APPENDIX 9-1

FLOOD RISK ASSESSMENT

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COOLE WIND FARM SID, CO. WESTMEATH

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

MKO IRELAND

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO), on behalf of Statkraft Ireland Ltd., to undertake a Flood Risk Assessment (FRA) for the proposed Coole Wind Farm (SID) development near Coole, Co. Westmeath and associated grid connection route between the Wind Farm Site and Irishtown, Mullingar, Co. Westmeath. 15 no. turbines are proposed within a 498 ha site referred to as the "Wind Farm Site". A site location map is attached as **FRA-Figure 1**. The Wind Farm Site is a former peat extraction bog, and as such the site is extensively modified, cutover and drained, with additional drainage measures introduced during construction of the wind farm. The area near the proposed turbine T15 is a mixture of uncut bog and poorly drained agricultural land.

The proposed development comprises of up to 15 No. turbines, turbine foundations and hardstanding areas, new access tracks and upgrading of existing access tracks, 1 No. substation including control buildings, underground electrical and communications cabling along the grid route, borrow pit, drainage and sediment controls, temporary site compound, tree felling and associated works.

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 QUALIFICATIONS

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

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 (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Adam Keegan is a hydrogeologist with 3 years of experience in the environmental sector in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the Inny River and the River Glore Catchments;
- Section 4 describes the existing site drainage;

- Section 5 presents a site-specific flood risk assessment (FRA) undertaken for the proposed SID which was carried out in accordance with the above-mentioned guidelines; and,
- Section 6 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 development.

2.2 SITE LOCATION AND TOPOGRAPHY

The proposed Wind Farm Site is located approximately 2.5km northwest of the village of Coole, and 3.5km south of the village of Finnea. The total Wind Farm Site area is approximately ~498ha.

The vast majority of the proposed Wind Farm Site has undergone peat harvesting, and the elevation of the site ranges between approximately 60 mOD and 66 mOD (metres above Ordnance Datum). Along the majority of the proposed Wind Farm Site boundary a slightly raised headland peat bank exists. The turbines are spread across 3 separate peat basins (northern, central and southern basin), while T15 is located within an area of rough grazing land, ~ 1km southeast of the central/northern basin. T5 and T14 are located within commercial forestry areas on the borders of the respective peat basin. Each area of bog is worked separately, and has its own separate drainage system. Lough Bane, a proposed National Heritage Area (pNHA) is located immediately northeast of the northern cutover bog area at the proposed Wind Farm Site. The overall site is also partially bound by the Inny River to the west, agricultural land to the south and east, and coniferous forestry and cutover bog to the north. The River Glore flows between the northern basin and the central basin and drains in a westerly direction towards the Inny River.

The surface of the 3 no. cutover bog [basins] within the proposed Wind Farm Site are drained by a network of open field drains that are typically spaced every 15 to 20m. These drains typically slope to the edges of the basins where a collector headland drain feeds surface water towards settlement ponds, and then out of the bogs into the surrounding natural drainage systems. Each basin has several outfalls and settlement ponds. Generally, there are large settlement ponds within each drainage sub-catchment on the bogs, and all discharges from the bogs are routed via these settlement ponds, prior to discharge to the off-site drainage network.

Turbine T14 is located towards the southwest of the proposed Wind Farm Site. The topography within this area slopes northwest towards the southwestern bog of the proposed Wind Farm Site, with elevations between 60-65 mOD. The site is currently under coniferous plantation.

Turbine T15 is situated within the townland of Carlanstown, ~1km southeast of the northern peat basin (T1-T4). Topography slopes northeast from ~60-85 mOD towards the River Glore, which runs near the T15 site area.

The proposed grid route is ~26km long and is located primarily along existing public roads. The grid route runs between the proposed Wind Farm Site and the 110kV substation at Mullingar, Co. Westmeath. The grid connection route will comprise underground cabling located primarily within the public road corridor, with a short section of underground cabling across private lands at the northernmost end. There is a total of 16 no. watercourse crossings along the public road section of the proposed grid connection (refer to Chapter 4 of the EIAR, Figure 4-22).

A Wind Farm Site and Grid Route location map is shown as **FRA-Figure 1**.

2.3 PROPOSED DEVELOPMENT DETAILS

The proposed development comprises of up to 15 No. turbines, turbine foundations and hardstanding areas, new access tracks and upgrading of existing access tracks, 1 No. substation including control buildings, underground electrical and communications cabling, borrow pit, drainage and sediment controls, temporary site compound, tree felling and associated works. The proposed Wind Farm Site layout is shown as **FRA-Figure 2**.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the region and the proposed development site.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

The proposed Wind Farm Site is located within the Upper Shannon surface water catchment (Hydrometric Area 16) of the Shannon River Basin District (SERBD).

On a more local scale the Wind Farm Site is located in the Inny River sub-catchment (Inny[Shannon]_SC_020) and two sub basins of the Inny River.

The majority of the Wind Farm Site is within the Inny_050 sub basin with a small section in the south of the site near the R396 within the Inny_060 sub basin. The Inny River flows in a southerly direction along the western boundary of the site and discharges into Lough Derraverragh approximately 7.5km downstream of the site.

The turbine T15 is located within the Inny_050 river sub basin of the Inny subcatchment and is drained by the River Glore.

The western section of the Wind Farm Site drains directly to the Inny River via a number of settlement ponds and outfall channels which are discussed further below in the site drainage section. The River Glore flows northwest by the T15 area and merges with the Inny River on the northern boundary of the Wind Farm Site between T1 and T7.

The Monktown stream flows northeast, just south of T14 and merges with the River Glore near the proposed T5.

A local hydrology map for the Wind Farm Site and upper reaches of the grid connection route is attached as **FRA-Figure 3**. The local hydrology along the grid route is shown in Figure 9-3 of Chapter 9 of the EIAR.

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Granard, the closest rainfall station to the proposed Wind Farm Site with long term SAAR data, is 999mm (www.met.ie).

The average potential evapotranspiration (PE) at Mullingar is taken to be 446mm (www.met.ie). The actual evapotranspiration (AE) is calculated to be 424mm (95% PE). Using the above figures the effective rainfall (ER)[1] for the area is calculated to be (ER = SAAR – AE) ~575mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. A summary of various return period and duration rainfall depth for the Wind Farm Site (point taken in townland of Clonsura) are presented in **Table A**.

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

Table A. Clonsura – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.7	6.7	12.2	17.7
15 mins	6.1	11.0	20.1	29.1
30 mins	7.9	13.7	24.3	34.6
1 hours	10.1	17.1	29.4	41.2
12 hours	24.3	37.5	58.4	76.8
24 hours	31.1	46.7	70.7	91.5
2 days	38.2	55.2	80.5	101.7

3.3 GEOLOGY

3.3.1 Wind Farm Site

Subsoils within the proposed Wind Farm Site are mapped as Cut over Raised Peat. Subsoils within the T15 site area are mapped as Till derived from Limestone towards the southwestern end of the land area, with Cut over Raised peat mapped to the northeast.

The published soils maps (www.gsi.ie) show that Cutaway Peat (Cut) is mapped as the topsoil for the majority of the proposed Wind Farm Site. Soils within the T15 site area are mapped as BminDW (well drained, basic mineral soil).

There is a small area of mapped sand and gravel deposits along the eastern edge of the central basin within the proposed Wind Farm Site. On the western boundary of the Wind Farm Site, where it borders the Inny River, the topsoil is identified as Mineral alluvium (AlluvMIN).

For the remainder of the proposed Wind Farm Site the mapped subsoil type (www.gsi.ie) is cutover raised peat. This has been proven on site by intrusive site investigation. Overall peat depths recorded during the peat probing investigation ranged from 0.67 to 7.8m with an average of 4.78m. Peat at the proposed Wind Farm Site is underlain by calcareous shell marl, and lacustrine deposits of varying thickness.

The bedrock geology underlying the proposed Wind Farm Site is mapped as Dinantian Upper Impure Limestones (DUIL). There are no mapped faults running through these areas. This type of rock is classified as a Locally Important Aquifer - bedrock which is Moderately Productive only in Local Zones (Ll) - by the GSI (www.gsi.ie). Bedrock was exposed during site investigation at the compound within the proposed Wind Farm Site, and also at the borrow pit area, and this comprised grey limestone [consistent with the mapped geology].

