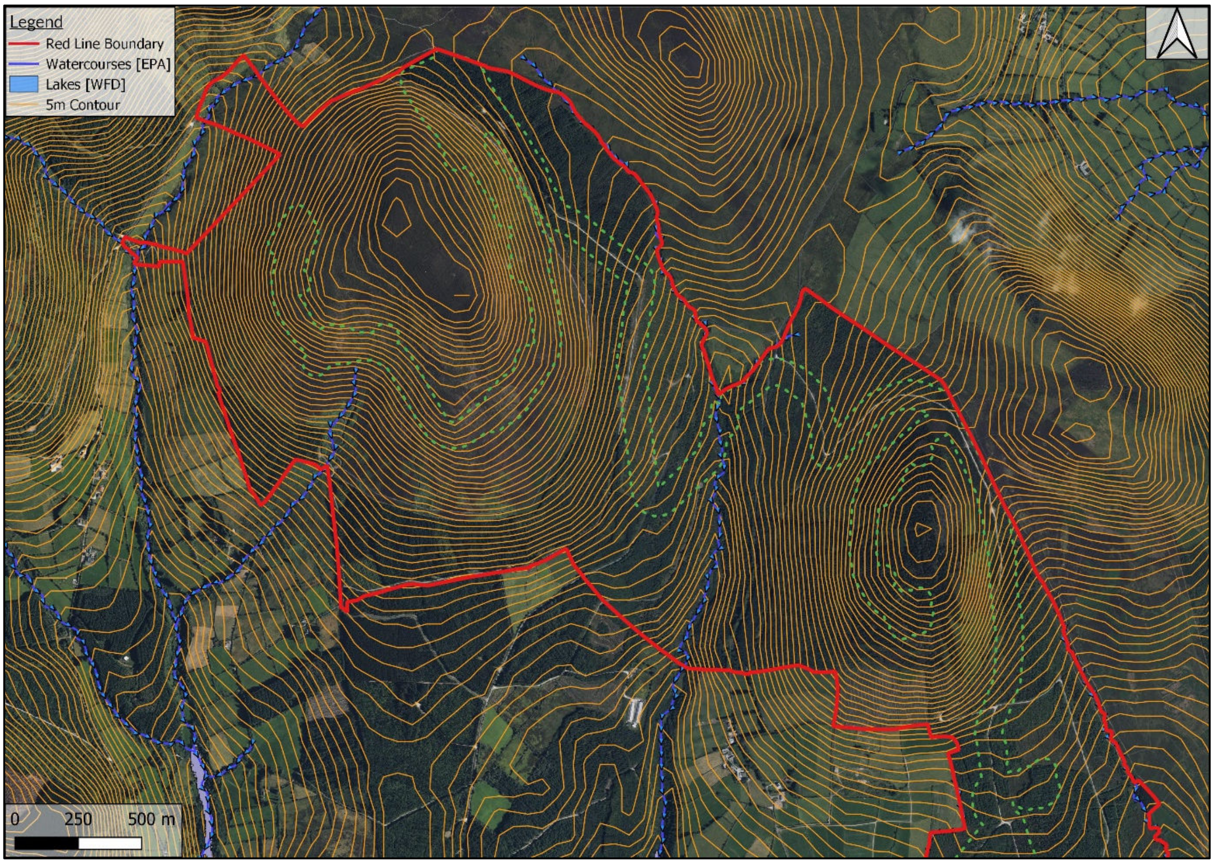

Figure 4-1: Wind Farm North Section Contour Map

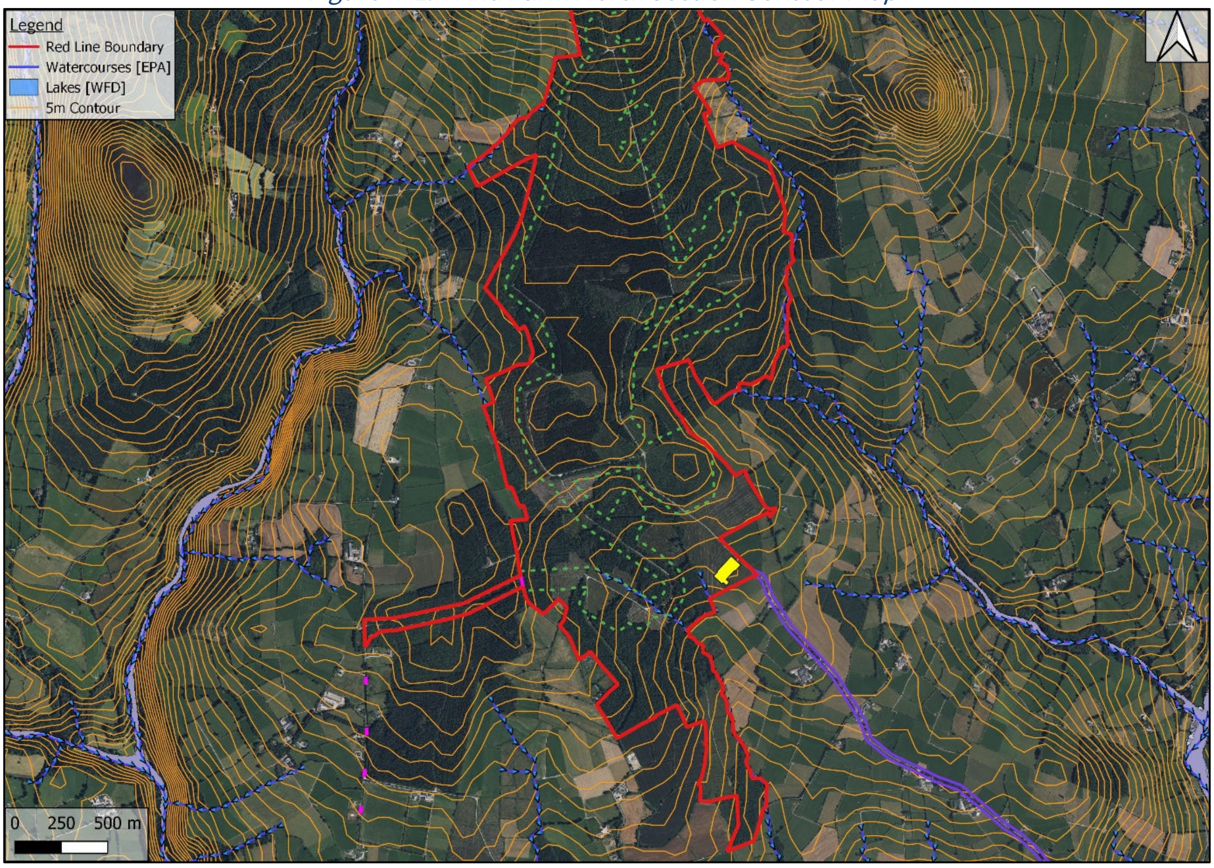

Figure 4-2: Wind Farm South Section Contour Map

The proposed substation is located at the southeastern corner of the proposed wind farm site. Using the Bluesky topographic survey, which was completed on a 1m grid. The ground level at the proposed substation is 165mOD. The bank level in the Monergorm east stream is 162mOD, providing a 3m freeboard to the substation. It should also be noted that in a 130m span of the stream the bed level drops 5m which makes it a steep valley and makes it increasingly difficult for floodwaters to extend laterally.

All proposed bridge crossings and any proposed modifications to existing crossings should be designed and approved appropriately following the OPW Section 50 Approval process. All proposed designs of each element have taken into account for the flood plains and climate change etc.

Given the topography of the site, the nature of the hydraulic features, extensive drainage network, and proposed site design, fluvial flood risk to the wind farm site is considered low.

Grid Connection Route (GCR)

Three additional watercourses flow through the proposed Grid Connection Route (GCR): the Finisk River, Ballykerin Stream, and the Colligan River. The Finisk and Ballykerin streams flow towards the Blackwater River before draining into Caliso Bay, Co. Waterford. The Colligan River drains into Dungarvan Harbour.

