APPENDIX 9-1

FLOOD RISK ASSESSMENT

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

SLIEVEACURRY RENEWABLE ENERGY DEVELOPMENT, CO. CLARE

SITE SPECIFIC FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

MKO

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

Document Title:	**SLIEVEACURRY RENEWABLE ENERGY DEVELOPMENT, CO. CLARE SITE SPECIFIC FLOOD RISK ASSESMENT**
Issue Date:	**29th April 2026**
Project Number:	**P1159-5**
Project Reporting History:	**-**
Current Revision No:	**P1159-5_ FINAL_F1**
Author(s):	**Michael Gill David Broderick**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI Managing Director – Hydro-Environmental Services**

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

TABLE OF CONTENTS

FIGURES IN TEXT

TABLES IN TEXT

1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO to complete a site-specific Flood Risk Assessment (FRA) for the proposed Slieveacurry Renewable Energy Development, Co. Clare. A site location map is shown as **Figure** A below.

The Proposed Project (Proposed Wind Farm Site, Proposed Grid Connection Site and Proposed Enhancement Site) is described in full in Chapter 4 of this EIAR.

Where the 'Site' is referred to, this relates to the primary study area for the Proposed Project EIAR, as delineated by the EIAR Site Boundary.

Where the 'Proposed Wind Farm Site' is referred to, this refers to the portion of the Site containing the proposed 9 no. turbines and ancillary infrastructure, excluding the Proposed Grid Connection Site and Proposed Enhancement Site. The 'Proposed Turbines' refers to the 9 no. turbines associated with the Proposed Wind Farm Site as outlined above.

Where the 'Proposed Grid Connection Site' is referred to, this refers to the part of the Site containing the extension to the Slievecallan existing 110kV substation and the 33kV underground cabling route from the Proposed Turbines to the substation at Slievecallan.

Where the 'Proposed Enhancement Site' is referred to, this refers to the portion of the Site containing the proposed biodiversity, ornithology enhancement and management areas, excluding the Proposed Wind Farm Site and Proposed Grid Connection Site.

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

1.2 STATEMENT OF 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 P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 24 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/EIARs for Seven Hills Wind Farm, Glenmore Wind Farm, Cahermurphy WF, Slievecallen Wind Farm, and over 100 other wind farm related projects across the country.

David Broderick P.Geo (BSc, H.Dip Env Eng, MSc) is a Hydrogeologist with over 19 years' experience in both the public and private sectors. David has a strong background in groundwater resource assessment and hydrogeological/hydrological investigations in relation to developments such as quarries and wind farms. David has completed numerous geology and water sections for input into Environmental Impact Assessment Reports/Environmental Impact Statements (EIAR/EIS) for a range of commercial developments. For example, David

has worked on the EIS/EIARs for Booltiagh WF, Cahermurphy WF Cahermurphy West WF, Glenmore WF, Crossmore WF and over 60 other wind farm related projects across the country.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the Site setting and details of the Proposed Project;
- Section 3 outlines the hydrological and geological characteristics of the surface water catchment and existing site drainage;
- Section 4 presents a site-specific flood risk assessment (FRA) undertaken for the Site which was carried out in accordance with the DoEHLG, 2009 guidelines;
- Section 5 presents Planning policy and responses to that policy outlined in this FRA; and,
- Section 6 presents the report conclusions.

As stated above, this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources:

- OPW Flood Studies Update (FSU) Web Portal;
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA/WFD hydrology maps;
- OPW National Indicative Fluvial Mapping (NIFM) and CFRAM mapping;
- Clare County Development Plan 2023 – 2029 (including Strategic Flood Risk Assessment);
- Lidar data for the project site; and,
- Site walkovers and surveys conducted by HES on 7th and 8th November 2012, 11th September and 21st November 2019, 26th February 2021, 28th and 29th March, 26th April, 18th July 2024, 16th May and 3rd October 2025, 6th and 13th March 2026.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

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

2.2 SITE LOCATION AND TOPOGRAPHY

The Site is located approximately 7km south of Ennistimon, Co. Clare and 8km west of Inagh, Co. Clare. The Proposed Wind Farm Site comprises mainly of open blanket bog, coniferous forestry planted on blanket bog and poorly draining agricultural land on the east and south of the Site along with turbary plots.

The Proposed Wind Farm Site is served by a number of existing local, forestry and agricultural roads and tracks. These existing forestry tracks have been in operation for a significant number of years. It is proposed that up to 2.3km of these existing tracks will be utilised by the Proposed Wind Farm Site.

The Proposed Wind Farm Site is characterised by a northeast / southwest orientated topographical divide/ridge of high ground, where the ground slopes steadily to the northwest and southeast away from the ridge. The elevation range of the Proposed Wind Farm Site is between 67 and 261m OD.

5 no. Proposed Turbines are located within forestry (T1, T2, T4, T8 and T9) with the other 4 no. Proposed Turbines located on open peatland (T3, T5, T6 and T7).

The Proposed Grid Connection Site 33kV underground cabling, which measures approximately 7.1km, will connect to the proposed substation extension at the existing Slievecallan 110kV substation located approximately 3.5km to the southeast of the Proposed Wind Farm Site.

The Proposed Grid Connection Site 33kV underground cabling exits the Proposed Wind Farm Site through forestry for approximately 0.83km, onto a farm track for 0.55km before entering the public road corridor. It stays within the public road corridor for approximately 1.55km. the cable route then exits onto existing forestry /windfarm roads, following these for approximately 4.17km before reaching the proposed extension to the Slievecallan 110kV substation.

The proposed substation extension will be located on an existing cleared and level area where the ground elevation is at approximately 242m OD.

A total of 172.7ha of lands are proposed for enhancement under Biodiversity Management and Enhancement Plan (BMEP). The Proposed Enhancement Site comprises areas of Peatland Restoration, Marsh fritillary Enhancement (grazing management) and Hen Harrier Habitat Enhancement (conifer felling areas and grassland management areas).

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

2.3 PROPOSED PROJECT DETAILS

The Proposed Project (Proposed Wind Farm Site, Proposed Grid Connection Site and Proposed Enhancement Site) is described in full in Chapter 4 of the accompanying EIAR.