3.3.2 Grid Connection Route

The published soils map (www.epa.ie) for the area indicates that the majority of the Grid Connection Route, north of Multyfarnham, including the area of the proposed onsite substation, is mapped as cut over peat, while the area around Coole village is mapped as basic, well drained mineral soil (BminDW). South of Multyfarnham, soils are mapped as being predominantly acidic, well drained mineral soil (AminDW) with some pockets of Fen Peat. The soils between the southern tip of Lough Owel and Mullingar town are mapped as BminDW.

Subsoils in the area are mapped by the GSI as generally cut over raised peat and Tills derived from Limestone north of Multyfarnham, transitioning to Tills derived from chert, raised peat and minor areas of Tills derived from Limestone.

The underlying bedrock along the Grid Connection Route is mapped by the GSI as being a mixture of Lucan Formation dark limestone and shale and Derraveragh Cherts, cherty Limestone with minor shales.

3.4 DESIGNATED SITES & HABITATS

3.4.1 Wind Farm Site

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

The northern boundary of the proposed Wind Farm Site intersects Lough Bane, which is mapped as a pNHA (Site Code: 001721). No other designated sites are located within the boundaries of the Wind Farm Site, however there are areas of ecological significance such as the dystrophic lake on the northwestern corner of the proposed Wind Farm Site and an area of intact raised bog that surrounds the lake.

The Inny River, which flows along part of the western boundary of the proposed wind farm discharges into the Derravaragh NHA, and the Lough Derravaragh SPA. The Monktown stream and River Glore, which drain the areas of T14 and T15 respectively, ultimately discharge to the River Inny.

The Hill Of Mael And The Rock Of Curry pNHA (Site Code: 000681) is situated ~1.2km northeast of the proposed Wind Farm Site. This pNHA is within an upland area and as such is hydraulically upgradient of the overall proposed development.

Refer to the Ecology Chapter of the EIAR for further details relating to Lough Bane and other ecological features.

3.4.2 Grid Connection Route

Designated sites located near the path of the Grid Connection Route are detailed in Section 9.3.12.2 and include the following sites;

- Gariskil Bog SAC
- Lough Owel SAC
- Scragh Bog SAC
- Lough Derravaragh NHA
- Derravaragh SPA
- Ballynafid Lake and Fen NHA

3.5 SITE DRAINAGE

3.5.1 Existing Site Drainage

A series of walkover surveys within the proposed Wind Farm Site were completed on several dates between December 2016 and March 2017 (13th to 15th December 2016, 2nd February, 8th March, and 23rd March 2017)[2]. Further site visits were conducted on 23rd September and 22nd October 2020. The purpose of the site surveys were to determine the topographic layout of the proposed Wind Farm Site, to investigate the hydrological regime of the area and to determine potential flood patterns and flood zones. A selection of photographs from the site walkover surveys are attached as **Appendix I**.

The follow up site visits (2020) were conducted in order to assess any changes in site drainage at the previously permitted (13 no. turbine) Wind Farm Site and to perform a walkover survey of the T14 and T15 site areas.

As outlined above the proposed Wind Farm Site is spread over 3 separate peat basins, and these have their own separate drainage systems. However, the format of the drainage systems in each of the 3 basins are generally the same.

Southern Basin

The surface of the cutover bog is drained by a network of south-southwest / north-northeast orientated field drains that are typically spaced every 15 to 20m. There are 4 main outfalls (S-OF1 to S-OF4), which are preceded by a series of settlement ponds. The western half of this southern basin drains to the Inny River, and the eastern half of the bog drains to the east and enters a tributary to the Glore River, which itself is a tributary to the Inny River. The existing drainage layout for the southern basin is shown on Error! Reference source not found.. [Please note that not all the internal field drains are shown, but they exist at 15-20m intervals as implied on the aerial photograph].

The T14 site outline area is ~ 0.8km long and ~0.19km wide at its widest point and is oriented in a generally north-south direction along the southwestern boundary of the southern basin. Drainage within this area is via ribbon drains which run northwest-southeast and are spaced at ~15m intervals. These drains flow southeast and discharge to the Monktown Stream (IE_SH_26I010600) along the southeastern margin of the site.

[2] *Site visits completed during the initial Coole WF (13 no. turbines) application and EIS (2017)*

Figure A: Southern Basin existing drainage network

Central Basin

The surface of the cutover bog is drained by a network of southwest / northeast orientated field drains that are typically spaced every 15 to 20m. There are 4 main outfalls (C-OF1 to C-OF4), which are preceded by a series of settlement ponds. The southern and western half of this central basin drains to Glore River, and the eastern half of the bog drains into the Inny River. The existing drainage layout for the central basin is shown as Error! Reference source not found.. [Please note that not all the internal field drains are shown, but they exist at 15-20m intervals as implied on the aerial photograph].

Figure B: Central and Northern Basin existing drainage network

Northern Basin

The surface of the cutover bog is drained by a network of southwest / northeast orientated field drains that are typically spaced every 15 to 20m. There are 5 main outfalls (N-OF1 to N-OF5), which are preceded by a series of settlement ponds. The southern portion of the northern basin drains to Glore River, and the northern and northwestern elements of the bog drains into a main drain that flows directly into the Inny River (west of the basin). The existing drainage layout for the northern central basin is shown as **Figure B**. [Please note that not all the internal field drains are shown, but they exist at 15-20m intervals as implied on the aerial photograph].

T15 Site Area

Turbine T15 is situated ~ 1.1km southeast of the northern basin within an area of rough grazing land. The land is drained by a number of arterial drains which run northwest-southeast across the land, with perpendicular drains running southwest towards the Glore river, which is situated ~ 200m southwest of T15. Towards the northeastern edge of the T15 site area, there is an area of coniferous plantation, where ploughed ribbon drains exist, draining southwest towards a collector drain, which ultimately discharges to the Glore river, situated ~ 0.35km from the forested area.

A generalised process flow diagram of the existing drainage systems within the proposed Wind Farm Site is shown as **Figure C**. This primarily relates to the T1-T14 locations within the peat basins.

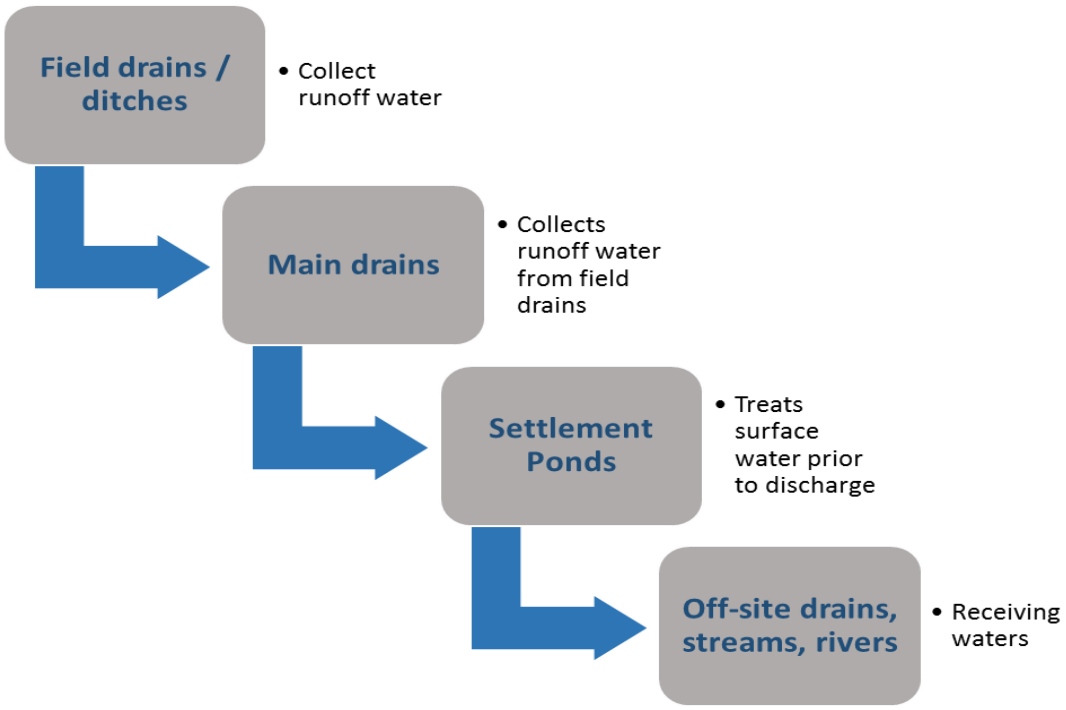


Figure C: Existing generalised surface water drainage route within proposed Wind Farm Site

3.5.2 Proposed site drainage

The proposed Wind Farm will not alter the existing drainage regime at the proposed Wind Farm Site (within the 3 existing basins) and will not significantly alter the drainage regime at the T15 location. Moreover, the proposed drainage system within the proposed Wind Farm Site will be fully integrated into the existing drainage systems.