PFRA mapping indicates four areas of the proposed route that are at risk of fluvial flooding, with NIFM mapping showing two areas of flooding along the proposed route. Given that the route for the underground grid connection is set and passes through areas identified as fluvial flood zones in both the PFRA and NIFM mapping, it is essential to justify this decision by highlighting the inherent advantages and mitigation measures associated with underground installations.

Firstly, underground cables are significantly less vulnerable to flood damage compared to overhead lines. They are protected from direct exposure to floodwaters, debris, and other physical impacts that can occur during flooding events. This protection ensures that the infrastructure remains operational, maintaining the reliability and resilience of the power supply even in flood-prone areas.

Typically, modern underground cable systems, as outlined by EirGrid[5], are designed with advanced waterproofing and insulation technologies. These systems are capable of withstanding prolonged exposure to moisture and potential water ingress. The use of high-quality materials and construction techniques ensures that the cables remain insulated and functional, even when submerged or exposed to high levels of moisture.

Additionally, the installation process for underground cables can include specific flood mitigation measures. For example, the cables can be laid within protective conduits that are designed to prevent water infiltration. Drainage systems can also be incorporated to divert floodwaters away from the cable routes, reducing the risk of water damage. Elevated conduits or reinforced trenches can be used in particularly vulnerable areas to provide additional protection.

[5] https://www.eirgrid.ie/grid/transmission-policies-and-standards

In conclusion, while the set route for the underground grid connection passes through areas of fluvial flooding, the decision is justified by the inherent resilience of underground cables, advanced construction techniques, and targeted flood mitigation measures. These factors collectively ensure that the grid connection remains secure and functional, even in the face of potential flood events. Therefore, provided the above measures are followed when installing the GCR, the risk of fluvial flooding will be minimal, and the Justification test is not required.

<u>Turbine Delivery Route (TDR)</u>

There is one watercourse which passes through the proposed Turbine Delivery Route (TDR), the Lackenrea stream. The PFRA mapping of the stream shows that it inundates an area of the proposed TDR

Given the area of fluvial risk to the proposed TDR, it is suggested to schedule the delivery during periods of low flood risk. By planning the delivery outside the rainy season and during times when river levels are typically lower, the likelihood of encountering floodwaters can be significantly reduced. This strategic timing, combined with thorough planning and coordination, will help ensure that the delivery proceeds safely and efficiently, minimizing any potential disruptions or hazards associated with fluvial flooding.

Therefore, provided that turbine deliveries are not undertaken at times of flood risk, the risk of fluvial flooding to the TDR is minimal and no Justification test is required.

4.2 Pluvial Flooding

<u>Wind Farm Site</u>

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, it is estimated that several areas of the wind farm site may be at risk of pluvial flooding in the southern portion of the subject site, corresponding to small localised depressions (see Figure 3-2). These areas correspond to undeveloped areas, the construction compound adjacent, and the eastern proposed borrow pit.

Any localized depressions or areas where ponding may occur will be raised to facilitate construction in areas where development is proposed. Therefore, eliminating the source of the flooding. One area which is indicated as liable to pluvial flooding will not be raised as it is a borrow pit and instead, it will be dug deeper. This area is not in the vicinity of any of the turbine locations.

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

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

<u>Grid Connection Route (GCR) and Turbine Delivery Route (TDR)</u>

The Turbine Delivery Route (TDR) and Grid Connection Route (GCR) are not expected to be at risk of pluvial flooding due to their alignment along existing roads. These roads are typically raised above the surrounding lands and lack localized depressions, which helps prevent water accumulation. The landscaping and topography of the existing roads provide safe exceedance flow paths, effectively managing surface water runoff and preventing surface water ponding. This design minimizes residual risks associated with extreme flood events, ensuring the routes remain secure and functional.

4.3 Groundwater Flooding

Based on a review of Geological Survey Ireland (GSI) subsurface mapping of karst features (Figure 3-15), predicted groundwater flooding in the area (Figure 3-16), and the PFRA study (Figure 3-2) there is no evidence to suggest liability to groundwater flooding to the proposed project.