Where the 'Proposed Wind Farm Site' is referred to, this refers to the 9 no. Proposed Turbines and associated foundations and hard-standing areas, access roads, 2 no. temporary

construction compounds, met mast, underground cabling, 5 no. peat and spoil management areas, wind farm drainage, tree felling, 1 no. borrow pit and all ancillary works.

Where the 'Proposed Grid Connection Site' is referred to, this refers to the proposed extension to the Slievecallan existing 110kV substation and the 7.1km of 33kV underground cabling route from the Proposed Turbines to the substation at Slievecallan.

The Proposed Enhancement Site contains the Biodiversity Management and Enhancement Areas.

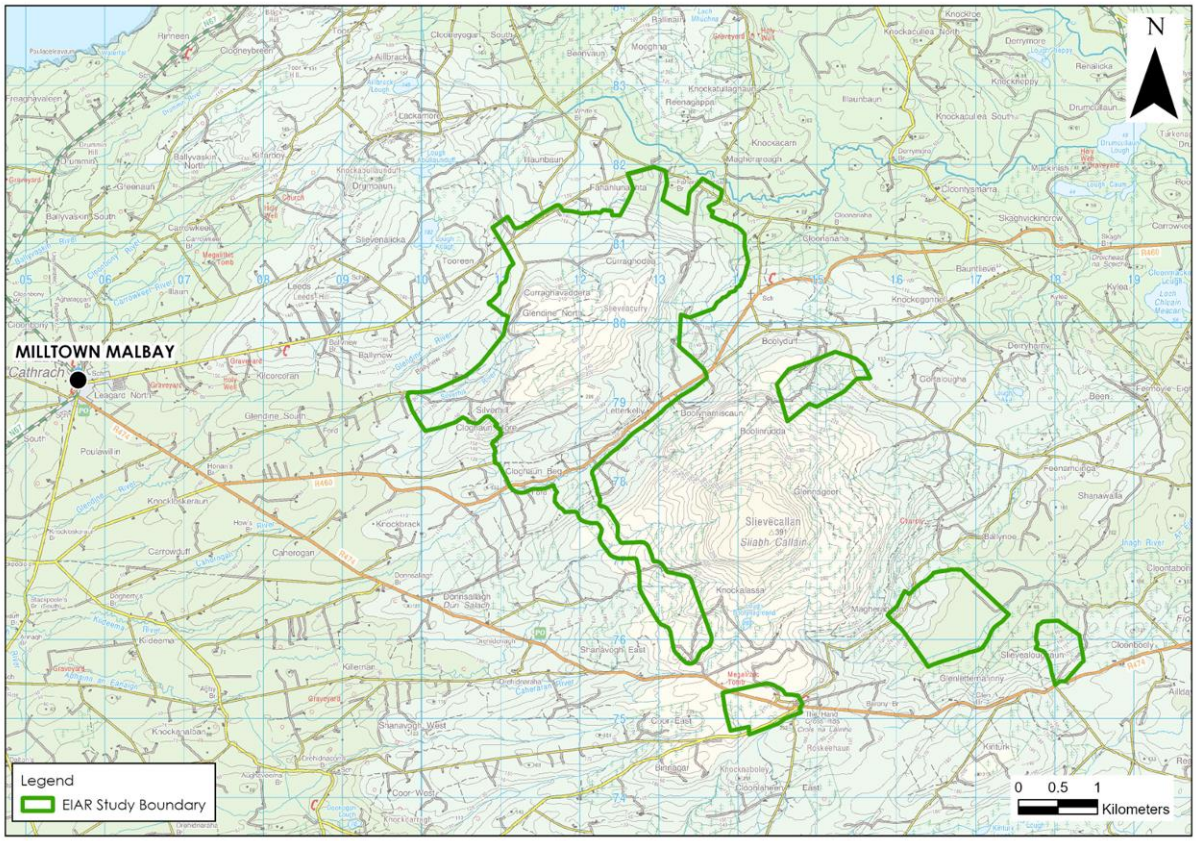

Figure A: Site Location Map

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

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

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

In terms of regional hydrology, the western half of the Proposed Wind Farm Site, including 3 no. Proposed Turbines (T7, T8 and T9), the proposed extension to the existing Slievecallan 110kV substation and approximately 5.6km of the Proposed Grid Connection Site underground electrical cabling route are located in the Annagh River catchment (Annagh(Clare)_SC_010). The Annagh River drains into Mal Bay approximately 7.5km downstream to the west of the Proposed Wind Farm Site.

The eastern half of the Proposed Wind Farm Site, including 6 no. Proposed Turbines (T1 to T6), along with 1.3km of the Proposed Grid Connection Site are located in the Inagh River surface water catchment (Inagh(Ennistymon_SC_010). The Inagh River flows approximately 0.5km to the northeast of the Proposed Wind Farm Site prior to flowing into Liscannor Bay at Lahinch, approximately 22km downstream of the Proposed Wind Farm Site.

A small section of the Site, which is limited to Proposed Enhancement Site (Area G) extends into the Annageeragh River catchment on the far south of the Site (Annageeragh_SC_010), which is upstream of Doo Lough.

The Proposed Enhancement Site areas are distributed mainly between the Inagh River and Annagh River surface water catchments, with one of the areas extending into the Annageeragh River catchment on the for south of the Site.

Locally the Site exits within 6 no. Water Framework Directive (WFD) mapped sub-basins. The north-western and southwestern sections of the Site drain into the headwaters of the Glendine River (Glendine (Clare)_010) and the Kildeema River (Kildeema_010) respectively with both rivers entering Mal Bay at the same point south of Spanish Point.

The eastern section of the Site along with 1.3km of the Proposed Grid Connection Site drains into the Inagh (Ennistymon)_040 sub-basin. The remainder of the Proposed Grid Connection Site, including underground electrical cabling (5.6km) and the proposed extension to the existing Slievecallan 110kV substation, is located in the Annagh(Clare)_010 sub-basin.

The Proposed Enhancement Site areas are distributed mainly between the Inagh (Ennistymon)_040, Glendine(Clare)_010 and Kildeema_010, along with 2 no. areas located in the Inagh (Ennistymon)_010 and one area in the Annageeragh_020.