Existing field drains and main drains will be routed under/around access tracks using culverts as required.

Runoff from access tracks and turbine bases within the Wind Farm Site will be collected and treated in local (proposed) silt traps and then discharged to existing drains. From there this water will flow towards the site boundaries (in field drains and main drains) and be treated further in the existing main settlement ponds (with the exception of T15) prior to discharge from the site.

3.5.3 Drainage along the grid connection route

The proposed grid connection will not alter the existing drainage regime along the ~26km route and will not significantly or measurably alter the drainage pattern across this area. As outlined in Chapter 9, Section 9.4.2.1 of the EIAR, the potential effect from any increase in less permeable surfaces is negligible given the scale of the trench dimensions to the overall subcatchments.

3.6 DEVELOPMENT WATER BALANCE

There are existing surface water control measures within the proposed Wind Farm Site which comprise field drains, main drains and settlement ponds. All these existing drainage measures offer surface water attenuation during rainfall events. The drainage design of the proposed wind farm included new silt traps, check dams and settlement ponds at hardstand and turbine base areas to treat and attenuate runoff prior to release into the existing wider bog

drainage network. This will create significant additional attenuation to what is already present within the proposed development site.

The net effect of these drainage design measures within the proposed Wind Farm Site is a reduction in the overall runoff coefficient as demonstrated by the use of the Rational Method in **Table B** below.

Based on a conservative reduction in the runoff coefficient from 0.85 to 0.7 for the overall site, there would a potential 16.7% reduction in runoff rates from the site. This assessment demonstrates that there will be no risk of exacerbated flooding down-gradient of the site as a result of the proposed wind farm development. The proposed development will in effect retain water within the bog for longer periods.

Table B. Water Balance Assessment at Proposed Wind Farm Site

Site Area	C [1]	Area (km^2)	Rc [2]	Rainfall Intensity (mm/hr)	Runoff Rate (m^3/s)	Total Site Runoff Rate (m^3/s)
Without Wind Farm Drainage Control						
Undeveloped Area	0.278	4.98	0.85	11	35.14	37.22
Development Footprint	0.278	0.264	0.95	11	2.08	
With Wind Farm Drainage Control						
Undeveloped Area	0.278	4.98	0.7	11	28.94	
Development Footprint	0.278	0.264	0.95	11	2.08	31.02
Estimated Potential Reduction in Peak Site Runoff Rate						16.7%

Notes: 1 – Constant, 2- Runoff Coefficient

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 Wind Farm Site, Grid Connection Route 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 assessment, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 OPW National Flood Hazard Mapping

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

No recurring flood incidents within the proposed Wind Farm Site (including the T15 site area) were identified from OPW's indicative river and coastal flood map. Recurring flooding incidences are mapped to west of the proposed Wind Farm Site on the R396 near Abbylara where fluvial flooding occurs after heavy rain. An August 2004 flood event is recorded south the proposed site at Coole relating to surface water flow. However, these maps are not definite and do not show specific flood zone areas. The flood event near the village of Coole is located along the public road, which comprises part of the Grid Connection route. This flood event has not reoccurred since 2004 and was likely due to a blocked drain. No further flood incidents are recorded along the Grid Connection Route.

According to the OPW, the land on the banks of the River Glore and Inny River within the proposed Wind Farm Site are mapped as "Benefiting Lands". The agricultural lands directly east of the area around T14 (opposite side of Monktown stream) and the northeastern end of the T15 area are also mapped as benefitting lands (OPW Arterial Drainage Channels C50 & C50/1). Benefiting lands are defined as a dataset prepared by the Office of Public Works identifying land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945) and indicating areas of land subject to flooding or poor drainage. See below **Figure D**.

Figure D: OPW Indicative Flood Map

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 area it appears that the proposed Wind Farm Site, is predominately underlain by poorly draining, waterlogged peaty soils. This would indicate that the area is historically prone to high water table levels. However, extensive drainage has occurred within the proposed wind farms site for peat production and extraction, with further constructed drains as part of the arterial drainage scheme within the area near T15.

4.3.3 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. Identifiable map text on local available historical 6" or 25" mapping for the study area identify lands that are "liable to flood" along the eastern bank of the Inny River where it borders the proposed Wind Farm Site. There were no areas mapped as liable to flooding within historical maps near the T15 site area. These areas are illustrated in **Figure E**.

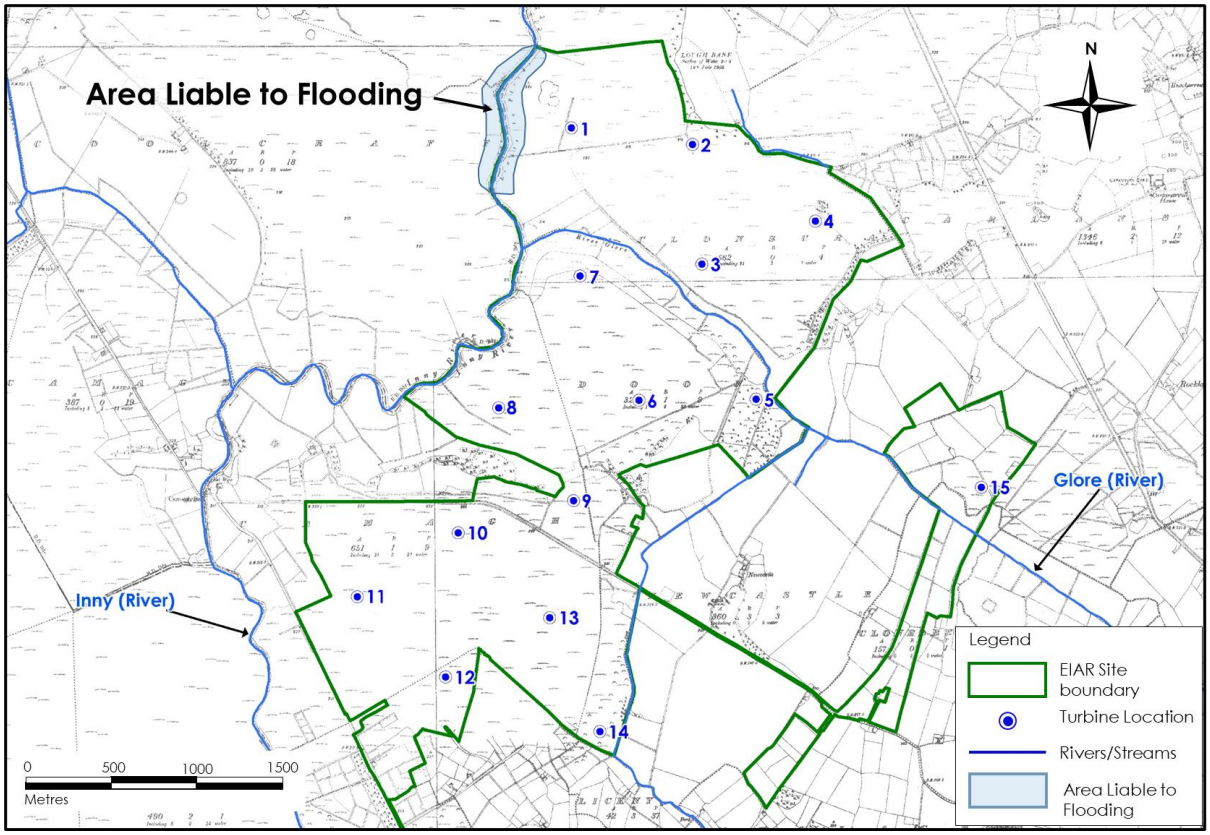


Figure E: 25" map showing areas liable to flooding

4.3.4 CFRAMS Mapping

Where complete the CFRAM[3] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the older PFRA maps. Generally speaking, the PRFA maps are no longer used as a data source for assessing flood risk, however, no CFRAM mapping is available for the area of the proposed site at the time of writing. PRFA mapping is therefore included. There are no areas of the proposed Grid Connection Route within areas mapped under the CFRAMS mapping. CFRAMS mapping has been completed in the area of Mullingar.

