FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX 2.2

Construction Environmental Management Plan

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED BARNADIVANE WIND FARM

CONSTRUCTION AND ENVIRONMENTAL MANAGEMENT PLAN

Prepared for: Barna Wind Energy (B.W.E) Ltd. & Arran Windfarm Ltd.

Date: **March 2023**

Core House, Pouladuff Road, Cork, T12 D773, Ireland
T: +353 21 496 4133 | E: info@FTo.ie

CORK | DUBLIN | CARLOW

www.fehilytimoney.ie

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 General Introduction and Purpose

This document is the Construction and Environmental Management Plan (CEMP) for the proposed Barnadivane Wind Farm and Substation and has been prepared by Fehily Timoney and Company (FT) on behalf of Barna Wind Energy (B.W.E.) Ltd. and Arran Windfarm Ltd.

The CEMP will be updated prior to construction to take account of any relevant conditions attached to the grant of permission and will be implemented for the duration of the construction phase of the project. The CEMP will be a live document and will be subject to ongoing review through regular environmental auditing and site inspections and updated as required. For the avoidance of doubt, all measures stipulated in this CEMP will be implemented in full.

The CEMP sets out the key construction and environmental management issues associated with the Proposed Project and will be developed further at the post-planning and construction stages by the client and on the appointment of the main contractor to the project.

The CEMP should be read in conjunction with the EIAR. In the case of any ambiguity or contradiction between this CEMP and the EIAR, the EIAR shall take precedence. The CEMP should be read in conjunction with the CEMP for other elements of the project including the Alternative Grid Connection Route (AGCR) CEMP which has been prepared in support of the consented route pursuant to planning ref. Cork County Council Ref. 15/730 & An Bord Pleanála Ref. PL04.246353.

The document is divided into six sections:

Section 1: *Introduction* provides an overview of the existing site and the Proposed Project

Section 2: *Existing Site Environmental Conditions* provides details of the main existing geotechnical, hydrological, ecological and archaeological conditions onsite. These conditions are to be considered by the contractor in the construction and operation and decommissioning of the Proposed Project.

Section 3: *Overview of Construction Works*, this section provides an overview of the construction works proposed, including drainage and sediment controls to be installed.

Section 4: *Environmental Management Plan (EMP)*, this section outlines the main requirements of the EMP and outlines operational controls for the protection of the environment including spoil management, habitat and species, site drainage control, archaeology, construction traffic, site reinstatement and decommissioning, waste management.

Section 5: *Safety & Health Management Plan,* this section defines the work practices, procedures and management responsibilities relating to the management of safety and health during the design, construction and operation of the Project.

Section 6: *Emergency Response Plan* contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the Project.

1.2 The Applicant

The applicant for the Proposed Project is Barna Wind Energy (B.W.E) Ltd. & Arran Windfarm Ltd.

1.3 The Project

The Proposed Project is comprised of the following key elements:

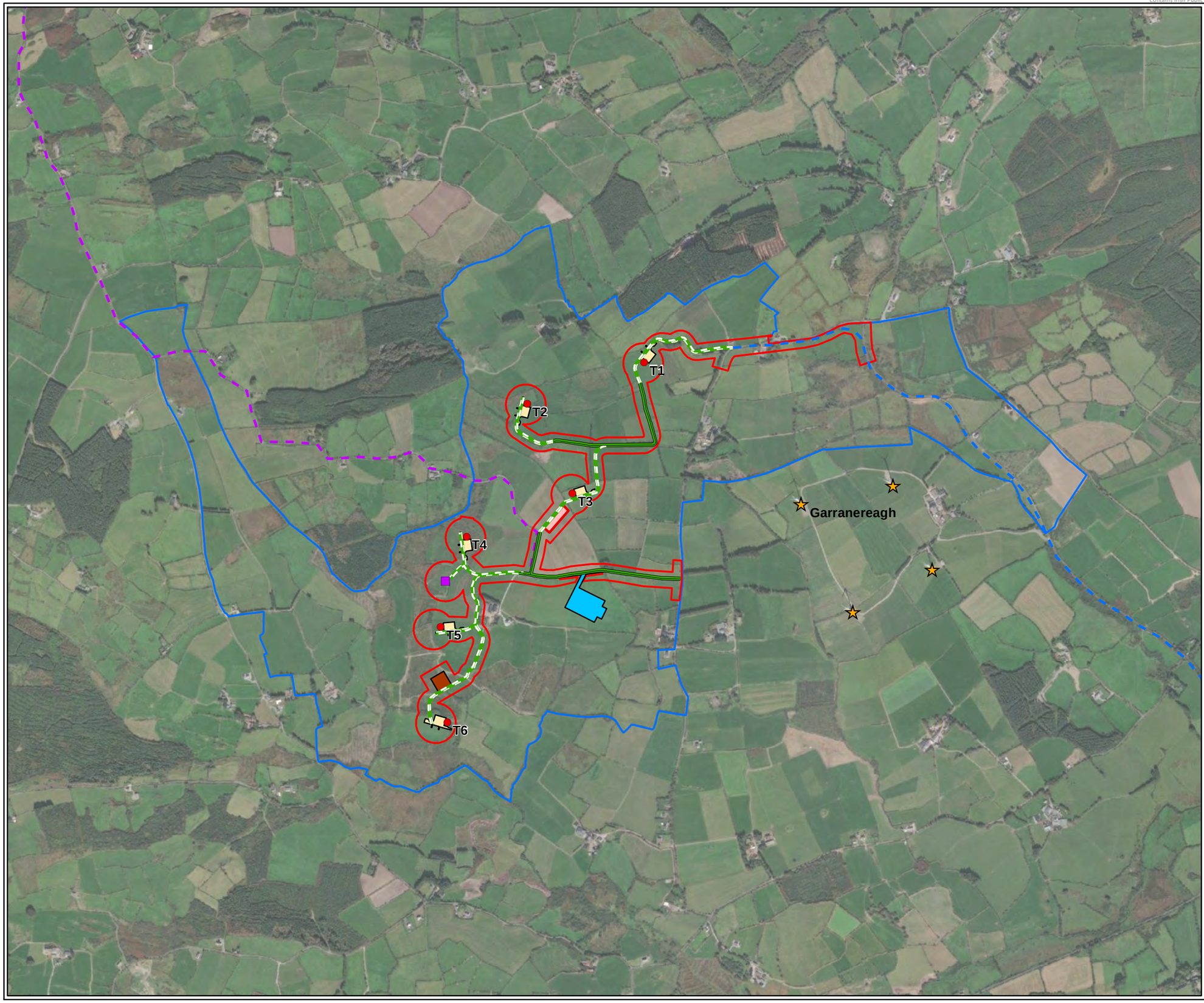
- Proposed 6 no. turbine windfarm also referred to in this document as 'the Proposed Wind Farm' or 'the Site';
- Proposed 110kV substation within the site of the Proposed Wind Farm, also referred to as 'the Proposed Substation';
- Enabling works for the Turbine Delivery Route, also referred to in this report as 'Enabling TDR Works';
- Potential alternative grid connection, also referred to in this report as the 'the AGCR'.

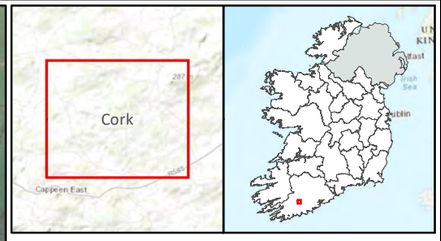
A detailed description of the Proposed Project is contained in Chapter 2 of the EIAR. A detailed description of the proposed construction works is outlined in Section 3.

An overview of the Proposed Project is shown in Figure 1-1. Figures 1-2 to 1-5 illustrate the general layout of the Proposed Wind Farm site, alternative grid connection route (AGCR), Turbine Delivery Route (TDR) and proposed BEMP measures associated with the project.

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001220 © Government of Ireland.
Contains Irish Public Sector Data licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig1_1_Site_Location_and_Project_Overview_A3.mxd





Legend

- Development Planning Boundary
- Study Area Boundary
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Tracks-Existing
- Tracks-Proposed
- Alternative Grid Connection Route
- Turbine Delivery Route
- Garranereagh Wind Farm

N W E S

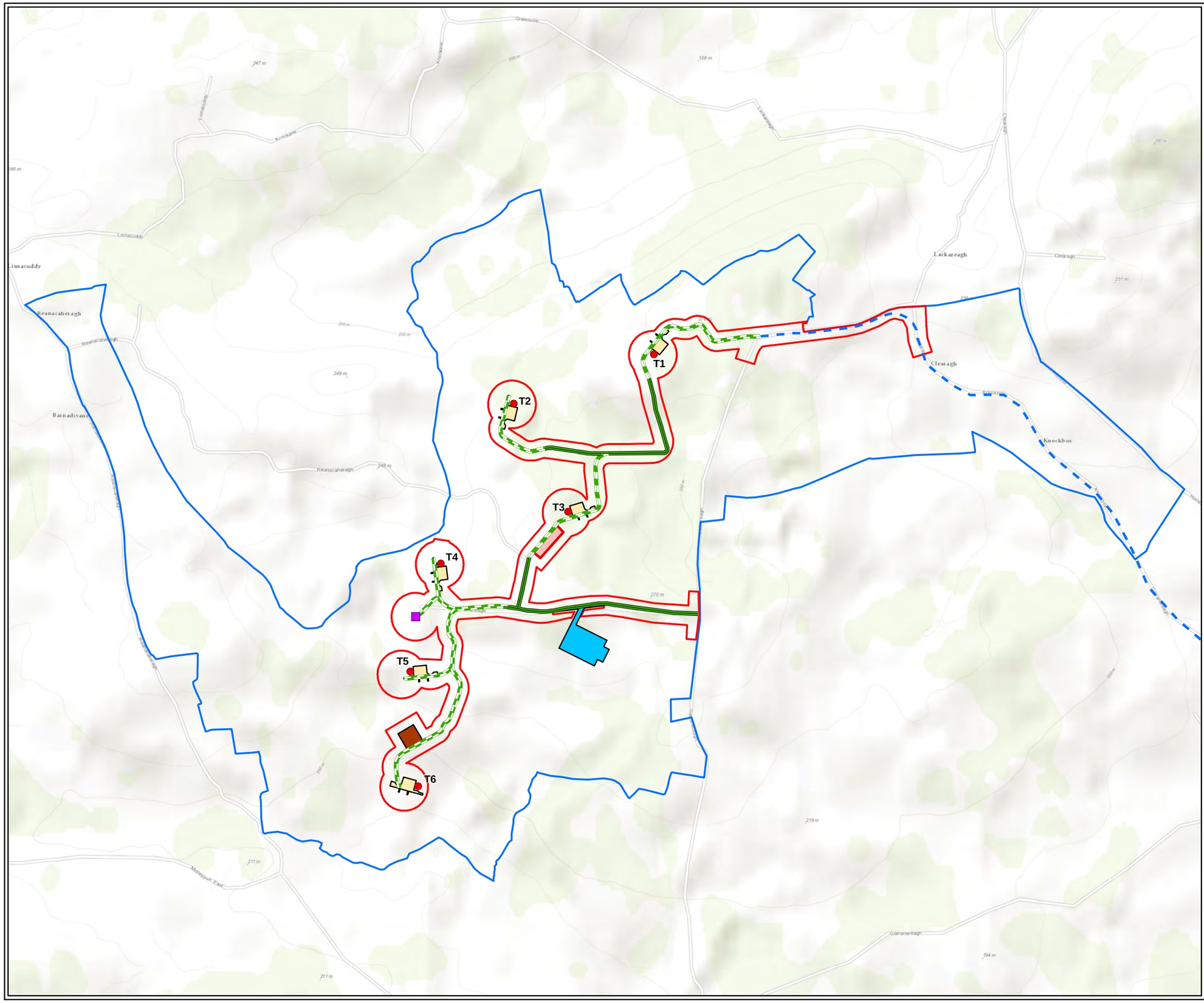
0 0.25 0.5 1 Kilometers

TITLE:	Site Location and Project Overview		
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork		
FIGURE NO:	1.1		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:15000	**REVISION:**	0
DATE:	3/8/2023	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig1-2_Wind_Farm_Site_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Creative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/; If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland



Legend

- Development Planning Boundary
- Study Area
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Turbine Delivery Route
- Tracks-Existing
- Tracks-Proposed

N W E S

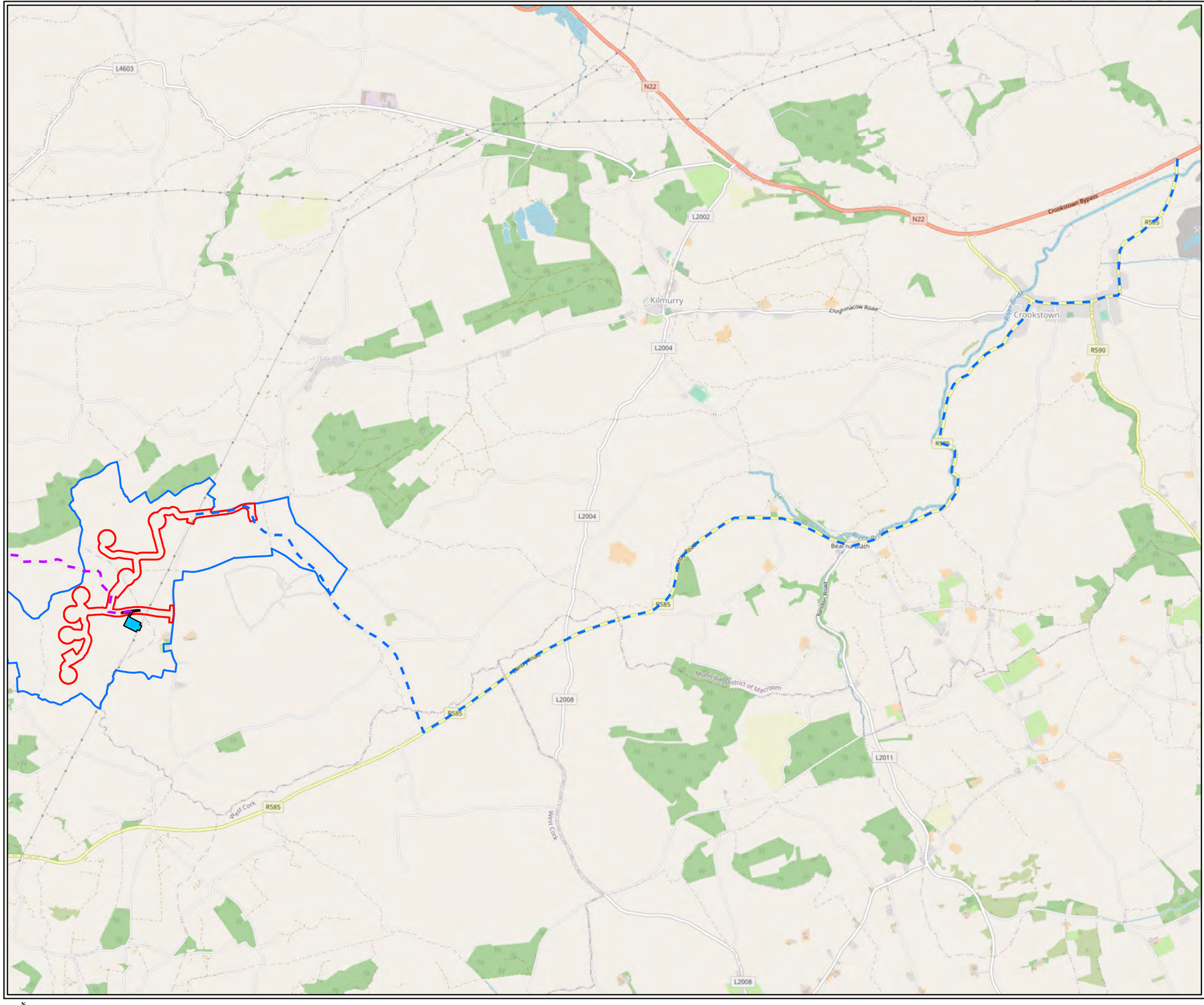
0 0.25 0.5 1 Kilometers

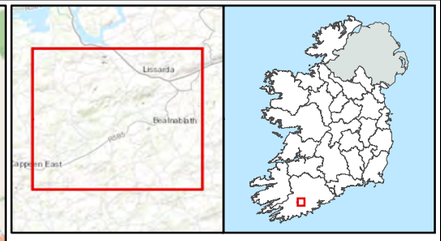
TITLE:	Wind Farm Site		
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork		
FIGURE NO:	1.2		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig1-3_TurbineDeliveryRoute_A3.mxd

© OpenStreetMap (and) contributors, CC-BY-SA
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Creative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/, ESB; If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





- Development Planning
- Study Area
- Proposed Substation
- Alternative Grid Connection
- Turbine Delivery Route

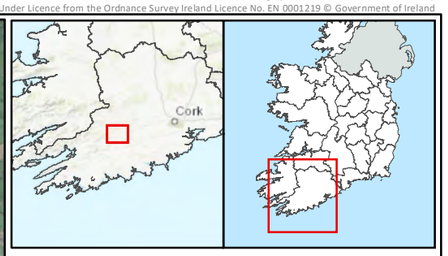
N
W E
S
0 0.5 1 2 Kilometers

TITLE: Turbine Delivery Route (TDR)	
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork	
FIGURE NO: 1-3	
CLIENT: Barna Wind Energy Ltd. & Arran Windfarm Ltd.	
SCALE: 1:35000	**REVISION:** 0
DATE: 3/8/2023	**PAGE SIZE:** A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig1-4_AlternativeGridConnectionRoute_AGCR_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Creative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/: If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland



- Development Planning Boundary
- Study Area
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Alternative Grid Connection Route
- Turbine Delivery Route
- Roads - Proposed

N
W E
S

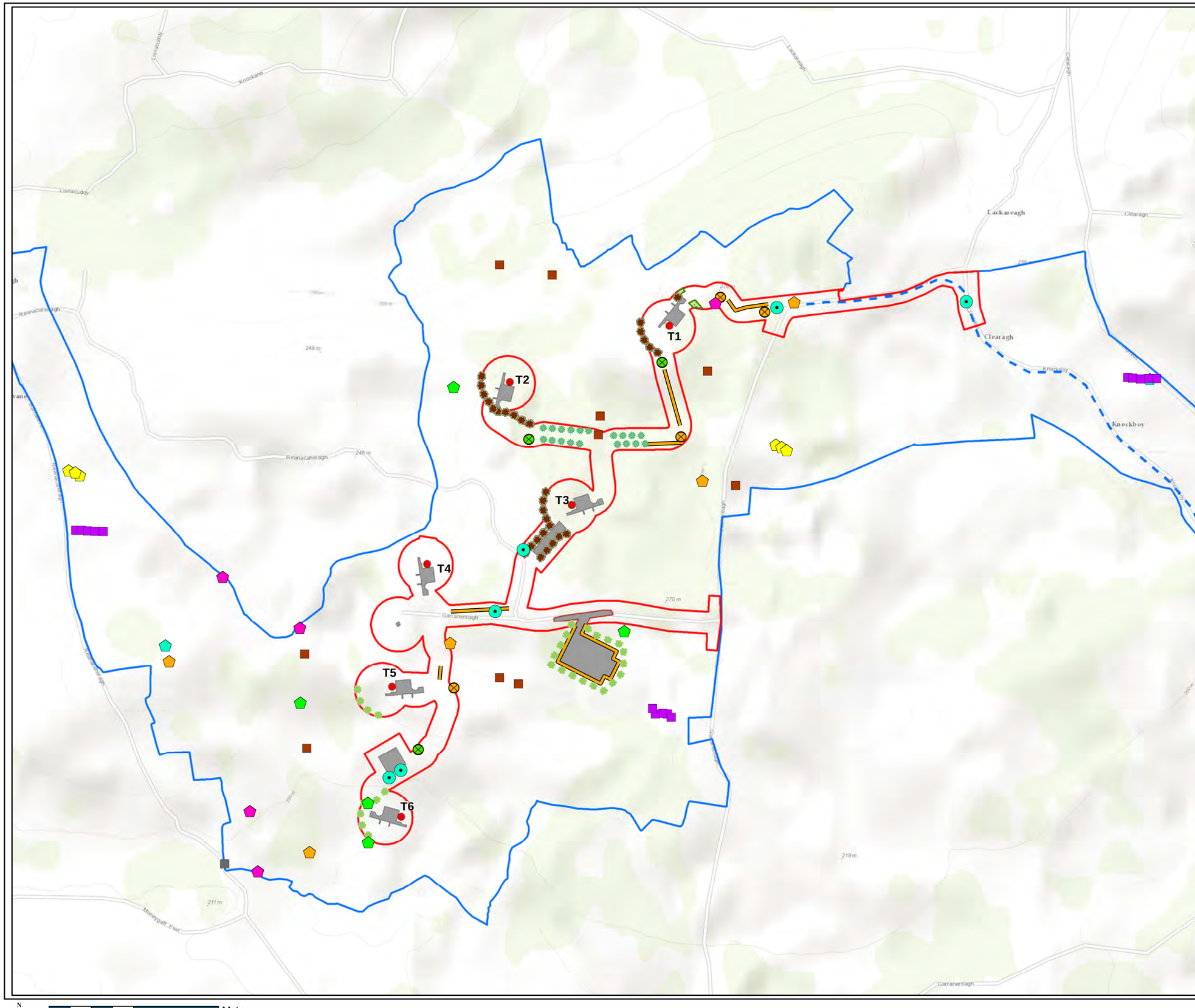
0 1.25 2.5 5 Kilometers

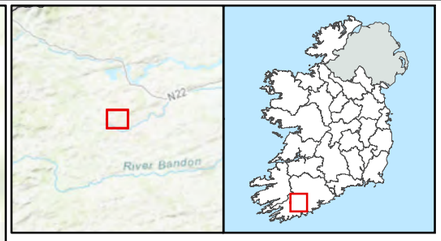
TITLE: Alternative Grid Connection Route			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	1-4		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:45000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig1_5_BEMP_Measures_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Creative and Commons Attribution 4.0 International (CC BY 4.0) licence https://creativecommons.org/licenses/by/4.0/; If Applicable: Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001219 © Government of Ireland





Legend

- Development Planning Boundary
- Lands in control of
- Proposed Project Infrastructure
- Proposed Turbine Layout
- Turbine Delivery Route
- Scrub

Habitat Enhancement Measures

Measure

- Bat box
- Bird box
- Bird box - grey wagtail
- Goldcrest nest roost
- Hedgehog house
- Kestrel nest box
- Log pile
- Red squirrel nest box
- Refugia/ hibernacula
- Starling nest box
- Wildlife pond
- Existing Hedgerow Enhancement
- New hedgerow
- New treeline
- Pollinator planting

TITLE: BEMP Measures			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	1.5		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:11000	**REVISION:**	0
DATE:	3/8/2023	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S

Meters
0 125 250 500

2. EXISTING SITE ENVIRONMENT

2.1 Proposed Wind Farm Site

The Proposed Wind Farm is located in the townlands of Lackareagh, Garranereagh and Barnadivane (Kneeves), near Teerelton, Co. Cork.

There is a good network of local roads accessing the Proposed Wind Farm. The nearest national route, the N22, is the main arterial route for traffic commuting between Cork and Killarney and is located approximately 5km to the north at its closest. The nearest regional route, the R585 between Cork and Bantry, passes 1km to the south of the site. The R585 connects to the N22 at Crookstown, 5km to the east of the Proposed Wind Farm.

Existing land use in the area surrounding the site is predominately agricultural, with some forestry nearby, particularly adjacent to the proposed road improvement works at the junction of the R585 and L6088 (subject to separate planning application).

The Site is currently used for agricultural grazing. The field boundaries are defined both by the hedgerows and by sod and stone banks. The land to the south of the Proposed Wind Farm, at the location of the permitted road improvement works (junction of L6088 and R585, subject to separate planning application CCC 146803) is in Coillte lands, adjacent to existing forestry.

There are a number of occupied dwellings within 1.5km of the site, with the closest being approximately 267m from the nearest turbine. This dwelling is occupied by a project stakeholder.

The landform reflects the underlying geology of the region which is dominated by east-west anticlines and synclines. The anticlines form the hills with sandstone dominated bedrock and the synclines form the main river valleys (Lee, Bride and Bandon Rivers) which are underlain by limestone.

The Site is predominantly underlain by Glacial Till deposits derived from sandstone and siltstone. Frequent areas of 'bedrock outcrop or subcrop' are also mapped throughout the site. Isolated albeit relatively large (up to 12 hectares) deposits of Blanket Peat can be found along the western and southern margins of the site.

In general, site slopes can be categorised as gentle to moderate generally sloping down the south. However, slope gradients increase along the northern and north-eastern margins of the Proposed Wind Farm Site where they become steep to extremely steep sloping down towards the north and northwest. Slope angles range from 2 to 10 degrees with a mean value of 6 degrees. Elevations range from 180m AOD in the south to 270m AOD in the north.

From a review of the GSI Landslide Susceptibility database, the Proposed Wind Farm Site and proposed infrastructure locations are generally located within areas of 'Low' to 'Moderately Low' susceptibility.

Turbine locations T5 and T6 and portions of the access road linking the two turbines are located within an area of 'Moderately High' susceptibility. Field observations at both turbine locations indicate gentle to moderate slopes (6° slope angle) with no evidence of historic slope instability. In addition, desktop review of available aerial photography did not identify evidence of slope instability. It is therefore considered that the risk of landslide at turbine locations T5 and T6 is considered to be negligible and that the GSI Landslide Susceptibility Classification rating at these locations does not accurately reflect actual ground conditions encountered on site.

An isolated area of 'High' landslide susceptibility is located to the north of the Proposed Wind Farm Site and relates to steepened topography; however, there is no infrastructure proposed here.

No evidence of slope instability was observed at the Proposed Wind Farm Site and there are no historical records of landslide activity within 1km of the Proposed Wind Farm Site on the GSI database.

Based on the GSI aquifer vulnerability mapping and findings from the site walkovers, overburden deposits are generally <3m deep across the majority of the Proposed Wind Farm Site.

The study area is located within Hydrometric Area No. 19 (HA 19) (Lee, Cork Harbour and Youghal Bay) of the Irish River Network System and is situated in the South Western River Basin District (SWRBD). The site is located within two waterbody catchments.

The average annual rainfall in period 1981-2010 in the area near the wind farm site recorded at Cork Airport is 1227.9mm.

The Proposed Wind Farm Site and AGCR is situated within two sub-catchments as defined by the Water Framework Directive (WFD). These waterbodies are known as:

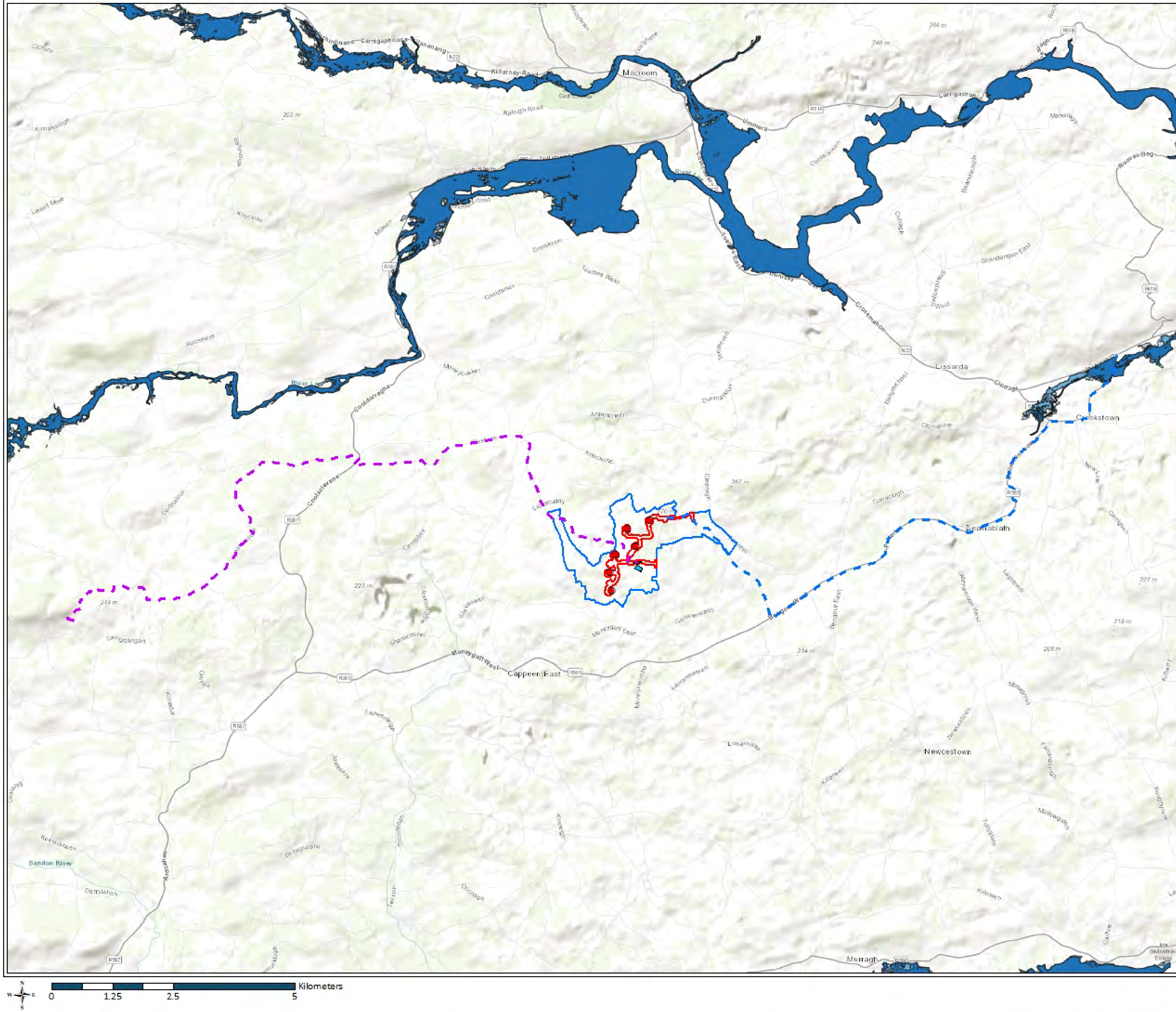
- Lee (Cork)_SC_050
- Lee (Cork)_SC_030

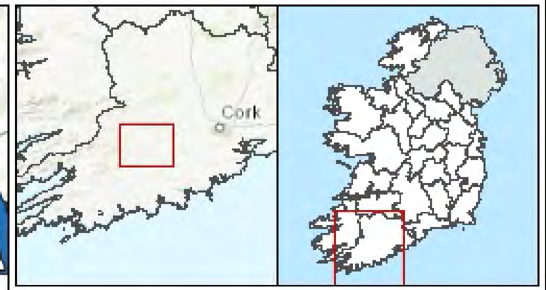
The national flood hazard mapping website, www.floodmaps.ie, does not indicate any record of flooding within 2.5 km of the site in either the tributaries or the main channel of the River Bride or the River Cummer. The nearest flood incident recorded by the OPW is at Teereeven, Poulanargid where the Area Engineer noted in the minutes of a meeting on 21 April 2005 that recurring road flooding occurs from the Cummer River (Flood ID 5173). This incident occurred just over 2.5 km to the north of the site boundary.

OPW flood data and existing hydrological features recorded within the site area shown on Figure 2-1 and Figure 2-2.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig2_1_OPW_Flood_Data_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001220 © Government of Ireland.
Contains Irish Public Sector Data licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.





Legend

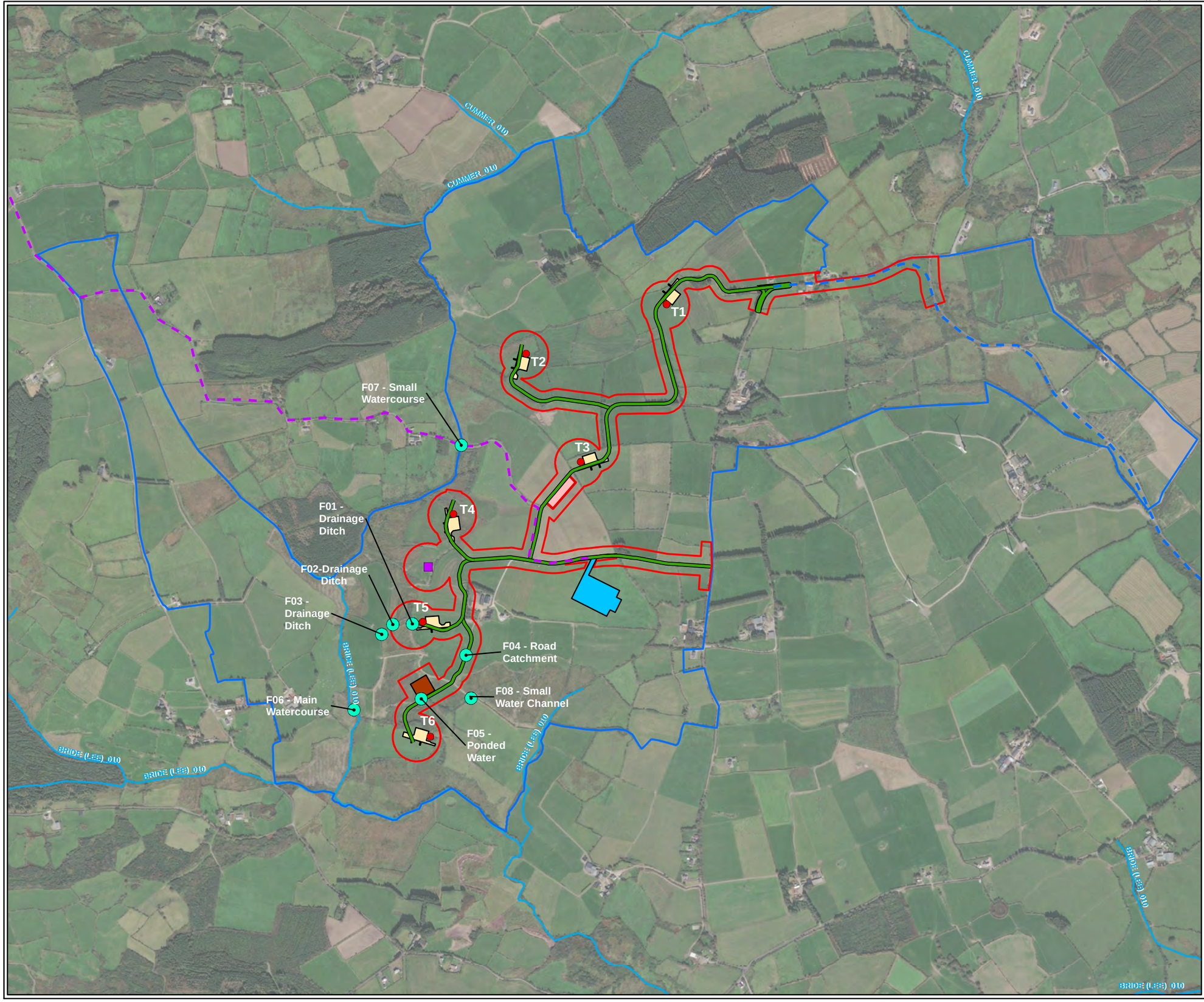
- Development Planning Boundary
- Study Area Boundary
- Proposed Substation
- Proposed Turbine Layout
- Alternative Grid Connection Route
- Turbine Delivery Route
- River - High Probability
- River - Medium Probability
- River - Low Probability

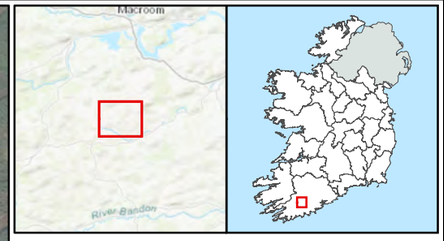
TITLE:	OPW Flood Data
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork
FIGURE NO:	2.1
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.
SCALE: 1:75000	REVISION: 0
DATE: 23/02/2023	PAGE SIZE: A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\CEMP\P21-143_GIS_Fig2_2_Hydrological_Features_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Mapping Reproduced Under Licence from the Ordnance Survey Ireland Licence No. EN 0001220 © Government of Ireland





- Development Planning Boundary
- Study Area
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Alternative Grid Connection Route
- Turbine Delivery Route
- Roads - Proposed
- WFD River Water
- Hydrological Features

TITLE:	Hydrological Features		
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork		
FIGURE NO:	2.2		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

FEHILY TIMONEY
Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S

0 0.25 0.5 1 Kilometers

The Site does not lie within any Natura 2000 sites. There are three Natura 2000 sites (two cSACs and one SPA) within a 10 km radius. The Gearagh cSAC (site code 000108) and the Gearagh SPA (004109) lie over 6.5 km to the north. The Bandon River cSAC (002171) lies over 9.5 km southwest of the Proposed Wind Farm site.

The Study Area is largely dominated by improved agricultural grassland (GA1) which is predominantly used for cattle grazing and silage cutting. Pockets of wet grassland (GS4) are found on the wetter or poorly draining areas. There are also numerous hedgerows (WL1) present within the Study Area. Patches of scrub (WS1) are also found, with gorse dominating. Pockets of conifer plantation (WD4) with mature and semi-mature sitka spruce (Picea sitchensis) are located within the Study Area. This habitat type is largely comprised of single rows of sitka spruce trees (WL2) along farm tracks. Some sections of native hedgerows have grown into treelines, typically dominated by willows, with elder (Sambucus nigra), hawthorn, bramble and gorse.

Minor watercourses (eroding/upland river (FW1)) occur within the site. Other habitats present were buildings and artificial surfaces (BL3) and drainage ditches (FW4).

No habitats listed on Annex 1 of the EU Habitats Directive were recorded within the Study Area. Similarly, no botanical species on the Flora Protection Order 2022 or on the 'Ireland Red List No. 10: Vascular Plants' (Wyse et al., 2016) were recorded during field surveys.

Both wet grassland and scrub are of 'Local Importance (Higher Value)' according to the NRA guidelines (2009), and they provide cover for birds, mammals and other wildlife. Hedgerows are considered to be of 'Local Importance (Higher Value)', and they provide ecological corridors for wildlife between habitats in the surrounding landscape. Improved agricultural grassland, conifer plantations and the other habitats mentioned above are artificial habitats, and are considered to be of 'Local Importance (Lower Value)'. Further details are outlined in Chapter 5 of the EIAR.

Himalayan knotweed Persicaria wallichii, a Third Schedule medium impact invasive alien plant species, was recorded along the edge of the unnamed local road within the site at the north-eastern boundary near the entrance to farm buildings. Cherry laurel Prunus laurocerasus and Sycamore Acer pseudoplatanus were also recorded at this location.

Sitka spruce Picea sitchensis is present in treelines along farm tracks and field boundaries near T1 and T3 as well as small blocks of conifer plantation near T1.

Fuchsia magellanica and New Zealand holly Olearia macrodonta are also present in the hedgerow adjacent to T3. The location of these invasive species can be seen in Figure 5-9 of Chapter 5, see Figure 2-3 for snapshot of map.

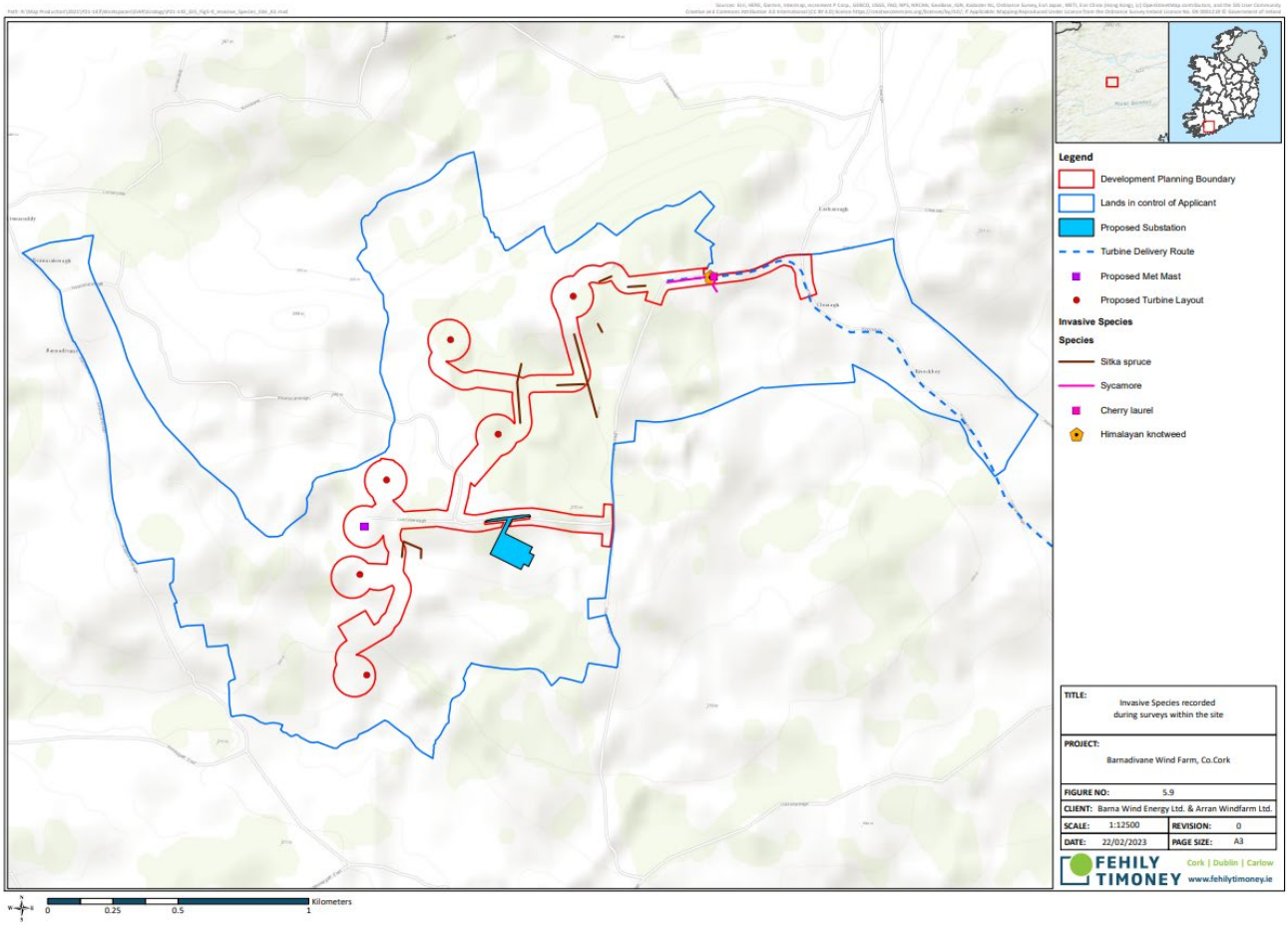


Figure 2-3: Invasive Species Map from Chapter 5 of the EIAR

Two hundred and ninety-two (292) recorded monuments are located within 5km of the nearest proposed turbine. They are listed in Table 12.3 of Chapter 12 and are presented according to the distance of each monument to the nearest proposed turbine. Over 58% of the monuments are located in excess of 3km from the nearest proposed turbine and in this regard the immediate setting of these monuments will not be impacted by the Proposed Development. Over 20% of the monuments are located between 2 and 3km from the nearest proposed turbine, while over 17% of monuments are between 1 and 2km from the nearest proposed turbine. Just over 3% (10) monuments are located less than 1km from the nearest proposed turbine. The nearest monuments CO095-001---- and CO083-078---- ringforts are situated 225m and 251m from turbine 6 and 2, respectively. The next nearest monument, Enclosure CO094-036---- , is situated c. 347m to the south-west of T6. The monuments are described in further detail in Chapter 12 and are shown on Figure 2-4 below.