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

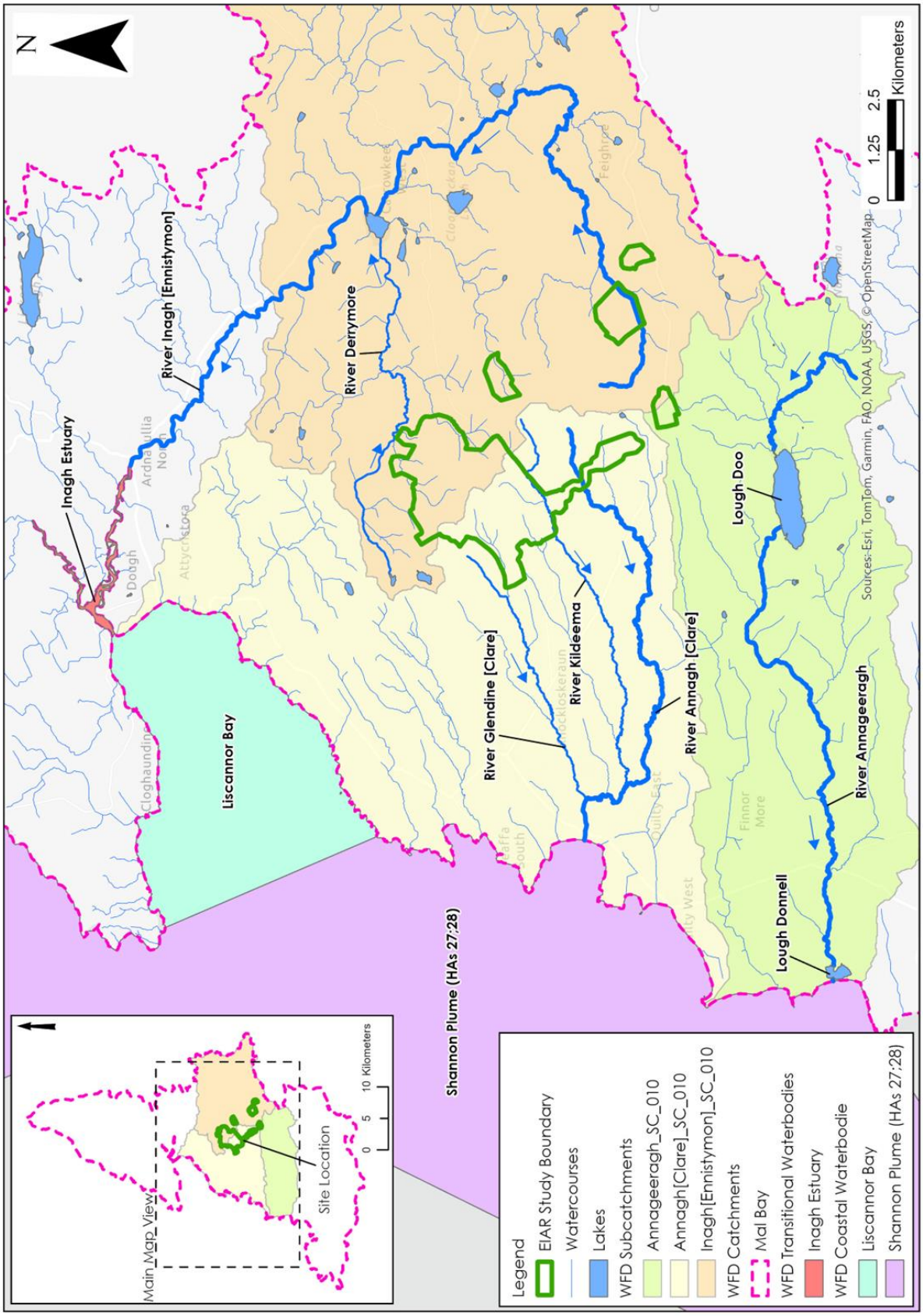

Figure B: Local Hydrology Map

3.2.2 Rainfall and Evaporation

Long term Average Annual Rainfall (AAR) and evaporation data was sourced from Met Éireann. The 30-year annual average rainfall (AAR) recorded at Inagh-Mt. Callan, ~4km southeast of the Site is 1,697mm/year.

Met Éireann (www.met.ie) also provide a grid of average annual rainfall for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the average annual rainfall at the Site ranges from 1,380 to 1,490mm/year. This is considered to be the most accurate estimate of average annual rainfall from the available sources. The higher 1991 to 2020 value is used in the water balance presented below.

The closest synoptic[1] station where the average potential evapotranspiration (PE) is recorded is at Shannon Airport, ~40km southeast of the Site. The long-term average PE for this station is 543mm/year. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the Site is estimated as 516mm/year (which is 0.95 × PE).

The effective rainfall (ER)[2] represents the water available for runoff and groundwater recharge. The ER for the Site is calculated as follows: (These rainfall depths are typical for the west of Ireland).

Effective rainfall (ER) = AAR – AE

= 1,490mm/year – 516mm/year

ER = 974mm/year

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie) an estimate of 50mm to 200mm/year maximum annual recharge cap is given for the area of the Site (recharge coefficient of 5% to ~20%).

Recharge is capped at 50mm/year due to low permeability peat coverage and higher at 200mm/year where peat is thin or absent, but restricted due the poorly productive nature of the underlying bedrock aquifer (refer to Section 9.3.8 of the EIAR which deals with Site hydrogeology). An average 10% groundwater recharge coefficient is taken for the Site.

This means that the hydrology of the Site is characterised by high surface water runoff rates (90%) and low groundwater recharge rates (10%). Therefore, conservative annual recharge and runoff rates for the Site are estimated to be 97mm/yr and 877mm/yr respectively.

In addition to average rainfall data, extreme value rainfall depths are available from Met Eireann. **Table** A below presents return period rainfall depths for the area of the Site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (10-year, 50-year and 100-year) (These extreme rainfall depths are typical for the west of Ireland).

1 Meteorological station at which observations are made for synoptic meteorology and at the standard synoptic hours of 00:00, 06:00, 12:00, and 18:00.

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

Table A. Return Period Rainfall Depths (mm)

Duration	10-year Return Period	50-Year Return Period	100-Year Return Period
15 min	12.5	18.7	22.1
1 hour	19.6	27.8	32.1
6 hour	35	46.3	52
12 hour	43.9	56.4	62.6
24 hour	54.9	68.8	75.5
48 hour	68.2	83.7	91.1

3.3 GEOLOGY

A detailed description of the geology of the Site is presented in Chapter 8 of the EIAR. A summary is presented here to inform the hydrogeological characterisation of the Site.