4.3.4.1 CFRAM - Present Day Scenario

There are currently no mapped river flood extents for the Inny and Glore Rivers or any other waterbodies near the proposed Wind Farm Site or Grid Connection route.

4.3.4.2 CFRAM Medium Range Future Scenario

There are currently no mapped Medium Range Future Scenario river flood extents for the River Inny, Glore river or any other waterbodies near the proposed Wind Farm Site or Grid Connection Route. The MRFS mapping takes into account the potential effects of climate change in the future. Model parameters include a 20% increase in rainfall and a sea level rise of 0.5m.

[3] 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.

4.3.4.3 PFRA Mapping

To identify those areas as being at risk of flooding the OPW Preliminary Flood Risk Assessment (PFRA) maps were also consulted. These data are no longer freely available but are archived as a data source by HES.

The PFRA mapping (maps no. 286 and 287) shows the extents of the indicative 1 in 100-year flood zone which relates to fluvial (*i.e.* river) and pluvial (*i.e.* rainfall) flood events. The PFRA mapping shows a section (~28%) of the proposed wind farm development site is located inside of the 1 in 100-year flood zone where the Inny River flows along the proposed Wind Farm Site's western boundary and also where the Glore River flows east to west across the site (refer to **Figure F** below). This section of mapped flood extents along the Glore River also encroaches into the area near T15. T14 is located within the 1 in 100-year flood zone adjacent to the Monktown stream.

It should be noted that the PFRA maps are very general, and local information (where available) can be used to update these generalised PFRA maps. Where triangular shapes are shown on the PFRA maps these usually indicate underlying deficiencies in the ground model used for the flood zone mapping. Local knowledge or better topographical data can be used to update the PFRA mapping.

For example, the area of the proposed T1 turbine within the proposed Wind Farm Site is on a piece of cutover bog, it is several meters above the local main drain. T7 and T8 are on the margins of the mapped flood zones. T5 is also at a location that is several meters above the local river level. The proposed turbine T14 is located ~100m northwest of the Monktown stream and is topographically elevated several metres above the stream. Based on site inspection and observation of drainage patterns in the area (i.e. the 3 no. bog basins of the proposed Wind Farm Site), and also based on local knowledge, it is our opinion that the locations of T1, T5, T7, T8 and T14 are likely located in Flood Zone C.

Similarly, at the proposed turbine T15, this turbine location is situated ~200m north of the main Glore river channel and several metres above current water level within the Glore (as of September 2020).

Also shown on the PFRA mapping is the indicative extent of pluvial flooding (*i.e.* flooding from rainfall ponding). As seen from **Figure F**, small areas of pluvial flooding appear to occur in a number of locations within the proposed Wind Farm Site, but these areas are distal to the existing infrastructure. No areas of pluvial flooding are mapped near the proposed T14 or T15.

The original OPW PFRA mapping[4] for fluvial and pluvial extents near the Wind Farm Site are included as **Appendix II**.

[4] The PFRA mapping were produced as draft maps by the OPW and are only available as such. The draft maps were used to inform the later CFRAM mapping. The PFRA flood map extents have been digitised in house by HES for use in report figures within the body of text.

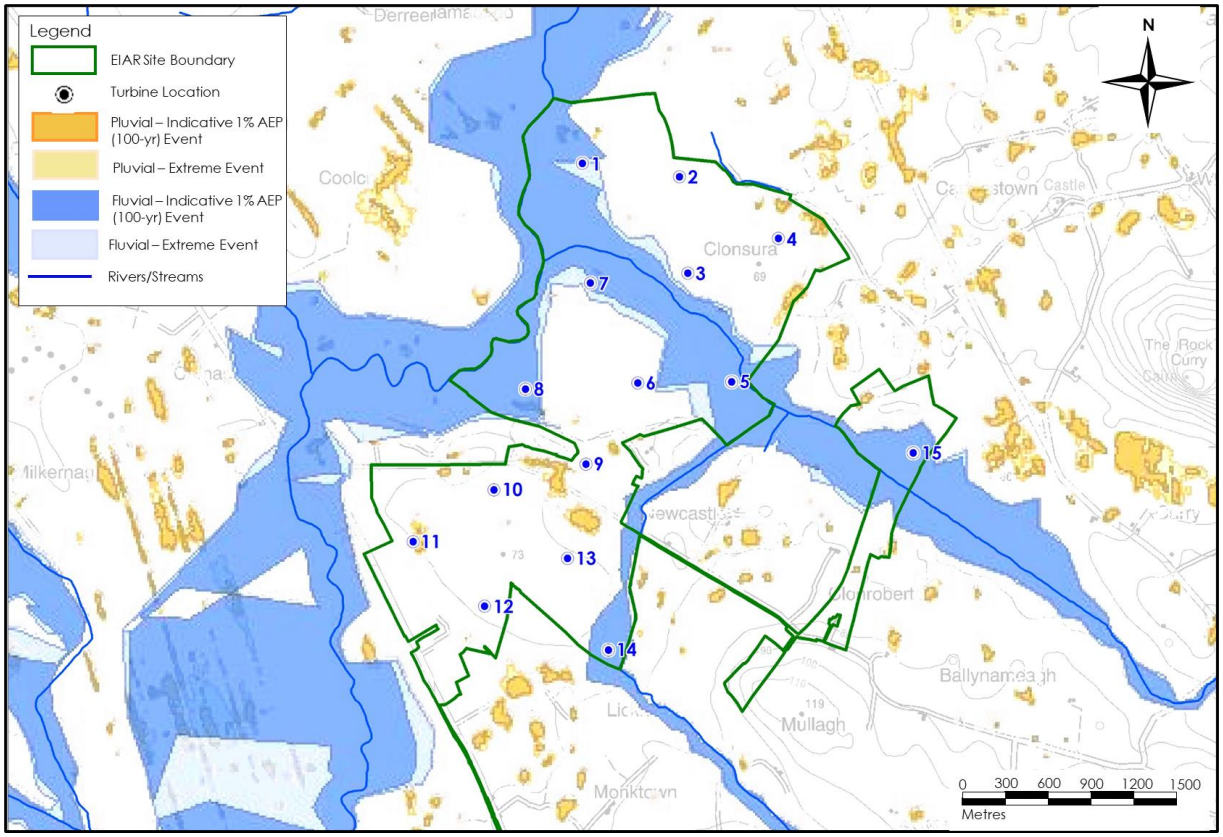


Figure F: PFRA Flood Zone Mapping (Flood Zones obtained from PFRA Map no. 286 and 287)

4.3.5 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it is apparent that sections of the proposed Wind Farm Site are located in Fluvial Flood Zone A or B, however the majority of the proposed development footprint is located in Flood Zone C.

The T14 site area is situated within an area mapped (within the older PFRA maps) as being within Flood Zone A. This is also true of the T15 site area.

The proposed Grid Connection Route is not located in areas mapped within Flood Zones A, B or C.

A historical flood issue near the existing Mullingar 110kV Substation was identified by a 3rd party. A site visit was conducted in this area, and the local drainage mapped. The issue appears to arise from surface water runoff from upgradient houses/hardstands and the road surface, flowing down the local road and backing up along near the existing substation and down gradient houses. This is an existing road drainage issue and is suggested (by a 3rd party) to be linked to insufficient capacity of the storm water holding tank (or perhaps an attenuation pond within the substation site). This location is not mapped by the OPW under the National Flood Hazard Mapping.

The Grid Connection Route trench is temporary, and the existing road surface will be reinstated once the grid cable is installed. No increase in hardstanding is proposed. As such the road surface will not be permanently altered. The installation of the Grid Connection Route will not alter the prevailing or baseline hydrology at the existing Mullingar Substation and will have neither a positive or negative impact on this existing issue.

4.4 INITIAL FLOOD RISK ASSESSMENT

During winter conditions the proposed Wind Farm Site holds/retains rainwater within the field drainage systems following heavy rainfall. The depth of this intermittent ponding is shallow. This retention of water on site is likely to reduce downstream flooding risk.

Potential flooding in the vicinity of the site can be described using the Source – Pathway – Receptor Model (S-P-R). The primary potential source of flooding in this area, and the one with most consequence for the proposed Wind Farm Site is fluvial flooding. The primary potential pathway would be overland flow if the Inny River, Glore River or Monktown stream exceeded their bank full capacity.