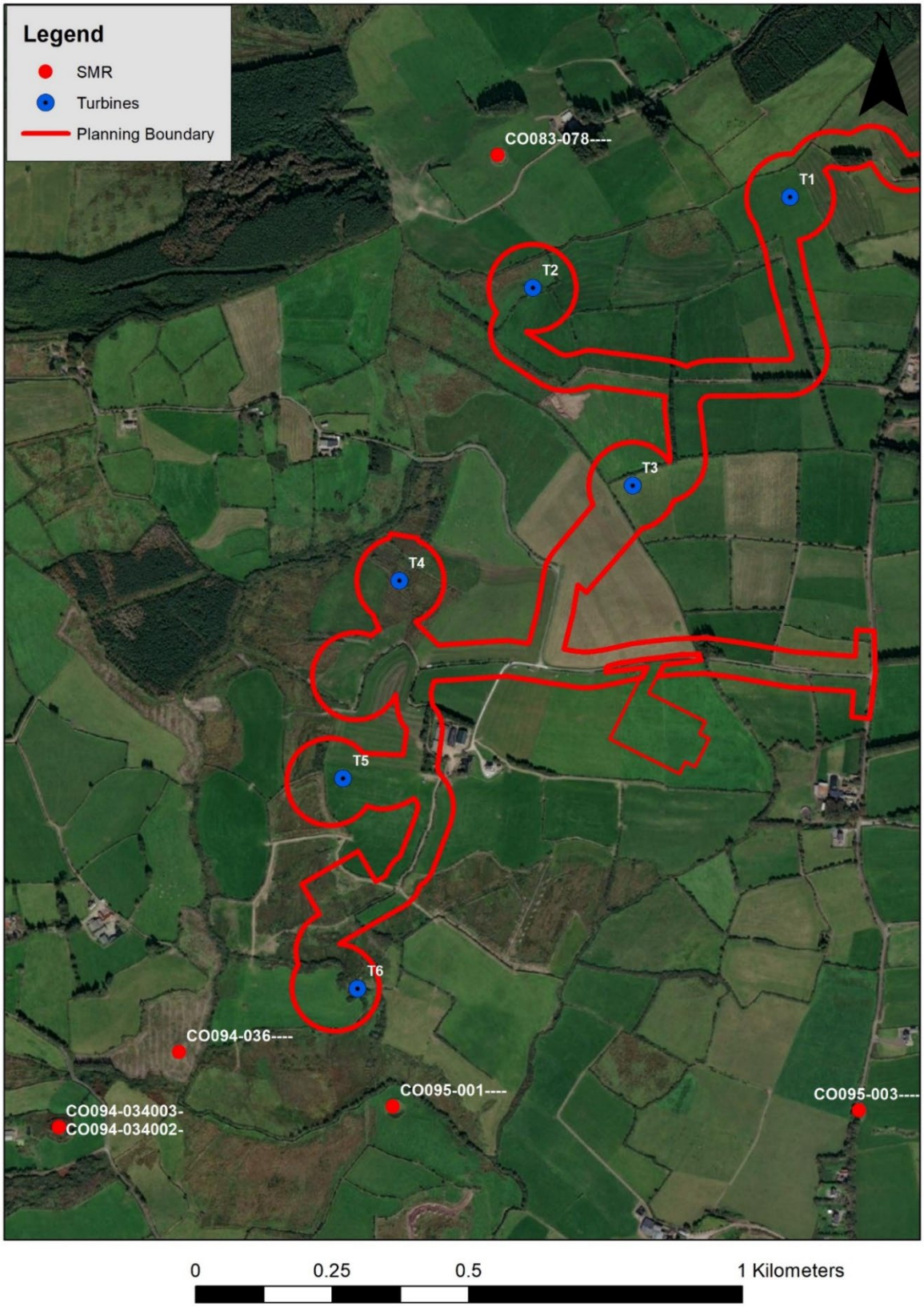


Figure 2-4: SMRs in the vicinity of the Proposed Development.

A detailed description of the existing site environment can be found in Chapter 2 of the EIAR.

The layout of the Proposed Wind Farm site is shown on Figure 1-2.

2.2 Proposed Substation

The Proposed Substation sits within the same study area as the Proposed Wind Farm, together considered 'The Proposed Development', and therefore is the subject of the same existing environment.

The Proposed Substation will be sited underneath the existing 110kv overhead line within an agricultural field, allowing for a loop-in loop-out connection to the existing grid network.

2.3 Alternative Grid Connection Route

A consented 38kV grid connection cable route between the permitted and constructed Carrigarierk Wind Farm and Proposed Development will be developed as an alternative should the proposed looped-in connection via the proposed onsite 110kV substation currently under consideration by An Bord Pleanála (PL04.308208) be refused consent and/or unviable at the time of development. In the event that the AGCR is developed, the proposed 110kv loop-in substation will not be developed.

The majority of the AGCR is located within the public road corridor.

Further details of the alternative grid connection route can be found in Section 3.1.

2.4 Turbine Delivery Route

Large components associated with the wind farm construction will be transported to the Site via the identified TDR. The point of arrival for the wind farm plant will be Cork Harbour. The TDR includes the following routes:

- Turn off the N22 national secondary road at Inchirahilly;
- R585 through Crookstown and Béal na Bláth;
- R585 / L6008 junction at Bengour West;
- Local road network through Lackereagh;
- Access junction and route through the Site.

The TDR is shown in Figure 1-3.

In some cases, accommodation works are required along the turbine delivery route such as hedge or tree cutting, relocation of powerlines/poles, lampposts, signage and local road widening. All accommodation works will be carried out in advance of the turbine deliveries in agreement with the landowner and local authority and subject to a road opening license as required.

A grant of permission by Cork County Council was received for road improvement works at the junction of the R585 and L6088 (CCC PL Ref. 14/6803) (enabling TDR works) to facilitate the delivery of turbine components to the site.

Further information on the proposed TDR and transport routes to the Proposed Wind Farm site can be found in Chapter 11 of the EIAR.

3. OVERVIEW OF CONSTRUCTION WORKS

3.1 Description of the Proposed Project

As outlined in Section 1.3, the Proposed Project is comprised of the following key elements:

- Proposed 6 no. turbine windfarm also referred to in this document as 'the Proposed Wind Farm' or 'the Site';
- Proposed 110kV substation within the site of the Proposed Wind Farm, also referred to as 'the Proposed Substation';
- Enabling works for the Turbine Delivery Route, also referred to in this report as 'Enabling TDR Works';
- Potential alternative grid connection, also referred to in this report as the 'the AGCR'.

A detailed description of each element of The Project is contained hereunder. Section 2 of Chapter 2 of the EIAR.

3.1.1 Proposed Wind Farm

The Proposed Wind Farm site layout is shown in Figure 1-2 and consists of the following:

- Erection of 6 no. wind turbines with a blade tip height of 131m, a hub height of 72.5m and a rotor diameter range of 117m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure;
- Construction of new access junction and improvement to the public road;
- All associated drainage and sediment control;
- 1 no. Temporary construction site compound and associated ancillary infrastructure including parking;
- Installation of underground medium voltage (20/33kV) and communication cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast with a height of 90m above ground level and associated access track;
- 1 no. borrow pit;
- All associated site development works.

Further details can be found in Chapter 2 of the EIAR.

3.1.2 Proposed Substation

The Proposed Substation location is shown on Figure 1-2 and consists of the following:

- Construction of 1 no. permanent onsite 110kV electrical substation to ESBN specifications including:
  - Control Building with welfare facilities;
  - Electrical infrastructure;
  - Parking;
  - Wastewater holding tank;
  - Rainwater harvesting;
  - Security fencing;
  - All associated infrastructure, services and site works.

The Proposed 110kV Substation sits within the same study area as the Proposed Wind Farm and will be sited underneath the existing 110kv overhead line within an agricultural field, allowing for a loop-in loop-out connection to the existing grid network.

Electricity generated from wind turbines shall be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which will follow on-site access tracks. Underground cables from each of the turbines will connect to a new permanent onsite electricity substation within the Proposed Wind Farm site. The location of the Proposed Substation is shown in Figure 1-2. The Proposed Substation will provide a connection point between the wind farm and the proposed grid connection point on the existing 110kV Macroom to Dunmanway overhead line through a looped-in connection The Proposed Substation will be situated beneath this line. No overhead lines or underground cables will therefore be required outside of the Proposed Wind Farm site, to connect this wind farm to the national grid, if this arrangement is progressed.

3.1.3 Alternative Grid Connection Route

The Alternative Grid Connection Route (AGCR) will consist of 38kV buried cable infrastructure in accordance with ESB Networks (ESBN) specifications.

The AGCR travels from the L8514-0 within the Proposed Wind Farm Site and follows the public road network for approximately 16.4km to location 523,095E 562,474N (ITM) before joining an existing forestry road in the townland of Gortatanavally (523,095E 562,474N). The cable route follows this forestry road for 240m and traverses approximately 280m of coniferous forestry to location 522,709E 562,203N (ITM). From here the cable route will be lain following a southwestern direction and connect into the Carrigarierk Wind Farm site infrastructure. The Carrigarierk Wind Farm will connect to the Carrickdangan 110kV substation, which in turn will connect to the Dunmanway ESB substation (CCC reference: 17/431; ABP reference: 301563-18).

This AGCR between the Proposed Wind Farm and connection point at Carrigarierk Wind Farm measures approximately 17.1 kilometres, and passes through the following townlands: Garranareagh, Barnadivane (Kneeves), Barnadivane, Reanacaheragh, Lisnacuddy, Teerelton, Deshure, Cooldorragha, Carrigboy, Coolaclevane, Dromleigh, Teeranassig, Clonmoyle, Gorteenadrolane, Haremont, Johnstown, Carrigdangan, Gortatanavally. This CEMP should be read in conjunction with the CEMP for the AGCR which has been prepared in support of the consented route pursuant to planning ref. Cork County Council Ref. 15/730 & An Bord Pleanála Ref. PL04.246353.

3.1.4 Turbine Delivery Route

The proposed Turbine Delivery Route (TDR) is presented in Figure 1-3.

Large components associated with the wind farm construction will be transported to the Site via the identified TDR. The point of arrival for the wind farm plant will be Cork Harbour. The TDR includes the following routes:

- Turn off the N22 national secondary road at Castlemore;
- R585 through Crookstown and Bealnablath;
- R585 / L6008 junction at Gortadinnaghboght;
- Local road network through Lackereagh;
- Access junction and route through the Site.

Enabling works associated with the TDR include consented temporary accommodation works to facilitate the delivery of turbine components (consented under CCC PL Ref. 14/6803).

Key elements of the temporary accommodation works for the delivery of turbines are summarised in Table 3-1 below. The general location of accommodation works are shown in Figure 3-1. The location and nature of proposed temporary accommodation works are summarised in Table 3.1 are described in further detail in Chapter 11.

Table 3-1: TDR Temporary Accommodation Works

Location	Location	Summary Description of Proposed Temporary Accommodation Works
3	Left turn at R585 / R590 junction at Crookstown	The temporary removal of existing street furniture and service cables. The possible temporary alteration of the footpath on the northern side of the R585. The temporary removal of all parking, including the area adjacent to the public house on the west side of the R585.
5	Series of bends in the R585	Some minor trimming of foliage will be required.
7	R585 / L6008 junction at Gortadinnaghboght	Enabling TDR works required to accommodate the turbine vehicles was granted at this location by Cork County Council as part of PL Ref. 14/6803. It is proposed that these vehicles will cut the corner through existing Coillte lands
9	Left turn off the L6008 at Lackereagh.	The existing geometry at this location will not accommodate the wind turbine design vehicles. It is proposed that these vehicles will cut the south west corner of the junction at a location within the development red line boundary.
10	Access into site at Lackareagh	The proposed access into the site involves the construction of a new access route heading in a western direction, while the existing road heads south. STOP junction markings and a stop sign will be implemented at the junction in accordance with Figure 7.35 of the Traffic Signs Manual.

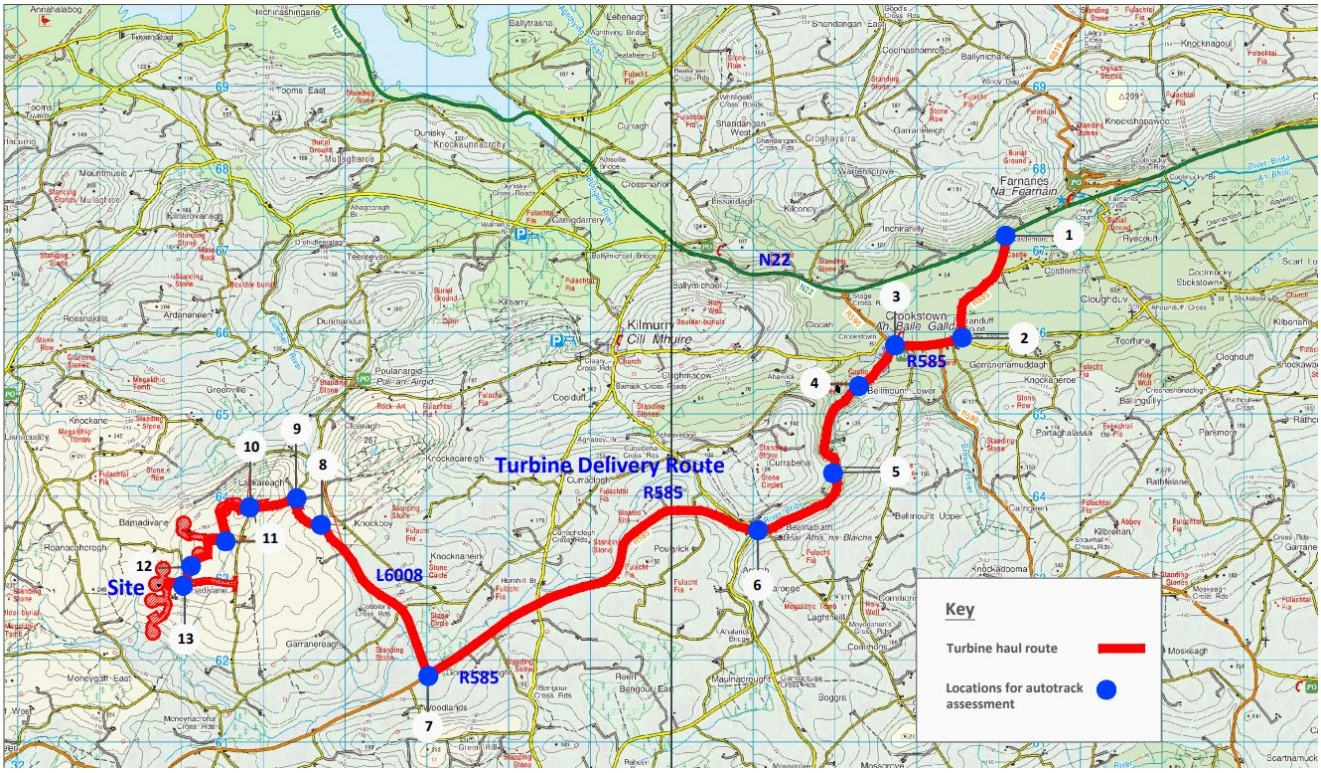


Figure 3-1: Turbine delivery route assessment location plan

3.2 Construction Period

The construction of the project in its entirety is expected to take between 12 - 18 months. The proposed construction programme upon which assessments in the EIAR have been based is presented in Figure 3-2 below.

Activity	Month																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Mobilisation and site setup																		
Site clearance																		
Internal access tracks																		
Turbine hard standings																		
Turbine foundations																		
TDR accommodation works																		
Turbine Installation																		
Onsite substation																		
Grid connection cable works																		
Private electrical network																		
Landscaping, reinstatement, demobilisation																		

Figure 3-2: Proposed Construction Programme

3.3 Overview of the Construction Sequence

The construction of a wind farm project is a major infrastructural project. The construction of this project will involve many inter-related, inter-dependent and overlapping elements of a complex nature.

The following section outlines the construction methodology for the proposed project. Upon mobilisation for the construction of the development, peat excavation (where required), upgrading of existing site tracks, felling and the provision of new site tracks will precede all other activities. Drainage infrastructure will be constructed in parallel with the track construction. This will be followed by the construction of the turbine foundations and the provision of the hardstanding areas. In parallel with these works the on-site electrical works; sub-station and internal cable network are constructed. The proposed grid connection cable route works will commence following the completion of the proposed on-site wind farm works.

3.3.1 Overview of the Construction Methodology

Method statements are presented below for the key elements of the construction process. The contractor for the main construction works will, following appointment, take ownership, expand upon and generally develop these method statements appropriately for the construction stage.

The proposed construction methodology is summarised under the following headings:

- Site Entrances
- Temporary Site Compounds
- Concrete Washout and Wheel Washing
- New Site Access Tracks
- Upgrade of Existing Internal Access Tracks
- Internal Wind Farm Cabling Works
- Drainage and Watercourse Crossings
- Borrow Pit Construction
- Turbine Hardstands
- Turbine Foundations
- Turbine Erection
- Substation Compound
- Electrical Works

3.3.1.1 Site Entrances

The site access point has been selected with consideration for safety of public road users and construction staff and to ensure it can be constructed to comply with the requirements of both Cork County Council and TII design requirements for direct accesses.

Site entrance designs and minimum visibility splays shall be provided for the construction and operation of the Proposed Wind Farm in accordance with the requirements of the local roads authority. Visibility splays are shown in planning application drawings.

The site entrance will be constructed using the same methodology as the construction of the wind farm tracks as described in section 3.3.1.4.

The site is accessed by the local road Amharcóir Bóithre Poiblí (L6007) road and is situated approximately 500m west of the local L6008 Road at its eastern boundary, 1.5kms north of the R585 Regional Road at its southern boundary and approximately 7 km west of Crookstown and the N22 National Road. The location of the access point is shown in Figure 3-3.

Access Point: The proposed access into the site is shown in Figure 11.24 of Chapter 11 and involves the construction of a new access route heading in a western direction, while the existing road heads south. STOP junction markings and a stop sign will be implemented at the junction in accordance with Figure 7.35 of the Traffic Signs Manual. The swept path requirements of the design vehicles are shown for the blade and tower transporters in Figures 11.25 and 11.26 of Chapter 11 respectively.

Figure 3-3: Access into Site at Lackareagh from the L-6007

3.3.1.2 Temporary Site Compounds

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. The location of the proposed temporary site compound is shown on Figure 1-2 close to the proposed turbine, T3.

Temporary compounds shall be aggregate hard standings surrounded by security fencing, located as shown on the accompanying drawings. On completion of the construction phase, the temporary compounds will be dismantled, the hardstanding will be left in situ and covered over with soil which will be allowed to revegetate naturally. Part of the southern compound will be kept as a carpark for the recreation trail.

Facilities to be provided in the temporary site compounds will include the following:

- site offices, of Portacabin type construction
- portaloos
- bottled water for potable supply
- a water tanker to supply water used for other purposes
- canteen facilities
- storage areas
- employee parking
- bunded fuel storage
- contractor lock-up facility
- diesel generator
- waste management areas

The temporary compound is shown on planning drawing P21-143-0100-0002 and will typically be constructed as follows:

- The area to be used as compounds will be marked out at the corners using ranging rods or timber posts;
- All drainage measures prescribed in the detailed drainage design for the Proposed Development will be implemented around the works area;
- The compounds will be established using a similar technique as the construction of the new access tracks as discussed in Section 3.3.1.4 below;
- Where required, a layer of geogrid will be installed and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.;
- If necessary, the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged;
- Upon completion of the Proposed Development the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with overburden material as required;
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor as required and will be removed from the site on completion of the construction phase; and
- The water supply to the site will be from a temporary water storage tank which will be filled using a mobile water tank which will source water locally as required.

3.3.1.3 Concrete Washout Area and Wheel Washing

No concrete wash out is permitted on the site. During construction concrete and wet concrete will be kept out of all watercourses and drains. Concrete washout of chutes only will be permitted onsite and designated lined area greater than 50m from a stream. The permitted locations on site for concrete washout of chutes shall be at turbine hard standings and the site compound.

A wheel wash will be provided at each of the site entrances draining to silt traps to avoid any silt laden run-off flowing on to the public road and entering roadside drains. An additional water tank will be provided at each wheel wash. These units will be self-contained, with waste removed from site by a licensed waste disposal company. Additional silt fencing will be kept on site in case of an emergency break out of silt laden run-off.

3.3.1.4 New Site Access Tracks

Drainage runs and associated settlement ponds will be installed. All site tracks have been designed taking account of the loadings required by the turbine manufacturer and will consist of a compacted stone structure. Material for the sub-base and base course of the road may be sourced from the borrow pit within the site. The Spoil Management Plan (see Appendix 6.1) estimates that 9,696m^3 of usable rock can be excavated from the borrow pit. Additional crushed rock for construction will be imported from local, authorised quarries. Imported crushed rock will be required for material such as 6F2 (capping), 6N1 (Fill to structures) and 6N2 (fill below structures). Some material for road construction may be imported or transported from one section of the site to another. All delivery truck movements between sites and from external sources will follow predefined haul routes as agreed with local authorities. A potential licensed quarry that would minimise the impact on the road network for the transportation of concrete and stone is the Kilmichael Quarry located approximately 5km to the west of the site.

Approximately 2.4km of new site access tracks are proposed at the development site. All access tracks will be a minimum of 6m wide along straight sections but wider at bends as required. All tracks on the site will be constructed using the traditional road construction method from suitable load bearing strata. This system will consist of either one or two layers of stone depending on the load bearing capacity of base layer. Where the underlying layer is mineral subsoil, two layers of stone are used; a stone capping layer and running layer. In areas where the load bearing layer is rock, the capping layer is omitted, and the running layer is installed directly onto the rock surface.

Track construction details are as follows:

- Establish alignment of the new site tracks from the construction drawings and mark out the centrelines with ranging rods or timber posts.
- The access tracks will be of single-track design with a minimum width of 6m. There will be some local widening on the bends, junctions and around Turbine Foundations for the safe passage of large vehicles. All bends have been designed to suit the requirements of the delivery vehicles.
- All machinery shall work within designated construction areas indicated on the contract drawings.
- All access for construction vehicles within the site shall follow the proposed internal access tracks as shown in Figure 1-2.
- Topsoil/subsoil will be stripped back to required levels. All material will be bunded and stored separately. Appendix 6.1 contains a Spoil Management Plan which details the storage and movement of materials on site.
- The soil will be excavated down to a suitable formation layer of either firm subsoil or rock.
- The formation will be prepared to receive the geotextile membrane.
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Site Manager based on the characteristics of the material and the compaction plant to be used.
- Batters will have a slope of between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species.

3.3.1.5 Upgrade of Existing Internal Access Tracks

It is proposed to upgrade approximately 1.4 km of existing agricultural tracks. All access tracks will be widened to 6m wide along straight sections and wider at bends as required. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks.

The upgrade of existing internal access tracks shall be carried out as follows:

- Establish extent of the widened site tracks from the construction drawings and mark out the finished centrelines with ranging rods or timber posts.
- Existing track drainage will be maintained and upgraded where necessary. Existing drainage channels within the footprint of the widened portion of access track shall be re-aligned or replaced in parallel with the track construction.
- The existing track shall be scraped to ensure suitable baring stratum for new track construction above. Soft spots and particularly damaged sections of existing track shall be removed and replaced with suitable fill material in accordance with the design.
- Subbase associated with the new widened section of access track shall be 'benched' into the existing track construction in accordance with the design.
- Geotextile membrane shall be placed on the surface of the existing track and new formation.

The remaining outline construction methodology shall follow the same steps as for new access tracks above.

Refer to 0300 series planning drawings for typical track dimensions.

3.3.1.6 Wind Farm Electrical Cabling Works – Internal

This section provides details on the outline construction methodology associated with the construction of internal private network electrical and communications cabling between the proposed wind turbines and proposed onsite substation. The specification for cable trenches will vary slightly depending on cable voltage, location and existing land use.

All electrical and fibre-optic cabling on site between the wind turbines and the substation building will be buried in trenches approximately 0.6m wide by 1m deep located within or directly adjacent to the internal tracks.

Some cables will be buried directly and some will be ducted. Direct buried cables will be used in non-load bearing areas and ducts will be used in load bearing areas.

For direct buried cables, the following outline methodology shall apply:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with environmental management plan outlined in Section 4 of this CEMP.
- The line of the cable trench will run beside the site access tracks until it exits to the public road.
- The ground will be excavated using a mechanical digger. The top layer of soil will be removed and placed to one side. It will be used for landscaping the top of the backfilled cable trench following the laying of the cables. The remaining subsoil, excavated to the required depth, will be placed separately and used as backfill for the trench.

- Safe ladder access/egress to trenches will be provided into the trench.
- The cables will be laid directly onto a bed of suitable material, free from sharp stones and debris*.
- A suitable material will be placed over the top of the cables to protect them during backfilling*.
- Warning tape, marker board and plates will be installed by hand in accordance with the trench design and ESBN specifications and the engineer's design.
- On completion, the ground will be reinstated, and marker posts will be positioned at agreed centres to the side of the trench highlighting the presence of cables below.
- Trenches will vary in width depending on the number and size of cables in the circuit. Where there is more than one set of cables they will be separated as per cable manufacturers, electrical designers and ESB/EirGrid requirements.

Where ducting is required within the wind farm site (i.e. for areas where cables will be laid under access tracks or other loaded surfaces), suitable ducting will be required to protect the cables. In this scenario, tasks marked by an asterisk (*) in the above methodology will be replaced by the following steps:

- Ducts will be placed into the trench manually, having been delivered to roadside embankment/verge by tractor and pipe trailer and then offloaded by hand.
- Approved bedding material will be used to surround the ducts. It will be delivered straight from a concrete truck or by skid steer along the route.
- Approved fill material will be compacted above and below the power cable ducting as per the engineer's design.
- Exposed duct ends will be capped.
- A 12mm Draw rope will be blown through the ducting at later date.
- Small jointing pit will be located along the route of the trench which will be left open until jointing takes place. A protective handrail/ barrier will be placed around each pit for health and safety reasons.
- Once the cables are joined and sealed the jointing container will be removed and the cables at the joint-bay locations will be back-filled in the same manner as the rest of the cable trench.
- The cables will connect the turbines to the substation. Ducts will be cast into each turbine foundation to provide access for the cables Likewise, at the substation, ducts will be cast through the building foundation to provide access for the cables.
- There are no existing buried services expected within the site however the appointed contractor will be responsible for carrying out pre-construction surveys ahead of construction.
- Prior to commencement of the works, records of services such as watermains, sewers, gas mains and other power cables will be obtained from the relevant service providers. Cable detection tools, ground penetrating radar and slit trenches will be used, as appropriate, to find the exact locations of existing services. The final locations of the cable trenches will be selected to minimise conflicts with other services.
- Trenches where ducts are laid will be back filled every evening. During excavation works signage will be erected at each location warning of the dangers.

3.3.1.7 Wind Farm Electrical Cabling Works – Public Road

This section provides details on the outline construction methodology associated with the construction of internal private network electrical and communications cabling between the proposed wind turbines and proposed onsite substation which are located within the public road corridor.

The proposed cable route is shown on Figure 1-4 and described in Section 2.3.

- All existing underground services shall be confirmed on site prior to the commencement of construction works.
- Traffic management measures will be implemented in accordance with those included in a Traffic Management Plan which will be prepared and agreed with the Local Authority. A TMP is included in this CEMP, in section 4.
- The excavated trench will be approximately 600 mm in width and approximately 1,200 mm deep both within the public road network and within private lands.
- The base of the excavated trench will be lined with sand bedding to be imported to site from a local licensed supplier. The 110mm diameter HDPE cable ducting will be placed into the prepared trench, inspected and backfilled.
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles

  will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager

  and Project Ecological Clerk of Works (ECoW).
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site.
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement.
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature.
- No more than a 100m section of trench will be opened at any one time. The second 100 metres will only be excavated once the majority of reinstatement has been completed on the first.
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section.
- Where required, grass will be reinstated by either seeding or by replacing with grass turves.
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together.
- Following the installation of ducting, cabling pulling shall take place at a later date.

Typical trench details are shown on 0300 Series planning application drawings and in Figure 3-4 below.

Figure 3-4: Typical 38kV Underground Duct Installation

Installation of Joint Bays and Link Box Chambers

- Joints Bays are to be provided along the UGC routes to facilitate the jointing of cables. 38kV Joint Bays are approximately 2 m x 4.5 m x 1.5 m pre-cast concrete structures installed below the finished ground level.
- Setting out and location of services will be carried out in the same manner as for trench excavations.
- Traffic management to be set up as per the construction stage traffic management plan, a TMP is included in Section 4 of this CEMP.
- A tracked excavator will be used for the excavation of the joint bay pits in accordance with detailed design drawings.
- A Tractor/dump trailer and/or tipper truck shall be used to remove excavated spoil from the work area. Spoil shall be removed to a licensed waste facility.
- A watchman will be used to assist machine operators while reversing or when their visibility is restricted.
- Where joint bays are located, the excavation shall be adequately protected with fencing with signage erected, warning of deep excavation.
- Safe ladder access/egress to excavation shall be in place. The ladder will be footed at the base and tied at the top.
- Base materials will be placed by the excavator from a truck and placed in the base of the excavation.

- Precast chamber sections will arrive on site via articulated lorries accompanied by a crane truck. The crane truck will load each unit separately from the articulated truck.
- The precast units will be transported to site and a flatbed trailer, and a truck mounted crane will lift the section into position.
- A lift plan /DJSP will be required for all Joint Bay installations.
- When the joint bays are in place, the sections will be back filled using approved fill material. The road surface will be reinstated using cold tar/surface dressing.
- Unauthorised access will be monitored and prevented.

Typical details for Joint Bays and Link Box Chambers are shown on 0300 Series planning application drawings and Figures 3-5 and 3-6 below.

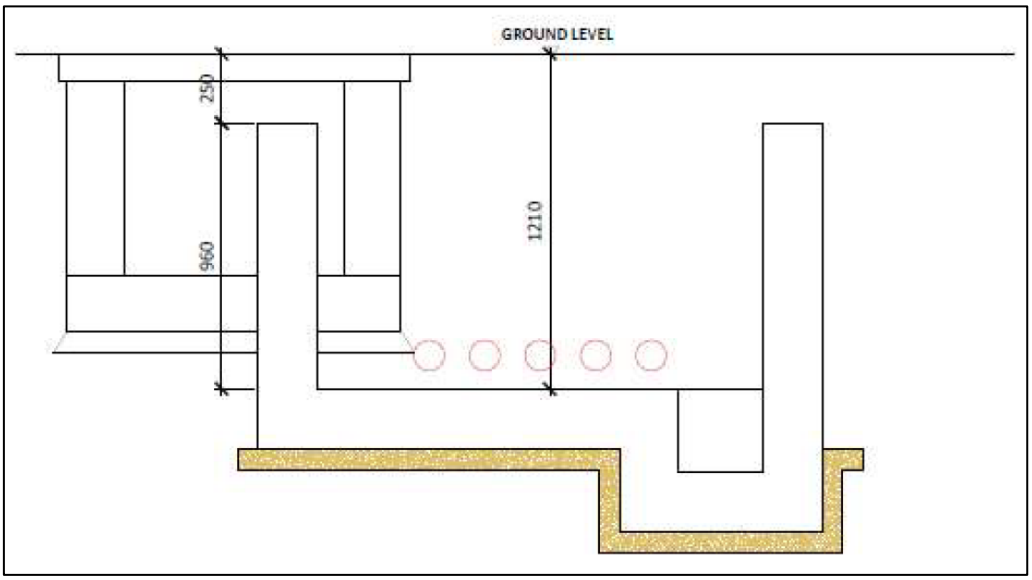


Figure 3-5: Typical Section through Joint Bay and Link Box

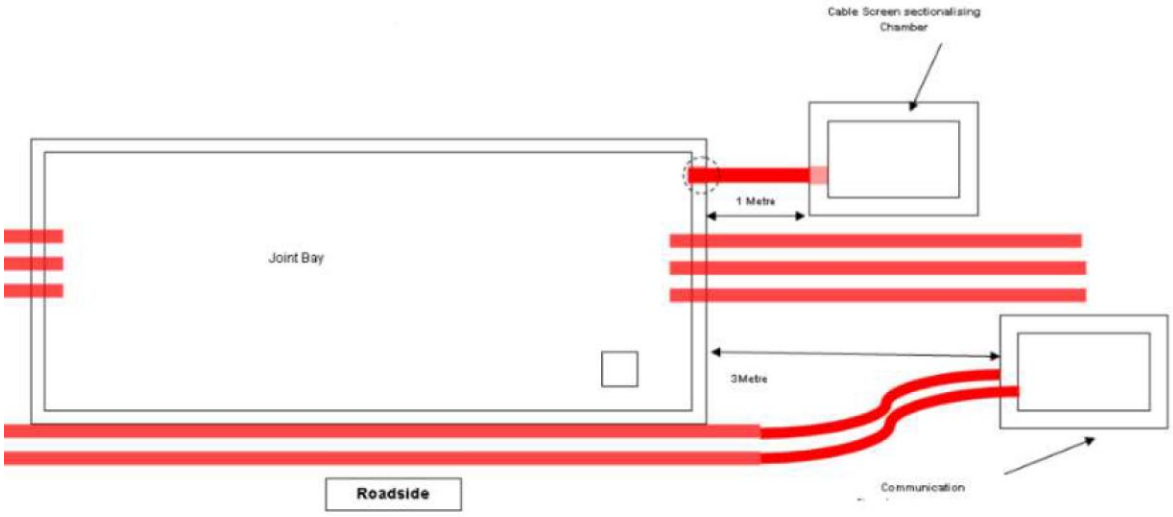


Figure 3-6: Typical Joint Bay and Link Box Plan Details

3.3.1.8 Alternative Grid Connection Route Cabling Works

The construction of the Alternative Grid Connection Route (AGCR) shall be carried out in accordance with Section 2.3.2 of the CEMP for Carrigarierk Wind Farm contained in Appendix 2.

3.3.1.9 Drainage and Watercourse Crossings

A surface water management plan has been prepared. It can be found in Appendix 7.3 of the EIAR. it contains methodology for drainage, water quality management and silt control. The measures contained within the plan will be applied when constructing the watercourse crossings.

No new stream crossings required as a result of the wind farm development.

Drainage design and details can be found on the 0100 and 0501 series planning application drawings.

3.3.1.10 Borrow Pit Construction

A rock outcrop was identified within the southern part of the site, close to Turbine 6 and this area has been selected for a proposed borrow pit location. The exposed rock is considered suitable for the excavation of material for the construction of the wind farm access tracks and hardstanding areas. The presence of shallow rock and thin soil cover contributes to the suitability of this location. The location of the proposed borrow pit is shown on Figure 1-2.

The borrow pit will be developed as follows:

- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the environmental management plan outlined in Section 4 of this CEMP.
- The access tracks will be prepared to the borrow pit locations in line with the methodology described in Section 3.3.1.4
- The extent of the works areas shall be accurately delineated using stakes and rope to prevent works being carried out outside the agreed areas.
- Stock proof fencing shall be installed around the borrow pit in advance of any works taking place.
- A bespoke method statement shall be drawn up by the contractor for the main construction works shortly before the works take place.
- After drainage and temporary dewatering infrastructure has been put in place, the main excavation works will commence by stripping the topsoil material.
- Topsoil will be stockpiled to be used for reinstatement of the borrow pit and used for local landscaping of the wind farm site.
- Excavation works will be carried out by the following means at the borrow pit:
    - Conventional excavators (using buckets) to excavate and load dumper trucks.
    - Rippers mounted on conventional excavators to ‘rip’ the rock where appropriate.
    - Rock breakers (where required)
- Excavated material will be processed by mechanical crusher and screened as necessary.
- Excavated rock will be loaded onto dumper trucks and transported to the required area for tipping and placement e.g. when building the access tracks.

- When the borrow pit have been exploited, they shall be closed and reinstated using surplus mineral soil or rock excavated from elsewhere on the site as described in accordance with an approved project reinstatement plan.
- The borrow pit, once reinstated, shall be covered with topsoil and allowed to re-vegetate naturally. However, appropriate measures will be taken if it is found that natural re-vegetation is too slow or if the area is being taken over by inappropriate species.
- Noise, dust and site drainage mitigation measures shall be implemented as described in the environmental management plan in Section 4 of this CEMP.

To monitor groundwater during the construction phase groundwater monitoring wells will be installed between areas of deeper excavations and sensitive groundwater receptors. The wells will be used to monitoring groundwater levels and quality to assess any potential impacts during the construction works.

The borrow pit is shown on planning drawing P21-143-0100-0003

3.3.1.11 Turbine Hardstands

A turbine hardstanding area will be constructed at the base of each turbine to provide a solid area for the main installation crane that will be used to erect the turbine and for the assembly of the turbine. This area will accommodate a main crane and an assist crane during the assembly of the turbine, as well as during occasional maintenance during the operation of the Proposed Wind Farm. The area of the hardstanding provided is deemed suitable for the assembly of a turbine with the proposed dimensions. The hardstanding areas will measure approximately 45m x 35m on plan, with blade fingers and tailing pad area.

The stone required for the construction of the turbine hardstanding areas will be sourced from the onsite borrow pit and/or licenced quarry in the vicinity of the wind farm site. One potential quarry that would minimise the impact on the road network for the transportation of concrete and stone is the Kilmichael Quarry located approximately 5km to the west of the site. This is discussed further in Chapter 11 - Traffic and Transportation of the EIAR.

Hard standing formation will consist of a minimum 500mm hardcore on geo-textile membrane. The construction methodology for newly constructed hardstandings will be the same as that for new site access tracks described in Section 3.3.1.4.

Hard standing drainage shall be installed in accordance with the drainage layout shown in planning application 0100-Series drawings and in line with the Surface Water Management Plan.

Surplus topsoil will be placed along the side of the hard standing and dressed to blend in with surrounding landscaping. Surplus excavated subsoil will be used for reinstatement throughout the wind farm site.

3.3.1.12 Turbine Foundations

The wind turbine foundations will be constructed using standard reinforced concrete construction techniques and will be designed as standard shallow foundations.

Turbine foundations will be designed to Eurocode Standards. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design regulations.

The turbine will be anchored to the foundation as per the turbine manufacturer's guidelines which will be incorporated in the civil foundation design.

The base of the foundations are excavated to competent bearing strata. Based on site investigations carried out to date, it is expected that turbines for the Proposed Wind Farm will have foundation depths of 3m and a base diameter of 22m.

Excavated soil will be placed in the temporary storage areas adjacent to the turbines in accordance with the Spoil Management Plan contained within Chapter 6 in Appendix 6.1 of the EIAR. Proposed spoil deposition areas are identified in the Spoil Management Plan.

Formwork and reinforcement are placed, and the concrete poured. Once the concrete is set the earthing system is put in place and the foundation is backfilled with suitable material.

The turbine foundations will be constructed as follows:

Standard Excavated Reinforced Concrete Base:

a) The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.
b) The excavated material will be stored at agreed locations close to the base. Topsoil and subsoil stockpiles will be formed, and the side compacted to prevent silt run off during heavy rain or air bourn dust during dry periods. The subsoil material will be used as backfill and the topsoil will be used for landscaping around the finished turbine post construction.
c) No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.
d) Around the perimeter of the foundation formation a shallow drain will be formed to catch ground water entering the excavation. The drain will direct the water to a sump if required where it will be pumped out to a settlement pond away from the excavation.
e) A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. If required, geogrid and soil replacement will be laid according to the foundation design, followed by placement of the concrete blinding layer.
f) If soil replacement is required, the aggregate used must be tested and approved by the project geotechnical engineer.
g) High tensile steel reinforcement will be fixed in accordance with the designer's drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools.
h) Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required.
i) The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base.
j) Concrete will be placed using a concrete pump and compacted using vibrating pokers to the levels and profile indicated on the construction drawings.
k) Upon completion of the concreting works the foundation base will be covered from the elements that could cause hydration cracking and/or delay setting in any way.
l) Steel shutters will be used to pour the upper plinth section.

m) The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the top-soil set-aside during the excavation. The suitability of backfill material is to be approved by the project geotechnical engineer.

n) A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance.

3.3.1.13 Turbine Erection

Once the turbine components arrive on site they will be placed on the hardstand and lay down areas prior to assembly. The towers will be delivered in sections and each blade will be delivered in a separate delivery. Once there is a suitable weather window the turbine will be assembled.

It is anticipated that each turbine will take approximately 3 to 4 days to erect (depending on the weather), requiring two cranes. Finally, the turbines will be commissioned and tested.

It is expected that the entire construction phase, including civil, electrical and grid works, and turbine assembly will take between approximately 12 – 18 months.

3.3.1.14 Substation Compound

The compound surrounding the substation will measure approximately 163m x 106m as shown in 0101-Series planning application drawings. This will provide a connection point between the wind farm and the proposed grid connection point to the existing 110kV Macroom to Dunmanway overhead line.