Regional baseline geological data is available from the GSI through their online map viewer (www.gsi.ie). The bedrock across the Site is mapped as the Central Clare Group (SILTSTONE, SANDSTONE and SHALE combinations). Subsoils are predominantly mapped as peat and Namurian sandstone and shale tills. GSI subsoil mapping for the Site is shown on **Figure C** below.

The follow up site investigations and geotechnical assessments were extensive and consisted of 914 no. peat depth probes, 7 no. trial pits and geophysical surveys. The geological setting of the Site has been thoroughly examined, and the geological/hydrogeological setting is fully understood.

The site-specific data on the geology as well as geotechnical aspects of the Site is included in Section 8.4 of Chapter 8 of the EIAR. The site-specific data is summarised as follows:

- Peat depths recorded across the Site ranged from 0 to 5m with an average depth of 0.7m, which is considered shallow for blanket bog;
- Approximately 74% of recorded peat depth were less than 1m and with 94% of less than 2.0m;
- The peat depths recorded at the Proposed Turbines varied from 0.2 to 2.0m with an average depth of 0.8m (this is considered shallow peat, turbines have successfully been constructed in several metres of peat);
- Of the 9 no. Proposed Turbines, only 3 no. recorded peat depths in excess of 1m (i.e. T1, T4 and T9);
- With respect to the new proposed access roads, peat depths are typically less than 1.0m (average 0.8m) and therefore most roads will be constructed by excavate and replace method;
- At the 1 no. proposed borrow pit location, peat depths are very shallow (0 - 0.2m);
- No evidence of past failures or any significant signs of peat instability were noted on site by FT at the time of the geotechnical walkover surveys;
- Mineral subsoils were typically described as soft to firm gravelly CLAY or SILT;
- Refusal on bedrock (presumed) was recorded in all 7no. trial pits at depths ranging from 0.3 to 2m;
- Depth to bedrock at Proposed Turbines where trial pits were carried out (T1, T2, T3, T5 and T6) ranged between 0.8m and 1.8m with an average of 1.2m;
- Geophysical surveys identified competent bedrock at Proposed Turbines T4, T7 and T8 at depths ranging between 1 and 5m below ground level (mbgl). Depths to bedrock at proposed turbine location T9 varied between 4.5 and 6.5mbgl;
- Geophysical surveys carried out at the borrow pit identified competent, strong SANDSTONE/SILTSTONE at shallow depths ranging from 1 to 3mbgl; and,
- No bedrock faults or fractures were identified by the geophysical surveys.

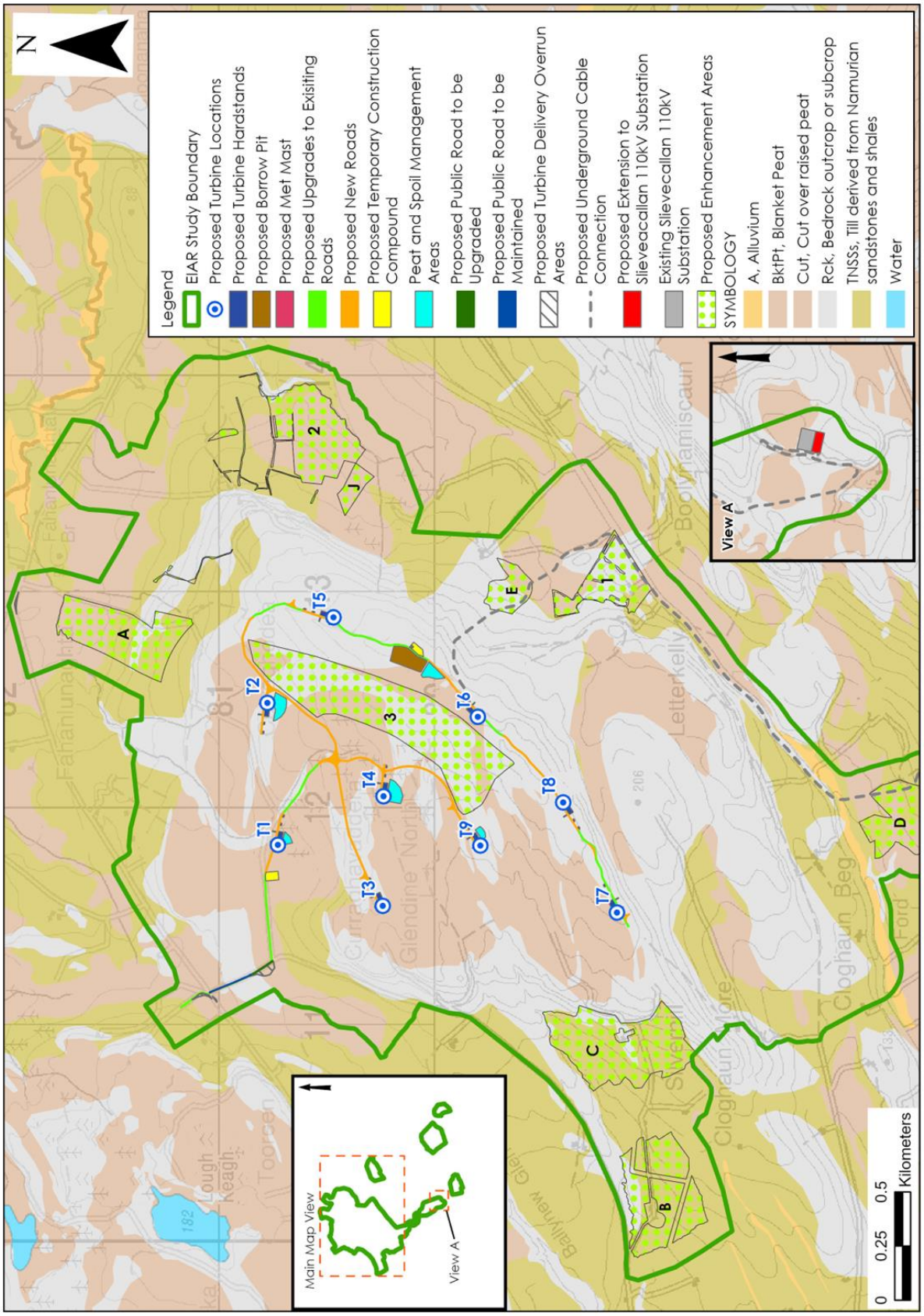

Figure C: GSI Subsoil Mapping

3.4 SITE DRAINAGE

3.4.1 Existing Site Drainage

The northern portion of the Proposed Wind Farm Site is drained by the Fahanlunaghtamore Stream (EPA Ref: 28F09 which is a tributary of the Inagh River. The Fahanlunaghtamore Stream emerges as four headwater streams within the Proposed Wind Farm Site. Two of these headwater streams emerge from within forestry in the vicinity of Proposed Turbine location T4, one from within open peatland area to the west of Proposed Turbine location T4 and the fourth from agricultural land to the north of Proposed Turbine location T5. Within the Proposed Wind Farm Site there are 4 no. proposed new watercourse crossing locations within the Fahanlunaghtamore Stream catchment.