Potential receptors in the area are infrastructure, people, land and other private property.

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process the sources of flood risk for the site are outlined and assessed in **Table C.**

Table C. S-P-R Assessment of Flood Sources for the Proposed Wind Farm Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the Inny and Glore Rivers and Monktown stream	Land, People, property, infrastructure	A section of the proposed Wind Farm Site is within Flood Zone A and B of the Inny and Glore River. These areas include the location of Turbines T1, T5, T7, T8, T14 and T15.
Pluvial	Ponding of rainwater on site	Land, People, property.	Evidence of small localised infrequent pluvial flooding/ponding areas within proposed Wind Farm Site.
Surface water	Surface ponding/ Overflow	Land, People, property.	Low risk of pluvial flooding within proposed Wind Farm Site with only minor areas identified as vulnerable to pluvial flooding.
Groundwater	Rising groundwater levels	Land, People, property	Based on local hydrogeological regime and PFRA mapping, there is a low risk from groundwater flooding within all areas.
Coastal/tidal	Overbank flooding	Land, People, property	Not applicable. The Wind Farm Site is over 70km from the coast and therefore there is no risk of coastal flooding.
Human/mechanical	Ponding of rainwater on site	Site land	Not applicable to this site.

5. JUSTIFICATION TEST & PLANNING POLICY

5.1 PLANNING POLICY & COUNTY DEVELOPMENT PLAN

The following policies (**Table D**) are defined in the Westmeath County Council CDP 2014-2020 in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the proposed development design. The Westmeath County Development Plan 2021-2027 is still at draft stage:

Table D: CDP Policy on flooding and reference to relevant sections of this FRA report

No.	Policy	Development Design Response
P-FL1	To comply with the requirements of the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (Department of Environment, Community and Local Government/Office of Public Works, 2009) through the use of the sequential approach and application of the Justification Test for Development Management and Development Plans.	Guidelines within DoEHLG document and CFRAM mapping used within development design process and in this assessment.
P-FL2	To ensure that a flood risk assessment is carried out for any development proposal on lands at risk of flooding, in accordance with the "Planning System and Flood Risk Management – Guidelines for Planning Authorities" (Department of Environment, Community and Local Government/Office of Public Works, 2009).	As outlined in this FRA.
P-FL3	To consult with the Office of Public Works in relation to proposed developments in the vicinity of drainage channels and rivers for which the Office of Public Works are responsible, and to retain a strip on either side of such channels where required, to facilitate maintenance access thereto.	N/A for this development
P-FL4	To implement the recommendations of the Shannon and Eastern CFRAM studies, when published.	CFRAM mapping not currently available for this site. Older Draft PFRA maps used.
P-FL5	To ensure new development does not increase flood risk elsewhere, including that which may arise from surface water runoff.	Attenuation of runoff included within this FRA. No increased risk of downstream flooding from the proposed development.
P-FL6	To protect and enhance the county's floodplains and wetlands as a valuable habitat, which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed and reducing the need to provide flood defences in the future.	Drainage design includes measures for attenuation and storage of surface water.

5.2 REQUIREMENT FOR A JUSTIFICATION TEST

The matrix of vulnerability versus flood zone is shown in **Table E** to illustrate appropriate development types or indicate when a Justification Test[5] is required. The detailed flood risk assessment has determined the majority of the proposed Wind Farm Site is within Flood Zone C. An area on the east, along the Inny River of the proposed Wind Farm Site, and an area in the centre along the Glore River, have been determined to be within Flood Zone A and B. There are 6 no. turbines in these areas mapped within the PFRA flood maps.

Areas of the proposed Wind Farm Site are mapped within Flood Zone A, however as discussed previously these PFRA maps have now been superseded by nationwide CFRAM mapping (Which is unavailable for this locality). The PFRA maps are draft maps based on relatively large-scale grids with simplified model parameters (i.e the topographic contours used are of a coarse detail).

The majority of the Wind Farm Site infrastructure, such as access roads and turbines (outside of the 6 no. named previously) as well as the proposed electricity substation within the proposed Wind Farm Site are located outside of a mapped flood zone.

However, there is some infrastructure located in Flood Zone A and B within the PFRA maps. It may be considered that the proposed development including the construction of the proposed substation is a 'Highly Vulnerable Development". Therefore, a Justification Test is required for this part of the development. A justification test is outlined below.

A Justification Test is not required for the proposed Grid Route Connection as it is not mapped within any Flood Zones.

Table E: Matrix of Vulnerability versus Flood Zone

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

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

Box 5. (**Table F**) of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

[5] 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).

Table F: 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:

1. The Wind Farm Site lies outside the extent of lands categorised into flood zones by the Westmeath County Development Plan 2014-2020.
2. The proposal for the proposed Coole Wind Farm has been the subject of a flood risk assessment (this report) and this assessment has shown that:
    i. The development is predicted to have an imperceptible impact on flood risk elsewhere in the locality. This is demonstrated through the water balance assessment outlined above in **Table B**. The turbine base levels and hardstands and all associated access tracks will be above existing ground levels and will therefore be above predicted flood levels. Based on local topographical data, and also local knowledge in respect of flood levels it is likely that the locations for T1, T5, T7, T8, T14 and T15 are actually located within Flood Zone C.
    ii. The proposed development is not predicted to impede the flow of surface water during extreme flood events. It is therefore estimated that the development presents minimal risk to people, property, the economy and the environment.
    iii. Residual risks to the area and to the proposed development during an extreme flood event can be managed.
    iv. The proposed development is compatible with the wider planning objectives of the area.

In addition, it is predicted that the provision of the Wind Farm Site development will not result in an increased risk to the environment and human health locally, or within the Inny River catchment.

With regards to the proposed Wind Farm Site, it will for the large part remain flood free. Surface water discharges from the site are attenuated and will be slowed down below greenfield runoff rates.

Surface water will be held on site behind, access tracks, in low-lying areas, in silt traps, and in settlement ponds. Given the large area of the Wind Farm Site (498ha), it has a significant capacity to store water following rainfall events, even if storage is only a couple of centimetres in depth.
Drainage at the proposed sub-station site will be managed to ensure no future risk of flooding. A raised formation level and improved drainage from this area will ensure no future flooding of this proposed sub-station area.

Given the large area of the overall Wind Farm Site, it has a massive capacity to store water following rainfall events, even if storage is only a couple of centimetres in depth.

No part of the proposed infrastructure will flood, and all access roads, and turbine bases will be designed to be above known pluvial flood levels.

Overall, during the wind farm operation phase of development for the site, water is more likely to be held on site, and this will have a positive impact on downstream flooding events.

6. REPORT CONCLUSIONS

- The Preliminary Flood Risk Assessment (PFRA) mapping indicates the majority of the proposed Wind Farm Site is located outside a Fluvial flood zone (>100-year flood zone). However, there are sections of the proposed Wind Farm Site within the 100-year and 1000-year flood zones. These areas do not include the area of the proposed substation;

- The Proposed Grid Connection Route is not located within any mapped Flood Zones;

- The Preliminary Flood Risk Assessment (PFRA) mapping indicates that T1, T5, T7, T8, T14 and T15 are within the Flood Zone A mapped extents, adjacent to the River Inny, Monktown stream and Glore river;

- The Preliminary Flood Risk Assessment (PFRA) mapping indicates that pluvial flooding appears to occur along the main drainage channels within the Wind Farm Site and this is as a result of surface water runoff backing up in the drainage routes when the capacity of the outfalls are exceeded;

- The PFRA mapping has been superseded, for the most part, by the CFRAM Flood mapping programme. The CFRAM mapping is based on a refined model, but has not been completed within the area of the proposed development;

- It may be considered that the proposed Wind Farm is a 'Highly Vulnerable Development – electricity generating power stations and substations'. Therefore, if development within the Flood Zone A and B area of the Wind Farm Site was proposed a Justification Test would be required. The proposed development is appropriate for Flood Zone C;

- The remaining land area of the proposed Wind Farm Site is located in Flood Zone C – where the probability of flooding from rivers pluvial flooding is low (less than 0.1% or 1 in 1,000 for both river);

- OPW records indicate there is no history of recurring flood incidents within the Wind Farm Site boundary. Recurring flooding incidences are mapped to the west of the proposed Wind Farm Site on an unnamed tributary of the Rathcronan River where fluvial flooding occurs after heavy rain;

- According to the OPW, the land on the banks of the Inny and Glore Rivers and the Monktown stream adjacent to the Wind Farm Site boundary are mapped as "Benefiting Lands". A small area of benefitting lands along the Inny and Glore rivers is mapped within the proposed Wind Farm Site;

- Identifiable map text on local available historical 6" or 25" mapping for the EIAR Wind Farm Site boundary identify lands that are "liable to flood" along the eastern bank of the Inny River where it borders the proposed Wind Farm Site. There is no identifiable map text for lands "liable to flood" near T14 or T15;

- Site walkover indicates the surface of the cutover bog within the proposed Wind Farm Site contains an extensive network of peat drains with surface water outflows from the bog located along the western, southern and eastern boundaries. A network of drains also exists within the forested area of the T14 area and along the agricultural lands which have undergone arterial drainage near T15;

- The overall increase in hardstanding area from the proposed Coole WF SID is relatively small due to the nature of the construction and operation, therefore no downstream flooding from storm water runoff is anticipated;

- The overall risk of flooding posed at the overall Wind Farm Site is estimated to be low which relates to the probability of being impacted by a 1000-year flood (*i.e.* the majority of the overall site is located in fluvial Flood Zone C);

- In addition, the risk of the Wind Farm Site contributing to downstream flooding is also very low, as the long-term plan is to retain and slow down drainage water within the site to promote ecological biodiversity; and,

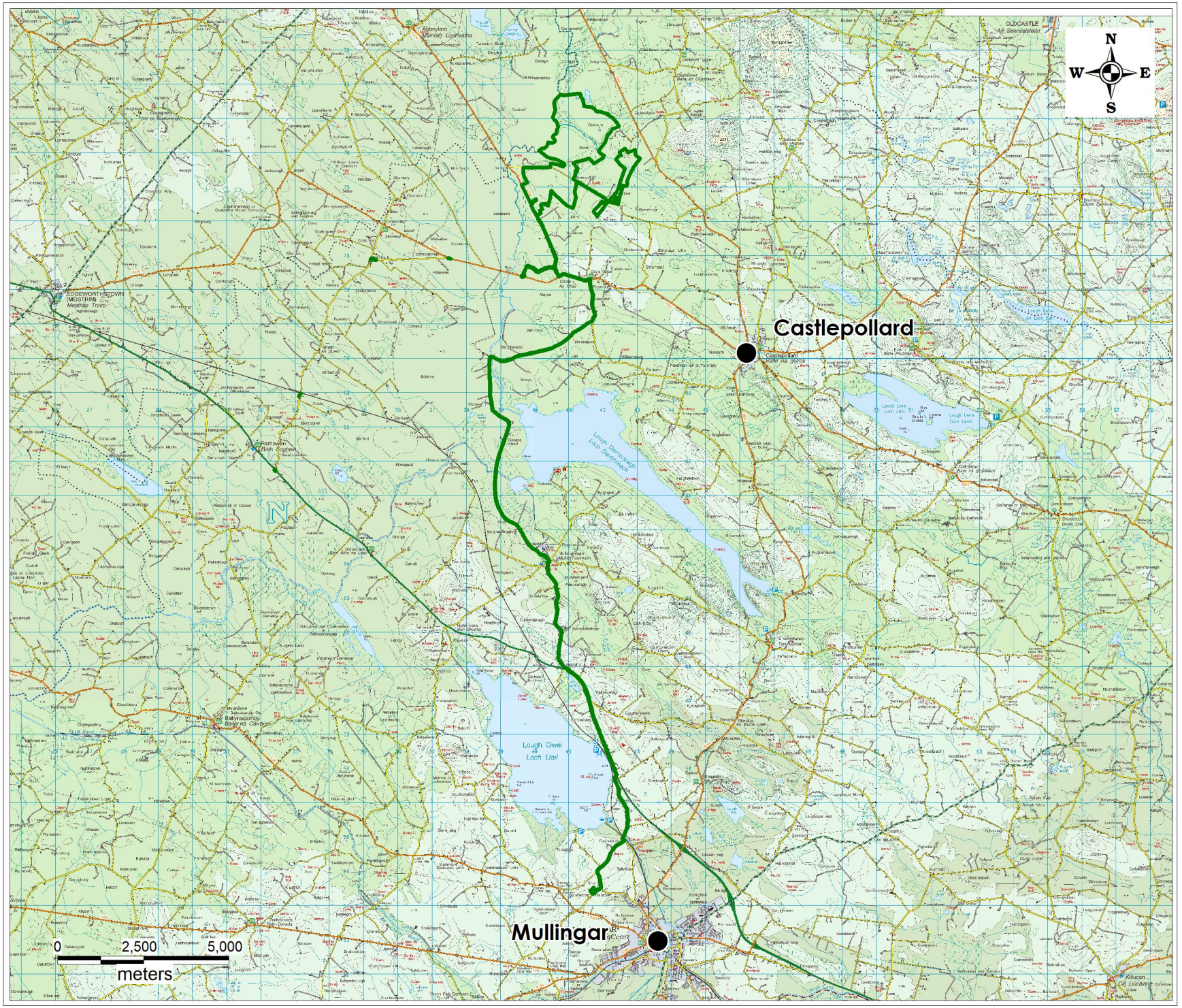
- The proposed Grid Connection Route will not have an impact or contribution to flood risk along the 26km length. Near the Mullingar substation, the overall hydrology and surface water drainage regime will not be altered, as the road will be reinstated after installation of the grid cable. There will be no net effect either positive or negative on the historical issue raised by a 3rd Party.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
Cawley, A.	1990	*The Hydrological Analysis of a Karst Aquifer System*. B.E., National University of Ireland.
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments.
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

FIGURES



Legend

EIAR Site Boundary

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
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tel: +353 (0)5844122
fax: +353 (0)5844244
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web: www.hydroenvironmental.ie

Title: Site Location Map
Client: MKO
Job: Coole WF, Co. West Meath
Project No: P1320-2
Figure No: FRA_Figure 1
Sheet Size: A4
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Date: 05/01/2021
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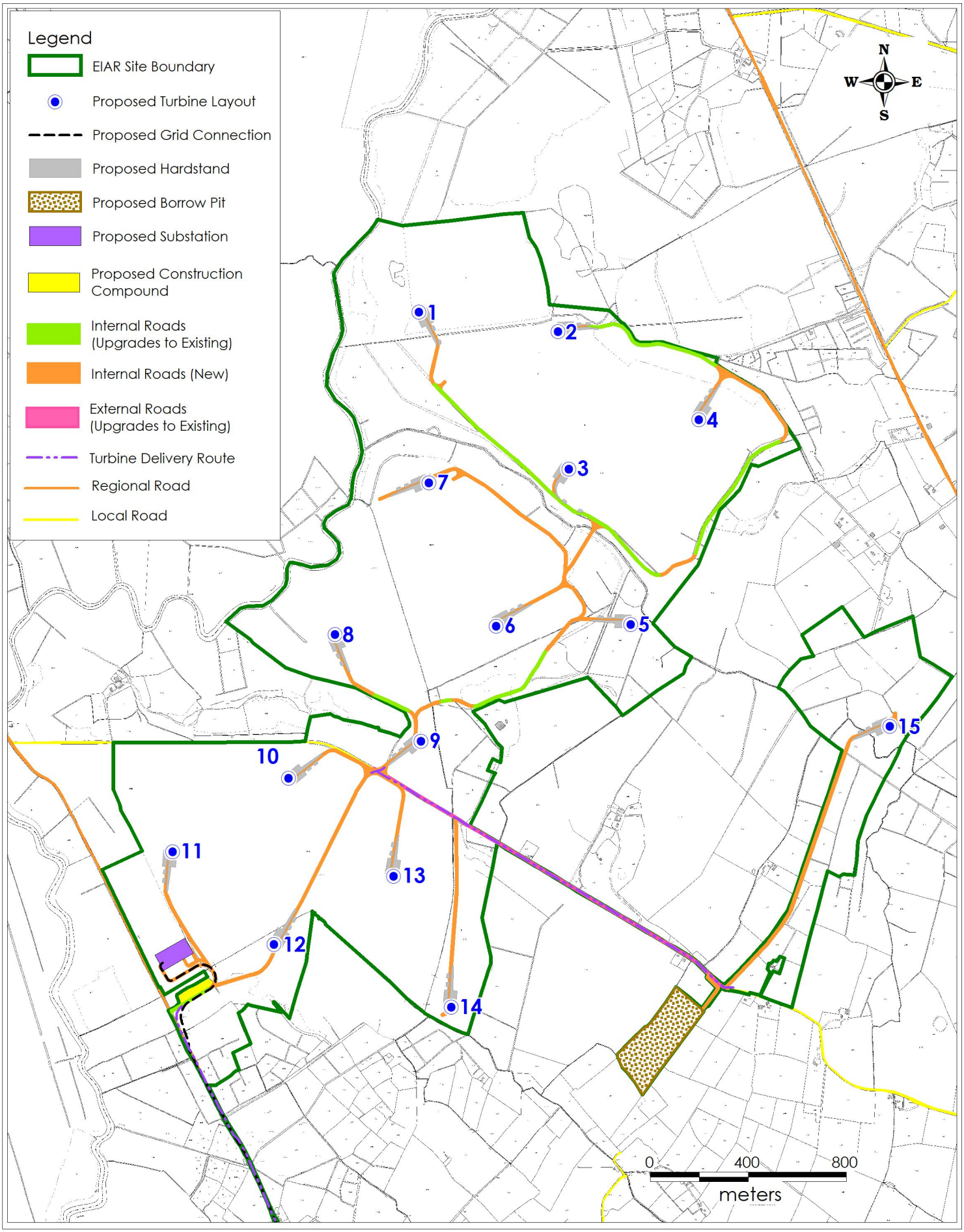
Drawn By: GD | Checked By: MG