The building's main function is to provide housing for switchgear, control equipment and monitoring equipment necessary for the proper functioning of the substation and wind farm. The building will be constructed by the following methodology:

- The area of the control buildings and compound will be marked out using ranging rods or wooden posts and the vegetable soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practises.
- Drainage runs and associated settlement ponds will be installed.
- The dimensions of the Building and Compound area will be set to meet the requirements of EirGrid and the necessary equipment to safely and efficiently operate the wind farm.
- The foundations will be excavated down to the level indicated by the designer and concreted.
- The blockwork walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.
- The blockwork will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation.
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane.
- The wooden roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.

The remainder of the substation compound will be brought up to the agreed formation and approved stone imported and graded to the correct level as per the detail design and constructed using the same methodology as the construction of the wind farm tracks as described in section 3.3.1.4.

Equipment plinths will be marked out, excavated and constructed using in-situ reinforced concrete or pre-cast concrete. Provision will be made in each plinth for earth connection.

Following the construction of the equipment plinths an earth mat will be installed throughout the compound. This will be connected to each plinth and the buildings as per the electrical earth protection design.

3.3.1.15 Electrical Works

Substation Fit Out and Switchgear Installation

The substations will have a domestic electrical system including lights, sockets, fire alarm and intruder alarm. The high voltage switchgear for the wind farm is installed through the following method.

- The switchboard units are delivered to site on a truck and unloaded using a forklift, front end loader or HIAB crane.
- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works.
- The switchgear will be unloaded on to a concrete plinth directly outside the substation building.
- The units will be moved inside the substation building using a hand driven forklift and positioned over the internal trench supports, prepared previously.
- The switchgear is then secured as per manufacturer's instructions, typically by bolting directly to steel support bars over the trench.
- The building is fitted out with small light and power and ancillary wind farm control equipment such as SCADA computer, remote telemetry units, metering etc.
- All equipment and fittings are then connected, wired tested and commissioned in accordance with the Electrical Contractor's commissioning plan.

Transformers

- The turbine transformers will be placed directly onto the turbine foundation upon delivery to site, prior to the installation of the turbine towers.
- The transformers will be of the sealed type and will be inspected for any damage prior to offloading. It is likely that the units will be installed using a small mobile all-terrain crane and will be tested, commissioned and energised by suitably trained and authorised persons.
- The accessible sections of the transformer will be protected within an enclosure which shall be locked at all times and displaying appropriate warning signs.
- Transformers and ancillary plinth-mounted equipment required in the substation compound will be delivered to site and unloaded directly in place by HIAB crane or similar.
- Suitable task specific RAMS and lifting plans will be in place prior to the commencement of all works.

3.4 Construction Working Hours

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 hours on Saturdays.

It should be noted that it will be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process. Foundation pours will likely extend beyond normal working hours also. Turbine component deliveries will be caried out at night. Consultation will be carried out with the local community in advance of out of hours working. Additional emergency works may also be required outside of normal working hours as quoted above which will be notified to the planning authority. Work on Sundays or public holidays will only be conducted in exceptional circumstances and subject to prior consultation and notification insofar as possible with the local community.

With respect to the delivery of abnormal loads associated with turbine components, it is now common practice that deliveries of the abnormally sized loads are made during night time hours when impacts to the existing traffic is significantly reduced. Abnormal loads will require an abnormal load permit prior to delivery and will be delivered mostly at night time as agreed with local authority and An Garda Siochána. More details on the management of loads associated with the construction of the project can be found in the Traffic Management Plan in Section 4.3.8.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 Introduction

This plan should be read in conjunction with the EIAR and in conjunction with the CEMP for other elements of the project including the Alternative Grid Route CEMP which has been prepared in support of the consented route pursuant to planning ref. Cork County Council Ref. 15/730 & An Bord Pleanála Ref. PL04.246353..

This Environmental Management Plan (EMP) defines the work practices, environmental management procedures and management responsibilities relating to the construction of the proposed Barnadivane Wind Farm and Substation.

This EMP describes how the Contractor for the main construction works will implement a site Environmental Management System (EMS) on this project to meet the specified contractual, regulatory and statutory requirements and identified mitigation measures. This plan will be further developed and expanded following the grant of planning permission and appointment of the Contractor for the main construction works. Please note that some items in this plan can only be finalised with appropriate input from the Contractor who will carry out the main construction works and once the planning conditions are known. It is the Contractor's responsibility to implement an effective environmental management system to ensure that environmental requirements for the construction of this project are met.

All site personnel will be required to be familiar with the environmental management plan's requirements as related to their role on site. The plan describes the project organisation, sets out the environmental procedures that will be adopted on site and outlines the key performance indicators for the site.

- The EMP is a controlled document and will be reviewed and revised as necessary.
- A copy of the EMP will be located on the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the EMP and its contents.

This section includes the mitigation measures to be employed by the contractor and client during each phase of the Proposed Project as per the EIAR and NIS.

4.2 Project Obligations

In the construction of the proposed Barnadivane Wind Farm there are a number of environmental management obligations on the developer and the contractor. As well as statutory obligations, there are several specific obligations set out in the EIAR and NIS. The final CEMP which will be produced by the main contractor following appointment will incorporate these obligations. The contractor and all of its sub-contractors will be fully aware of and in compliance with these environmental obligations.

4.2.1 EIA/NIS Obligations

The EIAR and NIS identified mitigation measures that will be put in place to mitigate the potential environmental impacts arising from construction of the project. Measures identified in the EIAR and NIS are detailed in this CEMP. The CEMP should be read in conjunction with the EIAR and NIS. In the case of any ambiguity or contradiction between this CEMP and the EIAR and NIS, the EIAR and NIS shall take precedence.

4.2.2 Planning Permission Obligations

All planning conditions associated with the project's planning permission shall be adhered to. All pre-commencement planning conditions shall be discharged fully by the project owner prior to site start.

4.2.3 Other Obligations

The developer and/or contractor for the main construction works will liaise directly with the County Council and An Garda Síochána in relation to securing any necessary permits to allow the works to take place including for example (non-exhaustive list):

1. Commencement notice
2. Special Permits in relation to oversized vehicles on public roads.
3. Temporary Road Closures (if required)
4. Road Opening Licence.

The developer will also liaise closely with the local residents, especially homeowners and landowners along the local access routes in relation to works and all reasonable steps will be taken to minimise the impact of the development on such persons. A traffic management plan is included in section 4.3.8.

4.3 Environmental Management Programme

4.3.1 Dust Management Plan

This Dust Management Plan (DMP) outlines the sources of dust during the works, identifies measures to minimise dust during the works and the complaints procedure for dust.

Construction stage mitigation measures to minimise dust and emissions are as follows:

- Construction vehicles and machinery will be serviced and in good working order;
- Receptors which receive dusting and soiling on the haul routes, entering the site; and dwellings directly adjacent to the grid connection route that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be minimised through regular servicing of machinery.

4.3.1.1 Dust generation and control

The proposed works associated with the Proposed Project that have the potential to cause dust include:

- Site clearance activities
- Soil excavations
- Movement of dump trucks containing soils/subsoils within the site
- Stockpiling of soils.

The following dust control measures will be put in place during construction and decommissioning works:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with high quality graded aggregate;
- A water bowser will be available to spray work areas and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits, which shall be reduced in periods of dry, windy weather;
- Wheel washing facilities will be provided at the two main entrance/exit points of the Proposed Project site.

Complaints Procedure

At the main site entrance, the contact details for the site will be available so that local residents are encouraged to contact the site in the event of an off-site dust impact.

The contractor on site will need to be immediately informed of the incident so that fugitive dust complaints can be substantiated.

In all instances, a complaint will be logged by the environmental manager and each complaint will be assigned a discrete complaint number in the Environmental Log.

The environmental manager will maintain the complaints register and any complaints received will be investigated and the dust suppression methods employed will be reviewed. Suitable remedial action will be undertaken as necessary.

4.3.2 Noise and Vibration

The predicted noise levels from on-site activity from the Proposed Project is below the noise limits in BS 5228-1:2009+A1:2014. Nonetheless, several mitigation measures will be employed to minimise any potential impacts from the proposed project.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays and public holidays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required but this would be necessary only on a relatively small number of occasions. It will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling during turbine deliveries. Local residents and the local authority will be consulted in advance of any activities likely to occur outside of normal working hours.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014. Proper maintenance of plant will be employed to minimise the noise produced by any site operations.

All vehicles and mechanical plant will be fitted with effective exhaust silencers. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity has been described in section 3.4.

The on-site construction noise levels will be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant.

4.3.3 Biodiversity / Flora and Fauna Management

4.3.3.1 Objectives

The primary objectives of biodiversity / flora and fauna management over the construction, operation and decommissioning phases of the project are as follows:

- Promote the conservation of habitats on site through the establishment of management and/or mitigation;
- Provide management and mitigation for aquatic habitats and water quality;
- Provide management and mitigation for avifauna;
- Provide management and mitigation for bats and terrestrial mammals;
- Monitor the usage of the wind farm site by birds post construction;
- Monitor for any collision by birds at the wind farm site post construction;
- Monitor for any collision by bats at the wind farm site post construction.

For mitigation measures associated with the protection of terrestrial ecology please refer to the Schedule of Mitigation Measures located in Appendix 1.

In addition to the above mitigation measures from the EIAR, the mitigation measures prescribed in the Natura Impact Statement (NIS) and the Invasive Species Management Plan (ISMP) carried out for the project will be implemented in full.

For mitigation measures associated with the NIS please refer to Appendix 5.6 and for mitigation measures associated with the Invasive Species Management Plan (ISMP) please refer to Appendix 5.8.

4.3.4 Spoil Management Plan

The Spoil Management Plan can be found in Appendix 6.1. All excavated material will be re-used within the site where possible, minimising the need for removal of any materials for off-site disposal. This will minimise the amount of construction traffic on local roads. This will in turn lead to the reduction of noise and dust associated with construction traffic.

There is one proposed borrow pit within the site that will provide general fill for construction. Where aggregate (structural fill) of a suitable quality required for construction cannot be sourced from the onsite borrow pit it shall be imported from a licensed quarry.

Daily Preparation during the Implementation of the Spoil Management Plan

The Geotechnical Engineer appointed by the contractor should conduct regular meetings with the Construction Management Team to discuss the phasing of spoil management as the work progresses.

Particular regard will be taken of daily weather conditions and long-range forecasts. The Geotechnical Engineer should have the authority to suspend the works if weather conditions are deemed too extreme for the effective protection of earthworks, excavations and slope stability.

Construction Stage Mitigation Measures

Earthworks

The project will be constructed in a phased manner within a 12 – 18 month period, as described in Chapter 2, to reduce the potential impacts of the project on the Land, Soils and Geology. Phased construction reduces the amount of open, exposed excavations at any one time. Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.

One of the primary mitigation measures employed at the preliminary design stage was the avoidance of volumes of excavated overburden deposits to be exported off site. All excavated overburden will be retained on-site.

This will include:

- Use of suitable site won material (bedrock) as general fill in the construction of access tracks, hardstands and in reinstatement around turbine foundations.
- Overburden will be re-used on site in the form of landscaping and for reinstatement purposes at the proposed borrow pit.

Overburden deposits excavated during the course of the works will be temporarily stored in a level area adjacent to the construction phase excavations prior to reuse.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement. No long-term stockpiles of material will remain after construction. No surplus/waste soil or rock will be removed from the proposed project site. Temporary stockpiles should be shaped and sealed to prevent the ingress of water from rainfall.

Excavated material will be managed in accordance with the project Spoil Management Plan which forms part of the EIAR for the project.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that peatland/soils outside the work area are not damaged. Excavations will then be carried out from access tracks as they are constructed in order to reduce the compaction of soft ground.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events (>10mm/hour). To mitigate against possible contamination of the exposed soils and bedrock, refuelling of machinery and plant will only occur at designated refuelling areas.

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel fill will be used to provide additional support to temporary cuts/excavations where appropriate. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion.

Excavations in Peat for Turbine Bases, Hardstandings and Infrastructure Foundations

As described in Chapter 6 and the Spoil Management plan, deposits of Blanket Peat can be found along the western and southern margins of the site, however there is no infrastructure located within these areas of Blanket Peat. It was also confirmed during a site walkover that there is no Blanket Peat located at or near infrastructure locations

Given the absence of peat deposits across the Proposed Wind Farm Site, and in accordance with the guidance in the Scottish Executive – Peat Landslide Hazard and Risk Assessments (2017), a peat stability analysis has not been carried out.

Measures for spills

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of to a licenced facility;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.

A Surface Water Management Plan (SWMP) can be found in Appendix 7.3 of the EIAR which contains further details on requirements for spill management.

Slope Stability

With regard to slope stability issues, detailed design and construction phase best practice will be implemented as follows:

- The works will be supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.
- Drainage infrastructure will be put in place in advance of excavations. Drains will divert surface water and groundwater away from excavations into the existing and proposed surface drainage network. Uncontrolled, direct and concentrated discharges of water onto the ground surface will not occur.
- Loading or stockpiling of materials on the surface of soft ground will not occur. Loading or stockpiling on other deposits will not be undertaken without first establishing the adequacy of the ground to support loads by an appropriately qualified geotechnical engineer experienced in construction within upland conditions. No stockpiling of material shall take place on steep slopes.
- Turbines located in areas adjacent to peat deposits will incorporate drainage measures such that surface water will be drained away from the peat and will not be allowed to collect adjacent to the peat mass.
- An assessment of the stability at proposed infrastructure locations has been carried out as part of the EIAR based on worst case conditions. A further assessment will be undertaken at detailed design stage by a suitably qualified and experienced geotechnical engineer prior to the commencement of all excavations to confirm the findings of this assessment.
- Blasting of rock will not be permitted.
- Excavations which could have the potential to undermine the up-slope component of an existing slope will be sufficiently supported to resist lateral slippage. Careful attention will be given to the existing drainage.
- Earthworks will not be commenced when heavy or sustained rainfall is forecast. A rainfall gauge will be installed on site to provide a record of rainfall intensity. An inspection of site stability, excavations and drainage by the Geotechnical Engineer will be carried out on site regularly.
- An emergency response plan is included in Section 6 outlining the action plan which would be implemented in the unlikely event of a landslide/slope failure. Should a landslide/slope failure occur or if signs of instability/ground movement are observed, work will cease immediately.

Borrow Pit

One location on site has been identified as potential borrow pit. The peat depth within the development footprint of the borrow pit is 0.0m.

Upon removal of the rock and gravel from the borrow pit, it is proposed to reinstate the borrow pit using excavated spoil. The excavated rock and gravel from the borrow pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated spoil to be placed safely. It is proposed to construct cells within the borrow pit for the placement of the excavated spoil.

This is to allow for the safe placement and grading of the spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the borrow pit.

The borrow pit shall be constructed as follows:

(1) The rock within the proposed borrow pit footprints will be removed by breaking based on ground investigation carried out at the proposed borrow pit.

(2) It is proposed to construct the borrow pit so that the base of the borrow pit are below the level of the adjacent section of access road. As excavation progresses into the back edge of the borrow pit, the base of the borrow pit may be raised to suit local conditions. Localised deepening of the borrow pit floors may be required depending on extraction operations.

(3) Depending on the depth and type of rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat and spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(4) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(5) The stability of the rock faces within the borrow pit will be inspected by an experienced geotechnical engineer upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.

(6) Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow pit. The rock buttresses should be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress should be inspected and approved by a competent person.

(7) It may be necessary to construct the rock buttresses within the borrow pit in stages as infilling of peat and spoil behind the buttresses progress. The buttress should be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil, as necessary.

(8) Infilling of the spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be reinstated safely.

(9) A number of rock buttresses to form cells with the borrow pit may be required to ensure access for trucks and excavators can be achieved.

(10) The rock buttresses should be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The side slopes of the rock buttress should be constructed between 45 to 60 degrees.

(11) The height of the rock buttresses constructed should be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. Buttresses up to 5m in height are likely to be required.

(12) The use of temporary access ramps and long reach excavators during the placement of the excavated spoil is likely to be required.

(13) The surface of the placed spoil will be shaped to allow efficient run-off of surface water from the placed arisings.

(14) A layer of geogrid to strengthen the surface of the placed spoil within the borrow pit may be required.

(15) An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.

(16) Control of groundwater within the borrow pit will be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations will to be required during construction.

(17) A settlement pond will be required at the lower side/outfall location of the borrow pit.

(18) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the spoil within the borrow pit.

(19) Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.

(20) All the above mentioned general guidelines and requirements will be confirmed by the designer prior to construction. A detailed construction methodology for the borrow pit should be compiled prior to construction.

4.3.5 Surface Water Management Plan

A Surface Water Management Plan (SWMP) can be found in Appendix 7.3 of the EIAR. The Surface Water Management Plan (SWMP) should be read in conjunction with the EIAR and shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works. It contains methodology for drainage, water quality management and silt control. The measures contained within the plan will be applied when working near water.

4.3.6 Archaeological Management Plan

Ten monuments are located less than 1km from the nearest proposed turbine. The nearest monuments CO095-001---- and CO083-078---- ringforts are situated 225m and 251m from turbine 6 and 2, respectively. The next nearest monument, Enclosure CO094-036---- , is situated c. 347m to the south-west of T6. To safeguard these monuments and to ensure that any other archaeological impacts are minimised, the following measures will be taken prior to and during construction of the Proposed Development.

Firstly, an exclusion zone of 100m should be maintained around the 2 recorded monuments located within close proximity to the Proposed Wind Farm Site boundary, for the duration of construction, in order to ensure no damage occurs from construction activities. Information regarding the extent of these sites would form part of the site induction for all on site personnel.

Archaeological testing under licence by a suitably qualified archaeologist of the turbine bases, hardstands and access roads should be undertaken. Should archaeological finds, features or deposits be uncovered during testing the DAHG should be consulted as to how best to proceed with the finds (i.e. preservation *in situ* or preservation by record).

Archaeological monitoring of all ground works associated with the construction of the Proposed Development should be carried out under licence by a suitably qualified archaeologist. A report on the findings should be furnished to the Planning Authority and the DAHG. If archaeological finds, features or deposits are uncovered during the course of monitoring all works at this location should be stopped pending a discussion with the relevant authorities as to how best to mitigate against impacting on the archaeology, if present.

In the event that any sub-surface archaeological features are identified they will be recorded and cordoned off while the National Monuments Service are consulted to determine further appropriate mitigation measures, which may include preservation *in situ* (by avoidance) or preservation by record (archaeological excavation).

Monitoring of mitigation measures

There are a number of obligatory processes to be undertaken as part of archaeological license applications and these will allow for monitoring of the successful implementation of the archaeological mitigation measures. These include the submission of method statements detailing the proposed strategy for all site investigations that will be submitted for the approval of the National Monuments Service as part of the license application. These documents will clearly outline the proposed extent of works and outline the onsite and consultation processes to be enacted in the event that any unrecorded archaeological sites or features are identified. A report will be compiled on all site investigations to comply with the licensing process which will clearly present the results in written, drawn and photographic formats and copies will be submitted to Cork County Council, the National Monuments Service, the Planning Authority and the National Museum of Ireland.

4.3.7 Waste Management Plan

It will be the objective of the Developer in conjunction with appointed contractor to prevent, reduce, reuse and recover as much of the waste generated on site as practicable and to ensure the appropriate transport and disposal of residual waste off site. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the development construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compound during construction.

This Construction Waste Management Plan has been prepared for the proposed Barnadivane Wind Farm in line with the ”Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects” (2006) as published by the Department of the Environment, Community and Local Government and the Regional Waste Management Plan for the Southern Waste Region 2015-2021.

The Waste Management Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works. This plan should be read in conjunction with the EIAR.

Assignment of Responsible Personnel

It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste. The waste manager will have overall responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements. They will ensure that at an operational level that each crew foreman is assigned direct responsibility.

Waste Generated

It is envisaged that the following categories of waste will be generated during the construction of the project:

- Municipal solid waste (MSW) from the office and canteen
- Sanitary waste from the temporary site compound
- Construction and demolition waste
- Waste oil/hydrocarbons
- Paper/cardboard
- Timber
- Steel.

A fully authorised waste management contractor will be appointed prior to construction works commencing. This contractor will provide appropriate receptacles for the collection of the various waste streams and will ensure the regular emptying/and or collection of these receptacles.

Sanitary waste from the temporary construction compound shall be collected on a regular basis by a licensed waste management contractor and exported to a wastewater treatment facility via tanker.

Waste Minimisation/Reduction

All efforts will be made by site management to minimise the creation of waste throughout the project.

This will be done by:

- material ordering will be optimised to ensure only the necessary quantities of materials are delivered to site.
- material storage areas will be of a suitable design and construction to adequately protect all sorted materials to ensure no unnecessary spoilage of materials occurs which would generate additional waste.
- all plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of waste oil/hydrocarbons on site.
- all operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc. for example cutting of plywood, built into the amount ordered.
- educating foremen and others to cut/use materials such as ply wisely for shutters etc.
- prefabrication of design elements will be used where suitable to eliminate waste generation on site.
- where materials such as concrete are being ordered, great care will be practiced in the calculation of quantities to reduce wastage.

Waste Reuse

When possible, materials shall be re used onsite for other suitable purposes e.g.

- re-use of shuttering etc. where it is safe to do so.
- re-use of rebar cut-offs where suitable.
- re-use of excavated soil for screening, berms etc.
- re-use of excavated rock or stone – where possible will be used as suitable fill elsewhere on site for the new site tracks, the hardstanding areas and embankments where possible.

Waste Recycling & Recovery

In accordance with national waste policy, source separation of recyclable material will take place. Receptacles will be clearly labelled, signposted and stored in dedicated areas in the construction compound.

The following sourced segregated materials container will be made available on site the construction compound:

- timber
- ferrous metals
- aluminium
- dry mixed recyclables
- packaging waste
- food waste.

The materials will be transported off-site by a licensed contractor to a proposed recovery centre and these materials will be processed through various recovery operations. A list of nearby licensed waste management facilities are shown in Table 4-1.

Table 4-1: Nearby Waste Management Facilities

Facility	Type of wasted accepted
Bandon Civic Amenity Site	Plastic, metals, oil, paper, cardboard, glass, electrical goods
Codrum Recycle Centre	Plastic, metal, oil, paper, cardboard, glass, Electrical good
Munster waste management	Domestic, commercial, industrial, agricultural

Waste Disposal

Residual waste generated on-site will require disposal. This waste will be deposited in dedicated receptacles and collected by the licensed waste management contractor and transported to an appropriate facility. All waste movements will be recorded, which records will be held by the waste manager on-site.

Contaminated Material

Any contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste. In particular, the following measures will be implemented:

- Contaminated material will be left in-situ and covered, where possible until such time as WAC (Waste Acceptance Criteria) testing is undertaken in accordance with recommended standards and in-line with the acceptance criteria at a suitably licenced landfill or treatment facility. This will determine firstly the nature of the contamination and secondly the materials classification i.e. inert, non-hazardous or hazardous.
- If the material is deemed to be contaminated, consultation will take place with the respective local authority and/or EPA on the most appropriate measures. Such materials will be excavated, transported by a contractor with a valid waste collection permit and recovered/disposed of at an appropriate facility.

Waste Management Training

Copies of the project waste management plan will be made available to all relevant personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the Waste Management Plan and informed of the responsibilities that fall upon them as a consequence of its provisions.

It will be the responsibility of the contractors appointed (Waste Manager) to ensure that all personnel are made aware of their responsibilities under the plan via a toolbox talk or otherwise.

4.3.8 Traffic Management Plan

This document is the Construction Traffic Management Plan (TMP) for the Proposed Wind Farm, Co. Cork. The Construction Traffic Management Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and the turbine supply contract.

Some items in this plan can only be finalised with appropriate input from the contractor who will be appointed to carry out and schedule the works. Furthermore, it is appropriate that the Project Supervisor Construction Stage (PSCS), when appointed, should have an active role in the preparation/review of the Traffic Management Plan.

This plan should be read in conjunction with Chapter 11 of the EIAR.

The contractor is required to prepare the necessary Site-Specific Traffic Management Plans prior to the construction works commencing in accordance with Chapter 8 of the Traffic Signs Manual 2019 and subject to load permits.

The contractor will be responsible for the implementation of all agreements between the developer and the County Council and local residents with the objective that the transportation needs for the proposed project will have a minimal impact on the road network and local communities.

As with any construction development project, the transport of materials onto the site will give rise to increased traffic and associated impacts. However due to the very nature of construction these impacts will be temporary.

Construction traffic will require regular access to the site at varying times throughout the construction phase. The aim of this TMP is to put in place procedures to manage traffic effectively on site and in the immediate vicinity of the Proposed Project, to ensure the continued movement of traffic on the public roads and to minimise disturbance during transportation of materials particularly oversize loads. The correct implementation of this TMP will ensure that appropriate procedures are in place to minimise any effects on the safety and movement of the general public.

Prior to the commencement of construction, the TMP will be reviewed by the main contractor (and any sub-contractors) and will be updated as necessary.

General Traffic Management Measures

General measures that shall be addressed in the TMP shall include:

Traffic Management Co-Ordinator – A dedicated Traffic Management Coordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management on the project.

Roads and Routes: The final TMP will clearly identify roads that will be used to access the project site and roads that are not to be used. Turbine component and quarry material deliveries shall use the N22, R585 and L6008 at Gortadinnaghboght and the L6007 through Lackereagh.

One-way Systems: as some of the local roads are relatively narrow, the roads authority may want to introduce a system of one-way construction traffic movements during the construction of the development. Any such one-way systems will be identified in the construction stage TMP in agreement with the roads authority.

Road Condition Survey: a pre-condition survey will be carried out on all public roads that will be used in connection with the development to record the condition of the public roads in advance of construction commencing. A post-construction survey will also be carried out after the works are completed. The specification and timing of the surveys will be agreed with the roads authority. Joint surveys shall be completed if the roads authority requests. Local sections of the TDR will be upgraded prior to construction starting.

Road Reinstatement: All roads will be reinstated expeditiously on completion of the construction works. Roads will be reinstated to their pre-works condition or better and to the satisfaction of the roads authority.

Site Inductions: All workers will receive a comprehensive site induction which will include a section on traffic management and clear guidance on the routes to be used/not used to access the site.

24-Hour Emergency Contact: a 24-hour emergency phone number will be maintained for the duration of the construction works and the number will be noted on temporary signage at the site entrance for the wind farm site.

Traffic Management Guidance: all necessary temporary traffic management will be planned and executed in accordance with best practice, including Chapter 8 of the Traffic Signs Manual published by the Department of Transport in 2019.

Community Liaison: A project website will be in place for the duration of the project's construction phase which will include regular project programme status updates, contact details, facilities for community feedback/observations as well as a complaints procedure. A community liaison will be appointed by the contractor in advance of the commencement of the construction phase who will have responsibility for consulting with members of the public and act as a first point of contact for the project management team. Letter drops will be carried out to notify members of the public living near the proposed site to advise them of any particular upcoming traffic related matters e.g. temporary lane/road closure or delivery of turbine components.

Signage: Clear signage relating to the development, both temporary and permanent, will be provided for accessing the site.

Road Sweeping: Appropriate steps will be taken to prevent soil/dirt generated during the works from being transported on the public road. When, if necessary, a road sweeper will be used to maintain the public roads in a clean condition during the construction activities of the project.

Site Entrances: The entrances to the site will be secured when the site is not in use. When necessary, a flagman will be used to assist traffic movements at the site entrance or in other areas as required. For example, during turbine blade and tower deliveries.

Abnormal Load Deliveries: Abnormal loads will require an abnormal load permit prior to delivery and will be delivered mostly at night time as agreed with local authority and An Garda Siochána.

Traffic management measures proposed for the consented 38kV grid connection cable route 'alternative grid connection route (AGCR)' (CCC reference: 15/730; ABP reference: PL04.246353) are outlined in the CEMP, it includes the following:

- A traffic management plan will be set up prior to any works commencing.
- A road opening license will be obtained where required and any conditions complied with.
- The road way will be maintained in clean condition at all times.
- Topsoil will be permanently reinstated where required or Clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.
- Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction the joint bay locations will be completely fenced off and will be incorporated into the traffic management system.

Construction Plant and Vehicles

The typical construction plant and vehicles used as part of the construction of a wind farm are as follows (non-exhaustive):

- Hydraulic Excavators
- Dump Trucks
- General construction delivery vehicles (e.g. steel reinforcement bar, electrical components etc.)
- Concrete trucks and pumps
- Cranes of various lifting capacities (up to 1000 tonnes)
- Oversized articulated delivery vehicles (for turbine component transport)

- Site Jeeps (off-road 4x4 all purpose vehicles)
- Private vehicles of those employed on site for the construction phase.

It should be noted however that final selection of construction plant and vehicles may vary depending on suitability, availability, contractor's choice, etc.

Plant operators will be responsible for the upkeep and maintenance of construction plant and vehicles, ensuring good working order prior to use. Should emergency maintenance need to be carried out on site, this will be carried out at a designated area away from sensitive receptors and will ensure that a spill kit is nearby.

Construction commencement dates are yet to be confirmed at this stage; these will be made known to the Planning Authority by way of formal Commencement Notice.

Construction Compound

The location of the construction compound is shown on the site layout, Figure 1-2.

Consultation and Notification

An Garda Síochána

The Transport Management Plan shall be finalised following the appointment of the contractor for the main construction works.

The contractor will liaise directly with An Garda Síochána in relation to the plan. Any concerns/requirements they have will be incorporated into the plan. This may include details in relation to the escorting of oversized loads.

The necessary permits (including approved route permits) will be applied for and obtained from An Garda Síochána.

Cork County Council

The contractor will liaise directly with the County Council in relation to the plan. Any concerns/requirements they have will be incorporated into the plan. The contractor will also liaise with Limerick County Council , as necessary, along the final turbine delivery route.

The necessary permits (including standard permits) will be applied for and obtained from the relevant local authorities.

Local Residents

The following measures will be used to communicate the necessary information to the households along the local road to be used as a haul road:

- Information signs will be erected in advance of the construction/transportation works.
- A flyer drop will be carried out to advise households along the local road leading to the site in relation to the programme of construction works and especially in relation to oversized load movements.
- Residents will be consulted with regarding the development of plans for the project.
- Contact details for a Liaison Officer will be provided so that any concerns can raised, logged and be easily channelled to the Developer to be dealt with.
- A project website will be in place for the duration of the project's construction phase which will include regular project programme status updates, contact details, facilities for community feedback/observations as well as a complaints procedure.

Complaints will be entered into the site complaints log and the relevant site environmental officer will arrange to meet with those affected. The situation will be acted upon immediately and reviewed by the Project Manager.

Key Personnel and Responsibility

Once prepared and agreed with the local County Council and An Garda Síochána the contractor will implement the project specific Traffic Management Plan (TMP).

Please note that some items in this plan can only be finalised with appropriate input from the contractor who will carry out and schedule the works. Furthermore, it is appropriate that the Project Supervisor Construction Stage (PSCS), when appointed, should have an active role in the preparation/review of the Traffic Management Plan.

Typically, the following members of the contractors' staff will have responsibility for adherence to the TMP as follows:

Traffic Management Coordinator

The Traffic Management Coordinator will be responsible for maintaining regular contact with An Garda Síochána, The local County Council, the statutory bodies and the client concerning traffic control, interference with services and co-ordination of crossings at roads, rivers and railways.

The Transport Officer will contact the relevant bodies in relation to develop method statements prior to the work taking place. The Transport Officer will be responsible for instructing the Construction Manager, Foreman and all other personnel on the information in the agreed method statement prior to the work commencing and ensuring that the method statement is adhered to.

The Transport Officer will be responsible for ensuring that the Traffic Management Plan will be implemented in full.

Safety Officer	The Safety Officer will be responsible for implementing all safety requirements detailed in the Project Safety Plan. Ensure that all operatives receive site safety induction prior to commencing work on site. They will ensure that all plant, particularly lifting equipment, on site has the relevant certification and are checked regularly by a competent person. The Safety Officer will carry out safety audits and checks on a regular basis and amend procedures where necessary.
Construction Manager	The Construction Manager will be responsible for overall supervision of the operations to ensure they are constructed in a safe and efficient manner. He will ensure that sufficient resources are available to meet the programme and that the necessary information is provided to the appropriate staff.
Foreman	The Foreman is responsible for ensuring that the crew carry out the work in accordance with the method statement and contract specifications and drawings using good working practices in a safe manner. He will supervise construction personnel ensuring their competence. He will check all plant and equipment on a regular basis ensuring it is maintained and in good working order.

Wind Turbine Generator Deliveries

The components of 6 no. wind turbines will be transported by road to the Wind Farm Site for on-site assembly, using the access route outlined in Section 3.1.4.

Wind turbine component deliveries, cranes and all large plant associated with turbine installations will use the TDR.

The impact of the deliveries on traffic is mitigated by delivering components during off-peak or night-time deliveries.

Mitigation measures proposed for the turbine delivery route also include:

Programme of Deliveries: a programme of deliveries will be submitted to the road's authority in advance of deliveries of turbine components to the site. The programme will include details of the dates and times of each component delivery along with the route to be taken.

Turbine component deliveries will be carried out during off-peak times and will be done using a convoy and a specialist heavy haulage company.

Garda Escort: Turbine deliveries will be escorted by An Garda Siochána. This will ensure the impacts of the turbine deliveries on the existing road network are minimised.

Reinstatement: Any area affected by the works to facilitate turbine delivery will be fully reinstated to its original condition.

Consultation: Consultation with the local residents and Cork County Council will be carried out in advance to manage turbine component deliveries.

The location of temporary accommodation works associated with turbine deliveries are shown in Figure 3-1. Swept path analysis drawings showing turbine component manoeuvres can be found in Chapter 11 of the EIAR.

It is proposed that deliveries will be made to the site in convoys of 5 vehicles at a time with escorts at the front and rear operating a "stop and go" system.

It is proposed that the large turbine components, including the blades, tower sections and nacelles, will be transported to the site in one convoy of 3 vehicles per night. In order to transport the 48 abnormally large components to the site it will take 16 convoys spread over 4 nights per week for 4 weeks to complete. On a further 6 days the remaining equipment required during this phase will be delivered to the site using standard HGVs.

It is now common practice that deliveries of the abnormally sized loads are made during night time hours when impacts to the existing traffic is significantly reduced.

Restricted Public Road Use by Construction Traffic

The local authority may impose restrictions on the use of some local roads. These will be agreed in liaison with Cork County Council prior to construction, as well as specific signage requirements for construction works.

Some of the existing local roads are narrow, and to this effect, one-way delivery and access route systems may be employed to mitigate against unsuitable two-way construction traffic.

Using local roads is unavoidable, however, introducing a one-way system where necessary and restricting construction traffic access to a small number of roads will minimise disruption to the local community.

Materials will be delivered to site via the indicative haul routes.

Road Closures, Diversions and Safety Measures for Road Crossings

It is envisaged that road closures will be necessary for the carrying out portions of cable trenching within the public road. The consent of Cork County Council will be required and the necessary road diversions together with the appropriate signage will be put in place. As there is a good network of local roads, it is anticipated that there are a number of options available for diverting traffic which will allow flexibility during this process of construction and maintain local access at all times during this element of the works.

It is proposed to maintain local access at all times during this element of the works. It is proposed that all access points (domestic, business, farm) are considered when finalising the temporary road closures and diversions. Diversion signage will also be included.

Safety measures for road users adjacent to deep excavations, such as temporary concrete barriers will be detailed for Trenchless Road Crossings in advance of construction and agreed with Cork County Council.

Temporary signage and traffic management for works in rural single carriageway roads in accordance with Chapter 8 of the Traffic Signs Manual is shown in Figure 4-1 and Figure 4-2.

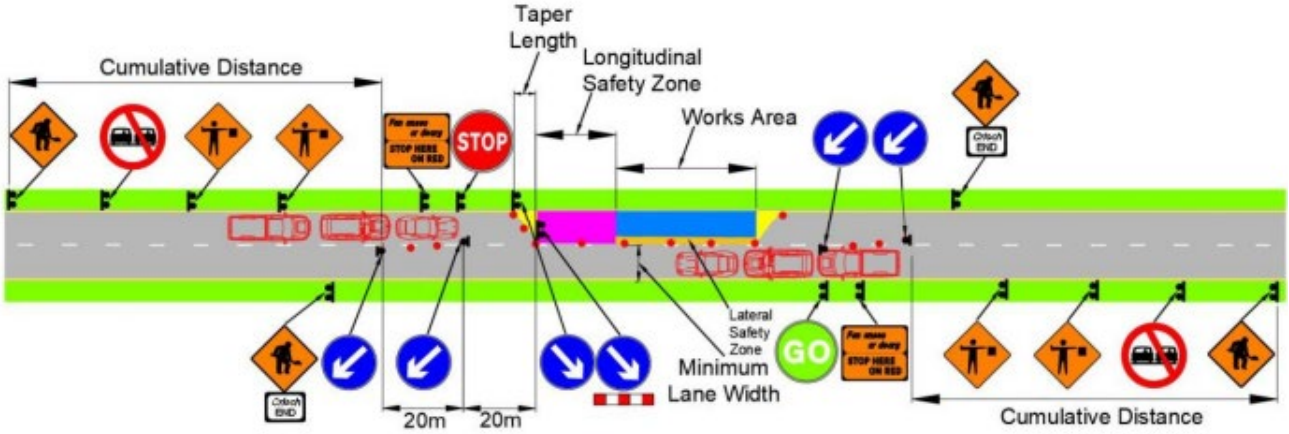


Figure 4-1: Stop and Go Traffic Control Signage for Single Carriageway Rural Road

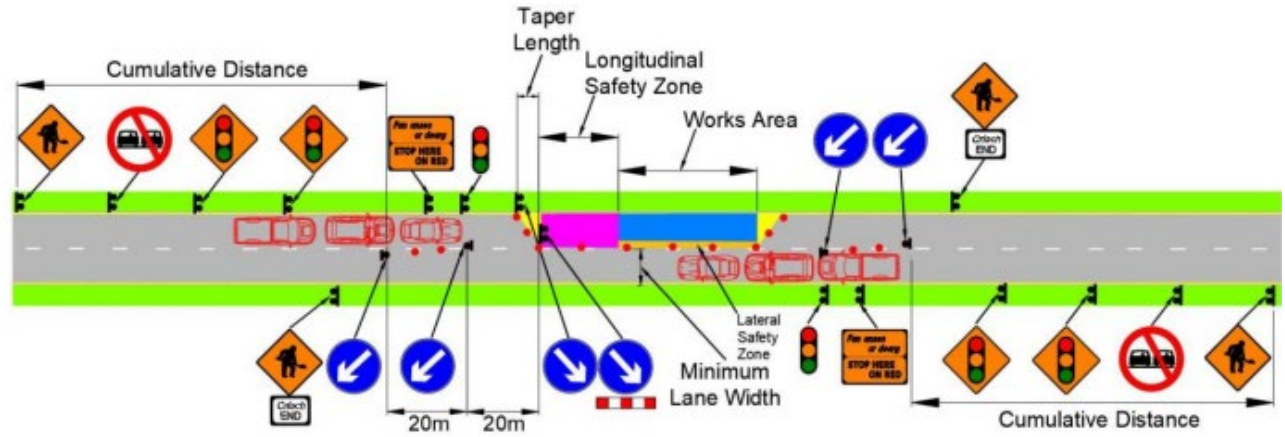


Figure 4-2: Temporary Traffic Signals Control for Works in Single Carriageway Rural Roads

Road Cleaning

Public roads shall be kept free of mud, dust, spillages and debris from the construction site, construction plant or haulage vehicles. Any necessary measures shall be put in place at the site entry/exit points.

Carriageway/ Road Reinstatement

It is anticipated that the proposed haul routes will be capable of accommodating the construction traffic associated with the project. In the event that there are concerns around the structural capacity of a road on a proposed haul route, a structural survey shall be carried out to determine suitability of the existing roads to carry the loading. Where the structural survey indicates that a proposed haul route is not in a suitable condition, details of any upgrading works required shall be submitted to Cork County Council for approval. The developer shall upgrade the road or junction in advance of haulage operations.

A pre-condition survey of haul routes, consisting of a video survey and photographs shall be carried out and a copy submitted to Cork County Council.

Any damage caused to the road shall be repaired to its previous condition, to the satisfaction of Cork County Council. Any defects that appear during the haulage period shall be rectified by the project owner.

4.4 Environmental Management Team - Structure and Responsibility

A preliminary organisation chart is included in Figure 4-3. Revisions to the project organisation chart shall be controlled independently of this plan following the appointment of the Contractor for the main construction works.

The Contractor's Project Manager will be responsible for the delivery of all elements of the Environmental Management Plan.

The Contractor's Project Manager will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan throughout.

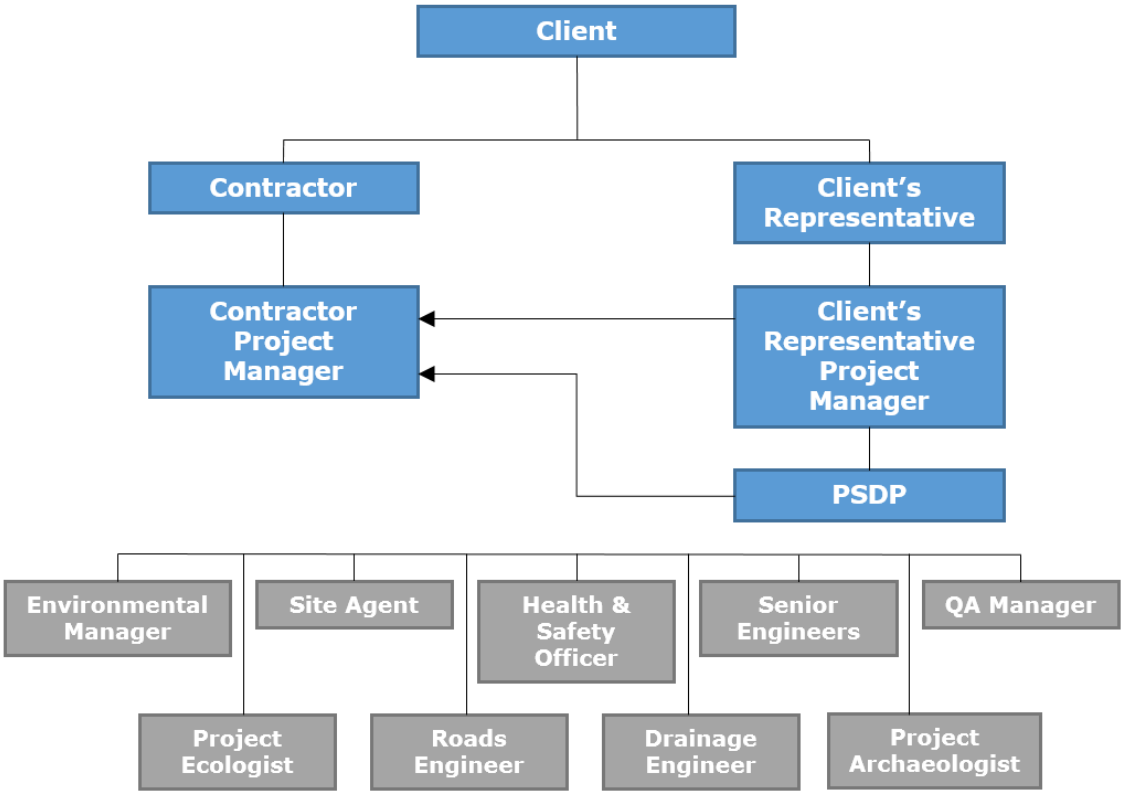


Figure 4-3: Project Management Team Organogram

4.5 Training, Awareness and Competence

All site personnel will receive environmental awareness information as part of their initial site briefing. The detail of the information should be tailored to the scope of their work on site.