The eastern and southeastern portions of Proposed Wind Farm Site are drained by the Knockacarn Stream (EPA Ref: 28K42) which is also a tributary of the Inagh River. The Knockacarn Stream flows northeasterly within a valley close to the eastern EIAR Site boundary. Three short headwater streams of the Knockacarn Stream emerge from a forested area on the southeastern facing slopes of the Proposed Wind Farm Site. There are no Proposed Wind Farm Site watercourse crossings within the Knockacarn Stream catchment.

The western portion of the Proposed Wind Farm Site is drained by the Ballynew Stream (EPA Ref: 28B27) which is a tributary of the Glendine River. Please note the Ballynew Stream is referred to as the Silverhill River on OSI mapping. The Ballynew Stream emerges as three headwater streams within the Proposed Wind Farm Site. The most northerly headwater stream emerges from within forestry in the vicinity of Proposed Turbine location T9, while the two southerly headwater streams emerge from within open peatland at lower elevations further downslope within the Proposed Wind Farm Site. Within the Proposed Wind Farm Site there is 1 no. proposed new watercourse crossing location within the Ballynew Stream catchment.

The southwestern portion of the Proposed Wind Farm Site is drained by the Letterkelly Stream (EPA Ref: 28L07) and the Kildeema North Stream (EPA Ref: 28K19), both of which are tributaries of the Kildeema River. The Letterkelly Stream emerges from open peatland on the southern slopes of the Proposed Wind Farm Site while the Kildeema North Stream emerges from an area of improved grassland at lower elevations of the Proposed Wind Farm Site. There are no Proposed Wind Farm Site watercourse crossings within the Letterkelly Stream and Kildeema North Stream catchments.

The Proposed Grid Connection Site underground cable route passes through 3 no. local catchments (i.e., Kildeema River, Annagh River and Inagh River catchments). There are a total of 15 no. watercourse and culvert crossings along the Proposed Grid Connection Site underground cable route, of which 4 no. are EPA mapped watercourses with the remaining 11 no. being drains.

A map showing the existing site drainage is shown as **Figure D** below.

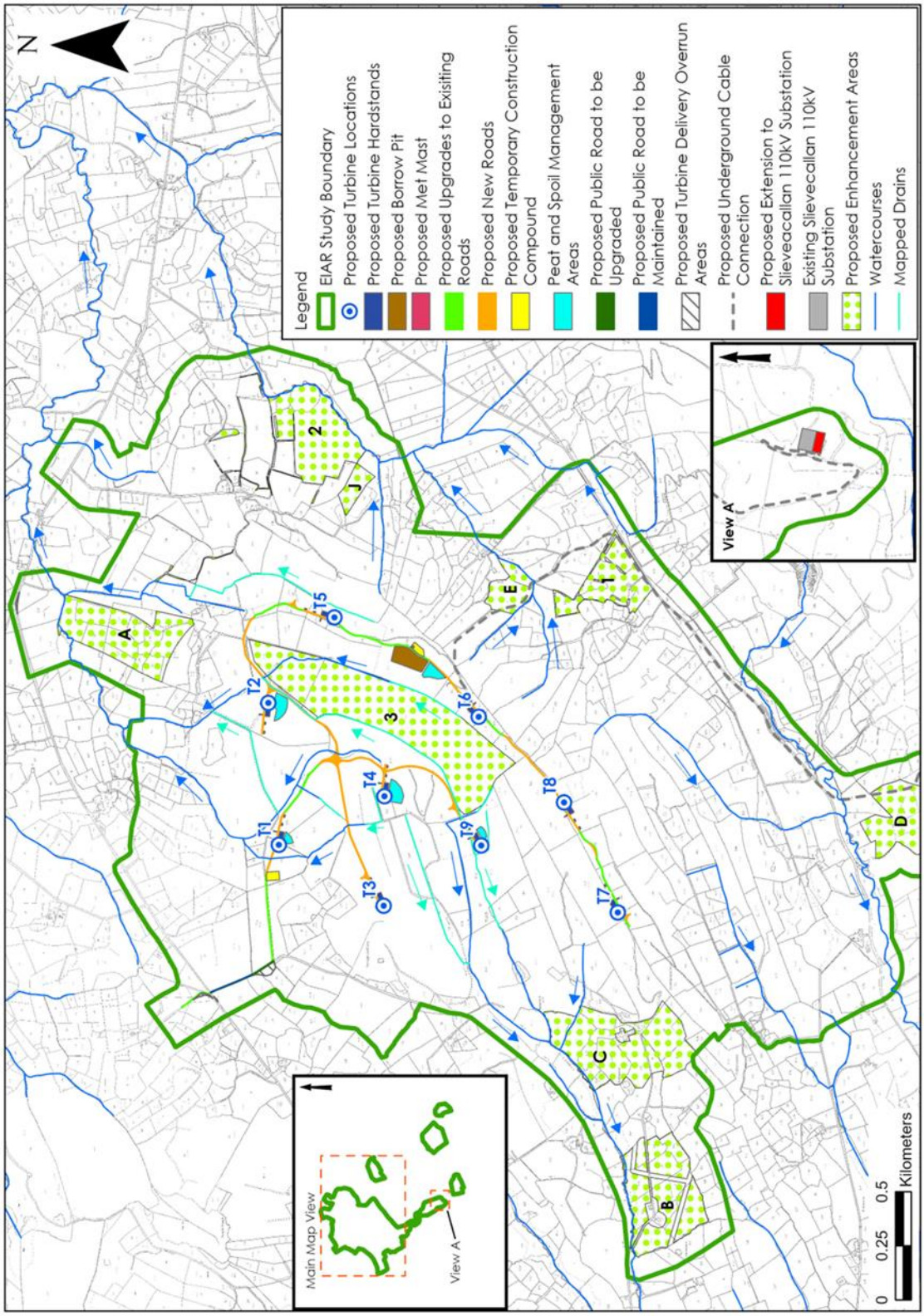

Figure D: Existing Site Drainage

3.5 DESIGNATED SITES & HABITATS

Designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The closest designated site to the Site is Slievecallan Mountain Bog NHA (Site code 002397) which exists approximately 2.5km to the southeast of the Proposed Wind Farm Site and approximately 0.21km east of the Proposed Grid Connection Site. The Site has no hydrological connectivity to Slievecallan Mountain Bog NHA.