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Date: 05/01/2020	Title: Proposed WF Layout Map
Scale: 1:20,000	Project No: P1320-2
Drawn By: GD / Checked By: MG	Drawing No: P1320-2-0121-FRA2-A4-00A

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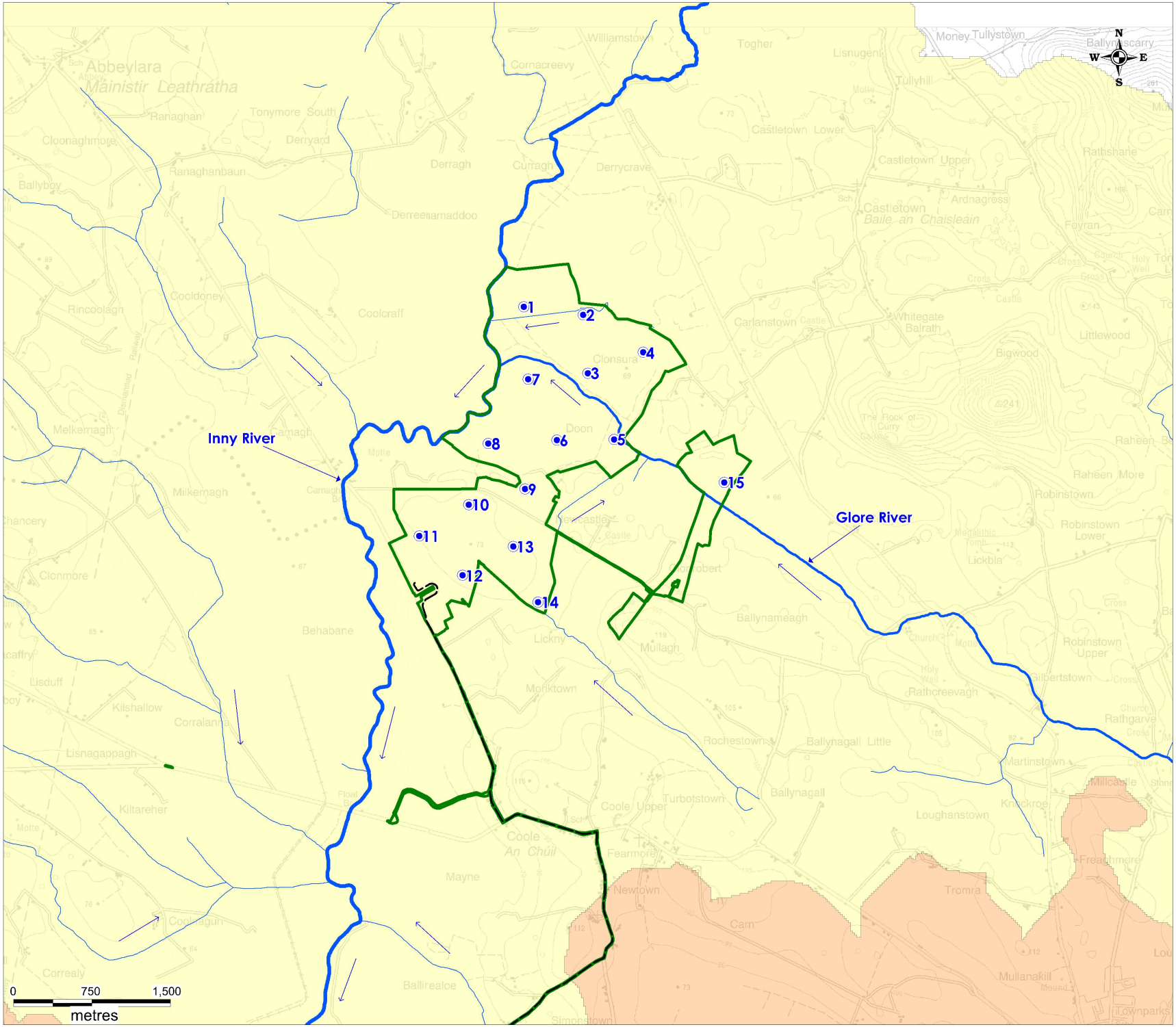

Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Grid Connection
- Rivers/Streams
- WFD Subcatchments
- Inny[Shannon]_SC_020
- Inny[Shannon]_SC_030

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Client: MKO	
Job: Coole WF, Co. West Meath	
Title: Local Hydrology Map	
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Scale: - 1:50000	Drawn By: GD
Date: 07/01/2021	Checked By: MG

APPENDIX I
SITE PHOTOGRAPHS

1. Existing wooden bridge between Northern and Central Basin

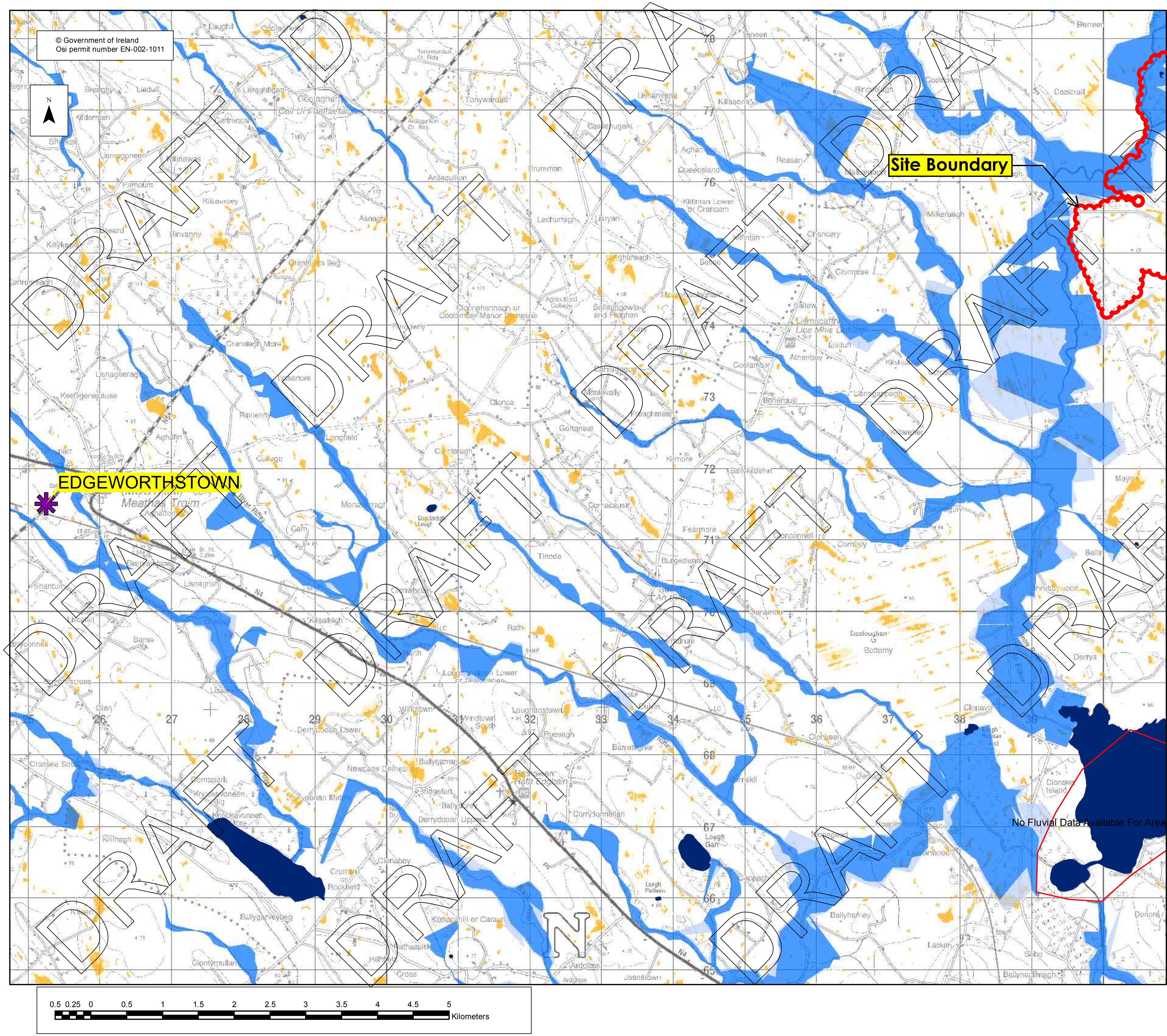
2. Typical headland boundary drain

3.. Typical settlement pond with flow control sluice and baffle

4. Typical peat field (bay) with field drains

5. River Inny south of site

APPENDIX II
PFRA FLOOD ZONE MAPPING



Location Plan :

Legend:

Flood Extents

- Fluvial - Indicative 1% AEP (100-yr) Event
- Fluvial - Extreme Event
- Coastal - Indicative 0.5% AEP (200-yr) Event
- Coastal - Extreme Event
- Pluvial - Indicative 1% AEP (100-yr) Event
- Pluvial - Extreme Event
- Groundwater Flood Extents
- Lakes / Turloughs

PFRA Outcomes

- Probable Area for Further Assesment
- Possible Area for Further Assesment

Important User Note:

The flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location. Information on the purpose, development and limitations of these maps is available in the relevant reports (see www.cfram.ie). Users should seek professional advice if they intend to rely on the maps in any way.

If you believe that the maps are inaccurate in some way please forward full details by contacting the OPW (refer to PFRA Information leaflets or 'Have Your Say' on www.cfram.ie).

Office of Public Works
Jonathon Swift Street
Trim
Co Meath
Ireland

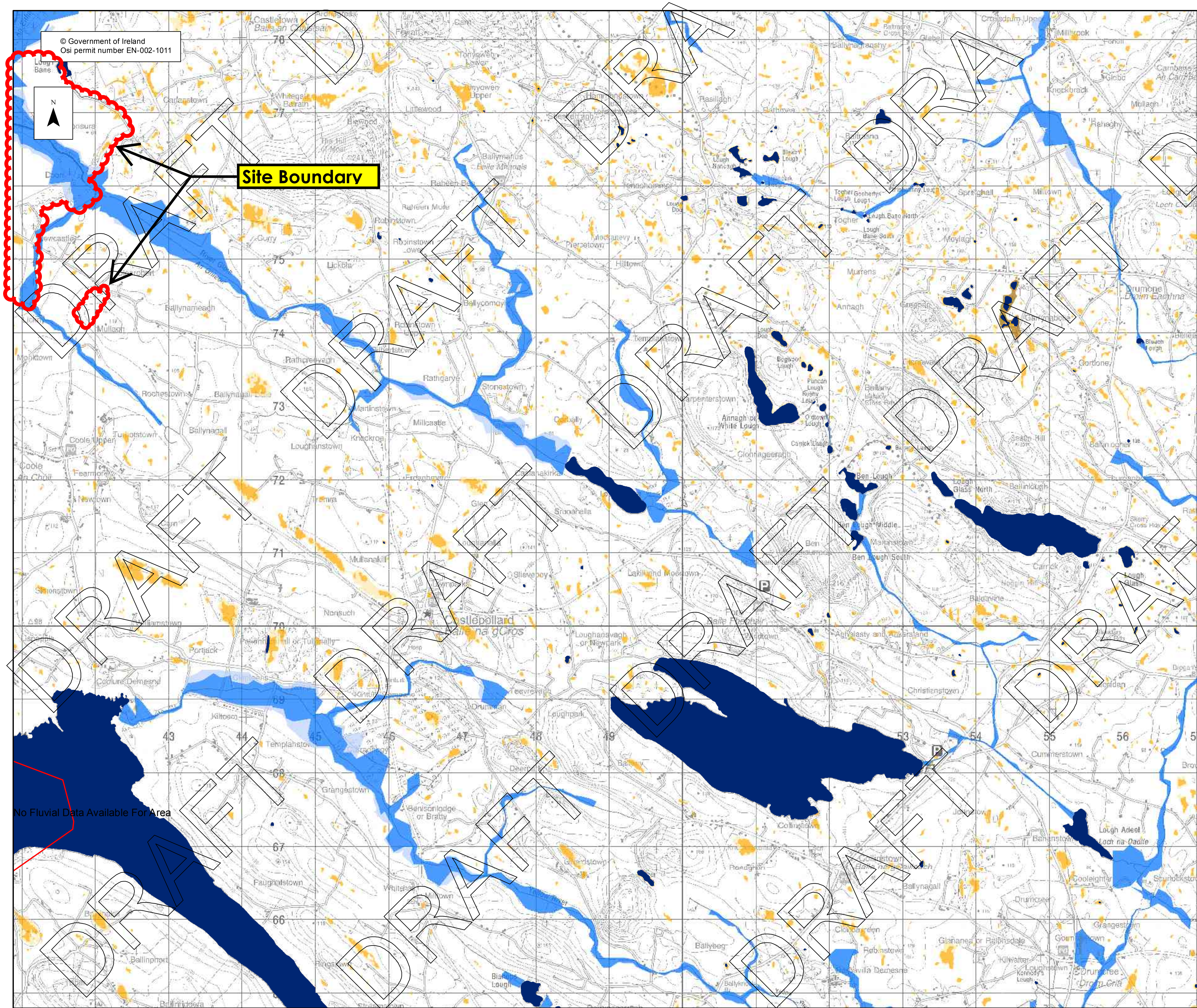
Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

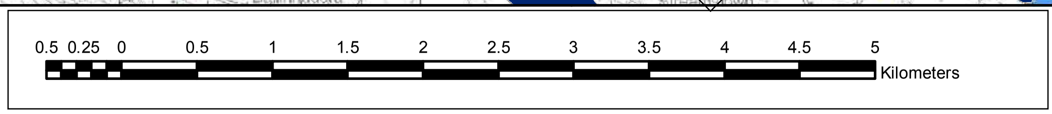
Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW Date : July2011
Checked By : MA Date : July 2011

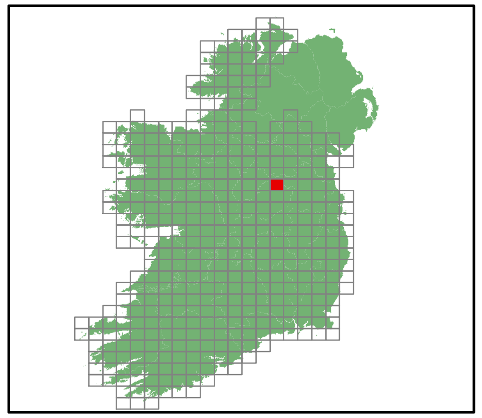
Figure No. : 2019 / MAP / 286 / A
Revision 0

Drawing Scale : 1:50,000 Plot Scale : 1:1 @ A3





Location Plan :



Legend:

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- Fluvial - Indicative 1% AEP (100-yr) Event
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Trim
Co Meath
Ireland

Project :
PRELIMINARY FLOOD RISK ASSESMENT (PFRA)

Map :
PFRA Indicative extents and outcomes
- Draft for Consultation

Figure By : PJW | Date : July2011
Checked By : MA | Date : July 2011

Figure No. : 2019 / MAP / 287 / A | Revision 0

Drawing Scale : 1:50,000 | Plot Scale : 1:1 @ A3

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