The contractor for the main construction works may decide to conduct the environmental awareness training at the same time as Health and Safety Training (often referred to as Site Inductions).

This will ensure that personnel are familiar with the environmental aspects and impacts associated with their activities, the procedures in place to control these impacts and the consequences of departure from these procedures.

The CEMP will be available in the main site compound during the project. The environmental performance at the site is on the agenda of the monthly project management meetings for the project.

Elements of the CEMP will be discussed at these meetings including objectives and targets, the effectiveness of environmental procedures etc. Two-way communication will be encouraged by inviting all personnel to offer their comments on environmental performance at the site.

4.6 Environmental Policy

The contractor is responsible for preparing and maintaining an Environmental Policy for the site. The policy should be appropriate to the project, commit to continuous improvement and compliance with legal requirements and provide a framework for objectives and targets. This will be communicated to all site personnel and will be available on site notice boards.

4.7 Register of Environmental Aspects

The contractor is responsible for preparing and maintaining a *Register of Environmental Aspects* pertaining to the site. This register will identify the environmental aspects associated with activities onsite and determine which aspects have or can have a significant impact on the environment.

4.8 Register of Legislation

The contractor is responsible for preparing and maintaining a register of key environmental legislation pertaining to the site. This register will reference all current environmental legislation and will be inspected, reviewed and updated regularly to ensure compliance.

4.9 Objectives and Targets

Objectives and targets are required to be set to ensure that the project can be constructed and operated in full accordance with the EIAR, planning conditions and legislative requirements, with minimal impact on the environment.

Environmental objectives are the broad goals that the contractor must set in order to improve environmental performance. Environmental targets are set performance measurements (key performance indicators or KPI's) that must be met in order to realise a given objective.

4.10 Non-Conformance, Corrective and Preventative Action

Non-Conformance Notices will be issued where there is a situation where limits associated with activities on the project are exceeded, or there is an internal/external complaint associated with environmental performance.

Non-Conformance is the situation where essential components of the EMS are absent or dysfunctional, or where there is insufficient control of the activities and processes to the extent that the functionality of the EMS is compromised, in terms of the policy, objectives and management programmes. A Non-Conformance register should be controlled by the contractor.

The EMS and all its components must conform to the EMP. In the event of non-conformance with any of the above, the following must be undertaken:

- Assess cause of the non-compliance;
- Develop a plan for correction of the non-compliance;
- Determine preventive measures and ensure they are effective;
- Verify the effectiveness of the correction of the non-compliance;
- Ensure that any procedures affected by the corrective action taken are revised accordingly.

Responsibility must be designated for the investigation, correction, mitigation and prevention of non-conformance.

4.11 EMS Documentation

The Contractor is required to keep the following documentation in relation to the environmental management of the project (as a minimum):

- Construction Environmental Management Plan
- Register of Environmental Impacts
- Register of Planning Conditions
- Monitoring Records
- Minutes of Meetings
- Training Records
- Audit and Review Records.

All these documents and records are to be available for inspection in the site office. The documentation shall be to date and shall be reviewed on a regular basis with revisions controlled in accordance with the site quality plan.

4.12 Control of Documents

The Contractor will establish, implement and maintain a procedure to control CEMP documents and records so they are clearly identifiable, organised, current, easily located and revised when necessary.

5. SAFETY & HEALTH MANAGEMENT PLAN

5.1 Introduction

This Safety and Health Management Plan (SHMP) defines the work practices, procedures and management responsibilities relating to the management of health and safety during the design, construction and operation of the Barnadivane Wind Farm and Substation and shall be read in conjunction with the Preliminary Safety & Health Plan prepared for the project by the Project Supervisor for the Design Process. The Safety and Health Management Plan for the construction stage shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works.

This SHMP describes how the contractor for the main construction works will implement a site Safety Management System (SMS) on this project to meet the specified contractual, regulatory and statutory requirements, environmental impact statement and natura impact statement mitigation measures and planning conditions. It is the contractor's responsibility to implement an effective SMS to ensure that the developer's safety requirements for the construction of this project are met.

All site personnel will be required to be familiar with the requirements of the safety management plan as related to their role on site. The plan describes the project organisation and sets out the health and safety procedures that will be adopted on site.

- The SHMP is a controlled document and will be reviewed and revised as necessary.
- A copy of the SHMP will be located on/near the site H&S notice board.
- All employees, suppliers and contractors whose work activities cause/could cause impacts on the environment will be made aware of the SHMP and its contents.

5.2 Project Obligations

The construction of the Proposed Wind Farm will impose numerous safety management obligations on the developer, designer and contractor. As well as statutory obligations, there are several specific obligations set out in the EIAR and in the planning conditions for the Proposed Wind Farm and Substation. These obligations are set out below. The contractor for the main construction works and all its sub-contractors are to ensure that they are fully aware of and in compliance with these safety obligations.

5.2.1 EIA Obligations

EIAR obligations are described in Section 4.2.1.

5.2.2 Planning Permission Obligations

Planning permission obligations will be fully outlined in the Contractor's CEMP.

5.2.3 Statutory Obligations

The Safety, Health and Welfare at Work Act 2005 (as amended) and the Safety, Health and Welfare at Work (Construction) Regulations 2013 (as amended) place a responsibility on the Developer as the "Client", the Designer, the Project Supervisors and the Contractor.

The Client must:

- Appoint a competent and adequately resourced Project Supervisor for the Design Phase (PSDP).
- Appoint a competent and adequately resourced Project Supervisor for the Construction Stage (PSCS).
- Be satisfied that each designer and contractor appointed has adequate training, knowledge, experience and resources for the work to be performed.
- Co-operate with the project supervisor's and supply necessary information.
- Keep and make available the safety file for the completed structure.
- Provide a copy of the safety and health plan prepared by the PSDP to every person tendering for the project.
- Notify the Authority of the appointment of the PSDP.

Designers must:

- Identify any hazards that their design may present during construction and subsequent maintenance.
- Eliminate the hazards or reduce the risk.
- Communicate necessary control measures, design assumptions or remaining risks to the PSDP so they can be dealt with in the safety and health plan.
- Co-operate with other designers and the PSDP or PSCP.
- Take account of any existing safety and health plan or safety file.
- Comply with directions issued by the PSDP or PSCS.

The PSDP must:

- Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project.
- Where possible, eliminate the hazards or reduce the risks.
- Communicate necessary control measure, design assumptions or remaining risks to the PSCS so they can be dealt with in the safety and health plan.
- Ensure that the work of designers is coordinated to ensure safety.
- Organise co-operation between designers.
- Prepare a written safety and health plan for any project and deliver it to the client prior to tender.
- Prepare a safety file for the completed structure and give it to the client.

The PSCS must:

- Co-ordinate the identification of hazards, the elimination of the hazards or the reduction of risks during construction.
- Develop the Safety and Health Plan initially prepared by the PSDP before construction commences.
- Co-ordinate the implementation of the construction regulations by contractors.
- Organise cooperation between contractors and the provision of information.
- Co-ordinate the reporting of accidents to the Authority.
- Notify the Authority before construction commences.
- Provide information to the site safety representative.
- Co-ordinate the checking of safe working procedures.
- Co-ordinate measures to restrict entry on to the site.
- Co-ordinate the provision and maintenance of welfare facilities.
- Co-ordinate arrangements to ensure that craft, general construction workers and security workers have a Safety Awareness card, e.g. Safe Pass and a Construction Skills card where required.
- Co-ordinate the appointment of a site safety representative where there are more than 20 persons on site.
- Appoint a safety adviser where there are more than 100 on site.
- Provide all necessary safety file information to the PSDP.
- Monitor the compliance of contractors and others and take corrective action where necessary.
- Notify the Authority and the client of non-compliance with any written directions issued.

The Contractor must:

- Co-operate with the PSCS
- Promptly provide the PSCS with information required for the safety file.
- Comply with directions of the project supervisors.
- Report accidents to the Authority and to the PSCS where an employee cannot perform their normal work for more than 3 days.
- Comply with site rules and the safety and health plan and ensure that your employees comply.
- Identify hazards, eliminate the hazards or reduce risks during construction.
- Facilitate the site safety representative.
- Ensure that relevant workers have a safety awareness card and a construction skills card where required.
- Provide workers with site specific induction.
- Appoint a safety officer where there are more than 20 on site or 30 employed.
- Consult workers with site specific induction.
- Monitor compliance and take corrective action.

Consequently, at all stages of the project there are statutory requirements for the management of safety, health and welfare of all involved in or affected by the development. This CEMP and specifically the SHMP address key construction management issues associated with the Proposed Wind Farm. This plan will be developed further at the construction stage, on the appointment of the Contractor for the main construction works.

5.2.4 The Management of Health and Safety during the Design Process

Fehily Timoney & Company (FT) has been appointed Project Supervisor for the Design Process (to prepare the Environmental Impact Assessment Report and planning application for the Proposed Development). FT is competent to fulfil this role in accordance with the Safety, Health and Welfare at Work (Construction) Regulations, 2013. Health and safety are a major priority for FT and FT adopts health and safety practices that are an inherent part of a safe and sustainable business. FT's objective is to provide a safe and healthy work environment for all and to meet our duties to clients, contractors and members of the public.

It is FT's policy to comply fully with all health and safety legislation, in particular the Safety, Health and Welfare at Work Act, 2005, Safety, Health and Welfare at Work (General Application) Regulations 2007, and the Safety, Health and Welfare at Work (Construction) Regulations 2013.

FT has developed in-house procedures to ensure, so far as is reasonably practicable, that all projects:

- are designed to be capable of being constructed to be safe/ without risk to health;
- can be operated and maintained safely and without risk to health during use; and
- comply in all respects, as appropriate, with the relevant statutory enactments and instruments.

These procedures include effective risk management procedures involving the identification and evaluation of risks and the development of mitigation measures to eliminate (where possible) or reduce those risks during the life-cycle of the project. The FT team is committed to health and safety and shares responsibility for managing risk at all stages of a project.

All work by FT is undertaken in a competent and efficient manner taking account of the general principles of prevention to safeguard the safety, health and welfare of construction & maintenance workers and other third parties.

The FT procedures for the management of safety during the design process are outlined in the in-house procedure PP09 "Health and Safety Requirements in Design Projects" and is adhered to on all design projects.

The purpose of this procedure is to define the requirements for the management of health & safety during design projects, to ensure compliance with The Safety, Health and Welfare at Work (Construction) Regulations 2013 (as amended).

The procedure includes standard forms which are used to communicate health and safety considerations within the design team and also guidelines which develop the company's health and safety procedure and outline the company's responsibilities for health and safety during the design process.

The procedure addresses health and safety issues at all stages of a project, from the preliminary design through to commissioning and operation. By establishing a chain of responsibility each party is clear on their role and obligations from a health and safety perspective.

Risk assessments are carried out, at preliminary and detailed design stages by every discipline involved in the design. Each risk assessment is prepared by the designers and reviewed by the Health and Safety Facilitator for the project.

Risk assessments are used to identify hazards and assess risk at all stages during the life of the project including the construction & maintenance stages.

A Health and Safety Facilitator for the Design Process (HSF) is appointed on all projects where FT are the Project Supervisor for the Design Process (PSDP).

Health & Safety Facilitators are selected from the senior ranks of FT design staff to ensure they have the required knowledge, experience and training to carry out the role.

Meetings will be held between the HSF and relevant design personnel to collate all the risk assessments and other pertinent information and to discuss any issues relating to health and safety and ensure the constructability of the designs. The minutes of these meetings are circulated to the entire design team complete with actions allocated to the designers as appropriate. At such a meeting a "Construction Risk Analysis" form is completed which forms the basis for the Preliminary Safety & Health Plan. This document outlines the particular, significant and residual risks and in addition specific construction methods or sequences assumed during the design. Special requirements for maintenance envisaged at design stage are also included.

A Designers Safety File shall be kept and maintained during the design. All design criteria adopted, and safety & health information required for the Safety File shall be kept in this file which is maintained by the HSF and is the pre-cursor to the Safety File. The information required from the Contractor/ PSCS for inclusion in the Safety File is specified at tender stage in the Preliminary Safety and Health Plan.

This information from the PSCS & Contractor(s) and the Designers Safety File is used to compile the Safety File in the latter stages of a contract and formally issued to the Client on completion of the contract.

FT promotes a collaborative approach to health and safety on site where the Client, PSDP, Designers, Contractors and PSCS co-operate with each other and share information. Joint site safety audits and/or walk-downs are carried out as part of this collaboration and safety is monitored and addressed on site on an ongoing basis. The regular safety meetings are held to document this ongoing co-operation, get an over-view of works currently in hand onsite and about to commence and share information.

5.2.5 The Preliminary Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 (as amended) a Preliminary Safety & Health Plan will be required as part of the design process. This plan will be further developed by the PSCS on appointment and maintained as a live document during construction and commissioning of the development.

The safety and health plan is required to include the following information:

- a general description of the project;
- details of other work activities taking place on site;
- works involving particular risks;
- the timescale for the project and the basis on which the time frame was established;

- conclusions drawn by designers and the PSDP having taken into account the General Principles of Prevention and any relevant Safety and Health Plan or Safety File;
- the location of electricity water and sewage connections so as to facilitate early establishment of welfare facilities.

In accordance with the PSDP's procedures the Preliminary Safety & Health Plan for the proposed Barnadivane Wind Farm and Substation should include the following sections and subsections to ensure the PSCS is aware of the health and safety issues at tender stage and enable them to price accordingly:

Preamble:

1 General Project Information:
- 1.1 Title
- 1.2 Description of Project
- 1.3 Employer
- 1.4 Designers / Other Consultants
- 1.5 Project Supervisor Design Process (PSDP)
- 1.6 Drawings, Specifications and Other Documents
- 1.7 Intended Contract Commencement Date
- 1.8 Intended Contract Completion Date
- 1.9 Basis for Contract Duration
- 1.10 Restrictions on Working Hours
- 1.11 Notification of Project
- 1.12 Termination of the PSCS Appointment

2 The Existing Environment:
- 2.1 Site Location
- 2.2 Relevant Adjoining Land Uses
- 2.3 Site Restrictions
- 2.4 Restrictions on Access
- 2.5 Hazardous Area Classification
- 2.6 Existing Services
- 2.7 Ground Conditions
- 2.8 Existing Hazards
- 2.9 Liaison with Statutory Bodies

3 Other Work Activities:
- 3.1 Other Contracts Which May Affect Work
- 3.2 Occupation of Site
- 3.3 Building Activities
- 3.4 Other Work Activities
- 3.5 Emergency Procedures in Place on Site

4 Particular and Residual Risks:
- 4.1 Works Which Puts Persons at Work at risk
- 4.2 Work Which Puts Persons at Risk from Chemical or Biological Substances
- 4.3 Work with Ionising Radiation
- 4.4 Work near High Voltage Power Lines
- 4.5 Work Exposing Persons at Work to the Risk of Drowning
- 4.6 Work on Wells, Underground Earthworks and Tunnels
- 4.7 Work Carried Out by Divers at Work Having a System of Air Supply
- 4.8 Work Carried Out in a Caisson with a Compressed Air Atmosphere
- 4.9 Work Involving the Use of Explosives
- 4.10 Work Involving the Assembly or Dismantling of Heavy Prefabricated Components
- 4.11 Work Involving Hazardous Material
- 4.12 Residual Risks

5 Additional Information:
- 5.1 Existing Documents
- 5.2 Site Possession
- 5.3 Site Rules
- 5.4 Site Specific Safety Objectives
- 5.5 Phasing of Works
- 5.6 Permits / Authorisation Required
- 5.7 Maintenance
- 5.8 Continuing Liaison
- 5.9 Specific Recommendations

6 Information Required for Safety File:
- 6.1 Information Required for Safety File from PSCS

5.2.6 The Management of Health and Safety during the Construction Phase

The selection criteria for the Contractor for the works will be based on the ability to construct the works in a manner that will not endanger the safety, health and welfare of any parties and competence to fulfil the role of PSCS.

The contract will be awarded on the basis of assessment of the candidates against relevant health and safety criteria including experience of similar projects, knowledge of the construction processes involved and training of their management and staff who will be involved in carrying out the works.

5.2.7 The Construction Stage Safety and Health Plan

In accordance with the requirements of the Safety, Health & Welfare at Work (Construction) Regulations 2013 (as amended) the preliminary Safety & Health Plan prepared by the PSDP will be further developed by the PSCS before the commencement of the construction work and updated on a regular basis during the construction phase of the project.

The document will include the following sections and subsections to ensure the management of health and safety during the construction phase of the project:

1. Description of Project:
    - Project description and programme details
    - Details of client, PSDP and PSCS, designers
    - Main contractor and other consultants
    - Extent and location of existing records and plans
    - Arrangements for communicating with Contractors, PSDP and others as appropriate.

2. Communication and Management of the Work:
    - Management structure and responsibilities
    - Safety and health goals for the project and arrangements for monitoring and review of safety and health performance
    - Arrangements for:
        - regular liaison between parties on site
        - consultation with the workforce
        - the exchange of design information between the Client, Designers, Project Supervisor for the Design Process, Project Supervisor Construction Stage and Contractors on site
        - handling design changes during the project
        - the selection and control of contractors
        - the exchange of safety and health information between contractors
        - security, site induction, and on-site training
        - welfare facilities and first aid
        - the production and approval of risk assessments and method statements
        - the reporting and investigation of accidents and other incidents (including near misses)
    - Site rules
    - Fire and emergency procedures

3. Arrangements for Controlling Significant Site Risks:
    - Safety risks
        - services, including temporary electrical installations
        - preventing falls
        - work with or near fragile materials
        - control of lifting operations
        - dealing with services (water, electricity and gas)
        - the maintenance of plant and equipment
        - poor ground conditions
        - traffic routes and segregation of vehicles and pedestrians
        - storage of hazardous materials
        - dealing with existing unstable structures
        - accommodating adjacent land use
        - other significant safety risks

- Health risks:
  - removal of asbestos
  - dealing with contaminated land
  - manual handling
  - use of hazardous substances
  - reducing noise and vibration
  - other significant health risks

The construction stage safety and health plan will be maintained on site by the PSCS and will be communicated to all relevant parties on an ongoing basis through inductions, site safety meetings and toolbox talks etc. as required.

6. EMERGENCY RESPONSE PLAN

6.1 Introduction

This chapter of the CEMP presents an Emergency Response Plan for the proposed project. The Emergency Response Plan shall be finalised in accordance with this plan following the appointment of the contractor for the main construction works and following detailed design development.

This Emergency Response Plan contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the Proposed Wind Farm. This outlines the immediate response to an emergency situation and will be developed by the main construction works contractor and PSCS as part of their construction stage Safety and Health Plan.

An emergency is any disruptive or harmful event that endangers people, environment, property or assets. Emergencies can be small, as in a fire contained by employees using firefighting equipment or large, as in damage resulting from a storm.

In the context of the Barnadivane Wind Farm and Substation, examples of Emergency Response Plan emergency events are:

- medical emergency
- explosion
- overheated equipment
- chemical and fuel spill
- fire
- loss of power
- vehicle incidents
- land slippage

Example sources of emergency or disaster events are:

- unstable/inappropriate stockpiles on site
- faulty or incorrect use of equipment
- falls from height
- storm/adverse weather
- power failure
- fuel spill
- road failure
- serious vehicle collisions or overturning

6.2 Emergency Response Plan

An emergency response plan deals with the immediate physical effects of a disaster and outlines the initial response.

6.2.1 Emergency Response Liaison

The contractor/PSCS will designate an individual to serve as the Emergency Response Liaison for this project. The emergency response liaison will coordinate the emergency response for the duration of any emergency at or nearby the project site.

Cork County Council, An Garda Síochána and the HSE Ambulance Co-ordinator will be provided with the construction programme and the onsite contact information from the Emergency Response Liaison prior to construction.

The Emergency Response Liaison will be immediately reachable at all times during project construction. The Liaison will coordinate with the above agencies to establish emergency procedures for access to and within the site in the event of an emergency.

6.2.2 Reporting Emergencies

In the event of fire, storm, flood, serious injury or other emergency, contact:

ALL ON SITE EMERGENCIES DIAL 999

6.2.3 Designated Responder

A map depicting turbine tower locations with the emergency meeting point will be furnished to Cork County Council Fire Department and HSE ambulance co-ordinators.

Upon arrival on the scene, the senior EMS Officer will set up the incident command structure. The Emergency Response Liaison and all contractor's personnel will cooperate with directions of the incident commander and assist as directed.

The nearest emergency services, ambulance and Accident & Emergency (A&E) facilities are:

Service:	Contact Details:	
Accident & Emergency (A&E)	Cork University Hospital	(021) 4922000
Ambulance Service	Dial 112 or 999	
Fire Services	Dial 112 or 999	

Service:	Contact Details:	
Garda Station	Crookstown Garda Station	021 7336002
District HQ:	Macroom Garda Station	026 20597
Divisional HQ:	Anglesea Street Garda Station	021 4522000

Each member of the contractor's site team who are First-Aid and Cardiopulmonary Resuscitation (CPR) trained personnel will be identifiable with a hard hat sticker indicating their training.

6.2.4 Emergency Alarm

The emergency alarm will be raised on site as soon as an emergency situation is detected, the alarm will be identified (contractor to check those that apply):

	Air Horn		Radio		Voice		Hand Signals		Siren

6.2.5 Emergency Reporting

In the event of an emergency the nearest supervisor with radio equipment/mobile phone will be notified. The degree of emergency will be reported to the Emergency Response Liaison who will contact the Emergency Services and request the appropriate emergency service.

6.2.6 Medical Protocol

In the event of a major medical emergency, the emergency centre (999) will be notified and an ambulance and emergency medical team will respond to the scene. All major medical cases require professional (ambulance) transportation. In the event of a minor medical case, the affected employee can be transported via company vehicle in the escort of a foreman or site engineer (with first aid training).

6.2.7 Emergency Response

Upon notification, the Emergency Response Liaison will respond to the emergency scene and manage emergency operations:

1. Assess hazards and make the area safe – If you cannot enter the area without risking your safety, don't do it, call the Emergency Services immediately and wait for them. If you think you can safely enter the area, look around the emergency scene for anything that can be dangerous or hazardous to you, the casualty, or anyone else at the scene. Bystanders can help with making the area safe. First aid kits will be available on site. Operators that have been first aid/CPR/AED trained will be listed on site and easily identifiable by a hard hat sticker.

2. Take charge of the situation – if you are the first-aid provider on the scene act fast. If someone is already in charge, briefly introduce yourself and see if that person needs any help. If there is any chance the casualty could have a head or spinal injury, tell them not to move.

3. Get Consent – always identify yourself as a first-aid provider and offer to help. Always ask for consent before touching a conscious adult casualty. Remember to protect yourself first by wearing gloves and eye protection.

4. Assess Responsiveness – is the casualty conscious or unconscious? Note their response while you are asking them for their consent. If they respond, continue with the primary survey, and if they don't respond, be aware that an unconscious casualty is or has the potential of being a breathing emergency.

5. Call out for help – this will attract bystanders. Help is always useful in an emergency situation. Someone can be called over to phone for medical help. Others can bring blankets if needed, get water, etc. a bystander can help with any of the following:

- Make the area safe.
- Find all the casualties.
- Find the first aid kit, or any useful medical supplies.
- Control the crowd.
- Call for medical help.
- Help give first aid, under your direction.
- Gather and protect the casualty's belongings.
- Take notes, gather information, be a witness.
- Reassure the casualty's relatives.
- Lead the ambulance attendants to the scene of the emergency.
- Notify Emergency Services as soon as you can. Either send a bystander or call yourself.

In the event of a major medical emergency the Emergency Response Liaison, as the person-in-charge of the emergency scene, will dispatch someone to the site access point nearest the emergency scene to direct and lead arriving outside responders to the emergency scene. The designated meeting point will be agreed prior to the commencement of construction. Emergency personnel will be met at this meeting point communicated by management during the 999 call. The emergency personnel escort will use the hazard lights on their vehicle, so they are easily identified.

6.2.8 Escape and Evacuation Procedure

Dependent upon the degree of the emergency and if safe to do so, employees will evacuate to the designated assembly area where the designated wardens shall account for all employees and determine if anyone still remains within the emergency scene.

Should a wild land fire or peat slippage occur, and the designated assembly area is compromised other locations will be designated as secondary assembly areas.

Wind turbines shall be fitted with fire suppression systems and will have emergency escape procedures in place for operational staff in the event of fire in a wind turbine.

6.2.9 Turbine Tower Rescue Procedure

In the event personnel are trapped or injured in an elevated turbine tower position the following protocol will be initiated:

1. The Emergency protocol will be initiated,
2. Emergency Response Liaison will be notified,
3. Tower Rescue Team will be activated and respond to the scene,
4. Outside medical and Rescue Teams will be notified and respond to the scene.

Tower Rescue Procedure:

1. Upon learning of an emergency, the on-scene foreman shall assess the emergency and ascertain its degree, location and the extent of any injuries.
2. Upon confirming that an emergency exists the on-scene foreman notifies the Emergency Response Liaison and the project Office.
3. Upon notification of the emergency the Emergency Response Liaison shall notify senior project supervision and the local emergency centre (999) of the emergency.
4. The Emergency Response Liaison shall inform the dispatcher of the location, tower number, the degree of the emergency and the extent of injuries.

6.2.10 Prevention of Illness/Injury Due to Weather/Elements

1. All employees will have access to shelter and heat in the event of inclement weather.
2. Employees will have access to at least a litre of water at all times.
3. High wind warnings and weather forecast will be discussed every morning with the crews. Weather conditions and forecast will be monitored regularly by management.
4. No Employee will work alone. A buddy system will be used so employees can contact a supervisor in case of an emergency.

6.2.11 Environmental Emergency Procedure

An emergency preparedness and response procedure is required to prevent environmental pollution incidents. Emergency Silt Control and Spillage Response Procedures are included in Section 4.3.3 to 4.3.5 of this CEMP.

Suitable spill kits and absorbent material for dealing with oil spills will be maintained on site. In the event of pollution or potential risk of pollution the Local Authority should be informed immediately.

In the case of water pollution in addition to the Local Authority, Inland Fisheries Ireland should also be informed immediately.

6.2.12 Emergency Response Plan – Haul Routes

Emergency Response Procedure relating to transportation of plant, equipment and materials to site to be developed by the main contractor during the construction phase of the wind farm.

6.2.13 Emergency Events – Wind Turbines

Each wind turbine, incorporating the tower, blades, gearbox and ancillary equipment in the tower and nacelle is a machine under the European Machinery Directive [2006/42/EC]. The duties of designers and manufacturers of machinery are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations [S.I.No.407/2008] (as amended). All wind turbines should be CE marked, which is in effect, a mark of assurance that the wind turbine complies with the essential health and safety requirements (EHSRs) of EU supply law. In all cases, the manufacturer or the manufacturer's authorised representative must compile information in a technical file confirming how the machine complies with these requirements. The commissioning of turbines and ancillaries must only be carried out by competent, trained and qualified personnel. The system of work for commissioning must be planned, organised, maintained and revised to ensure safety of personnel.

Potential emergency events associated with wind turbines include:

- Blade loss
- Fire
- Wind turbine toppling (due to foundation or tower failure);
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure);

The primary mitigation against an emergency catastrophic event that may endanger the health and safety of the public is implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of impact in the event of wind turbine collapse.

Peat slippage contingency measures have been included in Section 6.2.14 below in the unlikely event of landslide scenario.

6.2.14 Peat Slippage Contingency Measures

6.2.14.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All activities (if any) shall cease within the affected area.

(2) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities shall only start following a cessation of movement and a review by an experienced geotechnical engineer.

6.2.14.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) All relevant authorities should be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by an experienced geotechnical engineer and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

6.2.14.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

As detailed above, it is preferable to first prevent a peat slide from reaching a watercourse by constructing check barrages on land. Failing this, the most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

Typically, the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location shall be along the existing access roads on the wind farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 1

Schedule of Mitigation Measures

SCHEDULE OF MITIGATION MEASURES

This document sets out all mitigation measures as detailed in the Environmental Impact Assessment Report (EIAR) for the proposed Barnadivane Wind Farm.

1 AIR AND CLIMATE

1.1 Air Quality

1.1.1 Construction Phase

A Construction and Environmental Management Plan (CEMP) has been prepared and is included in Appendix 2.2, Volume 2. This includes for the following mitigation measures during the construction phase of the Proposed Project relevant to air quality:

- The internal access roads will be constructed prior to the commencement of other major construction activities. These roads will be finished with graded aggregate which compacts, preventing dust
- A water bowser will be available to spray work areas and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Earthworks and exposed areas/soil stockpiles will be re-vegetated to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled and directed to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the main entrance/exit point of the Proposed Development as described in the CEMP accompanying this EIAR (Appendix 2.2, Volume 2);
- The developer in association with the contractor will be required to implement the dust control plan as part of the CEMP (a CEMP is contained in Appendix 2.2, Volume 2). In the event the Planning Authority decides to grant permission for the Proposed Wind Farm, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Planning Authority;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

1.1.2 Operational Phase

As the operation of the Proposed Wind Farm will have positive impacts on air quality, mitigation measures are considered unnecessary.

1.1.3 Decommissioning Phase

Mitigation measures for the removal of wind turbines and all other site works from the Proposed Development site will be the same as the construction phase with respect to dust control and minimisation. The proposed access tracks across the Proposed Wind Farm site will be left in situ and utilised as forest roads following decommissioning and no mitigation measures are proposed. In terms of the Proposed Substation, this will be left in situ and so no mitigation measures are proposed.

1.2 Climate

It is considered that the Proposed Development will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting the new binding renewable energy target for the EU of 32% by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2022. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase up to 80% by 2030, with up to 8GW of increased onshore wind capacity. This will be achieved by:

- Phasing out fossil fuels;
- Harnessing renewable energy;
- Micro-generation; and
- Other measures.

As no significant impacts on climate are predicted during construction, operation and decommissioning no mitigation measures are necessary or proposed. In terms of the operational phase, the operation of the Proposed Development will have a positive effect on climate due to the displacement of fossil fuels.

2 NOISE AND VIBRATION

2.1 Construction Noise

The predicted noise from vehicle movements on the access track to the north of the site has the potential to exceed the noise limits in BS 5228-1:2009+A1:2014. This exceedance affects one property located immediately north of the access track (H1). It is therefore recommended that construction hoarding is located between this property and the adjacent access road for the duration of the construction works.

At other locations, the predicted noise levels from on-site activity from the Proposed Project is below the noise limits in BS 5228-1:2009+A1:2014. Nonetheless, several mitigation measures will be employed to minimise any potential impacts from the proposed project.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out in the Construction Environmental Management Plan (CEMP) within this EIAR. Proper maintenance of plant will be employed to minimise the noise produced by any site operations.

All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the project. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 - 19:00 hours Monday to Saturday However, to ensure that optimal use is made of fair-weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

The on-site construction and decommissioning noise levels will be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. However, there is potential for temporary elevated noise levels due to the grid connection works. However, the impact of these works at any particular NSL will be for a short duration (i.e. less than 3 days). Where the works at elevated noise levels are required over an extended period at a given location, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable.

2.2 Operational Noise

There are nineteen properties close to the Proposed Development which are either derelict, owned by stakeholders or both. Full details are provided in Appendix 9.3.

The predicted noise from the Proposed Development is within the daytime and night-time noise limits at all but one non-stakeholder NSL (H28). This location is a Garreneragh stakeholder property and exceeds the limits as a result of the adjacent Garreneragh windfarm. Noise from the Proposed Wind Farm only is within the criteria at this property. No noise mitigation is proposed at this location as the noise levels are determined by Garreneragh Windfarm.

There are two stakeholder properties (H34 and H36) that exceed daytime and night-time limits, as discussed in previous sections. Again, no noise mitigation is proposed for these properties. The stakeholder properties have been made aware of the exceedances and are happy to proceed on this basis.

This assessment is based on noise modelling which assumes that NSLs are downwind of all wind turbines. In practice, this will not occur all the time and when the NSL is upwind or cross-wind the actual noise levels will be lower.

2.3 Mitigation during Decommissioning

Similar mitigation measures should be employed as for during construction works, although construction noise levels are anticipated to be below the construction noise limits. The main noise mitigation measures include construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority. Decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, 07:00 - 19:00 hours Monday to Saturday in accordance with best practice.

3 SOILS, GEOLOGY AND HYDROGEOLOGY

The following section outlines appropriate mitigation measures by design and best practice to avoid or reduce the potential impact of the Proposed Project. Further details are given in Section 4.3 of the CEMP, which is contained in Appendix 2.2 of Volume 2.

3.1 Mitigation by Design and Best Practice

With regard to the Proposed Development, design and best practice has been and will be implemented as follows:

The primary mitigation measure employed has been the design of the Proposed Development site in terms of locating the turbines, access roads, material storage areas and other site infrastructure within an area comprising predominantly agricultural pastoral land where the soils are generally described as 'well drained' (from GSI Teagasc soils mapping).

In order to reduce the impacts on geology, hydrogeology and slope stability, infrastructure has been primarily located within areas of thinner soft ground and lower slope gradients. Extensive work has already been undertaken at the preliminary design stage to apply risk avoidance by design which included:

- Peat probing and site walkover surveys to identify geotechnical constraints (e.g. peat deposits and evidence of historic landslip) likely to adversely affect the design of the Proposed Development site.
- Relocation and micro-siting of turbines, hardstanding's and access roads based on the site assessments and geotechnical assessments in order to reduce ground risk associated with the Proposed Project.
- The works have been designed and checked by geotechnical and civil engineers, who are suitably qualified and experienced in excavation and earthworks design and construction methodologies. Details of experience and competence is included in Chapter 1.

The following will also be implemented:

- Any excavation and construction related works will be subject to a design risk assessment at detailed design stage to determine risk levels for the construction, operation and maintenance and decommissioning of the works. Identified impacts will be minimised by the application of principles of avoidance, prevention and protection. Information on residual impacts will be recorded and relayed to appropriate parties.
- A detailed method statement for each element of the works will be prepared by the Contractor prior to any element of the work being carried out.
- Given that the works comprise a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.
- The Contract will require programming of the works such that earthworks are not scheduled during severe weather conditions.

3.2 Construction Phase

The following sections outline appropriate mitigation measures to avoid or reduce the potential impact of the proposed development.

3.2.1 Construction Environmental Management Plan (CEMP)

A Construction Environmental Management Plan (CEMP) has been prepared for the Proposed Project and is included in Volume 2, Appendix 2.2. The CEMP defines the work practices, environmental management procedures and management responsibilities relating to the construction phase of the Proposed Development.

The CEMP sets out the key environmental management measures associated with the construction, operation and decommissioning of the site, to ensure that during these phases of the development, the environment is protected, and any potential impacts are minimised. The final CEMP will be developed further at the construction stage, on the appointment of the main contractor to the project to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned and shall be submitted to the planning authority.

Reference to relevant sections of the CEMP with respect to the mitigation of potential impacts to Soils, Geology and Hydrogeology from the Proposed Development are outlined below.

3.2.2 Earthworks

The Proposed Development will be constructed in a phased manner to reduce the potential impacts of the Proposed Project on the Soils, Geology and Hydrogeology. Phased construction reduces the amount of open, exposed excavations at any one time. Given that the works comprises a significant proportion of excavation and earthworks, suitably qualified and experienced geotechnical personnel will be required on site to supervise the works.

Details of the proposed methodology and mitigation measures are summarised below and are also outlined in Section 3.3.1 of the CEMP in Appendix 2.2 of Volume 2.

One of the primary mitigation measures employed at the preliminary design stage was the minimisation of volumes of excavated overburden deposits to be exported off site. All excavated overburden will be retained on-site.

This will include:

- Use of suitable site won material (crushed rock) as general fill in the construction of access tracks, hardstands and in reinstatement around turbine foundations.
- Surplus overburden will be re-used on site in the form of landscaping.

Surplus overburden deposits excavated during the course of the works will be temporarily stored in a level area adjacent to the construction phase excavations prior to reuse.

Some temporary stockpiles (not exceeding 2m in height) of material will be necessary adjacent to the excavation areas prior to reinstatement, however no long-term stockpiles of material will remain after construction and no surplus/waste soil or rock will be removed from the Proposed Project site.

Temporary stockpiles will be shaped and sealed to prevent the ingress of water from rainfall and placed away from open excavations, sloping / soft ground as not to create an instability risk during temporary works.

To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that soils outside the work area are not damaged. Excavations will then be carried out from access tracks as they are constructed in order to reduce the compaction of soft ground.

To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events (>10mm/hour). To mitigate against possible contamination of the exposed soils and bedrock, refuelling of machinery and plant will only occur at designated refuelling areas.

All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel fill will be used to provide additional support to temporary cuts/excavations where appropriate. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion.

3.2.3 Control of Sediment Laden Runoff

The potential impact from silt laden surface water runoff from increased erosion of exposed overburden deposits will be addressed particularly at drainage locations and where earthworks and vegetation clearance are proposed.

Details of the proposed Surface Water Management System and mitigation measures is summarised below and are also outlined in Section 4.3.5 of the CEMP in Appendix 2.2 of Volume 2.

Best practices will be employed in the prevention of silt laden run-off from entering watercourses as discussed below.

To minimise the impact to surface water quality, existing forestry drainage will be maintained outside the immediate site area, and where appropriate, additional site drainage and settlement ponds will be installed as required prior to construction activities. Silt fencing will be installed in new drainage and monitoring of water quality undertaken during the construction phase.

Final drainage will be constructed following the completion of these activities with silt fencing maintained until such time as a vegetation cover has become established. Chapter 7 of this EIAR discusses surface water issues in more detail.

3.2.4 Measures for Spills

Details of oil spill protection measures adjacent to sensitive receptors and emergency spill response procedures are outlined in Section 4.3 of the CEMP which is contained in Appendix 2.2 of Volume 2.

Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of construction vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage.

- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;
- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the Proposed Development site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage.

3.2.5 Slope Stability

With regard to slope stability issues, detailed design and construction phase best practice will be implemented as follows:

- The works will be supervised by a suitably qualified and experienced geotechnical engineer or engineering geologist, and hydrologist or drainage engineer.
- Drainage infrastructure will be put in place in advance of excavations. Drains will divert surface water and groundwater away from excavations into the existing and proposed surface drainage network. Uncontrolled, direct and concentrated discharges of water onto the ground surface will be avoided.
- Loading or stockpiling of materials on the surface of soft ground will be avoided. Loading or stockpiling on other deposits will not be undertaken without first establishing the adequacy of the ground to support loads by an appropriately qualified geotechnical engineer experienced in construction within upland conditions. No stockpiling of material shall take place on steep slopes.
- Excavation will be carried out from access roads or hardstanding areas to avoid tracking of construction plant across areas of soft ground.
- Blasting of rock will not be permitted.
- Excavations which could have the potential to undermine the up-slope component of an existing slope will be sufficiently supported to resist lateral slippage and careful attention will be given to the existing drainage.
- Earthworks will not be commenced when heavy or sustained rainfall (orange or red weather warnings) is forecast. A series of rainfall gauges will be installed across the Proposed Development site to provide a record of rainfall intensity. An inspection of site stability and drainage by the Geotechnical Engineer will be carried out on site when a daily rainfall of over 10mm/hr or 25mm/day is recorded on site, works will only recommence after heavy rain with the prior approval of the Geotechnical Engineer following their inspection.
- An emergency plan will be updated at pre-construction stage detailing the action plan which would be implemented in the unlikely event of a landslide/slope failure. Should a landslide/slope failure occur or if signs of instability/ground movement are observed, work will cease immediately.

Further details are given in the CEMP included in Appendix 2.2 of Volume 2 of this EIAR.

3.2.6 Groundwater

To mitigate against the increased vulnerability of the underlying aquifer to groundwater pollution, all excavations will be constructed and backfilled as quickly as possible. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the underlying groundwater, refuelling of machinery and plant will only occur at designated refuelling areas. Details of mitigation measures related to spills and fuel storage are outlined above.

The dewatering of the foundation excavations is not expected to cause interference with domestic wells in the area, due to large offset distances to known and presumed wells, relatively shallow depths of excavation and temporary short-term nature of dewatering, if required. To monitor groundwater during the construction phase groundwater monitoring wells will be installed between areas of deeper excavations and sensitive groundwater receptors. The wells will be used to monitor groundwater levels and quality to assess any potential impacts during the construction works.

The GSI database is however not complete; it is probable that there are other wells in addition to those in the GSI databases, but are generally associated with houses, the offset to which from the proposed turbines is a minimum of 750m. It is assumed in this assessment that there is a well present in every household within 1km of the site boundary. Given the limited depth of the excavations during the construction phase and the distance to sensitive groundwater receptors the potential risk posed to groundwater supply wells is considered to be Imperceptible following the implementation of mitigation measures discussed above.

If, however, in the exceedingly unlikely event of a previously unknown domestic well being impacted by the Proposed Development, an alternative supply will be provided – either a connection to mains water or a replacement well will be drilled.

Depending on the ground conditions, presence of services, traffic management required, weather conditions, etc., the rate of installation of cable ducting would vary between 50m and 100m per day. Dewatering is therefore unlikely to be required and no impacts on wells is envisaged.

The internal cable trenches could provide preferential pathways for groundwater and contaminant movement. Trenches will be excavated during dry periods in short sections (of approximately 50m – 100m) and left open for minimal periods, to avoid acting as a conduit for surface water flows. No excavations will be carried out in heavy rainfall. To further mitigate the risk of cable trenches becoming preferential pathways, clay plugs (or other low permeability material) will be installed at regular intervals along the trench to stop / inhibit water movement.