The Inagh River Estuary SAC (site code 000036) is located approximately 22km downstream of the Site near the town of Ennistimon.

The Mid-Clare Coast SPA (site code 004182), which encompasses a coastal area from Spanish Point south to Doonbeg, is located approximately 7.5km downstream of the Site via the Glendine River, Kildeema River and Annagh River.

Carrowmore Point to Spanish Point and Islands SAC/pNHA (site code 001021), which is largely coincident with the Mid-Clare Coast SPA, is also downstream of the Site via the aforementioned rivers.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

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.

A stage 1 assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets affected by it (*i.e*. the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed site that may warrant further detailed investigation.

As per the 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; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

Further to this, a stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

4.2 Flood Zone Mapping

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined according to OPW 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.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. There was no identifiable map text on local available historical 6" or 25" mapping for the Site that would identify lands that are "liable to flood" within or in the vicinity of the Site.

4.3.2 Soils Maps - Fluvial Maps

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

Based on the EPA/GSI soil map for the local area (refer to **Figure C** above), no fluvial or lacustrine deposits are mapped within the Site. There are no soils present that indicate areas where flooding may have occurred in the past.

4.3.3 OPW Past Flood Event Mapping

To identify any areas as being potentially at risk of regular flooding, OPW's Past Flood Event mapping (www.floodinfo.ie) were consulted.

No single or recurring flood incidents within the Site were identified from OPW's Past Flood Event mapping (refer to **Figure E** below).

The closest OPW mapped past flood event (Flood ID 3929) is located 5.5km downstream of the Site on the Kildeema River. The Ennistimon Area Engineer Meeting Minutes Report (January 2006) states:

> "*The Annagh/KIldeema River downstream of bridge is in a very poor state – overgrown and silted up. Following heavy rainfall and consequent runoff channel back up causes flooding on road and it is impassable. Road is impassable on average once per year. This has been a problem for the past 20 years*".

The closest mapped past flood event in the Inagh River catchment (Flood ID 3895) is located approximately 12km downstream of the Site. The Ennistimon Area Engineer Meeting Minutes Report (January 2006) states the following:

> "*The Inagh River overflowed causing flooding to the N85 at two locations an January 2005. Similar type flooding occurred around 8 months prior to this also. The L5224 was flooded also. Both roads were impassable for 3 to 4 hours. Considerable area of land was also flooded. No houses affected. Cause seems to be heavy rainfall and resulting lack of capacity of Inagh River*".

There are no recorded past flood events mapped within the Glendine River and Annagh River catchments.