4.4 Coastal Flooding

The 1 in 1000-year (0.1% AEP) MRFS maximum water level predicted by the 2018 Irish Coastal Wave and Water Level Modelling Study (ICWWS) at South Point S31 (nearest to the subject site) is 3.51mOD, with minimum site elevations of 140mOD. The receiving Blackwater River is tidally influenced more than 2km west of the TDR, as mapped by the CFRAM Study (see Figure 3-13). The River Cooligan, which is also modelled as part of the CFRAM study show that its flood extents do not inundate any of the GCR.

Therefore, it can be expected that coastal flood events will not affect the subject site, given the elevated nature of the proposed project site (140 mOD to 486 mOD); it is estimated that there is no risk of coastal flooding.

4.5 Justification Test

The vast majority of the wind farm site is in Flood Zone C which is appropriate for "highly vulnerable elements". There is one area of the subject site, which is in Flood Zone B, an area just along the banks of the Glenshelane River. All that is proposed in this area is a bridge crossing for the site roads. Local transport infrastructure is appropriate in Flood Zone B and therefore; no Justification Test is required.

The measures mentioned in Section 4.1 with regards to the TDR and GCR shows that no justification test is required for either.

5. CONCLUSIONS

TOBIN Consulting Engineers were appointed by FuturEnergy Scart Mountain Designated Activity Company in September 2023 to undertake a Flood Risk Assessment for their lands and proposed wind farm project including proposed turbine delivery route (TDR) and grid connection route (GCR) in Scart Mountain, Co. Waterford.

The Planning System and Flood Risk Management (PSFRM) Guidelines (OPW/DoEHLG, 2009) classify essential infrastructure, such as electricity substations, as 'highly vulnerable' in terms of their sensitivity to flooding (appropriate in Flood Zone C).

Fluvial Flooding

Wind Farm Site: The risk of fluvial flooding to sensitive elements of the proposed wind farm is estimated to be low due to the Glenshelane river's location between two mountain peaks in a steep valley, making it increasingly difficult for floodwaters to extend laterally.

The proposed substation is located at the southeastern corner of the proposed wind farm site. The ground level at the proposed substation is 166mOD. The bank level of the Monergorm east stream is 163mOD, providing a 3m freeboard to the substation.

Grid Connection Route GCR: While the set route for the underground grid connection passes through areas of fluvial flooding, the decision is justified by the inherent resilience of underground cables, advanced construction techniques, and targeted flood mitigation measures. These factors collectively ensure that the grid connection remains secure and functional, even in the face of potential flood events.

Turbine Delivery Route: By planning the delivery of turbines outside the rainy season and during times when river levels are typically lower, the likelihood of encountering floodwaters can be significantly reduced. This strategic timing, combined with thorough planning and coordination, will help ensure that the delivery proceeds safely and efficiently, minimizing any potential disruptions or hazards associated with fluvial flooding.

Pluvial Flooding

Any localized depressions or areas where ponding may occur within the wind farm site will be raised to facilitate construction in areas where development is proposed. Thereby, eliminating the source of the flooding. One area which is indicated as liable to pluvial flooding will not be raised as it is a borrow pit and instead, it will be dug deeper. This area is not in the vicinity of any of the turbine locations.

The Turbine Delivery Route (TDR) and Grid Connection Route (GCR) are not expected to face pluvial flooding risks due to their alignment along elevated existing roads. These roads lack localized depressions, preventing water accumulation. Their landscaping and topography ensure effective surface water runoff management, minimizing residual risks during extreme flood events and keeping the routes secure and functional.

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

Groundwater Flooding

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

Coastal Flooding

Given the elevated nature of the proposed project, it is estimated that the risk of coastal flooding associated with the development is minimal.

Based on the results of this Flood Risk Assessment, it is estimated that the risk of flooding to the proposed project will be minimal, and effectively managed, and that the development will not increase the risk of flooding elsewhere.