3.3 Mitigation Measures during Operation

It is not envisaged that the operation of the Proposed Development will result in significant impacts on the geological and hydrogeological regimes within the study area, as there will be no further disturbance of overburden post-construction.

There is a low risk to the geology receptors from compaction of soils due to the movement of HGVs and maintenance vehicles. All site traffic will be limited to access tracks, thereby reducing the area over which compaction of the underlying natural soils can occur.

The main potential residual impact during the operation phase would be the risk to groundwater from contamination from spills. Storage tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. Refuelling of maintenance vehicles will be carried out from these tanks or from delivery vehicles at designated refuelling areas. Specific mitigation measures relating to the management of hydrocarbons are as follows:

- Fuels, lubricants and hydraulic fluids for equipment used on the site will be carefully handled to avoid spillage.
- Any spillage of fuels, lubricants or hydraulic oils will be immediately contained, and the contaminated soil removed from the site and properly disposed of;

- Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling; and
- Appropriate spill control equipment, such as oil soakage pads, will be kept within the refuelling areas and in each item of plant to deal with any accidental spillage.

Due to the reduced magnitude of the impacts, no additional mitigation measures are required for the maintenance and operation of the Proposed Development site, over and above those incorporated into the design of the substation transformer, which will be bunded to protect soils against accidental leakages of oils and battery fluids.

3.4 Mitigation measures during Decommissioning

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant.

Some of the impacts associated with reinstatement of the site (excavation of turbine bases, access tracks etc.) will be avoided by leaving these in place where possible. The Irish Wind Energy Association (IWEA) (2012) states that when decommissioning a wind farm "the concrete bases could be removed, but it may be better to leave them under the ground, as this causes less disturbance". It is proposed to leave the access tracks in-situ at the decommissioning stage. IWEA also state that "it may be best" to leave site tracks in-situ depending on the size and geography of the development.

It is considered that leaving the turbine foundations, access tracks and hardstanding areas in-situ will cause less environmental damage than removing and recycling them. It is proposed to retain these elements of the construction. Turbine bases will be covered with overburden material to allow for re-vegetation of the Proposed Development site. It is proposed that the internal site access tracks and hard standings will be left in place and the land reinstated at these locations. The electrical infrastructure including substations and ancillary electrical equipment shall form part of the national grid and will be left in-situ.

Removal of this infrastructure would result in considerable disruption to the local environment in terms of increased sedimentation, erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required by the respective local authority all infrastructure will be removed with mitigation measures similar to those during construction being employed.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures outlined above.

4 HYDROLOGY AND WATER QUALITY

4.1 Proposed Mitigation Measures

4.1.1 Overview

The proposed surface water drainage strategy and construction techniques will also provide mitigation to ensure that there is no impact on water quality downstream of the site as a result of the Proposed Development.

The surface water management plan will include a Surface Water Quality Monitoring Programme. Monitoring will be undertaken at least 12 months prior to construction commencing to enable baseline conditions of surface water quality to be locally well established on the surface water receptors. This will be undertaken in co-ordination with aquatic ecology surveys to understand the baseline biodiversity.

Surface water sampling will be carried out to establish a baseline for water quality for the receiving waters of the Proposed Development. Water sampling will be coordinated with the aquatic ecological assessment to ensure comparability. Regarding acceptable water quality, as guidance, European Communities Environmental Objectives (Surface Water) Regulations S.I. 272 of 2009, (EOSWR 272/09) thresholds are shown in Table 4-1.

The following parameters will be measured in order to provide a comprehensive baseline of the biological water quality:

- pH.
- Alkalinity (mg CaCO3/l).
- Total Ammonia (mg N/l).
- Molybdate Reactive Phosphorus MRP (mg P/l).
- Total Oxidised Nitrogen TON (mg N/l).
- Dissolved Organic Carbon DOC (mg C/l).
- Biological Oxygen Demand BOD (mg O2/l).
- Chemical Oxygen Demand COD (mg O2/l).
- Suspended solids (mg/l).

Table 4-1: Acceptable Chemical Conditions (European Communities Environmental Objectives (Surface Water) Regulations S.I. 272 of 2009, (EOSWR 272/09))

Parameter	Threshold Values (mg/L)
BOD	High status ≤ 1.3 (mean)
	High status ≤ 2.2 (95%ile)
	Good status ≤ 1.5 (mean)
	Good status ≤ 2.6 (95%ile)
Total Ammonia	High status ≤ 0.040 (mean)
	High status ≤ 0.090 (95%ile)
	Good status ≤ 0.065 (mean)
	Good status ≤ 0.14 (95%ile)
Molybdate Reactive Phosphorus (mg/l P)	High Status < 0.025 (mean) or <0.045 (95%ile) Good Status <0.035 (mean) or < 0.075 (95%ile)

4.1.2 Proposed Mitigation Measures for the Construction Stage

Best practice construction methods will be used during the construction stage to minimise impacts on water quality. Examples of further mitigative measures for key parts of the construction phase are identified below.

These are outlined in more detail in the CEMP Chapter. For instance, regarding good practice associated with mitigating the risk of hydrocarbon release during construction, as stated in the SWMP, construction vehicles will be refuelled off-site, wherever possible. This will primarily be the case for road vehicles such as vans and trucks. Refuelling of mobile plant during construction will be carried out at the temporary construction compound. Any additional fuel containers, other than the fuel bowser, used for smaller equipment (such as generators, lights etc.) will be stored within additional secondary containment e.g. bund for static tanks or drip trays for smaller mobile containers. Taps/nozzles for fuels and storage containers for oils will be fitted with locks to ensure their use is controlled. Only designated trained and competent operatives will be authorised to refuel plant on site.

All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

a) 110% of the capacity of the largest tank or drum within the bunded area; or
b) 25% of the total volume of substance which could be stored within the bunded area.

Despite the area of the site delineated by the boundary, the footprint of the infrastructure and associated buffer of land changed on site is significantly less. This means the vast majority of the site will remain as its current land use. For instance, regarding the foundations of each turbine, each foundation is circular, with relatively narrow (25 m) diameter and (3.5m) depth. This is an inherent mitigation in design.

4.1.3 Proposed Mitigation Measures for Operation and Maintenance Stage

The proposed surface water management plan (SWMP) will ensure that there is no impact on water quality as a result of the Proposed Development. The proposed drainage system will provide several stages of treatment to surface water runoff from constructed areas, which follows the concept of a multi-stage SuDS 'treatment train'.

Interceptor drains installed upslope of access tracks and areas of hardstanding will divert surface water runoff from undeveloped land around the constructed areas to disperse naturally within open ground without mixing with the construction drainage.

The proposed swales will intercept surface water runoff from access tracks and areas of hardstanding. The grass within the swales will provide some filtration to remove a portion of silt and suspended solids. Silt traps will be provided upstream of outfalls from roadside swales. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to discharge. Additional treatment will be provided upstream of the settlement pond with the use of drainage stone at the inlet to provide filtration. In an emergency, the outfall from a settlement pond can be blocked to provide a temporary holding area for accidental spillages on site.

As stated in the SWMP, to adhere to CIRIA C753, part of the maintenance routine that will mitigate issues relating to surface water is to inspect the following: drains, cross-drains and culverts for blockages; outfalls to existing field drains and watercourses, existing roadside swales for obstructions; progress of re-vegetation.

The water quality will also be tested at outfalls at appropriate intervals (to be defined when informed) for 12 months to comprise the baseline monitoring regime pre-construction.

4.1.4 Proposed Mitigation Measure for Decommissioning Stage

The access tracks would remain in situ for land management purposes, after the end of the operational period. Additionally, the turbine foundations and hardstanding will remain in situ and be covered over with soil from the site to re-vegetate naturally. This inherently mitigates disturbance through decommissioning process. Silt protection procedures, similar to during construction will be re-instated for decommissioning. If there is perceived to be risk of erosion during inspection of the revegetated hardstandings then erosion control measures will be taken.

4.1.5 Proposed Mitigation Measures for Flooding

The Proposed Turbine Bases, new access tracks, widened existing access tracks and new compound areas will all increase the impermeable area within the site potentially increasing the rate and volume of surface water runoff during storm events.

All access tracks will be constructed from aggregate which will allow a portion of rainfall to infiltrate and, therefore, reduce surface water runoff. Adjacent swales will also intercept and retain surface water runoff allowing this to disperse naturally via infiltration and evapotranspiration. Where swales are installed on sloped ground, check dam structures will be used within the channels to provide storage, allowing a portion of the flows to disperse naturally.

Swales and drainage channels will discharge runoff from access roads and areas of hardstanding to settlement ponds. These will be suitably size to accommodate flows from storm events up to and including the 1 in 100-year storm event.

Settlement ponds will not discharge to a watercourse and flows from the ponds will disperse naturally within the catchment.

Watercourse crossings will be suitably sized to accommodate flows during the 1 in 100-year storm event, with no risk of impeding flows during extreme storm events and causing flooding upstream of the crossing. The cable trenches will be excavated in dry weather where possible and infilled and revegetated where appropriate. There will, therefore, be no increase in the risk of flooding.

The surface water management system at the site will ensure that there will be no increase in the risk of fluvial or surface water flooding downstream as a result of the Proposed Development.

5 POPULATION, HUMAN HEALTH & MATERIAL ASSETS

5.1 Population

As there are no significant effects predicted on population trends and population density, no mitigation measures are required.

5.2 Socio-economics, Employment and Economic Activity

Given that potential effects of the Proposed Development at construction, operation and decommissioning phases are predominantly positive in respect of socio-economics, employment and economic activity, no mitigation measures are considered necessary.

5.3 Land Use

Mitigation measures for land use are primarily related to preliminary design stage, which has allowed for the prevention of unnecessary or inappropriate ground works or land use alterations to occur. The construction and operational footprint of the Proposed Development has been kept to the minimum necessary to avoid negative effects on existing land uses as so far as possible.

Existing agricultural tracks have been incorporated into the design in order to minimise the construction of new tracks and roads and minimise the removal of agricultural and forested areas. Where new access tracks are required, these have been sensitively designed in order to minimise impact on agriculture so far as possible. Electricity cables will be installed underground in or alongside access tracks to avoid negative effects on agricultural practices.

The construction and decommissioning works will be planned and controlled by a Construction and Environmental Management Plan (CEMP). The CEMP for the construction phase is included in Appendix 2.2 of Volume 2 of this EIAR.

This provides details on day to day works and methodologies. As part of these works, the public and other stakeholders will be provided with updates on construction activities which will affect access to lands. This will be communicated to members of the public through a community liaison officer employed for the duration of the construction period.

5.4 Recreation, Amenity and Tourism

Mitigation measures for recreation, amenity and tourism are primarily related to the preliminary design stage of the Proposed Development, which has allowed for the prevention of unnecessary or inappropriate development to occur that would significantly affect any recreational or tourist amenity. In designing the Proposed Development, careful consideration was given to the potential impact on landscape amenity. The magnitude of visual impact on the landscape is assessed in Chapter 8 – Landscape and Visual.

The most significant potential for tourism and recreation activity at the site and surrounding area was identified as trail walking, historical areas, equestrian activity and sports activities (sports grounds). During the construction, operation and decommissioning phases it is unlikely that the Proposed Development will impact on these activities as the proposed site and works do not directly interact with any facilities or trails associated with these tourism and recreation activities, therefore mitigation is not required.

Chapter 11: Traffic and Transportation sets out mitigation measures for potential effects associated with increased traffic volumes of the construction and decommissioning phases of the Proposed Development which may have an indirect impact on recreation and amenity in the area of the Proposed Development and also potential indirect impact on town centre and village centre facilities and services along the TDR during transportation of turbine components.

5.5 Human Health & Safety

5.5.1 Construction & Decommissioning

To maintain safety and avoid health impacts on construction workers and the general public, best practice site safety and environmental management will be maintained. The Proposed Development will be designed, constructed, operated and decommissioned[1] in accordance with the following:

- Safety, Health & Welfare at Work (Construction) Regulations 2013
- Safety, Health & Welfare at Work Act 2005
- Safety, Health & Welfare at Work (General Applications) Regulations 2007

All construction staff will be trained to the correct Health and Safety standards in order to carry out their duties and will be informed and aware of potential hazards. A Construction and Environmental Management Plan is included in Appendix 2.2, will be circulated to all construction workers which will detail safety protocol and methodology. Furthermore, site investigation has been completed and mitigation has been proposed as detailed in Chapter 6: Lands, Soils and Geology and Chapter 7: Hydrology and Water Quality.

All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project.

FÁS Safe Pass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required.

The developer is required to ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety & Health Management Plan.

In relation to COVID-19, up to date HSE guidance will be consulted regularly in line with HSA recommendations and all reasonable on-site precautions will be taken to reduce the spread of COVID-19 on construction sites, should the virus be prevalent at the time of construction.

[1] The Proposed Substation will not be decommissioned as it will become an ESBN/EirGrid asset following construction and become a part of the electricity grid network.

Once mitigation measures and health and safety measures are followed, the potential for impact on human health on the construction site during construction and decommissioning is expected to be not significant and temporary to short-term.

Appropriate warning signage will be posted at the construction site entrance, directing all visitors to the site manager. Appropriate signage will be provided on public roads approaching site entrances and along haul routes to maintain public safety.

In relation to the TDR, extra safety measures will be employed when large loads are being transported, for instance, Garda escort will be requested for turbine delivery and a comprehensive turbine delivery plan will be utilised to avoid potential impact to human safety for road users and pedestrians. A traffic and transport assessment has been completed and is detailed in Chapter 11: Traffic and Transportation.

Once mitigation measures and health and safety measures are implemented and followed, the potential for impact on human health for members of the public during construction and decommissioning of the Proposed Project is expected to be not significant and temporary to short-term.

5.5.2 Operational Phase

For operation and maintenance staff working at the Proposed Wind Farm, appropriate site safety measures will be utilised during the operational phase by all permitted employees.

All personnel undertaking works in or around the turbines will be fully trained and will use appropriate Personal Protective Equipment (PPE) to prevent injury.

Equipment within high voltage substations presents a potential hazard to health and safety. The Proposed Substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESB and EirGrid standards.

All electrical elements of the Proposed Development are designed to ensure compliance with EMF standards for human safety.

All on-site electrical connections are carried by underground cable and will be marked out above ground where they extend beyond the track or hardstanding surface. Details of cables installed in the public road will be available from ESBN.

Lightning conductors will be installed on each turbine as all structures standing tall in the sky require this protection. Turbines specifically require this to prevent power surges to electrical components.

Turbines will be fitted with ice detection systems which will stop the turbine from rotating if ice is forming on a turbine blade. This aims to prevent ice throw which can cause injury.

Rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning and operation will ensure the risk posed to humans is negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts. In addition to scheduled maintenance, the maintenance contracts will allow for call out of local engineers to resolve any issues as soon as they are picked up on the remote monitoring system.

Access to the turbines inner structure will be locked at all times and only accessed by licenced employees for maintenance.

In line with the Health Service Executive's Emergency Planning recommendations, any incident which may occur at the site which requires emergency services, incident information will be provided in the 'ETHANE' format.

- Exact location;
- Type of incident;
- Hazards;
- Access and egress;
- Number of casualties (if any) and condition;
- Emergency services present and required.

The design of the Proposed Development has considered the susceptibility to natural disasters. The proposed site drainage will mitigate against any potential flooding risk with the use of swales as described in Chapter 7 – Hydrology and Water Quality.

A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of fire-fighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on site at all times.

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines to prevent operation during periods when shadow flicker is predicted to exceed the thresholds set out in WEDG 2006 at all sensitive receptors located within 10 rotor diameters of the Proposed Development. This is beyond the requirements of WEDG 2006, which recommends the limits apply only to properties located within 500 m of a development. This is further detailed in section 10.7.3.3 of Chapter 10.

In order to ensure the Proposed Wind Farm is compliant with the noise limits, some of the turbines may need to be operated in noise reduced modes of operation in order to protect residential amenity. Details of these mitigation measures are set out in Chapter 9: Noise and Vibration.

The wind farm system shall include a kill switch that can be operated at any time with an overriding manual shutdown system in case of an emergency.

5.6 Material Assets (Renewable, Non-Renewable Resources and Utility Infrastructure)

Non-renewable resources of stone and fill will be sourced locally insofar as possible to minimise transportation distances.

Where services and street furniture are required to be removed temporarily to accommodate turbine delivery, residents and business in proximity to the works will be informed in advance.

No accommodation works will be required for the TDR. It is likely that turbine delivery will take place outside of regular travelling/commuting hours in order to avoid potential traffic impacts on major routes and will be supervised under Garda escort.

A Construction Waste Management Plan has been prepared for the Proposed Development and is included in the CEMP in Appendix 2.2, in line with the" Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects" (2006) as published by the Department of the Environment, Community and Local Government and supported by the Southern Region Waste Management Plan 2015-2021.

The Waste Management Plan will be finalised in accordance with the CEMP following the appointment of the contractor for the main construction works and will take cognisance of any newly published waste management policy.

5.7 Shadow Flicker

Shadow flicker control modules, consisting of light sensors and specialised software, will be installed on the turbines to prevent operation during periods when shadow flicker is predicted to exceed the exposure thresholds set out in WEDG 2006 at all sensitive receptors located within 10 rotor diameters of the Proposed Wind Farm i.e. 30 minutes per day and / or 30 hours per year. This is beyond the requirements of WEDG 2006, which recommends the limits apply only to properties located within 500 m of a development.

The calculated shadow flicker periods, which are detailed in Appendix 10-3, can be input into the turbine control software and when the correct conditions are met when the light intensity is sufficient, the turbine is operational and orientated towards the receptor, the event is within a calculated potential period of shadow flicker, and the thresholds identified in the WEDG 2006 have been exceeded individual turbines will cease operation (allowing for a short period for the control software to react and for the turbine blades to gradually slow down) until the conditions for shadow flicker are no longer present.

6 TRAFFIC AND TRANSPORTATION

This section summarises the mitigation measures to minimise the effects of the Proposed Development during both the construction and operational stages.

6.1 Mitigation by Design

Mitigation by design measures includes the following;

- Selection of the most appropriate delivery route to transport the wind turbine components, requiring minimum remedial works to accommodate the vehicles as set out in Section 11.6 of Chapter 11.
- Construction of temporary improvements at locations identified in Section 11.6 of Chapter 11.
- Use of on-site borrow pit to produce materials to minimise deliveries to site during construction (a total of 1,793m^3 of soil and 9,696m^3 of rock will be won from the borrow pit),
- Use of granted grid connection between the site and the existing Carrigarierk Wind Site to alleviate requirement for construction works along regional road. It is noted that this will only be used in the eventuality that the substation included as part of the Proposed Development is not granted planning permission.

6.2 Mitigation Measures During the Construction Stage

The successful completion of the Proposed Development will require significant coordination and planning and it is therefore recommended that the following comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the Proposed Development.

6.2.1 Delivery of abnormal sized loads

The following are the main points to note for these deliveries which will take place after peak evening traffic:

- The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised.
- The deliveries will be made in consultation with the Local Authority and An Garda Síochána.
- It is estimated that 48 abnormal sized loads will be delivered to the site, comprising 10 convoys of 5, undertaken over 10 separate nights.
- These nights will be spread out over an approximate period of 5 weeks and will be agreed in advance with the relevant authorities
- In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 5 vehicles.
- There will also be two escort vehicles provided by the haulage company for each convoy.

6.2.2 Other traffic management measures

A **Traffic Management Plan (TMP)** has been prepared and will require to be adopted by the Contractor once engaged prior to the commencement of the construction phase of the Proposed Development. The TMP includes the following:

- **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management.
- **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site.
- **Information to locals –** Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Traffic Management Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided.
- **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated with the Proposed Development can be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.
- **Liaison with the relevant local authority** - Liaison with the County Council and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and “prior to commencement” status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for the Traffic Management Co-ordinator , the Project Developer/Contractor Site Manager as well as the Site Environmental Manager.
- **Utilisation of temporary alterations to road network at critical junctions –** at locations highlighted in Section 11.6 of Chapter 11. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable.
- **Identification of delivery routes** – These routes will be agreed with the County Council and adhered to by all contractors.
- **Delivery times of large turbine components** - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.
- **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking.

- **Additional measures** - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is included as Appendix 2.2 of Volume 2 of this EIAR.
- **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers

6.3 Mitigation Measures During Operational Stage

Due to the very low volumes of traffic forecast to be generated during this stage no mitigation measures are required.

6.4 Mitigation Measures During Decommissioning Stage

In the event that the Proposed Development is decommissioned after the c.25 years of operation, a decommissioning plan, including material recycling / disposal and traffic management plan will be prepared for agreement with the local authority. This plan will contain similar mitigation measures to those implemented during the construction phase.

7 CULTURAL HERITAGE

7.1 Proposed Mitigation Measures:

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Pre-construction archaeological testing of turbine bases and hardstands and proposed access tracks will be carried out prior to construction. A report setting out the results of the testing will be submitted to the relevant authorities.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project. This is in accordance with the appropriate guidelines.
- Archaeological monitoring of the removal of the townland boundary. A drawn and descriptive record of the portions of the boundary to be removed should be made and included in the monitoring report.

8 LANDSCAPE AND VISUAL IMPACT

Given the highly visible nature of commercial wind energy developments it is not generally feasible to screen them from view using on-site measures as would be the primary form of mitigation for many other types of development. Instead, landscape and visual mitigation for wind farms must be incorporated into the early stage site selection and design phases. In this instance, the main form of landscape and visual mitigation employed was:

- Mitigation by avoidance and design.

8.1 Mitigation by Avoidance and Design

In this instance, the main mitigation by avoidance measure is the siting of the proposed development in a robust part of Cork's landscape that is not heavily influenced by susceptible landscape receptors. Indeed, the current Cork CDP reinforces the robust nature of this landscape context as the Proposed Development is situated in a part of Cork classified as 'Areas Most Likely to be Suitable' in relation to wind energy development. Furthermore, the current CDP also designates the landscape of much of the central study area with 'local importance', 'low value' and 'low sensitivity', further highlighting the typical and non-distinctive nature of this landscape context that can well accommodate a modest-scale wind energy development.

It is also important to note that the Proposed Development is also sited adjacent to an existing wind farm development, and therefore, the proposed wind farm represents the intensification of an existing land use and not the introduction of a new and unfamiliar one.

9 TELECOMMUNICATIONS AND AVIATION

9.1 Telecommunications and Broadcasting

Mitigation measures consist of mitigation by design to avoid impacts on telecommunication links. As there is no potential for electromagnetic interference from the proposed project on telecommunications, there are no mitigation measures proposed for the construction, operation, or decommissioning phase of the Proposed Development.

There is potential for broadcasting to be affected at receivers close to the Proposed Development during the operational phase, i.e., nearby dwellings. Mitigation by design has achieved a significant setback between the turbines and the nearest dwelling which will reduce potential effects on receivers. RTE Transmission Network Ltd have requested that a protocol be signed between 2RN and the developer should the site go ahead. The protocol sets out the developer's obligation to correct any deterioration in television and radio signal reception.

It is possible that houses in the immediate vicinity of the turbines could require some remedial measures in relation to television reception. In practice, such measures are not difficult to implement, are relatively inexpensive and if necessary, will be undertaken by the developer in conjunction with RTÉ. Such measures could include:

- antenna relocation
- replacing aerials with more directional types
- the relaying of signals around the site using another transmitter
- the relaying of signals through the site using deflectors mounted on the turbines
- the cabling of signals underground through the site
- the installation of booster signals
- provision of satellite television facilities

The requirement for the implementation of such measures will be addressed individually with telecommunication service providers, should the need arise.

9.2 Aviation

In line with standard practice for wind farm developments, the coordinates and elevations for turbines will be supplied to the IAA at the end of the construction phase. An aeronautical obstacle lighting scheme will be agreed with IAA in line with IAA's consultation response and applied to the proposed turbines.

10 BIODIVERSITY

Mitigation measures are described below which will avoid, reduce and where possible, offset likely significant impacts arising in relation to ecology from the construction, operation and decommissioning of the site. These mitigation measures shall be implemented in full.

10.1 Mitigation by Avoidance and Design

The following measures are incorporated into the Proposed Development design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the Proposed Development has been kept to the minimum necessary for the maximum turbine envelope proposed, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct impacts effects on designated sites.
- All cabling for the project will be placed underground; this significantly reduces collision risk to birds over the lifetime of the Proposed Development (Drewitt and Langston, 2006).
- There will be no watercourse crossings within the Proposed Development. The access tracks will cross one manmade agricultural drain using 450mm diameter pipes.

10.2 Mitigation Measures during Construction

Construction of this project is expected to cause temporary (disturbance) adverse impacts effects on local ecological receptors, as outlined in the impact appraisal above. The mitigation measures described below will reduce these impacts effects significantly.

Project Ecologist

A Project Ecologist/Ecological Clerk of Works (ECoW) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will advise on environmental effects and communicate with the project owner and contractor to ensure the required actions to implement the mitigation prescribed in this EIAR are carried out. The ECoW will undertake a toolbox talk to all personnel before they commence work on-site.

Habitats and Flora

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the Proposed Development has been kept to the minimum necessary, including the use of layout design methods including existing roads and drain crossings to minimise excavation works.

No disturbance to habitats or flora outside the Proposed Development area will occur. Works will be restricted to the immediate footprint of the development (see CEMP; Appendix 2.2). Machinery, and equipment will be stored within the site compound.

Designated access points will be established within the site and all construction traffic will be restricted to these locations. Access to the site will be via the existing regional road R466.

Hedgerow and Treeline Reinstatement

Hedgerow and treeline planting will be carried out for the Proposed Development. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

A total of 8 new hedgerows or treelines totalling c. 1,804m in length will be planted, and 670m of existing hedgerow to be enhanced at the Proposed Development site to mitigate linear wooded habitat loss and enhance connectivity in the landscape, leading to an overall biodiversity net gain. Details are included in the Biodiversity Enhancement & Management Plan (Appendix 5.7). The species proposed to be planted at these locations are detailed in Table 10-1.

Table 10-1: Species to be planted in new hedgerows/ treelines

Linear Feature	Species
1	Oak, rowan, holly, grey willow
2	Oak, rowan, holly, grey willow
3	Oak, rowan, birch, grey willow, hawthorn, holly
4	Oak, rowan, birch, grey willow, hawthorn, holly
5	Holly, grey willow, rowan, bilberry
6	Holly, grey willow, rowan, bilberry
7	Hawthorn, elder, holly, grey willow
8	Hawthorn, grey willow, holly

10.2.1 Management of the Spread of Non-native Invasive Species

Where invasive non-native species are present within the Proposed Development site, measures will be implemented to ensure spread of these species is prevented, and where feasible eradicated as described below and in the invasive species management plan (Appendix 5.8)

- Prior to works an invasive species survey will be undertaken in the area to reconfirm the findings of the EIAR.

The invasive species plan and management plan (Appendix 5.8) will be adhered to for the works. According to Invasive Species Ireland (ISI) invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity.

Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

- Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication.
- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infestation to ensure that seeds are not transported to other sections of the site via vehicular traffic, equipment or PPE.
- No machinery or personnel shall be allowed within this restricted area. Similarly, there shall be no storage of materials within or adjacent to this restricted area.
- There shall be no vegetation clearance or trimming within the cordoned area (except were undertaken in accordance with the invasive species management plan) as this can lead to the species recolonising other areas via the wind, water if displaced into drains, or soil and vegetation attached to machinery, vehicles or personnel.
- If schedule III species are present, no soil or vegetation shall be removed from this area unless it is securely contained and is transported under licence to a suitably licenced facility for treatment.
- For non-schedule III species, no soil or vegetation shall be removed from this area unless it is securely contained and is to be disposed of appropriately onsite or transported to a suitably licenced facility for treatment.
- Informing all site staff through toolbox talk as part of site inductions.
- Any new sightings of the species shall by relayed to construction staff and the developer via the project ecologist/ECoW. These areas shall follow the same protocol as described above.
- Reporting sighting(s) to the NPWS and NBDC and liaising with the NPWS.

10.2.2 Mammals

A preconstruction mammal survey will be undertaken to reconfirm the findings of the EIAR.

An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate. This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. badger setts, red squirrel dreys) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with, relevant guidelines shall be followed and any licences/amendments to licences will be sought from NPWS.

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the site which avoid sensitive features (e.g. mature treelines and hedgerows).

Badger

No evidence of badger setts was observed within the study area, and no badger signs were recorded at the Proposed Development site.

A pre-construction mammal survey including a badger survey will be undertaken within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, in the event that a badger sett should be encountered at any point, then NPWS will be informed and NRA Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes will be followed.

There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works. If sets are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted, and the mitigation plan shall be amended as required. An activity survey shall be carried out to assess the potential for the sett to be used by badgers.

In the event that a badger is found injured during the proposed mitigation measures, it is important to realise that injured badgers will be frightened and can be very dangerous. They are strong animals and are not used to being handled, so no attempt will be made to touch an injured badger, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

Otter

No evidence of otter holts was observed within the study area, and no otter signs were recorded at the Proposed Development site.

A pre-construction mammal survey will be undertaken (no earlier than 12 months prior to construction) within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, if an otter holt should be encountered at any point, then NPWS will be informed and NRA Guidelines for the Treatment of Otters Prior To the Construction of National Road Schemes will be followed.

Red Squirrel

Where possible, any required removal of trees along the edges of the small stands of conifer plantation (WD4) will be limited to time periods outside which Red Squirrel may have young in dreys (peak period January to March).

If this is unavoidable, then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied dreys are present. A derogation/disturbance licence will be sought if dreys are found within the footprint or adjacent areas.

Pine Marten

Where possible, removal of trees in along the edges of the small stands of conifer plantation (WD4) will be limited to time periods outside which pine martens may have young in dens (March and April). If this is unavoidable, then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied pine marten dens are present. A license under the Wildlife act will be applied for should any sites have to be disturbed.

Irish Hare, Pygmy Shrew and Hedgehog

These species are mobile and will disperse, however, hibernating hedgehogs and the young of Irish hare, pygmy shrew or hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary).

Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming / maintenance during clearance works as appropriate.

- Outside of the bird breeding season (March 1st to August 31st inclusive) attention will be paid to the removal of vegetation, scrub and hedgerow with regards to leverets, October to March for hibernating Hedgehog and September to October for breeding Pygmy Shrew as is appropriate.
- Within the breeding bird season and outside of it, attention will be paid to the removal and/or maintenance of dense grassland for breeding hare (all year), pygmy shrew (April to October) and Hedgehog (April to July)

Bats

Buffer Zone

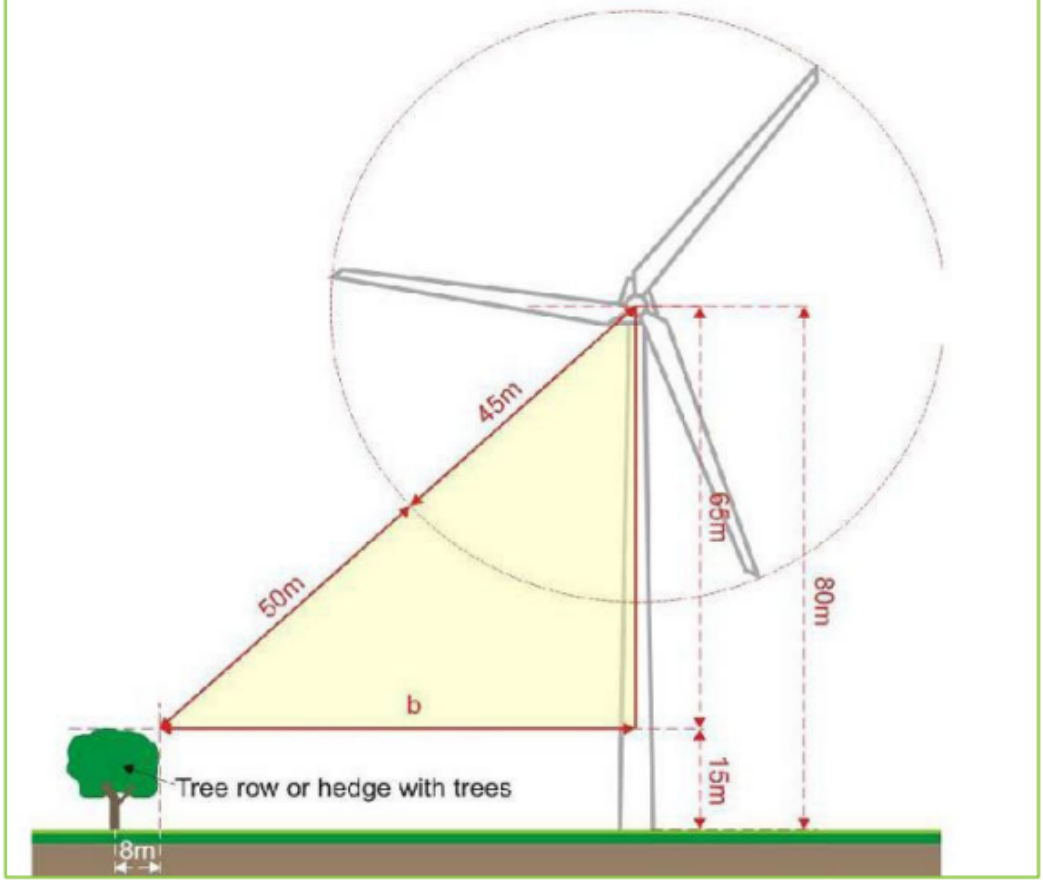
To minimize risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude.

According to NatureScot (2021) guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning."*

These distances were taken into account during the design phase of the Proposed Wind Farm Development.

The following formula was used to calculate the required bat buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$b = \sqrt{\{(50 + bl)2 - (hh - fh)2\}}$

where: b = the distance on the ground between the edge of the canopy and the turbine (m)

bl = blade length (m)

hh = hub height (m)

fh = feature height (m)

Locations representative of the habitat types and features at turbine locations were surveyed, and the bat activity survey findings recorded informed the application of the 50m blade tip buffer described above at all six proposed turbine locations. Surrounding habitats, height of surrounding hedgerows and bat buffer calculated using the above equation.

To minimise risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers for each turbine location is based on a blade length of 58.5m a hub height of 72.5m and a feature height of 5m. The bat buffer zone for vegetation clearance is therefore **84.9m** radius surrounding all six turbines.

Existing hedgerows and scrub will be cleared around all six turbines to provide a vegetation-free buffer zone around each turbine in accordance with above calculations. All buffers will be maintained throughout the lifetime of the Proposed Development.
Additionally, a section of drainage ditch will be cleared of vegetation extending beyond the bat vegetation clearance buffer of T2, to discourage bats travelling along this drainage ditch towards T2 and to redirect them along existing hedgerows onsite, see Figure 3-2 in Appendix 5.7 for location.

Vegetation will be cleared along c. 132m of this drainage ditch. The maintenance of vegetation within bat buffers will be cared out by mechanical means. No chemicals including herbicide are permitted.

The following additional mitigation measures for bats are proposed:

Supervision of Vegetation Clearance

An ecologist/ECoW will supervise areas where tailored discreet vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of Trees

Several species of bats roost in trees. No trees offering potential bat roosting habitat were found within the Proposed Development site.

Retained trees will be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

Pre-construction Surveys

If three years lapse from between planning-stage surveys in 2022 and installation of the wind turbines, it will be necessary to repeat one season of static detector surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; NatureScot, 2019; 2021) and includes static detector, activity and roost inspection surveys.

Compensation for loss of commuting routes/Diversion from vegetation clearance buffers

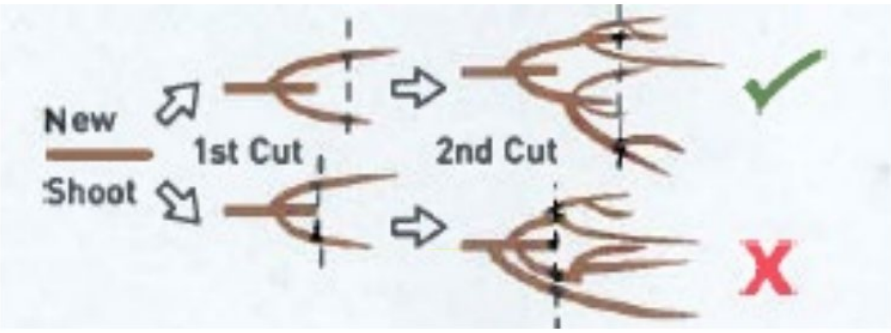
Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. Approximately 1,642m (equating to 18% of this habitat within the study area) of hedgerows is anticipated to be lost within the development footprint. Approx. 337m (equating to 14.1% of this habitat within the study area) of treelines is anticipated to be lost under the development footprint. Vegetation buffer clearance around turbines will alter commuting and foraging routes associated with existing hedgerows and woodland edges to avoid bats entering the rotor sweep zone of turbines.

Where hedgerows and treelines are affected by turbine clearance buffers, bats will be directed away from tree-free buffers along an alternative commuting route, see Figure 5-13 in Chapter 5. This will be achieved by planting new pollinator friendly hedgerows. Willow and Alder will also be included in these hedgerows due to their rapid growth. It is proposed to create double lines of hedgerow, with Willow on one side, and pollinator-friendly hedgerow species listed below on the other. Planting of these species will be staggered to prevent excessive shading and aid establishment of the hedgerows.

All hedgerow planting is required to use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. 2–3-year-old alder and willow trees are required for hedgerows to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species are to be planted along the inner edges of these hedgerows: grey willow Salix cinerea and alder Alnus glutinosa. The following native fruiting hedgerow species are to be planted along the outer edges of these hedgerows: whitethorn Crataegus monogyna, elder, Holly Ilex aquifolium and rowan Sorbus aucuparia.

Tightly cut hedgerows with flat tops provide little benefit to wildlife, taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Plate 10-1) as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.



Source: Teagasc

Plate 10-1: Hedgerow Level of Cut

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. A finger-bar cutter is recommended as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the Proposed Development site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. streams, treelines and hedgerows). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt, A. L. and Langston, R. H., 2006)

The clearance of vegetation at the Site should only be carried out in the period September to February inclusive, i.e. outside the main bird nesting season. Where vegetation removal is required outside this period, vegetation will be inspected for nesting birds by a suitably qualified Ecologist. In the event of birds nesting within areas required to be felled suitable mitigation (implementation of buffer zones and/or seasonal constraints; nest monitoring) will be put in place and felling will only proceed upon agreement with NPWS and receipt of a wildlife licence.

Planting new pollinator-friendly hedgerows, with willow included in these hedgerows due to it's rapid growth rate which will accelerate establishment. Wildflower strips will be planted to provide habitat analogous to rough grassland for raptor hunting. These strips will be located along access tracks away from proposed turbine locations (see Figure 5-13 of Chapter 5).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms (Drewitt and Langston, 2006).

Re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as Greenfinch. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006).

Grey Wagtail: Implement mitigation measures outlined in Chapter 7 - Hydrology and Water Quality of this EIAR, the CEMP and Aquatic Ecology Mitigation, section below, to minimise and prevent the identified indirect impacts to water quality.

Re-confirmatory surveys (March/April) of the proposed turbine locations, Roads and hard standings will be conducted to assess any evidence of Buzzard, Kestrel, Sparrowhawk and Snipe activity or taking up of new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

If construction commences during snipe breeding season, a survey to locate breeding territories and nests will be completed to reconfirm the findings of the EIAR, and any nest locations in the potential ZoI will be cordoned off, with a no works zone of 500m around the nests, until breeding activity is finished.

If construction commences during meadow pipit breeding season, a survey to locate breeding territories and nests will be completed to reconfirm the findings of the EIAR, and any nest locations in the potential ZoI will be cordoned off until breeding activity is finished.

Aquatic Ecology

Construction phase mitigation for hydrology will follow that outlined in Volume 2 Main EIAR Chapter 7-Hydrology and Water Quality, and the mitigation measures outlined will be adhered to in conjunction with those outlined in this section. Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

All measures for the protection of water quality within the Proposed Development site, as detailed in the CEMP, will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP will ensure effective protection of aquatic ecological interests downstream of the Proposed Development, particularly the habitats supporting sensitive aquatic species and with connectivity to the downstream watercourses.

Vegetation Clearance

It is estimated that a cumulative 1,643m of existing hedgerow and 337m of existing treeline habitats will be cleared to ground level at specific discreet locations to facilitate development of the Proposed Development infrastructure (e.g., turbine hardstands, bat buffers and associated access tracks. There are potential source receptor pathways from felling areas to the streams draining the Proposed Development site.

Check dams/silt fences will be installed within any drainage channels within vegetation clearance buffers prior to commencement of works. In addition, silt fencing will be installed along the eastern perimeter of the T6 buffer which abuts the riparian corridor of unnamed tributary of River Bride. Silt fencing will be installed along both sides of the un-named streams at T2 and T6. Drains and silt traps will be maintained throughout all vegetation clearance works, ensuring that they are clear of sediment build-up and are not eroded. Provision will be made for bog mats along all off-road routes in wet grassland (GS4), notably around the met mast, T4 and T6, to prevent soil erosion and potential water quality impacts from. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.

Where vegetation clearance within the riparian corridor is required, this will be carried out by hand only to prevent disturbance of stream banks. The use of machinery to collect felled trees is permissible where grab arms may reach into these areas, but no tracked machinery is permitted to enter streams.

To ensure vegetation clearance methodology that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following best practice guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000a). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000b). Forest Harvesting and Environmental Guidelines;

Additional mitigation measures for the protection of aquatic ecology and receptors during vegetation clearance activities will follow those outlined in section 10.7 of Chapter 10 (e.g. minimum buffer zone widths along watercourses).

Given the sensitivity of aquatic ecological receptors in the downstream receiving environment (e.g. salmonids, lamprey species, otter), it is proposed to undertake vegetation clearance in the spring period to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species Holcus lanatus and Agrostris capilaris (DAFM, 2018). Machine operations will not take place in the 48-hour period before predicated heavy rainfall, during heavy rainfall (>10mm/hour) or in the 48-hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from vegetation clearance areas within 20m of drainage channels will reduce nutrient seepage immediately post-clearance works and in the proceeding years after clearance has occurred (DAFM, 2019).

Wind Farm Construction

A Surface Water Management Plan is included in the CEMP. This has regard to guidelines included in 'Guidelines for the crossing of watercourses during the construction of national road schemes' (NRA, 2008b) and 'Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters' (IFI, 2016). This is considered to be the key mitigation measure for the protection of aquatic species located in downstream receiving waters. The Surface Water Management Plan sets out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. It also includes preparatory works on the site, including installation of silt fences and bunds.

All access tracks will be designed to minimise excavation on the site and reduce the risk of sediment runoff. A sealed silt fence will be placed at both sides of points where rivers or streams are crossed and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. Swales for turbine bases and hard standings will be constructed.

There are no stream crossings proposed within the Proposed Development site. Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system which is set out in the CEMP.

The internal access track will cross one manmade agricultural drain using 450mm diameter pipes. Installation will only be completed during a dry period between July and September (as required by Inland Fisheries Ireland for in-stream works) to avoid the salmonid spawning season and sensitive life stage period. The drain crossing will be constructed during low flow conditions and within a 5-day weather window.

Silt fences will be placed downstream of all works and regularly maintained. Spoil heaps from the excavations for the turbine bases and trenches (where cables are to be buried) will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Any berms will be covered with a geo-textile matting to avoid sediment runoff; berms will be surrounded by silt fencing until vegetation has been established in the following growing season. Underground cables will be located underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

An Emergency Erosion and Silt Control Response Plan is included as a contingency in the CEMP, the final version of which will be distributed for consultation, which will detail the required measures for the Contractor to implement in the event of a 'worst case' scenario on the site.

Secure concrete washout areas are designated on site and detailed in the CEMP. Concrete washout of chutes only will be permitted onsite and designated lined area greater than 50m from a stream.

Standing water in the excavations at the turbine bases will contain an increased concentration of suspended solids. The excavations will be pumped into temporary settlement basins as necessary which will be lined and which will drain into existing or proposed drainage channels on site. The velocity of water entering sedimentation basins must be controlled to ensure that sediment settled within these existing settlement basins is not washed out due to the increased velocity of water pumped into the system. A suitable setback distance is required for water pumped into settlement basins and check dams must be installed to maintain a low flow rate for water entering this system. The settlement ponds/basins will be constructed in advance of any excavations for the turbine bases.

Wheel washing facilities will be provided at the site entrance draining to silt traps. Additional silt fencing will be kept on site for the ongoing maintenance of the structures provided. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor and will not be discharged on site.

Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Refuelling of plant during construction will be carried out in an appropriately designed designated area, 50m away from watercourses. Drip trays and spill kits will be kept available on site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off site.

Appropriate preventative measures are detailed in the ISMP, Appendix 5.8, to ensure that non-native aquatic/riparian species are not introduced into the site. These measures follow the manual 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' by NRA (2010).

Strict biosecurity measures will be implemented if plant and machinery working in areas with invasive species along the grid route is used at the Proposed Development site. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

Strict measures shall also be implemented to prevent potential the spread of aquatic pathogens.

Operatives will be required to disinfect clothing and equipment prior to and after working near watercourses. For the purposes of this measure, watercourses include both include both drainage ditches and rivers.

An invasive species management plan which details management measures for each invasive plant species is included in Appendix 5.8.

10.2.3 *Mitigation measures during the operational phase*

Designated nature conservation sites

Implement mitigation measures outlined for the construction stage and Chapter 7 - Hydrology and Water Quality of this EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts effects on water quality as outlined previously.

Habitats and flora

Implement mitigation measures outlined in Chapter 7 - Hydrology and Water Quality of this EIAR, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Invasive species will continue to be monitored, and where required, treated within the project area according to the invasive species management plan for as long as they persist within the site.

Bats

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed (NatureScot, 2021). This is achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn et al., 2008). The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (NatureScot, 2021).

As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett et al., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

While bat activity varied considerably by species, all turbine locations had medium impact levels for the high risk bat species, see Table 5-62 in Chapter 5. Therefore, increased cut-in speeds will be implemented for all turbines from commencement of operation. From the commencement of operation of the Proposed Wind Farm cut-in speeds will be increased during the bat activity season (April-October) and/or where weather conditions are optimal for bat activity (see below) from 30 minutes prior to sunset and to 30 minutes after sunrise at all turbines.

Cut-in speeds restrictions will be operated according to specific weather conditions:

1. When the air temperature is above approximately 8°C at nacelle height.
2. Generally, bat activity peaks at a wind speed range of 5.0 to 6.5m/s (at nacelle height).

Intensive monitoring will be carried out during the operational phase of the Proposed Development. These monitoring surveys will be carried out during years 1, 2, and 3 post construction. Post-construction surveys will be undertaken for the first three years of operation to confirm if blanket curtailment restrictions can be amended in line with post-construction activity levels. If it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (from baseline levels present in this EIAR) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

In relation to the monitoring / fatality surveys, these may indicate a peak period of activity (i.e. a particular month or window during the bat activity season) where cut-in speeds / curtailment measures would be required only, rather than implementing them for the full season.

The post construction surveys will be used to update the current curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

Post Construction surveys

Monitoring will take place for at least 3 years after construction, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern remotely operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2008). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently medium and carcass searches indicate fatalities are occurring (refer below), increased cutin speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15 and 20 with further review after each monitoring period. An annual report (for years 1, 2, 3, 5, 7, 10, 15 and 20) detailing the results of this monitoring shall be submitted to the planning authority and the National Parks & Wildlife Service.

Data from a Supervisory Control and Data Acquisition (SCADA) system, or its equivalent, showing compliance with this measure shall be made available to the planning authority and the National Parks & Wildlife Service Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then consent will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

Where post construction acoustic surveys are undertaken, they will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines. Due to the level of Leisler's activity within the study area, nacelle-level surveys are also proposed for the post construction surveys. These will be used to identify the level of Leisler's bat activity above the tree canopy and within the height of the rotor-swept area.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by NatureScot (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

Lighting

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

As such, flashing red aviation obstruction lights will be provided on perimeter turbines, subject to approval by the IAA. These will not negatively impact bats (Bennett and Hale 2014).

Buffer zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only (no chemicals / herbicides) and maintained on an annual basis in the same condition as during first clearance.

Due to mitigation by design, turbines are proposed to be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundance is affected elsewhere on the site). This will be achieved through physical management of habitats in the turbine buffers without the use of toxic substances.

A buffer zone of 84.9m surrounding each turbine location will be implemented. Precautionary buffer options for vegetation management have been applied. These will apply in the case that regular grazing of this area ceases, and targeted intervention is required to keep vegetation short. Similarly for the remaining turbine locations, which are located in agricultural land, management in of surrounding grassland within buffers (in addition to tailored clearance of hedgerows) will be required in the event of cessation of grazing.

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project shall be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required.

Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the Proposed Development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 7, 10, 15 and 20 as part of the additional curtailment monitoring schedule. A comprehensive onsite avian fatality monitoring programme is to be undertaken following published best practice. This fatality monitoring programme will be extended and duplicated for bat fauna.

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality will essentially follow the same methodology:

- Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.
- Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (NatureScot, 2021) while also encompassing the wider search radius defined by bird fatality monitoring requirements, and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.
- A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
- Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 10-2: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitioring required	Description	Duration
Newly planted hedgerows	Ensure viable growth of planting	Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height specifications already specified in mitigation.	Years 1, 2, 3, 5, 10, 15 and 20, post construction
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 7, 10, 15 and 20 post construction.

Table 10-3: Summary of operational-phase mitigation measures for bats

Moderate-High Level Bat Mitigation	Category
A buffer zone free of hedgerows/trees within 50m of turbine blade tips will be created. Hedgerows and treelines will be planted to create corridors around the turbines, and link up with existing hedgerows, see Figure 5-13.	Habitat alteration
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Feathering
Implement curtailment all turbine locations during year 1-3 while post construction surveys are undertaken.	Blanket curtailment
The curtailment will involve operating the selected wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.0 to 6.5 m/s (at nacelle height) during specified weather conditions and during the active bat season (April to October).	Post construction monitoring
Implement a monitoring programme during years 1 – 3 post construction to detect any large-scale changes in bat activity including carcass surveys. Bat activity will be measured continuously between April and mid-October at each turbine location. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.	Smart curtailment
If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring, increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15 and 20with further review after each monitoring period.	Carcass monitoring
Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures through SCADA (or equivalent) operating systems.	Maintain vegetation free buffer

Avifauna

A post-construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the local authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects.

The following individual components are proposed.

1. Fatality Monitoring (to be conducted during for years 1, 2, 3, 5, 7, 10, 15 and 20 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:

- Initial carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn et al., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.
- Turbine searches for fatalities are to be undertaken following best practice (Fijn et al., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height = 102.5 - 110m around turbine bases) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month). To be conducted during for years 1, 2, 3, 5, 7, 10, 15 and 20 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.
- A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
- Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the local authority and NPWS following each round of surveys.

2. Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey is to be undertaken during the summer and winter months to include both Vantage Point and hinterland surveys as Per SNH (2017) guidance:

    - Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species and all wader species.
    - Record changes in flight heights of key receptors post construction.

Reports will be submitted to the local authority and NPWS following each round of surveys. This survey will be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPW.

3. Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period.

    This will:

    - Assess displacement levels (if any) of wildfowl such as swans post construction

- Assess overall habitat usage changes within the vicinity of the Proposed Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the local authority and NPWS following each round of surveys.

4. Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This will:

    - Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

5. Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated yearly April-May-June.

Lighting

Flashing lights are believed to be less attractive to birds than steady lights (NatureScot, 2020). Therefore, the use of flashing red lights will reduce the likelihood of birds being attracted to turbine locations.

It is also noted that red light is believed to be more attractive to birds than white light (NatureScot, 2020), however red light is known not to increase the attractiveness of turbine locations for bats (Bennett and Hale, 2014) and due to the level of bat activity onsite this ecological receptor takes precedence and red flashing lights will be used subject to the agreement with the IAA.

Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

Aquatic Ecology

The operational wind farm will have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

Sediment control measures for vegetation clearance buffers shall be maintained and replaced as required throughout the lifespan of the wind farm.

10.3 Mitigation Measures during the Decommissioning of the project

The same mitigation measures for the Proposed Development will apply for the decommissioning phase as for the construction phase. This will include a mammal survey to check if any setts or holts have become established during operation, in addition to breeding or resting places of any other protected mammals.
In relation to aquatic ecology, the same mitigation measures will apply for the decommissioning phase as for the construction phase. In the event of decommissioning of the Barnadivane wind farm, the access tracks may be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but potential impacts will be of reduced magnitude.
It is proposed that turbine foundations and hardstand areas should be left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid cable, ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required for these elements.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 2

Construction and Environmental Management Plan for Carrigarierk Wind Farm

Construction and Environmental Management Plan

Proposed Carrigarierk Wind Farm Development at Gurteen, Clogher, Derryleigh, Gortatanavally, Carrigdangan & adjacent townlands, Co. Cork

McCarthy Keville O'Sullivan

Planning & Environmental Consultants

DOCUMENT DETAILS

Client:	Keel Energy Ltd.
Project title:	Carrigarierk Wind Farm
Project Number:	131003
Document Title:	Construction and Environmental Management Plan
Doc. File Name:	131003 – CEMP– 2015.12.17 – F
Prepared By:	McCarthy Keville O'Sullivan Ltd. Planning & Environmental Consultants Block 1, G.F.S.C. Moneenageisha Road, Galway

Document Issue:

Rev	Status	Issue Date	Document File Name	Author(s)	Approved By:
01	Draft	17/12/2015	131003–CEMP–2015.12.17–D1	OC	MWa
02	Final	21/12/2015	131003–CEMP–2015.12.17–F	OC	MWa

Table of Contents

1 INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by McCarthy Keville O' Sullivan Ltd. on behalf of Keel Energy Ltd., who intend to apply to Cork County Council for planning permission, to construct a wind energy development and all associated infrastructure. This CEMP has been prepared in conjunction with the EIS which will accompany the planning application for the proposed development to be submitted to Cork County Council. The CEMP is a working document and will require further updating and final agreement with the various stakeholders should the project secure Planning Permission. Areas which will be revised and updated are coloured in grey

This report provides the environmental management framework to be adhered to during the pre-commencement, construction and operational phases of the proposed development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur. This report has been prepared in accordance with the mitigation measures and commitments made in the Environmental Impact Statement and other planning documents for the development.

1.1 Scope of the Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed Carrigarierk Wind Farm. It outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to construct the wind farm in an appropriate manner. The report is divided into nine sections, as outlined below.

Section 1 provides a brief introduction as to the scope of the report and the XX no. planning conditions it is intended to satisfy.

Section 2 outlines the site and project details, detailing the targets and objectives of this plan along with providing an overview of anticipated construction methodologies that will be adopted throughout the proposed project.

Section 3 sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage measures, peat management and a waste management plan are also included in this section.

Section 4 sets out a fully detailed implementation plan for the environmental management of the proposed project outlining the roles and responsibilities of the project team

Section 5 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection

Section 6 consists of a summary table of all mitigation proposals to be adhered to during the implementation of the proposed project, categorised into three

separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.

Section 7 consists of a summary table of all monitoring requirements and proposals to be adhered to during the implementation of the proposed project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.

Section 8 sets out an anticipated programme for the timing of the proposed works.

Section 9 outlines the proposals for reviewing compliance with the provisions of this report.

2 SITE AND PROJECT DETAILS

2.1 Site Location and Description

The site of the proposed wind farm development is located in the townlands of Gurteen, Clogher, Derryleigh, Gortatanavally and Carrigdangan and adjacent townlands, listed in Table 1.1 of the EIS, in County Cork. The proposed wind farm will comprise of the provision of a total of 5 No. wind turbines, with a maximum ground to top blade tip height of up to 140 metres and all associated infrastructure.

The proposed wind farm study area measures approximately 256 hectares. The Grid Reference co-ordinates for the approximate centre of the site are (E122000; N61800). The town of Dunmanway is located approximately 9 kilometres south of the proposed development site with the villages of Inchigeelagh and Shanlaragh located approximately 3.8 kilometres north and 5.5 kilometres southeast of the site respectively.

2.2 Targets and Objectives

In so far as they have been completed to date, or are to be further completed in future, the construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues and this is enhanced by the works proposals.

The key site targets are as follows;

- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the EIS and associated planning documentation;
- Ensure construction works and activities are completed in accordance with all planning conditions for the development;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure construction works and activities have minimal impact on the natural environment;
- Adopt a sustainable approach to construction; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, *e.g.* excavated stone, clay and peat material;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keeping all watercourses free from obstruction and debris;
- Correct implementation of the SuDS drainage design principles;
- Keep impact of construction to a minimum on the local environment, watercourses, and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping to be implemented;

- Air and noise pollution prevention to be implemented; and,
- Monitoring of the works and any adverse effects that it may have on the environment. Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Comply with all relevant water quality legislation;
- Ensure a properly designed, constructed and maintained drainage system appropriate to the requirements of the site is kept in place at all times.

2.3 Construction Methodologies Overview

2.3.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase. The appointed contractor for the works will be required to comply with this CEMP and any revisions made to this document. An overview of the proposed anticipated Construction Methodologies is provided below.

2.3.2 Overview of Proposed Construction Methodology

The proposed anticipated construction methodology is summarised under the following main headings:

- Temporary Construction Compounds;
- Borrow Pits;
- Drainage System;
- Upgrade of Existing Roads;
- Proposed new Site Access Roads;
- Crane Hardstands;
- Turbine Foundations;
- Electricity Substations and Control Buildings;
- Peat Repositories (cells within borrow pits); and,
- Cable Trenching and Directional Drilling.

2.3.2.1 Temporary Construction Compound

The proposed site will consist of a temporary construction compounds which will be located in the east of the site, north of the proposed Borrow Pit No. 1. The construction compounds will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors.

The compounds will typically be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
- The compound will be established using a similar technique as the construction of the excavated site tracks as discussed below;
- A layer of geo-grid will be installed and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.;

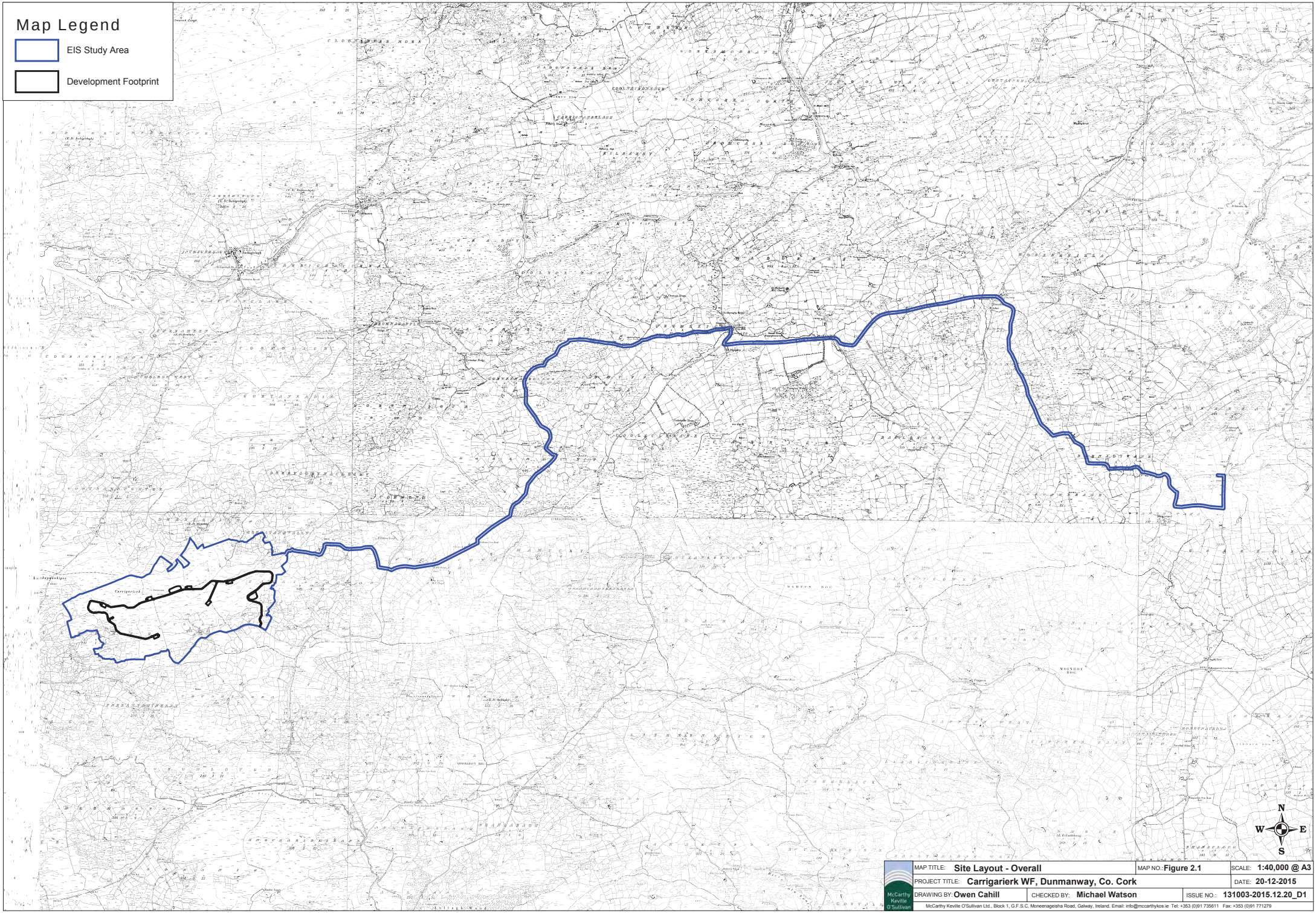
- If necessary the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged; and,
- Upon completion of the project the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase.

2.3.2.2 Borrow Pits

Two borrow pits are proposed within the development as outlined shown on Figure 2.1 & 2.1a. Borrow Pit No. 1 located in the eastern section of the site south east of Turbine No. 1, Borrow Pit No. 2 is located in the centre of the site west of Turbine No. 2.

The borrow pits will typically be excavated and backfilled as follows:

- The areas to be used for both borrow pits will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
- The initial borrow pit excavation will involve removal of peat (if present) and mineral soil to the top of bedrock. These materials will be stored temporarily or placed around the borrow pits to form berms to prevent surface water inflow to the borrow pit excavations;
- Interceptor drainage ditches will be excavated on all sides of the borrow pit to catch surface water runoff, and direct it to downstream re-distribution locations;
- The bedrock material will be extracted from the borrow pits and stockpiled or used as required;
- The use of material won from the borrow pits will be sequential with new road construction or turbine base formations;
- Temporary stockpiling of aggregates will be required to accommodate the cut and fill operations within the borrow pits, and the progression of access roads and turbine excavations;
- As the borrow pit excavations progress and become deeper, surface water and groundwater ingress will be removed via pumping to settlement ponds, and re-distribution locally across natural vegetated areas. Where required, additional specialist treatment will be employed to ensure no deterioration in downstream water quality occurs;
- The borrow pits, once exhausted, will be used to accommodate the disposal of spoil/peat from site excavations; and,
- The borrow pit will be filled initially with peat and other overburden material. Final filling will be predominately with topsoil and peaty soil such that vegetation can be re-established. The main source of subsoil and peat will be from the excavation of turbine foundations.
- When all material destined for the borrow pits has been deposited into them, an agricultural grass seed mixture will be spread across the area of the borrow pit to assist in establishing a vegetation community on the area. This will have the benefit of reducing run off and binding the soil surface to minimise the likelihood of silt running off the area. The grassland species will quickly be replaced by other local plant species through natural succession and it is envisaged that scrub will begin to encroach on the area and become established over time.

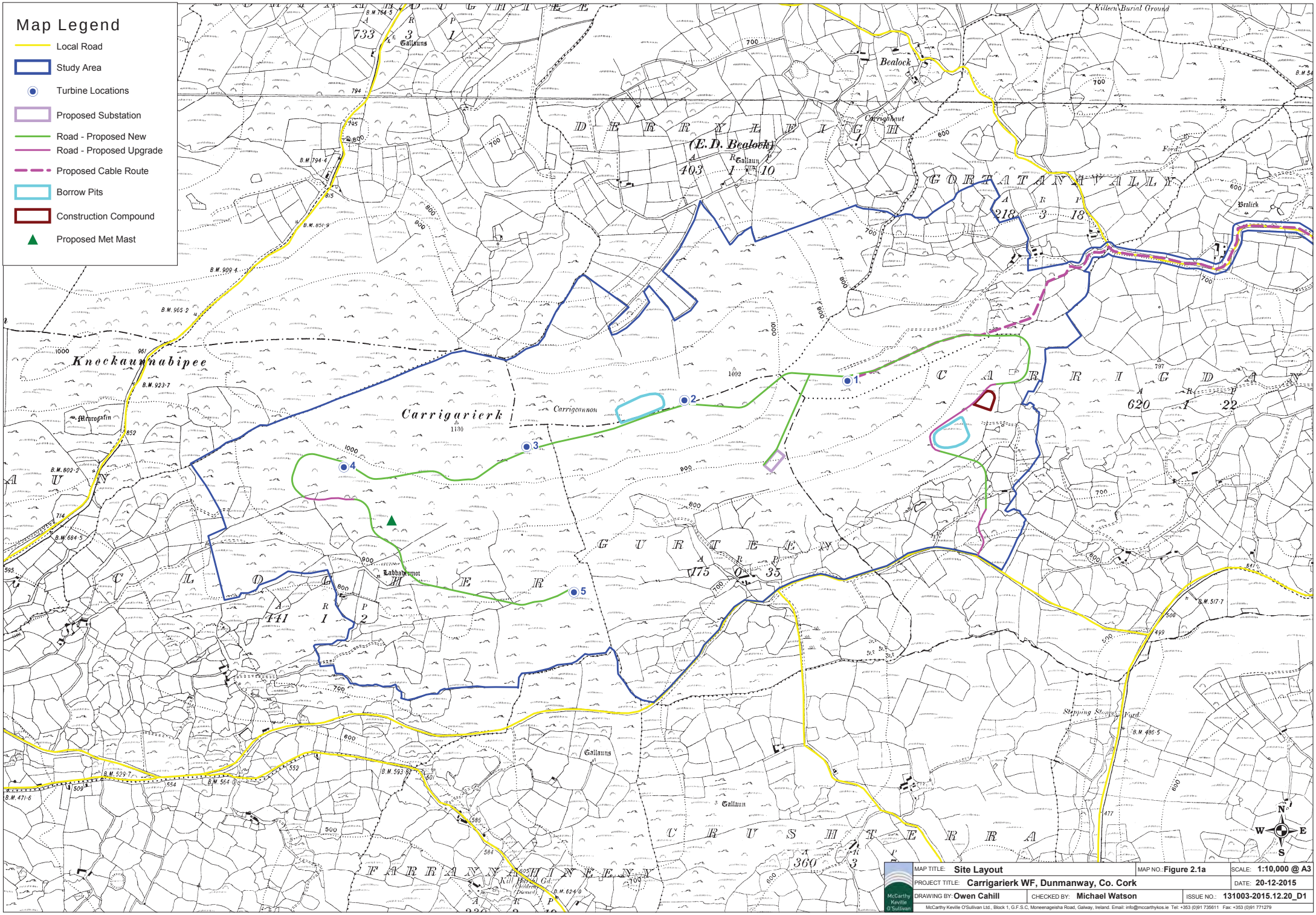


MAP TITLE: **Site Layout - Overall**	MAP NO.: **Figure 2.1**	SCALE: **1:40,000 @ A3**	
PROJECT TITLE: **Carrigarierk WF, Dunmanway, Co. Cork**		DATE: **20-12-2015**	
DRAWING BY: **Owen Cahill**	CHECKED BY: **Michael Watson**	ISSUE NO.: **131003-2015.12.20_D1**	

McCarthy Keville O'Sullivan

McCarthy Keville O'Sullivan Ltd., Block 1, G.F.S.C, Moneenageisha Road, Galway, Ireland. Email: info@mccarthykos.ie Tel: +353 (0)91 735611 Fax: +353 (0)91 771279

Ordnance Survey Ireland Licence No. AR 0021815© Ordnance Survey Ireland/Government of Ireland



MAP TITLE: Site Layout		MAP NO.: Figure 2.1a	SCALE: 1:10,000 @ A3
PROJECT TITLE: Carrigarierk WF, Dunmanway, Co. Cork			DATE: 20-12-2015
DRAWING BY: Owen Cahill	CHECKED BY: Michael Watson		ISSUE NO.: 131003-2015.12.20_D1

McCarthy Keville O'Sullivan

McCarthy Keville O'Sullivan Ltd., Block 1, G.F.S.C, Moneenageisha Road, Galway, Ireland. Email: info@mccarthykos.ie Tel: +353 (0)91 735611 Fax: +353 (0)91 771279

Ordnance Survey Ireland Licence No. AR 0021815© Ordnance Survey Ireland/Government of Ireland

- Borrow pit reinstatement will be supervised and monitored by the project ecologist and/or project geotechnical engineer.
- A final stability assessment on the reinstated borrow pits shall be issued by the contractors site geotechnical engineer at the end of construction
- A stock-proof fence will be erected around the reinstated borrow pits to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fences area.

2.3.2.3 Drainage System

The early establishment of temporary drainage facilities will reduce the risk of pollution problems during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other drainage features as each development phase progresses. They will therefore need to be designed with sufficient flexibility to respond to an early phase of limited incoming flow during the construction phase when sediment or other pollution may be a problem if upstream controls fail, and the final phase of maximum incoming flow.

Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site. The drainage regime will be installed in accordance with details submitted in the EIS.

2.3.2.4 Upgrade of Existing Roads

It is proposed to utilise the existing road network as much as possible with approximately 0.63 kilometres of existing roadway requiring upgrade. These roads will require upgrading which will entail widening of the roadway to a total running width of approximately six metres, with wider sections at corners and on the approaches to turbine locations, and the laying of a new surface dressing on the existing section of roadway where necessary. The road widening will be undertaken as follows:

- If it is considered that the current road formation level is adequate to support required bearing, then no upgrade or widening works will be completed;
- Otherwise, where required, the subsoil in the existing road verge will be excavated down to a suitable formation layer of rock and the spoil deposited in the peat reinstatement areas;
- Well-graded imported granular fill or material won from the borrow pits will be spread and compacted to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used. These layers of granular fill will be brought to the same level as the top of the existing paved surface;
- A layer of geo-grid will be installed directly onto the top of the granular fill layer and the existing road surface; and a layer of finer well graded stone for the running surface will be laid on the geo-grid and compacted.
- Prior to any works commencing on the upgrade of existing roads, the requirement for additional roadside drainage will be considered by the Project Hydrologist in line with the proposals outlined in Section 3.1.3 below.

2.3.2.5 Proposed New Site Access Roads

There is 4.17 kilometres of new access roads to be installed at the site. New roadway will be required in areas where existing roads are not already present, or where existing sections are too steep or otherwise unsuitable for the required purpose in the case of the proposed development. Maximum use has been made of the existing machine tracks and fire breaks within areas of forestry to ensure that the felling area required to make way for proposed new site roads is kept to a minimum.

The new access roads will be constructed as follows:

- Establish alignment of the new site roads from the construction drawings and mark out the centre lines with ranging rods or timber posts;
- The road layout has been designed to avoid crossings of natural watercourses;
- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.
- The access tracks will be of single-track design with an overall width of 6m. There will be some local widening on the bends, junctions and around turbine bases for the safe passage of large vehicles;
- All peat and other overburden material excavated will be deposited in the proposed borrow pits after the required rock volume has been extracted from the borrow pits.
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock;
- Well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- All new roadways will be constructed with a camber to aid drainage of surface water;
- Batters will generally be sloped to between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species. Design slopes will be informed by the Geotechnical Engineer;
- At bends or steep inclines from the roads, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the site road.
- All rock won from the borrow pit areas that are to be used in road construction on site will be tested to BS812-111:1990 "Ten percent fines value".

2.3.2.6 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will measure approximately to the turbine manufacturer's requirements. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the proposed turbine position.

2.3.2.7 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground surface. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square. Those shown on drawings included in this EIS are circular, but the final foundation could also be square or hexagonal

depending on the requirements of the final turbine supplier. The wind turbine foundations are shown to measure up to 19 metres in diameter in a circular configuration. The turbine foundations will be constructed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- All groundwater and surface water arising from turbine base excavation will be pumped to the dirty water system and treated in stilling ponds, and/or specialist treatment systems, prior to discharge from the works area; and,
- Soil excavation shall be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring, in order to identify any significant remains as they come to light.

Standard reinforced concrete bases will be completed as follows:

- A layer of concrete blinding will be laid approximately 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. The concrete should be protected from rainfall during curing and all surface water runoff from the curing concrete should be prevented from entering surface water drainage directly;
- High tensile steel reinforcement will be fixed in accordance with the designer's drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools;
- Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required;
- The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to turbine manufacturer for their approval;
- Concrete will be placed using a concrete pump and compacted when in the forms using vibrating pokers to the levels and profile indicated on the drawings. Upon completion of the concreting works the foundation base will be covered and allowed to cure;
- Steel shutters will be used to pour the circular chimney section;
- Earth wires will be placed around the base; and,
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetable soil set aside during the excavation. A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance.

2.3.2.8 Electricity Substation and Control Buildings

It is proposed to construct an electricity substation and associated control building within the site, as shown in Figure 2.1 & 2.1a. The control building will be located within the substation compound which will be located south of Turbines No. 1 & 2.

The substation will be constructed by the following methodology:

- The area of the substation will be marked out using ranging rods or wooden posts and the soil stripped and removed to the nearby storage area for later use in landscaping. No material will be removed from site and storage areas

will be stripped of vegetation prior to stockpiling in line with best working practises;

- The dimensions of the substation area will be set to meet the requirements of the ESB and the necessary equipment to safely and efficiently operate the wind farm;
- Wind farm control buildings will also be built within the substation compound;
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concreted will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
- Excavated material will remain on site at all times;
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The construction and components of the substation will be to ESB or EIRGRID specifications;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
- Due to the specific nature of the proposed development there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the proposed development does not necessitate a potable source. It is proposed to harvest rainwater from the building roofs.

2.3.2.9 Peat Repositories

The two borrow pits will serve to provide the required volume of rock for construction of the wind farm and associated infrastructure. Once excavated, the borrow pits will be reinstated with peat and overburden excavated from the works areas of the proposed development.

The proposed cells to be used within the borrow pits for the storage of peat shall be typically constructed as follows:

- The rock within each proposed borrow area footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at each of the proposed borrow pit areas. The ground investigation shall comprise rotary core drilling with associated engineering logging including rock quality designation and strength testing, as required.
- It is proposed to construct the borrow areas so that the base of the borrow area is typically 1.5m below the level of the adjacent sections of access road. This may vary for each of the borrow areas and as excavation progresses into the back edge of the borrow area, the base of the borrow area may be raised to suit local conditions. Localised deepening of the borrow area floor may be required depending on extraction operations.
- Depending on the depth and type of rock present in the borrow areas it may be possible to excavate the rock from the borrow area whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat. The upstands/segments of intact rock will essentially act as engineered rock buttresses.

- Slopes within the excavated rock formed around the perimeter of the borrow areas should be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes should be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.
- The stability of the rock faces within the borrow areas should be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock.
- Where it is not possible to leave upstands/segments of intact rock in place it may be necessary to construct rock buttresses founded on in-situ rock within the borrow areas. The rock buttresses should be constructed of rock fill from the borrow pit excavation. The founding stratum for each rock buttress should be inspected and approved by a competent person.
- It may be necessary to construct the rock buttresses within the borrow areas in stages as infilling of peat behind the buttresses progress. The buttress should be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat, as necessary.
- Reinstatement of the borrow pit area with peat and overburden should commence at the back edge of the borrow area and progress towards the borrow area entrance/rock buttress. The approach adopted by the contractor for excavating the rock from the borrow area will somewhat govern the methodology/approach for storing the excavated peat. see earlier comment
- A number of rock buttresses to form cells with the borrow areas will be required to ensure access for trucks and excavators can be achieved.
- The rock buttresses will be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat. The side slopes of the rock buttress should be constructed between 45 to 60 degrees.
- The height of the rock buttresses constructed will be greater than the height of the stored peat to prevent any surface peat run-off. Buttresses up to 5.0m in height are likely to be required.
- The use of temporary access ramps and long reach excavators during the placement of the excavated peat is likely to be required.
- Where possible, the surface of the stored peat should be shaped to allow efficient run-off of surface water from the stored peat.
- A layer of geogrid to strengthen the surface of the placed peat within the borrow pit areas may be required.
- An interceptor drain should also be installed upslope of the borrow area, where necessary. This drain will divert any surface water away from the borrow area and hence prevent water from ponding and lodging in the storage area.
- Control of groundwater within the borrow areas may be required and measures will be determined as part of the ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction.
- A silting pond may be required at the lower side/outfall location of the borrow areas.
- Where possible, the acrotelm (vegetated layer on the peat surface) shall be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the peat storage areas

2.3.2.10Cable Trenching

The transformer in each turbine is connected to the substation through a network of buried electrical cables. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the substation compound. The ground is trenched typically using a mechanical digging machine. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The depth of the cables is to meet all national and international requirements, and will generally be up to 1.3m below ground level depending on the ground conditions that are encountered. A suitable marking tape is installed between the cables and the surface. On completion the ground will be reinstated as previously described above. The route of the cables will generally follow the access tracks to each turbine location. A typical trench cross section detail is presented in Figure 3.3 of the EIS.

2.3.2.11 Grid Connection

A connection to the national electricity grid will be made by an underground electricity cable originating from the Carrigarierk wind farm will run to an ESB Networks substation located at Barnadivane. The installation of the underground electrical cable will be completed using the following construction methodologies:

2.3.2.11.1 *Parallel Road Excavations inroad & in Grass margin*

- The area where excavations are planned will be surveyed and all existing services will be identified.
- All relevant bodies i.e. ESB, Cork County Council etc. will be contacted and all drawings for all existing services sought.
- A traffic management plan will be set up prior to any works commencing.
- A road opening license will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks *"Specification for the Installation of Ducts and Structures for Underground Power Cables and Communications Cables"*.
- All excavated material not used for backfilling will be removed to the on-site peat disposal areas or to an approved tip or if suitable stock piled and reused where appropriate.
- All excavated material not used for backfilling will be removed from site using trucks.
- The trench depth is specified at 1220mm and trench support will not be required, however where depths exceed 1250mm trench support will be installed or the trench sides will be benched or battered back where appropriate.
- Any ingress of ground water will be removed from the trench using submersible pumps.
- A silt filtration system will be used to prevent contamination of any watercourse.
- Once the trench has been excavated a base layer of 15 N CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck directly into the trench.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure the trefoil ducts together (at 3 meter centres).
- Once the trefoil ducts have been installed couplers will be fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions the end of the

trefoil ducts will be shimmed up off of the bed of the trench to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected.

- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The as built location of the ducting will be surveyed using a total station/GPS.
- 15 N CBM4 concrete will be carefully installed so as not to displace the ducting to the underside of the communications duct and compacted as per approved detail. See Plate 1.1.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the trefoil ducting.
- ESB marker board will be fitted above the trefoil ducting.
- The Communication duct will be fitted and kept to one side of the trench ensuring that the minimum cover is achieved and 15N CBM4 concrete will be placed to the specified cover and compacted, see Plate 1.2.
- ESB red marker board will be installed and the remainder of trench will be backfilled in two compacted layers with approved material (lean mix concrete/clause 804).
- Yellow marker tape will be installed as per approved detail specifications, 300 mm maximum below finished road/ground level.
- Topsoil will be permanently reinstated where required or Clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.
-

Plate 1.1

Plate 1.2

2.3.2.11.2 *Road Crossing*

- A traffic management plan will be set up prior to any works commencing.
- The area where excavations are planned will be surveyed and all existing services will be identified
- A road opening license will be obtained where required and any conditions complied with.
- The road will be cut to the required width of trench using road saw.
- A truck will be used to remove excavated material from work area.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks manual for the *''Specification for the Installation of Ducts and Structures for Underground Power Cables and Communication Cables''*.
- Trench support will be installed where required.
- All excavated material from road crossing will be removed off site to an approved tip or if suitable stored for reuse.
- A base layer of 15N CBM4 concrete will be installed and compacted.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure trefoil ducts together (at 3 meter centres).
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The ducting will then be surveyed for both level and grid location using a total station.
- 15N CBM4 concrete will be carefully installed to the underside of the communications ducts and compacted.
- ESB marker board will then be placed at this level in the trench.
- Communication ducts will then be fitted and backfilled to the correct level with 15 N concrete and spacer boards to ensure correct cover is achieved.

- ESB marker board will be installed again at this level and the remainder of trench backfilled in two compacted layers of 15 N CBM4 concrete / Clause 804 material.
- Yellow marker tape will be installed at a maximum of 300 mm from the finished road level.
- The road surface will be temporarily reinstated with a blinding layer/cold mix tarmacadam.
- The road surface will then be permanently reinstated at a later date (2 – 3 weeks).

2.3.2.11.3 *Existing Underground Services*

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations an additional layer of marker tape will be installed between the communications layer and yellow top level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

2.3.2.11.4 *Joint Bays*

Joint bays are pre-cast concrete chambers where lengths of cable ducting will be connected. They will be located at various points along the ducting route approximately every 600-1000 meters. Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed they will be backfilled temporarily until cables are being installed.

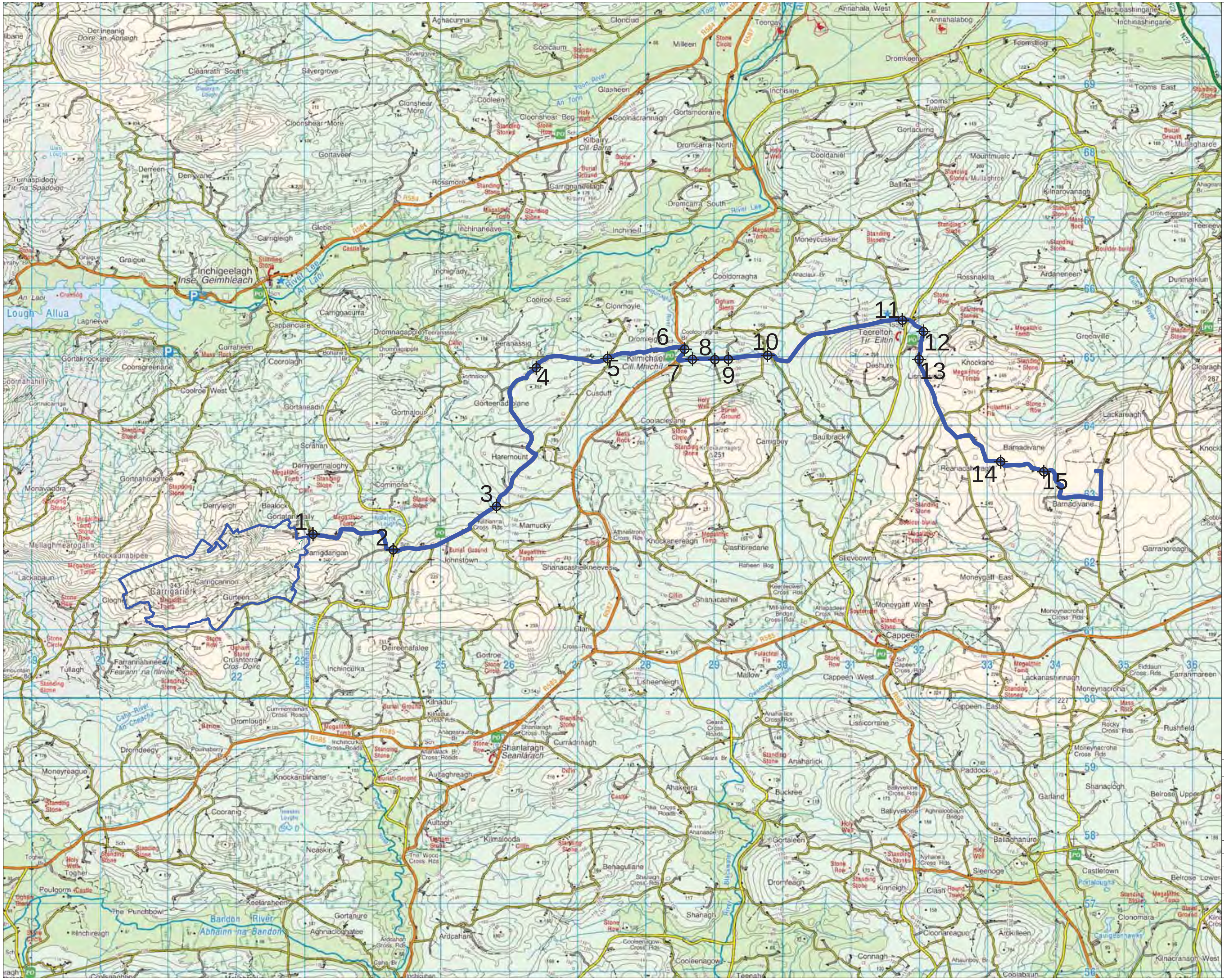
2.3.2.11.5 *Watercourse/Culvert Crossing*

There are a total of 15 no. watercourse/culvert crossings along the proposed cable route. The locations are mapped in Figure 2.2. Instream works are not required at any watercourse crossing along the proposed cable route.

The methodologies for the provision of watercourse crossings along the cable route are summarised in the following sections. The preferred methodologies for crossings at the individual watercourse crossing points are outlined in Table 2.1 which provides a summary of the culvert survey and description of works for culvert crossings.

<u>Crossings over Culverts using Standard Trefoil Arrangement – Option 1</u>

In the majority of watercourse crossings, the watercourse will not have to be disturbed because no instream works or bridge/culvert alterations are proposed. Where adequate cover exists above a culvert, the standard ESB approved trefoil arrangement will be used where the cable ducts pass over a culvert without any contact with the existing culvert or water course. The cable trench will pass over the culvert in a standard trench as outlined in Figure 2.3



Project Design Drawing Notes

1. Drawings issued are for planning application purposes only.
2. Drawings not to be used for construction/contract conditions.
3. Copyright, all rights reserved. No part herewith may be copied or reproduced partially or wholly in any form whatsoever without the prior notice of the copyright owner McCarthy Keville O'Sullivan.
4. Do not scale off this drawing. Figured metric dimensions only should be taken off this drawing.
5. All contractors, whether main or sub-contractors, must visit the site and are responsible for taking and checking any and all dimensions and levels that relate to the works.
6. The use of or reliance upon this drawing shall be deemed to be acceptance of these conditions of use unless otherwise agreed in writing, such written agreement to be sought from and issued by the copyright holder to the use or reliance upon this drawing.
7. Layout plans show typical Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drainage Design Notes

1. All drainage subject to micro-siting and optimisation on site.
2. The locations of the interceptor drains, check dams, culverts, swales, stilling ponds and level spreaders are shown as indicative, and may be changed to suit the requirements of the local topography.
3. Supervising hydrologist or environmental clerk of works (environmental scientist) to oversee installation of drainage features following detailed drainage design.
4. Drainage measures to be installed prior to, or at the same time as the works areas they are intended to drain.
5. Design elevation of the water surface along the route of the interceptor drains or swales will not be lower then the design elevation of the water surface in the outlet at the level spreader or stilling pond.
6. The spacing and frequency of the check dams will be dependant on the gradient of the interceptor drain or swale in which they are being installed.
7. Check dam designs to be selected best to suit particular topography and hydrological environment.
8. Down gradient slope below level spreader onto which the water will dissipate to have a grade less the 6%.
9. No direct discharge or pumping to watercourses will be permitted. All discharges from level spreaders or stilling ponds to be via vegetated filters. Selection or suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.
10. Stilling ponds to be sized according to the area they will be receiving water from.
11. Diversion of drainage ditches will only take place when alternative drainage ditch has been installed to handle the same water.
12. Existing drains/ditches to be incorporated or removed during wind farm construction.
13. All drainage system features to be subject of inspection and maintenance plan.
14. The layout shown is slightly offset for scale purposes, and all drainage would be installed as close to the road as possible.

Drawing Legend

- Landowners Boundary
- Cable Route to grid connection
- Culvert / Water Crossing Point

Ordnance Survey Ireland Licence No. AR0021815 © Ordnance Survey Ireland/Government of Ireland

N

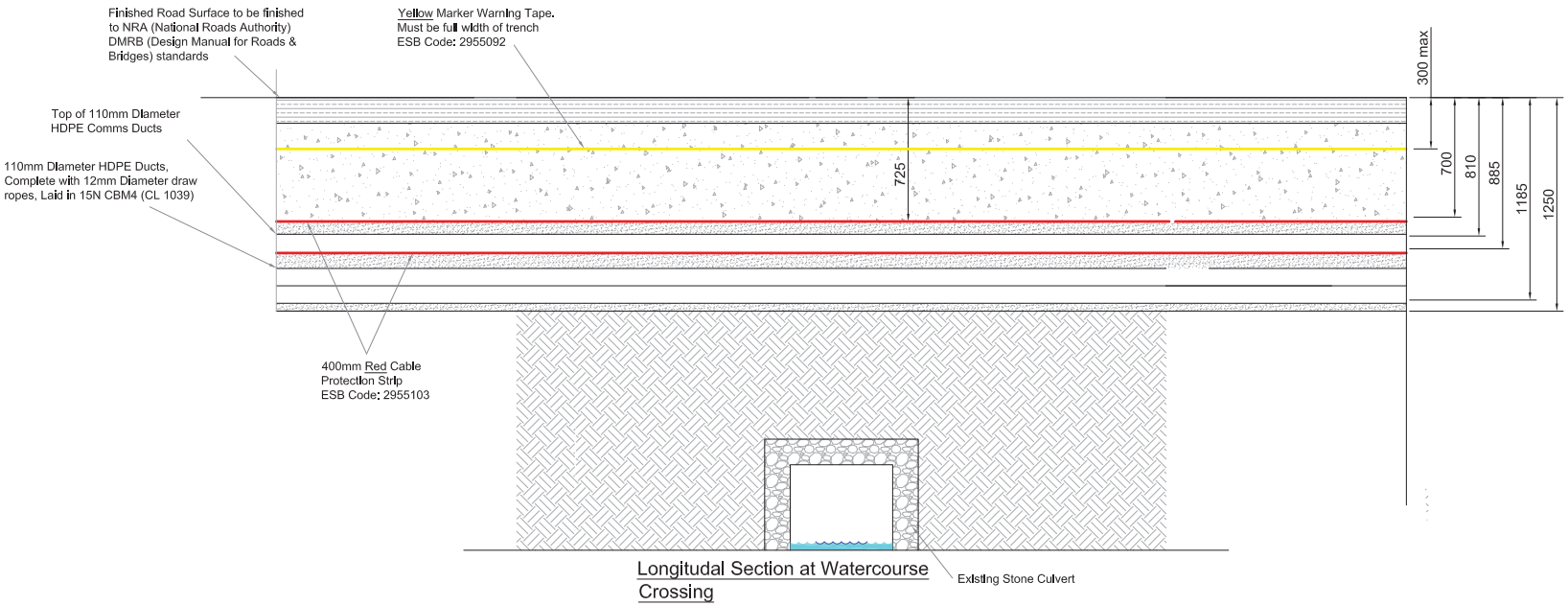
Figure 2.2

DRAWING TITLE:
Grid Connection Route Watercourse Crossings

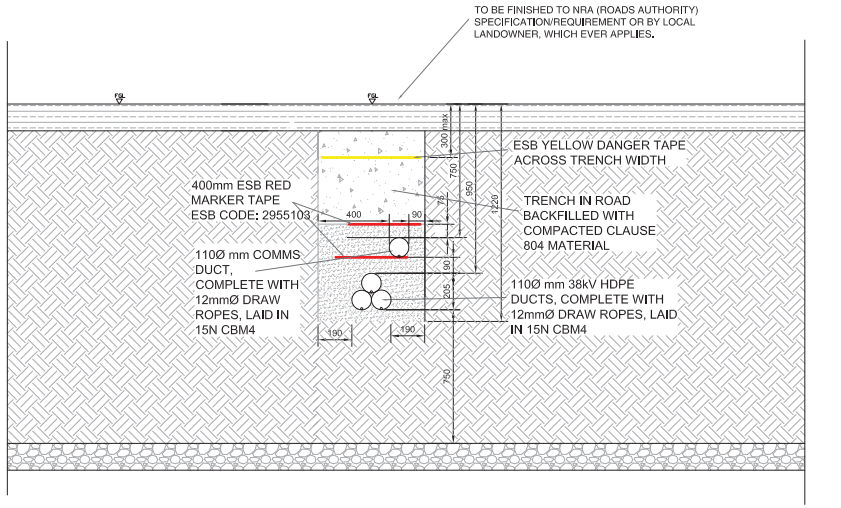
PROJECT TITLE:
Carrigarierk Wind Farm, Co. Cork

DRAWING BY: Shane O Connor	CHECKED BY: Michael Watson
PROJECT No.: 131003	DRAWING No.: 1003 - 46
SCALE: 1:50,000 @A3	DATE: 21.12.2015
OS SHEET No.: OS1004, OS1006, OS1204, OS1206	

McCarthy Keville O'Sullivan Ltd.
Planning & Environmental Consultants
Block 1,
Galway Financial Services Centre,
Moneenageisha Road,
Galway, Ireland.
email: info@mccarthykos.ie
website: www.mccarthykos.ie
Tel: +353 91 735611
Fax: +353 91 771279



Longitudal Section at Watercourse Crossing



Cross Section at Watercourse Crossing

DRAWING TITLE: **Typical Cable Trench Over Culvert in Trefoil Arrangement - Option 1**		DRAWING No.: **1003 - 43**	
PROJECT TITLE: **Carrigarlerk Wind Farm, Co. Cork**		PROJECT No.: **131003**	
DRAWING / MODIFIED BY: **Shane O Connor**	CHECKED BY: **Owen Cahill**	SCALE: **1:30 @ A3**	DATE: **18.12.2015**

McCarthy Keville O'Sullivan Ltd. Planning & Environmental Consultants Block 1, Galway Financial Services Centre, Moneenageisha Road, Galway, Ireland. email: info@mccarthykos.ie Tel: +353 91 735611 Fax: +353 91 771279

Figure 2.3

Trefoil Formation under Piped Culvert Crossings – Option 2

In the majority of watercourse crossings, the watercourse will not have to be disturbed because no instream works or bridge/culvert alterations are proposed. Where the culvert consists of a socketed concrete or sealed plastic pipe, a trench will then be excavated beneath the culvert and cable ducts will be passed under the sealed pipe as outlined in Figure 2.4. Works to replace any existing culverts, thereby giving rise to the requirement for in-stream works, will only be undertaken at the Local Authority's direction.

If this duct installation method cannot be achieved due to the invert level of the existing culvert or due to the composition of the culvert e.g. stone culverts, the ducts will be installed by alternative means as set out in the following sections.

Flatbed Formation over Culverts– Option 3

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench, the depth of which will be determined by the position of the top of the culvert. The ducts will be laid in this trench in a flatbed formation over the existing culvert and will be incased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESB Networks specification.

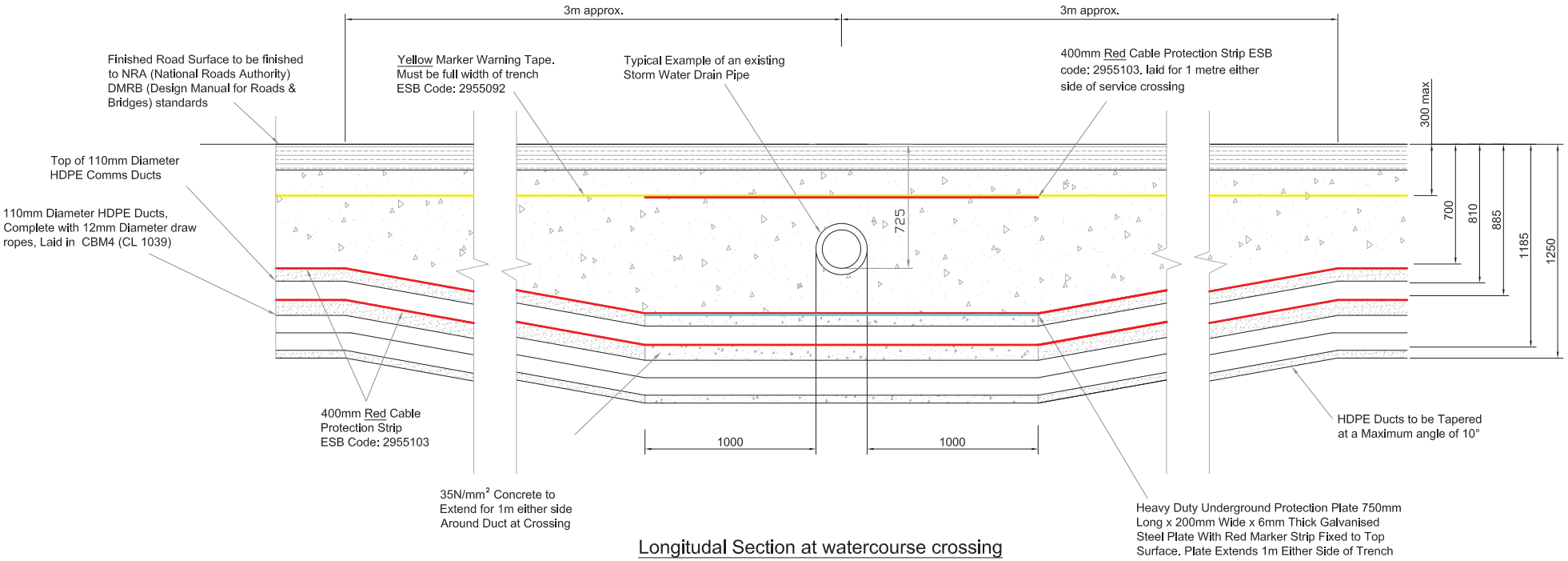
After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Figure 2.5.

Directional Drilling – Option 4

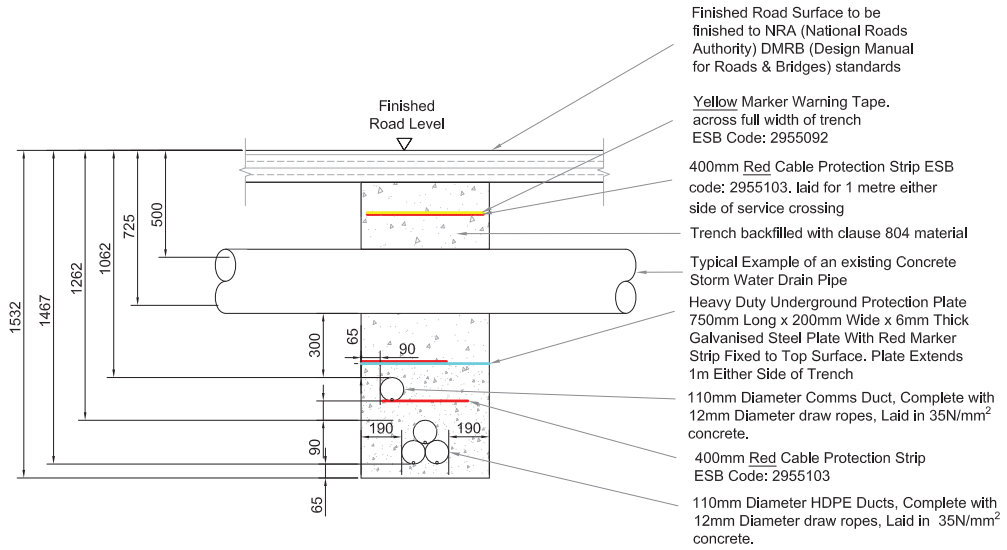
In the event that none of the above methods are appropriate, directional drilling will be utilised.

The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed above. The launch and reception pits will be approximately 0.55m wide, 2.5m long and 1.5m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as *Clear Bore*™ and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.



Longitudal Section at watercourse crossing

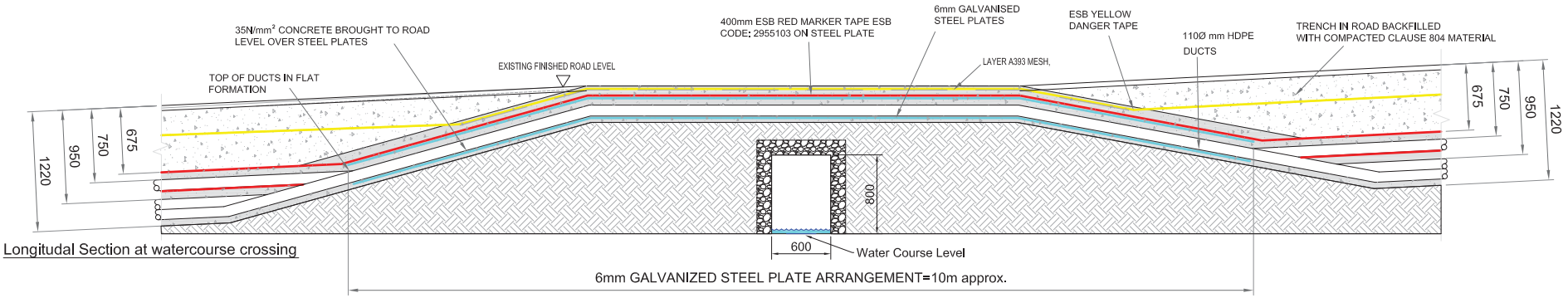


Cross Section at Watercourse Crossing

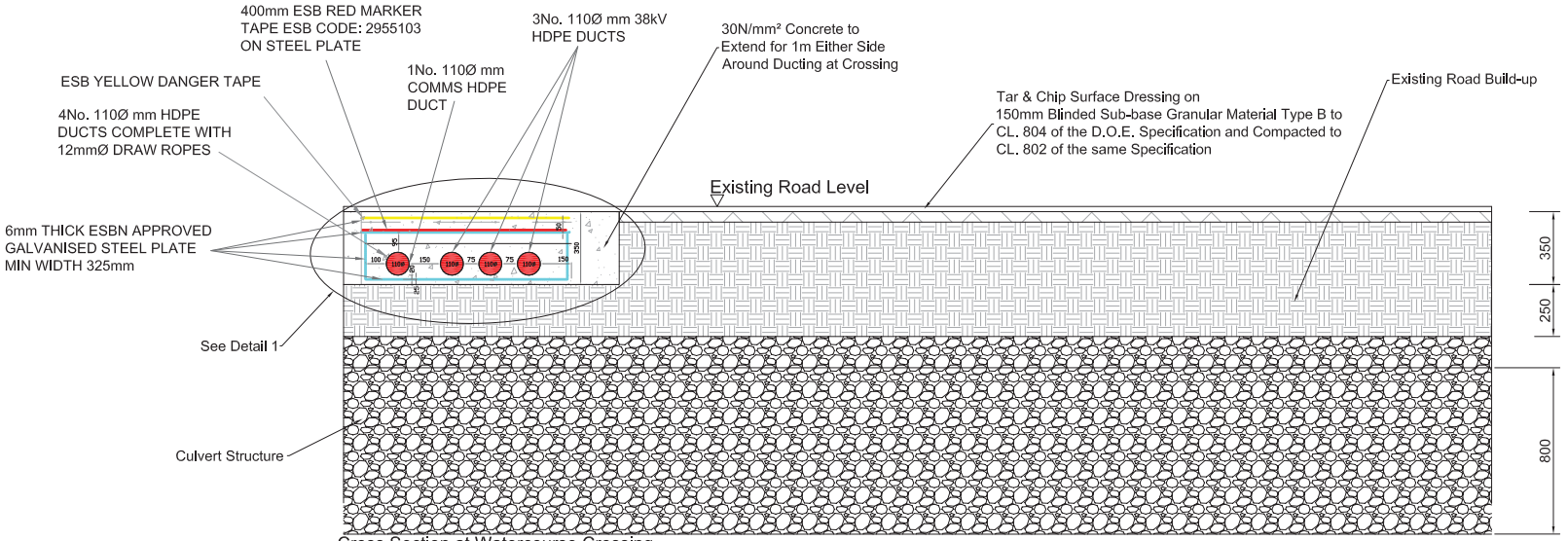
DRAWING TITLE: **Typical Cable Trench under Piped Culvert in Trefoil Arrangment - Option 2**		DRAWING No.: **1003 - 44**	
PROJECT TITLE: **Carrigarlerk Wind Farm, Co. Cork**		PROJECT No.: **131003**	
DRAWING / MODIFIED BY: **Shane O Connor**	CHECKED BY: **Owen Cahill**	SCALE: **1:25 @ A3**	DATE: **18.12.2015**

McCarthy Keville O'Sullivan Ltd. Planning & Environmental Consultants Block 1, Galway Financial Services Centre, Moneenageisha Road, Galway, Ireland. email: info@mccarthykos.ie Tel: +353 91 735611 Fax: +353 91 771279

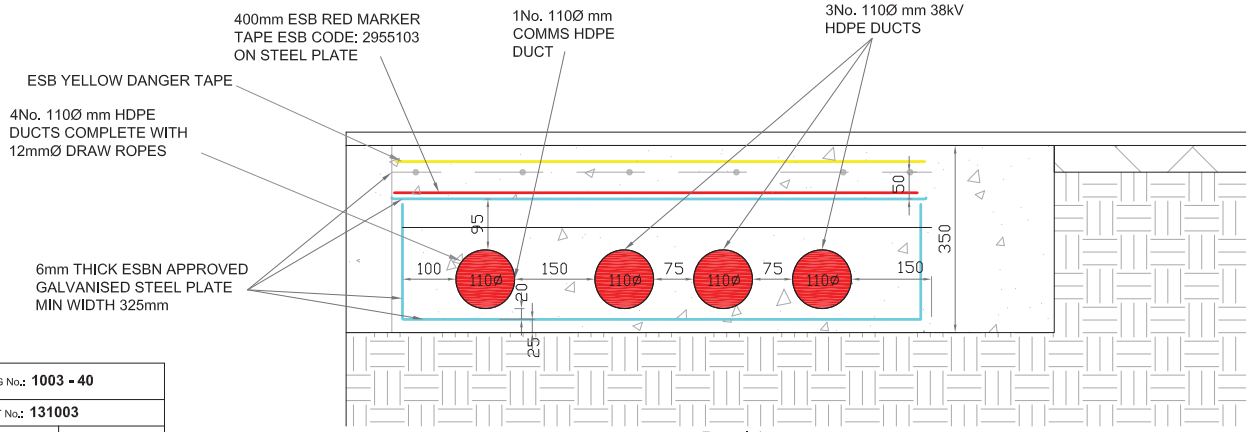
Figure 2.4



Longitudal Section at watercourse crossing



Cross Section at Watercourse Crossing



Detail 1
Scale 1:10

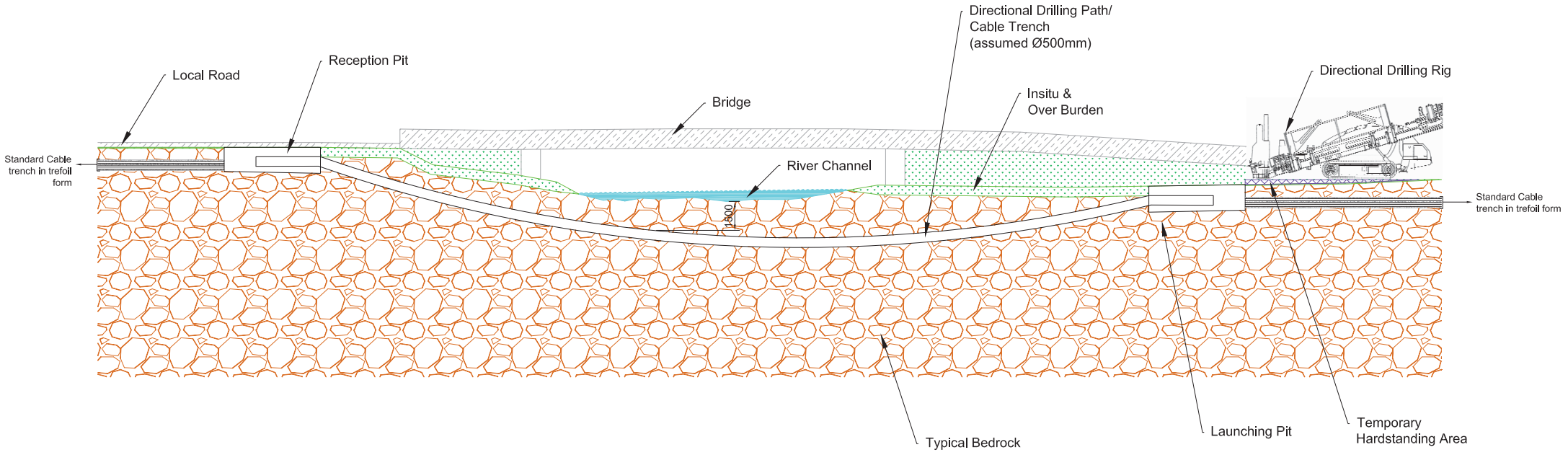
DRAWING TITLE: **Typical Cable Trench Flatbed Formation Over Culvert - Option 3**		DRAWING No.: **1003 - 40**	
PROJECT TITLE: **Carrigarlerk Wind Farm, Co. Cork**		PROJECT No.: **131003**	
DRAWING / MODIFIED BY: **Shane O Connor**	CHECKED BY: **Owen Cahill**	SCALE: **As Shown**	DATE: **18.12.2015**

McCarthy Keville O'Sullivan Ltd. Planning & Environmental Consultants Block 1, Galway Financial Services Centre, Moneenageisha Road, Galway, Ireland. email: info@mccarthykos.ie Tel: +353 91 735611 Fax: +353 91 771279

Figure 2.5

Typical Directional Drilling Rig

Typical Drilling Rig and Launch Pit



DRAWING TITLE: **Typical Directional Drilling Watercrossing Detail - Option 4**		DRAWING No.: **1003 - 46**	
PROJECT TITLE: **Carrigarlerk Wind Farm, Co. Cork**		PROJECT No.: **131003**	
DRAWING / MODIFIED BY: **Shane O Connor**	CHECKED BY: **Owen Cahill**	SCALE: **1:200**	DATE: **18.12.2015**

McCarthy Keville O'Sullivan Ltd. Planning & Environmental Consultants Block 1, Galway Financial Services Centre, Moneenageisha Road, Galway, Ireland. email: info@mccarthykos.ie Tel: +353 91 735611 Fax: +353 91 771279

Figure 2.6

The use of a natural, inert and biodegradable drilling fluid such as *Clear Bore*™ is intended to negate any adverse impacts arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved disposal site.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 2.6.

Table 2.1 Culvert Survey Summary and Preferred Crossing Methodology

Option No.	Culvert type and size	Cover from road level to top of culvert	Maximum depth of trench from road level under culvert	Description	Extent of Proposed Instream Works
1.	600x600mm stone culvert	1900mm	n/a	Due to the depth of covering over the existing culvert, the cable ducts will be laid over the culvert in the standard trefoil arrangement. Therefore no contact will be made with the watercourse during the works.	None. No in-stream works required.
2.	225mm internal Ø corrugated plastic pipe	500mm	1500mm	No in-stream works required at this culvert crossing. The culvert consists of a sealed corrugated pipe under which the trench for the proposed cable duct will be excavated. Therefore no contact will be made with the watercourse during the works.	None. No in-stream works required.
3.	800x600mm stone culvert	600mm	n/a	No in-stream works required at this culvert crossing. It is proposed to lay the cable ducts in a flatbed formation over the culvert. Therefore no contact will be made with the watercourse during the works.	None. No in-stream works required.
4.	600x600mm stone culvert	300mm	2400mm (directional drilling core)	As the top of the culvert is 300mm below the road surface, laying the duct over the culvert will not provide the necessary cover over the cable duct as well as the integrity of the stone culvert would be compromised by the excavation. Laying the ducts under the culvert is not an option as the structure of the stone culvert could not accommodate the excavation. Therefore the cable duct will pass under the culvert by means of directional drilling 1500mm below the base of the culvert with no contact with the watercourse.	None. No in-stream works required.

2.3.2.12 General Precaution

Prior to any works commencing a dilapidation survey will be conducted of the entire route, photographing and noting any existing damage or defects to structure or road surfaces. A copy of this survey will be submitted to Cork County Council prior to works commencing.

Communication with the public, local residences and businesses along the route will be an important responsibility of the project supervisor. Keeping all affected parties up to date and informed both shortly prior and during the construction period at all times. Two to three weeks before any work commencing reasonable efforts will be made to inform all affected parties of the oncoming works.

Signage will be erected in the weeks prior to any works commencing along and on adjacent roads to the proposed route notifying the public of the forthcoming construction. Contact details for the contractor and details of license will also be posted along the proposed cable route during construction.

Every effort will be made to minimise the impact of the above works on local residences and traffic. Consideration will also be given to the agricultural community and works will be organised and sequenced so as not to inconvenience any such activities.

- All personnel will be inducted and made familiar with the method statements, risk assessments and traffic management plans involved.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have FÁS Safe Pass training
- Fire extinguishers and first aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times.
- A competent foreman will be on site at all times.
- Excavations are back filled at the end of each working day.
- The trench will not be over crowded.
- Unauthorised access will be monitored and prevented.
- Pipe work will be lifted into position manually.
- Hand dig will be used to expose any services detected during the survey.

3 ENVIRONMENTAL MANAGEMENT

3.1.1 Site Drainage

3.1.1.1 Introduction

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. The proposed development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the proposed development as new watercourse crossings are kept to a minimum to facilitate the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses and existing roads are to be used wherever possible. Every effort has been made to ensure that as much of the proposed development as possible is kept a minimum of 50 metres from natural watercourses. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. Buffer zones around the existing natural drainage features have informed the layout of the proposed development.

3.1.1.2 Existing Drainage Features

The routes of natural drainage features will not be altered as part of the proposed development. Turbine locations have been selected to avoid natural watercourses. The proposed development has also been designed to require only five new watercourse crossings. Some new or extended culverts may be required under existing roadways to manage drainage waters, and these will be sufficiently sized to accommodate peak flows from storm events.

There will be no direct discharges to natural watercourses. Discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses in the majority of cases. There are exceptions to this where existing or proposed roadways have to cross, or run alongside, natural watercourses and it is necessary to provide drainage measures along such sections of roadway. Discharges will be made at a minimum distance of 20 metres from artificial drainage ditches unless otherwise specified in future revisions of the drainage design. Buffer zones around the existing natural drainage features have informed the layout of the proposed development, and are indicated on the drainage design drawings.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it may not be possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure sediment laden water from the works areas has no direct route to other watercourses. Where drains have to be blocked, the blocking will only take place after an alternative drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or

improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

3.1.1.3 Drainage Design Principles

Drainage water from any works areas of the site will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 3.1 below.

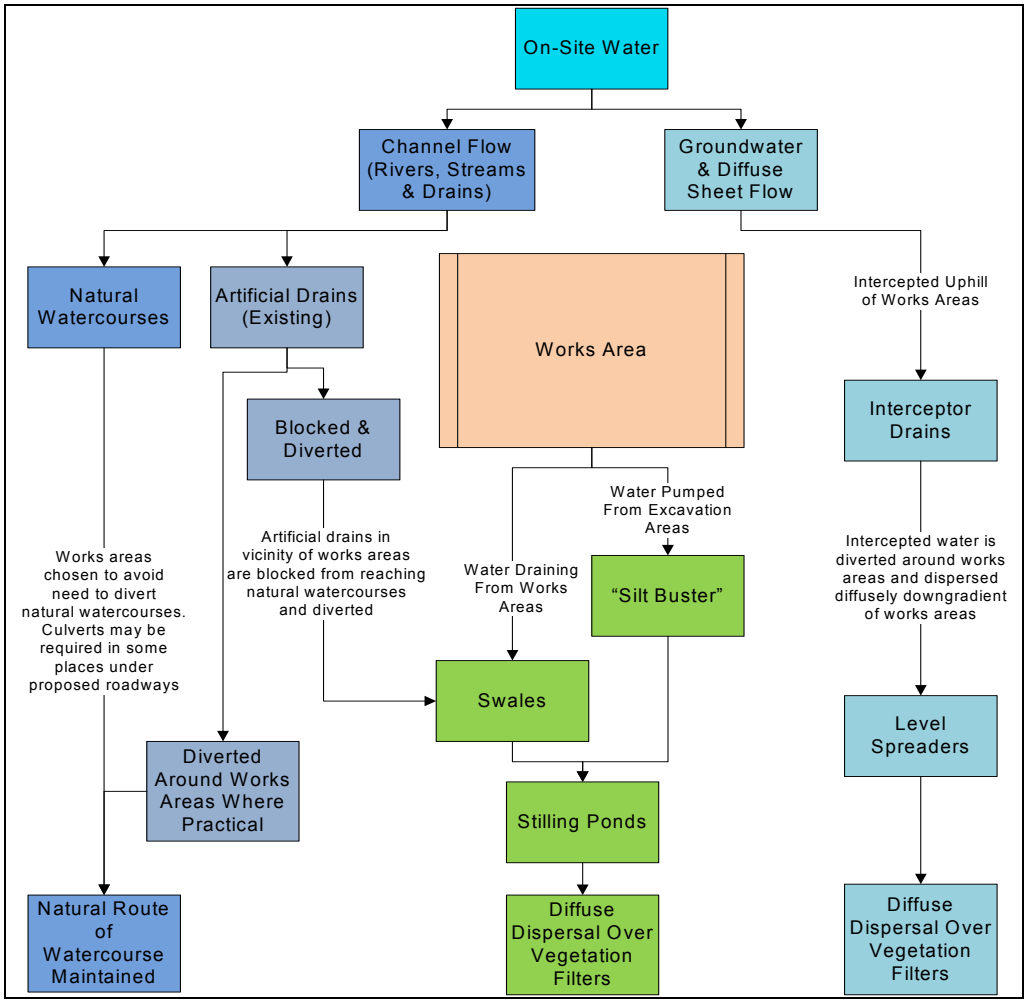


Figure 3.1 Schematic drawing of proposed drainage design

3.1.1.4 References

The drainage design has been prepared based on experience of the project team of other wind farm sites in peat-dominated environments, and the number of best practice guidance documents referred to in the References section of the EIS.

3.1.1.5 Drainage Design

Detailed drainage design measures are included in the site layout drawings of the proposed development included in Appendix 3-1 of the EIS. The drainage design employs the various measures further described below.

3.1.1.5.1 *Interceptor Drains*

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting as conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction.

Figure 3.2 shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 3.1.1.5.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 3.1.1.5.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

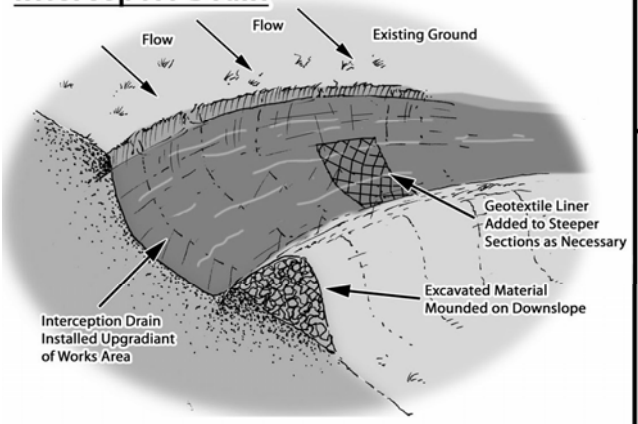
3.1.1.5.2 *Swales*

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 3.2 shows an illustrative example of a drainage swale.

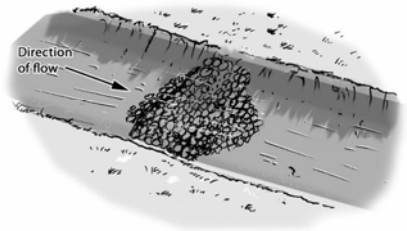
Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Drainage Design Measures

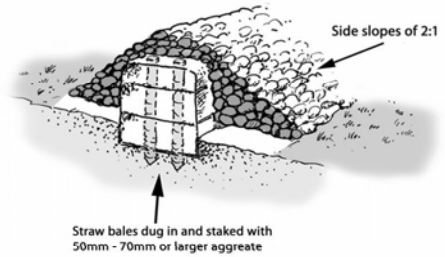
Interceptor Drain



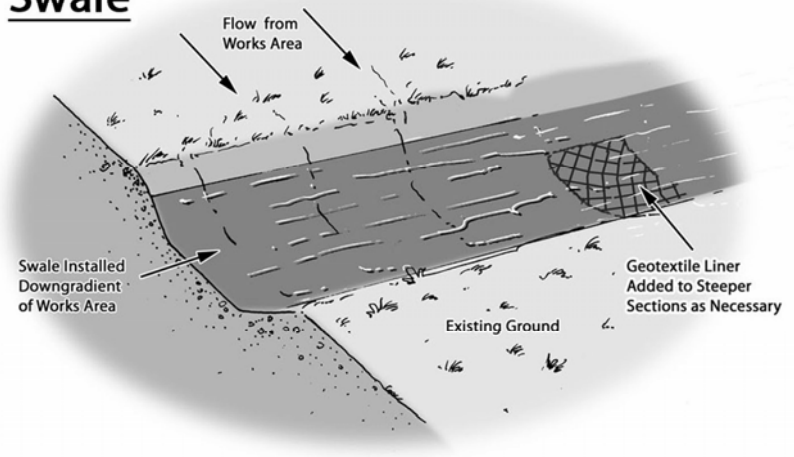
Check Dam (Stone Dam in Drain)



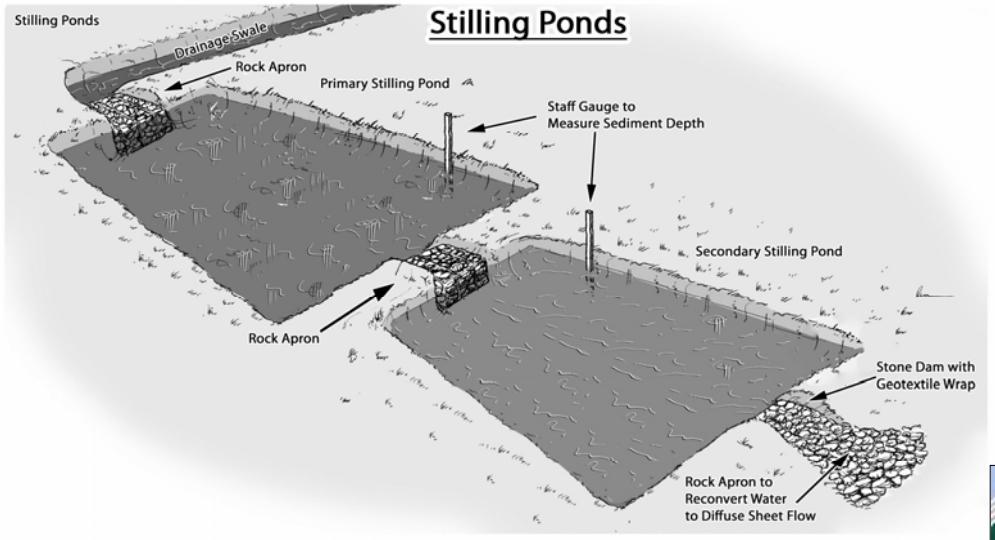
Check Dam
(Straw Bale & Stone Dam - Cross Section)



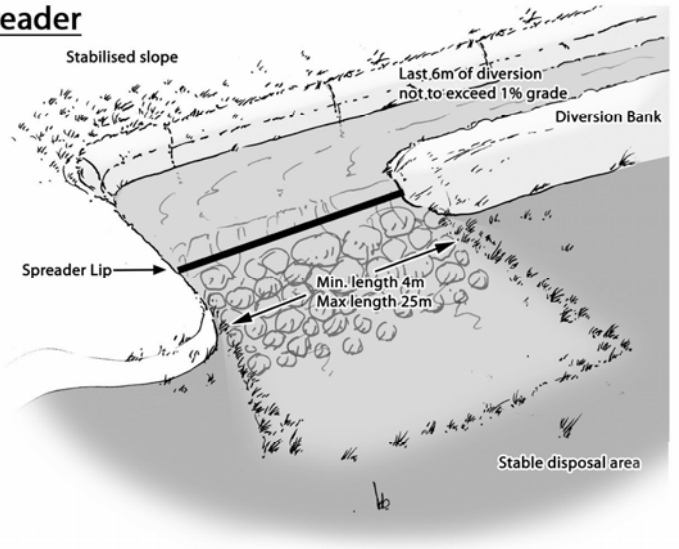
Swale



Stilling Ponds



Level Spreader



MAP TITLE: **Drainage Design Measures**		MAP NO.: **Figure 3.2**	SCALE: **N/A**
PROJECT TITLE: **131003 - Carrigarierk Wind Farm EIS**			DATE: **04-12-2014**
DRAWING BY: **Lorraine Meehan**	CHECKED BY: **Brian Keville**	ISSUE NO.: **131003-2014.12.04-D1**	

McCarthy Keville O'Sullivan Ltd., Block 1, G.F.S.C, Moneenageisha Road, Galway, Ireland. Email: info@mccarthykos.ie Tel: +353 (0)91 735611 Fax: +353 (0)91 771279

Ordnance Survey Ireland Licence No. AR 0021814 © Ordnance Survey Ireland/Government of Ireland

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

3.1.1.5.3 *Check Dams*

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator.

The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

3.1.1.5.4 *Level Spreaders*

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.
The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be

reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 3.2 shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders. If a slope grade of less than 6% is not available in the immediate area downgradient of a works area at the end of a diversion drain, a piped slope drain (see Section 3.1.1.5.5 below) will be used to transfer the water to a suitable location.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip, and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

3.1.1.5.5 *Piped Slope Drains*

Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion. Once the runoff reaches the flat areas it will be reconverted to diffuse sheet flow. Level spreaders will only be established on slopes of less than 6% in grade. Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.

The piped slope drains will be semi-rigid corrugated pipes with a stabilised entrance and a rock apron at the outlet to trap sediment and dissipate the energy of the water. The base of drains leading into the top of the piped slope drain will be compacted and concavely formed to channel the water into the corrugated pipe. The entrance at the top of the pipe will be stabilised with sandbags if necessary. The pipe will be anchored in place by staking at approximately 3-4 metre intervals or by weighing down with compacted soil. The bottom of the pipe will be placed on a slope with a grade of less than 1% for a length of 1.5 metres, before outflowing onto a rock apron.

The rock apron at the outlet will consist of 6-inch stone to a depth equal to the diameter of the pipe, a length six times the diameter of the pipe. The width of the rock apron will be three times the diameter of the pipe where the pipe opens onto the apron and will fan out to six times the diameter of the pipe over its length. Figure 3.2 shows a diagrammatic example of a piped slope drain and rock apron.

Piped slope drains will only remain in place for the duration of the construction phase of the project. On completion of the works, the pipes and rock aprons will be removed and all channels backfilled with the material that was originally excavated from them.

Piped slope drains will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill

over the pipe will be checked for settlement, cracking and stability. Any seepage holes where pipe emerges from drain at the top of the pipe will be repaired promptly.

3.1.1.5.6 *Vegetation Filters*

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

3.1.1.5.7 *Stilling Ponds*

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out. Figure 3.2 shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will

be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the still pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

3.1.1.5.8 *Siltbuster*

A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. *The* mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 3.3 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of *Siltbuster* units on construction projects.

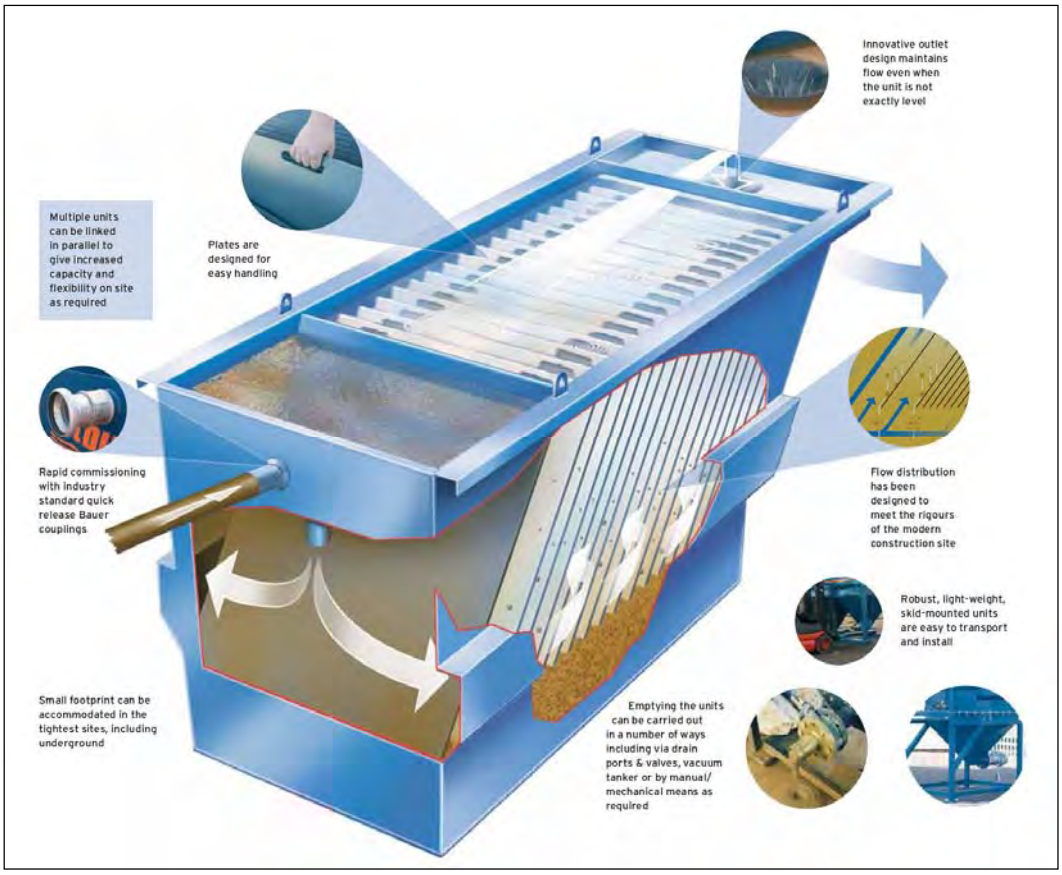


Figure 3.3 Siltbuster

3.1.1.5.9 *Culverts*

Where any new culverts of existing watercourses are proposed, they will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945. Some culverts may be installed to manage drainage waters from works areas of the proposed development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two, or more, smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

3.1.1.5.10 *Silt Fences*

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone from natural watercourses, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the site layout drawings included in Appendix 3-1 of the EIS.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document *'Control of Water Pollution from Linear Construction Projects'* published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series.

The Stage 1 (Coarse) silt fence will consist of a geotextile fabric such as Terram 1000 attached by staples to fixed stakes. The Terram sheets will be folded in an L shape with one metre extending horizontally in towards the works area. This horizontal section will be buried at a distance of approximately 150mm beneath a clean stone surface. Terram 1000 is a permeable fabric through which water can pass, but through which sediment particles cannot. It does however, impede water flow and can lead to the backing up of water and sediment, which reduce its effectiveness.

The Stage 2 (Medium) silt fence will consist of straw bales, embedded 100mm into the soil/ground and fixed in place with stakes. A geotextile fabric will be pegged and stapled to the straw bales and stakes.

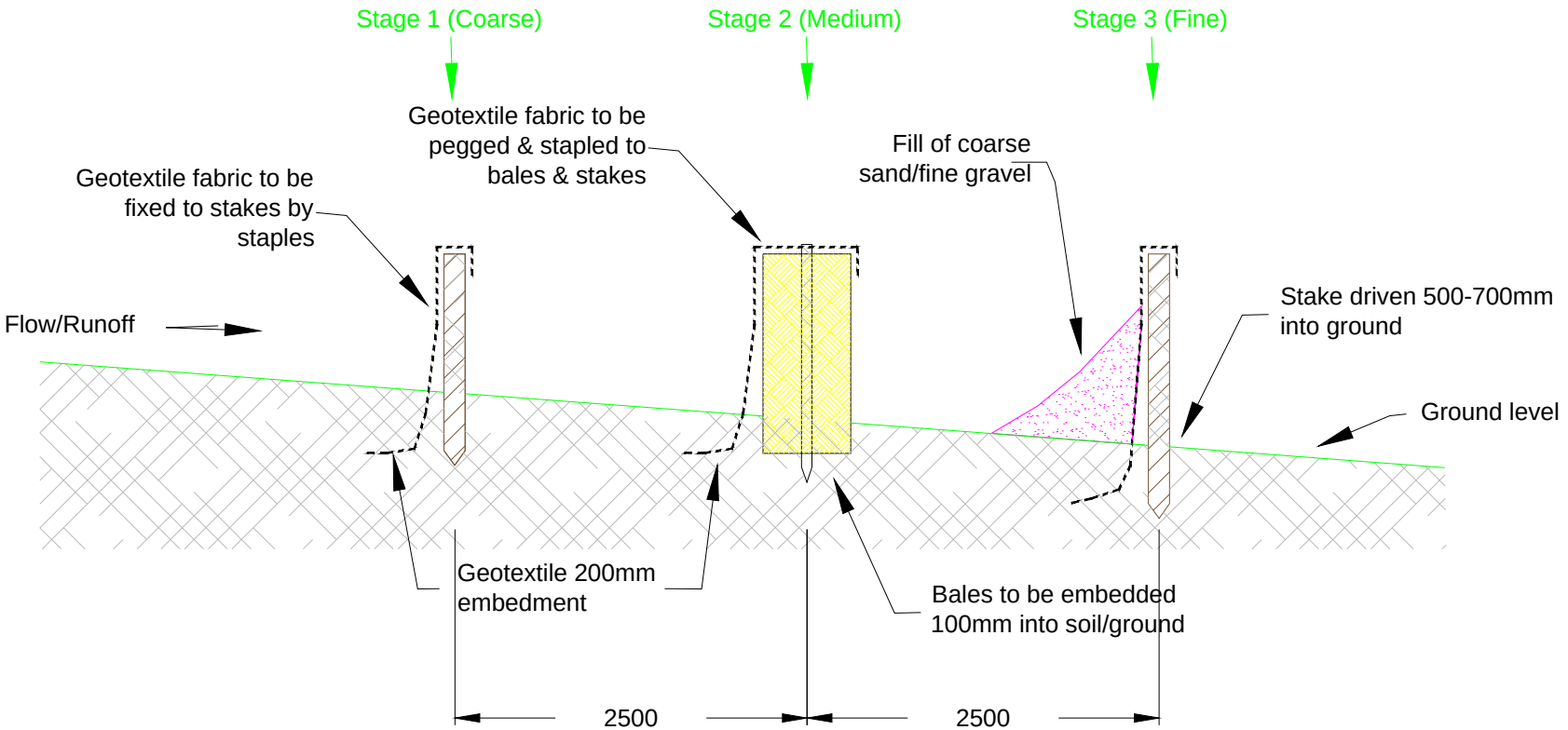
The Stage 3 (Fine) silt fence will be similar to the Stage 1 fence, with the addition of a course sand and/or fine gravel at the base of the geotextile.

In the case of all three types of fence, the geotextile fabric will be embedded at least 150mm below the ground surface.

In a small number of locations around the proposed site where space between the works areas and watercourses may be limited, silt fence designs will be combined to increase their effectiveness. For example, a straw bale silt fence (Stage 2) may be double wrapped with geotextile fabric (Stage 1) and course sand/fine gravel added on the upgradient side (Stage 3). See Figure 3.4. The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the site layout drawings shown in Appendix 3-1 of the EIS to be just a single line, silt fences may be installed in series on the ground.
Site fences will be inspected regularly to ensure water is continuing to flow through the Terram, and the fence is not coming under strain from water backing up behind it.

3.1.1.6 Borrow Pit Drainage

While surface water will be contained in the borrow pit area, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit areas will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to handle runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.



Staged silt fence treatment to run parallel to shoreline of senisitive lake or bank of senisitive water course.

Separate detail for ditch/stream crossing.

Figure 3.4

DRAWING TITLE:
Silt Fence Design Detail

PROJECT TITLE:
Carrigarierk Wind Farm,
Co. Cork

DRAWING BY:	CHECKED BY:
Adrian Behan	Brian Keville
PROJECT No.: 131003	
SCALE: 1 : 50 @ A4	DATE: 20.12.2015

McCarthy Keville O'Sullivan Ltd.
Planning & Environmental Consultants
Block 1,
Galway Financial Services Centre,
Moneenageisha Road,
Galway, Ireland.
email: info@mccarthykos.ie
website: www.mccarthykos.ie
Tel: +353 91 735611
Fax: +353 91 771279

Run off from the single outlet point will be diverted via a drainage swale to a series of settlement ponds and onwards to a level spreader, which will convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The management of surface runoff from the peat disposal area by converting it to diffuse sheet flow removes the risk of contamination of surface water drains and removes the requirement for silt traps leading from this particular area.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

3.1.1.7 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time, and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation, and in the case of the proposed development, would be transported to one of the on-site borrow pit disposal areas or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 3.5.5.10 of the EIS will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

3.1.1.8 Site and Drainage Management

3.1.1.8.1 *Preparative Site Drainage Management*

All materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in advance of any works commencing.

An adequate amount of straw bales, clean stone, terram, stakes, etc will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

3.1.1.8.2 *Pre-emptive Site Drainage Management*

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

3.1.1.8.3 *Reactive Site Drainage Management*

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental clerk of works or supervising hydrologist on-site. The environmental clerk of works or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

In the event that works are giving rise to siltation of watercourses, the environmental clerk of works or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

3.1.1.9 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the Environmental Manager of works or the Supervising Hydrologist.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified by reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

A water level indicator such as a simple staff gauge or level marker will be installed in each silt trap with marks to identify when sediment is at 50% of the trap's capacity. Sediment will be cleaned out of the silt trap when it exceeds 50% of trap capacity. Silt traps will be inspected weekly during the construction phase of the project and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction

phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

3.1.2 Refuelling, Fuel and Hazardous Materials Storage

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site.
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Fuels volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical control building should be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within Emergency Response Plan (Section 5.0). Spill kits will be available to deal with an accidental spillage.

3.1.3 Tree Felling

Mitigation measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are derived from best practice guidance documents as outlined in Section 7.1.3 of the EIS. The water protection measures to be adopted during felling operations are set out as follows:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of felling and to minimise soils disturbance;
- Use of buffer zones for aquatic zones (see Table 3.1 below);
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicles through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps should be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3%

gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;

- Sediment traps will be sited outside of buffer zones and will have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones. Where possible, all new silt traps will be constructed on even ground and not on sloping ground;
- In areas particularly sensitive to erosion, it may be necessary to install double or triple sediment traps. This measure will be reviewed on site during construction;
- All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction should be suspended during periods of high rainfall;
- Timber should be stacked in dry areas, and outside a local 50m stream buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works should be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- Refuelling or maintenance of machinery will not occur within 50m of an aquatic zone.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Table 3.1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

3.1.4 Peat Management

The total estimated volume of peat and overburden to be excavated during the construction phase of the proposed development of peat and other subsoils is 10,240m^3. This includes a reduction of 30% for drying out of peat as well as reuse of

material for backfilling and landscaping. This volume of excavated peat will be managed as outlined below:

- Excavators will remove the peat from the permanent development footprint areas i.e. excavated roads, hardstanding areas, turbine foundation areas and the substation compound.
- Temporary, sealed stockpiling areas, located adjacent to the hardstanding areas and turbine foundation areas, will be chosen following onsite discussions between the construction site manager, an ecologist, a geotechnical engineer and hydrologist.
- The excavators will move the excavated peat to the designated temporary stockpiling areas within the construction and soft levelled areas.
- The temporary stockpiling areas will be surrounded by silt fences to ensure sediment-laden run-off does not occur.
- The excavated peat will remain in these areas over a period of time until the peat disposal area that is nearest to the stockpiling area has a sufficient spoil storage capacity.
- Over this period of time, the volume of the peat will have reduced as the water drains out of the mounded peat.
- The excavators will load the peat directly into dump trucks, which will be used to transport the surplus peat to the nearest peat disposal area.
- The material will be backfilled, by the dump trucks and excavators, into the peat disposal areas and will be spread evenly across the area.

This method of managing the volume of surplus peat and other overburden material will ensure that no excavated material will be left on-site, adjacent to access roads and turbine locations, following the completion of the construction works.

A detailed Peat Management Plan is included in the EIS which outlines the methodology by which peat will be handled and stored at the site. A summary of the good construction practices which will be employed include

- Avoidance of placing arisings from excavations and local concentrated loads on peat slopes without first establishing adequacy of the ground to support the load.
- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge. All water discharged from excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directed into suitable drainage lines.
- Avoidance of unstable excavations. All excavation shall be suitably supported to prevent collapse and development of tension cracks.
- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be assessed by suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement,

disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

3.1.5 Peat Stability Management

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on proposed wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

3.1.5.1 General Recommendations for Good Construction Practise

The peat stability assessment indicates that there is insignificant risk of peat failure, although drainage mitigation measures would be required to prevent the buildup of water in the peat and reduce the risk of failure (AGEC, 2013).

The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (AGEC, 2013):

- Appointment of experienced and competent contractors;
- The site should be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);
- Prevent undercutting of slopes and unsupported excavations;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report readings from peat stability monitoring systems;
- Ensure construction method statements are followed or where agreed modified/ developed; and,
- Revise and amend the Geotechnical Risk Register as construction progresses.

3.1.6 Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, *i.e.* soil, sand, peat, etc and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Site Environmental manager for cleanliness, and cleaned as necessary;

- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;
- All construction related traffic will have speed restrictions on un-surfaced roads to 15 kph;
- Daily inspection of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper; and,
- All vehicles leaving the construction areas of the site will pass through a wheel cleansing area prior to entering the local road network.

3.1.7 Noise Control

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the wind farm. Proposed measures to control noise include:

- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts;
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations;
- Plant with the potential of generating noise or vibration will be placed as far away from sensitive properties as permitted by site constraints.
- Regular maintenance of plant will be carried out in order to minimise noise emissions. In particular, attention will be paid to the lubrication of bearings and the integrity of silencers;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works;
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machines, which are used intermittently, will be shut down during those periods when they are not in use;
- Training will be provided by the Site Environmental manager/appointed contractor's health and safety officer to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation; and,
- Local areas of the haul route will be condition monitored and maintained if necessary.

3.1.8 Waste Management

This section of the CEMP provides a Waste Management Plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by

recycling, recovery and reuse at each stage. Disposal of waste will be seen as a last resort.

This WMP has a number of key objectives as outlined below:

- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

3.1.8.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the proposed development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects.

3.1.8.2 Preliminary Plan

The Department of the Environment guidelines state that, at the design stage of the project, only a preliminary WMP is required,

> *"Formal production and presentation of the Plan may be at a later stage but a clear 'waste management philosophy' needs to be adopted…at the initial conceptual stage of the Project…"'*

This preliminary WMP has a number of key objectives as outlined below:

- To set out management prescriptions that adhere to a waste management hierarchy
- To outline the roles and responsibilities of the Waste Manager
- Prevention and minimisation of waste at the construction stage of the proposed development.

3.1.8.3 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:
The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:
Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:
There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.1.8.4 Excavation Waste Management Plan

The excavation phase of the proposed development will require the removal and management of peat and other subsoils from the proposed turbine locations, substation & control building and site roads. All the material to be excavated will be peat. The excavated material will be temporarily stockpiled before being deposited in the peat repositories. A volume of peat will be reused along road edges and around turbine bases as part of a reinstatement of the area after the construction works have been completed at these locations.

3.1.8.5 Construction Phase Waste Management Plan

3.1.8.5.1 Description of the Works

The construction of the proposed development will involve the construction of 5 turbines, associated new site roads and upgrade of some existing roads, two substations & control buildings and two anemometry masts.

The proposed turbines will be manufactured off site and delivered to site where on site assembly will occur.

The turbine and anemometry mast foundations will consist of stone excavated from the onsite borrow pits and a concrete base which will contain reinforcing steel. These concrete foundations will be shuttered with steel formwork specifically designed for the works and re-usable off site on similar projects.

The construction of the substations will comprise of a concrete foundation with concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from the onsite borrow pits.

The waste types arising from the construction phase of the proposed development are outlined in Table 3.3 below.

Table 3.3 Expected waste types arising during the Construction Phase

Materials type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03

Hazardous wastes that may occur on site during the construction phase of the proposed development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes that contamination does not occur.

3.1.8.5.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

3.1.8.5.3 Waste Arising from Construction Activities

All waste generated on site that will be contained in waste skips at a waste storage area on site. This waste storage area will be kept relatively tidy with a waste skip clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation. Therefore all wastes streams generated on site will be deposited into a single skip. This waste material will be transferred to a MRF by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited in the on-site skip and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the road as only the quantity of stone necessary will be excavated from the borrow pits on an 'as needed' basis.

Site personnel will be instructed at induction that no under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

3.1.8.6 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated peat can be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

3.1.8.7 Recycling

If a certain type of construction material cannot be reused on site then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The low volume of such material that is anticipated to be generated at the proposed development is the justification for adopting this method of waste management.

3.1.8.8 Implementation

3.1.8.8.1 Roles and Responsibilities for Waste Management

Prior to the commencement of the proposed development a Construction Waste manager will be appointed by the project team. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management

hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the management plan.

3.1.8.9 Training

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the construction phase of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

3.1.8.10 Record Keeping

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and EWC Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

3.1.8.11 WMP Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy will always be employed to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

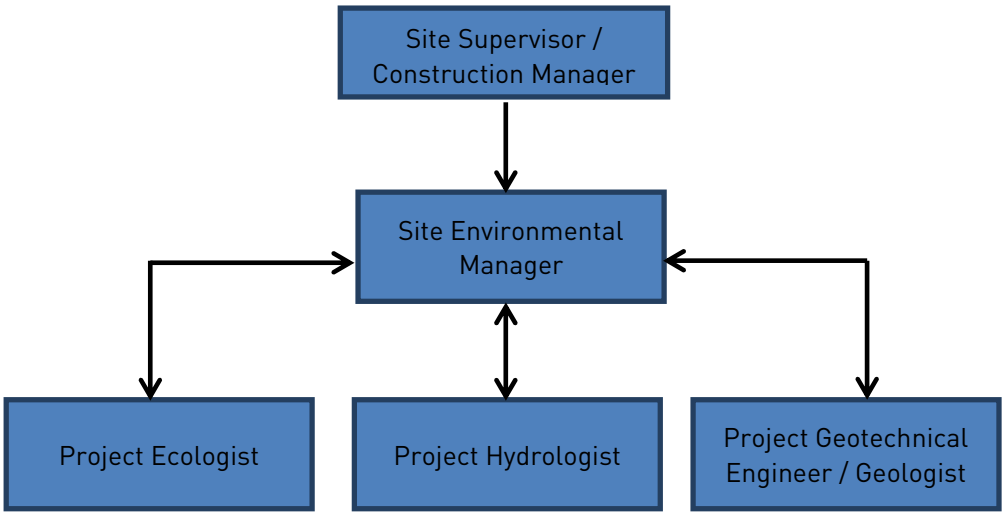
4 IMPLEMENTATION

4.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or Environmental Manager are the project focal point relating to construction-related environmental issues.

In general, the Environmental Manager will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The Environmental Manager will act as the regulatory interface on environmental matters by reporting to and liaising with Cork County Council and other statutory bodies as required.

The Environmental Manager will report directly to the Site Supervisor/Wind Farm Construction Manager. A Project Ecologist, Project Hydrologist and Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is as follows:



Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, shall certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

4.1.1 Wind Farm Construction Manager/Site Supervisor

The Site Supervisor/Construction Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Site Supervisor/Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the Project CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;

- Take advice from the Environmental Manager on legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

4.1.2 Environmental Manager

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Manager, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The Environmental Manager will report to the Site Supervisor/Construction Manager. The responsibilities and duties of the Environmental Manager will include the following:

- Preparation of the CEMP and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required Environmental Monitoring;
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Changes in legislation and legal requirements affecting the environment;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure proper mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,
- Identify environmental training requirements, and arrange relevant training for all levels of site based staff/workers.
- The level, detail and frequency of reporting expected from the Environmental Manager for the Construction Manager, developer's project manager, and any

Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

4.1.3 Project Ecologist

The Project Ecologist will report to the Environmental Manager and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will visit the site at least once a month during construction.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with Environmental Manager, oversee and provide advice on all relevant ecology mitigation measures set out in EIS and planning permission conditions;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Oversee the implementation of the Hen Harrier Conservation & Habitat Enhancement Plan in liaison with Environmental Manager, developer and landowners; and,
- Carry out ecological monitoring and survey work as may be required by the planning authority.

4.1.4 Project Hydrologist

The Project Hydrologist will report to the Environmental Manager and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of proposed drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIS, and in relevant planning conditions.

4.1.5 Project Geotechnical Engineer / Geologist

The Geotechnical Engineer or Project Geologist will report to the Environmental Manager and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during construction phase.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Geotechnical Risk Register and that these are subject to ongoing monitoring; and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and at borrow pits, and peat repository areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIS, and in relevant planning conditions.

4.2 Water Quality and Monitoring

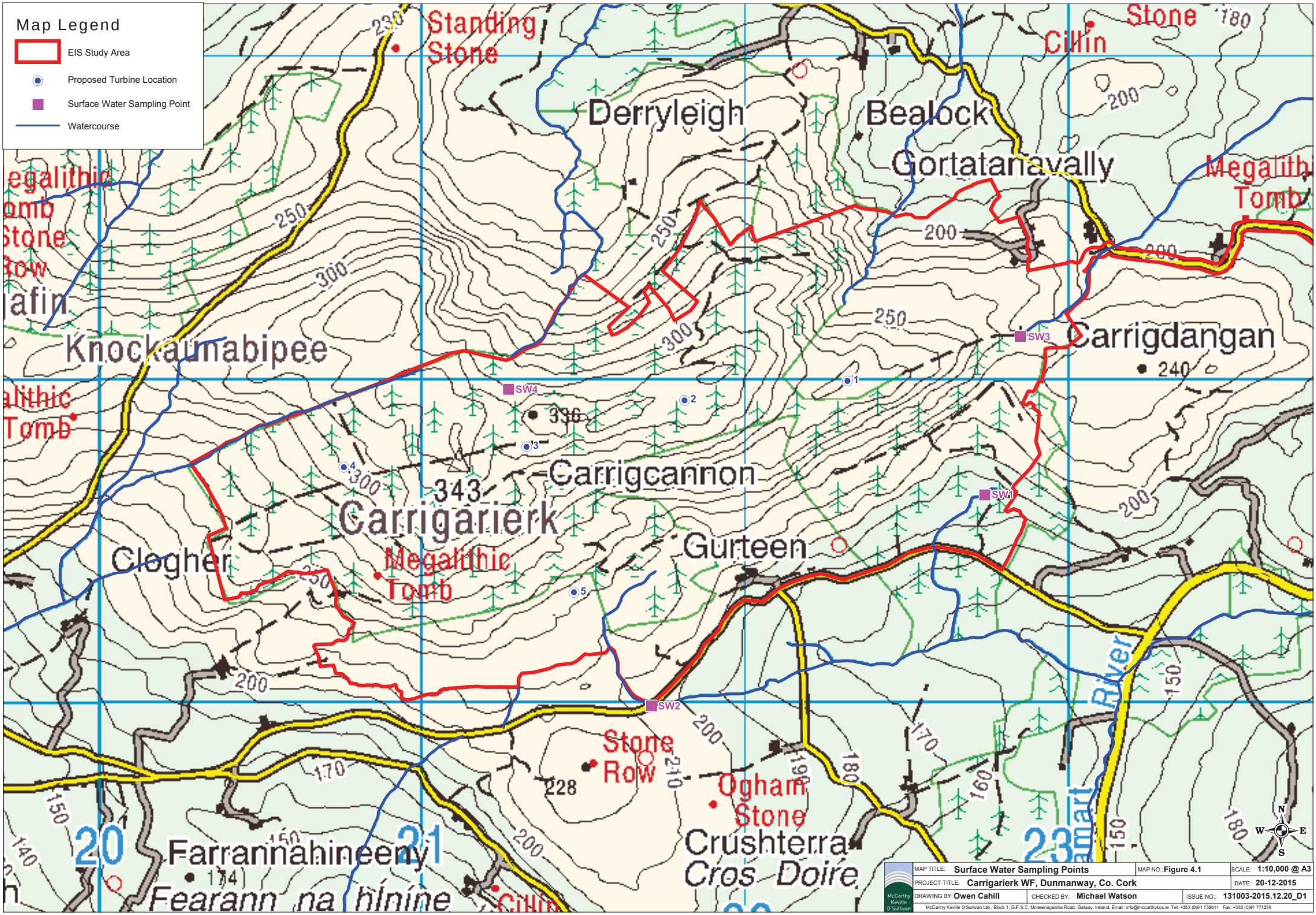
A water quality monitoring programme will be prepared well in advance of any construction commencing on site. This will be monitored independently by the supervising hydrologist who will provide the necessary guidance on the monitoring requirements. Considering this CEMP is a working document, the specifics of a water monitoring programme are not outlined in detail. However, a general overview of the water monitoring programme is outlined as follows:

Pre-Construction Monitoring:

- Monthly Laboratory Analysis Sampling: Baseline laboratory analysis for the parameters listed below with relevant regulatory limits and Environmental Quality Standards (EQSs) will be undertaken for each watercourse *e.g.* at SW1 – SW4 as outlined in Figure 4.1. This will not be restricted to just these two locations and further sampling points will be added as deemed necessary by the environmental manager in consultation with the project hydrologist.

Construction Monitoring:

- In-situ field monitoring: Field chemistry measurements of unstable parameters, (pH, conductivity, temperature) will be taken at the four locations outlined in Figure 4.1. These analyses will be carried out by either the Environmental Manager or the Project Hydrologist. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The supervising hydrologist will monitor and advise on the readings collected by in-situ field monitoring.
- Monthly Laboratory Analysis Sampling: Laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will continue throughout the construction phase for each watercourse *e.g.* at SW1 – SW4 as outlined in Figure 4.1. All samples will be sent for analysis to an independent laboratory. This sampling will also be completed on an event based basis, *i.e.* after major rainfall events (>25mm rainfall in any 24-hour period). The supervising hydrologist will monitor and advise on the readings being received from the testing laboratory.
- Weekly visual inspections: Inspection sheets and photographic records will be kept on site. Inspection points will include the in-situ field monitoring point locations and the laboratory analysis sampling point. Inspection points will depend on works being completed within the catchment upstream of the identified monitoring locations. Visual inspections will also be completed after major rainfall events, *i.e.* after events of >25mm rainfall in any 24-hour period



MAP TITLE: Surface Water Sampling Points	MAP NO.: Figure 4.1	SCALE: 1:10,000 @ A3	
PROJECT TITLE: Carrigarierk WF, Dunmanway, Co. Cork		DATE: 20-12-2015	
DRAWING BY: Owen Cahill	CHECKED BY: Michael Watson	ISSUE NO.: 131003-2015.12.20_D1	

McCarthy Keville O'Sullivan

McCarthy Keville O'Sullivan Ltd., Block 1, G.F.S.C, Moneenageisha Road, Galway, Ireland. Email: info@mccarthykos.ie Tel: +353 (0)91 735611 Fax: +353 (0)91 771279

Ordnance Survey Ireland Licence No. AR 0021815© Ordnance Survey Ireland/Government of Ireland

and data including photographs will be collected by visual inspections and independently assessed by the supervising hydrologist who will monitor and advise on the records being received;

Post-Construction Monitoring:

- Monthly Laboratory Analysis Sampling: Monthly sampling for laboratory analysis for the a range of parameters as adopted during pre-commencement and construction phases will continue for 6 months after construction is complete. The supervising hydrologist will monitor and advise on the readings being received from the testing laboratory.

The range of parameter for which surface water samples will be tested for are as follows:

- Total Suspended Solids (mg/l)
- Ammoniacal Nitrogen as NH3 (mg/l)
- Ammoniacal Nitrogen as NH4 (mg/l)
- Nitrite (NO2) (mg/l)
- Ortho-Phosphate (P) (mg/l)
- Nitrate (NO3) (mg/l)
- Phosphorus (unfiltered) (mg/l)
- Chloride (mg/l)
- BOD

When the final CEMP report is prepared further details will be provided which will include an inspection and maintenance plan for the on-site drainage system which will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

4.3 Environmental Awareness and Training

4.3.1.1 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case by case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;
- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the environmental Incident Management Procedure.

4.3.1.2 Toolbox Talks

Tool box talks would be held by the Environmental Manager/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the tool box talks are to identify the specific proposed work activities that are scheduled for that day. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities. The toolbox talks will be include training and awareness on:

- Ecological Sensitivities on site
- Buffers to be upheld – watercourses, archaeology, ecology
- Sediment and Erosion Control
- Good site practice
- On-site Traffic Routes and Rules
- Keeping to tracks – vehicle rules
- Strictly adhering to the development footprint
- Fuel Storage
- Materials and waste procedures

Site meetings would be held on a regular basis involving all site personnel. The objectives of the site meetings is to discuss the coming weeks proposed activities and identify the relevant work method statements and sub plans that will be relevant to that week's activities. Additionally, any non-compliance identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

5 EMERGENCY RESPONSE PLAN

An Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

5.1 Emergency Response Procedure

The site specific Emergency Response Plan (ERP) will be developed prior to the construction of the facility and will include details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP in terms of health and safety will require updating and submissions from the various contractors and suppliers on appointment as the proposed project progresses.

5.2 Environmental Emergency Response Procedure

An outline of the ERP in terms of an environmental emergency are presented in following sections which include peat movement, pollution control and notification to relevant authorities.

5.2.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

1. All construction activities shall cease within the affected area.
2. Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
3. Re-commencement of limited construction activity shall only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.

5.2.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

1. On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
2. Where considered possible action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
3. For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

5.2.3 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the proposed project. Oil/Fuel spillages are one of the main environmental risks that will exist on the proposed site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The Environmental manager will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The Environmental Manager will notify the appropriate regulatory body such as Cork County Council, Department of Communication, Energy and Natural Resources (DCENR) and Department of Environment, Community and Local Government (DECLG), if deemed necessary.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The Environmental manager must be immediately notified.
- If necessary, the Environmental manager will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site (pSPA or cSAC), the Environmental manager will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the Environmental manager will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the Environmental manager and the Main Contractor. These records will be made available to the relevant authorities such as Cork County Council, DCENR and DECLG if required.

The Environmental Manager will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate

6 MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIS.

This section of the CEMP groups together the mitigation measures presented in the EIS. It is intended that the CEMP would be updated prior to the commencement of the development, to include all mitigations measures, conditions and or alterations to the EIS and application documents that may emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

For the purposes of demonstration, a table of selected mitigation measures providing the structure of how the measures are presented is outlined in Table 6.1. The selected mitigation measures have been grouped together according to environmental field/topic, as follows:

- Environmental Manager
- Run-off, Sediment and Erosion Control
- Fuel and Oil Control
- Dust Control
- Hydrological Impacts on the Ecological Value of the Site

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits

Table 6.1 Site preparation and Mitigation Measures (Example Format)

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase				
		Environmental Manager		
1	CEMP 4.1.2	The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Manager, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.		
		Run-off, Sediment and Erosion Controls		
2	EIS 3.6.5.2 CEMP 3.1.1	Drainage swales will be installed in advance of any construction works commencing.		
3	-	To be populated with further mitigation measures prior to commencement		
4	-	To be populated with further mitigation measures prior to commencement		
5	-	To be populated with further mitigation measures prior to commencement		
Construction Phase				
		Fuel and Oil Control		
6	EIS 3.4.12.2 CEMP 3.1.5	On-site refuelling will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any		

Mitigation Measure	Reference	Mitigation Measure	Audit Result	Action Required
		accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
		Dust Control		
7	EIS 3.4.12.5 CEMP 3.1.8	If necessary, water will be taken from stilling ponds in the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression.		
8	-	To be populated with further mitigation measures prior to commencement		
9	-	To be populated with further mitigation measures prior to commencement		
10	-	To be populated with further mitigation measures prior to commencement		
Operational Phase				
		Hydrological Impact on the Ecological Value of the Site		
11	EIS 3.4.10	Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants.		
12	EIS 7.4.2.2	During the operational phase of the wind farm runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through silting ponds and buffered outfalls onto vegetated surfaces.		
13	-	To be populated with further mitigation measures prior to commencement		
14	-	To be populated with further mitigation measures prior to commencement		
15	-	To be populated with further mitigation measures prior to commencement		

7 MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIS.

This section of the CEMP groups together the monitoring measures presented in the EIS. It is intended that the CEMP will be updated prior to the commencement of the development, to include all monitoring measures, conditions and or alterations to the EIS and application documents that may emerge during the course of the planning process, and would be submitted to the Planning Authority for written approval.

For the purposes of demonstration, a preliminary table of selected monitoring measures providing the structure of how the measures are presented can be found in Table 7.1.

The monitoring proposals are presented in terms of frequency of monitoring, reporting measures and monitoring responsibility.

A timeline for the implementation of environmental monitoring can be found in Section 8.0 of this document.

Table 7.1 Schedule of Monitoring Measures

Monitoring Measure	Reference	Survey/Monitoring	Frequency	Reporting Measures	Responsibility
Pre-Commencement Phase					
		Hydrological			
1	EIS Sec 7.4.2.1	Surface water sampling will be completed before, during (if the operation is conducted over a protracted time) & after the felling activity. The 'before' sampling should be conducted within 4 weeks of the felling activity, preferably in medium to high water flow conditions	As necessary	Quarterly	Environmental Manager
2	EIS Sec 7.4.2.2	An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works.	Once	Quarterly	Environmental Manager
3	-	To be populated with further monitoring measures prior to commencement	-	-	-
4	-	To be populated with further monitoring measures prior to commencement	-	-	-
5	-	To be populated with further monitoring measures prior to commencement	-	-	-
Construction Phase					
		Hydrological			
6	EIS Sec 7.4.2.1	Surface water sampling will be completed before, during (if the operation is conducted over a protracted time) & after the felling activity. The "during" sampling will be undertaken once a week or after rainfall events.	Weekly	Quarterly	Environmental Manager
7	EIS Sec 7.4.2.2	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event based).	Weekly/Monthly	Quarterly	Environmental Manager
8	-	To be populated with further monitoring measures prior to commencement	-	-	-
9	-	To be populated with further monitoring measures prior to commencement	-	-	-
10	-	To be populated with further monitoring measures prior to commencement	-	-	-

Monitoring Measure	Reference	Survey/Monitoring	Frequency	Reporting Measures	Responsibility
Operational Phase					
		Birds			
11	EIS Sec 6.5.5	Post-construction monitoring will be carried out in years 1, 2, 3, 5, 10 and 15 of the life of a wind farm which will include ongoing breeding bird/activity surveys (that can be compared with the baseline studies to indicate any changes on bird activity within the study area) and similar surveys should also be carried out in areas of similar habitats outside the wind farm and the immediate environs of the turbines post construction for comparison. A programme of regular corpse searching should be carried out (at least as regularly as once per month) at the wind turbine sites in the same years to find the corpses of birds and bats that may be struck by the operating turbines	Annually	Annually	Project Ecologist
12	EIS Sec 6.5.5	Ideally, post-construction monitoring will include ongoing breeding bird/activity surveys and similar surveys should also be carried out in areas of similar habitats outside the wind farm and the immediate environs of the turbines post construction for comparison.	Annually	Annually	Project Ecologist
13	-	To be populated with further monitoring measures prior to commencement	-	-	-
14	-	To be populated with further monitoring measures prior to commencement	-	-	-
15	-	To be populated with further monitoring measures prior to commencement	-	-	-

8 PROGRAMME OF WORKS

8.1.1 Construction Schedule

It is estimated that the construction phase will take approximately 12 months from starting on site to the commissioning of the electrical system. In the interest of breeding birds, construction will not commence during the breeding bird season from April to July inclusive. Construction may commence at any stage from August onwards to the end of March, so that construction activities are ongoing by the time the next breeding bird season comes around, and can continue throughout the next breeding season.

The anticipated phasing and scheduling main construction task items are outlined in Figure 8.1 below.

ID	Task Name	Task Description
1	Site Health & Safety	Statutory H&S requirement
2	Site Compounds	Site Compounds, Site Access, Fencing, Gates
3	Site Roads	Excavate/upgrade roads; Install drainage measures; Install culvert; Install water protection measures; Open borrow pits
4	Turbine Hardstands	Excavate base; construct hardstanding areas
5	Turbine Foundations	Fix steel; Erect shuttering; Concrete pour
6	Substation Construction & Electrical Works	Construct Substation; Underground cabling between turbines; Export cabling
7	Grid Connection Works	Ducting between turbines and to ESB Networks substation
8	Cabling	Pulling and jointing of cables through cable ducts
9	Backfilling & Landscaping	Reprofiling of ground following excavations
10	Turbine Delivery & Erection	Delivery of turbine components to site
11	Substation Commissioning	Commissioning of substation by ESB Networks
12	Turbine Commissioning	Commissioning of turbines by supplier

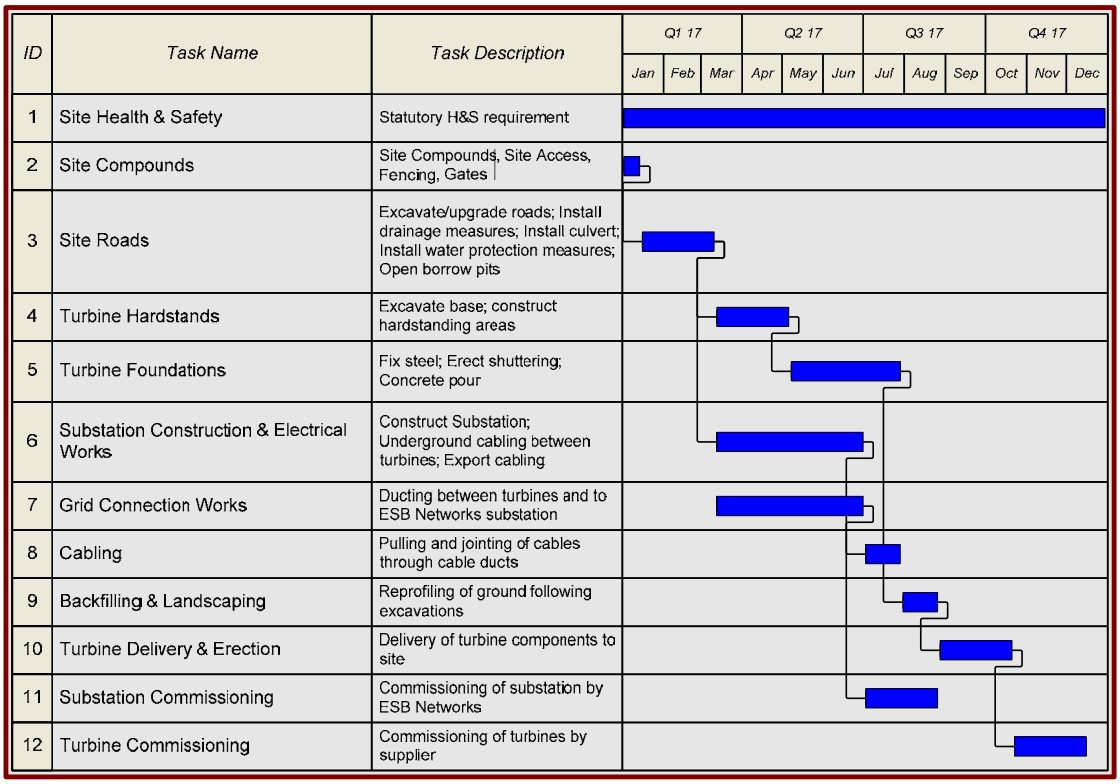


Figure 8.1 Indicative Construction Schedule

9 COMPLIANCE AND REVIEW

9.1 Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the Site Environmental Manager and the Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and any subsequent updates to this document. Environmental site inspections will be carried out by suitably trained staff.

9.2 Auditing

Environmental audits will be carried out during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

9.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

9.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site Environmental manager. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Construction Manager and the Site Environmental manager will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

9.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and also every six months thereafter during the construction phase of the project.

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

www.fehilytimoney.ie

Cork Office
Core House,
Pouladuff Road,
Cork, T12 D773,
Ireland
+353 21 496 4133

Dublin Office
J5 Plaza,
North Park Business Park,
North Road, Dublin 11, D11 PXT0,
Ireland
+353 1 658 3500

Carlow Office
Unit 6,
Bagenalstown Industrial Park,
Royal Oak Road, Muine Bheag,
Co. Carlow, R21 XW81,
Ireland
+353 59 972 3800

HEALTH & SAFETY I.S. ISO 45001:2018 NSAI Certified
QUALITY ISO 9001:2015 NSAI Certified
ENVIRONMENT ISO 14001:2015 NSAI Certified