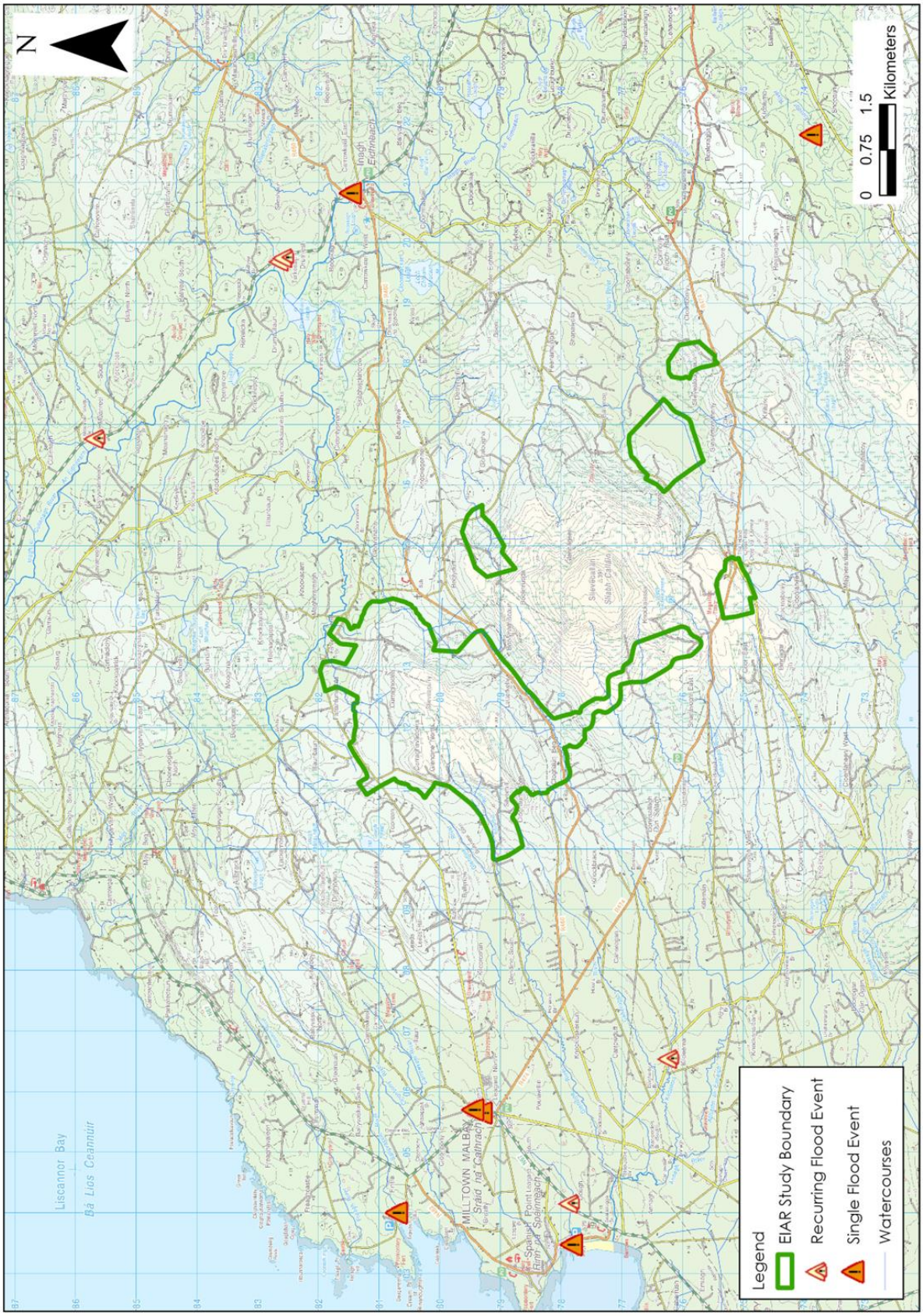

Figure E: OPW Past Flood Event Map

4.3.4 GSI Winter (2015/2016) Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding Map[3] shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas.

GSI Winter (2015/2016) Surface Water Flooding Maps have not recorded the occurrence of any surface water flooding within the Site.

The closest GSI Winter (2015/2016) Surface Water Flooding is mapped ~0.7km northwest of the Site at Lough Keagh.

4.3.5 CFRAM River Flood Extents Mapping

Catchment Flood Risk Assessment and Management (CFRAM)[4] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland.

CFRAM mapping has not been completed for the area of the Site as the catchments are too small.

4.3.6 OPW National Indicative Fluvial Mapping (NIFM)

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

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

For the Present-Day Scenario, no medium (1 in 100) and low probability (1 in 1,000) fluvial flood zones have been mapped to encroach upon the Proposed Wind Farm Site or Proposed Grid Connection Site. They are both are mapped entirely within Fluvial Flood Zone C (low risk).

Fluvial flood zones are mapped to encroach a small part of the Proposed Enhancement Site (Area F) on the southeast of the Site, but this has no consequence for the Proposed Project given works are limited to biodiversity enhancement only (i.e. no proposed infrastructure or significant drainage alterations).

A map showing the National Indicative Fluvial Mapping for the present-day scenario is included as **Figure F** below.

[3] GSI *Historical flood mapping principally developed using Sentinel-1 Satellite Imagery from the European Space Agency Copernicus Programme as well as any available historic records (from winter 2015/2016 or otherwise)*
[4] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

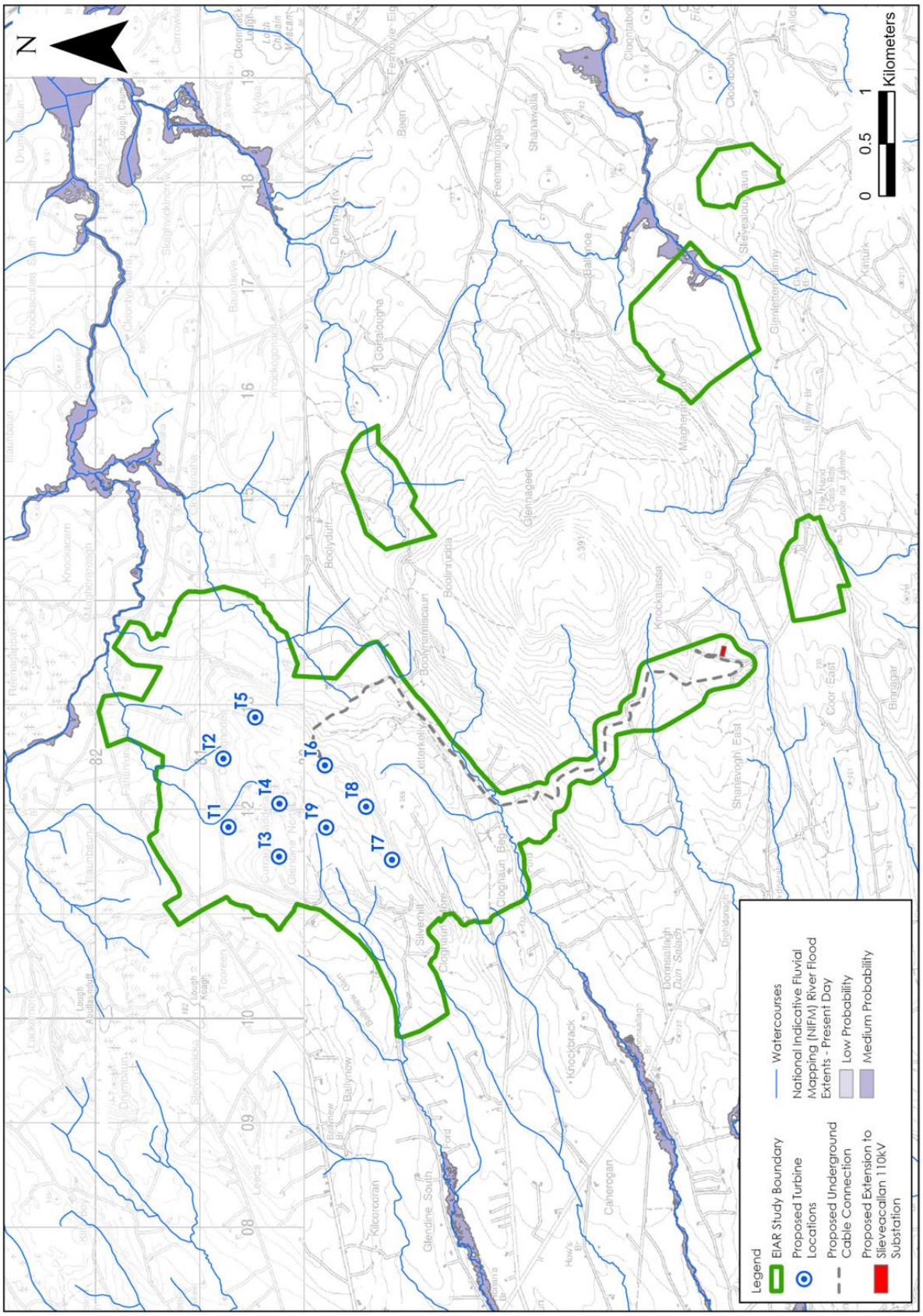

Figure F: National Indicative Fluvial Mapping

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Site.

4.3.8 Coastal Flooding

The Proposed Wind Farm Site is located 7.5km inland from the sea. Therefore, the Site is not at risk of coastal (tidal) flooding.

4.3.9 Climate Change

Fluvial flood modelling has also been completed to consider future climate scenarios where the potential effects of climate change can increase rainfall.

The National Indicative Fluvial Flood Mapping Mid-Range Future Scenario models flood extents based on a 20% increase in rainfall. Similarly, the National Indicative Fluvial Flood Mapping High-End Future Scenario models flood extends based on a 30% increase in rainfall.

Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in **Section 4.3.6.** Therefore, mapped flood zones further downstream of the Site are unlikely to be significantly impacted by future climate change.

4.3.10 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it is apparent that no part of the Proposed Wind Farm Site or Proposed Grid Connection Site is located in Fluvial Flood Zone A or B, therefore they are located in Flood Zone C where there is at low risk of fluvial flooding.

The proposed extension to the existing Slievecallan 110kV substation is also located in Flood Zone C.

Fluvial flood zones are mapped to encroach a small part of the Proposed Enhancement Site (Area F) on the southeast of the Site, but this has no consequence for the Proposed Project given works are limited to biodiversity enhancement only (i.e. no proposed infrastructure or alterations to drainage or topography).

4.4 INITIAL FLOOD RISK ASSESSMENT

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it has been determined that flooding is unlikely to pose a low risk within the Site. A summary of potential sources of flooding at the Site are shown in **Table B**.

Table B. S-P-R Assessment of Flood Sources for the Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the rivers and streams that are close to some of the wind farm infrastructures.	Land & infrastructure	The Proposed Wind Farm Site and Proposed Grid Connection Site are located in Fluvial Flood Zone C where there is a low risk of fluvial flooding. The 110kV substation extension element is also located in Flood Zone C. Fluvial flood zones have no consequence for the Proposed Enhancement Site.
Pluvial	Ponding of rainwater on site	Land & infrastructure	There is a low risk of pluvial flooding due to the extensive manmade drainage networks and sloping topography
Surface water	Surface ponding/ Overflow	Land & infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land & infrastructure	Based on local hydrogeological regime and GSI mapping, there is no apparent risk of groundwater flooding at the Site.
Coastal/tidal	Overbank flooding	Land, People, property	No coastal flooding will be possible at the Site due to distance to coast (>7.5km) and ground elevation.

4.5 JUSTIFICATION TEST

A matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test is shown in **Table C**. This table is adapted from Table 3.2 of the PSFRM Guidelines (DoEHLG, 2009).

It may be considered that the Proposed Wind Farm Site and proposed substation extension element of the Proposed Grid Connection Site can be categorised as "Highly Vulnerable Development".

The Proposed Enhancement Site as well as the 33kV underground cabling element of the Proposed Grid Connection Site can be categorised as "Water Compatible Development".

Therefore, the Proposed Project is appropriate from a flood risk perspective, and a Justification Test is not required.

Table C: 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.*

5. PLANNING POLICY

5.1 PLANNING POLICY AND COUNTY DEVELOPMENT PLAN

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

Table D: Clare County Council Planning Policy/Objective and Responses

No.	Policy/Objective	Development Design Response
CDP2.6	It is an objective of Clare County Council: a) To ensure development proposals have regard to the requirements of the SFRA and Flood Risk Management Guidelines; and where required are supported by an appropriately detailed hydrological assessment / flood risk assessment. b) To ensure that flood risk assessments include consideration of potential impacts of flooding arising from climate change including sea level rise and coastal erosion; c) To integrate sustainable water management solutions, prioritising nature based solutions (such as SUDS, nonporous surfacing and green roofs) into development proposals; d) To include Natural Water Retention Measures (NWRMS) where appropriate in consultation with the Office of Public Works (OPW) and other relevant stakeholders: e) To support investment in the sustainable development of capital works under the Flood Capital Investment Programme and Flood Risk Management Plans developed under the Catchment Flood Risk Assessment and Management (CFRAM) process; and f) To ensure that potential future flood information g) obtained/generated through the Development Management process is used to inform suitable adaptation requirements in line with the Guidelines for Planning Authorities on Flood Risk Management (DoECLG & OPW, 2009).	This document provides a site-specific FRA for the Site.
CDP2.8	It is an objective of Clare County Council: a) To support the implementation of the EU Floods Directive b) 2007/60/EC to manage flood risks; and c) b) To implement the recommendations of the Catchment d) Flood Risk Assessment and Management Study (CFRAMS) e) programme as it relates to County Clare and to ensure that f) flood risk management policies and infrastructure are g) progressively implemented.	This document provides a site-specific FRA for the Site.
CDP2.10	It is an objective of Clare County Council: a) To support investment in subsequent projects by capital spending agencies to deliver flood relief schemes under the National Strategic Outcome, Transition to a Low Carbon and	As Outlined in this FRA

	Climate Resilient Society. Such projects should be future proofed for adaptation to consider potential impacts of climate change; and b) To require that all infrastructure and energy providers/operators provide for adaptation measures to protect strategic infrastructure (including roads, railways, ports and energy infrastructure) from increased flood risk associated with climate change.	

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Proposed Project. From this study:
    - No instances of historical flooding were identified in historic OS maps within the Site;
    - No instances of single or recurring flooding were identified on OPW maps within the Site or immediately downstream;
    - The GSI Winter 2015/2016 Surface Water Flooding and Groundwater flood Mapping provides no evidence of historical flooding at the Site;
    - No CFRAM or NIFM fluvial flood zones are mapped within the Proposed Wind Farm Site or Proposed Grid Connection Site;
    - Fluvial flood zones are mapped to encroach a small part of the Proposed Enhancement Site, but this has no consequence for the Proposed Project or downstream flood risk.
- Therefore, the Proposed Project is appropriate from a flood risk perspective; and,
- This FRA fulfils the requirements for a site-specific flood risk assessment and is consistent with the recommendations made in the Clare County Development Plan (2023-2029).

* *

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
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 (IH 124).
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.
Clare County Council	2023	Clare County Development Plan 2023–2029

22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie