Natura Impact Statement

Tullaghmore Wind Farm

DEC Ltd.

January 2023

Tullaghmore Wind Farm

Co. Galway

Natura Impact Statement

Document Stage	Document Version	Prepared by
Final	1	Pat Doherty MSc, MCIEEM

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1 INTRODUCTION

Doherty Environmental Consultants Ltd. has been commissioned by Tullaghmore Windfarm Ltd. to undertake a Natura Impact Statement to inform an Appropriate Assessment (AA), to be undertaken by the competent authority under Article 6(3) of the EU Habitats Directive, Council Directive 92/43/EEC, as transposed into national legislation inter alia by Part XAB of the Planning and Development Act 2000 as amended (the "Planning and Development Act"), of a project comprising:

- A six turbine wind farm
- Proposed Peat Storage and Restoration (Habitat Enhancement) Area
- Grid connection route between the proposed wind farm site and the existing ESB substation at Screebe, Co. Galway; and
- A haul route along the R336 and N59 between Galway Port and the Site and the widening of the haul route at four no. locations along the R336.

The proposed wind farm is located in the townland of Tullaghmore, the location of which is indicated in red on Figure 1.1. The proposed Peat Storage and Restoration (Habitat Enhancement) Area is also included within the red line boundary of the proposed development and is situated at Maam Cross to the west of the proposed development. The location of the proposed Peat Storage and Restoration (Habitat Enhancement) Area is shown on Figure 1.1 and 1.2 below.

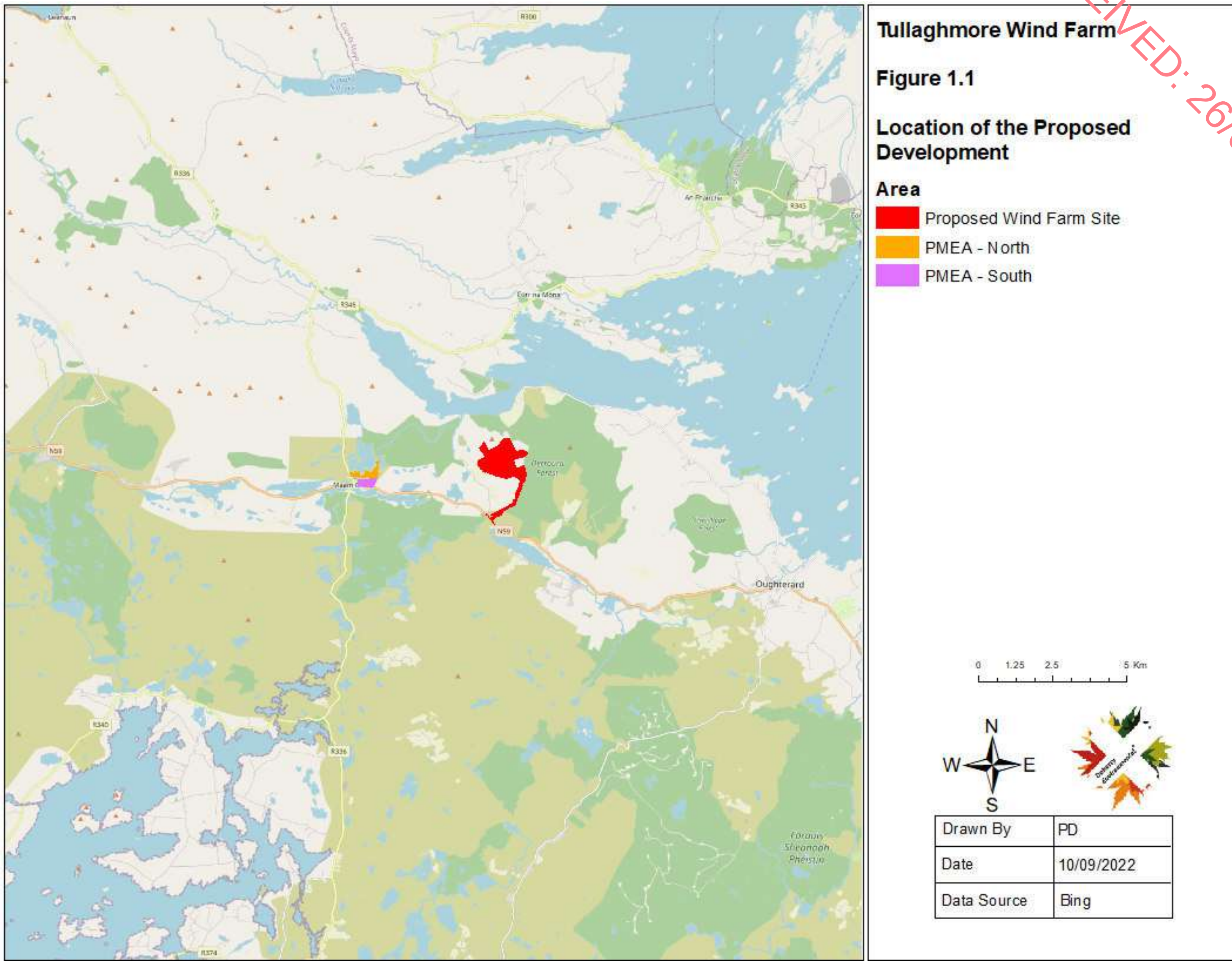
Figure 1.3 shows the location of the proposed grid connection route and the four no. haul route widening locations along the R336.

In accordance with Article 6(3) of the Habitats Directive, as transposed into Irish law by inter alia Part XAB of the Planning and Development Act, a screening exercise for Appropriate Assessment (AA) has been completed to assess whether it could or could not be excluded, on the basis of objective information, that the project, either individually or in combination with other plans or projects, was likely to have a significant effect on any European Sites. The screening exercise for Appropriate Assessment was completed by DEC Ltd. on behalf of Tullaghmore Wind Farm Ltd and concluded, on the basis of objective information, that, in the absence of appropriate mitigation, it could not be excluded at the screening stage that the project, individually or in combination with other plans or projects, will have a significant effect on eight European sites. These sites are:

- Connemara Bog Complex SAC
- Maumturk Mountains SAC
- Lough Corrib SAC
- Kilkieran Bay and Islands SAC
- Connemara Bog Complex SPA
- Lough Corrib SPA
- Lough Mask SPA
- Lough Carra SPA

The screening exercise was informed by a highly precautionary approach. Such an approach was adopted to ensure consistency with the extremely low threshold for triggering likely significant effects as determined in both European and Irish case law. On the basis of that conclusion, it has been determined that AA is required in order to assess the implications of the project for the above listed eight European Sites. In accordance with Section 177T of the Planning and Development Act, a NIS of the project has been prepared in order to assist the competent authority, in this case Galway County Council, in carrying out its Appropriate Assessment. This NIS provides an examination, analysis and evaluation of the likely impacts from the Project, both individually and in combination with other plans and projects, in view of best scientific knowledge and the conservation objectives of the European Sites concerned.

It also prescribes appropriate mitigation to ensure that the Project will not adversely affect the integrity of those sites identified as being at risk of adverse effects. Finally, it provides complete, precise and definitive findings, which are capable of removing all reasonable



Drawn By	PD
Date	10/09/2022
Data Source	Bing

Tullaghmore Wind Farm

Figure 1.2

Location of the Proposed Development

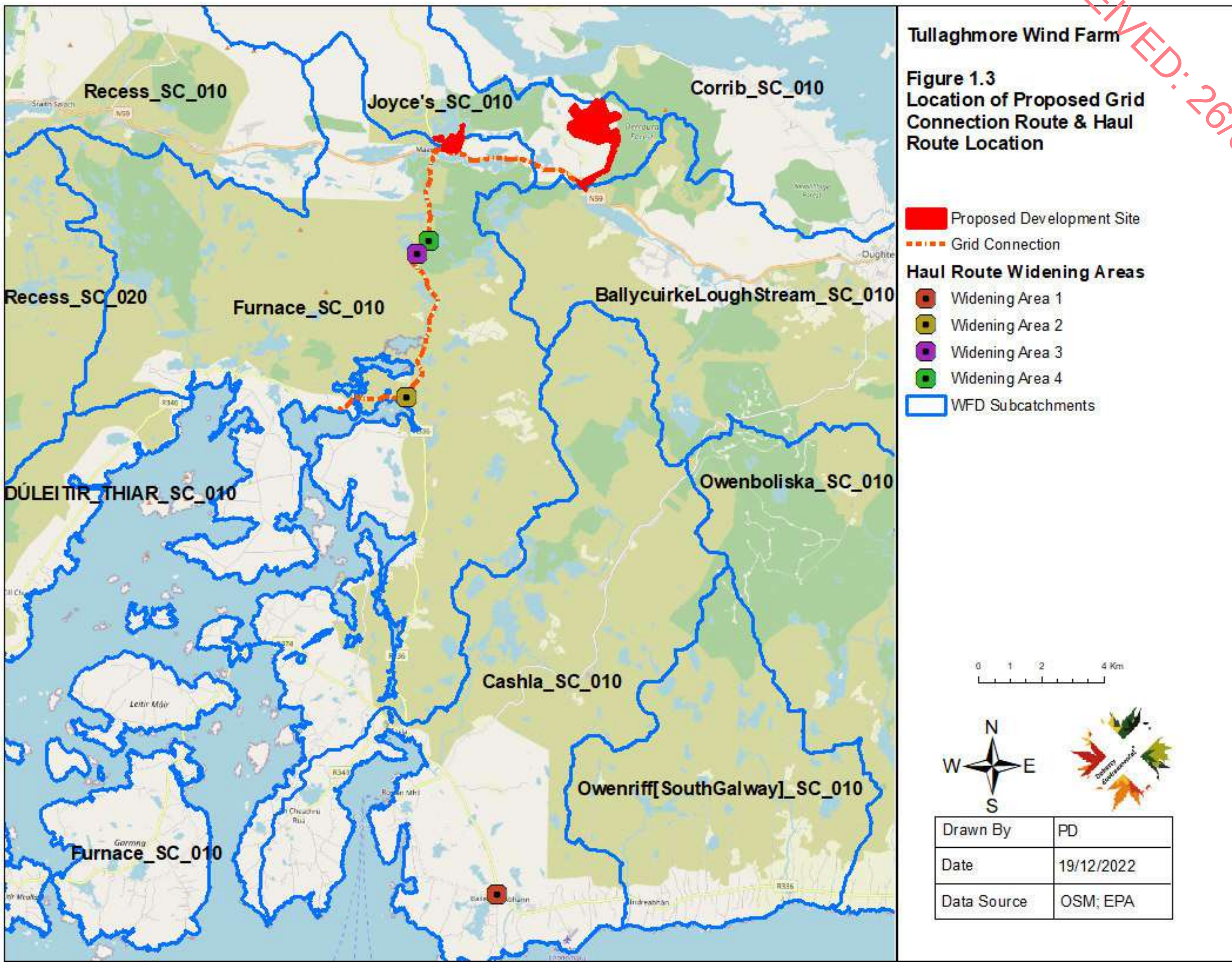
Area

- Proposed Wind Farm Site
- PMEA - North
- PMEA - South

0 0.3 0.6 1.2 Km

N W E S

Drawn By	PD
Date	10/09/2022
Data Source	Bing


Tullaghmore Wind Farm
Figure 1.3
Location of Proposed Grid Connection Route & Haul Route Location
Proposed Development Site
Grid Connection
Haul Route Widening Areas
Widening Area 1
Widening Area 2
Widening Area 3
Widening Area 4
WFD Subcatchments
Recess_SC_010
Joyce's_SC_010
Corrib_SC_010
Recess_SC_020
Furnace_SC_010
BallycuirkeLoughStream_SC_010
DÚLEITIR_THIAR_SC_010
Owenboliska_SC_010
Cashla_SC_010
Owenriff[SouthGalway]_SC_010
Furnace_SC_010
0 1 2 4 Km
N
S
E
W
Drawn By PD
Date 19/12/2022
Data Source OSM; EPA

scientific doubt as to the absence of adverse effects on the integrity of the European sites concerned.

1.1 STATEMENT OF AUTHORITY

This Natura Impact Statement has been prepared by Mr. Pat Doherty BSc., MSc, MCIEEM, of DEC Ltd. Mr. Doherty is a consultant ecologist with over 20 years' experience in completing ecological impact assessments and environmental impact assessments. Pat has been involved in the completion of assessment reports for proposed developments and land use activities under the EIA Directive and Article 6 of the Habitats Directive since 2003 and 2006 respectively. He has extensive experience completing such reporting for projects located in a variety of environments and has a thorough understanding of the biodiversity issues that may arise from proposed land use activities. Pat was responsible for completing one of the first Appropriate Assessment reports for large scale infrastructure developments in Ireland when he prepared the Appropriate Assessment for the N25 New Ross Bypass in 2006/07. Since then, Pat has completed multiple examinations of both plans and projects in Ireland. He has completed Natura Impact Statements for national scale plans such as Ireland's CAP Strategic Plan and National Seafood Development Plan and regional and county scale plans including County Development Plans, Local Area Plans, Tourism Strategies and Climate Action Plans. Pat has completed multiple Natura Impact Statements for a range of development types that include large scale infrastructure developments in sectors such as transport and energy as well as industrial, commercial and residential developments.

Pat has completed focused certified professional development training in Appropriate Assessment as well as in a range of ecological survey techniques and assessment processes. Training has been completed for National Vegetation Classification (NVC) and Irish Vegetation Classification (IVC) surveying, bryophyte survey for habitat assessment and identification, professional bat survey and assessment training, mammal surveying and specific training for bird and bat survey techniques. Ongoing training has been completed by approved training providers such as CIEEM, British Trust for Ornithology, the Botanic Gardens and the Field Studies Council.

2 METHODOLOGY

2.1 GUIDANCE

This NIS has been undertaken in accordance with National and European guidance documents: Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities (DEHLG 2010) and *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites – Methodological Guidance of the Provisions of Article 6(3) and (4) of the Habitats directive 92/43/EEC.* The following guidance documents were also adhered to during the preparation of this NIS:

- A guide for competent authorities. Environment and Heritage Service, Sept 2002. Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (2010). DEHLG.

- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites – Methodological Guidance of the Provisions of Article 6(3) and (4) of the Habitats Directive 92/42/EED. European Commission (2021).

- Managing Natura 2000 Sites – The provisions of Article 6 of the Habitats Directive 92/43/EEC. European Commission (2018).

The information provided in this NIS is also guided by European and Irish case law guiding the approach to Stage 2 Appropriate Assessment. It is noted that the consideration of impacts provided in Section 6 this NIS has been undertaken in the absence of any regard to construction phase best practice measures and operation phase design measures that aim to safeguard the receiving environment and European Sites from potential adverse impacts.

2.1.1 Background to Habitats Directive Article 6 Assessments

The EC (2001) guidelines outline the stages involved in undertaking an assessment of a project under Article 6(3) and 6(4) of the Habitats Directive. The assessment process comprises the three stages outlined below. This NIS presents the findings of an examination, analysis and evaluation of the project to inform a Stage 2 Appropriate Assessment of the project.

- Stage 1 – Screening: This stage defines the proposed plan, establishes whether the proposed plan is necessary for the conservation management of the European Site and assesses the likelihood of the plan to have a significant effect, alone or in combination with other plans or projects, upon a European Site.

- Stage 2 – Appropriate Assessment: If a plan or project is likely to have a significant affect an Appropriate Assessment must be undertaken. Case law has established that such an Appropriate Assessment, to be lawfully conducted, in summary:

  (i) must identify, in the light of the best scientific knowledge in the field, all aspects of the proposed development which can, by itself or in-combination with other plans or projects, affect the conservation objectives of the European site;

  (ii) must contain complete, precise and definitive findings and conclusions and may not have lacunae or gaps; and

  (iii) may only include a determination that the proposed development will not adversely affect the integrity of any relevant European site where the competent authority decides (on the basis of complete, precise and definitive findings and conclusions) that no reasonable scientific doubt remains as to the absence of the identified potential effects. If adverse impacts can be satisfactorily avoided or successfully mitigated at this stage, so that no reasonable doubt remains as to the absence of the identified potential effects, then the process is complete. If the assessment is negative, i.e. adverse effects on the integrity of a site cannot be excluded, then the process must proceed to stage three and, if necessary, stage four.

- Stage 3 – This stage of the process is govern by Article 6(4) and arises where adverse effects on the integrity of a European site cannot be excluded and where the developer considers that the plan or project is necessary for imperative reasons of overriding public interest. This is only possible if there are no alternative solutions, the imperative reasons of overriding public interest are duly justified, and if suitable compensatory measures are adopted to ensure that the overall coherence of the European Sites is protected.

2.1.2 Stage 2: Appropriate Assessment

The EC Guidance Assessment Criteria for a Stage Two Appropriate Assessment provides the following steps:

1. the collection of information on the project and on the European Sites concerned;
2. An assessment of the implications of the project in view of the site's conservation objectives, individually or in combination with other plans or projects;
3. An evaluation as to whether the project can have adverse effects on the integrity of European Sites;
4. The consideration of mitigation measures (including their monitoring).

This NIS addresses each of these items, through the following sections provided below.

2.2 SCIENTIFIC INVESTIGATIONS

A range of scientific site investigations have been completed for the project and these are relied upon in this Natura Impact Statement. The investigations include ecological field surveys, hydrological field surveys and geotechnical field surveys.

Desk-based investigations were completed to identify pathways connecting the proposed project to European Sites. Datasets used to assist with the desk-based investigations include:

- NPWS European Sites and site-specific conservation objectives datasets;
- EPA Rivers and Lakes dataset;
- EPA surface water catchment and sub-catchment datasets;
- NPWS Article 17 Habitats and Species datasets;
- OSI Geohive and OSI Historic townlands online mapping portal; and

- National Biodiversity Data Centre (NBDC) online mapping portal.

- NPWS Protected Species Dataset for the proposed development site and surrounding area.

The ecological field surveys that have been completed and that have informed this Natura Impact Statement include:

- Habitats and vegetation surveys and mapping as well as the recording of the presence of fauna at the proposed development site completed on the 27th & 28th August 2020; 10th November 2020; 17th March 2021; 28th January 2022; 16th March 2022; 29th April 2022; and 19th May 2022. The recording of the presence of special conservation interest bird species associated with surrounding SPAs was recorded during habitat field surveys completed at the proposed Peat Storage and Restoration (Habitat Enhancement) Area during the non-breeding over-wintering season on the 16th March 2022 and the 2nd November 2022 and during the breeding season on the 29th April 2022; and 19th May 2022.

- Ornithological surveys which included non-breeding season and bird species vantage point surveys, transect surveys and hinterland surveys completed over a 2.5 year period between winter 2019/2020and winter 2021/2022.

- Bat surveys over spring, summer and autumn 2020

- Aquatic surveys including habitat assessment, fish habitat suitability assessment surveys, fisheries surveys, biological water quality surveys and physio-chemical water sampling.

- Detailed hydrological and geotechnical surveys were also completed at the proposed development between 2020 and 2022.

The methods used during the completion of these site investigations are described in full in Chapter 6, 7 and 8 of the Tullaghmore Wind Farm EIAR (Jennings O'Donovan, 2022).

3 PROJECT DESCRIPTION

3.1 PROJECT OVERVIEW

The Project will comprise of the following main components:

- Erection of 6 no. wind turbines with an overall ground to blade tip height of 185m. The candidate wind turbine will have a rotor diameter of 162m and a hub height of 104m
- Construction of site access roads, crane hardstand areas and turbine foundations.
- Improvement of existing site entrance with access onto the N59
- Construction of one no. temporary construction compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent meteorological mast with a height of 104m
- Construction of new internal site access tracks and upgrade of existing Site track, to include all associated drainage
- Development of a site drainage network
- Construction of one no. permanent 38kV substation
- All associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation
- All works associated with the connection of the wind farm to the national electricity grid, which will be via 38kV underground cable connection approximately 18.65km in length to the existing ESB Screebe 110kV GIS Substation.
- Biodiversity enhancement measures
- Peat storage and restoration areas

3.2 WIND TURBINE GENERATOR

The proposed turbines will be of typical modern design and will be a three-bladed, rotor up wind of the tower, variable speed, pitched blade regulated machine. Turbine appearance will be a matt non-reflective finish in a white, off-white or grey colour. The foundation-to-tip height will be 185m consisting of a tower of 104m and a rotor diameter of 162m.

The turbine will have a circular based tower, sitting on a reinforced concrete foundation. The tower will support the nacelle, rotor hub, and rotor blades. Commercial wind turbine towers are typically made of steel or a hybrid of steel and concrete. The nacelle is mainly metal (steel, copper, aluminium, etc.) with a metal/plastic/glass-reinforced plastic (GRP) body, while the blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or similar composite materials.

Each turbine will have a generator with a maximum capacity of 6.8MW giving an overall capacity of 40.8MW. The turbines may be direct drive machines or may contain a gearbox. The final turbine will be chosen in a competitive tendering process as part of the Project financing process, after all necessary consents have been secured but will adhere to the parameters set out in **Table 3.1**.

The final choice of turbine model is unknown at this stage, but the candidate turbine model used for assessments at this stage is a Vestas V162 has been identified for the purposes of EIA and planning approval.

For the purposes of the assessments, the dimensions of the candidate turbine is presented in **Table 3.1**. These are the proposed dimensions of the turbines for which planning permission is being sought.

Table 3.1: Turbine Parameters

Turbine Parameter	Assessment Envelope
Turbine Blade Tip Height	185m

Turbine Parameter	Assessment Envelope
Rotor Diameter	162m
Hub Height	104m

3.3 TURBINE FOUNDATION AND TURBINE HARDSTANDS

All turbine suppliers have a requirement for a Turbine Hardstand area to be constructed beside each turbine. The layout of the Turbine Hardstand is designed to accommodate the delivery, laydown, and assembly of turbine components (in particular rotor assembly) prior to turbine lifting and assembly. The Turbine Hardstands are needed to support the cranes during turbine construction, the operational and maintenance phase, and for decommissioning. The Turbine Hardstands will be constructed in advance of the Turbine Foundation and will be used to facilitate foundation construction, such as steel reinforcement delivery and pouring of concrete.

Construction of the turbine and met mast hardstands will require the excavation of overburden material to the noted area and depth, the laying of a geotextile material on the formation surface and placing engineered stone and a top dressing. The main Turbine Hardstands will be 3,395m^2 and will be 0.6m in depth depending on the local bedrock profile and the varying soil depth giving a surface area of 20,370m^2 for 6 turbines and a material volume requirement of approximately 12,222m^3.

The Turbine Foundations will be approximately 25.5m in diameter and have a depth of approximately 3m. The Turbine Foundation design will depend on the turbine type and will be decided by the structural engineers at detailed design stage but will fall within the above dimensions. The central part of the foundation will be approximately 6m in diameter, will be raised from the main Turbine Foundation below ground level and will encompass cast-in bolts to connect to the bottom of the turbine tower and reinforced bar structural elements.

The volume of concrete and steel required for each Turbine Foundation will be 590m^3 and 86 tonnes respectively. The area around and above the Turbine Foundation will be backfilled with compacted granular material and the only portion exposed in the long term will be the central foundation section. Material will be sourced from a local quarry such as one of those identified in **Table 3.2** below.

Table 3.2: Local Quarries and Concrete Suppliers

Quarry	ITM (Easting)	ITM (Northing)	Distance (km)	Direction	Comments
Rock Aggregates					
Maam Cross	497388	744878	4.7	SW	Rock aggregates
Recess	485245	747775	16.5	W	Rock aggregates
Mannions, Recess	473449	749314	28	W	Stone aggregates
Killola Quarries, Gortnagroagh	515758	739801	13.5	SE	Stone aggregates
Kyne's Sand and Gravel, Lahardane	519397	735806	18.8	SE	Sand and gravel only
Mairtín O Flatharta Teo, An Spideál	515151	723083	25.5	SE	Granite rock aggregates
KG Fuels Menlo, Galway	530381	728317	32	SE	Stone aggregates
Concrete					
Harrington Quarries	538145	740396	35	E	Stone aggregates and Concrete
Coshla Quarries, Athenry	542651	728567	42.7	SE	Stone aggregates and Concrete
Esker Readymix, Athenry	554460	726236	54.7	SE	Concrete
McGraths, Cong	514093	756055	13	NE	Concrete, limestone rock and aggregates

Site investigations are required post consent to facilitate detailed design. Depending on the results of these further confirmatory site investigations, the possibility of installing rock anchors will be explored as a means of reducing the footprint and material volumes of the Turbine Foundations. Traditional gravity foundations are considered for EIA purposes as this represents a worst-case scenario due to the amounts of concrete required (c.750-800m^3 v c.300m^3 for rock anchors), but it should be noted that the predicted environmental effects, such as loss of habitats and/or impacts on water quality, could be reduced where rock anchor foundations could be used for some of the Turbine Foundations where there is solid competent rock at the foundation level.

Based on the results of peat probing and geotechnical assessments to date, peat depths are not deep enough to require piling of Turbine Hardstands. Therefore, the construction method for all the Turbine Hardstands will be via excavated approach.

The construction methodology for the wind Turbine Foundations will depend on the strength and depth of the substrata (layers of rock or soil beneath the surface) specific to each location. Turbine Foundations will need to be taken down to competent bearing strata by excavating through the peat / soil, subsoil and rock if necessary.

The method of construction for gravity Turbine Foundation is described as follows:

- Set out turbine foundations and required finish levels etc.
- Construct formation and/or supporting structures e.g. piles.
- Construct drainage as required.
- Provide a minimum of 100mm concrete blinding.
- Place bottom mat of steel reinforcing.
- Place free issue turbine base insert or anchor cage.
- Fix cable ducting and foundation earthing.
- Complete reinforcing steel.
- Fix shuttering to base sidewalls.
- Fix ducts and earthing wires between insert and walls of base.

- Carry out any corrective works as directed by Engineer.
- Check weather conditions and schedule concrete deliveries.
- Place concrete and take quality control slumps and cubes.
- Concrete surface finishing.
- Apply curing and protection of concrete.
- Strip formwork.
- Placing of any earthing wires around and over the base.
- Backfill base sides and place overburden.
- Confirm that cube results are satisfactory[1].
- Grout the top flange.

The method of construction for rock anchor Turbine Foundation is described as follows:

- Set out turbine foundations and required finish levels etc.
- Construct temporary coring drilling platform
- Drill cores for rock anchors to the required levels.
- Insert rock anchors and grout into position.
- Construct drainage as required.
- Provide a minimum of 100mm concrete blinding.
- Place bottom mat of steel reinforcing.
- Place free issue turbine base insert or anchor cage.
- Fix cable ducting and foundation earthing.
- Complete reinforcing steel.
- Fix shuttering to base sidewalls.
- Fix ducts and earthing wires between insert and walls of base.
- Carry out any corrective works as directed by Engineer.

[1] Concrete cubes made during the pouring of the base are crushed to confirm that the required concrete strength has been reached.

- Check weather conditions and schedule concrete deliveries.
- Place concrete and take quality control slumps and cubes.
- Concrete surface finishing.
- Apply curing and protection of concrete.
- Strip formwork.
- Placing of any earthing wires around and over the base.
- Backfill base sides and place overburden.
- Confirm that cube results are satisfactory.
- Grout the top flange.

3.3.1 Access to the Site

The site access will be from the existing entrance on the N59 which will be upgraded to allow vehicles to turn in and out and to achieve the required sightlines. This entrance will be used for delivery of both turbine components and building materials such as rock and concrete.

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed in Galway Port. From there, they will be transported to the Site via the R336 to Maam Cross and then the N59 east to the upgraded site entrance. The delivery of the turbines will require co-ordination with Galway County Council and An Garda Síochána. The process has been set out in the Transport Management Plan contained in Appendix 14.2 of the EIAR which will be implemented in full and will be further developed prior to the commencement of construction by the Contractor.

There are four areas on the haul route that will require works in third party lands. These are shown on **Table 3.3**.

Table 3.3: Areas of Works on Haul Route in Third Party Lands

No.	Area	ITM (Easting)	ITM (Northing)	Description
1	R336	497440	743302	Third Party Lands to east of R336. Inside of the right bend will require a load bearing surface should be

No.	Area	ITM (Easting)	ITM (Northing)	Description
				laid and one utility pole should be removed.
2	R336	497060	742884	Third Party Lands to east of R336. Loads will overrun on the outside of the junction where a load bearing surface should be laid and two road signs and trees should be removed.
3	R226/R340	496715	738300	Third Party Lands to the west of the R336 and north of R336. Loads will overrun the verge on the inside of the initial right bend where a load bearing surface should be laid.
4	Baile na hAbhann	499618	722390	Third Party Lands to the west of the R336. Loads will overrun the verge on the outside of the bend where a load bearing surface should be laid. Vegetation should be cleared.

3.3.2 Site Access Tracks

The Site Access Tracks are necessary to allow access for cranes and delivery trucks during construction of the Development and also during servicing/repairs to the wind turbines. The existing access track from the N59 will be upgraded and used to minimise additional land take. The Site Access Tracks will be upgraded and constructed so that the width will be 5m, but will be wider at bends where a width of 5.5m is to be provided. The maximum gradient on the site will be approximately 15% with the exception of the access track to the Met Mast which has a gradient of approximately 22%. A stone layer will be provided so as to provide a good grip during wet weather. Gradients above 12-14% will usually require components to be towed by a specialist towing vehicle. The maximum gradient on site is 15.3% with a gradient of 21.94% leading to the Met Mast location, and therefore towing of delivery vehicles is likely to be required.

Approximately 1,450m of the existing Site Access Track length will be used for the Development. The upgraded Site Access Tracks will be approximately 2,900m^2 in surface area and will require approximately 1,740m^3 of stone material.

There will also be 5,530m of new Site Access Tracks required for the Development. These will be constructed to provide a width of 5m and will cover an area of 27,650m^2 and require c.16,590m^3 of rock. These roads will be excavated to firm bearing strata and constructed using rock from the turbine foundation excavations or imported to Site from a nearby quarry as outlined in **Table 3.2**.

The Site Access Track layout follows the existing access track into the Site as far as possible, avoids environmental constraints, and follows the natural contours of the land. Every effort has been made to minimise the length of track necessary.

The Site Access Tracks will be upgraded to carry a minimum 12 tonne axle construction loading. The design will consist of 150mm of 50mm Down Quarried Rock / Gravel Pavement on an average of 400mm Down Crushed Run Rock.

Sections of the Site Access Tracks will need to be of a floated road design where areas of deeper peat (>1.5m depth with a crossfall of less than 1 in 10) are encountered. This means they will not be excavated but will be laid directly on the peat using geogrid and crushed stone. Pipes will be installed at intervals to allow the existing runoff regime on site to continue.

The surface of the Site Access Tracks will be maintained during the construction phase. Harmful constituents such as hydrocarbons pose a risk of environmental contamination and also a risk to human health if found in drinking water sources. All imported stone to the Site will have undergone appropriate quality testing to TII specifications.

There are four crossings of natural streams/flushes along the Site Access Tracks. The existing crossing over the Owenwee River on the main access Track from the N59 will be upgraded for the increased Site Access Track widths for the Development and to allow heavier vehicles to traverse it. The upgrade will involve the construction of a clear span bridge to the north of the existing bridge location.

3.3.3 Met Mast

As part of the grid code[2] requirements, all wind farms with an installed capacity of greater than 10MW are required to supply continuous, real-time data for the wind farm location. The data required is the wind speed and wind direction at turbine hub height, air temperature and air pressure. The data required for the Development will be provided by a dedicated meteorological mast of 104m in height.

The Met Mast will be located on the west of the Site and will be a free-standing lattice type structure. The Met Mast foundation will be approximately 12m by 12m, with a depth of 2.25m and will be designed and constructed similar to the turbine foundations. It will encompass a cast-in insert or bolts to connect to the bottom of the met mast and reinforced bar structural elements. The area around and above the foundation will be backfilled with compacted granular material. The Met Mast will be linked to the 38kV Substation via buried Internal Cabling for power and communication and will be required for the full operational duration of the Development.

3.3.4 Electrical Substation, Control Building and Associated Compound

It is proposed to construct a 38kV electricity substation on the Site. This will provide a connection point between the wind farm and the grid connection point at the existing Screebe 110kV substation. Electricity transmitted between the turbines and the substation on the Site will be at 38kV.

The substation will serve two main functions:

1. provide housing for switchgear, control equipment, monitoring equipment, and storage space necessary for the proper functioning of the wind farm; and

2. provide a substation for metering and for switchgear to connect to the national grid.

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[2] **EirGrid (22 July 2005). EirGrid Grid Code Version 6**

The construction and electrical components of the substation will be to ESB specifications within the parameters assessed. The substation compound will be c.837m^2 and will be 0.6m in depth and will be constructed from engineered stone material using similar construction techniques as for the crane hardstands. The overall compound will be enclosed by a 2.65m high fence and will contain a single building, ancillary equipment, including the transformers, switch gear, fault protection, metering, car parking and other ancillary elements necessary for the operation of the Development.

The substation building will contain control elements of the Development. The control components housed at the substation will include metering equipment, switchgear, the central computer system and electrical control panels. The control building will be a single story pitched roof structure with traditional rendered finishes and measure approximately 15.275m x 6.12m with a floor area of approximately 93.48m^2. The appearance and finish of the substation building will be similar to an agricultural building with a slated roof and nap plaster finished proposed. It will have a suitably sized footpath around it and an adjacent parking area. The final finish of the control building will be an off-white or grey colour.

The control building will contain an ESB room, control room, switchgear room, small store, an office and toilet. There will be two lightning monopole protection masts which will be approximately 17m in height and associated site works. Warning / health & safety signage will be displayed as is normal practice for such installations. Motion sensitive lighting only will be used. It is proposed to install a rainwater harvesting system as the source of water for toilet and welfare facilities, a potable water being brought onsite in bottles. Wastewater from the staff welfare facilities in the control building will be collected in a sealed storage tank, fitted with a high-level alarm. This is a device installed in a fuel storage tank that is capable of sounding an alarm, during a filling operation, when the liquid level nears the top of the tank. All wastewater will be tankered off-site by a licensed waste collector to Oughterard wastewater treatment plant. There will be no onsite treatment of wastewater.

A telecommunication antenna will be fixed externally to the substation control building for communication and control purposes (e.g. for the Supervisory Control and Data Acquisition (SCADA) System) for the Developer, turbine suppliers and ESB networks. There will be a small area outside the compound and adjacent to the access road that will be a hard-surfaced area for operation and maintenance for 4 parking spaces and will measure approximately 122m^2.

3.3.5 Transformers and Internal Cabling

The power generated by each wind turbine will be transmitted via underground Wind Farm Internal Cabling to the new electrical Substation, at either 20kV or 33kV, as will the communication signals whose cables will be installed in the same trench. The Wind Farm Internal Cabling network will be installed in trenches approximately 0.6m wide by 1m in depth and there will be approximately 5,530m of Wind Farm Internal Cable trenching (giving a surface area of approximately 3,152m²). The cable ducting will be installed to ESB Networks Limited requirements as per the design.

The electrical and fibre-optic cables running from the turbines to the substation compound will be run within the Site Access Tracks and/or their verges. Where the cables are located in blanket bog habitat, they will be laid in the Site Access Tracks themselves to minimise land take in this habitat. This will be the case for the cables between T1 and T2 and from T6 to the site entrance at the N59.

The Wind Farm Internal Cabling routes will be bedded in surplus excavated soil material. Danger tape, incorporating a metallic strip, will be laid during backfilling. Where the Wind Farm Internal Cabling is to cross Site Access Tracks, suitable electrical ducting will be provided. Permanent posts up to approximately 0.5m in height will mark the trenches at regular intervals and at all changes in direction. An as built layout plan showing the location of underground Wind Farm Internal Cabling will be on permanent display within the control building.

Clay plugs or concrete cut offs will be installed at regular intervals in the cable ducting trenches where they are located on slopes to prevent the trenches from becoming preferential flow paths for runoff from the Site.

Transformers will be located inside each turbine.

Excavated material will be stored uphill of the trench excavations which will prevent any sediments from being washed downhill as they will be contained in the trench. Silt fences will be installed downgradient of the excavations on steeper slopes to prevent silt runoff.

3.3.6 *Grid Connection*

Connection will be sought from the grid system operators by application to ESB Networks Limited. Mullen Grid Limited assessed possible connection options for the Development and found that a 38kV connection to Screebe was the best option which would require the uprating of the existing 31.5MVA transformer to 63MVA. The substation will connect via underground 38kV cable to the ESB 110kV Screebe substation. The overall length of the grid connection between the substation and the existing Screebe 110kV substation is 18.65km, of which, 3,295m is within the site of the Development with the remainder being located in the N59 and R336.The grid connection can be summarised as follows:

- UGC from Screebe SS to Tullaghmore WF utilising sections of UGC in public road, primarily regional roads, and private lands. [18.65km]

The route of the above grid connection is provided in **Figure 3.1.**

The Grid Connection will be constructed to the requirements and specifications of ESB Networks Limited. The three conductors will be laid in separate ducts which will be laid in accordance with the ESB functional specifications for 38kV Networks Ducting/Cabling. The width of a 38kV cable trench with a trefoil formation will be 600mm. The depth of the trench for 38kV cables is 1.22m. A separate duct will be provided within the trench for fibre optic communications.

The following is a summary of the main activities for the installation of ducts:

- All relevant bodies i.e. ESB Networks Limited, Gas Networks Ireland, Eir, Galway County Council, Irish Water etc. will be contacted and up to date drawings for all existing services will be sought so that the grid connection ducting does not damage or interfere with existing services. This will be rechecked by the Contractor prior to excavations taking place.

- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CATSCAN (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.

- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.

- A silt fencing filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of any watercourse.

- A 13-tonne rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions of 600mm wide by 1.22m deep.

- Once the trench is excavated, a 50mm depth base layer of sand (in road trench) or 15 Newton CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.

- uPVC ducts will be installed on top of the compacted base layer material in the trench.

- Once the ducts are installed, couplers (a device used for joining pipes) will be fitted and capped to prevent any dirt entering the unjointed open end of the duct.

- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts.

- The co-ordinates will be plotted on as-built record drawings for the grid connection cable operational phase.

- When ducts have been installed in the correct position on the trench base layer, sand (in road trench) or Lean-mix CBM4 (CL1093) (off road trench) will be carefully installed in the trench around the ducts so as not to displace the duct and will be compacted.

- Timer spacer templates will be used during installation so that the correct cover of duct surround material is achieved above, below and at the sides of the duct in the trench.

- A red cable protection strip will be installed above duct surround layer of material and for the full length of the cable route.

- A layer of Lean-mix CBM4 (CL1093) (in road) will be installed on top of the duct surround material to a level 300mm below the finished surface level.

- Yellow marker warning tape will be installed for the full width of the trench, and for the full length of the cable route, 300mm from the finished surface level.

- The finished surface of the road will then be reinstated on a temporary basis to the requirements of the Guidelines for Managing Openings in Public Roads, 2017[3].

- Precast concrete cable joint bays (junction boxes) will be installed within the excavated trench.

- The junction boxes will be backfilled and the finished surface above the junction box reinstated on a temporary basis as per the requirements of the Guidelines for Managing Openings in Public Roads, 2017. The cable junction boxes will be re-excavated a second time during cable pulling and jointing, after which the finished surface above the joint bays will be reinstated again to its original condition.

- When trenching and ducting is complete, the installation of the grid connection cable will commence between the substation and the existing 110kV substation at Screebe.

- The underground cable will be pulled through the installed ducts from a cable drum set up at one joint bay and using a winch system which is set up at the next joint bay, the cable will be pulled through.

- The cables will be jointed together within the precast concrete cable junction box (Joint Bay).

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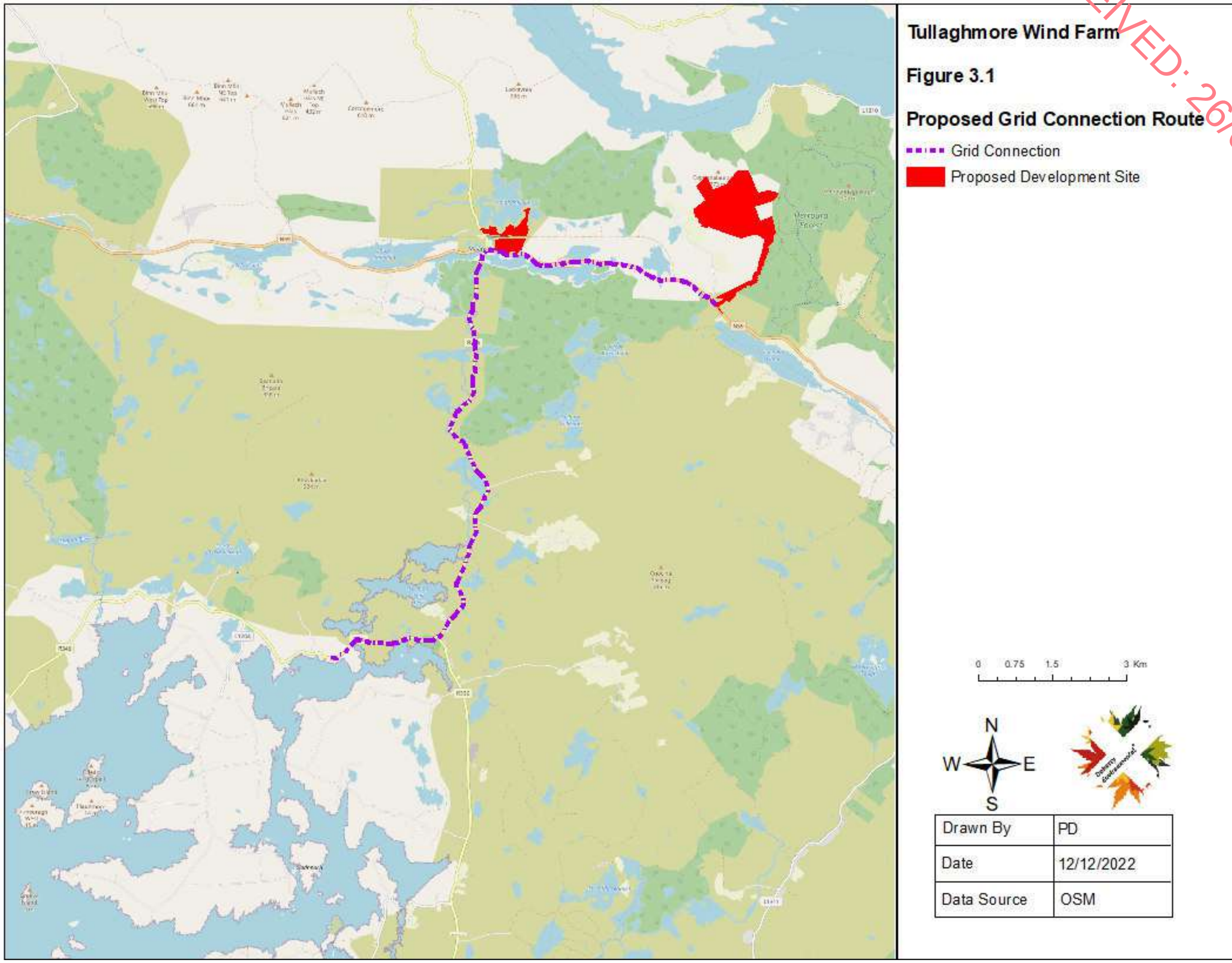
3 **https://www.gov.ie/en/publication/eda1ae-guidelines-for-managing-openings-in-public-roads-2017/**

- The finished surface above each cable joint bay is reinstated on a permanent basis to the requirements of the Guidelines for Managing Openings in Public Roads, 2017.



Drawn By	PD
Date	12/12/2022
Data Source	OSM

3.3.6.1 Joint Bays

Joint Bays are pre-cast concrete chambers where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay typically will be 6m long x 2.5m x 2.3m deep. A reinforced concreted slab will be constructed on top of the bay.

The joint bay locations have been dictated by suitable terrain and access to facilitate the operation of cable pulling equipment at any phase of the development and future operation of the installation in accordance with the ESB Networks Limited specifications.

Communication chambers, which are similar to small manholes, will be installed at the joint bay locations to facilitate connection of fibre-optic communication cables.

3.3.6.2 Trench Layout

The trench layout will be as per the appropriate ESB Networks Limited Specifications. The specification of Galway County Council will be followed for the excavation and reinstatement of the ducted cable trenches which is proposed to be in accordance with the requirements of the Guidelines for Managing Openings in Public Roads, 2017.

3.3.6.3 Joining Ducts

All joining ducts shall be laid in straight lines to even gradients. Once the ducts have been installed and backfilled with lean-mix concrete and with Clause 804 stone the duct run will be thoroughly cleaned by pulling the appropriate size of ESB Networks Limited approved duct brush through the duct.

Details of the construction methodology are summarised below:

- Preparatory Works
  - Preparatory Trial Pit Survey along the cable route
  - Access to the start point and setting out
  - Access to joint bays
  - Silt Attenuation Features and watercourse set back buffer
  - Joint Bay Excavation
- Trenching Works
  - Storage of Materials

- Trench Operations
- Managing excess material from trench works

3.3.6.4 Directional Drilling Works

There are 22 no. watercourse crossings along the grid connection route. From the bridge survey carried out by JOD, the majority of the crossings have sufficient cover in the road to allow the excavation of the cable ducting within the roadway or bridge. However, five of the crossings will be constructed by means of directional drilling technology. Directional drilling is the practice of drilling holes in a non-vertical direction for the laying of ducts which contain cables beneath features such as watercourse. The directional drilling commences at the launch pit which is the entry point for pipes and ducts to be placed. Pipes and ducts are brought through the drilled hole to a receiving pit on the opposite side of the hole to the launch pit. The crossings will comprise 4 x 110mm High Performance Polyethylene (HPPE) pipes/ducts each directionally drilled. Two separate excavations will be made to a depth of 2 metres to accommodate the directional drilling launch and reception pits in the road on either side of the crossing (no third-party lands either side of the road are anticipated to be required). Spoil arisings will be loaded onto trucks for disposal off-site as soil is excavated. The excavation launch and reception pits will be reinstated using compacted layers of crushed stone on completion of drilling and jointing operations.

The Drill head will be placed in the open excavation (launch pit) and it will be guided in by the operator for the first 1-2 metres. A series of drill rods will be connected to the head as it travels further along the shaft.

The drill position is always known to the operator and the drill can be manoeuvred in 3 planes / axis. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded. A drilling lubricant will be required and this will be delivered directly to the drill head by hydraulics. The lubricant will be chemically inert bentonite slurry mixture which lubricate the drill head and remove the drilled earth and stone. Once the conduit is completed, the drill head is exposed at the reception pit and removed. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side. The drill rods are connected to the duct pipe and the drill is reversed pulling the pipe back through the conduit.

A spoil volume of 5m³ will be excavated for each 100m run of 4 pipes. This spoil will be largely subsoil material. This material will exit the launch pit within the bentonite slurry mixture. A mobile bunded tank will be located next to the launch pit into which the material/slurry mixture will be pumped. This will be stored outside of the 25m watercourse buffer zone.

The following measures will be implemented during the directional drilling works:

- No in-stream works will be permitted
- Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast
- A floating hydrocarbon boom and spill kit will be employed
- Silt fencing will be erected at a setback distance of 5m during excavation
- Any excess construction material shall be removed from the works areas and disposed of in a fully licensed landfill
- No re-fuelling of machinery will take place on site or within 50 metres of any watercourse
- All construction workers will be given a toolbox talk addressing the environmental topics concerning the drilling prior to commencement of construction.

3.3.7 Borrow Pit

Due to the prevalence of bogland habitat on site, no borrow pits are proposed to minimise land take on site. While some, rock for the construction of Site Access Tracks and Turbine Hardstands will be sourced where rock is encountered during the excavations for Site Access Tracks and Turbine Hardstands or Turbine Foundations, the bulk is to be imported to the Site from a nearby quarry as listed on Table 3.2 above.

3.3.8 Turbine Foundation Rock Breaking

Weaker rock will be extracted using a hydraulic excavator and a ripper. Upon the completion of further confirmatory site investigation, where stronger rock is encountered and cannot be extracted using an excavator, then rock breaking equipment will be employed. This will involve the use of a 40-60 tonne 360 degree hydraulic excavator with a rock breaker. The rock breaker is supported by a smaller 30-40 tonne rock breaker which breaks the rock down further for feeding into the rock crusher machine. The larger rock breaker breaks out the rock in a progressive manner from the turbine foundations and the smaller rock breaker breaks it down further.

The broken-down rock is loaded into mobile crusher using a wheeled loading shovel machine and crushed down into the correct grade for use in the civil construction of Site Access Tracks and Turbine Hardstands.

3.3.9 Onsite Drainage

The surface water runoff contained within natural and artificial drainage channels includes stream and river waterbodies, drainage ditches, and other minor natural and artificial manmade drainage features. Drainage measures will be provided to attenuate runoff, guard against soil erosion, soil compaction, and safeguard local water quality. Details of the drainage system are outlined in detail in the Surface Water Management Plan, part of the CEMP attached as **Appendix 2.1** to the EIAR or the proposed development**.**

There is one river, the Owenwee River, which runs along the boundary of the site and next to the exiting access track into the site from the N59. A buffer zone of at least 50m will be in place for the Owenwee River where possible, with the exception of the section of existing access track to be upgraded near the Owenwee River. There will be upgrade works on this access track which will take place inside the buffer zone. Other watercourses on site consist of manmade drainage channels and headwaters of the Owenwee and Owenree Rivers, some of which are ephemeral. Sustainable Urban Drainage System (SuDS) principles will be employed as follows:

Source controls for surface water

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sandbags, oyster bags filled with gravel, filter fabrics, and other similar/equivalent or appropriate systems

- Small working areas, covering stockpiles with geotextiles layering to protect against water erosion and runoff in rainy weather, and/or cessation of works in certain areas such as working on a high gradient during wet and windy weather.

In-line controls for surface water

In line controls are controls which are directly applied to the surface water body, including interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriates systems

Treatment systems for surface water:

Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbusters and/or other similar/equivalent or appropriate systems.

When heavy rainfall is predicted, then works will be suspended or scaled back.

3.3.10 Table of Key Development Infrastructure Metrics

The Key Development Infrastructure Metrics are contained in **Table 3.4**.

Table 3.4: Key Development Infrastructure Metrics

Description	Length [m]	Width [m]	Depth [m]	No.	Area [m^2]	Volume of Excavation [m^3]
Upgraded Site Access Track	1,450	2	0.6	1	2,900	1,740
New Site Access Track	5,530	5	0.6	1	27,650	16,590
Internal Cabling (power & communications)	5,530	0.57	1.05	1	3,152	3,310
Turbine Hardstands - cranes	-	-	0.6	6	20,370	12,222
Turbine Foundations (25.5m diameter)	-	-	3	6	3,064	9,192
Met Mast foundation	12	12	2.25	1	144	324
Electrical Substation	-	-	0.6	1	837	502
Site Compound	30	45	0.3	1	1,350	405
38kV Cable Grid Connection (Option A)	18,650	0.6	1.220	1	11,190	13,652
Total					**70,657**	**57,937**

Taking the above figures into consideration, the permanent land take from the Development will be 54,965m^2 (5.9ha) which is the sum of the figures above which are to be retained following construction e.g. Site Access Tracks, Turbine Foundations, Met Mast Foundation, Turbine Hardstands, Met Mast Hardstand and 38kV Substation. Temporary land take on Site will be 4,502m^2. The grid connection will involve works on 11,190m^2 of area on the public roads to be reinstated following the laying of the ducts and so is classed as temporary land take. Therefore, the total land take required for the Development will be approximately 5.4ha.

3.3.11 Site Signage

Signs will be placed on the N59 showing directions to the Site. Additional signage will be placed on the road, warning of construction vehicles entering and egressing the Site for road safety measures. The Site entrance on the N59 will have a sign confirming that it is the entrance to the Site and the speed limit of 30 km/h. There will also be additional signs during the construction phase confirming that construction works are taking place and proper precautions must be taken by anyone entering the Site. There will be no entry to unauthorised persons or the general public during construction.

3.3.12 Peat and Spoil Management

3.3.12.1 Spoil Quantities

The quantities of spoil likely to be generated at the Development have been calculated by Jennings O'Donovan & Partners. It is estimated that based on site surveys carried out by Andrew Garne Geotechnical Services using peat probes that the amount of peat spoil predicted to be generated during construction of the wind farm is approximately 84,760m^3 of peat spoil.

The total amount of cut material below the peat layer estimated from the Development is approximately 218,635m^3 with the amount of fill being estimated at 174,526m^3. This leaves a surplus of 44,109m^3 that it is envisaged can be used as structural fill in Site Access Tracks, Turbine Hardstand and Turbine Foundation construction.

3.3.12.2 Landscaping & Reinstatement

Due to the nature of the peat habitats on site, berms or large designated storage areas for the storage of spoil will not be permitted. A waste licence will be procured for handling and storage of the excess spoil from the Site. However, peat spoil will be used to reinstate exposed areas around infrastructure such as slopes/graded ground around Site Access Tracks and Turbine Hardstands and on the Turbine Foundations or where there is degraded bog that can be enhanced by depositing peat on it. Peat that cannot be used for reinstatement around the Site, will be taken off site to the designated spoil storage area to the east of Maam Cross, approximately 3.5km to the west of the wind farm site. The designated spoil area has an area of approximately 65,182m^2 (6.5ha) and a capacity of approximately 97,000m^3 assuming that the areas of cutover peat can be filled in and berm constructed in cells so that spoil can be stored up to a total height of approximately 1.5m. This will allow the total estimated amount of spoil to be stored taking into account a bulking factor of 10% (total of approximately 93,236m^3). The existing site conditions are shown in **Plates 2.1** and **2.2**.

Plate 2.1 – Site of Spoil Storage and Biodiversity Enhancement

Plate 2.2 – Site of Spoil Storage and Biodiversity Enhancement

Works at the spoil storage areas will involve the machinery similar to that used for peat excavation. A 40-60 tonne 360 degree long reach hydraulic excavator and tractors and trailers will be used to place the spoil in areas of cut away to create level surface. Where these areas are less than 1.5m deep (expected to be the majority), they will be filled with peat to the adjoining ground level and then a containment berm will be created to create cells. The cells will be bermed and will measure a maximum size of approximately 30m x 30m and have outfalls blocked and overflow management with the creation of drainage channels for excess water and sphagnum inoculation. Where the storage is on areas of non cutover peat, then the cells will be provided on the surface of the existing degraded/de-vegetation peat surface. The width of the cell, in an east to west orientation will be dictated by the width of the existing areas of cutover blanket bog either side of the degraded/de-vegetated area, but will not be wider that 45m in width. The length of the cells along their broadly north to south axis will not be longer than 60m in length.

3.3.12.3 Non-Peat Spoil

Non peat spoil will consist of glacial till from granite bedrock / rock. It is envisaged in the design that all the non-peat material won on Site can be used as fill on site in the following places:

- Subsoil to be used around the blade laydown areas where load capacities required are less; and
- Rock won from excavations to be used within Site Access Track and Turbine Hardstand build up.

There will also be spoil generated from the grid connection works. This will be in the form of tarmacdam/asphalt, Clause 804 running layer material, compacted rock fill material and subsoils. The total amount of spoil material from the grid connection works is estimated to be 12,590m^3. This material will need to be taken off site and recycled/disposed of at Carrowbrowne Recycling Centre which is an appropriate licenced facility to deal with inert waste.

3.3.13 Peat Storage and Restoration (Habitat Enhancement) Area

A Peat Storage and Restoration (Habitat Enhancement) Area of approximately 296,625m^2 (29.6ha) has been designated around the peat spoil storage areas identified above that will be used as a biodiversity enhancement area. The land use restrictions that would be required for peatland restoration in this area will comprise:

- Cessation of turbary activity
- Cessation of drainage: Drain blocking with control of water levels

- Cessation of inappropriate livestock grazing levels and no grazing between 1st November and 28th February
- Active seeding with peat vegetation such as Sphagnum moss or heather brashing

4 DESCRIPTION OF THE PROPOSED DEVELOPMENT AREA

The proposed wind farm development site (referred to hereafter as the "proposed wind farm site" or the "Site" as appropriate) is located near the townland of Tullaghmore, approximately 9km west of Oughterard in County Galway. The proposed wind farm site is located across land which is predominantly Atlantic blanket bog and upland heath and blanket bog (>200m in altitude) situated to the west of the Derroura Forest which is managed by Coillte. To the south of the Site is the N59 Road, Lough Bofin and the Connemara Bog Complex Special Area of Conservation (SAC). North of the proposed wind farm site there are additional areas of blanket bog, forestry, Curraun Lough, the Western Way long-distance walking trail and the Lough Corrib SAC. To the east and south of the proposed wind farm site flows the Owenwee River, which flows into Tawnaghbeg Lough. Loughaunierin is located further to the west/southwest of Tawnaghbeg Lough.

The proposed wind farm site contains a number of small streams, all of which are headwaters of the Owenwee and Owenree Rivers, the latter of which ultimately flows into Lough Corrib Upper to the north of the Site. There are no lakes located within the Site boundary where the predominant land use is agricultural grazing land for both sheep and cattle. The land within the Site boundary has also been utilised for peat extraction purposes. There are no dwellings located within the Site boundary which is characteristic of the wider rural setting. The Site is serviced by a pre-existing access road off the N59 road along the southern Site boundary and adjacent to the Owenwee River.

The proposed wind farm site extends to 161.88 hectares (ha), the majority of which consists of peat and heath habitats used for grazing sheep and is in the ownership of three local landowners. The area designated for spoil storage and ecological enhancement (the Peat Storage and Restoration (Habitat Enhancement) Area) is located approximately 3.4km to the west of the Site in the townland of Lurgan or Shindilla. The Peat Storage and Restoration (Habitat Enhancement) Area extends to 29.86ha. Therefore, the total site area is 191.74ha.

The topography of the proposed wind farm site is variable, and it is broadly surrounded by or is partially overlapping three elevated areas. These include Knockbrack to the east of the Site (299m OD (metres above Ordnance Datum)) near Lough Beg in the Derroura Forest and Cappanalaurabaun (273m OD) at the northern extent of the Site. Further north beyond the Site boundary is Curraun Hill at 252m OD. The southern and southeastern extents of the Site are low lying areas ranging from 50 – 100m OD. The topography beyond the southern and western extent of the Site is characterised by low lying surface water features such as the Owenwee River, Owenree River, Lough Bofin, Loughanaduff, Loughaunierin and Tawnaghbeg Lough. The N59 road which bounds the proposed southern Site boundary is also generally low lying.

The proposed wind farm site is generally topographically elevated in the north / north-west and generally topographically low lying in the south and east. The steepest incline across the Site occurs at the north-western extent of the Site near the proposed T4 position. Elevations typically range from between 100m and 200m OD in the north and northwest of the Site with areas or relatively flat ground existing within the central areas of the Site between elevations of 110m – 150m OD. This central area gives way to lower ground to the south and southeast of the site with elevations ranging from 50 – 100m OD.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located on relatively flat low-lying peatland at approximately 43m OD.

The proposed grid connection route will be installed along the proposed wind farm site access track and within the formation of the N59 national road between the site entrance and Maam Cross; the R336 between Maam Cross and R336/R340 junction; and the R340 between the R336/R340 junction and the existing ESB substation at Screebe.

The R336 regional road from Galway to Maam Cross and the N59 national road from Maam Cross to the Site entrance will be used as the haul road. The four proposed areas to be widened along the haul route, as shown on Figure 1.3 are located within the following townlands:

- Widening Area 1: Ballynahown South
- Widening Area 2: Camus Eighter
- Widening Area 3: Knockaphreaghaun
- Widening Area 4: Knockaphreaghaun

The proposed wind farm Site, Peat Storage and Restoration (Habitat Enhancement) Area, proposed grid connection route and haul route are located within the Corrib and Galway Bay North catchment areas in Hydrometric Area 30 and 31. The Site, the Peat Storage and Restoration (Habitat Enhancement) Area, the grid connection to Screebe, and the section of the haul route along the N59 and the northern stretch of the R336 (including widening areas 2 – 4) are located within four WFD sub-catchments. These include the Corrib_SC_010, Joyce's_SC_010 and Furnace_SC_010 sub-catchments as well as a minor overlap between the Site boundary and the Ballycuirke Lough Stream_SC_010 sub-catchment. The section of the haul route between Casla and Galway also passes through the Cashla_SC_010; Owenriff[SouthGalway]_SC_010; Owenboliska_SC_010; and Knock[Furbo]_SC_010 sub-catchments.

The Site and its surrounds are located upstream of Lough Corrib Upper which is located approximately 850m from the Site boundary at the closest extent near the proposed T3 turbine position. The Site has indirect hydraulic connectivity to Lough Corrib Upper via the headwaters of the Owenwee and Owenree Rivers which drain the site. Lough Corrib is the second largest lake in Ireland in terms of area (176 km^2) and is designated as the Lough Corrib SAC. The western portion of the Site is primarily hydraulically characterised by a number of unnamed rivers and streams that are headwaters of the Owenree River which ultimately discharges into Lough Corrib Upper.

4.1 DESCRIPTION OF HABITAT AT THE PROPOSED DEVELOPMENT

4.1.1 Proposed Wind Farm Site

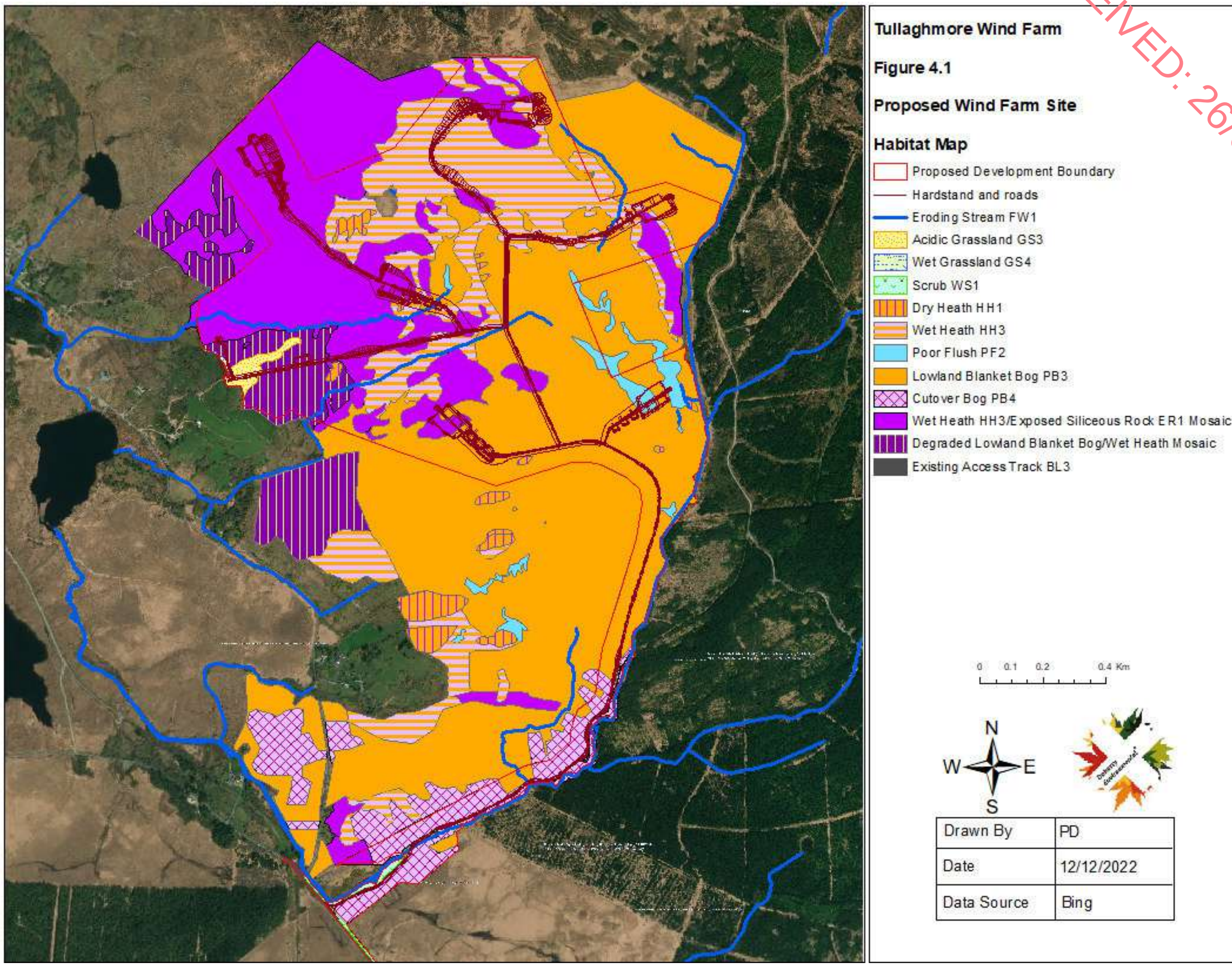
The habitats occurring within the proposed wind farm site are dominated by open peatland habitats in the form of lowland blanket bog and wet heath habitats. The range of habitats occurring at the wind farm site and the relationship between these habitats and the proposed wind farm infrastructure are set out in Table 4.1 below. Detailed descriptions of these habitats and associated vegetation communities are set out in Chapter 6 of the EIAR for the proposed development. A habitat map showing the distribution of habitat at the proposed wind farm site is provided as Figure 4.1 below.

Table 4.1: Habitats at the proposed wind farm site and interaction with the proposed wind farm site infrastructure

Fossitt 2000 Code (s)	Name of Fossitt 2000 Habitat Communities	Relationship with the proposed wind farm infrastructure
FW1	Eroding Watercourse	The Owenwee River flowing along the eastern boundary of the proposed wind farm is representative of an eroding watercourse. This river will be crossed by the existing access track that will be upgraded and used as part of the proposed wind farm infrastructure. The existing bridge crossing of the Owenwee River will require to be upgraded as part of the construction works for the proposed wind farm.
FW4	Drainage ditches	Drainage ditches are predominantly located towards the west of the proposed wind farm site in areas of improved habitat underlain by peat substrate and with wet heath and blanket bog habitat. These drains are principally located in the vicinity of the access track to the proposed meteorological mast.
GS3	Acidic grassland	One area of acid grassland occurs towards the west of the proposed wind farm site. This is located in an area where past land management has converted the habitat from wet heath to grassland habitat. The area is now grazed by livestock in the form of both sheep and cattle. The access track to the proposed meteorological mast passes through this habitat.
GS4	Wet grassland	One small area of wet grassland occurs along the western boundary of the proposed wind farm site in the vicinity of the proposed meteorological mast location. This habitat is representative of a dense stand of high sward *Juncus effusus*.
WS1	Scrub	Scrub habitat occurs adjacent to the existing site access road at the proposed site entrance from the N59 road and also along the riparian corridor of the Owenwee River along the eastern boundary of the wind farm site
HH1	Dry heath	Patches of dry heath habitat occur within the proposed wind farm site on outcrops of bedrock that are covered by a thin film of peat substrate. One

Fossitt 2000 Code (s)	Name of Fossitt 2000 Habitat Communities	Relationship with the proposed wind farm infrastructure
		small area of dry heath outcrop occurs under the footprint of the proposed turbine 5 hardstand.
HH3	Wet heath	Wet heath habitat occurs throughout the proposed wind farm site on areas of thin peat (c. less than 0.5m in depths). The access track and the proposed turbines 2, 3 and 5 are located within wet heath habitat.
PF2	Poor flush	The examples of poor flush occurring within the proposed wind farm site are examples of topogenous flushes occurring in depressions and fed by surrounding surface water flows. They are located on areas of deeper peat and the examples of this habitat occur to the east of the proposed wind farm site. The proposed turbine 1 hardstand area is located within an example of poor flush habitat.
PB3	Lowland blanket bog	The lowland blanket bog habitat occurring within the wind farm site dominates the ground cover at low elevations to the east of the site. Within the proposed wind farm site it occurs between an elevation of 60m and 150m OD Malin. *Molinia caerulea* generally dominates the sward with *Trichophorum germanicum*, *Calluna vulgaris* and *Erica tetralix* occurring abundantly. The infrastructure elements of the proposed wind farm that occur within this habitat comprise the access track, and the proposed turbines 1, 2, 5 and 6.
PB4	Cutover blanket bog	Areas of cutover blanket bog occur to the east of the proposed wind farm site adjacent to the access track. The upgraded access track that will be used for the proposed wind farm is located within this habitat.
HH3/ER1	Wet heath/Exposed Siliceous Rock Mosaic	This mosaic habitat dominates the western side of the proposed wind farm in areas of elevated and sloping ground on thin peat cover, less than 0.5m in depth. The infrastructure elements of the proposed wind farm that occur within this habitat comprise the access track, and the proposed turbines 2, 3, 4, 5 and 6 and the meteorological mast.

Fossitt 2000 Code (s)	**Name of Fossitt 2000 Habitat Communities**	**Relationship with the proposed wind farm infrastructure**
PB5/HH3	Degraded blanket bog/Wet heath Mosaic	An area of degraded blanket bog and wet heath mosaic occurs towards the southwest of the proposed wind farm site on lands that have been subjected to drainage and extensive grazing by sheep and cattle. The infrastructure elements of the proposed wind farm that occur within this habitat comprise the access track, the proposed substation and the meteorological mast.
BL3	Buildings and artificial surfaces	The examples of this habitat occurring within the proposed wind farm site is characterised by access track and the N59 national road.


Tullaghmore Wind Farm
Figure 4.1
Proposed Wind Farm Site
Habitat Map
Proposed Development Boundary
Hardstand and roads
Eroding Stream FW1
Acidic Grassland GS3
Wet Grassland GS4
Scrub WS1
Dry Heath HH1
Wet Heath HH3
Poor Flush PF2
Lowland Blanket Bog PB3
Cutover Bog PB4
Wet Heath HH3/Exposed Siliceous Rock ER1 Mosaic
Degraded Lowland Blanket Bog/Wet Heath Mosaic
Existing Access Track BL3
0 0.1 0.2 0.4 Km
N
W
E
S
Drawn By PD
Date 12/12/2022
Data Source Bing

4.1.2 Peat Storage and Restoration (Habitat Enhancement) Area

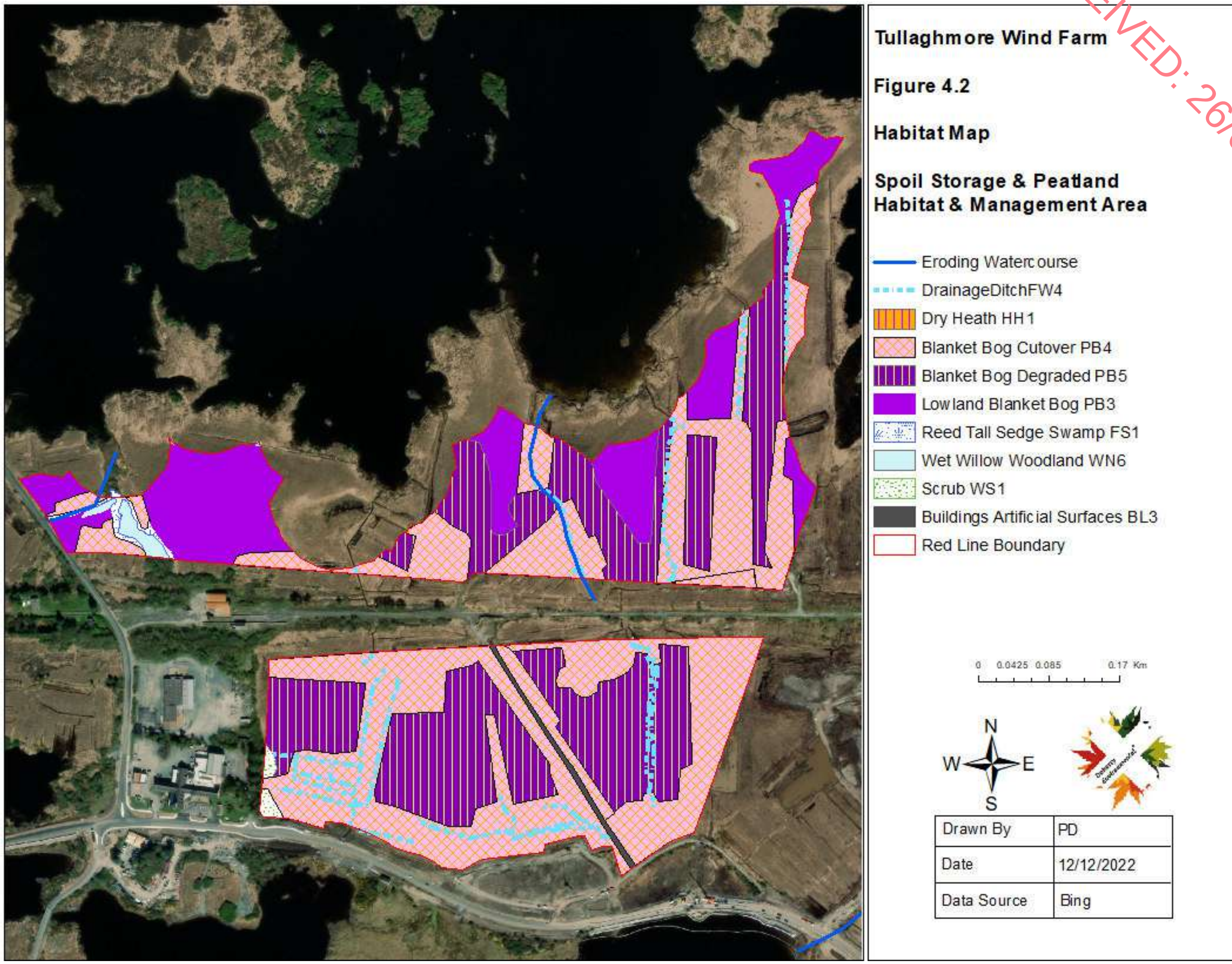
The habitats occurring within the Red Line Boundary surrounding the proposed Peat Storage and Restoration (Habitat Enhancement) Area consist of cutover blanket bog (PB4) and degraded blanket bog (PB5).

The cutover blanket bog is represented by areas of existing cut cells created as a result of past and ongoing industrial scale peat harvesting. Peat harvesting has been undertaken in this area over a protracted period of time and this has resulted in a variation in the vegetation communities occurring within the cut cells. Recently cut cells are generally either devoid of vegetation or only support a sparse cover of pioneering species. However, cells that have been historically cutover have in general become recolonised by typical blanket bog vegetation. Notwithstanding this recolonisation, water is being lost from these cells and also from the uncut areas immediately adjacent to these areas. Scouring was also noted along drainage channels with silt-laden surface water emissions to the receiving lakes to the north and south of the proposed spoil storage areas likely to be ongoing.

Areas of denuded peat surface that have not been cut into cells but where the vegetation and surface layer of acrotelm has been removed are also occur within the areas to be used for spoil storage. These examples of degraded blanket bog are generally denuded or where vegetation occurs supports a very sparse cover of pioneering vegetation such as *Eriophorum angustifolium, Eriophorum vaginatum* and *Campylopus atrovirens*.

The Level 3 Fossitt habitats occurring within the red line boundary of the proposed Peat Storage and Restoration (Habitat Enhancement) Area is shown on **Figure 4.2**.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located in close proximity of two lakes, Loughanillaun to the north and Lough Ardderry to the south. Both lakes have been classed as high-status waterbodies under the Water Framework Directive. Loughanillaun forms part of the Maumturk Mountains SAC and represents an example of oligotrophic lake which is a qualifying habitat of the SAC. The 2019 Water Framework Directive Cycle 2 report for the Joyce's_SC_010 sub-catchment has noted that Loughanillaun has been identified as failing to meet High Ecological Status objectives due to chlorophyll and phytoplankton. Peat cutting, overgrazing and erosion have been identified as the land use


Tullaghmore Wind Farm
Figure 4.2
Habitat Map
Spoil Storage & Peatland Habitat & Management Area
Eroding Watercourse
DrainageDitchFW4
Dry Heath HH1
Blanket Bog Cutover PB4
Blanket Bog Degraded PB5
Lowland Blanket Bog PB3
Reed Tall Sedge Swamp FS1
Wet Willow Woodland WN6
Scrub WS1
Buildings Artificial Surfaces BL3
Red Line Boundary
0 0.0425 0.085 0.17 Km
N
W
E
S
Drawn By
PD
Date
12/12/2022
Data Source
Bing

pressures that are likely contributing to the at-risk status of this lake. Channelisation of inputting streams and drains has also been identified as a significant pressure impacting this lake.

Lough Ardderry is spilt into two sections by the N59 to the south of Maam Cross with a channel under the road linking both sections. The western section of the lake forms part of the Connemara Bog Complex SAC and represents an example of oligotrophic lake which is a qualifying habitat of the SAC. O' Reilly (2002), described Lough Ardderry as a "*shallow lough, holding brown trout and in the wet season a relatively small head of sea trout and occasional salmon*". This lake was surveyed during September 2010 by Inland Fisheries Ireland (IFI, 2010). A total of five species were recorded during this survey including high numbers of perch (99) and lower numbers of brown trout (20), salmon (2), Arctic Charr (10) and European eel (2).

4.1.3 Haul Route & Haul Route Widening Locations

The haul will utilise the R336 regional road from Galway Port to Maam Cross and will then use the N59 national road for the final leg of the route between Maam Cross and the proposed wind farm site.

Temporary widening at 4 locations on the haul route from Galway Port to the proposed wind farm site to allow a load bearing surface will be provided as part of the proposed development. The four widening locations are shown on **Figure 4.3**.

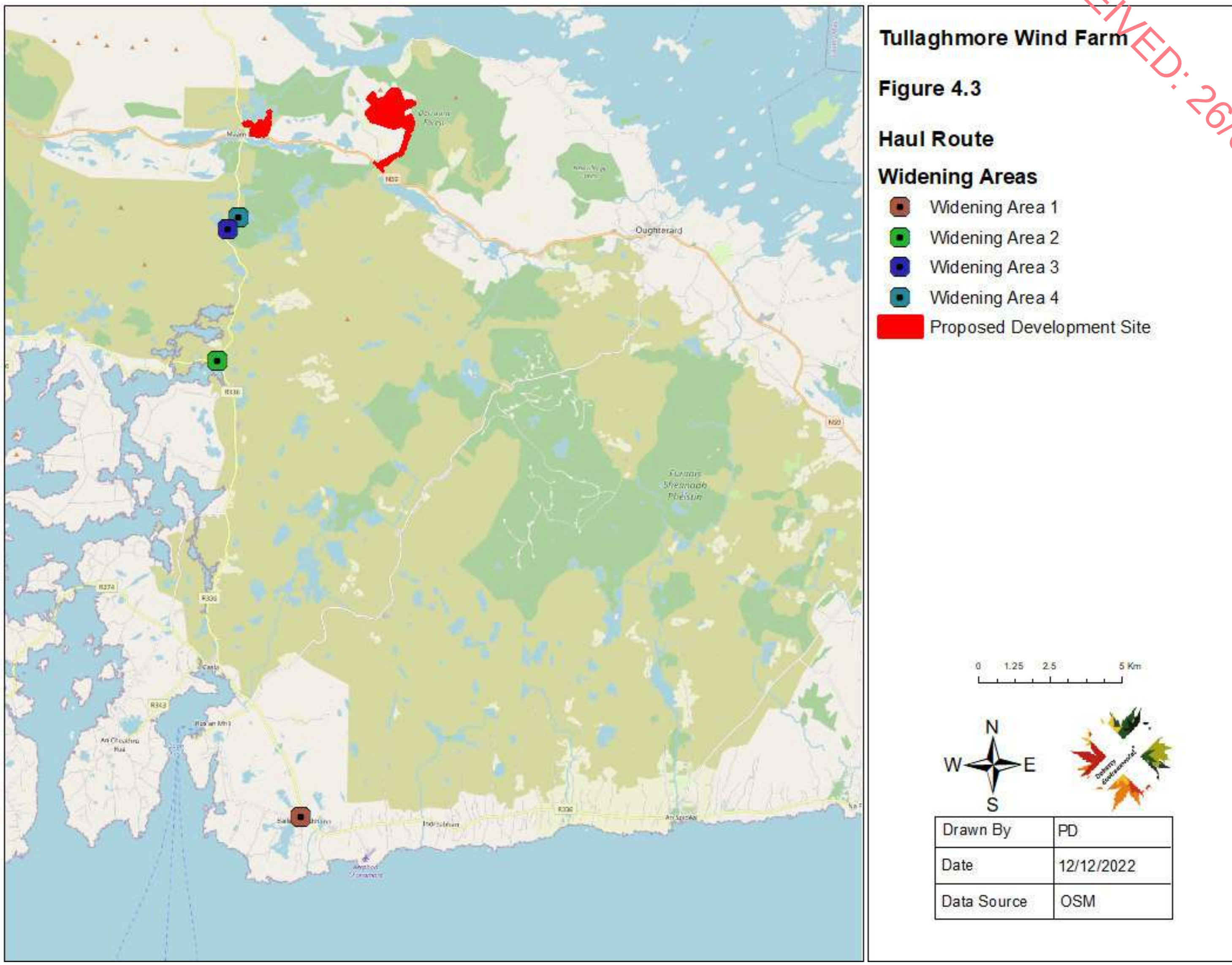
The first temporary widening area, moving from Galway Port to the proposed wind farm site, is located along the R336 in the townland of Ballynahown South. The existing R336 will be widened to the west side of the road. The habitats occurring here comprise a grassy verge along the road edge that gives way to a pasture field representative of improved agricultural grassland. No non-native invasive species were recorded at this location during field surveys. The boundary of the Connemara Bog Complex SAC is located to the east and on the opposite side of the R336 at this location. No widening works will be completed within the SAC.

The second temporary widening area is located at in the townland of Camus Eighter, south of the junction of the R336 and the R340. The existing R336 will be widened to the west side of the road. The habitat occurring at this location is comprised of scrub. The vegetation occurring here include *Salix cinerea, Salix aurita, Fraxinus excelsior* and *Betula pubescens*. No non-native invasive species were recorded at this location during field surveys. The boundary of the

Connemara Bog Complex SAC is located to the north and south of this location. No widening works will be completed within the SAC.

The third temporary widening area is located along the R336 to the east of Loughaunfree in the townland of Knockaphreaghaun. The existing R336 will be widened to the east side of the road. The land cover occurring at this location is comprised of an existing area or road verge hardstanding that is representative of buildings and artificial surfaces (BL3). No non-native invasive species were recorded at this location during field surveys. The boundary of the Connemara Bog Complex SAC is located to the west and on the opposite side of the R336 at this location. No widening works will be completed within the SAC.

The fourth temporary widening area is located along the R336 approximately 600m to the north of the third temporary widening area in the townland of Knockaphreaghaun. The existing R336 will be widened to the east side of the road. Grassy verge (GS2) habitat borders the R336 to the east within the footprint of the temporary widening area. Moving east this first gives way to wet grassland (GS4) dominated by Juncus effusus, which in turn gives way to wet heath (HH3) habitat dominated by Calluna vulgaris and Erica tetralix. No non-native invasive species were recorded at this location during field surveys. The boundary of the Connemara Bog Complex SAC is located to the west and on the opposite side of the R336 at this location. No widening works will be completed within the SAC.


Tullaghmore Wind Farm
Figure 4.3
Haul Route
Widening Areas
Widening Area 1
Widening Area 2
Widening Area 3
Widening Area 4
Proposed Development Site
Oughterard
N59
R336
0 1.25 2.5 5 Km
N
W
E
S
Drawn By PD
Date 12/12/2022
Data Source OSM

4.1.4 Grid Connection Route

The entire stretch of the grid connection route from the proposed wind farm site to the existing ESB substation at Screebe will be located within the footprint of existing public road corridors. The electrical cable and associated ducting will be installed in the formation of the N59 road between the proposed development site and Maam Cross; within the formation of the R336 between Maam Cross and R336 and R340 junction; and within the formation of the R340 between this junction and the substation.

Horizontal directional drilling will be used at five locations to cross watercourses along the route. At these bespoke locations the electrical cable ducts will be drilled underground below the watercourses. The launch and receptor pits required for the horizontal directional drilling will be positioned within the road corridor.

The habitat occurring along the cable route is entirely comprised of road surface which is representative of buildings and artificial surfaces (BL3).

4.1.5 Non-volant mammals

Irish hare was observed at the proposed wind farm site during field surveys and evidence indicating the presence of red deer was also observed. No evidence indicating the presence of badgers was observed during field surveys.

No otter holts or couches were observed along the stretch of the Owenwee River bounding the proposed wind farm site during surveys. The Owenwee River provides some foraging habitat for otters, although the low fisheries value of the stretch of this river bounding the site is likely to limit its use by otters. No otter activity was recorded along this stretch of the river during camera trap monitoring.

The lakes surrounding the proposed Peat Storage and Restoration (Habitat Enhancement) Area provide suitable habitat for otters and this species is known to use these lakes for foraging. No evidence indicating the presence of otters was observed within the proposed Peat Storage and Restoration (Habitat Enhancement) Area during field surveys and there are no aquatic habitats occurring within this area of the proposed development site that are suitable for supporting otters.

No evidence of non-volant mammals was recorded at the four proposed widening areas along the haul route.

4.1.6 Bat Species

The bat landscape association model (Lundy *et al,* 2011) suggests that the proposed wind farm site boundary is part of a landscape that is of High (Amber) suitability for bat species as a whole (33.6). The landscape suitability is highest for Brown Long-eared bats and Common Pipistrelle, high for Natterer's bats and Leisler's bat and moderate for Soprano Pipistrelle and Daubenton's bat. The site is of low suitability for Lesser horseshoe and lowest for Nathusius's Pipistrelle and Whiskered bat.

During transect and emergence surveys, a total of five species of bats were recorded: Common Pipistrelle, Soprano Pipistrelle, Leisler's bat, Daubenton's Bat, Natterer's bat. Where the call could not be identified to species, the identification was determined to the highest level possible. The most commonly recorded species was Common and Soprano Pipistrelle, with much lower levels of Leisler's and Myotis spp.

During the automatic static detector surveys low and low to moderate levels of bat activity was recorded at all monitoring locations within the proposed wind farm site. Overall bat activity for all Myotis species, Nathusius pipistrelle, Common pipistrelle, brown long-eared bat and Leisler's bat was categorised as low while the overall levels of bat activity recorded for Soprano pipistrelle were categorised as low to moderate.

No lesser horseshoe bat calls were recorded at monitoring locations occurring within the proposed wind farm site.

4.1.7 Bird Species

A total of 44 target species and/or species of conservation concern were recorded during bird surveys for the proposed wind farm site and in the surrounding hinterland. Of these 39 have been identified as key avifauna receptors. These species are listed in Table 4.2 below. The key avifauna receptors that are included in the list of special conservation interest bird species for which SPAs are designated in Ireland are highlighted in yellow in Table 4.2. A total of 19 such species were identified as key ornithological receptors. Of these 19 species, seven have been identified as occurring within the zone of influence of the proposed development. These seven species are: cormorant; merlin; hen harrier; Greenland white-fronted geese; golden plover; common gull; and lesser-black backed gull. These seven species are listed as special conservation interest bird species of the four SPAs in the wider area surrounding the proposed development that have been screened in for examination as part of this Natura Impact Statement. The proposed development is not located within the foraging zone of the other 11 species identified in yellow in Table 4.2 and as such no SPAs that include these species as special conservation interest bird species have been identified as occurring within the zone of influence of the proposed development.

Table 4.2: Key Avifauna Receptors

Species				
Raptors	**Gulls**	**Wildfowl**	**Waders**	**Passerines & Others**
Buzzard	Common gull	Greylag goose	Common Sandpiper	Goldcrest
Hen harrier	Great Black-backed gull	Mute swan	Grey heron	Greenfinch
Kestrel	Lesser black-backed gull	Mallard	Greenshank	Meadow pipit
Merlin	Herring gull	White-fronted goose	Great northern diver	Linnet
Peregrine		Whooper swan	Golden Plover	Redwing
Sparrowhawk		Wigeon	Cormorant	Sand martin
White-tailed eagle			Red-breasted merganser	Skylark
			Little grebe	Starling
			Snipe	Swallow
			Woodcock	Wheatear
				Willow Warbler
				Red grouse

4.1.8 Aquatic Fauna

The proposed development site is not located within a freshwater pearl mussel sensitive catchment. The Corrib – Owenriff freshwater pearl mussel catchment is located to the south of the Site and is separated from the Site by the catchment boundary which is broadly delineated by the N59 road to the south of the Site. The Ballycuirke Lough Stream sub-catchment is the nearest sub-catchment of the Corrib – Owenriff freshwater pearl mussel sensitive catchment to the proposed wind farm. This is located to the south of the N59 national road. Freshwater pearl mussel are known to occur within this sub-catchment, with the nearest record located downstream of the Letterfore River, approximately 3km to the southeast of the Site. Aside from a minor area of the Red Line Boundary for the Site that overlaps the existing N59 road corridor, the Site is not located within the Ballycuirke Lough Stream sub-catchment or the freshwater pearl mussel sensitive area. As noted above, no works are to be undertaken within this minor area of the Red Line Boundary that occurs within the Corrib – Owenriff freshwater pearl mussel catchment.

The potential for the Owenwee River to support freshwater pearl mussels was previously assessed as part of the N59 Road project between 2010 and 2012. This assessment concluded that the Owenwee River does not provide suitable habitat for freshwater pearl mussels (Moorkens, 2012).

From the review of aerial imagery for the period 2005 – 2012, 2013 – 2018 and current google satellite imagery it has been found that conditions along the Owenwee River remain unchanged from those identified by Moorkens (2012) during the assessments completed between 2010 and 2012 and that the river continues to remain unsuitable for freshwater pearl mussels. The spate conditions of this river and the propensity for much of the river channel to dry out during periods of low rainfall and then be subject to high and turbulent flows during spate conditions are in keepings with Moorkens (2012) assessment of this watercourse and its unsuitability for freshwater pearl mussels.

The fisheries habitat survey for the Owenwee River bounding the proposed wind farm site found this stretch of the river to be almost dry during surveys and too small to provide habitat for fish species. Further downstream along the stretch of this river that runs parallel to the N59 fisheries habitat conditions improve with brown trout occurring. This stretch of the river has been identified as an important spawning and nursery channel for salmonids. No Atlantic salmon were identified along the stretch of the Owenwee River upstream of Tawnaghbeg Lough. Atlantic salmon were only recorded from one fisheries sampling location along the Owenwee/Owenree River, upstream of its confluence with the Folore River.

The other minor streams draining the western side of the proposed wind farm site that are minor tributaries of the Owenwee are of low fisheries value and are too small to provide habitat for any fish species.

5 EUROPEAN SITES

Likely significant effects to eight European Sites were identified during the screening for Appropriate Assessment. The potential for likely significant effects to occur to these European Sites is based upon the potential impacts that could arise as a result of the proposed development, the presence of pathways connecting the source of impact to qualifying features of interest of these eight European Sites and the sensitivity of these qualifying features of interest to these impacts. The eight European Sites identified as occurring within the zone of influence of the proposed development and their qualifying features of interest are listed in Table 5.1 below. The qualifying features of interest of each of these European Sites that are connected via pathways to the proposed development and are located within its zone of influence are highlighted in yellow in Table 5.1

Table 5.1: European Sites and relevant qualifying features of interest (highlighted in yellow) within the zone of influence of the Proposed development

European Sites	Distance	Qualifying features of interest	Pathway	Source
Connemara Bog Complex SAC	0km Overlaps with the proposed development boundary	Coastal lagoons [1150]		
		Reefs [1170]		
		Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]	hydrological pathway	proposed grid connection route proposed haul route
		Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3130]		
		Natural dystrophic lakes and ponds [3160]		
		Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]	hydrological pathway	proposed grid connection route proposed haul route

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Northern Atlantic wet heaths with *Erica tetralix* [4010]	air emission pathway	
		European dry heaths [4030]		
		Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410]		
		Blanket bogs (* if active bog) [7130]	air emission pathway	proposed grid connection route proposed haul route
		Transition mires and quaking bogs [7140]		
		Depressions on peat substrates of the Rhynchosporion [7150]		
		Alkaline fens [7230]		
		Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]		
		Euphydryas aurinia (Marsh Fritillary) [1065]		
		Salmo salar (Salmon) [1106]	hydrological pathway	proposed grid connection route proposed haul route
		Lutra lutra (Otter) [1355]	hydrological pathway	proposed grid connection route proposed haul route
		Najas flexilis (Slender Naiad) [1833]		
Maumturk Mountains SAC	0km Overlaps with the proposed	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]	physical disturbance hydrological pathway	proposed Peat Storage and Restoration (Habitat

European Sites	Distance	Qualifying features of interest	Pathway	Source
	development boundary			Enhancement) Area
		Northern Atlantic wet heaths with *Erica tetralix* [4010]	physical disturbance air emission pathway	proposed Peat Storage and Restoration (Habitat Enhancement) Area
		Alpine and Boreal heaths [4060]		
		Blanket bogs (* if active bog) [7130]	physical disturbance air emission pathway	proposed Peat Storage and Restoration (Habitat Enhancement) Area
		Depressions on peat substrates of the Rhynchosporion [7150]		
		Siliceous rocky slopes with chasmophytic vegetation [8220]		
		Salmo salar (Salmon) [1106]	hydrological pathway	proposed Peat Storage and Restoration (Habitat Enhancement) Area
		Najas flexilis (Slender Naiad) [1833]		
Lough Corrib SAC	1km north of the proposed wind farm site 2km north of the PMEA 2.1km north of the haul route and grid connection route	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]	hydrological pathway	proposed wind farm site
		Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3130]		
		Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140]		
		Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]		

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210]		
		Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]		
		Active raised bogs [7110]		
		Degraded raised bogs still capable of natural regeneration [7120]		
		Depressions on peat substrates of the Rhynchosporion [7150]		
		Calcareous fens with Cladium mariscus and species of the *Caricion davallianae* [7210]		
		Petrifying springs with tufa formation (Cratoneurion) [7220]		
		Alkaline fens [7230]		
		Limestone pavements [8240]		
		Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]		
		Bog woodland [91D0]		
		Margaritifera margaritifera (Freshwater Pearl Mussel) [1029]		
		Austropotamobius pallipes (White-clawed Crayfish) [1092]	hydrological pathway	proposed wind farm site
		Petromyzon marinus (Sea Lamprey) [1095]	hydrological pathway	proposed wind farm site
		Lampetra planeri (Brook Lamprey) [1096]	hydrological pathway	proposed wind farm site
		Salmo salar (Salmon) [1106]	hydrological pathway	proposed wind farm site
		Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]		
		Lutra lutra (Otter) [1355]	hydrological pathway	proposed wind farm site
		Najas flexilis (Slender Naiad) [1833]	hydrological pathway	proposed wind farm site

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Hamatocaulis vernicosus (Slender Green Feather-moss) [6216]		
Kilkieran Bay and Islands SAC	9km southwest of the proposed wind farm site 8km south of the PMEA adjacent to haul route and grid connection route	Mudflats and sandflats not covered by seawater at low tide [1140]		
		Coastal lagoons [1150]	hydrological pathway	proposed haul route
		Large shallow inlets and bays [1160]		
		Reefs [1170]	hydrological pathway	proposed grid connection route
		Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]		
		Mediterranean salt meadows (*Juncetalia maritimi*) [1410]		
		Machairs (* in Ireland) [21A0]		
		Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* [3130]		
		Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510]		
		Lutra lutra (Otter) [1355]	hydrological pathway	proposed grid connection route proposed haul route
		Phoca vitulina (Harbour Seal) [1365]		

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Najas flexilis (Slender Naiad) [1833]		
Connemara Bog Complex SPA	Adjoins the haul route. 1km from the grid connection route. 5.5km from the PMEA. 8km from the wind farm site.	Cormorant (*Phalacrocorax carbo*) [A017]	hydrological pathway noise pathway air pathway mobile species pathway	Grid connection route haul route
		Merlin (*Falco columbarius*) [A098]	noise pathway air pathway mobile species pathway	Grid connection route haul route
		Golden Plover (*Pluvialis apricaria*) [A140]	hydrological pathway noise pathway air pathway mobile species pathway	Grid connection route haul route
		Common Gull (*Larus canus*) [A182]	mobile species pathway hydrological pathway noise pathway air pathway light emissions	proposed wind farm site: proposed Peat Storage and Restoration (Habitat Enhancement) Area; grid connection route; haul route
Lough Corrib SPA (Site Code: 4042)	1km from the wind farm site 2.3km from the PMEA 2.5km from the grid connection route & the haul route	Gadwall (*Anas strepera*) [A051]		
		Shoveler (*Anas clypeata*) [A056]		
		Pochard (*Aythya ferina*) [A059]		
		Tufted Duck (*Aythya fuligula*) [A061]		
		Common Scoter (*Melanitta nigra*) [A065]		
		Hen Harrier (*Circus cyaneus*) [A082]	mobile species pathway	proposed wind farm site
		Coot (*Fulica atra*) [A125]		

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Golden Plover (*Pluvialis apricaria*) [A140]	mobile species pathway	proposed wind farm site: proposed Peat Storage and Restoration (Habitat Enhancement) Area; grid connection route; haul route
		Black-headed Gull (*Chroicocephalus ridibundus*) [A179]		
		Common Gull (*Larus canus*) [A182]	mobile species pathway hydrological pathway light emissions	proposed wind farm site: proposed Peat Storage and Restoration (Habitat Enhancement) Area; grid connection route; haul route
		Common Tern (*Sterna hirundo*) [A193]		
		Arctic Tern (*Sterna paradisaea*) [A194]		
		Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]	mobile species pathway hydrological pathway light emissions	proposed wind farm site: proposed Peat Storage and Restoration (Habitat Enhancement) Area; grid connection route; haul route

European Sites	Distance	Qualifying features of interest	Pathway	Source
		Wetland and Waterbirds [A999]	mobile species pathway hydrological pathway light emissions	proposed wind farm site: proposed Peat Storage and Restoration (Habitat Enhancement) Area; grid connection route; haul route
Lough Mask SPA	9.5km from the wind farm site 9.7km from the PMEA10.5km from the grid connection route and the haul route	Tufted Duck (*Aythya fuligula*) [A061]		
		Black-headed Gull (*Chroicocephalus ridibundus*) [A179]		
		Common Gull (*Larus canus*) [A182]	mobile species pathway light emission pathway	proposed wind farm site
		Lesser Black-backed Gull (*Larus fuscus*) [A183]	mobile species pathway	proposed wind farm site
		Common Tern (*Sterna hirundo*) [A193]		
		Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395]		
		Wetland and Waterbirds [A999]		

European Sites	Distance	Qualifying features of interest	Pathway	Source
Lough Carra SPA	24km from the wind farm site 27km from the PMEA 27km from the grid connection route and the haul route	Common Gull (*Larus canus*) [A182]	mobile species pathway light emission pathway	proposed wind farm site

5.1 CONNEMARA BOG COMPLEX SAC

The Connemara Bog Complex SAC is a large site encompassing the majority of the south Connemara lowlands in Co. Galway. The site is bounded to the north by the Galway–Clifden road and stretches as far east as the Moycullen–Spiddal road. The site supports a wide range of habitats, including extensive tracts of western blanket bog, which form the core interest, as well as areas of heath, fen, woodlands, lakes, rivers and coastal habitats.

The qualifying features of interest of this SAC that have been identified as occurring within the zone of influence of the proposed development are:

- 3110 Oligotrophic Isoetid Lake Habitat
- 3260 Floating River Vegetation
- 4010 wet heath
- 7130 blanket bog
- 1106 Atlantic salmon
- 1355 otter

A hydrological pathway connects elements of the project to the Oligotrophic Isoetid Lake Habitat, Floating River Vegetation habitat and Atlantic salmon and otter populations of this SAC. These qualifying features are sensitive to downstream surface water quality impacts.

Blanket bog and wet heath habitat of this SAC is located within 50m of the proposed haul route and grid connection route. These habitats support vegetation communities that are sensitive to air emissions. Given the location of examples of these habitats within 50m of these elements of the project, the potential for air emissions to result in adverse effects to the conservation status of these habitats requires examination in this Natura Impact Statement.

5.2 MAUMTURK MOUNTAINS SAC

The Maumturk Mountains are situated east of the Twelve Bens and west of the Maumtrasnas, between the Inagh Valley and the Leenaun/Maam road in Co. Galway. The site is bounded to the north by Killary Harbour and to the south by the Galway/Clifden road. Most of the mountains exceed 600 m in height and about half of the land within the site lies above an altitude of 250 m. In addition, many rivers criss-cross the site.

The qualifying features of interest of this SAC that have been identified as occurring within the zone of influence of the proposed development are:

- 3110 Oligotrophic Isoetid Lake Habitat
- 4010 Wet heath
- 7130 Blanket bog
- 1106 Atlantic salmon

A hydrological pathway connects the proposed Peat Storage and Restoration (Habitat Enhancement) Area to the Oligotrophic Isoetid Lake Habitat and Atlantic salmon populations of this SAC. These qualifying features are sensitive to downstream surface water quality impacts.

The boundary of the proposed Peat Storage and Restoration (Habitat Enhancement) Area overlaps within this SAC and as such the potential for direct impacts and physical disturbance to the blanket bog and wet heath habitat of this SAC has been identified and requires examination in this Natura Impact Statement.

5.3 LOUGH CORRIB SAC

Lough Corrib is situated to the north of Galway city and is the second largest lake in Ireland, with an area of approximately 18,240 ha (the entire site is 20,556 ha). The lake can be divided into two parts: a relatively shallow basin, underlain by Carboniferous limestone, in the south, and a larger, deeper basin, underlain by more acidic granite, schists, shales and sandstones to the north. The surrounding lands to the south and east are mostly pastoral farmland, while bog and heath predominate to the west and north.

The qualifying features of Strategic Plan interest of this SAC that have been identified as occurring within the zone of influence of the proposed development are:

- 3110 Oligotrophic Isoetid Lake Habitat
- 1092 White-clawed crayfish
- 1095 Sea lamprey
- 1096 Brook lamprey
- 1106 Atlantic salmon
- 1355 Otter
- 1833 *Najas flexilis*

A hydrological pathway connects the proposed wind farm site to the above listed qualifying features of interest of this SAC. These qualifying features are sensitive to downstream surface water quality impacts.

5.4 KILKIERAN BAY AND ISLANDS SAC

Kilkieran Bay and Islands SAC is located just north of Galway Bay and extends from Keeraun Point, south of Carraroe, westwards to Mace Head, west of Carna, all in Co. Galway. The site contains a large area of open marine water, many islands and rocky islets, and the coastline is much indented with a series of bays (notably the interconnected Kilkieran Bay and Greatman's Bay), channels and inlets. Generally, the site has a rocky shoreline which in most places gives way to mud in shallow water. The surrounding land is dominated by lowland blanket bog, with rock outcrops and small hills to the north.

The qualifying features of interest of this SAC that have been identified as occurring within the zone of influence of the proposed development are:

- 1150 Coastal lagoons
- 1170 Reefs
- 1355 Otters

A hydrological pathway connects the proposed haul route and the grid connection route to the above listed qualifying features of interest of this SAC. These qualifying features are sensitive to downstream surface water quality impacts.

5.5 CONNEMARA BOG COMPLEX SPA

The Connemara Bog Complex SPA is a large site encompassing much of the south Connemara lowlands of Co. Galway. The site consists of three separate areas–- north of Roundstone, south of Recess and north-west of Spiddal. It is characterized by areas of deep peat surrounded by heath-covered rocky outcrops. The deeper peat areas are often bordered by river systems and the many oligotrophic lakes that occur, resulting in an intricate mosaic of various peatland/wetland habitats and vegetation communities; these include Atlantic blanket bog with hummock/hollow systems, inter-connecting pools, Atlantic blanket bog pools, flushes, transition and quaking mires, as well as freshwater marshes, lakeshore, lake and river systems.

The special conservation interests of this SPA that have been identified as occurring within the zone of influence of the proposed development are:

- Cormorant
- Merlin
- Golden plover
- Common gull

The above four species have been identified as key avifauna receptors of the proposed wind farm site. However, the proposed wind farm site as well as the proposed Peat Storage and Restoration (Habitat Enhancement) Area are located outside of the foraging range for the populations of cormorant, golden plover and merlin associated with this SPA and as such these species are located outside the zone of influence of these elements of the proposed development.

Cormorant, merlin and golden plover have been identified as occurring within the zone of influence of the project owing to the location of the haul route adjacent to a section of this SPA. No widening locations of the haul route are located adjacent to this SPA, with the nearest widening location (widening area 2 as shown on Figure 4.3) located over 1km to the north. As such this Natura Impact Statement will examine the potential for the use of the existing public road network for haulage of wind farm infrastructure to result in adverse effects to these species.

Common gull has been identified as occurring within the zone of influence of all elements of the proposed development. This is due to the wider foraging range of this species and its potential to range from this SPA to areas that include the proposed wind farm site.

5.6 LOUGH CORRIB SPA

Lough Corrib is the largest lake in the country and is located, for the most part, in County Galway, with a small section in the north extending into County Mayo. The lake can be divided into two parts: a relatively shallow basin in the south, which is underlain by Carboniferous limestone, and a larger, deeper basin to the north, which is underlain by more acidic granite, schists, shales and sandstones. The main inflowing rivers are the Black, Clare, Dooghta, Cregg, Owenriff and the channel from Lough Mask. The main outflowing river is the Corrib, which reaches the sea at Galway City.

The special conservation interests of this SPA that have been identified as occurring within the zone of influence of the proposed development are:

- Hen harrier
- Greenland white-fronted geese
- Golden plover
- Common gull
- Wetland and waterbirds

The above four special conservation interest bird species of the SPA have been identified as key avifauna receptors of the proposed wind farm site. These species occur within the zone of influence of the project owing to the projects location within the foraging range of these species. This establishes a mobile species pathway between the project and these species. Given the potential for the foraging range of these species to overlap with the proposed wind farm site, operation phase turbine lighting and associated emissions have also been identified as a potential impact pathway to these species.

A hydrological pathway connects the proposed wind farm site to this SPA and common gull and wetlands and waterbirds are sensitive to downstream surface water quality impacts.

5.7 LOUGH MASK SPA

Lough Mask, at over 8,000 ha, is the sixth largest lake in the country. It is located in south Co. Mayo with a small area extending across the border into Co. Galway. It extends for over 14 km along its long axis and is on average about 5 km in width. The underlying geology is of Carboniferous limestones, with some shales and sandstones. The main inflowing rivers are the Cloon and Robe, and the stream from Lough Carra to the north-east. The main outflow is to Lough Corrib to the south. The eastern part of the lake is edged by a low-lying shoreline which is subject to winter flooding but is considerably deeper on the western side where there is a long narrow trench with a maximum depth of 58 m. The water of the lake is moderately hard. Islands are a feature of the lake, especially in the south-east sector.

The special conservation interests of this SPA that have been identified as occurring within the zone of influence of the proposed development are:

- Common gull
- Lesser-Black Backed Gull

The above two species have been identified as key avifauna receptors of the proposed wind farm site and have been identified as occurring within the zone of influence of all elements of the proposed development owing to the wide foraging range of these species and their potential to range from this SPA to areas that include the proposed wind farm site.

5.8 LOUGH CARRA SPA

Lough Carra, which extends for over 9 km along its long axis, lies to the north-east of Lough Mask, in the Corrib catchment in Co. Mayo. It is one of the best examples in Ireland of a hard water marl lake. It is a shallow (mean depth 1.5 m, maximum depth 18 m), predominantly spring-fed lake with only a few inflowing streams. It is connected to Lough Mask via the Keel River. The water has an alkaline pH and negligible amounts of iron and manganese. Sodium and chloride are present in relatively high concentrations. Lough Carra is classified as a mesotrophic system. It is of considerable ornithological importance for supporting a nationally important population of breeding Common Gull.

The special conservation interests of this SPA that have been identified as occurring within the zone of influence of the proposed development are:

- Common gull

Common gull has been identified as occurring within the zone of influence of all elements of the proposed development. This is due to the wider foraging range of this species and its potential to range from this SPA to areas that include the proposed wind farm site.

6 EXAMINATION OF IMPACTS

The following subsections provide an examination of the impacts that could arise as a result of the elements of the proposed development during the construction, operation and decommissioning phases and adversely affect the European Sites and relevant qualifying features of interest occurring within the zone of influence of the proposed development.

6.1 CONNEMARA BOG COMPLEX SAC

6.1.1 Water Quality Impacts

The proposed grid connection route and the haul route widening areas have been identified as the source of potential impacts to Oligotrophic Isoetid Lake habitat, Floating River Vegetation habitat and Atlantic salmon and otter populations of this SAC. The construction phase of the proposed development and the works associated with the installation of ducts and electrical cabling along the public road and the road widening works for haul route widening represent the source of potential water quality impacts to these qualifying feature receptors.

As the proposed grid connection route follows along existing public roads there will be no potential for this element of the proposed development to result in an increase in the rate of surface water runoff to receiving rivers and lakes.

The potential impacts that may arise as a result of the proposed development relate to the discharge of contaminated surface water during the construction works associated with the installation of the proposed grid connection ducting and cabling and the works associated with the haul route widening.

6.1.1.1 Release of Suspended Solids

Earthworks and excavations associated with the construction phase will have the potential to generate particulate/silt-laden runoff from the works area and for this runoff to be discharged via existing surrounding roadside drains and watercourses to lake and river habitats of the SAC. Examples of Oligotrophic Isoetid Lake Habitat that occur immediately adjacent to and downstream of sections of the proposed grid connection route and haul route widening areas include:

- Nahasleam Lough which is crossed by the R336 and proposed grid connection route;
- Loughaunfree west of the proposed grid connection route and haul route widening area 3;
- Aughawoolia Lough which is located immediately to the west and downstream of the proposed grid connection route; and
- Ahalia South Lough which is located immediately to the west and downstream of the proposed grid connection route.

The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g., clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand) and will require lower flow rates and longer retention rates to settle out of the water column when given the opportunity.

The negative impacts of silt-laden runoff to fish species such as Atlantic salmon include:

- The settlement of silt on spawning redds resulting in the infilling of intra-gravel voids and the smothering of eggs and newly hatched fish.
- The settlement of silt on river beds can smother and displace macroinvertebrates, reducing the prey resource for fish species.
- Suspended solids can settle in pool and riffle habitats resulting in a reduction in the availability and quality of rearing habitat for fish.
- Silt-laden runoff can result in a reduction in transparency, impairing the ability of fish and otters to find food.
- Suspended solids can abrade or clog salmonid fish gills. Whilst high concentrations of suspended solids are required to clog fish gills, small concentrations can result in abrasion to gills a create the potential for infection.

The negative impacts of silt-laden runoff to otters include a reduction in suitable foraging habitat and prey availability.

Inputs of suspended solids can also contribute to nutrient enrichment in receiving waters as a result of the release of nutrient bound to sediments following mobilisation (Sharpley et al., 1992; Ballatine et al. 2006). The degree to which sediment loss contributes to nutrient enrichment is dependent on the type of soil, for example; peat released in water will disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve in to the water column and/or consumed by micro-organism. However, peat and other soils/subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to nutrient enrichment, or excessive loading of N and P in waters. The release of such sediment in silt-laden surface water runoff from works at locations along the proposed grid connection route and at the haul route widening locations noted above will have the potential to contribute to nutrient inputs to Oligotrophic Isoetid Lake Habitat. This lake habitat is characterised by low primary productivity and is highly sensitive to nutrient inputs, increases in primary productivity and ultimately the adverse effects of eutrophication.

The instream Floating River Vegetation habitat generally requires conditions along stream beds to be low in silt content, except for localised deposits at channel margins and along the channel bed where macrophytes can take root (Hatton-Ellis et al. 2003). High concentrations of suspended solids can also reduce transparency in the water column and perturb photosynthesis and plant growth (Mainstone et al. 2000).

6.1.1.2 Release of Hydrocarbons

Plant equipment and vehicles associated with excavation, material transport, and construction activities introduce the risk of hydrocarbon (fuel and oil) spillages and leaks, particularly in relation to regular refuelling which in turn implies the requirement of a fuelling station or will be supplied by fuel tanker scheduled to refuel the plant machinery directly. Similar to suspended solids arising from excavation activities, hydrocarbons accidentally introduced to the environment will likely be intercepted by drainage and surface water networks crossed by or adjacent to the proposed grid connection route and haul route widening area 3.

Hydrocarbons are a pollutant risk due to their toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface. Hydrocarbons adsorb ('stick') onto the majority of natural solid objects they encounter, such as vegetation, animals, and earth materials such as soil. They burn most living organic tissue, such as vegetation, due to their volatile chemistry. They are also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water-based vertebrate such as Atlantic salmon and invertebrate life.

From a land and soils perspective, the naturally occurring chemical in crude oil and gasoline products, Polycyclic Aromatic Hydrocarbons or (PAHs), can burn most living organic tissue, such as vegetation, due to their volatile chemistry.

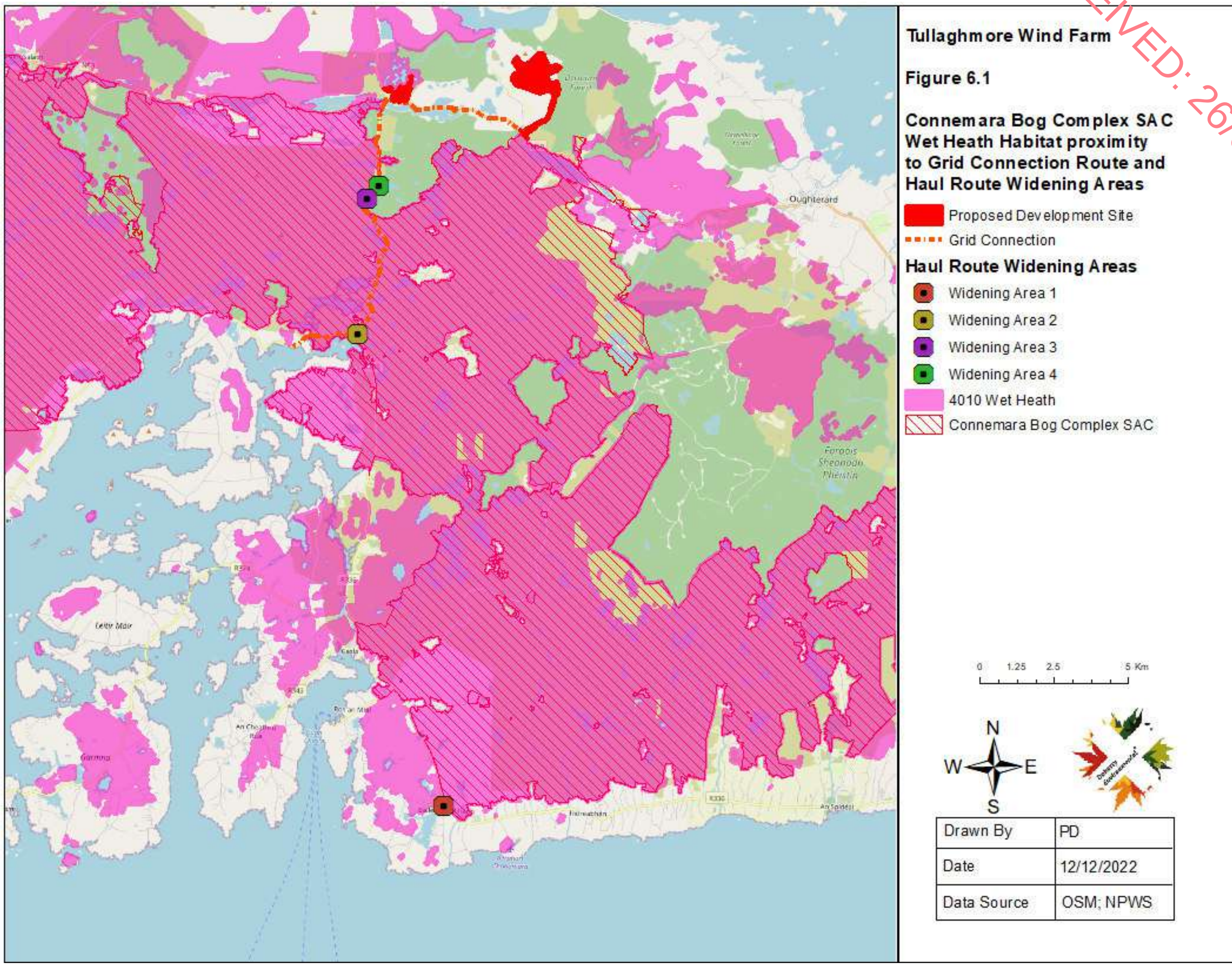
Potential incidents or accidental release of contaminants will likely be short lived or temporary, however the potential impacts to downstream receptors such as Oligotrophic Isoetid Lake Habitat, Atlantic salmon can be long lasting, or permanent.

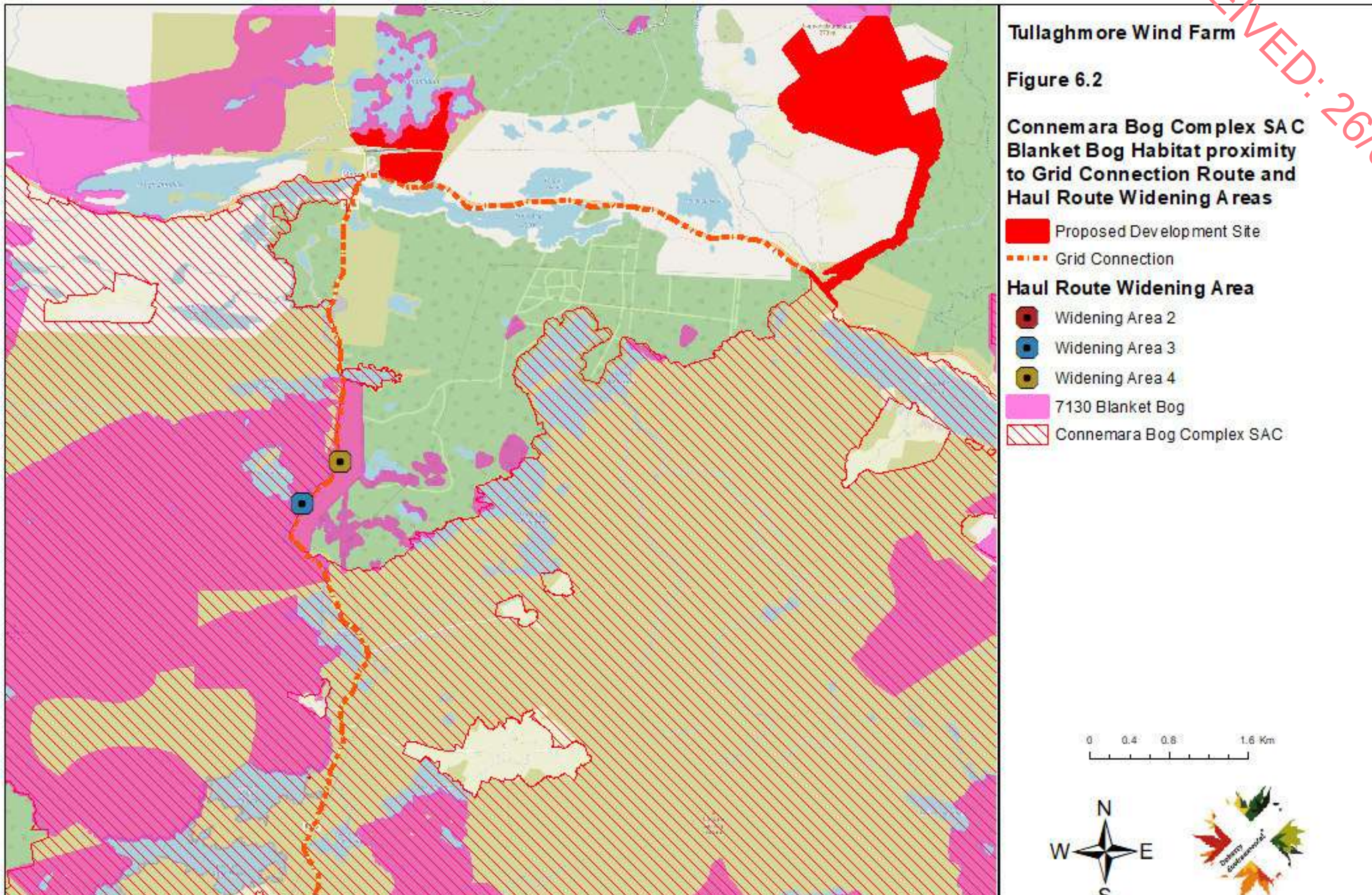
6.1.2 Air Emissions Impacts

Air emissions pathways and impacts to the wet heath and blanket bog habitat of this SAC are considered to have the potential to arise during the construction phase and works associated within the installation of the grid connection route and the provision of haul route widening areas. The operational phase of proposed development will not result in air quality impacts to these habitat receptors of the SAC.

Blanket bog and wet heath habitats of this SAC are located adjacent to sections of the proposed grid connection route and haul route. Wet heath habitat occurs along the section of the proposed grid connection route and haul route that pass through the SAC boundary along the R336 and R340 (see Figure 6.1). As can be seen on Figure 6.1, the section of the R336 and R340 grid connection route within and adjacent to the Connemara Bog Complex SAC is flanked for much of its length by wet heath whilst the haul route widening locations 1 to 4 are also located in the vicinity of this habitat. It is noted that each of the widening areas are located outside the SAC boundary and will not result in any loss of wet heath habitat.

Blanket bog habitat occurs along the section of the proposed grid connection route and haul route that pass through the SAC along the R336 (see Figure 6.2). As can be seen on Figure 6.2 the section of the R336 grid connection route in the area east of Loughaunfree is flanked by blanket bog whilst the haul route widening locations 3 and 4 are also located in the vicinity of this habitat.


Tullaghmore Wind Farm
Figure 6.1
Connemara Bog Complex SAC Wet Heath Habitat proximity to Grid Connection Route and Haul Route Widening Areas
Proposed Development Site
Grid Connection
Haul Route Widening Areas
Widening Area 1
Widening Area 2
Widening Area 3
Widening Area 4
4010 Wet Heath
Connemara Bog Complex SAC
Oughterard
0 1.25 2.5 5 Km
N
W
E
S
Drawn By PD
Date 12/12/2022
Data Source OSM; NPWS



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Date	12/12/2022
Data Source	OSM; NPWS

In line with the Institute of Air Quality Management 2014 guidance, the main air quality impacts potentially arising during construction are considered to be:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions; and
- Elevated PM10 concentrations, as a result of dust generating activities on the Site

Dust soiling can also affect sensitive habitats such as wet heath and blanket bog and impact vegetation. For example, dust coating plant foliage during long dry periods may adversely affect photosynthesis and other biological functions.

Notwithstanding the potential effects of dust soiling to sensitive habitats such as blanket bog and wet heath outlined above it is considered that given the minor scale of works required for the installation of the ducts and electrical cable associated with the grid connection route and the resurfacing of existing buildings and artificial surfaces or grassy verges will not have the potential to generate levels of dust that will have a perceptible effect on vegetation occurring adjacent to these areas.

In light of this consideration no potential for adverse effects to the blanket bog and wet heath habitat of the Connemara Bog Complex SAC will arise as a result of works associated with grid connection route and haul route widening area and they are not considered further in this Natura Impact Statement.

6.2 MAUMTURK MOUNTAINS SAC

6.2.1 Physical Disturbance

The boundary of the proposed Peat Storage and Restoration (Habitat Enhancement) Area was identified as overlapping with the boundary of this SAC and areas of wet heath and blanket bog that have been mapped as part of the Article 17 habitat dataset.

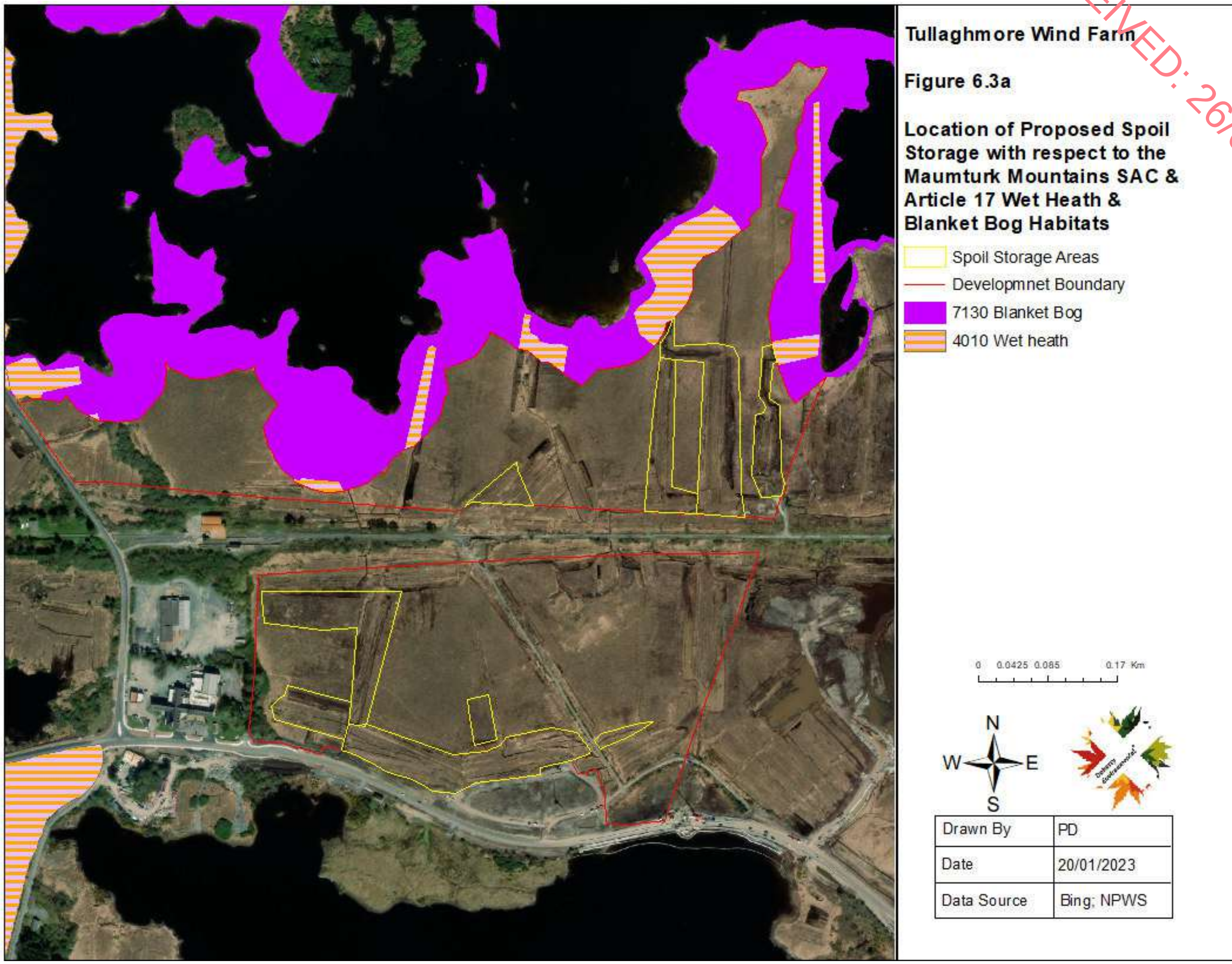
A further examination of this overlap has been completed for this Natura Impact Statement. This examination shows that the areas proposed for spoil storage and related peatland habitat management are located outside the boundary of the SAC and the footprint of the Article 17 blanket bog and wet heath. The location of the proposed spoil storage area where works will be completed are shown on Figure 6.3a, while Figure 6.3b provides a high resolution view of the proposed spoil storage area with respect to the SAC boundary and wet heath and blanket bog habitats. No area of the proposed spoil storage will overlap with the Maumturk Mountains SAC or Article 17 mapped areas of wet heath or blanket bog occurring within the SAC. As such there will be no potential for loss of these habitats or physical disturbance to the extent of wet heath and blanket bog habitat occurring within this SAC. In light of this finding of no potential for adverse effects, associated with habitat loss or physical disturbance, no mitigation measures are required for the proposed development with respect to the blanket bog and wet heath habitat of the Maumturk Mountains SAC and they are not considered further in this Natura Impact Statement.

6.2.2 Water quality Impacts

6.2.2.1 Release of Suspended Solids

Excavations and spoil disposal activities associated with the works within the proposed Peat Storage and Restoration (Habitat Enhancement) Area introduce the risk of solids being entrained in runoff. Runoff contaminated with suspended solids will add turbidity to the receiving surface water body, which in the case of the Maumturk Mountains SAC will be the Oligotrophic Isoetid Lake Habitat of Loughanillaun. The disposition of suspended solids to this lake will have the potential to block fish gills and smother foraging habitats for Atlantic salmon and other aquatic species, reduce light penetration for flora growth, and promote bacteria and algae production. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons, and sewage if present) can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply.

The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g. clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand), and will require lower flow rates and longer retention rates to settle out of the water column when given the opportunity. Peat, comprising mostly of organic matter, will behave in a similar manner to a fine-grained soil whereby much of the material will remain in suspension for a relatively long



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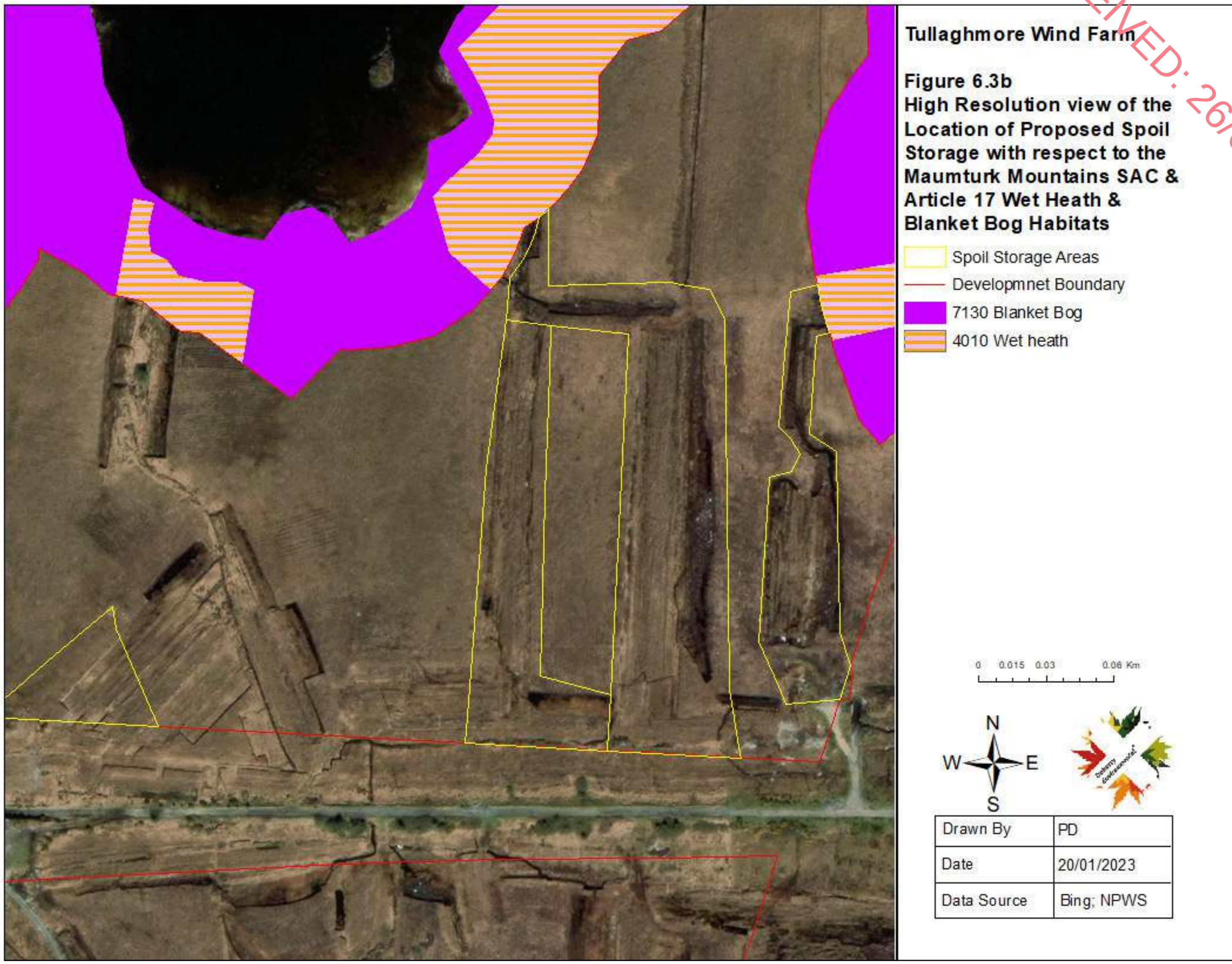
Data Source	Bing; NPWS


Tullaghmore Wind Farm
Figure 6.3b
High Resolution view of the Location of Proposed Spoil Storage with respect to the Maumturk Mountains SAC & Article 17 Wet Heath & Blanket Bog Habitats
Spoil Storage Areas
Developmnet Boundary
7130 Blanket Bog
4010 Wet heath
0 0.015 0.03 0.06 Km
N
W
E
S
Drawn By PD
Date 20/01/2023
Data Source Bing; NPWS

period of time, but will also dissolve and degrade within the water body, dramatically impacting on water quality.

Release of suspended solids can be attributed to enhanced nutrient enrichment. This is highly dependent on the type of soil, for example; peat released in water will disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve in to the water column and / or consumed by micro-organism. However, peat and other soils / subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to Nutrient Enrichment, or excessive loading of N and P in waters leading to eutrophication and potentially profound adverse impacts on ecological attributes downstream of the site at Loughanillaun.

6.2.2.2 Release of Hydrocarbons

Plant equipment and vehicles associated with works to be undertaken at the proposed Peat Storage and Restoration (Habitat Enhancement) Area introduce the risk of hydrocarbon (fuel and oil) spillages and leaks, particularly in relation to regular refuelling which in turn implies the requirement of a fuelling station which will likely include fuel storage on site or will be supplied by fuel tanker scheduled to refuel the plant machinery directly.

Similar to suspended solids arising from the activities at the proposed Peat Storage and Restoration (Habitat Enhancement) Area described above, hydrocarbons accidentally introduced to the environment will likely be intercepted by drainage features occurring at this area.

Hydrocarbons are a pollutant risk due to their toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface (whether surface water or groundwater). Hydrocarbons adsorb ('stick') onto the majority of natural solid objects they encounter, such as vegetation, animals, and earth materials such as soil. They burn most living organic tissue, such as vegetation, due to their volatile chemistry. They are also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water-based vertebrate such as Atlantic salmon.

6.3 LOUGH CORRIB SAC

6.3.1 Water Quality Impacts

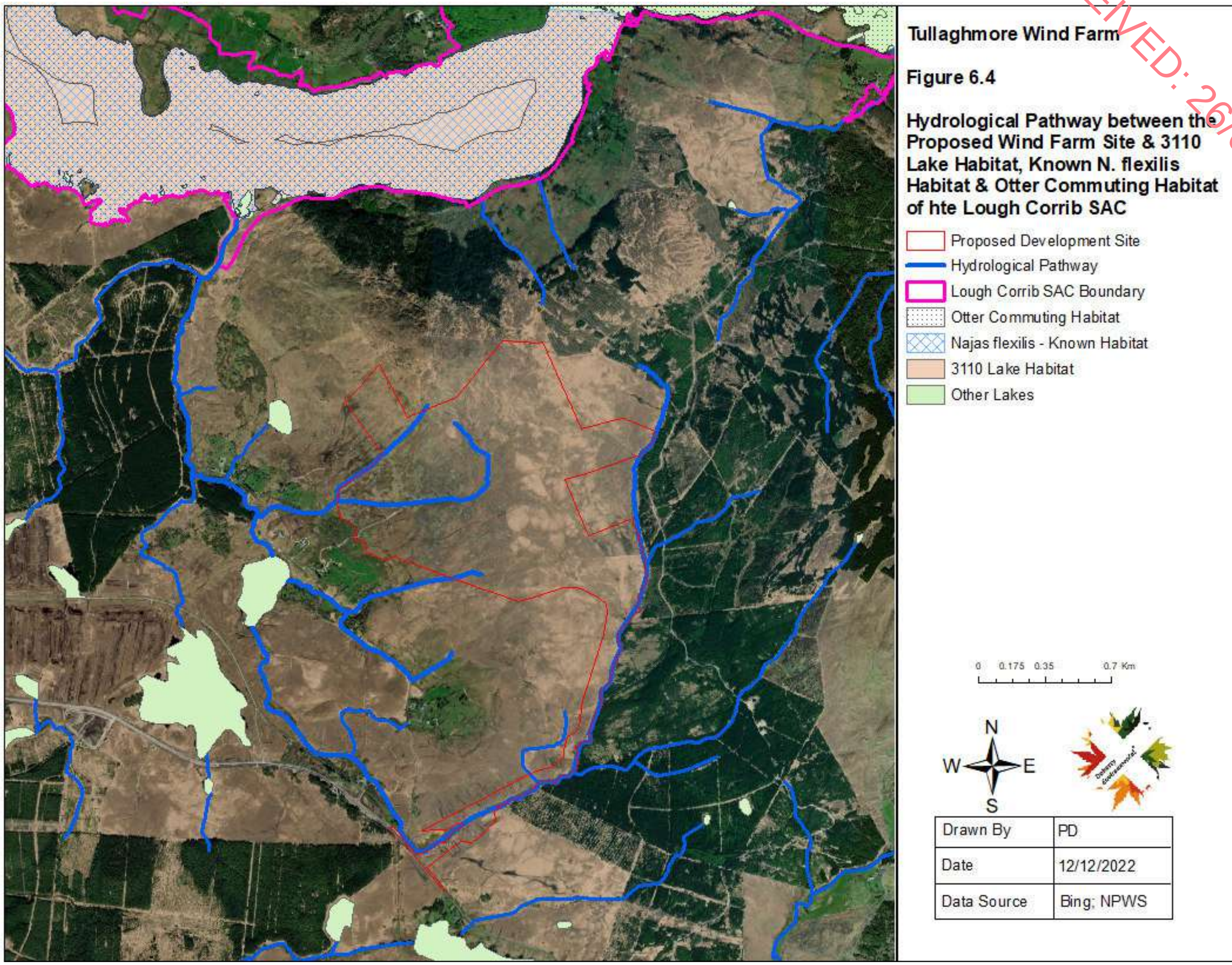
The Lough Corrib SAC has been identified as occurring within the zone of influence of the proposed development owing to the presence of a hydrological pathway between the proposed wind farm site and this SAC and its following qualifying features of interest:

- 3110 Oligotrophic Isoetid Lake Habitat
- 1092 White-clawed crayfish
- 1095 Sea lamprey
- 1096 Brook lamprey
- 1106 Atlantic salmon
- 1355 Otter
- 1833 *Najas flexilis*

The location of Oligotrophic Isoetid Lake Habitat and the known habitat of *Najas flexilis* habitat of Lough Corrib SAC as well as the mapped otter commuting habitat for this SAC are shown on Figure 6.4. The type of impacts to water quality that could adversely affect the conservation status of these species are examined in the following subsections.

6.3.1.1 Hydraulic Loading

The proposed wind farm development has the potential to result in increased volumes of runoff during the operational phases of the wind farm relative to baseline conditions. This is a function of the progressive excavation and removal of vegetation cover and replacement with hardstanding surfaces (effectively or assumed impermeable) associated with turbine hardstands and access tracks and the installation of constructed drainage around the wind farm footprint and thus removing the hydraulic absorption/buffer control from areas of hardstand within the project site.


Tullaghmore Wind Farm
Figure 6.4
Hydrological Pathway between the Proposed Wind Farm Site & 3110 Lake Habitat, Known N. flexilis Habitat & Otter Commuting Habitat of hte Lough Corrib SAC
Proposed Development Site
Hydrological Pathway
Lough Corrib SAC Boundary
Otter Commuting Habitat
Najas flexilis - Known Habitat
3110 Lake Habitat
Other Lakes
0 0.175 0.35 0.7 Km
N
W
E
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Drawn By PD
Date 12/12/2022
Data Source Bing; NPWS

Increased runoff, or an increased hydrological response to rainfall has the potential to exacerbate flooding events and exacerbate flooding and erosion within the boundary of the wind farm site. This in turn will have the potential to generate increased rates of suspended solids within waters draining the project site and for their conveyance downstream to the Lough Corrib SAC. Further discussion of the release of suspended solids are set out below.

6.3.1.2 Release of Suspended Solids

Earthworks associated with the construction phase of the wind farm will require the denuding of surface vegetation within the of the proposed wind farm site. In the absence of an appropriate design and mitigation measures such activities will have the potential to generate silt-laden runoff from the works area and for this runoff to be discharged via the Owenwee catchment downstream to Lough Corrib.

Runoff contaminated with suspended solids will add turbidity to the receiving surface water body. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons, and sewage if present) can lead to eutrophication of the water environment.

The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g. clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand), and will require lower flow rates and longer retention rates to settle out of the water column when given the opportunity. Peat, comprising mostly of organic matter, will behave in a similar manner to a fine grained soil whereby much of the material will remain in suspension for a relatively long period of time, but will also dissolve and degrade within the water body, dramatically impacting on water quality.

Release of suspended solids can be attributed to enhanced nutrient enrichment. This is highly dependent on the type of soil, for example; peat released in water will disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve in to the water column and / or consumed by micro-organism. However, peat and other soils / subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to Nutrient Enrichment, or excessive loading of N and P in waters leading to eutrophication and potentially profound adverse impacts on ecological attributes downstream of the site at Lough Corrib.

6.3.1.3 Release of Hydrocarbons

Plant equipment and vehicles associated with works to be undertaken at the proposed wind farm site introduce the risk of hydrocarbon (fuel and oil) spillages and leaks, particularly in relation to regular refuelling which in turn implies the requirement of a fuelling station which will likely include fuel storage on site or will be supplied by fuel tanker scheduled to refuel the plant machinery directly.

Similar to suspended solids arising from the activities at the proposed wind farm site described above, hydrocarbons accidentally introduced to the environment will likely be intercepted by drainage features occurring at the wind farm site.

Hydrocarbons are a pollutant risk due to their toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface (whether surface water or groundwater). Hydrocarbons adsorb ('stick') onto the majority of natural solid objects they encounter, such as vegetation, animals, and earth materials such as soil. They burn most living organic tissue, such as vegetation, due to their volatile chemistry. They are also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water-based vertebrate such as Atlantic salmon.

6.3.1.4 Release of Construction or Cementitious Materials

The proposed wind farm has the potential to result in the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the wind farm site.

Depending on the material in question, the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitivities such as ecology. For example, the introduction of cementitious material (concrete/cement/lean mix etc.) can lead to changes in soil and water pH, and increased concentrations of sulphates and other constituents of concrete. Fresh or wet concrete is a much more significant hazard when compared to old or set concrete which is considered inert in comparison, however it should also be noted that any construction materials or non-natural materials deposited, even if inert, are considered contaminants.

Surface water runoff coming into contact with concrete structures will be impacted to a degree, however water percolating through lean mix will be impacted significantly.

6.3.1.5 Release of Wastewater or Sanitation Contaminants

Temporary sanitation facilities will be provided at the temporary construction compound during the construction phase. The presence of these facilities will introduce the potential for the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto soils, and into the Owenwee catchment during the construction phase of the project.

Wastewater and wastewater sanitation chemicals are pollutant risks due to their potential impact on the ecological productivity or chemical status of surface water systems, and toxicity to water-based flora and fauna.

The level of risk posed by such facilities is dependent on the condition and upkeep of the facilities that are put in place, and the chemical agents used if applicable.

The potential impacts associated with wastewater sanitation is the potential for sanitation chemical, particularly related to porta-loos, accidentally spilling or leaking and being intercepted by surface water drainage features and in turn surface water networks associated with the proposed development.

6.3.1.6 Surface water Crossings

The proposed wind farm will comprise four crossings of natural streams/flushes along the proposed Access Track. The existing crossing over the Owenwee River on the main Access Track from the N59 will be upgraded for the increased proposed Access Track widths and to allow heavier vehicles to traverse it. The upgrade will involve the construction of a clear span bridge to the north of the existing bridge location. Further to consultation with Inland Fisheries Ireland (IFI) the crossings have been designed in accordance with detail shown in Figure 2.6(a), (b), (c) and (d) of the EIAR for the proposed development (reproduced as Appendix 2 of this Natura Impact Statement). These crossings comprise clear span bridges of each of the three watercourses and will not result in any modifications to the watercourse channels at the crossing locations. In addition, no instream works will be required during the construction of these four watercourse crossings. As such there will be no direct physical impacts to watercourses as a result of the proposed wind farm.

Notwithstanding the absence of instream works potential impacts on hydrology and water quality associated with the construction or upgrading of water course crossings include:

- Alteration of flow regime potentially leading to erosion and/or flooding and
- Harmful discharges during construction and operation, in particular the release of suspended solids.

Unmitigated, the alteration of watercourse crossings poses a high level of risk and potentially profound adverse, potentially permanent impacts on the quality and flow characteristics of the receiving surface water feature.

6.3.1.7 Implication of Water Quality Impacts for Relevant Qualifying Features of Interest

The implications of water quality impacts for Oligotrophic Isoetid Lake Habitats, Atlantic salmon and otters that have been detailed in Section 6.1.1 are also applicable to these qualifying features of interest of Lough Corrib SAC. The implications of such impacts to Atlantic salmon, as discussed in Section 6.1.1 are also applicable for sea lamprey and brook lamprey.

The implication of water quality impacts for white-clawed crayfish and Najas flexilis which were not considered under Section 6.1.1 are examined below.

The threats and pressures to white-clawed crayfish in Ireland relate to the spread of pathogens and invasive crayfish species (NPWS, 2019b). The NPWS (2019b) do not list negative impacts to water quality of freshwater bodies as a pressure or threat to this species, however they do include water quality as an attribute defining the favourable conservation status of this species and have set a biological water quality target of a minimum of Q3-4 for the white-clawed crayfish population of the Lough Corrib SAC. Demers & Reynolds (2002) suggested that white-clawed crayfish can occur in water that is rated as moderately polluted, while Holdich (2003) pointed to poor water quality as a limiting factor in achieving the favourable conservation status of this species. Overall, it is considered that any perturbations to water quality as a result of the proposed development will have the potential to undermine the favourable conservation condition of crayfish within the Lough Corrib SAC.

Najas flexilis occurs in clear-water lakes of intermediate alkalinity with a well-developed deep-water vegetation and flora. High water colour and reduced water transparency have been identified as factors that undermine the suitability of lakes to support this species, whilst increased nutrient loading has been singled out as being the most likely significant threat to the conservation status of this species in Ireland (Roden et al., 2021). Any losses of excessive silt-laden surface water runoff from works at the wind farm site to Lough Corrib will have the potential to contribute towards an increase in colour and reduction in transparency whilst also contributing to nutrient loading within the lake.

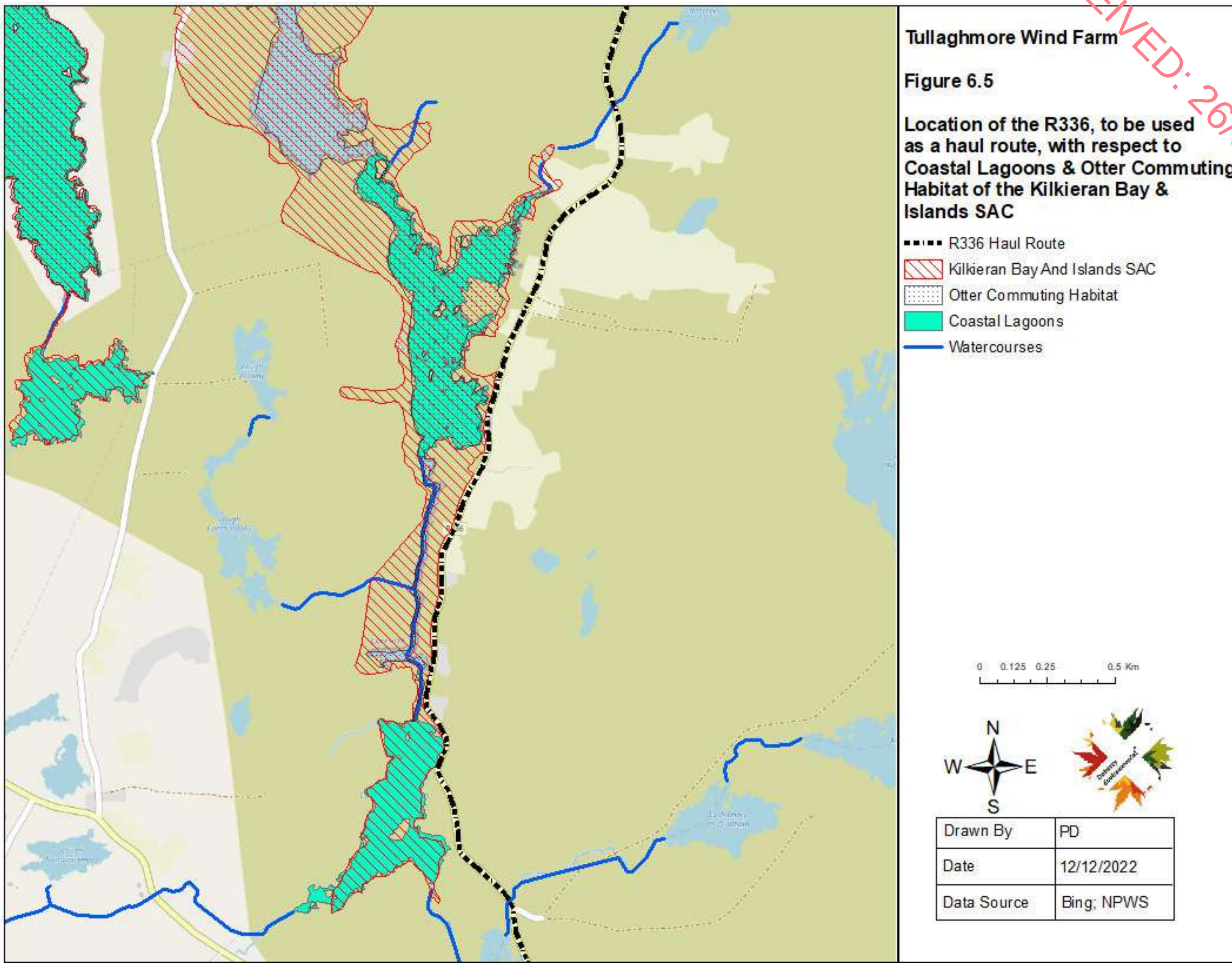
6.4 KILKIERAN BAY AND ISLANDS SAC

6.4.1 Water Quality Impacts

The Kilkieran Bay and Islands SAC has been identified as occurring within the zone of influence of the proposed development owing to the presence of a hydrological pathway between the proposed grid connection route and/or the haul route and this SAC and its following qualifying features of interest:

- 1150 Coastal lagoons
- 1170 Reefs
- 1355 Otters

Lough Cara Finonnla and Lough Cara na gCaorach are two coastal lagoons of this SAC that are located to the west of the R336, which will be used as a haul route for the delivery of wind farm infrastructure from Galway Port to the wind farm site. These coastal lagoons and the Derrynea Stream that connects them together and flows north to south to the west of the R336 is also identified as otter commuting habitat. The location of these coastal lagoons and otter commuting habitat with respect to the haul route along the R336 is shown on Figure 6.5. Streams flow under the R336 along the proposed haul route and drain into examples these examples of coastal lagoons and otter commuting habitat.


Tullaghmore Wind Farm
Figure 6.5
Location of the R336, to be used as a haul route, with respect to Coastal Lagoons & Otter Commuting Habitat of the Kilkieran Bay & Islands SAC
R336 Haul Route
Kilkieran Bay And Islands SAC
Otter Commuting Habitat
Coastal Lagoons
Watercourses
0 0.125 0.25 0.5 Km
N
W
E
S
Drawn By PD
Date 12/12/2022
Data Source Bing; NPWS

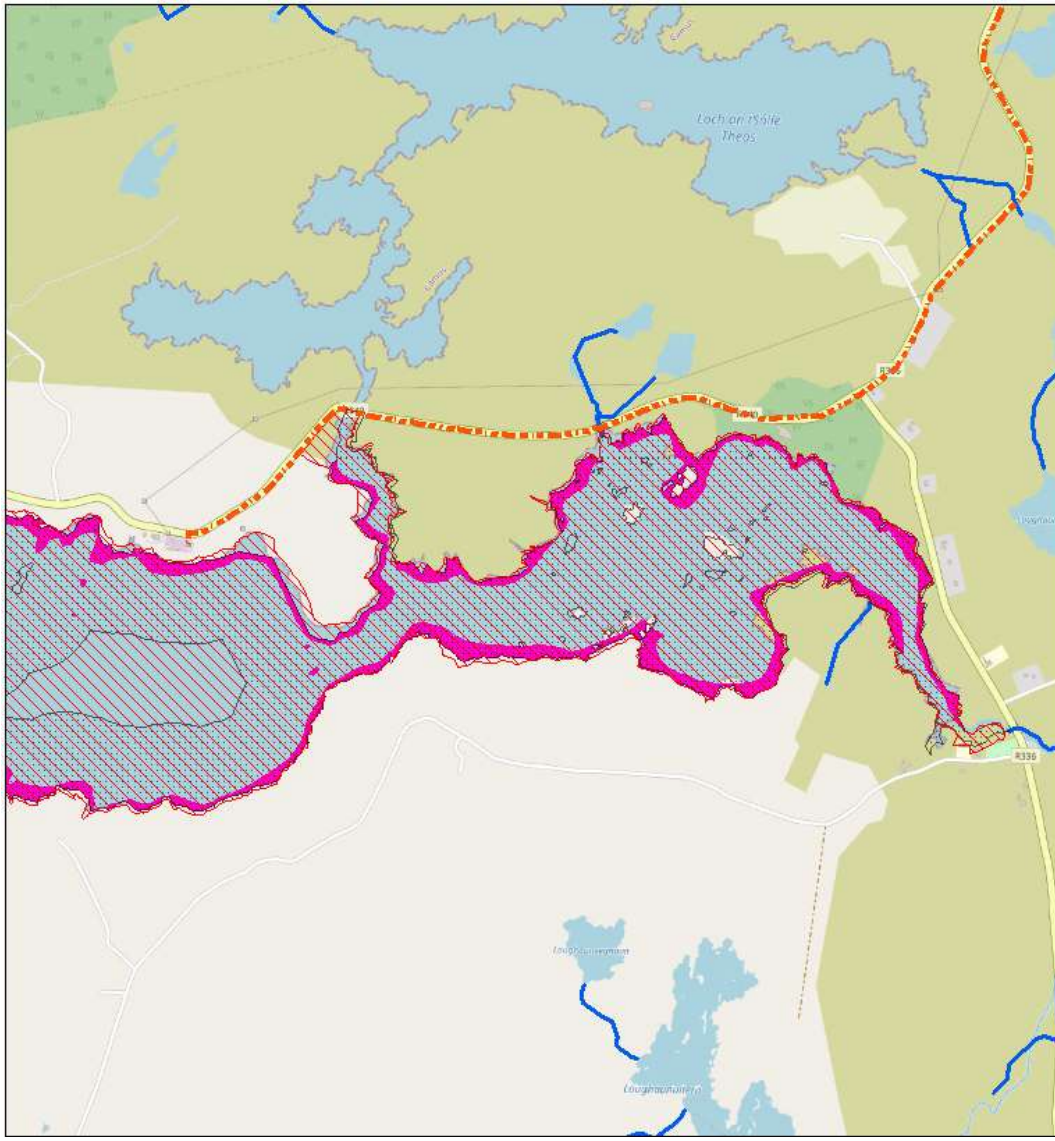
No works that are associated with the proposed development are proposed along the section of the R336 that will be used as a haul route to the west of these two coastal lagoons and otter commuting habitat. No proposed haul route widening areas are located within the vicinity of these lagoons or otter commuting habitat and there are no pathways connecting these widening areas to these habitats. Given that it is proposed only to use the existing R336 road whilst transporting wind farm infrastructure to the wind farm site there will be no potential for the proposed development to result in adverse effects to the conservation status of the coastal lagoons or otter commuting habitat of this SAC. In light of this finding of no potential for adverse effects, no mitigation measures are required for the proposed development with respect to coastal lagoon habitat of the Kilkieran Bay and Islands SAC and it is not considered further in this Natura Impact Statement. In addition, the haul route is not identified as have the potential to result in adverse effects to the otter commuting habitat of this SAC adjacent to the haul route.

Reef habitats of this SAC are located in the vicinity of the proposed grid connection route along the R340 and streams flowing under the R340 along the proposed grid connection route drain into the coast in the vicinity of this habitat (see Figure 6.6 for location of reef habitat with respect to the section of the proposed grid connection route along the R340). Otter habitat which also occurs along the coast adjacent to this section of the proposed grid connection route is also connected to this element of the proposed development via culverted streams.

The construction phase of the proposed grid connection route and the works associated with the installation of ducts and electrical cabling along the public road represent the source of potential water quality impacts to these qualifying feature receptors.

As the proposed grid connection route follows along existing public roads there will be no potential for this element of the proposed development to result in an increase in the rate of surface water runoff to receiving coastal waters to the south of the section of the route along the R340.

The potential impacts to reefs and otter habitat that may arise as a result of the works associated with the proposed grid connection route relate to the generation of particulate/silt-laden runoff from the works area and for this runoff to be discharged via existing surrounding roadside drains and streams to these coastal habitats of the SAC. Given the scale of the works associated with the installation of the grid connection route at this location and the receiving



Tullaghmore Wind Farm

Figure 6.6

Location of the R340 section of the proposed Grid Connection Route with respect to Reef & Otter Commuting Habitat of the Kilkieran Bay & Islands SAC

Grid Connection
Kilkieran Bay And Islands SAC
Reefs
Otter Commuting Habitat
Watercourses

0 0.125 0.25 0.5 Km

N W E S

Drawn By	PD
Date	12/12/2022
Data Source	Bing; NPWS

coastal waters that will provide for significant dilution, dispersion and attenuation of silt-laden runoff, the potential for such emissions to adversely affect the conservation status of reef and otter habitat is considered to be low. Notwithstanding this mitigation measures are set out in Section 7 below and will be implemented for the construction of this section of the proposed grid connection route along the R340.

Plant equipment and vehicles associated with excavation, material transport, and construction activities introduce the risk of hydrocarbon (fuel and oil) spillages and leaks, particularly in relation to regular refuelling which in turn implies the requirement of a fuelling station or will be supplied by fuel tanker scheduled to refuel the plant machinery directly. Similar to suspended solids arising from excavation activities, hydrocarbons accidentally introduced to the environment will likely be intercepted by drainage and surface water networks crossed by or adjacent to the section of the proposed grid connection route along the R340.

Hydrocarbons are a pollutant risk due to their toxicity to all flora and fauna organisms. Hydrocarbons chemically repel water and sparingly dissolve in water. The majority of hydrocarbons are light non-aqueous phase liquids (L-NAPL's) which means that they are less dense than water and therefore float on the water's surface (whether surface water or groundwater). Hydrocarbons adsorb ('stick') onto the majority of natural solid objects they encounter, such as vegetation, animals, and earth materials such as soil.

From a land and soils perspective, the naturally occurring chemical in crude oil and gasoline products-Polycyclic Aromatic Hydrocarbons or (PAHs), can burn most living organic tissue, such as vegetation, due to their volatile chemistry. From a hydrological standpoint, they are also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life.

Potential incidents or accidental release of contaminants will likely be short lived or temporary, however the potential impacts to downstream receptors such as reef and otter habitat can be long lasting, or permanent.

6.5 CONNEMARA BOG COMPLEX SPA

The cormorant, merlin, golden plover and common gull populations of this SPA have been identified as occurring within the zone of influence of the proposed development.

The element of the proposed development that has been identified as a possible source of impacts to cormorant, merlin, golden plover are the grid connection route and the haul route and their presence within the zone of sensitivity for these species which ranges from 2 to 5km for these species. All other elements of the proposed development (i.e. proposed wind farm site and the proposed Peat Storage and Restoration (Habitat Enhancement) Area are located outside the zone of influence of these species).

6.5.1 Cormorant

The zone of sensitivity for cormorant is 2km as per SNH guidelines. The only area where works will be undertaken along the haul route that is within 2km of this SPA is at haul route widening area 2. This is located approximately 1km to the north of the nearest point of the SPA. The nearest point of the grid connection route to this SPA is also located 1km to the north of this SPA. The pathways that were listed during the screening of cormorant as having potential to connect the haul route and grid connection route to this species were hydrological, noise, air and mobile species pathways.

There are no hydrological pathways connecting the grid connection route to this SPA. There are no hydrological pathways between the four no. haul route widening locations and this SPA. The only section of the haul route that is hydrologically connected to this SPA is the section of the R336 that passes through the townland of Camus Eighter. No works are proposed along this section of the haul route and it will only be used for the transport of wind farm infrastructure during the construction phase of the proposed development. This will not represent a change to the existing use of this public road and will not trigger any impact to cormorants.

Cutts et al. (2013) defined the maximum distance from a noise source, from which cormorant are sensitive to noise disturbance to be 300m. Given that the nearest location of construction works to this SPA will be circa 1km there will be no potential for construction works associated with the haul route or the grid connection to result in noise disturbance and a noise emission pathway to cormorant. The use of the section of the R336 adjacent to the SPA, in the townland of Camus Eighter, as a haul route for the transport of wind farm infrastructure is not considered to have the potential to result in changes to baseline noise emissions associated with this existing public road corridor. In light of the above it is found that no noise emission pathway connects the proposed development to the cormorant population of this SPA.

The main source of air emission and associated impact arising from the proposed development will be dust. As noted in the Screening Report for Appropriate Assessment dust emissions can have potential impacts to habitats and vegetation where they are located within 50m of the source of dust. Given that the nearest location of works associated with the haul route or grid connection to this SPA will be circa 1km there will be no potential for these works to result in the emission of dust to this SPA. The section of the haul route, that passes through the townland of Camus Eighter is located within 50m of the SPA. However, no works are proposed to be undertaken along this section of the haul route and as such there will be no risk of dust emission to the SPA. In light of the above it is found that no air emission impact pathway connects the proposed development to the cormorant population of this SPA.

The foraging range for cormorant is 2km (SNH, 2016). The areas of construction works along the haul route that is located within a 2km distance of the SPA is restricted to the road widening works at haul route widening area 2. The habitat occurring at this location are representative of terrestrial grassland habitat and are not suitable for supporting cormorants. The sections of the grid connection that occur within 2km of this SPA are restricted to the existing road network of the R336 and R340. These road surfaces do not provide suitable habitat for cormorant. Given the absence of suitable habitat occurring at these locations no mobile species impact pathway is considered to connect this area of works associated with the haul route and grid connection route to the cormorant population of this SPA.

6.5.2 Merlin

The zone of sensitivity for merlin is 5km as per SNH guidelines. The areas where works will be undertaken along the haul route that is within 5km of this SPA is at the 4 no. haul route widening areas. The majority of the grid connection route between Maam Cross and Screebe is also within 5km of this SPA. The pathways that were listed during the screening of merlin as having potential to connect the haul route to this species were noise, air and mobile species pathways. Given that this species is not reliant on aquatic habitats no hydrological pathway was identified as having the potential to connect the proposed development to this species.

Ruddock & Whitfield (2007) identified a zone at which merlin are sensitive to development works and other human activity to be up to a maximum distance of 500m. Livezey et al. (2016) identified a minimum approach distance (i.e. the distance at which humans should be separated) from Falconiformes (which include merlin) at 714m. Given that the nearest location of construction works to this SPA will be circa 1km, there will be no potential for construction works associated with the haul route or the grid connection to result in noise disturbance and a noise emission pathway to merlin. The use of the section of the R336 adjacent to the SPA, in the townland of Camus Eighter, as a haul route for the transport of wind farm infrastructure is not considered to have the potential to result in changes to baseline noise emissions associated with this existing public road corridor. In light of the above it is found that no noise emission impact pathway connects the proposed development to the merlin population of this SPA.

The main source of air emission and associated impact arising from the proposed development will be dust. As noted in the Screening Report for Appropriate Assessment dust emissions can have potential impacts to habitats and vegetation where they are located within 50m of the source of dust. Given that the nearest location of works associated with the haul route or grid connection to this SPA will be circa 1km there will be no potential for works associated with these elements of the proposed development to result in the emission of dust to this SPA. The section of the haul route, that passes through the townland of Camus Eighter is located within 50m of the SPA. However, no works are proposed to be undertaken along this section of the haul route and as such there will be no risk of dust emission to the SPA. In light of the above it is found that no air emission impact pathway connects the proposed development to the merlin population of this SPA.

The foraging range for merlin is 5km (SNH, 2016). The areas of construction works along the haul route that is located within a 5km distance of the SPA is restricted to the road widening works at the four haul route widening areas. The habitats occurring under the footprints of the widening location are representative of terrestrial grassland, buildings and artificial surfaces and scrub habitat and are not suitable for supporting breeding or foraging merlin. The grid connection works within a 5km distance of the SPA will be restricted to the existing road surface of the R336 and the R340 which do not offer suitable habitat for merlin. Given the absence of suitable breeding and foraging habitat occurring at these locations no mobile species impact pathway is considered to connect this area of works to the merlin population of this SPA.

6.5.3 Golden plover

The zone of sensitivity for golden plover is 3km as per SNH guidelines. The areas where works will be undertaken along the haul route that is within 3km of this SPA is at the haul route widening area no. 2 and the section of the grid connection route in the vicinity of this haul route widening location. The pathways that were listed during the screening of golden plover as having potential to connect the haul route to this species were hydrological, noise, air and mobile species pathways.

There are no hydrological pathways connecting the grid connection route to this SPA. There are no hydrological pathways between the four no. haul route widening locations and this SPA. The only section of the haul route that is hydrologically connected to this SPA is the section of the R336 that passes through the townland of Camus Eighter. No works are proposed along this section of the haul route and it will only be used for the transport of wind farm infrastructure during the construction phase of the proposed development. This will not represent a change to the existing use of this public road and will not trigger any impact to golden plover.

Livezey et al. (2016) identified a minimum approach distance (i.e. the distance at which humans should be separated) from Charadriiformes (which include golden plover) at circa 100m. Given that the nearest location of construction works to this SPA will be circa 1km there will be no potential for construction works associated with the haul route or the grid connection to result in noise disturbance and a noise emission pathway to merlin. The use of the section of the R336 adjacent to the SPA, in the townland of Camus Eighter, as a haul route for the transport of wind farm infrastructure is not considered to have the potential to result in changes to baseline noise emissions associated with this existing public road corridor. In light of the above it is found that no noise emission impact pathway connects the proposed development to the golden plover population of this SPA.

The main source of air emission and associated impact arising from the proposed development will be dust. As noted in the Screening Report for Appropriate Assessment dust emissions can have potential impacts to habitats and vegetation where they are located within 50m of the source of dust. Given that the nearest location of works associated with the haul route or grid connection to this SPA will be circa 1km there will be no potential for works associated with these elements of the proposed development to result in the emission of dust to this SPA. The section of the haul route, that passes through the townland of Camus Eighter is located within 50m of the SPA. However no works are proposed to be undertaken along this section of the haul route and as such there will be no risk of dust emission to the SPA. In light of the above it is found that no air emission impact pathway connects the proposed development to the golden plover population of this SPA.

The foraging range for golden plover is 3km (SNH, 2016). The areas of construction works along the haul route that is located within a 3km distance of the SPA is restricted to the road widening works at the haul route widening area 2. The habitat occurring under the footprint of this widening location is representative of scrub habitat and is not suitable for supporting breeding or foraging golden plover. The grid connection works within a 3km distance of the SPA will be restricted to the existing road surface of the R336 and the R340 which do not offer suitable habitat for golden plover. Given the absence of suitable habitat breeding habitat occurring at these locations no mobile species impact pathway is considered to connect this area of works to the golden plover population of this SPA.

6.5.4 Common Gull

The zone of sensitivity for common gull is 25km (Thaxter et al., 2012). All areas of the proposed development occur within the potential foraging zone of the common gull population associated with the Connemara Bog Complex SPA. The pathways that were listed during the screening of common gull as having potential to connect the proposed development to this species were hydrological, noise, air, mobile species and light emission pathways.

There are no hydrological pathways connecting areas of the proposed development where works will be undertaken to this SPA. The only section of the proposed development that is hydrologically connected to this SPA is the section of the haul route along the R336 that passes through the townland of Camus Eighter. No works are proposed along this section of the haul route and it will only be used for the transport of wind farm infrastructure during the construction phase of the proposed development. This will not represent a change to the existing use of this public road and will not trigger any impact to common gulls.

Human disturbance to common gull can arise where human activities are undertaken at or in the vicinity of breeding colonies (European Commission, 2009). Given that no breeding colonies associated with the common gull population of this SPA are located in the vicinity of any element of the proposed development there will be no potential for noise or air emissions generated during works associated with the proposed development to result in adverse effects to common gull. As such no noise or air impact pathways are considered to connect the proposed development to the common gull population of this SPA.

As noted above the foraging range for common gull is 25km and as such the range for the common gull population of this SPA overlaps with the proposed wind farm site. Common gulls were observed three times at and in the vicinity of the proposed wind farm site during winter VP surveys and 18 times during summer VP surveys. Most sightings (12) were of single birds, however there were four sightings of two birds, one record of four birds, and another single record of six birds. The high count of six birds were observed on the 21st April from VP2, and were noted as probable breeding pairs, and were observed landing by the lake shoreline near the VP.

A published review of the number of common gull bird fatalities owing to collision with wind turbines showed there were 14 fatalities across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting common gulls exhibit high levels of micro-avoidance at wind farms. A collision risk assessment for common gulls with the proposed wind farm has been completed and resulted in an predicted number of <0.01 collisions per year. The ornithology assessment provided as Chapter 7 of the EIAR classified the magnitude of this potential collision effect as negligible (<1% population lost), whilst the overall effect significance is very low (Criteria: Percival, 2003). Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA (see Section 6.9 below).

The ornithology assessment (EIAR Chapter 7) also found that the potential impact of habitat loss or displacement associated with the proposed wind farm for common gull will represent an imperceptible effect to this species. Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA.

The ornithological assessment for the proposed wind farm identified the potential for disturbance and displacement during construction and operation phase for common gull. This potential disturbance/displacement impact was assessed as being a temporary to short-term, imperceptible effect for the construction phase and an imperceptible, long-term effect for the operation phase.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm to common gull will represent an imperceptible, long-term effect.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located within the 25km common gull foraging zone of this SPA. No common gull were recorded at this location during habitat surveys completed during the 2022 breeding bird season on the 16th March, 29th April and 19th May 2022. The proposed Peat Storage and Restoration (Habitat Enhancement) Area is subjected to intensive peat extraction activities during the spring and summer months that overlap with the common gull breeding season. This activity significantly limits the likelihood of common gull associated with the SPA breeding population relying on the Peat Storage and Restoration (Habitat Enhancement) Area. Given the absence of common gull in this area during the 2022 season and the existing sub-optimal conditions at this area, there is no potential for a mobile species impact pathway to connect the proposed Peat Storage and Restoration (Habitat Enhancement) Area to the breeding common gull population of this SPA.

Sections of the R336, R340 and the N59 occurring within the 25km common gull foraging zone of this SPA will be used for the installation of the grid connection route. The N59 and R336 will also be used as a haul route for the transport of wind farm infrastructure. These road corridors do not offer suitable habitat for common gull. The four proposed widening areas along the haul route are also located within the 25km common gull foraging zone for this SPA. The habitats occurring at each of these four locations do not represent suitable habitat for breeding common gull populations. Given the absence of suitable habitat occurring along the grid connection route, the haul route and at the four haul route widening locations no mobile species impact pathway is considered to connect these elements of the proposed development to the common gull population of this SPA.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for common gull population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.6 LOUGH CORRIB SPA

The hen harrier, golden plover, common gull and wetlands and waterbirds populations of this SPA have been identified as occurring within the zone of influence of the proposed development.

All elements of the proposed development have been identified as a possible source of impacts to hen harrier, golden plover, common gull and wetlands and waterbirds. This is due to the proximity of all elements to this SPA which falls within the foraging range of the above listed special conservation interest bird species as well as other waterbirds whose populations are protected as part of the SPA.

6.6.1 Hen Harrier

The zone of sensitivity for hen harrier is 2km (SNH, 2016). The proposed wind farm site occurs within the potential foraging zone of the hen harrier population associated with the Lough Corrib SPA. All other elements of the proposed development (i.e. the grid connection route; proposed Peat Storage and Restoration (Habitat Enhancement) Area; and haul route are located outside the 2km foraging zone of sensitivity. The pathways that were listed during the screening of hen harrier as having potential to connect the proposed wind farm site to this species relates to a mobile species pathway and a light emission pathway. Given that the nearest distance between this SPA and the proposed development is approximately 1km there will be no potential for other pathways, such as noise, air etc. to connect proposed development to the hen harrier population.

Eight sightings of hen harrier were recorded between May and June 2020 at VPs 1 and 4. Note that all records in May occurred at VP1 on the same date – 24th May 2020. Likewise, all June records occurred at VP4 on the same date – 12th June 2020. None of the hen harrier flights associated with these sightings occurred within a 500m buffer distance of the proposed turbines. No birds were recorded breeding on site and there were no additional observations of the species during the two years of bird surveys within the larger flight activity survey area.

No hen harriers were observed breeding on site, so potential collision risk is significantly reduced due to the absence of the territorial display known as 'sky-dancing', which often occurs at heights within the predicted rotor envelope. In addition, no documented roosts were recorded within 10 km of the proposed wind farm site.

Scientific literature suggests that flying at low heights is a 'ubiquitous trait' of hen harrier (Whitfield and Madders, 2006). The species has a high avoidance rate (99%) (SNH, 2017) in relation to wind turbines. Due to the lack of observations of the species within rotor-swept heights or within a 500m buffer zone of the proposed turbines no collision risk modelling was required to be completed for hen harrier and the collision risk for this species is considered to be effectively zero.

Habitat on Site is highly degraded and is not considered to be optimum breeding habitat for hen harrier, and likewise, the foraging habitat is deemed to be suboptimal. Hen harrier typically forage over heath bog, low intensively farmed grassland with well-established hedgerows and areas of scrub (Irwin et al., 2012). Thus, taking this into consideration, there will be a 9.15 Ha loss of suitable foraging habitat within the proposed wind farm site. Given that similar foraging habitat for this species in common in the surrounding landscape the potential impact of habitat loss arising at the wind farm site has been assessed as a long-term slight effect.

The ornithological assessment for the proposed wind farm also identified the potential for disturbance and displacement during construction and operation phase for hen harriers hunting within the proposed wind farm site or breeding/hunting nearby the Site. This potential disturbance/displacement impact was assessed to be representative of a temporary to short-term slight effect for the construction phase and a long-term insignificant effect to slight effect during the operation phase.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm will represent a long-term and insignificant effect.

The slight effects associated with habitat loss at the proposed wind farm site and disturbance/displacement during construction works at the wind farm site are not considered to be representative of adverse effects to the hen harrier population of this SPA. This is based on the findings that such slight effects will not have the potential to undermine the conservation objectives for the hen harrier population of this SPA (see Section 6.10 below).

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for hen harrier population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.6.2 Golden plover

The zone of sensitivity for golden plover is 3km (SNH, 2016). All elements of the proposed development, with the exception of the proposed haul route widening locations, occur within the potential foraging zone of the golden plover population associated with the Lough Corrib SPA. The pathway that was listed during the screening of golden plover as having potential to connect the proposed development to this species relates to a mobile species pathway and light emission pathway. Given that the nearest distance between this SPA and the proposed development is approximately 1km there will be no potential for other pathways, such as noise, air etc. to connect proposed development to the golden plover population.

Golden plover was recorded five times during winter VP surveys, and four times during winter walkover surveys. Both winter 2020/21 VP survey records involved an unknown number of birds heard calling over VP3 on the 19th November 2020 and over VP1 on the 28th February 2021. On the 11th January 2022, two records of fifteen birds, presumably the same birds, occurred at VP1, initially flushed by a merlin – they flew for a combined 16 seconds at 0-10m. The final record occurred from VP4 on the 22nd February 2022 and involved three birds seen flying for five seconds at 10-20m.A high count of 20 birds were flushed from transect 2 on the 29th December 2021.

Golden Plover have been recorded in low numbers as collision fatalities at wind farms (Hoetker et al., 2006; Grunkorn 2011). The published avoidance rate by SNH for collision risk modelling for this species is 98% (SNH 2010), indicating a high micro-avoidance rate regarding collision with turbines. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities (Krijgsveld et al., 2009). Golden plovers were not recorded breeding within the 500m turbine envelope during the bird surveys completed for the proposed wind farm. In addition, this species was not recorded within the 500m turbine buffers at rotor swept heights, and thus the effective collision risk for this species is zero. The ornithological assessment (EIAR Chapter 7) has identified the collision risk posed by the proposed wind farm as long-term imperceptible effect.

The ornithological assessment for the proposed wind farm found that the potential impact of habitat loss arising from the construction of the wind farm will be a long-term and insignificant effect.

The ornithological assessment for the proposed wind farm also identified the potential for disturbance and displacement during construction and operation phase for golden plover. This potential disturbance/displacement impact was assessed as being a temporary to short-term insignificant effect for the construction phase and a long-term insignificant effect for the operation phase.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm will represent an imperceptible long-term effect.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located within the 3km golden plover foraging zone of this SPA. No wintering golden plover were recorded at this location during habitat surveys completed during the 16th March (during the 2021/2022 over-wintering bird season) or on the 2nd November 2022 (during the 2022/2023 over-wintering bird season). The proposed Peat Storage and Restoration (Habitat Enhancement) Area is subjected to intensive peat extraction activities. Given the absence of golden plover in this area during the 2021/2022 over-wintering season and the 2022/2023 over-wintering season and the existing sub-optimal conditions at this area there is no potential for a mobile species impact pathway to connect the proposed Peat Storage and Restoration (Habitat Enhancement) Area to the over-wintering golden plover population of this SPA.

Notwithstanding this finding of an absence of a mobile species pathway mitigation measures are set out in Section 7 below that will provide for the avoidance of disturbance to wintering golden plover populations in the event that evidence of their reliance on the wind farm site or peat storage and restoration (habitat enhancement) area is identified prior to or during the construction phase.

No areas of construction work along the haul route are located within the 3km golden plover foraging zone of this SPA. Section of the R336 and the N59 occurring within the 3km golden plover foraging zone of this SPA will be used as a haul route for the transport of wind farm infrastructure. The grid connection works within a 3km distance of the SPA will be restricted to the existing road surface of the R336 and the N59. These road corridors do not offer suitable habitat for golden plover. Given the absence of suitable habitat occurring along the grid connection route and haul route no mobile species impact pathway is considered to connect these elements of the proposed development to the golden plover population of this SPA.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for golden plover population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.6.3 Common Gull

The zone of sensitivity for common gull is 25km (Thaxter et al., 2012). All elements of the proposed development occur within the potential foraging zone of the common gull population associated with the Lough Corrib SPA. The pathways that were listed during the screening of common gull as having potential to connect the proposed development to this species were hydrological, noise, air, mobile species and light emission pathways.

There are hydrological pathways connecting the proposed wind farm to this SPA. The potential impacts to the water quality of Lough Corrib that could arise as a result of the proposed development have been identified in Section 6.1 to 6.4 above. Such impacts will have the potential to contribute towards undermining the status of this waterbody to function as a key foraging habitat for the common gull population of this SPA.

Human disturbance to common gull can arise where human activities are undertaken at or in the vicinity of breeding colonies (European Commission, 2009). Given that no breeding colonies associated with the common gull population of this SPA are located in the vicinity of any element of the proposed development there will be no potential for noise or air emissions generated during works associated with the proposed development to result in adverse effects to common gull. As such no noise or air pathways are considered to connect the proposed development to the common gull population of this SPA.

As noted above the foraging range for common gull is 25km (SNH, 2016) and as such the range for the common gull population of this SPA overlaps with the proposed wind farm site. The observed interactions between common gull and the proposed wind farm have been summarised in Section 6.5.4 above.

As detailed in Section 6.5.4 above the predicted collision risk of <0.01 collisions per year between the proposed wind farm and common gull has been classified as a negligible magnitude effect to this species with an overall effect significance is very low (Criteria: Percival, 2003). Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA (see Section 6.9 below).

Section 6.5.4 outlines the results of the ornithological assessment for common gull with respect to habitat loss during the construction phase; disturbance and displacement during the construction phase and operation phase; and barrier effects during the operational phase. This assessment concluded that:

- habitat loss during the construction phase will represent an imperceptible effect to common gulls;

- disturbance and displacement during the construction phase and operational phase will represent a temporary to short-term, imperceptible effect for the construction phase and an imperceptible, long-term effect for the operation phase.

- barrier effects during the operation phase will represent an imperceptible, long-term effect to common gull.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located within the 25km common gull foraging zone of this SPA. No common gull were recorded at this location during habitat surveys completed during the 2022 breeding bird season on the 16th March, 29th April and 19th May 2022. The proposed Peat Storage and Restoration (Habitat Enhancement) Area is subjected to intensive peat extraction activities during the spring and summer months that overlap with the common gull breeding season. This activity significantly limits the likelihood of common gull associated with the SPA breeding population relying on the Peat Storage and Restoration (Habitat Enhancement) Area. Given the absence of common gull in this area during the 2022 season and the existing sub-optimal conditions at this area, there is no potential for a mobile species impact pathway to connect the proposed Peat Storage and Restoration (Habitat Enhancement) Area to the breeding common gull population of this SPA.

Section of the R336, R340 and the N59 occurring within the 25km common gull foraging zone of this SPA, will be used for the installation of the grid connection route. The N59 and R336 will also be used as a haul route for the transport of wind farm infrastructure. These road corridors do not offer suitable habitat for common gull. The four proposed widening areas along the haul route are also located within the 25km common gull foraging zone for this SPA. The habitats occurring at each of these four locations do not represent suitable habitat for breeding common gull populations. Given the absence of suitable habitat occurring along the grid connection route, the haul route and at the four haul route widening locations no mobile species impact pathway is considered to connect these elements of the proposed development to the common gull population of this SPA.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for common gull population of this SPA (see Table 6.2), mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.6.4 Greenland white-fronted geese

The zone of sensitivity for Greenland white-fronted geese is 8km (SNH, 2016). All elements of the proposed development, with the exception of the proposed haul route widening locations 1 and 2, occur within the potential foraging zone of the Greenland white-fronted geese population associated with the Lough Corrib SPA. The pathway that was listed during the screening of Greenland white-fronted geese as having potential to connect the proposed development to this species relates to a mobile species pathway and light emission pathway. Given that the nearest distance between this SPA and the proposed development is approximately 1km there will be no potential for other pathways, such as noise, air etc. to connect proposed development to the Greenland white-fronted geese population.

Greenland white-fronted geese was recorded once on the 28th October 2019, when a lone white-fronted goose or small family group gave three single calls over an approximate sixty second period, flying low over forestry behind the observer at VP1.

Published fatality rates for Greenland white-fronted geese at operational wind farm site are low, with one fatality of a bean/Greenland white-fronted geese from a review of 46 wind farm site across Europe (Hoetker et al., 2006). This species was not recorded within the 500m turbine buffers at rotor swept heights, and thus the effective collision risk for this species is zero. The ornithological assessment (EIAR Chapter 7) has identified the collision risk posed by the proposed wind farm as long-term imperceptible effect.

The ornithological assessment for the proposed wind farm noted that no Greenland white-fronted geese were observed using the Site and that this species does not breed in Ireland, and as such there will be no habitat loss impact on the species.

The ornithological assessment for the proposed wind farm also identified the potential for disturbance and displacement during construction and operation phase for Greenland white-fronted geese. This potential disturbance/displacement impact was assessed as being a temporary to short-term imperceptible effect for the construction phase and a long-term imperceptible effect for the operation phase.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm will represent an imperceptible long-term effect.

The proposed Peat Storage and Restoration (Habitat Enhancement) Area is located within the 8km Greenland white-fronted geese foraging zone of this SPA. No wintering Greenland white-fronted geese were recorded at this location during habitat surveys completed during the 16th March (during the 2021/2022 over-wintering bird season) or on the 2nd November 2022 (during the 2022/2023 over-wintering bird season). The proposed Peat Storage and Restoration (Habitat Enhancement) Area is subjected to intensive peat extraction activities. Given the absence of Greenland white-fronted geese in this area during the 2021/2022 over-wintering season and the 2022/2023 over-wintering season and the existing sub-optimal conditions at this area there is no potential for a mobile species impact pathway to connect the proposed Peat Storage and Restoration (Habitat Enhancement) Area to the over-wintering Greenland white-fronted geese population of this SPA.

Notwithstanding this finding of an absence of a mobile species pathway mitigation measures are set out in Section 7 below that will provide for the avoidance of disturbance to wintering Greenland white-fronted geese populations in the event that evidence of their reliance on the wind farm site or peat storage and restoration (habitat enhancement) area is identified prior to or during the construction phase.

Construction work along the haul route, associated with the haul route widening area 3 and 4 are located within the 8km Greenland white-fronted geese foraging zone of this SPA. The habitats occurring at these locations are representative of existing buildings and artificial surfaces and roadside grassy verge. These habitats and their locations along the verge of an existing regional road are not representative of suitable habitat for Greenland white-fronted geese. Given the absence of suitable habitat at these two widening locations no mobile species impact pathway is considered to connect these widening areas to the Greenland white-fronted geese of this SPA.

Section of the R336 and the N59 occurring within the 8km Greenland white-fronted geese foraging zone of this SPA will be used as a haul route for the transport of wind farm infrastructure and the grid connection route. Works associated with the grid connection route will be restricted to the existing road surface of the R336 and the N59. These road corridors do not offer suitable habitat for Greenland white-fronted geese. Given the absence of suitable habitat occurring along the grid connection route and haul route no mobile species impact pathway is considered to connect these elements of the proposed development to the Greenland white-fronted geese population of this SPA.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for common gull population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.6.5 Waterbirds

Other waterbirds, that are not listed as specific special conservation interest bird species of this SPA have been identified as key avifauna receptors for the proposed wind farm development. These species include common sandpiper, little grebe, great northern diver, greenshank, grey heron, greylag goose, greater-black backed gull, herring gulls, mallard, mute swan, red-breasted merganser, greenland white-fronted geese and whooper swan.

The zone of sensitivity for these species is generally greater than 2km and as such all elements of the proposed development occur within the potential foraging zone of the of these waterbird species and the associated Lough Corrib SPA. The pathways that were listed during the screening of waterbirds as having potential to connect the proposed development to these species were hydrological, noise, air and mobile species pathways.

Potential water quality impacts to Lough Corrib have been set out in Section 6.3.1 above. In the event that the construction, operation or decommissioning phase results in pollution to the Owenwee catchment, it will have the potential (given the presence of a hydrological pathway) to undermine lake habitat conditions at Lough Corrib required to sustain waterbird populations.

Cutts et al. (2013) defined the maximum distance from a noise source, from which waterbirds are sensitive to noise disturbance to be 300m. Given that the nearest location of proposed development to this SPA will be circa 1km there will be no potential for construction works to result in noise disturbance and a noise emission pathway to waterbirds.

The main source of air emission and associated impact arising from the proposed development will be dust. As noted in the Screening Report for Appropriate Assessment dust emissions can have potential impacts to habitats and vegetation where they are located within 50m of the source of dust. Given that the nearest location of works to this SPA will be circa 1km there will be no potential for these works to result in the emission of dust to this SPA.

The foraging range for waterbirds identified as key avifauna receptors overlaps with the proposed wind farm site. A collision risk assessment for the operation phase of the proposed turbines to these waterbird species has been completed as part of the ornithological assessment. This has found that the potential impact of collision risk arising from the proposed wind farm will be a long-term imperceptible effect for all waterbird species identified as key avifauna receptors.

The ornithological assessment for the proposed wind farm found that the potential impact of habitat loss arising from the construction of the wind farm for waterbird species listed as key avifauna receptors will be a long-term and imperceptible effect for all waterbird species.

The ornithological assessment for the proposed wind farm also identified the potential for disturbance and displacement during the construction and operation phase for waterbirds. This potential disturbance/displacement impact was assessed as being a temporary to short-term imperceptible effect for the construction phase and a long-term insignificant/imperceptible effect for the operation phase for all waterbird species.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm will represent an insignificant/imperceptible long-term effect for all waterbirds identified as key avifauna receptors.

6.7 LOUGH MASK SPA

6.7.1 Common Gull

The zone of sensitivity for common gull is 25km (Thaxter et al., 2012). All elements of the proposed development occur within the potential foraging range of the common gull population associated with the Lough Mask SPA. The pathways that were listed during the screening of common gull as having potential to connect the proposed development to this species were mobile species and light emission pathways.

The observed interactions between common gull and the proposed wind farm have been summarised in Section 6.5.4 above.

As detailed in Section 6.5.4 above the predicted collision risk of <0.01 collisions per year between the proposed wind farm and common gull has been classified as a negligible magnitude effect to this species with an overall effect significance is very low (Criteria: Percival, 2003). Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA (see Section 6.9 below).

Section 6.5.4 outlines the results of the ornithological assessment for common gull with respect to habitat loss during the construction phase; disturbance and displacement during the construction phase and operation phase; and barrier effects during the operation phase. This assessment concluded that:

- habitat loss during the construction phase will represent an imperceptible effect to common gulls;
- disturbance and displacement during the construction phase and operation phase will represent a temporary to short-term, imperceptible effect for the construction phase and an imperceptible, long-term effect for the operation phase.
- barrier effects during the operation phase will represent an imperceptible, long-term effect to common gull.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for common gull population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.8 LOUGH CARRA SPA

6.8.1 Common Gull

The zone of sensitivity for common gull is 25km (Thaxter et al., 2012). All elements of the proposed development occur within the potential foraging range of the common gull population associated with the Lough Carra SPA. The pathways that were listed during the screening of common gull as having potential to connect the proposed development to this species were mobile species and light emission pathways.

The foraging range for common gull is 25km (SNH, 2016). The foraging range for the common gull population of this SPA overlaps with the proposed wind farm site. The observed interactions between common gull and the proposed wind farm have been summarised in Section 6.5.4 above.

As detailed in Section 6.5.4 above the predicted collision risk of <0.01 collisions per year between the proposed wind farm and common gull has been classified as a negligible magnitude effect to this species with an overall effect significance is very low (Criteria: Percival, 2003). Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA (see Section 6.9 below).

Section 6.5.4 outlines the results of the ornithological assessment for common gull with respect to habitat loss during the construction phase; disturbance and displacement during the construction phase and operation phase; and barrier effects during the operation phase. This assessment concluded that:

- habitat loss during the construction phase will represent an imperceptible effect to common gulls;
- disturbance and displacement during the construction phase and operation phase will represent a temporary to short-term, imperceptible effect for the construction phase and an imperceptible, long-term effect for the operation phase.
- barrier effects during the operation phase will represent an imperceptible, long-term effect to common gull.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to conservation objectives for common gull population of this SPA (see Table 6.2), mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.8.2 Lesser-Black Backed Gull

The zone of sensitivity for lesser-black backed gull is 70km (Thaxter et al., 2012). All elements of the proposed development occur within the potential foraging range of the lesser-black backed gull population associated with the Lough Carra SPA. The pathways that were listed during the screening of lesser-black backed gull as having potential to connect the proposed development to this species were mobile species and light emission pathways.

Lesser-black backed gull were recorded on five occasions between May and June of 2020, only. No evidence of breeding or foraging was noted on site. Typically, lesser black-backed gull is a coastal breeding species, however colonies do occur inland, alongside lakes, including in Co.

Galway. Once a common breeding species at Lough Corrib, numbers have declined drastically in recent years, and now just small numbers occur. There is no suitable breeding habitat for this species at the wind farm site and foraging habitat is suboptimal, at best.

A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. This species was not recorded within the 500m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero. Based on this the ornithology assessment provided as Chapter 7 of the EIAR classified the magnitude of this potential collision effect as negligible (<1% population lost), whilst the overall effect significance is very low (Criteria: Percival, 2003) and representative of a long-term imperceptible effect (Criteria: EPA, 2022). Such an effect is not considered to have the potential to represent a potential adverse effect to the population of common gull supported by this SPA (see Section 6.9 below).

The ornithology assessment (EIAR Chapter 7) also found that the potential impact of habitat loss or displacement associated with the proposed wind farm for lesser-black backed gull will represent a long-term, imperceptible effect to this species. Such an effect is not considered to have the potential to represent a potential adverse effect to the population of lesser-black backed gull supported by this SPA.

The ornithological assessment for the proposed wind farm identified the potential for disturbance and displacement during construction and operation phase for lesser-black backed gull. This potential disturbance/displacement impact was assessed as being a temporary to short-term, imperceptible effect for the construction phase and an imperceptible, long-term effect for the operation phase.

The potential for operation phase barrier effects was assessed as part of the ornithological assessment and it was found that the potential for a barrier effect posed by the proposed wind farm to common gull will represent an imperceptible, long-term effect.

Lighting associated with the operation phase of turbines has been considered as a potential impact to bird species in the ornithological assessment for the proposed wind farm (see EIAR Chapter 7). The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. Whilst the effects of lighting associated with the proposed turbines have not been identified as having the potential to affect the conservation objectives for lesser-black backed gull population of this SPA (see Table 6.2) mitigation measures to avoid potential adverse effects of lighting to birds, including common gulls, are set out in Section 7 below.

6.9 IN-COMBINATION EFFECTS

6.9.1 In-Combination Effects During the Construction Phase

Past land use practices have resulted in negative impacts to peatland habitats within and adjacent to the proposed development site. Blanket bog habitats have been subjected to historical turbary towards the east of the proposed wind farm site in the vicinity of the proposed access track while overgrazing has led to damage and erosion to heath and blanket bog habitats to the west of the site. The presence of extensive forestry to the east and north of the site has also resulted in the drainage of peatland habitats and the loss of areas of blanket bog and heath habitat. The proposed spoil storage area has been subject to intensive industrial scale peat harvesting. All of these land use practices are likely to have resulted in the loss of sediment from these areas to the Owenwee catchment and ultimately Lough Corrib downstream of the wind farm site and Loughanilluan and Lough Arrderry downstream of the proposed Peat Storage and Restoration (Habitat Enhancement) Area. The receiving Lough Corrib and Loughanillaun are examples of Annex 1 lake habitats of the Lough Corrib SAC and the Maumturk Mountains SAC and as set out in Section 6.1 and 6.2 above are sensitive to pollution and water quality degradation. In the absence of any changes to land management particularly with respect to grazing pressures at the western side of the proposed wind farm site and at the PMEA excessive sediment loss to these receiving waterbodies will continue.

The risks to receiving waterbodies posed by the Development will also have the potential to combine with these existing land use activities to result in cumulative sediment loss to these waterbodies and associated pressures to water quality and the freshwater ecology supported by them.

It is noted that the provision of habitat enhancement measures such as the implementation of, and commitment to, appropriate grazing regimes within the Site and the rehabilitation of blanket bog habitat within the proposed Peat Storage and Restoration (Habitat Enhancement) Area, along with the blocking of existing drains in this latter area will have the potential to reduce the impact of historical land use activities within the proposed development site with associated positive impacts for the status of the Loughanillaun Oligotrophic Isoetid Lake Habitat and the Lough Arrderry lake habitat downstream and to the north and south of this area.

In terms of other projects there are no recent large-scale infrastructure projects permitted in the vicinity of the proposed development site. The permitted N59 upgrade works between Maam Cross and Bunnakill Road were completed in 2022 and as such there will be no potential for the proposed development to overlap with the construction phase of this project.

Other specific live or recently approved projects in the vicinity of the Site, that are considered to be minor in scale, are listed below and an examination of the potential for the proposed development to combine with these projects to result in cumulative adverse effects to the European Sites within the zone of influence is provided.

Planning Reference No. 21963: planning permission for the retention of a temporary meteorological mast within the Site. A screening for Appropriate Assessment for this project was completed by the Planning Authority and it was determined that this project, alone or in-combination with other plans or projects, would not have the potential to result in likely significant effects to European Sites or the environment. Given this determination the proposed development will not combine with this project to result in cumulative adverse effects to European Sites in the surrounding area.

Planning Reference No. 201558: planning permission for a general purpose shed. A screening for Appropriate Assessment for this project was completed by the Planning Authority and it was determined that this project, alone or in-combination with other plans or projects, would not have the potential to result in likely significant effects to European Sites or the environment. Given this determination the proposed development will not combine with this project to result in cumulative adverse effects to European Sites in the surrounding area.

Planning Reference No. 211067: planning permission for a partial change of use of an existing shop to use as an off-licence. This project represents a change of use of an existing retail premise in terms of the products sold from the premises. It does not involve any proposals with potential to result in land use effects and will not have the potential to combine with the proposed development to result in cumulative adverse effects to European Sites in the surrounding area.

Planning Reference No. 212279: planning permission for a dwelling house. A screening for Appropriate Assessment for this project was completed by the Planning Authority and it was determined that this project, alone or in-combination with other plans or projects, would not have the potential to result in likely significant effects to European Sites or the environment. Given this determination the proposed development will not combine with this project to result in cumulative adverse effects to European Sites in the surrounding area.

Planning Reference No. 221051: planning application for a dwelling house. This project is located within the Ballycuirke Lough Stream_SC_010 sub-catchment within which no element of the proposed development will be located. No drainage waters from the proposed development will drain to this sub-catchment and as such there will be no potential for the project to combine with this other live planning application project to result in cumulative adverse effects to European Sites in the surrounding area.

Planning Reference No. 221052: planning application for an agricultural shed to house livestock. This project is located within the Ballycuirke Lough Stream_SC_010 sub-catchment within which no element of the proposed development will be located. No drainage waters from the proposed development will drain to this sub-catchment and as such there will be no potential for the project to combine with this other live planning application project to result in cumulative negative effects to the freshwater aquatic environment of the Ballycuirke Lough Stream_SC_010 sub-catchment.

The ornithological assessment for the proposed development (EIAR Chapter 7) examined the potential for cumulative impacts to bird species to arise during the construction phase of the proposed development. This assessment examined the potential for the proposed development to combine with other wind farms within a 20km distance to result in cumulative impacts. This 20km distance is considered to be adequate for the purposes of this Natura Impact Statement and the examination of the potential for the proposed wind farm to combine with other wind farm site in the wider surrounding area to result in cumulative adverse construction phase impacts. This consideration is, in turn, based on the fact that:

- all SPAs, with the exception of Lough Carra SPA, are located within 20km of the proposed wind farm site and that no other wind farms (consented or operational) occur between proposed wind farm site and Lough Carra SPA; and

- this 20km area encompasses the foraging area of the special conservation interest bird species of the SPAs that have been identified as occurring within the zone of influence of the proposed development.

The wind farms identified in this 20km area are listed in Table 6.1.

Table 6.1: Consented & Operational Wind Farms within 20km of the proposed wind farm

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development
Knockranny	Consented	11	c. 15km	Southeast
Clochar na Lara	Operational	11	c. 19.8km	Southeast
Galway Wind Park Phase 1, Cloosh Valley/Seecon	Operational	36	c. 6.8km	Southeast
Galway Wind Park Phase 2, Ugool/Lettercraffoe	Operational	22	c. 10km	Southeast
Galway Wind Park Phase 3, Derradda, Seecon, Shannapheasteen, Uggool, Letter, Finnaun	Consented	9	8.5km	Southeast
Ardderroo	Consented	25	c. 13.5km	Southeast

The ornithological assessment found that based on the evidence available in addition to the fact that there is a significant distance to many of these wind farms, the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the proposed development, any cumulative effects on birds during the construction phase would be a Long-Term Imperceptible Cumulative Effect. This cumulative effect is not representative of an adverse cumulative effect to the SPAs occurring within the zone of influence of the proposed development.

6.9.2 *In-Combination Effects During the Operation Phase*

It is anticipated that, in the absence of mitigation, the key cumulative impacts upon European Sites during the operation of the proposed development will relate to the European Sites and relevant receptors occurring downstream of the proposed development. In the absence of an adequate operational phase drainage design, the drainage at the wind farm site and the proposed Peat Storage and Restoration (Habitat Enhancement) Area could exacerbate peatland erosion within the vicinity of the proposed infrastructure and the loss of sediment to downstream aquatic receptors such as Lough Corrib and Loughanillaun. Under such a scenario the potential will exist for the operation phase of the proposed development to combine with other sources of water pollution in the surrounding sub-catchment areas to result in adverse effects to the conservation status of these lake habitats and the Annex 2 qualifying species supported by them.

The ornithological assessment (EIAR Chapter 7) also examined the potential for cumulative effects to birds during the operation phase of the proposed wind farm with the other seven listed wind farm site listed in Table 6.1 above. Direct effects on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement, and barrier effect. Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects.

These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

This examination concluded that in view of the distances of these seven other wind farm sites in relation to the proposed wind farm site, the lack of migration paths during surveys, along with the results of hinterland surveys undertaken for the proposed development, the cumulative collision risk on any avian receptors is considered negligible. Furthermore, studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision (Langston & Pullan, 2004). Cumulative collision mortality combined with other wind farm developments is predicted to be a Long-Term Imperceptible Cumulative Effect. This cumulative effect is not representative of an adverse cumulative effect to the SPAs occurring within the zone of influence of the proposed development.

6.9.3 *In-Combination Effects During the Decommissioning Phase*

Given that the decommissioning phase of the proposed development will not take place until the termination of the operation phase of the proposed wind farm it is not possible at this time to identify other plans or projects with which activities associated with the decommissioning phase could combine to result in adverse effects to European Sites. Notwithstanding this it is noted that the activities associated with the decommissioning phase will be similar to those that will be required for the construction phase and will have the potential to result in similar impacts. With respect to the European Sites occurring in the zone of influence of the proposed development, these impacts will relate to pollution of receiving watercourses and qualifying Annex 1 lake habitats occurring downstream of the proposed wind farm site. The potential effects of pollution derived from construction phase and decommissioning phase activities have been set out in Section 6.1 to 6.8 above. In the event that other land use activities occurring within the Owenwee River catchment are known to, or have the potential to, result in threats or pressures to this catchment during the decommissioning phase, then the potential will exist for this phase of the proposed development to combine with these other sources of pollution to result in cumulative adverse effects to the conservation status of the Lough Corrib SAC and SPA downstream of the proposed wind farm. It is noted that mitigation measures are set out in Section 7 below and their full implementation will provide safeguards such that the decommissioning phase of the proposed wind farm site will not have the potential to combine with other land use activities that pose a threat/pressure to the water quality of the Owenwee catchment and Lough Corrib during this phase of the proposed development.

6.10 EXAMINATION OF EFFECTS TO CONSERVATION OBJECTIVES

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level. Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and

- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and

- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and

- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis

A NIS is required to assess the potential for impacts to the integrity of a European Site, with respect to the site's structure and function and its Conservation Objectives. The structural and functional elements of a European Site to maintain the favourable conservation status of qualifying features of interest are embedded into the list of detailed SSCO attributes and targets for each of the site's interest features. As such a European Sites' SSCOs represent the parameters against which a project's potential to adversely affect the integrity of a European Sites should be considered.

Table 6.2 lists the Conservation Objectives attributes and targets for each of qualifying features of interest of the eight European Sites occurring within the zone of influence of the proposed development and examines how the project, in the absence of mitigation, will have the potential to result in adverse effects to these attributes and targets.

Site-specific conservation objectives have been published for the 4 SACs that are examined in this Natura Impact Statement and so these are used in Table 6.2 below.

No site-specific conservation objectives have been published for any of the four SPAs that are examined in this Natura Impact Statement. In their absence a review was undertaken of other SPAs to identify sample attributes and targets for special conservation interest bird species within the zone of influence of the proposed development.

Sample Conservation Objectives for the breeding population of the following have been taken from the Saltee Islands SPA (2011):

- cormorants of Connemara Bog Complex SPA;
- common gull of Connemara Bog Complex SPA; Lough Corrib SPA; Lough Mask SPA & Lough Carra SPA; and
- lesser-black backed gull of the Lough Carra SPA.

Sample Conservation Objectives for the breeding population of Merlin of the Connemara Bog Complex SPA have been taken from the Antrim Hills SPA in Northern Ireland which is the nearest known publication of detailed SSCOs for any SPA supporting breeding Merlin.

Sample conservation objectives for the wintering population of hen harrier of the Lough Corrib SPA have been taken from the Wexford Harbour & Slobs SPA (NPWS, 2012).

Sample conservation objectives for the wintering population of golden plover of the Lough Corrib SPA have been taken from the Cork Harbour SPA (NPWS, 2014b).

Sample conservation objectives for the wintering population of Greenland white-fronted geese of the Lough Corrib SAC have been taken from the River Shannon Callows SPA (NPWS, 2022).

Table 6.2: Examination of Potential Impacts to the Conservation Objectives of qualifying features of interest/special conservation interests

No. Ref	Attribute	Target	Assessment	Mitigation Required
Oligotrophic Isoetid Lake Habitat of Connemara Bog Complex SAC; Maumturk Mountains SAC & Lough Corrib SAC				
1	Habitat Area	Area stable or increasing, subject to natural processes	Given that the proposed development is located outside the examples of this lake habitat associated with the above listed SACs there will be no potential for the proposed development to result in changes to the area of Oligotrophic Isoetid Lake Habitat within these SACs.	No
2	Habitat Distribution	No decline, subject to natural processes.	The proposed development will not result in any direct impacts to lake habitats during either the construction, operation or decommissioning phase and will not have the potential to result in changes to their distribution.	No
3	Typical Species	Typical species present, in good condition, and demonstrating typical abundances and distribution	In the event that the proposed development results in the discharge of contaminated surface water runoff to lake habitats during either the construction, operation or decommissioning phase there will be potential for such pollutants to result in a change to the typical species support by these habitats.	Mitigation measures provided in Section 7
4	Vegetation composition: characteristic zonation	All characteristic zones should be present, correctly distributed and in good condition	In the event that the proposed development results in the discharge of silt-laden runoff to this habitat during either the construction, operation or decommissioning phase and contributes towards excessive loading of this habitat with sediment it will in turn have the potential to contribute towards changes in water colour and	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			transparency. Such changes can adversely affect the euphotic zone of lake habitats and vegetation occurring within this zone.	
5	Vegetation distribution: maximum depth	Maintain maximum depth of vegetation, subject to natural processes	The discharge of pollutants and particularly suspended solids during either the construction, operation or decommissioning phase will have the potential to change transparency and light conditions within the water column with the potential for consequent effects to the maximum depth at which vegetation can be supported.	Mitigation measures provided in Section 7
6	Hydrological regime: water level fluctuations	Maintain appropriate natural hydrological regime necessary to support the habitat	The potential for increased hydraulic loading is examined in Section 6.3.1.1 above. In the absence of mitigation measures such increases in loading will have the potential to undermine the achievement of the targets for this attribute.	Mitigation measures provided in Section 7
7	Lake substratum quality	Maintain appropriate substratum type, extent and chemistry to support the vegetation	The discharge of pollutants and particularly sediment and suspended solids during either the construction, operation or decommissioning phase, will have the potential to result in changes to lake substratum quality.	Mitigation measures provided in Section 7
8	Water quality: transparency	Maintain appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	The discharge of pollutants and particularly suspended solids during either the construction, operation or decommissioning phase will have the potential to change transparency and light conditions within the water column with the potential for consequent effects to the maximum depth at which vegetation can be supported.	Mitigation measures provided in Section 7
9	Water quality: nutrients	Maintain the concentration of	The examination provided in Section 6.1 to 6.4 above with respect to water quality and the release of suspended solids noted that in the	Mitigation measures

No. Ref	Attribute	Target	Assessment	Mitigation Required
		nutrients in the water column at sufficiently low levels to support the habitat and its typical species	event of the discharge of sediment and suspended solids to lake habitats, nutrients associated with such solids will have the potential to become mobilised in these habitats with resultant impacts to trophic status.	provided in Section 7
10	Water quality: phytoplankton biomass	Maintain appropriate water quality to support the habitat, including good chlorophyll a status	Any changes resulting from the effects considered under Attribute 9 above could also have the potential to undermine the targets of this attribute.	Mitigation measures provided in Section 7
11	Water quality: phytoplankton composition	Maintain appropriate water quality to support the habitat, including good phytoplankton composition status	Any changes resulting from the effects considered under Attribute 9 above could also have the potential to undermine the targets of this attribute.	Mitigation measures provided in Section 7
12	Water quality: attached algal biomass	Maintain trace/absent attached algal biomass (<5% cover) and good phytobenthos status	As changes resulting from the effects considered under Attribute 9 above could also have the potential to undermine the targets of this attribute.	Mitigation measures provided in Section 7
13	Water quality: macrophyte status	Maintain good macrophyte status	Any changes resulting from the effects considered under Attribute 9 above could also have the potential to undermine the targets of this attribute.	Mitigation measures

No. Ref	Attribute	Target	Assessment	Mitigation Required
				provided in Section 7
14	Acidification status	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	The release of excess sediment and particularly peat-derived sediment, to lake habitats during either the construction, operation or decommissioning phase could result in an increase in the discharge of low pH silt material to these lakes.	Mitigation measures provided in Section 7
15	Water colour	Maintain appropriate water colour to support the habitat	For reasons outlined for attribute no. 5 and 8 above the proposed development could lead to an increase in sedimentation within lake habitats with the potential for resultant changes to transparency in the water column.	Mitigation measures provided in Section 7
16	Dissolved organic carbon (DOC)	Maintain appropriate organic carbon levels to support the habitat	The release of excess peat-derived silts could result in an increase in DOC within the lake habitats downstream.	Mitigation measures provided in Section 7
17	Turbidity	Maintain appropriate turbidity to support the habitat	In the event that the proposed development results in the release of polluted surface water to watercourses during either the construction, operation or decommissioning phase, the project could result in an increase in sedimentation deposition within lake habitats	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			downstream. Increases in sedimentation could in turn increase turbidity within these lakes.	
18	Fringing habitat: area	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of the lake habitat	Any changes to pH levels within the lake habitat as outlined above could result in a change to the structure of fringing habitats.	Mitigation measures provided in Section 7
Otters of the Connemara Bog Complex SAC; Maumturk Mountains SAC; Lough Corrib SAC; Kilkieran Bay and Islands SAC				
19	Distribution	No significant decline	Adverse effects to water quality in receiving lake habitats, watercourse and coastal waters downstream of the project will have the potential to affect the distribution of otters. It is likely that the otter population of these SACs utilise these waterbodies and thus any adverse impacts to them could result in adverse effects the overall distribution of this species.	Mitigation measures provided in Section 7
20	Extent of terrestrial habitat	No significant decline	The proposed development will not result in the loss of any terrestrial habitat used by otters.	No
21	Extent of freshwater habitat (river)	No significant decline	As per attribute no. 19 above adverse impacts to water quality during either the construction, operation or decommissioning phase will have the potential to undermine the potential for waterbodies downstream of the project site to support otters.	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
22	Extent of freshwater habitat (lakes)	No significant decline	As per attribute no. 19 above adverse impacts to the water quality of lake habitats, watercourses or coastal waters downstream will have the potential to undermine its potential to support otters.	Mitigation measures provided in Section 7
23	Couching sites and holts	No significant decline	No breeding or resting sites for otters occur at or in the vicinity of the proposed development. As such the project will not have the potential to undermine this target.	No
24	Fish biomass	No significant decline	As per attribute no. 19 above the proposed development will have the potential to undermine water quality downstream and within waterbodies likely to be used by the SAC's otter population. Any adverse impacts to these waterbodies could result in a decrease in fish biomass (i.e. through mortalities resulting from a major pollution event) and undermine the target for this attribute.	Mitigation measures provided in Section 7
Atlantic salmon of the Connemara Bog Complex SAC; Maumturk Mountains SAC; Lough Corrib SAC;				
25	Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	The proposed development does not involve any instream works and in light of this it will not have the potential to result in barriers to the movement of Atlantic Salmon.	No
26	Adult spawning	Conservation Limit (CL) for each system consistently exceeded	Suitable spawning habitat for Atlantic salmon occurs downstream of the proposed development. In the event that the project results in the release of polluted surface water to the surrounding sub-catchment, during either the construction, operation or decommissioning phase,	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			the conditions of these spawning habitats could be undermined with adverse effects for achieving the target of this attribute.	
27	Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value.	In the event that the proposed development results in the release of polluted surface water downstream, during either the construction, operation or decommissioning phase, it could result in excessive sedimentation within suitable spawning habitat. Any negative impacts to spawning habitat within the lower stetches of watercourses downstream of the proposed development elements will, over time, have a resultant effect on the abundant of salmon fry.	Mitigation measures provided in Section 7
28	Out-migrating smolt abundance	No significant decline	In the event of a decrease in suitable spawning habitat as a result of the potential impact identified in attribute no. 26 & 27 above, there will be a potential population effect such that in subsequent years the number of smolt within the catchment could decrease.	Mitigation measures provided in Section 7
29	Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	For reasons outlined for attribute no. 26 & 27 above the project will have the potential to undermine this conservation objective.	Mitigation measures provided in Section 7
30	Water quality	At least Q4 at all sites sampled by EPA	In the event that the project results in the release of polluted surface water to watercourses, during either the construction, operation or decommissioning phase, the resulting pollution could cause a negative impact to biological water quality status downstream within the surrounding sub-catchments.	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
Lamprey Species of the Lough Corrib SAC				
31	Distribution (extent of anadromy for sea lamprey) &/or barriers to movement	Access to all watercourses down to first order streams for brook lamprey. Greater than 75% of main stem length of rivers accessible from the estuary.	Activities associated with the construction, operation and decommissioning phase of the wind farm will not have the potential to undermine this attribute. The proposed development will not result any barriers to the movement of lampreys throughout the Lough Corrib SAC. Given the absence of any physical interactions with watercourses of this catchment there will be no potential for the proposed development to result in a reduction in the distribution of lamprey species within the Lough Corrib SAC.	No
32	Population structure of juveniles	At least three age/size groups present	The preferred spawning habitat for lamprey is gravel-dominated substratum typical of eroding watercourses in the upper reaches of catchments. After hatching the larvae swim or are washed downstream and settle in areas of preferred juvenile habitat. The juvenile stage of the lifecycle of lamprey species is generally restricted to depositing freshwater and estuarine environments where the substratum supports areas of sandy silt. Suitable spawning habitat for lamprey species does not occur downstream of the proposed wind farm site along the Owenwee catchment and no lamprey were recorded during baseline electrofishing surveys (see EIAR Chapter 6). Nevertheless, the lake habitat at Lough Corrib at the outfall of the Owenwee River is representative of a depositing environment and is	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			considered to provide suitable juvenile habitat for lamprey species. In the event of negative effects to this lake habitat downstream as a result water quality impacts, the potential will exist for indirect impacts to the juvenile stage of this species.	
33	Juvenile density in fine sediment	Mean catchment juvenile density of at least 2/m^2 for brook lamprey and 1/m^2 for sea lamprey	As set out for attribute no. 32 above in the event of negative effects to juvenile lamprey habitat, the potential will exist for impacts to the density of juveniles occurring within suitable juvenile habitat downstream.	Mitigation measures provided in Section 7
34	Extent and distribution of spawning habitat	No decline in distribution and extent of spawning beds.	Given that no suitable spawning habitat for lamprey species occurs downstream of the proposed development, between it and the Lough Corrib SAC, there will be no potential for the construction, operation or decommissioning phase of the proposed wind farm to result in a decline in the extent or distribution of this habitat.	No
35	Availability of juvenile habitat	More than 50% of sample sites positive	Suitable juvenile habitat is likely to occur downstream at the Owenwee outfall to Lough Corrib and any deleterious inputs to this watercourse draining to the lake could have adverse implications for the status of juvenile habitats.	Mitigation measures provided in Section 7
White-clawed crayfish of the Lough Corrib SAC				

No. Ref	Attribute	Target	Assessment	Mitigation Required
36	Distribution	No reduction from baseline.	In the event that the proposed development causes pollution to the Owenwee River sub-catchment and Lough Corrib downstream, it could undermine the status of these waterbodies to support crayfish.	Mitigation measures provided in Section 7
37	Population structure: recruitment	Juveniles and/or females with eggs in all occupied tributaries.	In the event that the construction phase of the proposed development causes pollution to the Owenwee River sub-catchment and Lough Corrib downstream it will have the potential to undermine the population structure of crayfish occurring within these waterbodies downstream.	Mitigation measures provided in Section 7
38	Negative indicator species	No alien crayfish species.	The proposed development will not have the potential to result in the introduction of alien crayfish species. The proposed development will not result in any instream works or the use of any machinery, watercraft etc instream that could result in the spread of these non-native invasive species.	No
39	Disease	No instances of disease.	As per attribute no. 38 the project is not predicted to have the potential to result in the spread of crayfish disease within the catchment.	No
40	Water quality	At least Q3-4 at all sites sampled by EPA.	In the event that the proposed development causes pollution to the Owenwee River sub-catchment and Lough Corrib downstream, it will have the potential to adversely affect water quality downstream.	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
41	Habitat quality: heterogeneity	No decline in habitat heterogeneity or habitat quality.	In the event that the construction, operation or decommissioning phase of the proposed development results in the discharge of silt-laden surface water downstream to the Owenwee River sub-catchment or Lough Corrib downstream, it will have the potential to undermine crayfish habitat heterogeneity.	Mitigation measures provided in Section 7
***Najas flexilis* of the Lough Corrib SAC**				
42	Population extent	Restore the spatial extent of *Najas flexilis* within the lake, subject to natural processes	In the event that the proposed development results in the release of deleterious water emissions such as silt-laden, hydrocarbon laden or nutrient enriched waters during the construction, operation or decommissioning phase there will be potential for the proposed development to undermine the suitability of this habitat downstream at the Owenwee River outfall to the lake to support *Najas flexilis*. The release of silt-laden or nutrient enriched water emissions to Lough Corrib represents a threat to this species as such emissions have been identified as the principal threats to the conservation status of *Najas flexilis*. Such effects could contribute to an effective reduction in the extent of the *Najas flexilis* population occurring within this section of Lough Corrib.	Mitigation measures provided in Section 7
43	Population depth	Restore the depth range of Najas flexilis within the lake, subject to natural processes	In the event that the construction, operation or decommissioning phase of the proposed development results in the emission of contaminants to Lough Corrib, via the Owenwee River, it will have the potential to combine with other source of water pollution in the	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			catchment, to result in an increase in colour and reduction in transparency. Such changes could undermine the target of this conservation objective to restore the depth range of *Najas flexilis* within the lake.	
44	Population viability	Restore plant fitness, subject to natural processes	For the reasons outlined under attribute no. 42 above the proposed development will have the potential to undermine plant fitness should it occur in suitable habitat at Lough Corrib in the vicinity of the Owenwee River outfall to the lake.	Mitigation measures provided in Section 7
45	Population abundant	Restore the cover abundance of Najas flexilis, subject to natural processes	For the reasons outlined under attribute no. 42 above the proposed development will have the potential to undermine the population abundance of this species in suitable habitat at Lough Corrib in the vicinity of the Owenwee River outfall to the lake.	Mitigation measures provided in Section 7
46	Species distribution	Restore to at least the north-western bay, subject to natural processes	As per attribute no. 42 above the emissions of deleterious to Lough Corrib as a result of the proposed development will have the potential to undermine the restoration of this species in suitable lake habitat in the vicinity of the Owenwee River outfall to the lake.	Mitigation measures provided in Section 7
47	Habitat extent	Restore, subject to natural processes	For reasons outlined under attribute no. 42 and 46 above the proposed development will have the potential to undermine this conservation objective.	Mitigation measures provided in Section 7
48	Hydrological regime: water level fluctuation	Maintain appropriate natural hydrological regime necessary to	For reasons outlined under attribute no. 43 above the proposed development will have the potential to result in changes to the	Mitigation measures

No. Ref	Attribute	Target	Assessment	Mitigation Required
		support the habitat for the species	hydrological regime underpinning suitable habitat conditions for this species.	provided in Section 7
49	Lake substratum quality	Restore appropriate substratum type, extent and chemistry to support the population of the species	For reasons outlined for attribute no. 42 above, in the event that the proposed development results in the emissions of deleterious water emissions to the lake via the Owenwee River catchment there will be potential for it to undermine the suitability of lake substratum to support this species in the vicinity of the Owenwee River outfall to the lake.	Mitigation measures provided in Section 7
50	Water quality	Restore appropriate water quality to support the population of the species	For reasons outlined for attribute 42 above the proposed development will have the potential to contribute to undermining water quality at Lough Corrib in the vicinity of the Owenwee River outfall to the lake.	Mitigation measures provided in Section 7
51	Acidification status	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the population of Najas flexilis, subject to natural processes	The emissions of deleterious water emissions, as described in Section 6.3.1 above, from the proposed development to Lough Corrib via the Owenwee River catchment could contribute to changes in the acidification status of the lake with consequential adverse effects for this area of the lake to function as suitable habitat for *Najas flexilis*.	Mitigation measures provided in Section 7
52	Water colour	Restore/maintain appropriate water colour to support the population of Najas flexilis	For reasons outlined for attribute no. 42 above and particularly relating to any emissions of silt lade waters, the proposed development could contribute to a decrease in water colour in the vicinity of the Owenwee River outfall to the lake, thereby	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			undermining the potential suitability of this area of the lake to support *Najas flexilis*.	
53	Associated species	Restore appropriate associated species and vegetation communities to support the population of Najas flexilis	For reasons outlined under attribute no. 42 above the proposed development could undermine attempts to restore appropriate vegetation communities in the vicinity of the Owenwee River outfall to the Lough Corrib.	Mitigation measures provided in Section 7
54	Fringing habitat: area and condition	Maintain the area and condition of fringing habitats necessary to support the population of Najas flexilis	Given that the proposed development is located circa 1km from the lake habitat of Lough Corrib SAC it will not have the potential to result in changes to the area or condition of fringing habitat bounding the lake.	No
Reef habitat of the Kilkieran Bay and Islands SAC				
55	Distribution	The distribution of reefs remains stable, subject to natural processes.	The proposed grid connection route is located outside the SAC, along the existing R340 regional road and is buffered from the nearest example of reef habitat by approximately 40m. There will be no potential for the project to result in changes to the distribution of reef habitat within the SAC.	No
56	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	The proposed grid connection route is located outside the boundary of the SAC and does not involve any activities within the SAC that could result in the loss of reef habitat. There will be no potential for the grid connection route to result in a decrease in habitat area of this qualifying habitats within the SAC.	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
57	Community structure	Conserve the following community types in a natural condition: Intertidal reef community complex; Subtidal reef with echinoderms and faunal turf community complex; and Laminaria-dominated community complex.	Intertidal reef community complex occurs to the south of the proposed grid connection route. The discharge of inadequately treated surface water runoff from the grid connection route works area during the construction phase could result in the discharge of contaminants to coastal waters and contribute towards pollution of the receiving waterbody with resultant changes to the reef community supported by this habitat. Such changes in turn could lead to changes in the community structure supported by this reef habitat.	Mitigation measures provided in Section 7
Cormorant (Connemara Bog Complex SPA) Common Gull (Lough Corrib SPA; Lough Mask SPA; Lough Carra SPA) & Lesser-black Backed Gull (Lough Carra SPA)				
58	Breeding population abundance: apparently occupied nest (AONs)	No significant decline	Neither cormorant, common gull nor lesser-black backed gull have been recorded breeding at the proposed development site and do not rely upon it for foraging. The nearest point of the Lough Corrib SPA, which is the nearest of the four SPAs associated with these species is approximately 1km to the north. Given this separation distance and the findings of the ornithological assessment with respect to habitat loss, disturbance, displacement and barrier effects, the proposed development will not have the potential to affect number of apparently occupied nest sites for these species.	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
59	Productivity rate	No significant decline	As per the examination provided for attribute no. 58 above and set out in the ornithological assessment for the proposed development, the proposed development will not have the potential to result in a significant decline in the productivity rate of cormorant, common gull, or lesser-black backed gull.	No
60	Distribution breeding colonies	No significant decline	As per the examination set out above for attribute no. 58 no breeding colonies of cormorant, common gull or lesser-black backed gull occur at the proposed development site and is buffered from the nearest point of any of the three SPAs designated for these species by a distance of 1km. As such the proposed development will not have the potential to result in a significant decline in the distribution of breeding colonies of these species.	No
61	Prey biomass available	No significant decline	As set out in the ornithological assessment and summarised in Section 6.5 to 6.8 above the proposed development site is not relied upon by cormorant, common gull or lesser-black backed gull as a foraging habitat and the habitat occurring at the proposed development site is considered to be sub-optimal for these species. In light of these findings the project will not have the potential to result in a significant decline in the availability of prey biomass for these bird species.	No
62	Barriers to connectivity	Number. Location, shape, area	The potential for the proposed wind farm site to result in a barrier effect to cormorant, common gull and lesser-black backed gull has	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
			been examined as part of the ornithological assessment and the conclusions of this assessment are described in Sections 6.5 to 6.8 above. The ornithological assessment has concluded that the proposed wind farm site will represent an imperceptible, long-term effect for these species. Such an effect is not representative of a potential adverse effect to these species and will not have the potential to result in barriers to the movement of these species in the wider area surrounding the SPAs that support them.	
63	Disturbance at the breeding site	Level of impact	No breeding sites for cormorant, common gull or lesser-black backed gull occur at the proposed development site. The nearest point of any of the four SPAs that are designated for these species to the proposed development site is approximately 1km to the north. Given this separation distance there will be no potential for the proposed development to result in disturbance to the breeding sites of these bird species.	No
Merlin (Connemara Bog Complex SPA)				
64	Breeding population	No significant decline	Merlin have not been recorded breeding at the proposed development site and do not rely upon it for foraging. The nearest point of the Connemara Bog Complex SPA is approximately 4.5km to the west of the proposed development. Given this separation distance and the findings of the ornithological assessment with respect to habitat loss, disturbance, displacement and barrier effects, the proposed	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
			development will not have the potential to result in a significant decline to the breeding population of this species. It is also noted that the proposed wind farm site and the operational turbines, which represent the only possible collision risk to merlin, is located outside the 5km foraging range of the merlin population associated with this SPA. Furthermore, the ornithological assessment for the proposed wind farm has found that the collision risk posed by the proposed wind farm site to the general merlin population will be representative of a long-term, imperceptible effect. Such an effect is not representative of a potential adverse effect to these species and will not have the potential to result in a decline in the general merlin population occurring in the wider area surrounding the proposed development.	
65	Fledgling success	No significant decline	Given the findings set out in Section 6.5.2 above and those set out in the ornithological assessment for merlin, the proposed development will not have the potential to result in a significant decline in the fledgling success of the merlin population supported by this SPA.	No
66	Habitat quality and extent	Maintain the area of natural and semi-natural habitat used or potentially usable within the SPA subject to natural processes	The proposed development is located outside of the SPA, with the nearest area of construction works, associated with the installation of the grid connection route, being separated from the SPA by approximately 1km. As such the proposed development will not have	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
			the potential to undermine the habitat quality and extent within this SPA.	
Hen Harrier (Lough Corrib SPA)				
67	Roost attendance: individual hen harriers	No significant decline	No hen harrier were recorded roosting within the proposed development and the nearest point of this SPA from the proposed development is approximately 1km to the north. Given the absence of roost sites at the proposed development and this separation distance there will be no potential for the proposed development to result in any significant decline in the attendance of hen harrier at roost sites within this SPA.	No
68	Suitable foraging habitat	No significant decline	The ornithological assessment for the proposed wind farm has identified the potential for a loss of approximately 9.15 Ha of suitable foraging habitat for hen harrier. This has been identified as being representative of a long-term slight effect for the hen harriers. The ornithological assessment notes that there are no records of a hen harrier winter roost site occurring within 10km of the proposed wind farm and that similar foraging habitat for this species is common in the surrounding landscape. Given the widespread availability of such habitat in the wider surrounding the Lough Corrib SPA, the loss of c. 9.15 ha of suitable habitat at the wind farm will not be biologically significant for hen harriers and is not representative of a significant decline in the availability of suitable foraging habitat for this species.	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
69	Roost site: condition	The roost site should be maintained in a suitable condition	No roost sites occur within the proposed development site and the Lough Corrib SPA which is designated for its role in supporting winter roosts is separated from the nearest point of the proposed development by circa 1km. In addition, as noted in the ornithological assessment there are no records of a hen harrier winter roost occurring within 10km of the proposed wind farm site. Given this separation distance between the proposed development site and Lough Corrib SPA there will be no potential for the project to undermine the condition of roost sites occurring within the SPA.	No
70	Disturbance at the roost site	Human activities should occur at levels that do not adversely affect the Hen Harrier winter roost population	No roost sites occur within the proposed development site and the Lough Corrib SPA which is designated for its role in supporting winter roosts is separated from the nearest point of the proposed development by circa 1km. In addition, as noted in the ornithological assessment there are no records of a hen harrier winter roost occurring within 10km of the proposed wind farm site. Given this separation distance between the proposed development site, Lough Corrib SPA and the associated winter roost site for hen harrier there will be no potential for the project to result in disturbance to such winter roosts.	No
Golden plover (breeding at Connemara Bog Complex SPA; wintering at Lough Corrib SPA)				
71	Population trend	Long term population trend stable or increasing	Golden plover were recorded using the wind farm site only during the non-breeding season. The effects of habitat loss to golden plover	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
			as a result of the proposed wind farm site was assessed to be representative of a long-term and not significant effect. The collision risk posed by the proposed wind farm has been assessed to be representative of a long-term imperceptible effect, whilst the potential for disturbance during the construction or decommissioning phase and the operation phase was found to be representative of a temporary to short-term insignificant effect for the construction phase and a long-term insignificant effect. The potential for a barrier effect to golden plover during the operation phase of the wind farm was assessed to be representative of a imperceptible long-term effect. Given these findings of the ornithological assessment, the proposed development will not have the potential to result in any long-term decline in the population trend of breeding golden plover for the Connemara Bog Complex SPA and the wintering population of the Lough Corrib SPA. No golden plover were recorded relying on the proposed Peat Storage and Restoration (Habitat Enhancement) Area during non-breeding season habitat surveys and the storage of spoil at this location will not result in disturbance to this species during the construction phase. The enhancement of peatland habitat at the proposed Peat Storage and Restoration (Habitat Enhancement) Area during the operation phase along with the cessation of turbary activity in this area will	

No. Ref	Attribute	Target	Assessment	Mitigation Required
			have the potential to result in a long-term positive effect for the golden plover by providing suitable undisturbed peatland habitat for this species.	
72	Distribution	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	Given the findings of the ornithological assessment as set out in Section 6.5.3 and 6.6.2 and for attribute no. 71 above, the proposed development will not have the potential to result in any significant decrease in the distribution of golden plover within either the Connemara Bog Complex SPA or the Lough Corrib SPA.	No
Greenland white-fronted geese (Lough Corrib SPA)				
73	Winter population trend	Long term winter population trend is stable or increasing	Greenland white-fronted geese were no recorded using the wind farm site during the non-breeding season. The effects of habitat loss to Greenland white-fronted geese as a result of the proposed wind farm site was assessed to be representative of a long-term and imperceptible effect. The collision risk posed by the proposed wind farm has been assessed to be representative of a long-term imperceptible effect, whilst the potential for disturbance during the construction or decommissioning phase and the operation phase was found to be representative of a temporary to short-term imperceptible effect and a long-term imperceptible effect respectively. The potential for a barrier effect to Greenland white-fronted geese during the operation phase of the wind farm was assessed to be representative of a imperceptible long-term effect.	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
			Given these findings of the ornithological assessment, the proposed development will not have the potential to result in any long-term decline in the population trend of breeding golden plover for the Connemara Bog Complex SPA and the wintering population of the Lough Corrib SPA. No Greenland white-fronted geese were recorded relying on the proposed Peat Storage and Restoration (Habitat Enhancement) Area during non-breeding season habitat surveys and the storage of spoil at this location will not result in disturbance to this species during the construction phase. The enhancement of peatland habitat at the proposed Peat Storage and Restoration (Habitat Enhancement) Area during the operation phase along with the cessation of turbary activity in this area will have the potential to result in a long-term positive effect for the Greenland white-fronted geese by providing suitable undisturbed peatland habitat for this species.	
74	Winter spatial distribution	Sufficient number of locations, area, and availability (in terms of timing and intensity of use) of suitable habitat to support the population target	The proposed development will not result in a decline in any area of suitable habitat relied upon by Greenland white-fronted geese and as such will not have the potential to undermine the target for this attribute.	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
75	Disturbance at wintering site	The intensity, frequency, timing and duration of disturbance occurs at levels that do not significantly impact the achievement of targets for population trend and spatial distribution	No Greenland white-fronted geese sites occur at or in the vicinity of the proposed development and as set out under attribute no. 73 above the proposed development will not have the potential to result in disturbance to Greenland white-fronted geese at their wintering sites. As such the proposed development will not have the potential to undermine the target for this attribute.	No
76	Barriers to connectivity and site use	The number, location, shape and area of barriers do not significantly impact the wintering population's access to the SPA or other ecologically important sites outside the SPA	As set out under attribute no. 73 above the proposed development will not have the potential to result in a barrier to connectivity and use of wintering sites for Greenland white-fronted geese. As such the proposed development will not have the potential to undermine the target for this attribute.	No
77	Forage spatial distribution, extent and abundance	Sufficient number of locations, area of suitable habitat and available forage	As set out under attribute no. 73 and 74 above the proposed development will not have the potential to result in a reduction in the spatial distribution, extent and abundant of foraging for Greenland	No

No. Ref	Attribute	Target	Assessment	Mitigation Required
		biomass to support the population target	white-fronted geese and will not undermine the targets for this attribute.	
78	Roost spatial distribution and extent	Sufficient number of locations, area and availabilty of suitable roosting habitat to support the population targe	No Greenland white-fronted geese roost sites occur at or in the vicinity of the proposed development and the proposed development will not have the potential to result in a reduction of or disturbance to roost sites for this species.	No
79	Supporting habitat: area and quality	Sufficient area of utilisable habitat available in ecologically important sites outside the SPA	No Greenland white-fronted geese have been found to rely on the proposed development site and are not representative of ecologically important sites for Greenland white-fronted geese outside the boundary of the SPA. As such there will be no potential for the proposed development to undermine the target for this attribute.	No
Waterbirds (Lough Corrib SPA)				
73	Population trend	Long term population trend stable or increasing	Waterbirds were recorded using the wind farm site only during the breeding season. The effects of habitat loss to waterbirds as a result of the proposed wind farm site was assessed to be representative of a long-term and not significant effect. The collision risk posed by the proposed wind farm has been assessed to be representative of a long-term imperceptible effect, whilst the potential for disturbance during the construction or decommissioning phase and the operation phase was found to be representative of a temporary to short-term	Mitigation measures provided in Section 7

No. Ref	Attribute	Target	Assessment	Mitigation Required
			insignificant effect for the construction phase and a long-term insignificant effect. The potential for a barrier effect to waterbirds during the operation phase of the wind farm was assessed to be representative of an imperceptible long-term effect. Given these findings of the ornithological assessment, the proposed development will not have the potential to pose a risk of habitat loss, collision or barrier effects that could result in any long-term decline in the population trend of wintering waterbird populations of the Lough Corrib SPA. Potential water quality impacts to Lough Corrib have been set out in Section 6.3.1 above. In the event that the construction, operation or decommissioning phase results in pollution to the Owenwee catchment, it will have the potential (given the presence of a hydrological pathway) to undermine lake habitat conditions at Lough Corrib required to sustain waterbird populations. Pollution inputs that could result in long-term perturbation to water quality will over time have the potential to have a adverse impact on the long-term population trend of waterbirds supported by the section of Lough Corrib downstream of the proposed development.	
74	Distribution	No significant decrease in the range, timing or intensity of use of areas	Given the findings of the ornithological assessment as set out in Section 6.5.3 and 6.6.2 and for attribute no. 71 above, the proposed	Mitigation measures

No. Ref	Attribute	Target	Assessment	Mitigation Required
		by golden plover, other than that occurring from natural patterns of variation	development will not have the potential to result in any significant decrease in the distribution of waterbird population of the Lough Corrib SPA.	provided in Section 7
Wetlands (Lough Corrib SPA)				
75	Habitat area	The permanent area occupied by the wetland habitat should be stable	The wetland habitat of the Lough Corrib SPA are buffered from the proposed development by a distance of circa 1km and there will be no potential for the proposed development to result in a reduction in the area of wetland habitat supported by the SPA. The proposed development will have the potential to result in perturbations to water quality within wetland habitats, such as lake habitats, of the SPA. These water quality effects have been identified above (see examination of impacts to the conservation objectives of Oligotrophic Isoetid Lake Habitat and Section 6.3.1 above) and mitigation measures will be implemented to protect water quality downstream and avoid adverse effects to such wetland habitats.	No

7 MITIGATION MEASURES

The mitigation measures required to safeguard European Site qualifying features of interest from adverse effects have been identified in Section 6 above and relate to mitigating the potential for the proposed development to result in perturbations to water quality and downstream effects to qualifying feature receptors. Whilst the examination of the potential impacts posed by the proposed development to the conservation objectives of special conservation interests did not identify the potential for lighting emissions from proposed turbines to adversely affect specific conservation objectives, the potential for lighting effects to birds has been identified in Sections 6.5 and 6.8 above. As such mitigation measures are also outlined for the operation phase of the proposed wind farm site with respect to the lighting design to be provided.

Targeted mitigation measures are provided to safeguard against the potential adverse effects to the Annex 1 habitats and the Annex 2 species identified as requiring mitigation in Table 6.2 above. The measures to be implemented to protect the water quality downstream of the proposed development and within European Sites are outlined in the following sub-sections. These measures shall be implemented by the contractor appointed for the construction and decommissioning phase, in consultation with the appointed Ecological Clerk of Works (ECoW) so that the sensitive receptors of these European Sites are safeguarded and pathways connecting the project site to these receptors are eliminated as potential impact pathways.

The Ecological Clerk of Works (ECoW) will be appointed to supervise the works and to ensure that all biodiversity receptors are protected during the construction and decommissioning phase. The ECoW will be appointed to ensure that habitat restoration and enhancement activities are implemented as planned, and to advise on any environmental or ecological aspect of the works. The ECoW will inspect habitat and ditches/water courses during the construction phase and during habitat restoration works and will be in charge of water quality monitoring throughout the construction phase. The ECoW will be the first point of contact with the NPWS if required.

All operation phase mitigation measures will be required to be implemented by site management during the operation phase of the proposed development. A project ecologist will be appointed for the operation phase to supervise the ongoing implementation, management and monitoring of peatland habitat management and enhancement measures. These measures are set out in Tullaghmore Wind Farm Habitat Management Plan (provided as part of the EIAR) and will be implemented throughout the lifetime of the proposed wind farm.

7.1 WIND FARM SITE EARTHWORKS

Mitigation measures to avoid the potential for adverse impacts arising from earthworks and management of spoil will comprise:

- Management of excavated material will adhere to the measures related to the management of temporary stockpiles as set out in Section 7.1.2 below.

- No permanent or semi-permanent stockpiles will remain on the Site during the construction decommissioning or operational phase of the Development. Spoil to be taken off site to the designated spoil storage area near Maam Cross

- Construction activities will not be carried out during periods of sustained heavy rainfall events[4], or directly after such events. This will allow sufficient time for work areas to drain excessive surface water loading and discharge rates to be reduced

- Following heavy rainfall events, and before construction works recommence, the Site will be inspected to confirm that conditions are suitable for construction activities to recommence.

- An emergency response plan has been prepared as part of the CEMP and SWMP for the proposed development, both of which are provided under separate cover as part of the planning application documentation associated with the EIAR. All measures outlined in the ERP will be implemented throughout the construction phase of the project. This plan includes for 24-hour advance meteorological forecasting linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded such as a very heavy rainfall at >25mm/hr, planned responses will be undertaken. These

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[4] As per the Met Office National Meteorological Library and Archive Fact Sheet 3 – Water in the atmosphere (Met Office, 2012) a heavy rainfall event for: rain (other than in showers) is assigned to an event where rates of accumulation are greater than 4mm/hour; and for rain showers is assigned to an event where rates of accumulation are >10mm/hour.

responses will include cessation of construction until the storm event, including storm runoff has ceased

- Sediment fencing will be erected along proximal and paralleling areas of watercourses, such as along the Owenwee River and other first order tributaries occurring within the proposed wind farm site, channels and drains spanned by the works to reduce the potential for sediment laden run-off to reach sensitive receptors

- No direct flow paths between stockpiles and watercourses will be permitted at the Site

- Excavated material will be backfilled and transported to the spoil storage area as soon as is reasonably practicable to prevent long duration storage at the Site which increases the risk of adverse effects on aquatic environments

- All mitigation measures related to surface water quality will be implemented before excavation works commence.

7.2 TEMPORARY STOCKPILE MANAGEMENT FOR WIND FARM SITE WORKS

Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, which will also reduce the requirements to stockpile soils. Generally excavated rock will be used immediately for Site Access Track construction. Topsoil and peat will be transported to the proposed spoil storage area and PMEA. Whenever possible stockpiles will be avoided. Stockpiles of rock on peat soils will be avoided to prevent instability. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas which have been assessed for stability by a suitably experienced geotechnical engineer.

7.3 EXCAVATION REQUIREMENTS FOR THE PROPOSED GRID CONNECTION ROUTE

The following mitigation measures will be implemented during excavations for the proposed grid connection route:

- The timing of grid connection cable laying will be carried out during metrologically dry seasons/periods.

- An Ecological Clerk of Works (ECoW) will be onsite in order to lessen environmental disruption and ensure site integrity is maintained. The ECoW will also be responsible for routine environmental monitoring and report writing.

- excavated material will be temporarily stockpiled adjacent to the section of trench, with appropriate material used as backfill.

- Excess/unsuitable material will be immediately removed and disposed at a licenced waste disposal facility.

- Appropriate siltation measures, as per the measures set out in the subsequent sections below will be put in place prior to excavations.

- Stockpiles will be temporarily stored a minimum of 25m back from rivers/streams on level ground with a silt barrier installed at the base.

- For all grid connection trenching along the local road, any unsuitable backfill material excavated will be immediately taken away from the works area in trucks and disposed of under license to an authorised waste disposal facility. This will prevent any contaminated run-off to roadside drains during heavy rainfall.

7.4 EXCAVATION DEWATERING REQUIREMENTS FOR THE WIND FARM SITE

The following mitigation measures will be implemented for dewatering activities at the wind farm site:

- Areas of peat and subsoils to be excavated will be drained ahead of excavation works. This will reduce the volumes of water encountered during excavation works and will therefore reduce the volume of water that is required to be dewatered whilst excavations are being carried out.

- Engineered drainage and attenuation features outlined in the Surface Water Management Plan attached in Appendix 1 will be established ahead of excavation works

- Dewatering pumping rates will be controlled by an inline gate valve or similar infrastructure which will facilitate a reduction of loading on the receiving environment, thus enhancing the attenuation and settlement of suspended solids

- The direct discharge of dewatered loads to surface waters will not be permitted under any circumstances

- All dewatering will follow a strict procedure of pumping to a settlement tank and then to a dewatering bag, or settlement ponds prior to discharging to receiving environment for overland flow

- Geofabric lined settlement ponds will buffer the run-off discharging from the drainage system which will reduce the hydraulic loading to watercourses. Settlement ponds will be designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. In areas of the Site where the placement of settlement ponds is not feasible, other mitigation measures described below will be implemented

- Check Dams will be constructed across drains and will reduce the velocity of run-off which will in turn promote settlement of solids upstream of potential surface water receivers. An additional benefit of check dams is that they will reduce the potential for erosion of drains. Rock filter bunds may be used for check dams, wood or hay bales can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately down gradient of construction areas

- Overland flow paths of the final dewatered discharge will be maximised to the greatest practical extent to avoid prematurely draining to drainage channels or surface waters. This approach will allow for enhanced settling out of suspended solids entrained in the run-off

- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated

- Sediment fencing will be installed up gradient of water courses which may receive the final overland flow

- The final treated dewatered discharge will be directed towards heavily vegetated areas to allow for further natural filtration of suspended solids

- A programme of water quality monitoring will be implemented during the construction phase which is outlined in detail in Section **Error! Reference source not found.**

- No extracted or pumped water will be discharged directly to the surface water network associated with the Site (this is in accordance with Local Government (Water Pollution) Act 1977 as amended)

- Any discharges of sediment treated water will meet the requirements of the Surface Water Regulations 2009, as amended.

7.5 WATERCOURSE CROSSINGS

7.5.1 Wind Farm Site

At the wind farm site, two new watercourse crossings / culverts will be constructed as part of facilitating access to the proposed turbines T4 and T5. Both of the required crossings are across small streams that are headwaters of the Owenree River, the locations of the proposed crossings and proposed designs are mapped on Figure 9.7 in Volume III of the Tullaghmore Wind Farm EIAR and are reproduced in Appendix 2 of this Natura Impact Statement. It is noted that the small stream which will require crossing for access to the T4 turbine position was consistently dry during baseline water quality monitoring (As described in Chapter 9 of the Tullaghmore Wind Farm EIAR) and it is therefore considered to be an ephemeral stream which may not be in flow during the time at which the construction of a crossing is required. However, the following measures provide for the planning and consideration of this watercourse as part of the overall approach to watercourse crossing to ensure potential impacts are adequately mitigated.

A confirmatory assessment in terms of bridge or culvert design will be carried out that will have cognisance to both locations including the characteristics of water flow at both locations. The proposed crossing locations will be situated relatively near the headwaters of both of these small streams. As a result, bridge or culvert specification and construction are envisaged to be of relatively low significance in terms of expected flow and culvert diameter. As per details set out above the following design measures have been implemented for the watercourse crossings to ensure any potential impacts of the proposed watercourse crossings are minimised:

- The design of the proposed crossings and a method statement for the proposed construction will be agreed in advance with Inland Fisheries Ireland (IFI)

- Crossings have been designed to minimise in so far as practical the disturbance or alteration of water flow, erosion and sedimentation patterns and rates

- Vehicles and plant used in the construction of the proposed crossings will only be refuelled at the Sites bunded and designated refuelling area, no refuelling will be permitted within 50m of any watercourse at the Site

- To mitigate against the potential risk of accidental leaks or spillages from plant and equipment the following measures will be implemented: Multiple spill kits will be maintained on the Site at all times within the cabs of vehicles and placed strategically at environmentally sensitive locations across the Site. Spill kits will be routinely inspected to ensure that they are fully stocked with oil absorbent booms and pads at all times. Oil absorbent booms will be installed downstream of channel crossing work areas within 25m of the works location prior to the commencement of works.

7.5.2 Grid Connection Route

The proposed grid connection route includes the construction of 17 no. watercourse crossings by means of crossing existing culverts.

These 17 watercourse crossings relate to the crossing of an already installed culvert crossing i.e. the cable route is crossing the culvert. This will involve excavating at the culvert location, exposing the culvert, installing the cable duct and reconstructing and reforming the overburden and road formation over the culvert location. The following mitigation measures will be implemented during the installation of the grid connection route over existing the 17 no. existing culverts and watercourse crossings:

- Excavated road and soil will be stored in an area at least 10m from the crossing structure and watercourse, and preferably down gradient of the watercourse crossing but up-gradient of the excavated trench so that after rainfall, material in run-off is contained in the trench.

- Silt fencing and silt capture structures such as straw bales will be deployed along either side of a watercourse crossing beyond the full width of the pipe, culvert or bridge structure. Silt fencing will be installed so that the wooden posts and attached fence is buried at least 300mm below the surface of road-side vegetation.

- Gullies that lead directly to a watercourse either side of a structure are key pathways for run-off conveyance and these will be blocked to ensure that the direction of potential run-off is conveyed to vegetated verges to allow for infiltration and trapping.

- A pre-emptive site drainage management plan will be applied to take account of predicted rainfall so that large excavations adjacent to watercourse crossing can be suspended or scaled back when heavy rain is forecast.

These measures will prevent the run-off of excess sediments via the key watercourses intersecting the cable route to key adjoining downstream watercourses that connect the crossing points to European Sites and sensitive aquatic receptors. The mitigation measures also will apply to any small drains that represent a pathway for conveyance of sediment to watercourses and qualifying Annex 1 lake habitats of SACs and SPAs downstream of the proposed development.

7.6 HORIZONTAL DIRECTIONAL DRILLING

The following mitigation measures to reduce potential impacts associated with horizontal directional drilling will be implemented:

- Clearbore, which is not toxic to aquatic organisms and is biodegradable will be the drilling fluid used.
- Mud mixing will be monitored to suit the ground conditions encountered.
- The drilling fluids will be constantly monitored, any changes required to the mix will be performed on site by specialised HDD Contractor upon consultation with the drilling fluid supplier and Environmental Clerk of Works.
- Mud testing equipment will be available at all times during drilling operations to monitor key mud parameters.
- All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages.
- Spill kits, including an appropriate hydrocarbon boom will be available on the site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use.
- All plant, materials and wastes will be removed from site following the HDD works.
- The launch pit will be reinstated to the original land surface condition and the normal duct trench will continue from this point.
- Should any dewatering be required, it will be carried out in accordance the CEMP provided in Appendix 1.
- Test pits and boreholes will not be located directly on, or extend through, the proposed alignment, as these weak points may serve as conduits where inadvertent fluid returns

or frac outs could occur. At least a 3m offset will be provided between the boreholes and pipe alignment.

7.7 RELEASE & TRANSPORT OF SUSPENDED SOLIDS

The following mitigation measures will be implemented at the wind farm site during the construction and decommissioning phase to prevent the release and transport of silt-laden surface water runoff:

- Collector drains and soil berms will be implemented to direct and divert surface water runoff from construction areas such as temporary stockpiles into established settlement ponds, buffered discharge points and other surface water runoff control infrastructure. This planning and placement of these control measures will be of fundamental importance, especially for the areas where works within the 50m buffer zone of surface waters and significant drainage features.

- Sediment control fences will be implemented significantly upgradient of potential receiving waters and as part of the drainage network. Sediment control fences will also be established upgradient of the Sites pre-existing natural and artificial drains in addition to degraded areas of peat that are likely to receive surface water runoff. This practice will reduce the potential for elevated suspended solids entrained in surface water runoff to discharge to surface waters

- Multiple silt fences will be used in drains discharging to the surface water network. This will be especially important for the areas where works within the 50m buffer zone of surface waters and significant drainage features.

- A dedicated silt fence will be established along all sections of the wind farm access track that are with the 50m buffer zone of the Owenwee River and its upper tributaries.

- The drainage, attenuation and other surface water runoff management systems will be installed prior to the commencement of construction activities. Whenever possible, drainage and attenuation control measures will be installed during seasonally dry conditions to limit the potential for sediment laden run-off to discharge to surface waters during the installation of these measures

- Surface water runoff will be discharged to land via buffered drainage outfalls that will contain hardcore material of similar composition to the geology of the bedrock at the Site. This mitigation measure will promote the capture and retention of suspended sediment

- Buffered drainage outfalls also promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to adjacent watercourses and avoiding direct discharge to the watercourse

- Buffered drainage outfalls will be placed outside of the 50m buffer zone and will not be positioned in areas with extensive erosion and degradation

- A relatively high number of discharge points will be established to decrease the loading on any one particular outfall

- Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points

- A CEMP has been developed which will mandate regular inspections and maintenance of pollution control measures. Contingency measures outlining urgent protocols to repair or backup any breaches of designed mitigation measures are also be incorporated into the CEMP (Appendix 1)

- In the event that mitigation measures are failing to reduce suspended solids to acceptable levels, construction works will cease until remediation works are completed

- Fine solids or colloidal particles are very slow to settle out of waters, coagulant or flocculant will be used as appropriate to promote the settlement of finer solids prior to discharging to surface water networks. Flocculant gel blocks can be placed in drainage channels, these are passive systems that are self-dosing, self-limiting and are environmentally friendly. Flocculant gel blocks bind elevated levels of silt and associated contaminants into masses that are easily separated, captured and then removed from the water

- Surface water runoff controls will be checked and maintained on a daily basis. Check dams and settlement ponds will be maintained and emptied prior to the build-up of excessive sediment. The frequency of maintenance and emptying will be dictated by levels of sediment accumulation.

The adoption of precautionary principles and the implementation of mitigation measures listed above will ensure that the risk of elevated suspended solids to surface waters is low. This in turn will ensure that potential risks to sensitive receptors is also low. Nevertheless, should a significant discharge of suspended solids to surface waters occur, the absence of immediate proximity to designated sites and the assimilative capacity of the localised surface waters will act as a natural hydrological buffer in terms of suspended solids loading. Should such a discharge occur, the dilution and retention time of suspended solids in the localised surface water network will reduce potential impacts on highly sensitive downstream designated sites. It should be noted that this natural mitigation measure is not to be adopted as a first principle and will not be relied upon to prevent adverse impacts on designated sites.

A detailed design of required drainage, collector drainage, stilling ponds and other listed mitigation infrastructure is contained in the Surface Water Management Plan contained in the CEMP (Appendix 1).

7.8 RELEASE OF HYDROCARBONS

The following mitigation measures will be implemented during all construction and decommissioning phase works for the proposed development to prevent the release and transport of hydrocarbons to receiving surface waters:

- Refuelling of vehicles will be carried out off site to the greatest practical extent. This refuelling policy will mitigate the potential for impacts by avoidance. Due to the remote location nature of the Site, it is unlikely that implementation of this refuelling policy will be practical in all circumstances. In instances where refuelling of vehicles on Site is unavoidable, a designated and controlled refuelling area will be established at the Site. The designated refuelling area will enable low risk refuelling and storage practices to be carried out during the works. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:

- The designated refuelling area will be located a minimum distance of 50m from any surface waters or Site drainage features
- The designated refuelling area will be bunded to 110% volume capacity of fuels stored at the Site
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip site
- Any minor spillage during this process will be cleaned up immediately
- Vehicles will not be left unattended whilst refuelling
- All machinery will be checked regularly for any leaks or signs of wear and tear
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. To mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the Development. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard

- Spill kits will also be available at construction areas such as at turbine erection locations, the temporary site compound, on-site substation, spoils storage areas and met mast location etc.

- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter

- Should an accidental spill occur during the construction or operational phase of the Development, such incidents will be addressed immediately, this will include the cessation of works in the area of the spillage until the issue has been resolved

- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators

- No materials, contaminated or otherwise will be left on the Site

- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site

- A detailed spill response plan is provided as part of the CEMP.

Implementation of the above mitigation measures will significantly reduce the risk of hydrocarbon contamination being released to the surface water network. Nevertheless, the potential risk cannot be entirely eradicated. Therefore, precautionary measures and emergency response protocols have been prepared and are provided as part of the CEMP.

7.9 RELEASE OF CEMENTITIOUS MATERIALS

The following mitigation measures will be implemented during all construction and decommissioning phase works for the proposed development to prevent the release and transport of cementitious material to receiving surface waters:

- The procurement, transport and use of any cement or concrete will be planned fully in advance and supervised by appropriately qualified personnel at all times

- Vehicles transporting cement or concrete to the Site will be visually inspected for signs of excess cementitious material prior to being granted access to the Site. This will prevent the likelihood of cementitious material being accidentally deposited on the Site Access Tracks or elsewhere at the Site.

- Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants

- Precast concrete will be used wherever possible, although the use of pre-cast concrete is not viable option for large structures such as Turbine foundations and so concrete will be delivered to the Site

- Concrete will not be poured during periods of rainfall or if any kind of precipitation is forecast. This policy will limit the potential for freshly poured concrete to adversely impact on surface water runoff.

- Raw or uncured waste concrete will be disposed of by removal from the Site

- Washout of concrete trucks shall be strictly confined to the batching facility and shall not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the Temporary Site Compound

- Spill kits will be readily available to Site personnel, and any spillages or deposits will be cleaned up as soon as possible and disposed of appropriately

- Pouring of concrete into standing water within excavations will be avoided

- Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place

- Any surplus concrete will not be stored or deposited anywhere on Site and will be returned to the source location or disposed of appropriately at a suitably licensed facility

- Any required shuttering installed to contain the concrete during pouring will be fully secured around its perimeter to minimise any potential for leaks.

7.10 PEAT STORAGE AND RESTORATION (HABITAT ENHANCEMENT) AREA

All existing drainage channels draining the proposed Peat Storage and Restoration (Habitat Enhancement) Area and draining to Loughanilluan to the north and Lough Arrderry to the south will be blocked prior to the commencement of works in this area. The blocking of these drains will contribute to the peatland habitat enhancement objectives of the Habitat Management Plan as well as eliminating the potential for the conveyance of surface water runoff and silt-laden runoff from this area to Loughanillaun or Lough Arrderry to the south.

All works associated with the proposed Peat Storage and Restoration (Habitat Enhancement) Area and the ongoing management and rehabilitation of blanket bog habitat at this area will be completed in accordance with the details set out in the Tullaghmore Wind Farm Habitat Management Plan, provided under separate cover as part of the Tullaghmore Wind Farm EIAR documentation.

7.11 HAUL ROUTE WIDENING

All mitigation measures set out in Section 7.7 to 7.9 above with respect to the control of suspended solids, hydrocarbons and cementitious materials will be implemented in full, wherever applicable, during the construction works associated with the widening of the haul route at the four no. locations.

Management of spoil arising at the widening locations will be undertaken in accordance with the approach to spoil management set out for the wind farm site (Section 7.1 & 7.2) and grid connection route (Section 7.5), as applicable to the widening location.

7.12 WATER QUALITY MONITORING

The following water quality monitoring will be implemented to mitigate against potential impacts on the surface water receiving environment:

- A programme of water quality monitoring outlining the selected parameters and monitoring frequency will be agreed with Inland Fisheries Ireland and Galway County Council prior to the commencement of construction

- In order to assist in the detection of any deviations from the baseline hydrochemistry conditions at the Site, regular periodic monitoring of the Sites surface waters will be carried out prior to and during construction

- It is proposed that a programme of operational phase water quality monitoring is also implemented at a monitoring frequency agreed with Galway County Council in order to aid the detection of any potential operational phase impacts on surface water quality

- As a minimum requirement, field measured parameters such as pH, conductivity, total dissolved solids (TDS), temperature, dissolved oxygen (DO) and turbidity will be included in the water quality monitoring programme. The results will be compared to the applicable EQS to determine if adverse impacts on water quality are occurring

- Water quality will be monitored for trace metal concentrations prior to, during and after the construction phase

- Water quality monitoring locations will include both upstream and downstream points relative to the works locations. The locations of the water quality monitoring points will be flexible and will be moved as the construction phase progresses so that monitoring points remain representative of the most likely construction impact receptor points

- The watercourses within and adjacent to the proposed spoil storage area will be included within the water quality monitoring programme

- The downstream monitoring locations will be positioned as close as possible downstream of the works location and another positioned further downstream. This approach will allow for an assessment of the dilution of potential contaminations (if present) as the distance from the point of diffuse source location increases

- Watercourses which do not have year round flows such as artificial drains, ditches or ephemeral streams will be avoided as water quality monitoring locations

- During the construction phase, daily visual inspections of excavations, dewatering procedure, settlement ponds, silt traps, buffered outfalls and drainage channels etc. will be carried out by a suitably qualified person. Any excess build-up of sediment at settlement ponds, drains or at any other drainage features that may decrease the effectiveness of the drainage feature will be promptly removed

- During the construction phase of the Development, all development areas will be monitored on a daily basis for evidence of groundwater seepage, water ponding and wetting of previously dry spots

- Following the completion of the construction phase, inspection of silt traps, buffered outfalls and drainage channels will be periodically inspected during maintenance visits to the Site when the operational phase water quality monitoring will also be carried out

- During both the construction and operational phases of the Development, the proposed watercourse crossings discussed in Section **Error! Reference source not found.** will be monitored daily during construction and during each Site visit during the operational phase. The water course crossings will be monitored in terms of their impacts (if any) on the receiving watercourses and in terms of their structural integrity to identify any signs of erosion or potential for sediment release

- It is proposed that a handheld turbidity meter is available at the Site to accurately measure the quality of water discharging from the Site. The meter will be maintained and calibrated frequently.

- A detailed inspection and monitoring regime to be agreed with Inland Fisheries Ireland and Galway County Council will be included in the CEMP.

- Any discharges of sediment treated water will meet the requirements of the Surface Water Regulations 2009, as amended.

7.13 AVOIDANCE OF DISTURBANCE TO SPECIAL CONSERVATION INTEREST BIRD SPECIES

The following mitigation measure will be implemented to avoid disturbance to special conservation interest bird species of surrounding SPAs, in the event that they are found to rely on the Development site prior to or during the construction phase. Pre-construction surveys and ongoing construction phase bird monitoring will be completed to identify the presence of special conservation interest bird species at the Development site. In the event that wintering special conservation interest bird species of surrounding SPAs, such as golden plover or Greenland white-fronted geese are found to rely on the Development site during the construction phase, works will be restricted from the areas that are being relied upon by these species. A buffer area of 100m and 150m will be established around areas that have been identified as being relied upon by wintering populations of golden plover or Greenland white-fronted geese. These distances are line with the minimum approach distances for these species, as published by Livezey et al. (2016).

A re-confirmatory survey (March/April) will be conducted of the proposed wind farm site and peat storage and restoration (habitat enhancement) area to assess any evidence of activity or occupation of new territories by breeding of special conservation interest (breeding) bird species. Should any nesting locations for these species be recorded, works at these locations will be restricted to outside the breeding season (March 1st to August 31st inclusive) or until chicks are deemed to have fledged (following monitoring).

7.14 EMERGENCY RESPONSE

Mitigation measures outlined in the previous sections of this chapter will significantly reduce the potential for contamination of surface water or groundwater associated with the Development. Nevertheless, as is the case with all construction projects, a risk of accidental chemical spillages, sediment overloading of control measures or leaks of contaminants from plant or equipment remains a possibility. Emergency response procedures to potential contamination incidents have been prepared as part of the CEMP and will be implemented at the Site prior to the commencement of the construction phase. The following is a non-exhaustive list of potential emergencies and respective emergency responses:

- Spill or leak of hazardous substances (less than 20 litres);

- All spill incidents will be dealt with immediately as they arise

- Spill kits will be prepared and available in vehicles associated with the construction phase of the Development

- Spill kits will also be prepared and made available at primary work areas such as at proposed turbine, hardstand, substation, met mast and construction compound locations

- Disposal receptacles for hydrocarbon contaminated materials will also be available at the Site

- Major spill of hazardous or toxic substance off Site or to environmentally sensitive areas:

    - Immediate escalation measures will be implemented for all major spill events

    - Escalation measures may include installation of temporary sumps or drains to control the flow or migration of hydrocarbons or other chemicals

    - Attempts to be made to limit or contain the spill using sandbags to construct a bund wall, use of absorbent material, temporary sealing of cracks or leaks in containers, use of geotextile or silt fencing to contain the spill

    - Excavation and disposal of contaminated material will be immediately carried out following any such incidents

    - Evacuation procedures will be implemented to remove non-essential personnel from the area

    - Data gathering and an investigation will commence immediately after the emergency is contained

    - If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer will have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill

  - All major spills of this nature will be reported to Galway County Council immediately following such instances.

- Flooding of low-lying areas of the Site:

  - Immediately remove all chemicals, fuels and other hazardous substances from low lying areas of the Site
  - Immediately remove plant and equipment from low lying areas
  - Recover materials washed from Site including sediment and other waste
  - Review and address the potential for excess water entering the Site
  - Review and maintain erosion and sedimentation controls.

- Spills of cementitious material:

  - Cement / concrete contamination incidents will be cleaned up immediately as they arise
  - Spill kits will also be established at key construction areas and they will also be readily available in the cabs of plant and equipment
  - Suitable receptacles for cementitious materials will also be available at the Site.

7.15 HYDRAULIC LOADING DURING THE OPERATION PHASE

The proposed wind farm will lead to an increase in impermeable surface area through the construction of hard stand areas within the Site. This in turn will lead to an increase in hydraulic loading by surface water runoff. However, water balance calculations indicate that the worst-case net increase in surface water runoff volumes will be approximately 1,117 m^3/month, or 0.38% relative to the area of the Site, therefore this is considered an imperceptible, or not significant impact.

As a consequence of the estimated low significance of the impact of hydraulic loading during the operational phase, mitigation measures to facilitate a reduction in surface water runoff are limited to ensuring that pre-existing and newly established drainage infrastructure is sufficiently maintained for the discharge rates associated with all areas of the Site. Any and all blockages which may adversely impact upon the drainage regime at the wind farm site will be immediately removed during the operational phase of the proposed Development. No other additional impacts are anticipated during the operational phase of the Development.

7.16 TURBINE LIGHITNG DURING THE OPERATION PHASE

The use of "white lights" on the turbines will be avoided as these can attract night flying birds such as migrants. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where required by the IAA. Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

8 EVALUATON OF MITIGATION MEASURES

The mitigation measures and environmental safeguards outlined above for the construction phase of the project are taken from established best practice guidelines that have been successfully implemented for a wide range of project-level infrastructural developments. These measures have undergone extensive and rigorous monitoring for their effectiveness at development sites where they have previously been applied to ensure adverse environmental impacts are avoided.

It is further noted that the range of mitigation measures outlined in this NIS and the associated Tullaghmore Wind Farm EIAR to avoid perturbations to European Site receptors occurring within the zone of influence of the project have been successfully implemented for a range of other wind farm development projects in Ireland.

The results of this monitoring and the proposal of these measures as standard best practice guidelines is based upon their high degree of success in ensuring negative environmental impacts are avoided.

The best practice guidance that have informed the mitigation measures and environmental safeguards proposed in this NIS and that will be adhered to throughout the construction, operation and decommissioning of the proposed development include:

- The Good Practice Guidance notes proposed by EA/SEPA/EHS:
- PPG 1: Understanding your environmental responsibilities - good environmental practices
- GPP 2: Above ground oil storage tanks
- PPG 3: Use and design of oil separators in surface water drainage systems
- GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer
- GPP 5: Works and maintenance in or near water
- PPG 6: Working at construction and demolition sites
- PPG 7: Safe storage - The safe operation of refuelling facilities
- GPP 8: Safe storage and disposal of used oils
- GPP 8: Safe storage and disposal of used oils
- GPP 8: Safe storage and disposal of used oils
- GPP 19: Vehicles: Service and Repair
- GPP 21: Pollution incident response planning
- GPP 22: Dealing with spills
- GPP 26 Safe storage - drums and intermediate bulk containers
- PPG 27: Installation, decommissioning and removal of underground storage tanks
- CIRIA Environmental Good Practice on Site.
- CIRIA Control of Water Pollution from Construction Sites. Technical Guidance C648.
- CIRIA SuDS Manual Technical Guidance C697.
- Development on Unstable Land. Department of Environment (DOE), UK.

9 CONCLUSION

This Natura Impact Statement presents an analysis of the potential for the proposed development to result in adverse impacts to eight European Sites and their relevant qualifying features of interest as set out in Table 5.1 above. An evaluation of the potential impacts that could arise as a result of the proposed development to these qualifying features of interest and their conservation objectives has been completed.

During the evaluation of potential impacts associated with the proposed development it was found that the project will not have the potential to undermine the conservation objectives of the four SPAs and their relevant special conservation interests occurring within the zone of influence of the development.

The proposed development has been identified as having the potential to result in adverse effects to the relevant qualifying features of interest of the four SACs occurring within the zone of influence of the development (see Table 5.1 and Table 6.2).

A range of mitigation measures have been prescribed that once implemented in full will remove the risk of adverse effects posed by the proposed development to these qualifying features of interest.

Based upon the information provided in this NIS, it is the considered view of the authors of this NIS that it can be concluded by Galway County Council that the project will not, alone or in-combination with other plans or projects, result in adverse effects to the integrity and conservation status of European Sites in view of their Conservation Objectives and on the basis of best scientific evidence and there is no reasonable scientific doubt as to that conclusion.

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Appendix 1: CEMP

TULLAGHMORE WIND FARM LIMITED.

Tullaghmore Wind Farm, Maam Cross, Co. Galway

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

January 2023

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DOCUMENT APPROVAL

PROJECT	Proposed Tullaghmore Wind Farm	
CLIENT / JOB NO	Tullaghmore Wind Farm Limited	6276
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP)	

	Prepared by	Reviewed	Approved by
Document Rev 0	Name Monica Sullivan	Name Andrew O'Grady	Name David Kiely
Date October 2022	Signature	Signature	Signature

	Prepared by	Reviewed	Approved by
Document Final	Name Monica Sullivan	Name Andrew O'Grady	Name David Kiely
Date January 2023	Signature	Signature	Signature

TULLAGHMORE WIND FARM LIMITED.
TULLAGHMORE WIND FARM,
MAAM CROSS, CO. GALWAY

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

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APPENDIX

1 BACKGROUND TO REPORT

1.1 INTRODUCTION

Jennings O'Donovan & Partners Limited, on behalf of Tullaghmore Windfarm Limited (TWL), has prepared this Construction Environmental Management Plan (CEMP) for the construction of the proposed 6 turbine, Tullaghmore Wind Farm, improvement works to roads to facilitate turbine delivery at 4 no. locations and the construction of underground cable ducting to connect the proposed wind farm substation to the National Grid at Screebe 110kV substation. The Development, as proposed, has been designed to ensure that any environmental impacts which may arise can be appropriately mitigated such that there will be no likely significant environmental effects.

This document will be further developed and expanded following the appointment of the Contractors for the main construction works. Some items of this CEMP can only be finalised with appropriate input from the Contractors who will actually carry out the main construction works. This CEMP identifies, for the incoming Contractors, the key planning, environmental and contract document constraints that must be adhered to in order to deliver optimum environmental reassurance for the site.

The preparation of this document, and its continued development, is considered to be an appropriate mechanism to address the requirements of the aforementioned condition to see that the appropriate management of construction activities is in accordance with the relevant environmental requirements.

This document should be read in conjunction with the Appropriate Assessment Screening Report, Natura Impact Statement, Environmental Impact Assessment Report (EIAR) and Planning Drawings.

1.2 PURPOSE

Jennings O'Donovan & Partners Limited (JOD) on behalf of TWL has prepared this CEMP for the proposed construction of the Tullaghmore Windfarm (the Development). This document will be further developed and expanded following the appointment of a Contractor for the main construction works. Some items of this CEMP can only be finalised with appropriate input from the Contractor who will actually carry out the construction works. In the event planning consent is granted for the proposed development, the CEMP will be updated prior to commencement of development to address the requirements of any relevant planning conditions, including any additional mitigation measures, which are conditioned and will be submitted to the planning authority for written approval.

This CEMP has been developed in accordance with the Institute of Environmental Management and Assessment (IEMA) Practitioner "Environmental Management Plans", Best Practice Series, Volume 12, December 2008 and has been designed to cover the proposed environmental strategies that will be carried out, before and during the Development works. This procedure ensures that whilst work is being carried out that the Contractor is solely responsible for ensuring that all aspects of the environment are managed according to required standards and legislation.

This CEMP defines good practice as well as specific actions required to implement mitigation requirements as identified in the Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR). The principal objective is to avoid, minimise and control adverse environmental impacts associated with the Development. This document will act as a continuous link and main reference document for environmental issues between the design, decommissioning, construction and the maintenance and operation stages of the project.

The CEMP is considered to be a live document which will be developed further and / or amended where necessary subsequent to planning consent to take account of planning condition requirements.

The CEMP will form part of the main Civil Construction works Contract. The Contractor will take account of the structure, content, methods and requirements contained within the various sections of this CEMP when further developing this document (to include environmental plans and other related Construction Management Plans) as required by the Contract. Site specific sensitivities and requirements of any planning consent, along with updates in legal requirements and construction best practice will also be required to be considered in the development of the site CEMP.

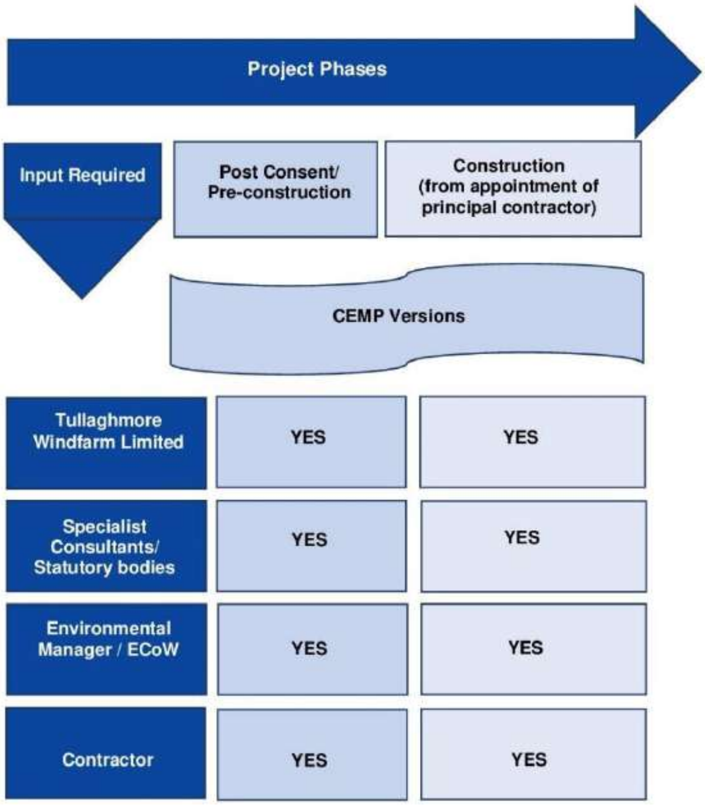

Figure 1.1 Summary of CEMP development process

As such, the Developer commits to safeguarding the environment through the identification, avoidance and mitigation of the potential negative environmental impacts associated with the development, decommissioning, construction and operation of the Tullaghmore Windfarm Project by ensuring all of the mitigation measures identified in the EIAR and NIS are implemented in full.

A summary of the CEMP development process and the required input from the main parties involved in the post planning and decommissioning and construction of the windfarm is indicated in **Figure 1.1**.

2 RESPONSIBILITIES FOR ENVIRONMENTAL MANAGEMENT

Environmental Management responsibilities for the site require to be documented. The **Contractor** will be responsible for the environmental management of the TWL site, including the preparation of on-site environmental documentation.

This section shall set out the environmental responsibilities on site, including identification of key site staff and their environmental management responsibilities and how this links in with "Client" responsibilities and that of the project team.

Prior to commencement of construction works, the Contractors will identify a core Environmental Management Group, comprising of specific project personnel and the Ecological Clerk of Works. The Environmental Management Group will meet monthly to discuss the monthly environmental report and will advise site personnel on areas where improvements may be made on site. The group will draw on technical expertise from relevant specialists where required, including the Resident Engineer and will liaise with other relevant external bodies as required.

The Developer will appoint an Ecological Clerk of Works who will be responsible for coordination, compliance monitoring and continued development of the CEMP and any other surveys, reports or method statements required. The Ecological Clerk of Works will also review the Contractors' method statements and environmental plans as required by the CEMP, carry out compliance auditing during the construction phase and coordinate the Environmental Management Group and required liaisons between Tullaghmore Wind Farm Limited, the Contractors, the Planning Authority and other statutory authorities.

3 COMMUNICATION PLAN

Both the Contractor and TWL will appoint Project Managers to the Tullaghmore Windfarm project. These Project Managers will be the main points of contact between the two parties. The Contractor's team will report directly to the Construction Project Manager, with all TWL's staff reporting directly to the Project Manager.

The main project communications will take the form of structured reporting arrangements and meetings.

All issues in relation to environmental management/monitoring will be reported to the Site Environmental Manager/Engineer. The Site Environmental Manager/Engineer shall report to the Contractor and TWL on a regular basis at a minimum.

In advance of any works commencing on site, TWL will appoint a dedicated Project Liaison Officer (PLO) for the duration of construction works. The PLO will be responsible for advising local residents of impending works, road closures, traffic diversions, and any other queries which may be forthcoming from local residents, landowners or businesses.

It is proposed that the PLO will conduct house-to-house calls at all dwellings along the proposed route to advise of the upcoming works and to inform residents of traffic diversions, for example during the grid connection works. Signage will be erected during the works to inform the general public that works are ongoing. These signs/posters will include information about the project and the PLO's contact details to ensure that any queries from the public can be responded to in an appropriate manner.

All staff will be advised to direct any queries from the public to the PLO or developer's Project Manager and to ensure that all interactions are recorded on the site register.

Relevant departments, including the Environment Section, Roads Department and Planning Department, within Galway County Council will be contacted in advance of the commencement of works and will be consulted throughout the duration of construction activities. In addition, where it is deemed necessary to consult with statutory consultees (e.g., Inland Fisheries Ireland), such consultations will take place in advance of and throughout the duration of construction.

TWL will develop a Contact Sheet with a list of all TWL contractors and relevant third-party contact details. This table will be updated prior to construction and kept current by the Contractor for the duration of the Contract.

4 SITE DESCRIPTION AND ASSOCIATED ENVIRONMENTAL SENSITIVITIES

The Project will comprise of the following main components:

- Erection of 6 no. wind turbines with an overall ground to blade tip height of 185m. The candidate wind turbine will have a rotor diameter of 162m and a hub height of 104m
- Construction of site access roads, crane hardstand areas and turbine foundations.
- Improvement of existing site entrance with access onto the N59
- Construction of one no. temporary construction compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent meteorological mast with a height of 104m
- Construction of new internal site access tracks and upgrade of existing Site track, to include all associated drainage
- Development of a site drainage network
- Construction of one no. permanent 38kV substation
- All associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation
- All works associated with the connection of the wind farm to the national electricity grid, which will be via 38kV underground cable connection approximately 18.65km in length to the existing ESB Screebe 110kV GIS Substation.
- Biodiversity enhancement measures
- Peat storage and restoration areas

A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm is being sought.

The EIA also assesses the Works at 4 no. locations along the proposed turbine delivery haul route from Galway Port and the proposed underground grid connection from the Site to Screebe 110kV Substation.

The location of the site is shown on **Figure 4.1**.

Figure 4.1 – Site Location

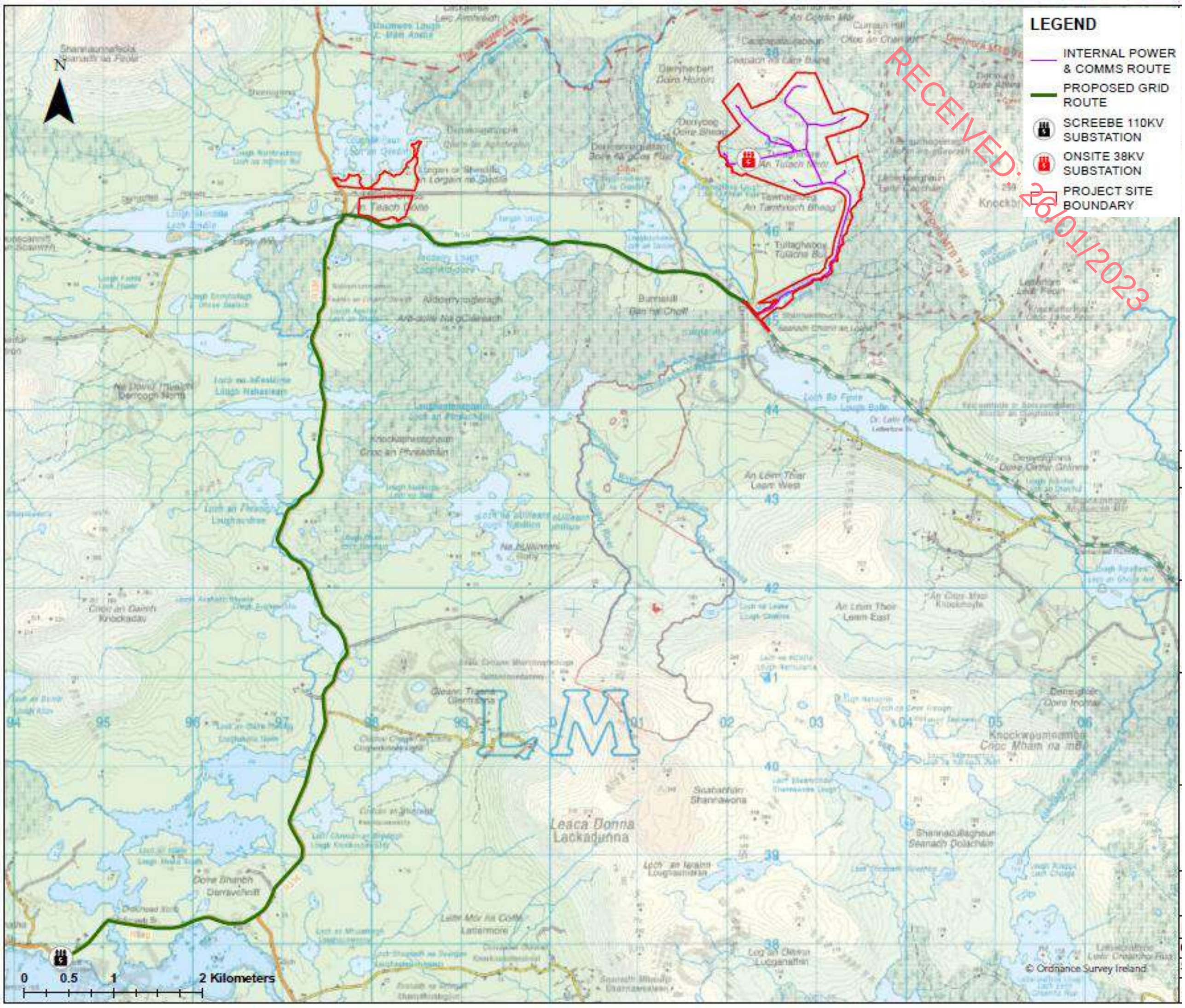

Figure 4.2 – Proposed Site and Grid Connection

5 ENVIRONMENTAL MANAGEMENT

This CEMP is informed by Planning Conditions where the Project is granted planning consent, mitigation measures set out in Environmental Impact Assessment Report (2022) and associated documents and by the guidance documents and best practice measures listed below. This CEMP will be adhered to and further developed by the Contactor and will be overseen by the project representative/foreman.

5.1.1 Guidance Documents

- Construction Industry Research and Information Association (CIRIA) (2006) Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London.
- CIRIA (2006) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).
- COFORD (2004) Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads.
- CIRIA (2015) SuDS Manual, (CIRIA Report C753, 2015)
- Coillte (2009): Forest Operations & Water Protection Guidelines.
- Department of Agriculture, Food and the Marine (2018) DRAFT Plan for Forests & Freshwater Pearl Mussel in Ireland – Consultation Document.
- Forestry Commission (2004) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh.
- Forest Services (2006) Draft Plan for Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.
- Forest Service (2000) Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- IFI (2016) Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- GPP1 (2020) Understanding your Environmental Responsibilities – Good environmental Practices, NetRegs.
- GPP 5 (2018) Works and Maintenance In or Near Water, NetRegs.
- GPP21 (2021) Pollution Incident Response Planning, NetRegs.
- GPP 22 (2018) Dealing with Spills, NetRegs.

5.2 HUMAN BEINGS AND COMMUNITY

The assessment set out in **Chapter 4: Population & Human Health** has not identified any likely significant effects from the Development on population or human health. The Development has been assessed as having the potential to result in effects of slight positive, long-term impact overall. Cumulative effects are predicted unlikely.

The main mitigation measure is by design or avoidance. A suitable separation distance from turbines and other key infrastructure to properties has been embedded in the EIA Development design. Additional mitigation to protect site personnel and the public will also be implemented in the event of damage to a turbine and subsequent likely turbine or turbine component failure.

These are:

- Physical and visual warnings such as signs will be erected as appropriate for the protection of site personnel and the public.
- The construction of the Proposed Development shall be managed in accordance with the Safety, Health and Welfare at Work Act 2005 (as amended), the Safety, Health and Welfare at Work (General Application) Regulations 2007 (as amended), and the Safety Health and Welfare at Work (Construction) Regulations 2013 (as amended).
- As required under the Safety, Health and Welfare at Work (Construction) Regulations 2013, the Client shall appoint a Project Supervisor for the Design Process (PSDP) and a Project Supervisor for the Construction Stage (PSCS). The PSDP shall compile a Preliminary Safety and Health Plan (PSHP), which details general information about the project and envisaged health and safety risks. The PSHP shall be made available to the PSCS. The PSCS shall develop a Construction Stage Health and Safety Plan (CSHSP) which incorporates the information contained in the PSHP and details how safety and health will be managed during the construction of the project. Pending approval of the application, the PSCS may also develop the following documents during the pre-construction stage of the Proposed Development, for implementation during the construction stage:
  - Emergency Response Plan
  - Detailed Traffic Management Plan
- Measures are set out in **Chapter 15: Transport and Transport** relating to how delivery of goods and services would be managed during works to minimise impacts.

Once the above mitigations are taken into account, the residual risk on population and human health is assessed to be an imperceptible, long-term effect.

5.3 ECOLOGY

All mitigation measures have been developed in the context of national and international legislative guidance for the protection and management of flora, habitats of conservation importance, fauna and aquatic ecological interest.

Guidelines to be adhered to in the delivery of the CEMP and method statements include the following:

- *'Guidelines on protection of fisheries during construction works in and adjacent to waters'* (Inland Fisheries Ireland, 2016)
- *'Guidelines for the treatment of Badgers prior to the construction of National Road Schemes'* (National Roads Authority, 2005)
- *'Guidelines for the protection and preservation of trees, hedgerows and scrub prior to, during and post construction of National Road Schemes'* (National Roads Authority, 2006a)
- '*Guidelines for the treatment of bats during the construction of national road schemes'* (National Roads Authority, 2006b)
- *'Guidelines for the treatment of Otters prior to the Construction of National Road Schemes'* (National Roads Authority, 2006c)
- *'Guidelines for the crossing of watercourses during the construction of national road schemes'* (National Roads Authority, 2008)
- *'Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads'* (National Roads Authority, 2010)

The description of mitigation measures is provided in terms of mitigation by avoidance, reduction and remediation.

5.3.1 Monitoring

Monitoring of flora and fauna will be undertaken as part of the daily/weekly site inspections carried out by the on-site Ecological Clerk of Works (ECoW)[1] or environmental advisor/manager. All details from the inspections will be recorded in the form of a monthly report; the report will be issued to TWL and the Contractor; with findings of the report being discussed at the monthly health, safety and environmental meetings.

Depending on the location of the site Consents/Licenses may also be required in relation to Protected Species and Habitats.

5.3.2 Mitigation by Avoidance

The Development has been designed to ensure that an adequate buffer zone is provided for between this infrastructure and watercourses. In addition, the design has sought to minimise the requirement for new watercourse crossings. This has been achieved by restricting the need for watercourse crossing to a total of four crossings within the Site, with one (the crossing of the Owenwee River)

[1] Note The requirement to have an Ecological Clerk of Works will depend on the site sensitivities and planning condition requirements

comprising an upgrade to the existing crossing. The buffer zone implemented between all large-scale infrastructure associated with the wind farm site, such as turbines, hardstand, and access tracks are located at distances of over 50m from any watercourses, except for where the Access Track crosses watercourses at the above three referenced locations. In addition, the best practice construction measures that are described above are designed to avoid impacts on areas that are outside the site including watercourses.

A Surface Water Management Plan (see **Appendix B**) has been prepared for the proposed wind farm and this plan aims to implement a suite of measures that will avoid negative impacts to water quality and the hydrological regime of the Owenwee River.

5.3.3 Protection of Designated Areas

The project is not located within any designated areas and as such the potential for direct impacts to these areas will be avoided. As set out in the accompanying Natura Impact Statement the principal risk posed by the proposed development to designated areas in the surrounding area relate to indirect impacts arising from negative impacts to water quality and associated adverse effects to freshwater dependent habitats and species. Mitigation measures are set out in Section 6.7.2.2.2 of Chapter 5 of the EIAR that aim to protect water quality in receiving watercourses and thereby avoid the potential for adverse effects to the freshwater dependent qualifying habitats and qualifying species of surrounding designated areas.

5.3.4 Protection of Important Habitats

The Development will result in the loss of areas of Annex I (and non-Annex I habitats), including 7130* Active Blanket Bog, 7130 Blanket Bog, 4010 Wet Heath and 7150 Transition Mire as. It is essential that the direct loss of any such habitat is fully minimised (notably also taking account of the international/national nature conservation value of these habitats) and so mitigation by avoidance is essential to limit such losses within the footprint of the Development, and its zone of influence. Mitigation in this respect is:

- The full extent of the infrastructure footprint will be marked out prior to the commencement of works, with an appropriately robust and visible fencing / marker system. Where this meets Annex I habitats, this will also be the full extent of the works corridor, with no machinery access (access will only be allowed on foot and only for the purposes of silt / pollution control if required), storage or other works allowed outside this area.
- The efficacy and coherence of the marker system (and required remediation) will form an essential part of the Site operations.
- A pre-construction Invasive Species Survey will be conducted during the optimal growing season (May to August immediately prior to works occurring at this site for the Development) and shall include data on all locations, extents and potential construction impacts in relation to scheduled and non-scheduled Alien Invasive Species (IAS). This survey will be completed

along with reporting on the best course of action to be implemented to avoid the spread of such IAS on the Site or further afield. Advice will be required from an invasive species specialist, particularly in relation to the appropriate treatment / removal or waste disposal of potentially contaminated materials.

5.3.5 Protection of Important Mammal Species

The Ecological Clerk of Works for the construction phase will complete a pre-construction survey of the construction footprint in order to confirm the continued absence of mammal breeding and resting places within the construction footprint and within 50m of the construction footprint or identify the presence of newly established breeding/resting places. Based upon the results of these surveys, the ECoW will establish whether or not there is a need at that stage for the implementation of further mitigation measures and the requirement for protected species licences. An example of where such a need could arise is where an otter holt becomes established in the immediate vicinity of the proposed bridge crossing of the Owenwee River.

5.3.6 Protection of Bats

Any trees and treelines along approach roads and planned site access tracks will be retained unless felling is unavoidable. Retained trees should 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.

5.3.7 Protection of Herpetofauna

The Ecological Clerk of Works for the construction phase will complete a survey of the construction footprint during spring (late February / March / early April) ahead of the proposed works in order to identify any key amphibian breeding areas. This will allow wildlife barriers to be installed where necessary to minimise impacts upon such features where these are likely to be indirectly affected by the works.

5.3.8 Mitigation by Design

5.3.8.1 Protection of Annex 1 Blanket Bog

In order to minimise the impact of the proposed Access Tracks that will traverse across blanket bog habitat, floated roads will be incorporated into the design of the Access Tracks. A general rule of thumb in the industry is for site tracks across peat greater than 1.5m deep to be floated using layers of geosynthetic materials and following the best construction practices and guidance as highlighted, for example, in the guidance produced by Forestry Civil Engineering (FCS) and Scottish Natural Heritage (SNH) (2010) "Floating Roads on Peat".

The aim during floating road construction is to load the road slowly, to achieve a slow and steady settlement as the peat changes volume and water is forced out of the peat mass. This permits the peat to gradually compress and consolidate allowing time for it to gain in strength and take up the new load. Sufficient time must be allowed for the loading phases of the floating road and these loading phases must be carefully controlled in order to keep the stresses induced in the peat below the strength of the peat at the time. This prevents rapid peat failure which has been the cause of the creation of unsuccessful 'sinking' roads in the past.

In recent years a vast amount of experience on constructing floating roads has been gained from methods used in Scandinavian countries (e.g. Munro and MacCulloch, 2006) reporting on experience from the Roadex III Project), and from the experience of construction contractors working in difficult peatland habitats in northern Scotland. These methods have previously been brought together in the FCS and SNH (2006) guidance. When properly implemented these methods produce robust engineering and drainage solutions that cause minimal impact on peat hydrology.

Apart from engineering facility across soft terrain, floating roads are used to minimise potential effects on peat hydrology. Excavating and cutting into peat severs hydrological flow routes and cuts off the sources of water required to maintain peat bog vegetation communities. Well designed and constructed floating roads, with frequently spaced cross-drainage, permit diffuse drainage through the structure of the road throughout the life of the wind farm. It is important that vegetation communities on the upslope side of the road, supported by aerobic acrotelmic peat conditions, are not saturated, and lose their character, while vegetation communities on the downslope side of the road are not dried out through lack of water supply. Incorporation of diffuse drainage also prevents turbulent point sources which can cause erosion and damage vegetation communities.

A number of considerations for the Site have contributed to the choice of routing and design of floating road selection. These are:

- minimising length of peat or mire to be crossed;
- gradient – the shallowest gradients have been sought, using detailed LiDAR mapping. However a shallow gradient assists road drainage; and
- design – the construction method, drainage frequency and materials to be used (particularly the type of geogrid).

Since strength of peat in a deposit is seldom directly related to depth, peat depth was not a prime consideration in choice of routing for sections of floating road. Custom-designed floating road solutions will be used at the Development, which address the site-specific needs of each stretch of track. Where a gradient exists, the permanent drainage for floating roads will be designed with sufficient cross drainage to ensure hydrological connectivity from the upslope side to the downslope side. This will be especially important along the section of floated road that will be provided along the section of the access track in the vicinity of poor flush and transition mire habitat to the south of the proposed turbine T1. The construction and loading of stretches of floating road will progress in phases to allow time for settlement and equilibration of underlying peat, which is vital for long term maintenance of peat strength.

The design of the floating road will incorporate within-road cross drains in addition to culverts where the floated road will cross existing ditches or preferential flow paths. Beyond this, the selection of floated track sections will be made in advance of construction works, and following completion of detailed pre-construction design and with approval of ECoW, Geologist, Hydrologist, etc.

5.3.8.2 Protection of Watercourses

An Ecological Clerk of Works ("ECoW") will be employed from the commencement to completion of construction works, including Access Tracks, On-site Substation and Control Building, Temporary Construction Compound, Turbine Hardstands and Turbine Foundations and Wind Farm Internal Cabling, Spoil Storage and Restoration (Enhancement) areas and grid connection works at a minimum. Primary roles for the ECoW will include the setting out and monitoring of the working corridor and review of pollution control measures and working practices during the active construction period as well as ad hoc input into site remediation.

For the construction of culverts, all activities must adhere to IFI, (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Section 9 Planning, Design and Construction Issues details on Best Practice guidance for the installation of culverts on watercourses.

All measures outlined in the accompanying SWMP will befully implemented by the contractor and will be agreed to with the planning authority in advance of construction activities. The objective of the SWMP is to prevent pollution to watercourses and adverse impacts to sensitive fauna. The SWMP has provided sufficient detail so that all activities that could potentially lead to negative impacts on water quality have been identified. The SWMP is based upon a detailed understanding of the hydrology, hydrogeology and geology within and surrounding the proposed wind farm extension.

All watercourses draining the Site will be examined on a repeated scheduled timeframe (i.e. daily/weekly/fortnightly etc.) as deemed appropriate by the Contractor, NPWS and Inland Fisheries Ireland. A log will be kept of these examinations and a water sampling protocol to monitor key water quality parameters will be established in agreement with the NPWS and Inland Fisheries Ireland. The monitoring protocol will be devised so that sediment release (should it occur) from the Site is detected at an early stage. Sediment release to the above watercourses from the site will be restricted to <25mg/l as per the Salmonid Water Regulations.

Method statements outlining the approach to all surface watercourse crossing will be approved in advance with Inland Fisheries Ireland.

Disturbance to natural drainage features will be avoided during the construction phase of the Development. The design of the Development has allowed for the establishment of a 50m wide watercourse buffer zone during the construction phase.

Uncontaminated surface runoff will be diverted away from construction areas through the installation of interceptor drains up-gradient of construction areas.

Drainage waters originating in construction areas will be collected in a closed system and treated prior to controlled, diffuse release. Drainage waters from construction areas will be managed through a series of treatment stages that include swales, check dams and settlement/attenuation ponds along with other pollution control measures such as silt fences and silt mats.

A three-stage treatment train will be employed to capture, retain and treat discharges during the construction phase. This treatment train is also proposed for discharges from hard surfaces that will be installed as a result of the Development.

Settlement/attenuation ponds will be used to attenuate and treat runoff. A detailed pre-construction peat stability assessment has considered the appropriate location of settlement/attenuation ponds so that these facilities will not increase the risk of slope failure. These will have permanent open water to minimise the risk of sediment washout. Settlement/attenuation pond side slopes will be constructed at shallow grades such as 1 in 3 side slope. Settlement/attenuation ponds will be designed so that outflows are spread diffusely over a wider area so that increases in run-off can be mitigated. Erosion control and detention ponds will be regularly maintained during the construction phase.

Standing water from excavations will not be pumped directly into watercourses. Where dewatering of excavations is required, water will be pumped to the head of a treatment train in order to receive full treatment prior to discharge.

Roadside drains will be shallow with moderate gradients to prevent scouring. In steep areas check dams (possibly in conjunction with settlement ponds and / or check dams and / or cross drains) may be necessary to reduce flow rate.

Oil fuel will be stored within containment areas and emergency response measures for oil spillage on site will be prepared.

Refuelling of plant during construction will be carried out at a designated area, a minimum of 50m from watercourses. Drip trays and spill kits will be available on site. Maintenance of all plant and machinery will be undertaken off-site. Only emergency break-down maintenance will be carried out on site.

Cement will be mixed within containment areas and if Readymix vehicles are used these will be washed in the same area and the water cycled.

All vehicles transporting materials to and from the Site will store materials in a contained load so that the potential for emissions or spillage is reduced during journeys and bridge crossing over watercourses. The measures outlined in the UK's Planning Policy Guidance No. 26: Dealing with Spillages on Highways (a Good Practice Guidance notes proposed of the UK EA/SEPA/EHS) will be adhered to in the event of a spillage or accident during the transportation of materials.

All construction personnel will be trained in pollution incident control response. An emergency response plan has been prepared as part of this CEMP (**Appendix A**) for the proposed development and information outlining response procedures and contingency plans to contain pollution, as set out in the CEMP, will be made available on site.

Access Tracks and turning areas will be confined to areas of shallow peat where possible and will be constructed on a geotextile layer. These areas will also be kept as level as possible to avoid fast run-off. This can be achieved by following contours where possible.

At the proposed spoil storage area, impermeable berms will be put in place surrounding peat spoil receptor cells. The berms will be established in advance of the deposition of peat surplus material. The berms will be designed to account for a bulking factor of 10% of the surplus peat material to be disposed in these areas. In addition, all existing drainage ditch outflows from cutover blanket bog that will be used as receptor cells for surplus peat will be blocked in advance of the deposition of any surplus material within these cells. This will prevent the ongoing loss of water from these cut areas to receiving lakes to the north and south and also prevent the migration of peat spoilt material from the cells to these lakes.

5.3.8.3 Prevention of Spread of Alien Invasive Species

The presence of the non-native invasive species Rhododendron ponticum within the study area provides the potential for the spread of this species by the proposed works. This species is highly invasive and out-compete native flora to form mono-specific stands. Its presence along watercourses is particularly significant, as contaminated soil or vegetative material washed from an infected area can result in the spread of this species downstream. Appropriate mitigation measures including management and control measures are required at all sites within the proposed works area where this species is encountered for the prevention of spread of these species. The mitigation measures for the control of invasive species follow the NRA *Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 2010). A summary of the physical and chemical control measures for Rhododendron ponticum are as follows:

- Cutting – anytime of the year. This approach can be very labour intensive and does not kill the plant. Regular follow up is required to deal with re-growth.
- Uprooting - anytime of the year. Small plants can be pulled by hand while large stems can be cut and the roots grubbed out by winch or machine.
- Mulch matting - anytime of the year. This approach can be labour intensive and regular follow up is required to deal with re-growth.
- Bud-rubbing – spring to autumn. This approach can be labour intensive and and regular follow up is required to deal with re-growth.
- Glyphosate – during the active growth in late spring or summer. Spot treatment of stands of Rhododendron ponticum on site.
- Triclopyr - during the active growth in late spring or summer. Spot treatment of stands of Rhododendron ponticum on site.

Due to the legislative requirements to control the spread of noxious weeds and non-native invasive plant species, it is important that any activities associated with the planning, construction and operation of wind farm developments comply with the requirements of the Wildlife Acts, 1976-2012. Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011) include legislative measures to deal with the dispersal and introduction of Invasive Alien Species (IAS), which are listed in the Third Schedule of the regulations. Regulation 49 deals with the Prohibition on introduction and dispersal of certain species while Regulation 50 relates to Prohibition on dealing in and keeping certain species (Regulation 50 has not yet been commenced). Invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). The introduction and/or spread of invasive species such as Himalayan Balsam, Giant Rhubarb or Rhododendron for example, could result in the establishment of invasive alien species and this may have negative effects on the surrounding environs. Appropriate spread prevention measures have been incorporated into the design of the project. The following measures address potential effects associated with the construction phase of the project:

- Good construction site hygiene will be employed to prevent the introduction and spread of problematic invasive alien plant species (e.g. Himalayan Balsam, Japanese Knotweed etc.) by thoroughly washing vehicles prior to leaving any site.
- All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival on site to prevent the spread of invasive plant species
- All washing will be undertaken in areas with no potential to result in the spread of invasive species. This process will be detailed in the contractor's method statement.
- Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present.
- All planting and landscaping associated with the Development shall avoid the use on invasive shrubs such as Rhododendron.

5.3.9 Mitigation by Reduction

5.3.9.1 Protection of Important Habitats

This CEMP will be implemented to ensure that potential adverse impacts to upland watercourses flowing through the site are avoided. Minimum buffer zones will be implemented between areas associated with the construction of Turbine Foundations and streams/eroding gullies, except where stream crossings are required.

During the construction phase, spoil will be transferred to the spoil storage areas where it will be used.

5.3.9.2 Protection of Watercourses

All elements of the SWMP and the mitigation measures outlined in Chapter 9 to reduce the amount of silt-laden water generated within the construction footprint will be implemented. These measures will include the provision of clean water catch drains upslope of construction areas and the minimisation of excavation footprints and the time excavations and surfaces are left exposed and denuded.

5.3.9.3 Offsetting – Habitat Restoration

The Site as well as the proposed spoil storage and peatland rehabilitation area provide significant opportunities for habitat restoration and enhancement. A Habitat Management and Peatland Rehabilitation Plan is provided as Technical Appendix 6.6 of the EIAR and all measures set out in this plan will be implemented as part of the Development. The restoration of areas of cutover blanket bog within the proposed spoil storage area and the implementation of other measures such as the cessation of turbary activity and the installation of drain blocks within the overall peatland rehabilitation area will aim to achieve the restoration of approximately 6.5ha of cutover blanket bog as well as improving the water balance within an area of approximately 30ha of blanket bog habitat occurring within the peatland rehabilitation area.

5.4 HYDROLOGY AND DRAINAGE

The following section details environmental control measures which will be implemented on site in relation to hydrology and drainage and provide the framework within which the targeted CMS must be prepared. In addition, a Surface Water Management Plan (**Appendix B**) has been prepared which provide further details of control measures and monitoring procedures.

5.4.1 Site Drainage

Details of the Site drainage can be found in the **Surface Water Management Plan** (**Appendix B**). The design criteria for the Sustainable Drainage Systems (SuDS) design are as follows:

- To select and install drainage.
- To minimise alterations to the ambient site hydrology and hydrogeology.
- To provide settlement and treatment controls as close to the Site footprint as possible and to replicate the existing hydrological environment of the Site.
- To minimise sediment loads resulting from the Development run-off during the construction phase.
- To preserve Greenfield runoff rates and volumes.
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement.
- To reduce stormwater runoff velocities throughout the Site to prevent scouring and encourage settlement of sediment locally.
- To manage the problems of erosion and allow for the effective revegetation of bare surfaces.
- To control water within the Site and allow for the discharge of runoff from the Site within the limits prescribed in the Salmonid Regulations.

5.4.2 Surface Water Design Philosophy

The SuDS design must be managed and monitored at all times and particularly after storm or heavy rainfall and during construction phase environmental auditing. The design rationale is that of an integrated approach where each element is assessed for its potential contribution to sediment suspension and the appropriate mitigation measures integrated into the layout design. The design principles are as follows:

Minimise → Intercept → Treat → Disperse → Dilute

5.4.2.1 Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. It achieves this by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering site/ roadside drains.

5.4.2.2 Intercept

The key sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the site and surrounding lands. This significantly reduces the volume and velocity of dirty water that the sediment and erosion control measures need to deal with. To achieve separation, clean water infiltration collector drains or silt fences are positioned on the upslope and dirty water v-drains positioned along the verge, with site surfaces sloped towards dirty water v-drains. The remainder of this clean water will be regularly piped under the site roads and dirty water v-drains to avoid contamination. Piping the clean water regularly under the site roads allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water sheet flow pattern of the site.

5.4.2.3 Treat, Disperse and Dilute

The clean water infiltration interceptor drains are positioned upslope of the development footprint, to prevent any mixing of the clean and 'dirty' water. The infiltration interceptor drains redirect the clean water away from the site infrastructure, as best suits the natural topography of each sector. The clean water outflow is then discharged into either, an existing drainage network or dispersed through an area of vegetation where it can percolate into the ground naturally.

In the drawings, 'dirty water' drains, indicated in orange, collect all incident rainwater that falls on the development infrastructure. These then drain to buffered outfalls or into settlement ponds. The treated effluent from the settlement ponds is then dispersed across vegetation (through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing the smaller particle sizes to be taken up by the vegetation.

5.4.3 SuDS Overview

This SuDS adopts a design for the drainage of the site. The following elements in series are proposed:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;

- Settlement Ponds and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates.

These measures provide a surface water management train that will mitigate any adverse impact on the hydrology of the site and surrounds during the construction phase of the project.

5.4.4 Cut-off Ditches / Collector Drains (Clean Water)

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or track runoff. Design will ensure that infiltration interceptor drains be installed upslope of development, to intercept and divert clean surface water runoff, prior to it coming in contact with areas of excavation. Design will ensure that natural runoff infiltration interceptor drains are installed ahead of main earthworks wherever practical.

This is intended to reduce the flow of natural runoff onto any exposed areas of peat/soil, thereby reducing the amount of potential silt laden runoff requiring treatment. Installed drainage will allow provision for natural runoff water, upslope of the development, to collect in infiltration interceptor drain and directed away from the development. In certain areas it will be required to pass through under track clean water culverts, separate to drainage provided for track runoff, and be discharged downstream of site development.

Temporary silt / pollution prevention and scour protection measures will be provided in artificial natural runoff drainage installed in order to mitigate potential for scouring and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions.

Frequency of outflow points are designed to avoid collection and interception of large catchments creating significant point flows, with associated risks due to scour and hydraulic capacity.

The drains will be max 350mm – 500mm in depth.

5.4.5 Buffered Outfalls

Dirty water will be discharged to land via buffered outfalls. These drainage outfalls will contain hardcore material of similar or identical geology to the bedrock at the Site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent watercourses and avoiding direct discharge to the watercourse. It is recommended that a relatively high number of discharge points are established, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.

5.4.6 Trackside Drains (Dirty Water)

These are open gently sloping drainage channels to convey dirty water, trap sediment, enhance filtration and slow down the rate and magnitude of runoff that could enter the local watercourses. The drains will be max 350mm – 500mm in depth and the turve will be taken as a single piece and placed on the downslope side of the drain. Therefore, once construction works are complete the turve can be put back in place with minimal ecological damage. These drains will be reinstated following the works.

5.4.7 Silt Fences

Silt Fences are designed in order to effectively filter the water, holding back the silt and allowing the water through, they require to be installed correctly with the lower part of the fence dug into the ground. Silt fences will also be required to be cleaned out on a regular basis, particularly after periods of heavy rainfall. Silt fences are required to be inspected and maintained on a regular basis in order to ensure that silty water is not running under or around the silt fences. Silt fences can also be used to divert clean water away from the development area, minimising the volume of dirty water.

5.4.8 Filtration Check Dams

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within the dirty trackside drains in order to reduce erosion and allow for greater flow control. These check dams are required in order to reduce the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent scouring of the drainage channel itself. Rock filter bunds may be used for check dams however, stone can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately downgradient of construction areas.

Settlement build up will be monitored and cleaned during the construction stage when necessary. The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

- The maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- The centre of the check dam should be at least 0.2m lower than the outside edges;
- Side slopes should be 1:2 or less;
- A Terram membrane barrier or similar non-woven geotextile membrane placed around check dam
- Check dams should be keyed at least 0.1m into the drainage channel bottom in order to prevent the dam washing out; and
- Check dams will be maintained and monitored on a regular basis. Sediment will be removed before it reaches one half the original dam height.

5.4.9 Settlement Ponds

Runoff from the windfarm track surface will be attenuated to mimic natural runoff patterns. To capture runoff generated within the development footprint, it is proposed to use constructed trackside drains. Accumulations of runoff will then be transferred to settlement ponds. All ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Settlement ponds are to be securely fenced to prevent easy access.

The ponds are utilised to attenuate and to aid the removal of suspended solids from site runoff water. All the pond locations are displayed within the site drainage drawings. Settlement ponds will be emplaced at twenty four (24) locations along the drainage footprint.

Further details are contained in the accompanying SWMP.

5.4.10 SuDS Design Principles

The design criteria for the SuDS design are as follows:

- To select and install ecologically sensitive drainage.
- To minimise alterations to the ambient site hydrology and hydrogeology.
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate where possible the existing hydrological environment of the site.
- To minimise sediment loads resulting from the development run-off during the construction phase.
- To preserve Greenfield runoff rates and volumes.
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement.
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally.
- To manage the problems of erosion and allow for the effective revegetation of bare surfaces.
- To control water within the site and allow for the discharge of runoff from the site within the limits prescribed in the Salmonid Regulations.

Flocculants **-** may also be used to aid settlement of fine particles. These involve a chemical solution that can be used to force very fine particles to clump together and settle out of the water column. The point of treatment will be constructed in such a way to allow controlled dosing and a documented register shall be kept recording the use of chemicals at each treatment location. A settlement area will be provided after the point of treatment to give the flocculants a chance to work and the particles to settle out.

The use of Flocculants will require approval from the EPA, and will be reserved for only if issues are encountered with conventional treatment methods, and if very fine sediment particles (e.g. clay) are being encountered. All surface water management measures on site will be maintained by the Contractor. It is important that maintenance is undertaken in order to ensure that settlement lagoons and silt fences are de-sludged when required as the retention capacity of the system will be affected by a build-up of sediment.

All mitigation measures implemented on site will require to be visually monitored on a regular basis this will be weekly as a minimum (frequency related to risk, site sensitivity, weather conditions, etc), with inspections of mitigation measures also being carried out after periods of heavy rainfall. Inspections of mitigation measures and any required maintenance will be carried out by the Contractor. A record of any findings from the inspections carried out by the Contractor will be recorded including details of any silty water runoff impacting on watercourses or any maintenance required to mitigation measures e.g. such as the cleaning out of silt fences or lagoons.

A mobile siltbuster may also be employed to treat silt laden construction runoff where additional treatment is required.

5.4.11 Design Phase Mitigation

5.4.11.1 Mitigation by Avoidance

The fundamental mitigation measure to be implemented during each stage of the proposed Development will be avoidance of sensitive hydrological or hydrogeological receptors wherever possible, this key principle is referred to as "mitigation by avoidance". This principle has been adopted during the design of the turbine and associated infrastructure layout across multiple design iterations. Hydrological constraints maps have been developed which identified areas of the Site where surface water and drainage constraints resulted in areas of the Site being deemed less suitable for development. The multiple constraints maps are presented in Volume III. The identified constraints have been extensively discussed in consultation with the design team. The final Site layout plan has been identified as the optimal layout design available for protecting the existing hydrological regime of the Site, while at the same time incorporating and overlaying engineering and other environmental constraints.

5.4.12 Construction

5.4.12.1 Earthworks

Mitigation measures to reduce the potential for adverse impacts arising from earthworks and management of spoil include the following:

- Management of excavated material will adhere to the measures related to the management of temporary stockpiles outlined in **Chapter 8: Soils and Geology**
- No permanent or semi-permanent stockpiles will remain on the Site during the construction or operational phase of the Development. Spoil to be taken off site to the designated spoil storage area near Maam Cross
- Suitable locations for temporary stockpiles will be identified on an individual basis. The suitability of any particular location will consider Site specific characteristics, including;
    - The location of drainage networks in the vicinity
    - The slope incline and topography of the downgradient area

- Any other relevant characteristics which are likely to facilitate or increase the potential for entrainment by surface water runoff.

- Construction activities will not be carried out during periods of sustained significant rainfall events, or directly after such events. This will allow sufficient time for work areas to drain excessive surface water loading and discharge rates to be reduced
- Following heavy rainfall events, and before construction works recommence, the Site will be inspected and any required corrective measures implemented
- An emergency response plan will be developed for the construction phase of the project (based on the Plan in **Appendix A**). The plan, at a minimum, will involve 24-hour advance meteorological forecasting linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded such as a very heavy rainfall at >25mm/hr, planned responses will be undertaken. These responses will include cessation of construction until the storm event, including storm runoff has ceased
- Sediment fencing will be erected along proximal and paralleling areas of watercourses, channels and drains spanned by the works to reduce the potential for sediment laden run-off to reach sensitive receptors
- No direct flow paths between stockpiles and watercourses will be permitted at the Site
- Excavated material will be backfilled are transported to the spoil storage area as soon as is reasonably practicable to prevent long duration storage at the Site which increases the risk of adverse effects on aquatic environments
- All mitigation measures related to surface water quality described throughout section 9.5 will be implemented before excavation works commence.

5.4.12.2 Excavation Dewatering

Mitigation measures to reduce the potential for adverse impacts arising from dewatering activities include the following:

- Management of excavations will adhere to the measures outlined in **Chapter 8: Soils and Geology**. Areas of peat and subsoils to be excavated will be drained ahead of excavation works. This will reduce the volumes of water encountered during excavation works and will therefore reduce the volume of water that is required to be dewatered whilst excavations are being carried out.
- Engineered drainage and attenuation features outlined in the Surface Water Management Plan (**Appendix B**) will be established ahead of excavation works
- Dewatering pumping rates will be controlled by an inline gate valve or similar infrastructure which will facilitate a reduction of loading on the receiving environment, thus enhancing the attenuation and settlement of suspended solids

- The direct discharge of dewatered loads to surface waters will not be permitted under any circumstances
- All dewatering will follow a strict procedure of pumping to a settlement tank and then to a dewatering bag, or settlement ponds prior to discharging to receiving environment for overland flow
- Geofabric lined settlement ponds will buffer the run-off discharging from the drainage system which will reduce the hydraulic loading to watercourses. Settlement ponds will be designed to reduce flow velocity to 0.3 m/s at which velocity silt settlement generally occurs. In areas of the Site where the placement of settlement ponds is not feasible, other mitigation measures described below will be implemented
- Check Dams will be constructed across drains and will reduce the velocity of run-off which will in turn promote settlement of solids upstream of potential surface water receivers. An additional benefit of check dams is that they will reduce the potential for erosion of drains. Rock filter bunds may be used for check dams, wood or hay bales can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately down gradient of construction areas
- Overland flow paths of the final dewatered discharge will be maximised to the greatest practical extent to avoid prematurely draining to drainage channels or surface waters. This approach will allow for enhanced settling out of suspended solids entrained in the run-off
- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated
- Sediment fencing will be installed up gradient of water courses which may receive the final overland flow
- The final treated dewatered discharge will be directed towards heavily vegetated areas to allow for further natural filtration of suspended solids
- A programme of water quality monitoring will be implemented during the construction phase which is outlined in detail in Section 9.5.2.10 of the EIAR.
- No extracted or pumped water will be discharge directly to the surface water network associated with the Site (this is in accordance with the Local Government (Water Pollution) Act 1977 as amended)
- Any discharges of sediment treated water should meet the requirements of the Surface Water Regulations 2009, as amended.

5.4.12.3 Release and Transport of Suspended Solids

The following mitigation measures to reduce potential impacts from the release of suspended solids to the surface waters will be implemented:

- Collector drains and soil berms will be implemented to direct and divert surface water runoff from construction areas such as temporary stockpiles into established settlement ponds, buffered discharge points and other surface water runoff control infrastructure. This planning and placement of these control measures will be of fundamental importance, especially for the areas where works within the 50m buffer zone will be unavoidable which is discussed in Section 9.5.1.2 of the EIAR.
- Sediment control fences will be implemented significantly upgradient of potential receiving waters and as part of the drainage network. Sediment control fences will also be established upgradient of the Sites pre-existing natural and artificial drains in addition to degraded areas of peat that are likely to receive surface water runoff. This practice will reduce the potential for elevated suspended solids entrained in surface water runoff to discharge to surface waters
- Multiple silt fences will be used in drains discharging to the surface water network. This will be especially important for the areas where works within the 50m buffer zone will be unavoidable which is discussed in section 9.5.1.2 of the EIAR
- The drainage, attenuation and other surface water runoff management systems will be installed prior to the commencement of construction activities. Whenever possible, drainage and attenuation control measures will be installed during seasonally dry conditions to limit the potential for sediment laden run-off to discharge to surface waters during the installation of these measures
- Surface water runoff will be discharged to land via buffered drainage outfalls that will contain hardcore material of similar composition to the geology of the bedrock at the Site. This mitigation measure will promote the capture and retention of suspended sediment
- Buffered drainage outfalls also promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to adjacent watercourses and avoiding direct discharge to the watercourse
- Buffered drainage outfalls will be placed outside of the 50m buffer zone and will not be positioned in areas with extensive erosion and degradation
- A relatively high number of discharge points will be established to decrease the loading on any one particular outfall
- Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points
- In the event that mitigation measures are failing to reduce suspended solids to acceptable levels, construction works will cease until remediation works are completed
- Fine solids or colloidal particles are very slow to settle out of waters, coagulant or flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks. Flocculant gel blocks can be placed in drainage channels, these are passive systems that are self-dosing, self-limiting and are environmentally friendly. Flocculant gel blocks bind elevated levels of silt and associated contaminants into masses that are easily separated, captured and then removed from the water

- Surface water runoff controls will be checked and maintained on a regular basis and as soon as any signs of deterioration become visible. Check dams and settlement ponds will be maintained and emptied on a regular basis and as soon as any signs of deterioration become visible.

The adoption of precautionary principles and the implementation of mitigation measures listed above will ensure that the risk of elevated suspended solids to surface waters is low. This in turn will ensure that potential risks to sensitive receptors is also low. Nevertheless, should a significant discharge of suspended solids to surface waters occur, the absence of immediate proximity to designated sites and the assimilative capacity of the localised surface waters will act as a natural hydrological buffer in terms of suspended solids loading. Should such a discharge occur, the dilution and retention time of suspended solids in the localised surface water network will reduce potential impacts on highly sensitive downstream designated sites. It should be noted that this natural mitigation measure is not to be adopted as a first principle and will not be relied upon to prevent adverse impacts on designated sites, it will be rather a last line of defence.

A detailed design of required drainage, collector drainage, stilling ponds and other listed mitigation infrastructure is contained in the Surface Water Management Plan in **Appendix B**. Unsuitable and particularly sensitive areas are identified and presented in various figures contained in **Volume III** of the EIAR.

5.4.12.4 Horizontal Directional Drilling on Grid Route

The following mitigation measures to reduce potential impacts associated with horizontal directional drilling will be implemented:

- Clearbore, which is not toxic to aquatic organisms and is biodegradable will be the drilling fluid used.
- Mud mixing will be monitored to suit the ground conditions encountered and will initially be based on a mud programme developed by the specialised HDD Contractor, the drilling fluid supplier and an Environmental Clerk of Works.
- The drilling fluids will be constantly monitored, any changes required to the mix will be performed on site by specialised HDD Contractor upon consultation with the drilling fluid supplier and Environmental Clerk of Works.
- Mud testing equipment will be available at all times during drilling operations to monitor key mud parameters.
- All equipment will be carefully checked on a daily basis by the Site Supervisor prior to use to ensure plant and machinery is in good working order with no leaks or potential for spillages.
- Spill kits, including an appropriate hydrocarbon boom will be available on the site in the event of any unforeseen hydrocarbon spillages and all staff shall be trained in their use.

- All plant, materials and wastes will be removed from site following the HDD works.
- The launch pit will be reinstated to the original land surface condition and the normal duct trench will continue from this point.
- Test pits and boreholes will not be located directly on, or extend through, the proposed alignment, as these weak points may serve as conduits where inadvertent fluid returns or frac outs occur. At least a 3m offset will be provided between the boreholes and pipe alignment.

5.4.12.5 Release of Hydrocarbons

The following mitigation measures to reduce potential impacts from the environmental release of hydrocarbons and other harmful chemicals to the surface waters will be implemented:

- Refuelling of vehicles will be carried out off site to the greatest practical extent. This refuelling policy will mitigate the potential for impacts by avoidance. Due to the remote location and nature of the Site, it is unlikely that implementation of this refuelling policy will be practical in all circumstances. In instances where refuelling of vehicles on Site is unavoidable, a designated and controlled refuelling area will be established at the Site. The designated refuelling area will enable low risk refuelling and storage practices to be carried out during the works. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:
    - The designated refuelling area will be located a minimum distance of 50m from any surface waters or Site drainage features
    - The designated refuelling area will be bunded to 110% volume capacity of fuels stored at the Site
    - The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
    - Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis
    - Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip site
    - Any minor spillage during this process will be cleaned up immediately
    - Vehicles will not be left unattended whilst refuelling
    - All machinery will be checked regularly for any leaks or signs of wear and tear
    - Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. To mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the Development. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard
- Spill kits will also be available at construction areas such as at turbine erection locations, the temporary site compound, on-site substation, spoils storage areas and met mast location etc.
- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter
- Should an accidental spill occur during the construction or operational phase of the Development, such incidents will be addressed immediately, this will include the cessation of works in the area of the spillage until the issue has been resolved
- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators
- No materials, contaminated or otherwise will be left on the Site
- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site

Implementation of the above mitigation measures will significantly reduce the risk of hydrocarbon contamination being released to the surface water network. Nevertheless, the potential risk cannot be entirely eradicated. Therefore, precautionary measures and emergency response protocols are have been included.

5.4.12.6 Construction and Cementitious Materials

The following mitigation measures to reduce potential impacts posed by the use of concrete and the associated effects on surface water in the receiving environment are proposed:

- The procurement, transport and use of any cement or concrete will be planned fully in advance and supervised by appropriately qualified personnel at all times
- Vehicles transporting cement or concrete to the Site will be visually inspected for signs of excess cementitious material prior to being granted access to the Site. This will prevent the likelihood of cementitious material being accidentally deposited on the Site Access Tracks or elsewhere at the Site.

- Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants
- Precast concrete will be used wherever possible, although the use of pre-cast concrete is not viable option for large structures such as Turbine foundations and so concrete will be delivered to the Site
- Concrete will not be poured during periods of rainfall or if any kind of precipitation is forecast. This policy will limit the potential for freshly poured concrete to adversely impact on surface water runoff.
- Raw or uncured waste concrete will be disposed of by removal from the Site
- Washout of concrete trucks shall be strictly confined to the batching facility and shall not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the Temporary Site Compound
- Spill kits will be readily available to Site personnel, and any spillages or deposits will be cleaned up as soon as possible and disposed of appropriately
- Pouring of concrete into standing water within excavations will be avoided
- Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place
- Any surplus concrete will not be stored or deposited anywhere on Site and will be returned to the source location or disposed of appropriately at a suitably licensed facility
- Any required shuttering installed to contain the concrete during pouring will be fully secured around its perimeter to minimise any potential for leaks.

5.4.12.7 Watercourse Crossings

At the Site, two new watercourse crossings / culverts will be constructed as part of facilitating access to the proposed turbines T4 and T5. Both of the required crossings are across small streams that are headwaters of the Owenree River, the locations of the proposed crossings are mapped on **Figure 9.7** in **Volume III**. It is noted that the small stream which will require crossing for access to the T4 turbine position was consistently dry during the water quality monitoring rounds discussed in Section 9.3.10 of the EIAR and it is therefore considered to be an ephemeral stream which may not be in flow during the time at which the construction of a crossing is required. However, detailed planning and consideration as described below, to ensure potential impacts are assessed adequately and in turn mitigated against will be implemented for these locations.

A detailed design stage assessment in terms of bridge or culvert design will be carried out that will have cognisance to both locations including the characteristics of water flow at both locations. The proposed crossing locations will be situated relatively near the headwaters of both of these small streams. As a result, bridge or culvert specification and construction are envisaged to be of relatively low significance in terms of expected flow and culvert diameter. In the absences of a detailed design at this stage of the project's development, the following mitigation measures will be implemented as minimum requirements to ensure any potential impacts of the proposed watercourse crossings are minimised:

- The design of the proposed crossings and a method statement for the proposed construction will be agreed in advance with Inland Fisheries Ireland (IFI)
- This design of all crossings will adhere to relevant available guidance and will be reviewed through consultation with the OPW which will mitigate against any significant impact on surface water flow and in turn the risk of localised or downstream flooding
- Crossings will be designed to minimise in so far as practical and to the extent deemed acceptable by the competent authority, the disturbance or alteration of water flow, erosion and sedimentation patterns and rates
- A Construction Environmental Management Plan has been prepared and is appended to the EIAR in Technical Appendix 2.1. Adherence to this plan will be mandatory throughout the construction of the watercourse crossings.
- Vehicles and plant used in the construction of the proposed crossings will only be refuelled at the Sites bunded and designated refuelling area, no refuelling will be permitted within 50m of any watercourse at the Site
- To mitigate against the potential risk of accidental leaks or spillages from plant and equipment, the Emergency Response Plan will be followed (**Appendix A**). Multiple spill kits will be maintained on the Site at all times within the cabs of vehicles and placed strategically at environmentally sensitive locations across the Site. Spill kits will be routinely inspected to ensure that they are fully stocked with oil absorbent booms and pads at all times. Oil absorbent booms will be installed downstream of channel crossing work areas within 25m of the works location prior to the commencement of works.

Section 50 of the European Communities (Assessment and Management of Flood risks) Regulation SI 122 of 2010 states; *"No Person, including a body corporate, shall construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners*". The same regulations also state that the word "bridge" includes a culvert or other like structure. The OPW is the agency in Ireland responsible for the implementation of the regulations and consent to construct all crossings will firstly be sought from the OPW via their application process. This

OPW application and consent process will mitigate against the potential for the design of the crossings to result in significant adverse impacts on the surface water network at the Site. Relevant guidance documents will also be consulted, and applicable mitigation measures incorporated at the detailed design stage of the proposed crossings with a view to mitigating and reducing any potential impact on the receiving watercourse. The following is a non-exhaustive list of relevant guidance documents:

- OPW (2013) Construction, Replacement, or Alteration of Bridges and Culverts, A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945
- OPW (2019), Environmental Guidance: Drainage Maintenance and Construction
- Inland Fisheries Ireland (IFI) (2016) Guidelines on the Protection of Fisheries During Construction Works in and Adjacent to Waters
- National Roads Authority (NRA) (2008) Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes
- Scottish Environment Protection Agency (SEPA) (2010) Engineering in the water environment: good practice guide – River Crossings.

5.4.12.8 Groundwater Contamination

A combination of the underlying bedrock geology, the associated poor aquifer potential, low permeability subsoils beneath the peat and low recharge rates has resulted in the risk posed to groundwater quality by the Development being considered as low risk. Nevertheless, mitigation measures to reduce potential risks to groundwater will be implemented. A primary risk to the underlying groundwater quality would be through the accidental release of hydrocarbons from fuels or oils during the construction phase of the Development. In order to mitigate against potential groundwater contamination by hydrocarbons, implementation of the following mitigation measures is proposed:

- In the first instance, no fuel storage will occur at the Site whenever feasible and refuelling of plant and equipment will occur off site at a controlled fuelling station
- In instances where on Site refuelling is unavoidable, then the bunded on Site designated refuelling area must be used. The designated refuelling area must be bunded to 110% volume capacity of fuels stored at the Site
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant or licensed tip Site
- Any minor spillage during this process will be cleaned up immediately
- Vehicles will not be left unattended whilst refuelling

The following mitigation measures are proposed in relation to non-hydrocarbon potential contamination of groundwater:

- All other liquid based chemicals such as paints, thinners, primers and cleaning products etc. will be stored in locked and labelled bunded chemical storage units
- Temporary sanitation facilities such as portaloos used during the construction phase will be self-contained and supplied with water by tank trucks. Portaloos will contain water storage tanks and separate wastewater storage tanks which will be routinely emptied by vacuum removal for offsite disposal via a tank truck. All temporary sanitation facilities will be removed from the Site following the completion of the construction phase
- The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the presence of elevated contaminants were not detected during any of the four surface water quality monitoring rounds which are discussed in Section 9.3.10.
- It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality will be monitored for trace metal concentrations prior to, during and after the construction phase
- The potential for livestock such as cattle and sheep which have been observed grazing at the Site to cause bacteriological contamination of groundwater will be controlled through the implementation of strict grazing control zones, Site perimeter fencing and exclusion zones around all open excavations.

5.4.12.9 Water Quality Monitoring

The following Site monitoring recommendations will be implemented to mitigate against potential impacts on the surface water and groundwater receiving environment:

- A programme of water quality monitoring outlining the selected parameters and monitoring frequency should be agreed with Inland Fisheries Ireland and Galway County Council prior to the commencement of construction
- In order to assist in the detection of any deviations from the baseline hydrochemistry conditions at the Site, regular periodic monitoring of the Sites surface waters will be carried out prior to and during construction

- It is proposed that a programme of operational phase water quality monitoring is also implemented at a monitoring frequency agreed with the competent authority in order to aid the detection of any potential operational phase impacts on surface water quality
- As a minimum requirement, field measured parameters such as pH, conductivity, total dissolved solids (TDS), temperature, dissolved oxygen (DO) and turbidity will be included in the water quality monitoring programme. The results should be compared to the applicable EQS to determine if adverse impacts on water quality are occurring
- Water quality will be monitored for trace metal concentrations prior to, during and after the construction phase
- Water quality monitoring locations will include both upstream and downstream points relative to the works locations. The locations of the water quality monitoring points will be flexible and will be moved as the construction phase progresses so that monitoring points remain representative of the most likely construction impact receptor points
- The watercourses within and adjacent to the proposed spoil storage area will be included within the water quality monitoring programme
- The downstream monitoring locations will be positioned as close as possible downstream of the works location and another positioned further downstream. This approach will allow for an assessment of the dilution of potential contaminations (if present) as the distance from the point of diffuse source location increases
- Watercourses which do not have year round flows such as artificial drains, ditches or ephemeral streams will be avoided as water quality monitoring locations
- During the construction phase, daily visual inspections of excavations, dewatering procedure, settlement ponds, silt traps, buffered outfalls and drainage channels etc. will be carried out by a suitably qualified person. Any excess build-up of sediment at settlement ponds, drains or at any other drainage features that may decrease the effectiveness of the drainage feature will be promptly removed
- During the construction phase of the Development, all development areas will be monitored on a daily basis for evidence of groundwater seepage, water ponding and wetting of previously dry spots
- Following the completion of the construction phase, inspection of silt traps, buffered outfalls and drainage channels will be periodically inspected during maintenance visits to the Site when the operational phase water quality monitoring will also be carried out
- During both the construction and operational phases of the Development, the proposed watercourse crossings discussed in Section 9.5.2.7 of the EIAR will be monitored daily during construction and during each Site visit during the operational phase. The water course crossings will be monitored in terms of their impacts (if any) on the receiving watercourses and in terms of their structural integrity to identify any signs of erosion or potential for sediment release

- It is proposed that a handheld turbidity meter is available at the Site to accurately measure the quality of water discharging from the Site. The meter will be maintained and calibrated frequently.
- Any discharges of sediment treated water should meet the requirements of the Surface Water Regulations 2009, as amended.

5.4.12.10 Emergency Response

Mitigation measures outlined in Chapter 9 of the EIAR will significantly reduce the potential for contamination of surface water or groundwater associated with the Development. Nevertheless, as is the case with all construction projects, a risk of accidental chemical spillages, sediment overloading of control measures or leaks of contaminants from plant or equipment remains a possibility. Emergency response procedures to potential contamination incidents contained in this CEMP will be implemented at the Site prior to the commencement of the construction phase. The following is a non-exhaustive list of potential emergencies and respective emergency responses:

- Spill or leak of hazardous substances (less than 20 litres);
  - All spill incidents will be dealt with immediately as they arise
  - Spill kits will be prepared and available in vehicles associated with the construction phase of the Development
  - Spill kits will also be prepared and made available at primary work areas such as at proposed turbine, hardstand, substation, met mast and construction compound locations
  - Disposal receptacles for hydrocarbon contaminated materials will also be available at the Site
- Major spill of hazardous or toxic substance off Site or to environmentally sensitive areas;
  - Immediate escalation measures will be implemented for all major spill events
  - Escalation measures may include installation of temporary sumps or drains to control the flow or migration of hydrocarbons or other chemicals
  - Attempts to be made to limit or contain the spill using sandbags to construct a bund wall, use of absorbent material, temporary sealing of cracks or leaks in containers, use of geotextile or silt fencing to contain the spill
  - Excavation and disposal of contaminated material will be immediately carried out following any such incidents
  - Evacuation procedures will be implemented to remove non-essential personnel from the area
  - Data gathering and an investigation will commence immediately after the emergency is contained

  - If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer must have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill
  - All major spills of this nature will be reported to the competent authority immediately following such instances.
- Flooding of low lying areas of the Site;
  - Immediately remove all chemicals, fuels and other hazardous substances from low lying areas of the Site
  - Immediately remove plant and equipment from low lying areas
  - Recover materials washed from Site including sediment and other waste
  - Review and address the potential for excess water entering the Site
  - Review and maintain erosion and sedimentation controls.
- Spills of cementitious material;
  - Cement / concrete contamination incidents will be cleaned up immediately as they arise
  - Spill kits will also be established at key construction areas and they will also be readily available in the cabs of plant and equipment
  - Suitable receptacles for cementitious materials will also be available at the Site.

5.5 SOILS AND GEOLOGY

The following section details the environmental control measures which must be incorporated into the Contractors' Construction Method Statement (CMS) to ensure the protection of soils and geology.

5.5.1 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur throughout the construction of the wind farm and is unavoidable. However, the impacts associated with this removal will be minimised using the following practices.

5.5.1.1 Mitigation by Avoidance

As mentioned previously, areas of deep peat and shallow bedrock have been avoided during construction by careful design of the wind farm.

5.5.1.2 Mitigation by Good Practices

Best practice practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any works commencing on Site.

Excavated peat will mostly be taken off site and used in the restoration of an area of cutover bog located near Maam Cross. Localised areas of landscaping will be sealed and levelled using the back of an excavator bucket to prevent erosion.

5.5.1.3 Mitigation by Reduction

The disturbance of soil, subsoil and bedrock is an unavoidable effect of the Development, but careful design of the Wind Farm layout has been undertaken to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the effect on the geological aspects of the Site (by avoiding areas of deep peat and shallow bedrock where possible and reducing the length of site tracks). The management of geological materials is an important component of controlling dust and sediment and erosion control.

5.5.1.4 Mitigation by Reuse

Bedrock will be re-used for construction of Site Access Tracks wherever possible. The bedrock will comprise predominantly granite and quartzite which, when crushed and graded, will provide a good sub-base for Site Access Track construction. In addition, where excavated, glacial till and gravel will also be re-used for construction of access tracks.

Peat, overburden, and rock will be reused wherever possible on Site to reinstate excavated areas. Where possible, the upper vegetative layer will 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 landscaped peat. These measures will prevent the erosion of peat in the short and long term.

5.5.1.5 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This will include the Temporary Construction Compound, turning areas and any materials storage areas. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage will be reinstated, if required, in order to minimise future erosion of the soils and restore the pre-development state of the environment.

5.5.2 Storage and Stockpiles

5.5.2.1 Mitigation by Avoidance and Good Practice

As discussed previously, the opportunity to mitigate any effect is greatest at the design period. In this respect, a detailed Site selection process was carried out by the Developer. This process identified deep peat and shallow bedrock as specific geotechnical constraints. The detailed Site selection process is described in **Chapter 3: Alternatives**. Furthermore, within the chosen Site, areas of deep peat and shallow bedrock were identified, and the infrastructure design sought to avoid those areas where possible. In this respect, by minimising volumes of excavation, volumes for storage and stockpiles will also be reduced, thus reducing the impacts associated with them.

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

5.5.2.2 Mitigation by Reduction

Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, which will also reduce the requirements to stockpile soils. Generally excavated rock will be used immediately for Site Access Track construction. Topsoil and peat will be transported to the designated storage area located near Maam Cross. Whenever possible stockpiles will be avoided. Stockpiles of rock on peat soils will be avoided to prevent instability. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas which have been confirmed for stability by a suitably experienced geotechnical engineer.

5.5.2.3 Vehicular Movements

Vehicular movements will be restricted to the footprint of the proposed Development, particularly with respect to the newly constructed Site Access Tracks. This ensures that machinery must be kept on tracks and will not move onto areas that are not permitted for the Development.

Vehicular traffic on Site will be reduced through the re-use of excavated material on Site which will reduce the need to source material from external quarries.

5.5.2.4 Mitigation by Avoidance and Good Practice

As discussed previously, excavation volumes have been reduced during the design phase by avoiding areas of deep peat, shallow bedrock and by avoiding excessive cut and fill during construction. This will result in reduced excavation volumes and therefore reduced Site traffic.

Best practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise double handling, again reducing the Site traffic. All works will be managed and carried out in accordance with this CEMP which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

Excavated peat will only be moved a short distance from the point of extraction to the restoration areas near Maam Cross and will be also be used locally for landscaping, thus again reducing the on-Site traffic. Excavated rock (and any glacial till) will be used for access track construction as close to the source of extraction as possible.

5.5.3 Ground Stability

5.5.3.1 Mitigation by Avoidance and Good Practice

As discussed previously, careful design of the wind farm has reduced the amount of construction required in areas of deep peat, high slopes and other areas of potential ground instability. Additionally, the following mitigation measures will also be applied as recommended in the PSRA (included as Appendix 8.1 of the EIAR):

- Avoidance of floating road construction
- Avoidance of stockpiling on the peat
- Avoidance of peat berms in areas of potential instability (highlighted by low safety ratios)
- Additional drainage will be provided in areas of construction
- Avoidance of drains discharging onto areas of weak or deep peat or areas of low safety ratios
- Avoidance of blasting

As noted in the PSRA, vehicular access to any areas of deep peat (>1m) during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice practice as described in the IWEA and Scottish Best Practice Guidelines will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with this CEMP, which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat, in particular areas of deep peat and the areas of potential instability highlighted in the PSRA. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met. In particular, construction areas will be checked for signs of cracking, movement, bulking or subsidence which may give rise to subsequent instability. Any areas identified will require a detailed peat stability risk assessment and ongoing monitoring which will include sighting poles and lines to be set-up across slopes in addition to ground surveying to check for any signs of ground movement.

5.5.3.2 Emergency Response

This CEMP includes an Emergency Response Plan (**Appendix A**) to be applied in the event of a landslide or ground instability. In particular, catch fences and other physical barriers (i.e. concrete blocks) will be on Site and available in sufficient quantities to be used in the event of ground instability.

5.5.4 Soil Contamination

Plant, vehicles, fuel bowsers etc. will be checked on a regular basis during the construction phase of the Development. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations.

5.5.4.1 Mitigation by Avoidance and Good Practice

A fuel management will include the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g. bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Only designated trained operators will be authorised to refuel plant on Site.

5.5.4.2 Mitigation by Reduction

As discussed previously, careful design of the wind farm has reduced the amount of Site traffic required on Site by reducing access tracks lengths, excavation volumes and double handling. Similarly, good Site practice will also result in less traffic and a lower potential for fuel spills and leakages.

5.5.4.3 Emergency Response

Procedures and contingency plans are proposed to deal with any emergency accidents or spills. In particular an emergency spill kit with oil boom and absorbers will be kept on Site in the event of an accidental spill. All Site operatives will be trained in its use. In addition, all vehicles will also contain emergency spill kits.

5.5.5 Material and Waste Management

All materials used on Site and wastes generated on Site will be reduced by good Site practice and attention to this CEMP. A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from Site for recycling. Any waste which is not recyclable or compostable will be properly disposed to landfill. Whenever possible, excavated materials will be re-used close to the area of excavation. The careful design which has been achieved will result in minimal excess soil and rock.

5.6 OIL AND CHEMICAL DELIVERY AND STORAGE

Oils and chemicals will only be ordered in manageable quantities and stored responsibly i.e. in a bunded area or suitable container/storage area, in accordance with relevant legislation and containers must be labelled with details of contents. No concrete batching will take place on site but will instead be delivered to site with only the chutes being washed out in a designated area.

All deliveries of oils and chemicals will be met by a competent member of staff who will direct the driver to the delivery point. Fuel oil shall be delivered by a road tanker and transferred to mobile bowsers and/or the static tank(s) within a designated fuel transfer area (refuelling area) in the site compound and/or designated refuelling areas on site for mobile bowsers. Any fuel bowsers or static tanks on site will be required to be bunded to 110% capacity. Spillage kits must be available at or near the delivery point for emergencies.

All fuel tanks will be kept locked when not in use. All oils and chemicals will be returned to the storage area after use.

It is a TWL requirement that storage of static generator(s) and associated fuel tank(s), which are separate with inter-connecting hoses, will be located within a covered impermeable bund – where these will be located on site and follow best practice as set out in PPG 6[2]. Bunds shall be constructed from concrete block work or similar (e.g. a walled containment facility). Rainwater will be prevented from accumulating in bunds as this compromises the containment. If required, drainage of these areas shall be via an oil separator.

Where more than one container is stored, the storage bund will be capable of storing at least 110% of the largest container or at least 25% of the total storage capacity, whichever is the greater. Oil absorbent spill response kits will be immediately to hand and be used to mop up any spillage. The following sets out storage requirements for oils and chemicals;

- All storage containers will be clearly labelled in accordance with Control of Substances Hazardous to Health (COSHH) requirements or appropriate replacement legislation. All containers will be stored in an upright position.
- The Site will maintain a COSHH inventory.
- Storage of oils and chemicals will be controlled (such as segregation) to prevent a reaction between the different types; for example, gas cylinders will be stored separately, as will substances marked flammable.
- When determining storage locations consideration will be made to enable adequate access and egress for plant and manual handling.
- Where external storage is required, locations will be sited at appropriate distances from watercourses, possible routes to watercourses and drains and will consider site sensitivities and

[2]https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/ppg-6-working-at-construction-and-demolition-sites/

the scope of activities being undertaken. Storage areas will be located in areas free from vehicle movements to minimise the risk of collision damage.

- The Contractor will also install oil interceptors within compound drainage where a significant volume of fuel and oil is stored.

A Chemical and Waste Inventory will be kept. This inventory will include:

- List of all substances stored on-site (volume and description);
- Procedures and location details for storage of all materials listed; and
- Waste disposal records, including copies of all Waste Transfer Notes detailing disposal routes and waste carriers used.
- Any tap or valve permanently fixed to the mobile unit through which oil can be discharged to the open or when delivered through a flexible pipe which is fitted permanently to the mobile unit, will be fitted with a lock and locked shut when not in use.
- Sight gauges will be fitted with a valve or tap, which will be shut when not in use. Sight gauge tubes, if used will be well supported and fitted with a valve.
- Mobile units must have secondary containment when in use/out on site.
- Where mobile bowsers are used on site guidelines will be followed so that:
    - Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and be locked shut when not in use;
    - Flexible delivery pipes will be fitted with manually operated pumps or a valve at the delivery end that closes automatically when not in use. Where possible, a nozzle designed to dispense oil is used; and
    - The pump or valve will have a lock and be locked shut when not in use.

Diesel is classified as a dangerous substance. Under the EU Directive 95/55/EC all such dangerous substances will be conveyed in a container that complies with the ADR. As such, the manufacturer of each bowser will provide certification to contractors of the following:

- A leak-proof test certificate
- A copy of the IBC approval certificate
- An identification plate attached to the container

For loads in excess of 1,000 litres (220 gallons), the bowser vehicle driver will have undergone training and hold a special license.

5.6.1 Inspection and Maintenance

Oil and chemical storage areas will be inspected, at least weekly for signs of spillage, leaks and damage. Rainwater, materials and general debris in bunds and drip trays will be removed as part of the maintenance programme.

5.7 REFUELLING

Refuelling activities on site will be undertaken by a designated and trained member of staff. Refuelling will only be carried out in designated refuelling areas. These areas will be located away from watercourses and drains and will consider site sensitivities and the scope of activities being undertaken. There will be no fuel stored on site.

Vehicles will be refuelled off-site where possible. For vehicles that require being refuelled on-site (e.g. cranes), fuels will be stored in the temporary construction compound and bunded to at least 110% of the storage capacity of fuels to be stored. High-density Polyethylene (HDPE) membrane will be provided beneath connection points to catch any residual oil during filling and disconnection. This membrane will be inspected and if there is any sign of oil contamination, it will be removed from site by a specialist licensed waste contractor. All vehicles will be well maintained and free from oil or hydraulic fuel leaks. No refuelling will take place within 65m of a watercourse. Refuelling will take place via a mobile double skinned fuel bowser. The bowser will be a double axle refuelling trailer which will be towed to the refuelling locations by a 4x4 vehicle. The 4x4 will carry, a drip tray, spill kit and absorbent mats in case of any accidental spillages. Only designated competent personnel will refuel plant and machinery on the Site.

Used spillage response kit material and waste oil shall be treated as hazardous/special waste and stored appropriately on site. All waste will require will be disposed of off-site to a licensed disposal site, in this case Carrowbrowne Recycling Centre.

5.8 WASTEWATER AND WATER SUPPLY MONITORING AND CONTROL

Wastewater presents a hazard to the environment and can cause contamination of groundwater and pollution of surface waters. In order to manage wastewater and water supply facilities at construction sites a series of monitoring and maintenance control measures will be put in place.

Wastewater Monitoring and Control

The maximum wastewater production is estimated to be the same as the maximum water consumption (of approximately 2,000 litres per day). The Development includes port-a-loos connected to an integrated waste holding tank at the Contractor's Temporary Compound capable of handling the demand during the construction phase, when as many as up to 40 people will be working on site at peak times. The holding tank will be fitted with an alarm so that when it reaches a certain capacity an alarm will warn that the tank will need to be emptied. The tank will be collected by a licenced waste contractor and disposed of at an appropriate licenced facility.

No concrete washout will be undertaken on site. Only the chutes of the trucks will be cleaned prior to leaving site and this will take place at a designated area at the Temporary Compound. Concrete washout areas will be planned to see that they do not cause congestion with site traffic and designed to prevent the escape of run off into the natural environment of the site such as a lined containment system. When washout areas are full, and the concrete has hardened it will be broken out and disposed of in an appropriate manner.

5.9 WATER SUPPLY

Drinking water will be supplied via drinking water coolers and toilet and kitchen facilities will be supplied via rainwater harvesting via holding tanks on the roof of the construction compound or via tankered water.

During the construction phase, water will be supplied by a water bowser which will supply an estimated demand of 1-2,000 litres per day. Drinking water will be supplied by bottled water brought to site daily or as an when required.

5.10 WASTE AND RESOURCE MANAGEMENT

5.10.1 Waste Hierarchy

TWL aims to manage waste in accordance with the waste hierarchy by avoiding waste generation and promoting waste minimisation in the first instance. This will apply to both the TWL construction and operational site. Where waste is produced, we will aim to reuse, recycle or recover where practical and economically feasible prior to considering disposal. We support the Circular Economy and encourage Contractors to also adopt this approach where practicable when considering the management of materials.

TWL together with our Suppliers and subcontractors who generate or dispose of waste as a result of carrying out their agreed activities are required to do so in a controlled manner and in line with current legislation.

5.10.2 Types of Waste

Waste produced on site will generally be regarded as 'controlled' waste, which comprises household, commercial or industrial waste. Waste produced by the construction site will be regarded as commercial waste since it will have been produced from premises used wholly or mainly for trade or business purposes.

Some controlled wastes are often further classified in view of their difficult nature and additional regulatory controls. In general terms and for most practical purposes it is often easiest to consider wastes as either hazardous or non-hazardous.

General waste arising at the site such as waste paper, plastics, wood, metal, packaging, small quantities of waste food and food containers and septic tank waste are likely to fall in the non-hazardous category.

Hazardous wastes produced on site are likely to include oils and fuels, oily rags, solvents, chemicals, and electrical equipment. Absorbent materials used for containing/cleaning spills of substances will be classified as hazardous waste e.g. oil absorbent matting. The materials will be bagged, sealed and labelled and placed in a hazardous waste storage container in the same way, as any other waste contaminated with a hazardous substance must be treated, and disposed of, as hazardous waste.

5.10.2.1 Packaging

Packaging will be brought on site during the construction, operational and decommissioning phases and can include cardboard, wood and plastics used to package turbine components. In accordance with the waste hierarchy, packaging will be returned to the originator ahead of re-use or recycling. Where this is not possible, waste will be separated as appropriate and safely stored on site appropriately site in anticipation of recycling. This waste is non-hazardous, and the effects of this waste are not significant.

5.10.2.2 Metals

Waste metals from concrete reinforcing during construction and removal of metals during decommissioning etc. will have commercial value and will be re-used or recycled with the appropriate licensed waste contractor. This waste is non-hazardous, and effects will be not significant.

5.10.2.3 Excavated Materials

The amount of peat spoil predicted to be generated during construction of the wind farm is approximately 84,760m^3 of peat spoil.

The total amount of cut material below the peat layer estimated from the Development is approximately 218,635m^3 with the amount of fill being estimated at 174,526m^3. This leaves a surplus of 44,109m^3 that it is envisaged can be used as structural fill in Site Access Tracks, Turbine Hardstand and Turbine Foundation construction. More information can be found in Chapter 8 of the EIAR.

Due to the nature of the peatbog habitats on site, it is not envisaged that berms or large designated storage areas can be used for the storage of spoil will not be permitted. However, peat spoil will be used to reinstate exposed areas around infrastructure such as slopes/graded ground around Site Access Tracks and Turbine Hardstands and on the Turbine Foundations or where there is degraded bog that can be enhanced by depositing peat on it. Peat that cannot be used for reinstatement around the Site, will be taken off site to the designated spoil storage area to the east of Maam Cross, approximately 3.5km to the west of the wind farm site.

Works at the spoil storage areas will involve the machinery similar to that used for peat excavation. A 40-60 tonne 360 degree long reach hydraulic excavator and tractors and trailers will be used to place the spoil in areas of cut away to create level surface. Where these areas are less than 1.5m deep (expected to be the majority), they will be filled with peat to the adjoining ground level and then a containment berm will be created to create cells. The cells will be bermed and will measure a maximum size of approximately 30m x 30m and have outfalls blocked and overflow management with the creation of drainage channels for excess water and sphagnum inoculation. Where the storage is on areas of non cutover peat, then the cells will be provided on the surface of the existing degraded/de-vegetation peat surface. The width of the cell, in an east to west orientation will be dictated by the width of the existing areas of cutover blanket bog either side of the degraded / de-vegetated area, but will not be wider that 45m in width. The length of the cells along their broadly north to south axis will not be longer than 60m in length. More information can be found in Chapter 8 of the EIAR.

Non-Peat Spoil

Non peat spoil will consist of glacial till from granite bedrock / rock is present on site according to the PSRA report by EcoQuest Environmental Services contained in Appendix 8.1 of the EIAR. It is envisaged in the design that all the non-peat material won on Site can be used as fill on site in the following places:

- Subsoil to be used around the blade laydown areas where load capacities required are less; and
- Rock won from excavations to be used within Site Access Track and Turbine Hardstand build up.

There will also be spoil generated from the grid connection works. This will be in the form of tarmacdam/asphalt, Clause 804 running layer material, compacted rock fill material and subsoils. The total amount of spoil material from the grid connection works is estimated to be 12,590m^3. This material will need to be taken off site and recycled/disposed of at Carrowbrowne Recycling Centre which is an appropriate licenced facility to deal with inert waste.

5.10.3 Storage of Waste

Waste will be deposited and contained within suitable labelled storage facilities until its removal from site by an authorised waste carrier. Waste will be segregated as appropriate for recycling such as paper, cans, plastics, wood, metal, packaging.

Labelling on containers must be durable and permanent. When determining storage locations, adequate access and egress for plant and manual handling will be provided.

5.10.4 Transfer of Waste

Only authorised waste carriers will be employed to remove waste from Construction Sites. The Contractor will be responsible to ensure that carriers have the required documentation such as waste carriers licence.

A Waste Transfer Note must accompany and be raised before transfer of any non-hazardous waste off site.

All wastes that are classified as special or hazardous waste are subject to the Consignment Note system for transfer.

Copies of the above documentation shall be required to be retained on site, in line with applicable legal requirements.

5.10.5 Waste Management Plan (WMP)

TWL construction sites shall be required to have a Site Waste Management Plan, which will be the responsibility of the Contractor. The Plan will record the following information, as a minimum:

- The types of waste generated by the site
- The management approach for each waste type (Reuse, Recycle, Recover, Dispose)
- The storage arrangements for each waste type
- Licenced Waste Management companies will be used to deal with waste from the project
- The site waste monitoring and reporting arrangements

5.10.6 Staff Facilities

During the construction, there will be the typical waste generated in an office such as left-over food and sandwich wrappers. This is a non-hazardous waste. All such waste will be stored appropriately and safely from wind, rain and wild animals that often tear apart rubbish bags. Provision for separation of waste streams will be provided so that e.g., paper and cardboard waste and bottles may be recycled. The effects of this waste will be not significant.

5.10.7 Sewage

The self-contained port-a-loo units which will be located in the temporary site compound during the construction phase, will be managed and serviced regularly (by removal of the contents by tanker to a designated sewage treatment plant such as Oughterard Wastewater Treatment Plant) and removed off site on completion of construction. Toilet waste is a non-hazardous waste and effects will be not significant.

5.10.8 Concrete

During the construction phase:

- Precast concrete will be used wherever possible i.e., formed offsite. Where the use of precast concrete is not possible the following mitigation measures will apply.
- The acquisition, transport and use of any cement or concrete on site will be planned fully in advance and supervised at all times.

- Vehicles transporting such material will be relatively clean upon arrival on site, that is; vehicles will be washed/rinsed removing cementitious material leaving the source location of the material. There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on site. To this end, vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the contractor's yard. Vehicles will also be in good working order.
- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during meteorologically dry periods/seasons. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e. avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will be avoided. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.
- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

5.11 ARCHAEOLOGY AND CULTURAL HERITAGE

The following section details the environmental control measures which will be incorporated into the Contractors' Construction Method Statement in respect of archaeology and cultural heritage. An assessment of the impacts from works on Archaeology and Cultural Heritage can be found in the EIAR, **Chapter 13: Cultural Heritage**.

Ground works during the construction phase of the Development will be subject to archaeological monitoring under licence by the National Monuments Service. In the event that any sub-surface archaeological features are identified during these site investigations they will be recorded and then securely 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).

The southern section of the roadway forming the grid connection route extends into the Galway Gaeltacht area and any signage erected within the public realm in this area during the construction phase will include Irish and English text.

5.12 AIR, NOISE AND VIBRATION

Emissions to Air

During construction in dry weather, there is the potential for a certain amount of dust to be generated. Measures implemented on site will include, but will not be limited to the following:

- Adherence to the speed limit on site in order to reduce the dust generated from transport on site roads
- Water bowsers – Spraying with water to dampen dust down
- Road sweepers – remove silt from the road surface to reduce the potential for dust on the public road, if required
- Materials with the potential to produce dust must be stored accordingly to prevent dust generation e.g. materials stored out of the wind and covered
- Transport of dust generating material will be covered

5.12.1 Noise and Vibration

There is the potential for noise and vibrations to be generated during the construction process. Measures will require to be implemented on site to minimise any effects and a programme of monitoring may be required. General guidance for controlling construction noise through the use of good practice given in BS 5228 will be followed. Construction and Decommissioning of the Development shall be limited to working times given and any controls incorporated in any planning permission.

6 CONSTRUCTION

The following sections detail an outline construction sequence to provide an overview of the construction process; The construction-stage details of the sequence and methodologies, to be undertaken within the framework of this CEMP, will be determined by the Contractors.

6.1.1 Phasing of Works

It is envisaged that the following will be the sequence of construction for the Development:

1. Site Preparation including drainage

2. Site Access Tracks
3. Contractors Compound and Welfare Facilities
4. Crane hardstands
5. Turbine Foundations
6. Internal cable ducting
7. Installation of the Grid Connection
8. Erection of wind turbines
9. Commissioning and Energisation

6.1.2 Working Hours

The Development will have approximately 50 construction workers during the peak of the construction phase. Working hours for construction will be from 07:00 to 19:00 on weekdays, with reduced working hours at weekends, from 08:00 to 13:00 on a Saturday. It should be noted that during the turbine erection phase, operations will need to take place outside those hours with concrete pours commencing at 05:00 and continuing till 16:00, to facilitate turbine foundation construction and so that lifting operations are completed safely. Hours of working for turbine foundation construction will be agreed with Galway County Council prior to the commencement of turbine foundation construction. **Chapter 14: Traffic and Transportation** refers to this in further detail. A detailed Traffic Management Plan will be implemented for the construction phase. This shall be agreed during the planning compliance stage with the Planning Authority so that strict controls described therein are in place with all suppliers coming to the Site.

6.1.3 Site Management Procedures and Construction Methodologies

Prior to commencement of construction, the appointed Contractors(s) will prepare detailed method statements and work programmes for the construction stage. These method statements will be prepared in the context of measures set out in this CEMP and will take account of mitigation measures as outlined in the planning application and accompanying environment reports, and site investigations to be carried out prior to construction. Any specific requirements will be fully incorporated into the appointed Contractors scopes of work and appropriate supervision and management will be carried out to ensure full compliance.

The method statements produced by the Contractors(s) will be reviewed by the Ecological Clerk of Works (EM) and will be agreed with the appropriate parties, including Galway County Council. The developer will employ a project manager to monitor the construction phase of the project and ensure works are being carried out in accordance with the agreed method statements, safety procedures and pollution control measures.

6.1.3.1 Mobilisation of Contractors Plant

Prior to commencement of construction works, the selected Contractors shall submit to the Developer a full list of plant, equipment and accommodation (site offices etc.) proposed for use during the works.

Dates for mobilisation will be agreed with the developer and/or his representative/Owners Engineer.

6.1.3.2 Site Infrastructure

Site Access Roads / Turbines

Machinery and vehicles used in access track construction are operated from the track only as it is constructed.

The location of all infrastructure required for this Development shall be set out by GPS (Real-Time Kinematicenabled3) equipment to the permitted detail as noted on the approved drawings. The Site will be set out using wooden posts to mark the boundary and extent of construction activities, in accordance with the Site layout and environmental constraints drawings, and with contributions from the appointed ecologist. The boundaries of the buffer zones will be taped/fenced off to prevent construction plant from entering the buffer zones and impacting on water quality. Site personnel will be informed of the buffer zones through toolbox talks onsite, both before and during construction. New personnel will be informed of the construction buffer zones with induction training before commencing work.

6.1.3.3 Establish Pre- Commencement Mitigation Measures

Prior to construction works advancing on site, the Contractors shall confirm to the Employer of their intention to advance the works in a sound practical manner with no undue impact on the receiving environment. The Contractors shall identify all sensitive environmental areas within the Site and confirm their intended method of construction works regarding these areas in line with the methods outlined in this CEMP. All environmentally sensitive areas shall be identified prior to the detailed design/construction phase.

Where the estimated working area is reduced by any sensitive environmental areas i.e., buffer zones, post and tape marking shall be used to set out these locations and thus prevent the entry of Contractors plant within these areas during construction works.

To protect any known ecological features that occur close to the planned infrastructure, a delineated working corridor will be employed throughout the construction. Posts and tape will be used to establish these areas and thus prevent the entry of Contractors plant outside the working corridor during construction works. Locations of ecological significance or where invasive species are identified will also be fenced off.

[3] Real-time kinematic (RTK) processing on a drone **records GPS information and geotags images as they're captured during flight**.

A 50m buffer to natural watercourses will be employed during construction to protect water quality and to see that there is no significant direct effect on existing watercourses. Where temporary spoil storage areas are located in proximity to watercourse buffer zones, silt fencing will be installed along the area facing the buffer zone and maintained in line with the instructions of the manufacturer. Works within the buffer zone will be subject to specific method statements.

6.1.3.4 Site Preparation

Works required at the site entrances will include the following:

- Clearing visibility splays of vegetation / soil to a level surface;
- Extending the entrance to allow HGVs turn into the site from the N59;
- Excavating to solid formation level;
- Installing roadside drainage features;
- Placing entrance sub-base with rockfill material;
- Placing capping layer; and
- Providing surface dressing where necessary to prevent rutting of existing road surface.

The detailed construction method statement for site entrance preparation is included in **Table 6.1**.

Table 6.1: Site Entrance Preparation CMS

Activity	Notes
Video Road Condition Survey.	The Contractors will arrange and provide a video survey to establish the condition of the road prior to mobilisation to site.
Prepare a Traffic Management Plan (TMP) in coordination with Galway County Council and An Garda Síochána and implement.	The Contractors will agree an approved TMP with the Roads Section at Galway County Council and An Garda Síochána and the developer.
Set out the alignment of the site entrance using GPS equipment.	Wooden pegs/posts or similar to be used in setting out, following a site walkover by the Ecological Clerk of Works.
Archaeology Requirements.	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.

Activity	Notes
Install drainage treatment features as per the Surface Water Management Plan.	Required to minimise the transportation of suspended solids generated during the construction stage.
Excavate and/or clear the area which is required to accommodate the visibility splays.	The top layer of vegetated material is set aside for re-use as a sealing layer to prevent sediment runoff and reduce visual impact.
Re-align private fences as required by the visibility splays and detailed design.	Required for stock control, security, and sight line visibility requirements.
Excavate to track formation level along the extent of the site entrance and accommodate drainage.	The Contractors shall provide that soil is carefully distributed and banked adjacent to the entrance within the construction boundary. Soil will be managed as per the spoil management plan. Any storage of material will be located to see that no interference with visibility splays occurs.
Installation of stone foundation and surfacing of apron to be installed.	In the interests of road safety, appropriate construction measures will be implemented to see that site debris is not deposited on the carriageway. In the unlikely event of same occurring, the Contractors shall see that all material is removed immediately in accordance with the provisions of the TMP to be agreed with Galway County Council.
Installation of security gates/hut (where required), tied into the re-aligned fence.	Required for site security.

<u>Contractors Compound and Welfare Facilities</u>

The temporary site compound will be in place for the duration of the construction works only. The compound will be used as a secure storage area for construction materials and to contain temporary site accommodation units for sealed type staff welfare facilities. The compound will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel type facilities.

An area within the compound will be used for the storage of fuel and oils and this will be suitably bunded to 110% of the storage volume. The bund will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays and details

During the construction phase, water will be supplied by water bowser. The maximum wastewater production is estimated to be the same as the maximum water consumption (2,000 litres per day). The project will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase with 50 construction workers on site at peak. A holding tank is proposed for wastewater management. Wastewater which will be removed off-site and disposed at an appropriate licenced facility.

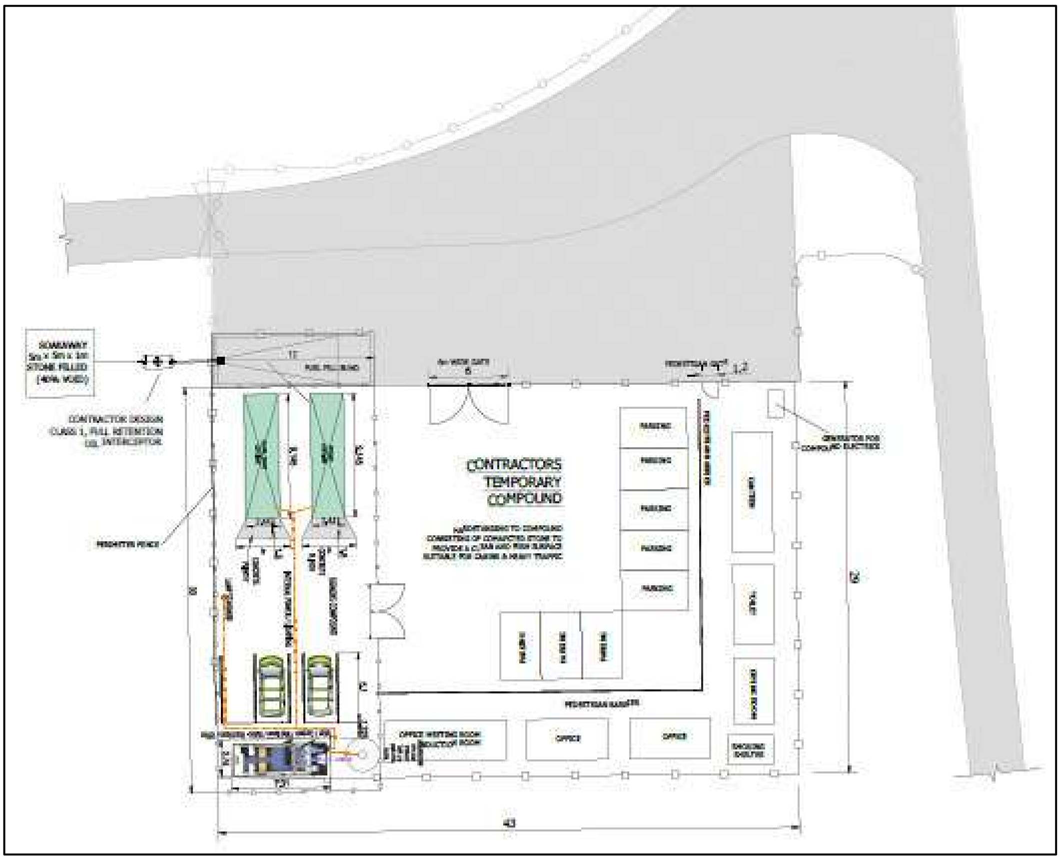

Figure 6.1: Contractor's Temporary Construction Compound

The proposed construction method statement for the construction compound / storage area is detailed in **Table 6.2**.

Table 6.2: Contractors' Compound and Welfare Facilities CMS

Activity	Notes
Set out the perimeter of the site compound using GPS equipment following a site walkover by the Ecological Clerk of Works	Setting out must be undertaken to Irish Grid co-ordinates and to sub-centimetre accuracy in the X, Y and Z plane.
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours.

Activity	Notes
	The nominated archaeologist will monitor all invasive works.
Install drainage treatment and flow attenuation features as per the detailed design	Required to minimise the transportation of suspended solids generated during the construction stage.
The top layer of vegetated material will be stripped and stored for re-use onsite.	The top layer of vegetated material is set aside for re-use as a sealing layer to prevent sediment runoff and reduce visual impact. The location for storage of these vegetated turves will be around the perimeter of the site compound away from any sensitive habitats.
Stone will be placed in layers to form the hardstanding area for the site compound.	Hardcore area with Clause 804 stone on geotextile layer (Netlon SS30 or similar) for temporary site offices and for vehicle movements / parking.
The accommodation, eating and sanitary cabins will be installed in accordance with the construction drawings. The site office will be located in the temporary storage area.	Foul drainage from site welfare accommodation will discharge to a holding tank. The holding tank will be fully enclosed with no discharge outlet. The toilets will be the 'portaloo' chemical toilet type. The holding tank will be emptied as required by a licenced waste disposal operator. Temporary power supply and telecommunications will be connected to the relevant cabins.
Construct covered bunded area for oil tanks Construct Plant refuelling Area	Bund to absorb 110% of potential spill volume. Non-permeable concrete refuelling area with petrol interceptor.
Storage units for hazardous products and covered waste skips will be installed as per best industry practice. Complete temporary service provisions – electrical, telecommunications, etc.	All storage units for hazardous products will be fully lockable and bunded proprietary steel containers.
Provide measures for waste management.	Waste segregation skips will be deployed for optimum recycling and re-use of materials. Skips will be covered with lid.

Activity	Notes
Construct an impervious bunded area for plant refuelling and plant maintenance and cleaning operations.	An oil interceptor will be installed on the drainage outlet from the bunded area to separate any oils from the surface run off. Generators and associated diesel tanks are to be installed on such an area.
Parking	Parking areas shall be identified by signage with a handrail system or barrier separating pedestrian areas and vehicle routes.
Reinstatement	Compound areas to be restored to pre-construction condition at completion and demobilisation stage.

Site Security

From an operational point of view, for control of site access and for proper site management, the access to the Site will require passage through a controlled safety barrier/gate or hut. The exact location(s) shall be decided by the Contractors with primary responsibility for safety on the Site. The barrier will be set back sufficiently so that HGVs can enter the Site without stopping.

The Contractors shall be responsible for securing each area of work, so as to ensure the safety and health of all affected persons (Contractor's personnel, site supervision staff, members of the general public, traffic, etc.). The Contractors will provide details to the Developer of security arrangements for the following:

- Fencing specification;
- Provision of personnel to man site access point(s);
- Signage; and
- Signing in/out procedures.

6.2 SITE CLEARANCE AND CONSTRUCTION METHODS

The management of earthworks will be of paramount importance throughout the construction of the project. The general principles that will apply to earthworks include:

- Excavations to only take place following implementation of setting out the working corridor, drainage treatment and flow attenuation provisions.
- Archaeological supervision works will be undertaken.
- Vegetation within the construction corridor shall be cleared as part of the excavation works.
- Suitable plant to be used, particularly when working off road i.e., use of geotextile mats.

- Machinery and vehicles used in access track construction are operated from the track only as it is constructed.
- Vegetated top-mat layer to be removed separately and set aside from other spoil and place around the excavations for use in reinstatement. Spoil storage areas will be located at the designated areas near Maam Cross.
- Topsoil stockpiles shall be no more than 1m in height, smoothed to prevent erosion, and watered to prevent them drying out.
- Apply the vegetated capping layer to permanently exposed excavations or storage areas to mitigate against movement and to avoid sediment run-off. Input from the appointed ecologist will be used to apply the appropriate species of the immediate environment in the capping layer.
- No permanent stockpiles will remain on site after completion of the construction phase.
- Monitor all rock breaking activities and survey areas for indicators of peat/soil movement/slide. The appropriate remedial action will be taken.

The construction method statement for excavation and spoil management is shown in **Table 6.3**.

Table 6.3: Excavation and Spoil Management Method Statement

Activity	Notes
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.
Install drainage treatment and flow attenuation features as per the detailed design, which includes recommendations of an expert ecologist	Required to minimise the transportation of suspended solids generated during the construction stage. Temporary and permanent ponds and outflow buffers will be constructed as per the attached Surface Water Management Plan (**Appendix B**).
Spoil locations to be identified to machine drivers	Spoil storage and restoration areas to be mapped and pegged out prior to excavation commencing.
A Risk Assessment shall be developed for each and every excavation location to be carried out on site.	Control measures to mitigate safety, stability and environmental risks specific to the local conditions.
The vegetated layer will always be removed and set aside separately from any spoil material.	Required to enhance revegetation.

Activity	Notes
Excavated material will not be stored in areas which have been identified as unsuitable for spoil storage.	Prevent movement of stored material and protect watercourses against harmful run offs.
Excavated material will be separated and stored so that it is not left exposed to the elements. This will be provided for through the immediate application of a vegetated capping layer.	All spoil to be taken to the designated spoil storage areas near Maam Cross unless it is used for landscaping.
Interim (temporary) material storage during the construction stage will be kept to a minimum by the implementation of a continuous construction cycle: 1) Excavate material; 2) Handle material; 3) Permanently store material	Return and re-vegetate the Site to its original state as soon as possible.
Permanent excavated or spoil surfaces shall be re-vegetated without undue delay using seed collected pre-construction, final details of which will be approved by the ecologist. Reseeding will occur within the growing season.	To encourage growth of locally common habitats
Material from excavations in rock, suitable sands and gravels will be carefully managed and re-used as structural fill in the locality of the excavation where possible.	To minimise the volume of imported material required and ensure no impact on the local pH level. No spoil will be permitted to be stored on areas identified as sensitive or high value habitats.

6.2.1 New Site Access Tracks

Carrying capacity will be based on the weight restriction for the installation crane, which typically has a maximum 20 tonne axle weight with a minimum of 12 tonnes.

Prior to advancing any construction works, final road design shall take into account the following:

- Existing Ground Profile
- Existing Ground Soil Type
- Bearing Capacity

- Natural Drainage
- Proposed Turbine Delivery Specification
- Existing Environmental Buffers

As this project will most likely be advanced as Design & Build, the Contractors will be obliged to form the design and construction works with reference to the above and seek final approval from the Engineer for their design prior to advancing any work on site. In any event, it is proposed that the roads are built as follows:

- The alignment of the new Site Access Tracks will be established and the centrelines will be marked out with ranging rods or timber posts.
- Any trees/hedgerow within the construction corridor shall be cleared prior to any construction works. All works will be undertaken outside of the breeding season.
- The first phase of drainage will then be installed in accordance with the detailed drainage design. Track construction will likely require the crossings of a number of cut drains and minor drainage paths.
- The angle of repose of the cut face of excavations shall be battered back approximately 45 degrees. However, where peat is encountered, it will be increased to 26.5 degrees.
- Slopes will not be undercut or excavations left unsupported for periods in excess of 24 hours.
- Soil excavation shall be observed by a qualified archaeologist, in accordance with the approved scheme of archaeological monitoring in order to respond appropriately to identification of any potential archaeological remains.
    - Where necessary, stone will be delivered to site by tipper trucks from approved local quarries and will be placed, spread and compacted in layers to form the running surface. The compaction will be carried out using a dead weight roller.
    - Imported stone will be used throughout for the final surfacing layer.
- Well-graded granular fill (quarry sourced clean stone) 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.

As is typical with windfarm tracks, the construction method will be Cut and Fill for the majority of the tracks with 2 areas where the peat depths are generally greater than 1.5m.

6.2.2 Cut and Fill (Excavated) Tracks

This form of Track construction is a traditional method whereby the final track construction is formed on a firm bearing strata. This is generally found following removal of the initial vegetation layer and more than likely the underlying layer of soft material found between the topsoil layer and the firm strata. Typically, this form of Track construction could be founded on relatively shallow excavations. However, if soft spots are encountered locally they will be excavated out and in-filled with selected excavated. Rock will be extracted from the turbine bases. Imported rock will be chemically compatible with the existing geology. It will be tested for compatibility prior to entering the Site. This involves using rock that is similar to the geology of the Site and locally sourced. Construction of Cut and Fill Track sections will be carried out in accordance with detailed design. This system will consist of either 1 or 2 layers of stone depending on the load bearing capacity of base layer and the design loading required with construction traffic. Where the underlying layer is clay, 2 layers of stone are used. 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.

If the vertical alignment requires local infilling for the formation of the Track, the above process of exposing a firm strata is followed and infill material is employed to raise the Track profile in a local embankment.

6.2.3 Road Drainage

A vegetative filter strip and under-road drainage will allow discharge in a controlled manner downslope of the works.

Any crossing of field drains, man-made drains and vegetated drains will be piped directly under the track through appropriately sized drainage pipes. Where appropriate, a lateral drainage ditch (interceptor drain) will be cut along the uphill side of the track to intercept the natural runoff. This lateral drain will be drained under the track at regular intervals through correctly sized cross drains. In cases where the tracks must run significantly downhill, transverse drains ('grips') will be constructed where appropriate in the surface of the tracks to divert any runoff down the road into the drainage ditch. Where the crossing of ditches, field drains, man-made drains and vegetated drains cannot be avoided, the design of the crossing, (in this case culverts) shall be prepared in line with the drainage design philosophy. This is further detailed in the Surface Water Management Plan in **Appendix B**.

Under track drainage will be provided under the excavated tracks at all locations where existing land drainage passes under the proposed tracks. Conventional cross drains will be 150mm diameter and increased to 300mm diameter (minimum) at points for land drainage or natural drainage paths. The spacing of the cross drains will be dependent upon whether the tracks run parallel or tangential with the general contours of the Site.

The detailed design of all under-track drains in areas near flushes will have the input from the Ecological Clerk of Works to see that there is sufficient flow connecting the upstream and downstream habitats. These will be inspected by the Ecological Clerk of Works during construction.

All existing site drainage channels and culverts shall be maintained and any additional drainage design required on-site shall be carried out as per the detailed design. Any such additional requirements will be reviewed by the Engineer, Ecological Clerk of Works prior to site clearance activities taking place on-site.

There are four proposed water crossings on site, two existing crossings to be upgraded and two new crossings.

6.2.3.1 Turbine Bases/Foundations

Foundation requirements will be provided by the wind turbine supplier, and appropriate factors of safety will be applied to these by the project Structural Design Engineer in accordance with Draft Revised Wind Energy Development Guidelines, 2019[4]. The turbine towers will be anchored to the concrete foundation using a bolt assembly which shall be cast into the concrete.

Each turbine will be constructed on a cast in-situ concrete foundation requiring approximately 590m^3 of concrete which, for the most part, is buried in the ground. The turbine foundations will be constructed so that the top of the foundation is at the existing ground level, with an acceptable tolerance of +/- 1m. The turbine foundation is estimated to be between 2.8m and 3.2m deep and therefore the formation level is 2.8m to 3.2m below existing ground level.

Plate 6.1: Turbine foundation under construction with adjoining crane pad[5]

[4] Draft Revised Wind Energy Development Guidelines, December 2019, [Accessed Online 25/05/2022_ file:///C:/Users/sbradley/Downloads/109102_ae9107b8-6a27-4f26-9a12-6b00632ceaf0%20(1).pdf]

[5] Good Practice during Wind Farm Construction, 2019. Online: https://www.nature.scot/doc/guidance-good-practice-during-wind-farm-construction [Accessed 15/02/2022]

There are two options for design and construction of Turbine foundations as follows:

- **Option 1 – Turbine Foundation constructed directly on in-situ ground:**

  The Contractors shall demonstrate that the soil/rock properties at the formation level are in compliance with the Turbine Foundation Design limiting criteria for a ground bearing base.

- **Option 2 –Turbine Foundation constructed on engineering fill:**

  If it cannot be demonstrated that Option 1 is achievable, the Contractors shall establish and demonstrate a suitable bearing stratum at a lower level, design and construct engineering fill to the formation level of the foundation and demonstrate that the fill properties at the formation level are in compliance with the Turbine Foundation Design limiting criteria for a ground bearing base.

Plate 6.2: Wind turbine foundation[6]

The construction method statement for the turbine bases will generally follow the sequence as defined in **Table 6.4**.

6 https://www.grousemountwindfarm.ie/documents/downloads/EIS%20Vol%201%20-%20Section%203%20-%20Text%20-%20Project%20Implementation.pdf [Accessed 15/02/2022]

Table 6.4: Turbine Base Construction Method Statement

Activity	Notes
Set out the turbine location with the use of GPS (RTK) equipment.	The Contractors shall tape off buffer zones with assistance from the Ecological Clerk of Works, and toolbox talks will be used to inform site staff of the importance of the buffer zones.
Archaeology	The Site will be accessible to the appointed archaeologist at all times during working hours. The nominated archaeologist will monitor all invasive works.
Set out and install drainage treatment and flow attenuation features.	Required to minimise the transportation of suspended solids generated during the construction stage.
Remove and locally store the top layer of vegetated material over the excavation area.	This material will be stored for re-use to cover and promote natural re-vegetation of the inorganic spoils that will be deposited at the nearest suitable location to the excavation, monitored by the Ecological Clerk of Works.
Excavate remaining material to 1m depth and segregate organic material from mineral material.	Selected excavated organic material will be considered for re-use as backfilling material.
Excavate to formation level. Complete plate bearing tests.	Any excavated inorganic material will be re-used as structural ballast to minimise the required volumes of spoil and imported stone.
A reinforcement steel cage for the foundation will be assembled after insertion of the turbine foundation insert arrangement (required for fixing steel tower) and formwork will be fixed to surround the cage.	
Reinforcement steel for the top section of the foundation is fixed along with the required number of cable ducts.	Reinforcing steel shall be checked for design compliance and signed off upon acceptance.
Erect the formwork to contain the concrete pour.	Formwork will be re-used and removed offsite when foundation construction is complete.
The foundation anchorage system will be checked both for level and line prior to the	

Activity	Notes
concrete being installed in the base. These checks will be passed to the appointed Turbine Contractors for their approval.	
The foundation will be backfilled with a cohesive material.	Using the material arising during the excavation and landscaped using the vegetated soil set-aside during the excavation.

Plate 6.3: Wind Turbine Erection[2]

Plate 6.4: Assembly of wind turbine blades [2]

6.2.3.2 Turbine Hardstands/Crane Pads

A crane pad hardstand area will be required at each turbine. The hardstands must allow for two cranes (including outriggers) to operate in the vicinity of the turbine to allow for turbine erection. The hardstand must also provide storage and set down areas for turbine components. The hardstand requirements are specified by the turbine supplier and require strict compliance so that there are no stability issues during erection of the turbine sections.

All Turbine Hardstands will be designed to take account of the loadings which will be provided by the appointed turbine and installation Contractors and will consist of a compacted stone structure which is to be installed in accordance with the Transport Infrastructure Ireland (TII) Specification 800 2013.

Two types of hardstands are facilitated:

- Locations that will require a turning head.
- Standard Hardstand arrangement where delivery vehicles do not require a turning area.

Hardstand formation will consist of either 1 or 2 layers of stone depending on the properties of the underlying load bearing layer. Where the underlying layer is clay, 2 layers of stone formation are used, the stone capping layer and, the 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 (in this case siltstone). The crane pad layout measures c.74m by 58m. The proposed Turbine Hardstand design is shown on **Figure 5.5**.

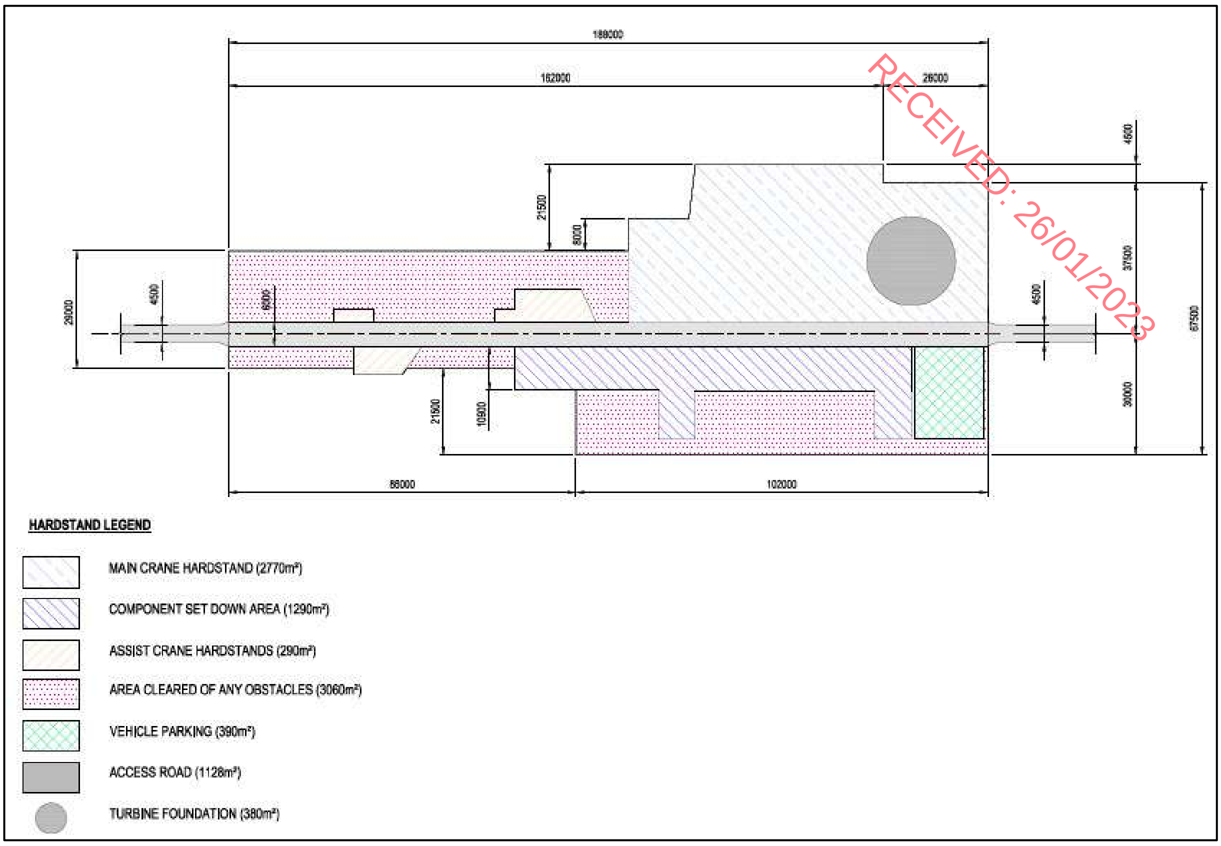

Figure 6.5: Turbine Hardstand

The hardstand area will be excavated to a formation level of weathered rock where possible or on stiff bearing strata on overlaying material.

Following completion of the hardstands, a series of plate load tests will be undertaken to demonstrate compliance with the turbine supplier requirements of 260kN/m^2.

Excavated material will be used for side slope formation local to the hardstands. Material from the excavation of the hardstands will be used to dress exposed areas around the hardstand with the remainder being used for landscaping around the turbine base or for the rehabilitation of the proposed borrow pits in accordance with the attached Spoil Management Plan. A Hardstand construction method statement is set out in **Table 6.5**.

Table 6.5: Typical Hardstands Construction Method Statement

Activity	Notes
Set out the crane hardstands with the use of GPS (RTK) equipment.	The Contractors shall see that buffer zones and areas of restricted working width are taped off with assistance from the ECoW and toolbox talks used to inform site staff of the importance of the buffer zones with identification of areas on drawings and maps.

Activity	Notes
Archaeology	The site will be accessible to the appointed archaeologist at all times during working hours.
Set out and install drainage treatment and flow attenuation features around the crane hardstand and turbine area.	In areas of peat only 'bog master' low ground pressure excavators will be used to minimise the impact on the vegetation layer. Temporary and permanent ponds and outflow buffers will not be constructed in sensitive habitats or buffer zones. Liaison with the ECoW at the detailed design stage will assist in the identification of suitable locations.
Remove and locally store the top layer of vegetated material over the area of the crane hardstand excavation.	This material will be stored for re-use to cover and promote natural re-vegetation of the amorphous peat and /or inorganic spoils that will have to be deposited at the nearest suitable location to the excavation.
Excavate remaining material to 1m depth and segregate organic material from mineral material.	Selected excavated organic material will be considered for re-use as backfilling material.
Excavate material to the required formation level.	The formation level for the crane hardstands will be on weathered rock or stiff overlaying material. Where suitable, the excavated material will be re-used as structural backfill material to minimise the required volumes of spoil and stone.
Place rock fill in accordance with the design to form the crane hardstand structure. Where appropriate, geotextile and/or geogrid should be used to help reduce the volume of stone. Fence off steep edges.	Special consideration will be given towards the stone placement and compaction so that the structural integrity meets the loading requirements.
Plate bearing tests will be undertaken following completion of the hardstand structure.	The number and location of the plate bearing tests shall be specified by the Contractor's designer.

Plate 6.5: Crane for wind turbine erection [2]

6.2.3.3 Handling/Disposal of Excavated Material

Excavated soil will be used for landscaping, stored in the designated areas at Maam Cross or used to restore areas of cutover peat for ecological enhancement at the areas near Maam Cross.

6.3 TRAFFIC AND TRANSPORT

During the construction phase, there will be traffic movements within the site boundary in addition to associated traffic movements on the local road network such as heavy goods vehicles, turbine deliveries. TWL construction sites shall be required to have a Traffic Management Plan (TMP), which will be the responsibility of the Contractor. The detailed TMP will be put in place for the construction phase, which shall be agreed during the planning compliance stage with the Planning Authority so that strict controls are in place with all suppliers coming to the Site. A TMP accompanies the Application and can be found in **Appendix 14.2** of the EIAR. This TMP will be required to be further developed by the appointed contractor in accordance with the relevant conditions of the permission.

6.3.1 Mitigation Measures

The impact of the proposed development has been identified as being temporary in nature and associated with short construction and decommissioning stages only. It is still important that any impact is minimised as far as possible and, in light of this, the following mitigation measures are proposed:

- HGV movements will generally be limited to 08:00 - 18:00 Monday to Saturday. Deliveries will be scheduled to avoid peak times around the morning and evening peak hours. This will avoid HGV traffic arriving during the morning peak hour creating conflict with local residents on their commute/school run. Construction personnel will be encouraged to car-pool, or to travel to site in minibuses.
- Wheel wash equipment will be used on site to prevent mud and stones being transferred from the Development Site to the public highway. All drivers will be required to check that their vehicle is

free from dirt and stones prior to departure from the construction site. In addition, any dust generating activities will be minimised where practical during windy conditions, and drivers will adopt driving practices to minimise dust creation. Finally, loads will be covered into and out of the site where required to ensure that the spillage or deposit of clay, rubble or other debris on the public road network is prevented.

- Construction works on the public road network will be carried out using a traffic management plan (based on this TMP) in accordance with Chapter 8 of the Traffic Signs Manual and agreed with Galway County Council.
- During the construction phase, clear construction warning signs will be placed on the N59, advising the general public as to the presence of the construction site. The site entry points will also be appropriately signed. Access to the construction site will be controlled by on site personnel and all visitors will be asked to sign in and out of the site by security / site personnel. Security gates will be sufficiently set back from the road, so that vehicles entering the site will stop well clear of the public road, thus obviating the queuing of construction traffic on the public road network. Site visitors will all receive a suitable Health and Safety site induction, and Personal Protective Equipment ("PPE") will be worn.
- Grid connection works will proceed at a rate of approximately 100m per work shift, the rate will depend on the ground conditions and the number of existing services encountered in the excavation. The works area will be fully enclosed within the traffic management system. Traffic management using temporary traffic lights shall be kept to the minimum length necessary to accommodate the works being undertaken and to minimise delays to the public.
- Longitudinal trench excavations in the public road shall be straight and parallel to the centre of the road/footway where practicable. Transverse road or footway crossings shall be at right angles to the kerb or property line. Bituminous and concrete road surfaces and footways be cut using a road saw, concrete saw or equivalent mechanical means to the full depth of the bituminous or concrete material prior to any excavation work. The edges of the road shall be trimmed to provide an overlap for permanent road reinstatement in accordance with chapter 7 of the Managing Openings in Public Roads Specification.
- The 38kV cable trench shall be excavated using a rubber tyre excavator on all public roads. The sides of the trench shall be supported to prevent damage to the road. Material arising from trench excavations may be stored at a safe location within the works area and used to backfill trenches, surplus excavated material shall be removed from site and disposed at licenced landfills.
- All excavated trenches in the public road network are to be reinstated at the end of the work shift, A temporary reinstatement shall be carried out in the event that the works are not completed at the end of the work shift.
- Once construction of the Development is completed, all portacabins, machinery and equipment will be removed and temporary hardstanding's excavated and reinstated. The area will be re-graded with the topsoil to a natural profile and allowed to regenerate from the seed bank within the topsoil.

6.4 PLANNING CONDITIONS AND OUTLINE METHOD STATEMENTS

This CEMP and its future versions/revisions will form part of the Contract for Tullaghmore Wind Farm. It will therefore be updated and revised during the different stages of the Development. Where the project is granted planning permission all the planning conditions associated with the Planning Application, applicant Tulaghmore Wind Farm Limited will be listed in **Table 6.6**.

Table 6.6: Relevant Planning Conditions and Related Documentation

Condition No.	Planning Condition	Reason
Planning Ref: INSERT NUMBER		

The Contractors will address all of the mitigation measures and best practice construction methods detailed within the above consent in his design and in any detailed environmental plans as required by this CEMP or the Contract.

6.5 SCHEME AMENDMENTS

Scheme Amendments will be recorded in **Table 6.7**. These amendments do not include changes to the scheme design which are completed in accordance with the existing planning consent. Instead, this refers to changes in the design of the wind farm for which additional approvals and / or consents may be required from Cork County Council. For example, amendments to layouts or in accordance with the current grant of planning permission.

Table 6.7: Scheme Amendments

Reference	Date	Scheme Amendment Description	Environmental Sensitivities potentially impacted by Scheme

6.6 REGISTER OF VARIATIONS

Where any variations to the Management Plans and CEMP are required (either as a result of Scheme Amendments or through corrective actions or improvements noted and undertaken on site) these will be recorded in **Table 6.8**, Register of Variations. Furthermore, all changes to construction methods, design, mitigation and the implications of these changes and authorising personnel will be recorded in **Table 6.8**.

Table 6.8: Register of Variations

No.	Variation Description	Authorising Personnel	Completion Date

7 COMMUNICATION PLAN

7.1 INTRODUCTION

Both the Contractors and the Client will appoint Project Managers to the project. These Project Managers will be the main points of contact between the two parties. This includes the Contractors Construction Project Manager and the Client.

It is envisaged that main project communications will take the form of structured reporting arrangements and meetings.

All issues in relation to environmental management/monitoring will be reported to the Ecological Clerk of Works. The Contractors Ecological Clerk of Works will report to the Contractors and Client on a regular basis.

7.2 CONTACT SHEETS

Table 7.1 provides a list of Tullaghmore Wind Farm Limited, Contractors and relevant third party contact details. This table will be updated and maintained by the Contractors for the duration of the Contract.

Table 7.1: Contact Sheets

Company	Position	Name	Telephone
Tullaghmore Wind Farm Limited	Client Project Manager		
Contractors	Site Manager / EM		
Contractors	Contracts Manager		
Contractors	General Manager		
Contractors	Foreman		
Tullaghmore Wind Farm Limited	Construction Project Manager		

7.3 MEETINGS REPORTS AND CONSULTATIONS

Table 7.2 lists all meetings and consultations as required by the Contract. The table also provides details on the schedule/frequency, scope & objectives and attendees / responsibility for each meeting.

7.4 ROLES & RESPONSIBILITIES

Roles and responsibilities for environmental management, monitoring and reporting are detailed in **Table 7.3**. The Ecological Clerk of Works Contractors will be responsible for the delivery of all elements of the Environmental Management Plan. The Ecological Clerk of Works Contractors will retain all responsibility for issuing, changing and monitoring the Environmental Management Plan.

7.5 REPORTING PROCEDURES

Figure 7.1 provides a diagrammatic outline of the general tasks and communication lines, based on the roles described in **Tables 7.2** and **7.3** and tasks detailed in the Management Plans. The Contractors will update this information as part of the construction stage CEMP.

Emergency Response Plan (Appendix A) includes the communications plan for reporting procedures for all potential environmental risks, hazards or incidents which may relate to ecology, water quality, dust, noise or archaeology. Environmental reporting to statutory bodies, such as Galway County Council will be managed by the relevant Contractors in accordance with an agreed reporting schedule.

Table 7.2: Meetings, Reports and Consultations

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
A Record of all meetings, checks, permissions and licenses will be retained within Section 7 of this CEMP			
Site Inductions	All new site personnel and visitors		Contractors to organize and maintain records
Weekly environmental meetings	Weekly	To provide updates on environmental mitigation measures and performance and identify actions for improvement. The Ecological Clerk of Works Contractors is required to maintain a Pollution Prevention Measures Register in which mitigation measures put into place will be listed and	Attendance required: Ecological Clerk of Works Contractors Site Manager, and any other relevant personnel or statutory consultees where necessary.

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		checked weekly to assess the requirement for maintenance. The results of these checks will be discussed at the meeting and corrective actions agreed as required.	
Monthly Environmental Report & Monthly Environmental Management Group Meeting	Monthly	To provide a compiled record of weekly meeting minutes and environmental performance and monitoring results (e.g. air, noise or water quality monitoring as appropriate). To identify any areas / action for improvement.	To be prepared by Ecological Clerk of Works. Report to be issued to the Contractors and Construction Project Manager before the end of each calendar month. Report to be discussed at the monthly meeting with recommendations for improvement passed to the Contractors in written format
Final Environmental Report	Upon completion of construction works	The final report will document the environmental and ecological effects of the construction period. The evidence for effects will be based on findings included in the minutes of weekly meetings and monthly meetings, together with other recording information maintained by the Ecological Clerk of Works. The report will relate results to residual effects predicted in the EIAR.	The Final Report will be prepared by the Ecological Clerk of Works. The report will be made available to the Contractors, Construction Project Manager and Planning Authority, if required.

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
Environmental Checks and Monitoring of Mitigation Works	As required in advance of construction works regular checks will also be made at least every 14 days.	Environmental Checks are to be carried out in advance of construction works. This will comprise an on-site meeting / inspection to confirm the appropriate use of identified mitigation measures and highlight any further issues / measures which may be relevant prior to commencement of works in any area. As a minimum, Environmental Checks will be completed at each main piece of site infrastructure (turbine bases, construction compounds, sub-station, control room) prior to works commencing in that area. Environmental Checks will include: • Checks for visual evidence of contamination / sediment alongside watercourses, nearby working areas and in areas of surface water discharge. • Regular checks of all plant and equipment	Environmental checks will be undertaken by the Contractors Ecological Clerk of Works. The Ecological Clerk of Works may also undertake regular checks, either independently or in conjunction with the Contractors checks as required. The Contractors and Ecological Clerk of Works will retain a record of all inspections / findings of Environmental Checks within Section 7 of this CEMP. All records will be made available for audit / review. All records will also be made available for discussion during regular meetings as scheduled herein.

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		to identify any oil or fuel leaks to confirm the condition of the plant. • Inspection of drainage and erosion and sediment control measures. Additional checks will be made before, during (where safe to do so) and immediately following anticipated storm events or periods of continuous or heavy intermittent rainfall over one or more days. • Environmental checks will also encompass a review of: - Waste management procedures - General site tidiness - Temporary materials storage (extracted materials stockpiles) and restoration works and - Soil stability	

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
		- Signs of any mammal activity on site - Buffer zones (if any) are being maintained	
Environmental Audit	At least once every month.		Environmental Audits may be carried out by the Contractors, or Tullaghmore Wind Farm Limited. at any time during the works. Audit procedures and forms are included within Section 7. These will be followed / completed by the Employer when undertaking environmental audits and may also be adopted by the Contractors, unless alternative procedures and forms are submitted and approved as part of the Contractors' construction stage CEMP.
Liaison with regulator / statutory Consultees	As Required	Provide regular updates to relevant authority on environmental performance and maintain good working relationships with the regulatory bodies.	Contractors and Ecological Clerk of Works where required. Meetings will be initiated as required by Planning Conditions, Management Plans or as agreed throughout the duration of the construction phase. The Contractors is responsible for obtaining all relevant permissions, consents, licenses and permits. Some permits may require application and implementation by an appropriately qualified person. In these instances, the Contractors will consult with the other specialist

Meeting/ Report	Schedule/ Frequency	Scope & Objective	Attendees/Responsibilities
			Environmental Consultants where required.

Table 7.3: Roles and Responsibilities

Position	Roles and Responsibilities
Construction Project Manager	The Construction Project Manager will: Ensure that the Contractors has obtained the relevant approvals and licenses and consents from regulatory bodies and statutory consultees where required. Ensure that the Contractors has submitted all relevant documentation to t, liaise with the Site Manager and the Ecological Clerk of Works and ensure that corrective actions and variations to the CEMP have been instigated.
Project Site Manager/ Engineer	The Site Manager will provide liaison between the Ecological Clerk of Works and the Contractors where environmental sensitivities, instruction for environmental performance improvements or corrective actions are requested by the Ecological Clerk of Works or other appropriate person(s) as a result of environmental checks or audits conducted by this person(s). The Site Manager will ensure that all notifications of environmental sensitivities and incidents as well as other general observations on environmental performance are reported back to the Construction Project Manager. The Project Site Manager is responsible for review and further development of the CEMP.
Environmental Manager	The Ecological Clerk of Works will be a member of the Environmental Management group and will work with the Contractors to ensure compliance with best practice and with all environmental mitigation and monitoring requirements as detailed within the relevant planning conditions, compliance documents and CEMP during both the pre-construction and construction phases. The main roles of the Ecological Clerk of Works are as follows: • Organise start-up meeting / Toolbox talks with the Contractors to agree working methods, specifically including communications; schedules; monitoring of data storage; and preparation of plans indicating location of key features including mitigation measures, monitoring points and sensitive habitats (where not previously highlighted and approaches agreed).

Position	Roles and Responsibilities
	• Give tool-box talks as agreed with the Contractors to address key areas, including water pollution prevention, protected species management, and on-site biodiversity. Highlight to staff the requirement for compliance with planning conditions. • Undertake a pre-construction walkover with the Site Engineer / Site Manager to confirm that access routes remain appropriate to the conditions present at the time of construction • Delineate any sensitive habitats or features with wooden stakes and high visibility tape • Undertake or delegate to an appropriately qualified person, a pre-construction Invasive Alien Species survey along the works route • Monitor the installation of poles and infrastructure • Inspect pollution control measures during the works • Maintain a presence on site during the pre-construction and construction works, including setting out of access routes. • Organise a minimum of weekly meetings with the Site Environmental Supervisor and / or Foreman, to allow briefing on the programme of works on site and to provide on-site guidance during construction. • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractors. • Develop written reports / audits and submit to the Contractors and present findings at meetings as required. Prepare updated reports and a final report on mitigation measures, procedures and monitoring. • Monitor potential environmental impacts and the successful implementation of all mitigation as detailed in the NIS and this CEMP. • Maintain a weekly presence on site during the main construction works. • Prepare a pre-construction Invasive Alien Species survey along the works route. • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractors. • Produce written reports to the Contractors following site visits and meetings. This includes monthly reports and a final report.

Position	Roles and Responsibilities
	The Contractors will provide comprehensive information on all proposed works and all scheduling to the Ecological Clerk of Works in advance, to anticipate and address any issues, especially access to new areas including areas where Invasive Alien Species may occur, vegetation clearance, setting out of buffer zones, excavation and silt mitigation measures, temporary compound works and vegetation reinstatement.
Ecological Clerk of Works and/ or Water Quality Specialist	The Ecological Clerk of Works will work with Tullaghmore Wind Farm Limited, the Contractors to see that compliance is achieved with best practice and with all environmental mitigation and monitoring requirements as detailed within the NIS and CEMP, relevant planning conditions and CEMP. The Ecological Clerk of Works will delegate and oversee the work to ensure competency of tasks achieved. Where a particular ecological concern exists at the Site, or specific habitat management activities are to be undertaken in conjunction with the main civils construction works, a Specialist Ecologist / Environmental Consultant may also be required unless the Ecological Clerk of Works is suitably qualified to undertake the particular ecological responsibilities. The main roles of the Ecological Clerk of Works are as follows: • Organise start-up meeting / Tool box talks with the Contractor to agree working methods, specifically including communications; weekly schedules; monitoring of data storage; and preparation of plans indicating location of key features including mitigation measures, monitoring points and sensitive habitats. • Maintain a weekly presence on site during the main construction works. • Organise a minimum of weekly meetings with the Site Manager and / or Foreman, to allow briefing on the programme of works on site and to provide on-site guidance during construction. Note: It is essential that the Contractor supplies information on works and scheduling to the ECoW in advance in order to anticipate and address any issues, specifically including drainage, buffer /protection zones, silt mitigation measures, cabling, roads, turbine bases, met masts, compounds, landscaping, topsoil removal, storage and replacement, vegetation reinstatement and restoration works, planting, felling and habitat management. • Highlight the need for compliance with planning conditions.

Position	Roles and Responsibilities
	Contractors Note: If failures occur and actions are taken which contravene legislation then the Project Ecologist has the power to stop works in the affected area with immediate effect. These actions will only be taken where appropriate. Notification to stop works will be by verbal means, followed up with written confirmation recording the time and date of the instruction, personnel involved and reasons for the instruction. Upon recommencement of works, details of any corrective actions and / or remedial measures implemented will be recorded within Section 7. • Give tool-box talks as agreed with the site contractor to address key areas, including water pollution prevention, protected species management, and on-site biodiversity. • Monitor potential environmental impacts, including: - Use of and storage of oils and toxic chemicals on site, e.g. cement - Dewatering of excavations (including turbine bases) - Silt control - Water management, including working in or close to watercourses - Protection of ecological interests, e.g. protected species and habitats • Identify environmentally sensitive areas and ecological hazards for demarcation by the Contractor. • Produce written reports to the Contractor following site visits and meetings. This includes monthly reports and a final report.
Specialist Ecologist/ Environmental Consultant	Where a Specialist Ecologist / Environmental Consultant is employed, this person(s) will: • Provide advice and maintain regular liaison with the Project Site Manager, Project Manager, Ecological Clerk of Works and Contractors and / or other specialist Environmental Consultant as and when required. • Undertake specific monitoring activities and reporting as defined in agreed documentation prepared as part of the planning process. • The Ecological Clerk of Works or a Water Quality Specialist will be appointed. They will have responsibility for fulfilling the following requirements re water quality monitoring:

Position	Roles and Responsibilities
	- Daily visual inspection of: access roads for signs of ground damage or solids escape to nearby watercourses in vicinity of construction works - The ground between the structure under construction and the nearest downslope watercourse for signs of solids escape or ground damage - Surface water features in vicinity of construction works - Any pollution control measures at structures and along access roads (e.g. silt fences, drain or stream crossings etc.) for evidence of contaminated run-off or mitigation failure - Attendance at the critical work phases including, access road construction, foundation excavation, watercourse crossings, concrete pouring and back-filling. - Collection and analysis of water samples at a number of monitoring locations (i.e. upstream & downstream of the 4 no. instream work locations) before, during (if potential pollution visually identified) and after construction works at that location. - EPA Q Value Biological Monitoring at monitoring locations (i.e., upstream & downstream of instream construction work locations) before and after construction works.
Archaeological Clerk of Works	The main roles of the Archaeological Clerk of Works (licenced) are as follows: • Maintain regular liaison with the Project Site Manager, Project Manager, Ecologist and Ecological Clerk of Works as appropriate. • Maintain liaison with officers of the Planning Authority, specifically the Council Archaeologist and Planning Officers as appropriate. • Where applicable, apply for licence application; the Minister for Dept of Culture Heritage and Gaeltacht can approve and issue a licence under Section 26 of the National Monuments Act 1930. • Facilitate compliance with planning conditions and agreed Archaeological Programme of Works. • Demarcate any archaeologically sensitive areas and set up exclusion zones as required on site. • Immediately notify the relevant authorities in the event of the discovery of archaeological finds or remains and suspend works in the immediate

Position	Roles and Responsibilities
	area pending consultation. Allowance will also be made for full archaeological excavation if required. • Complete a full report for submission to the Planning Authority and the Department of Housing, Local Government and Heritage on completion of the works.
Geotechnical Clerk of Works or Appointed Geotechnical Consultant	The Geotechnical Clerk of Works will be responsible for preparation and monitoring of a geotechnical risk register as well as specific duties relating to geotechnical issues as they may arise during site construction works. Soil instability and the potential for slide even can have a significant impact on environmental receptors. In completing the geotechnical risk register, the Geotechnical Clerk of Works will work with the Contractors to identify suitable mitigation and monitoring methods. Where possible, construction works will avoid causing change to local hydrological and hydrogeological flow patterns and water levels.
Contractors Appointments	
Construction Manager	[The Contractors is required to specify roles and responsibilities for each individual below]
Site Agent	[To Be Confirmed]
Foreman	[To Be Confirmed]
Other Nominated Person(s)	[To Be Confirmed]

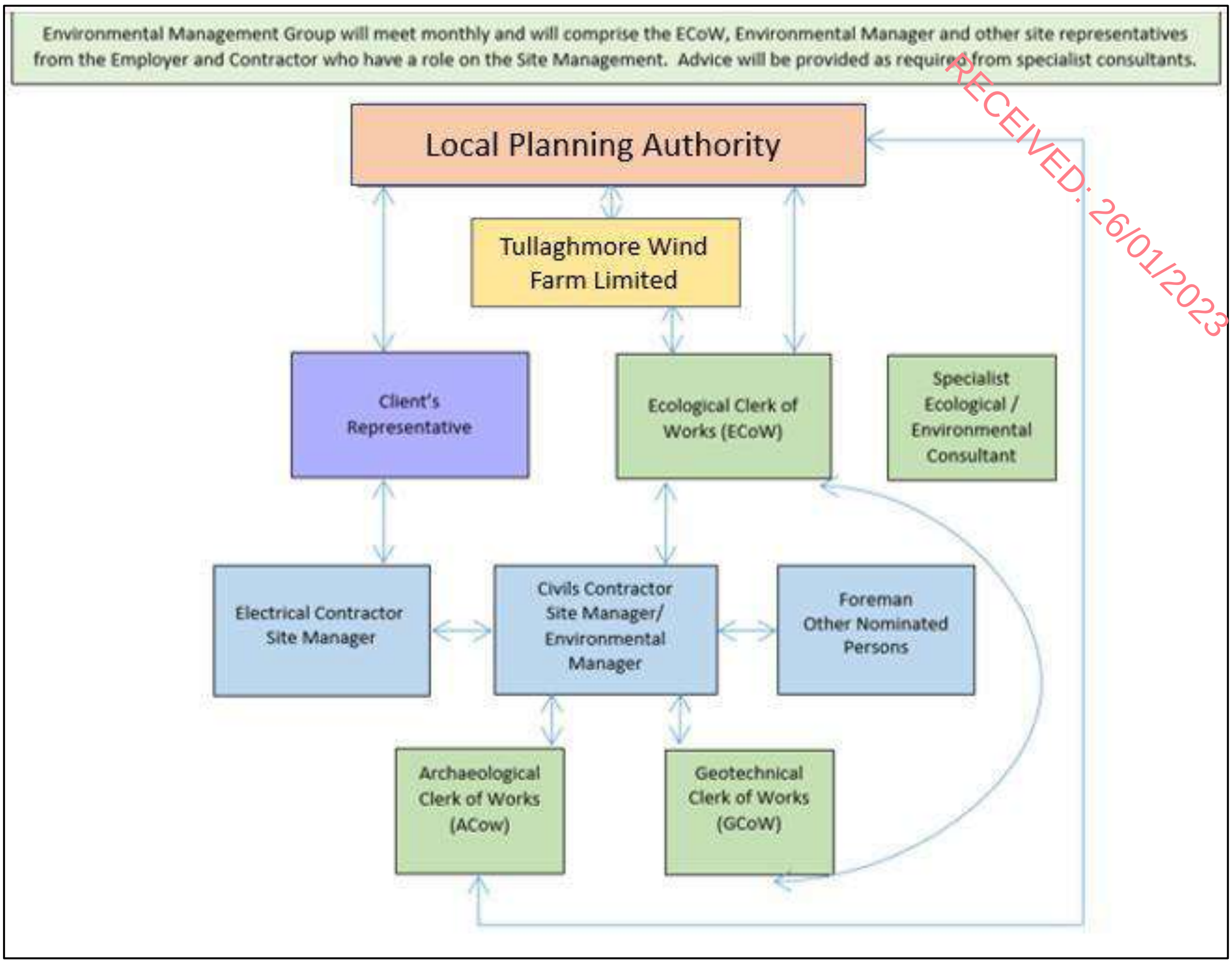

Figure 7.1 General Communication Plan

7.6 TRAINING, AWARENESS AND COMPETENCE

All site personnel will receive environmental awareness information as part of their initial site briefing. The detail of the information will be tailored to the scope of their work on site. 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 posted on the main site notice board during the project. The environmental performance at the Site will be 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.

7.7 EMERGENCY PREPAREDNESS AND RESPONSE

An emergency preparedness and response procedure is required to prevent environmental pollution incidents. 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, Galway County Council will be informed immediately. In the case of water pollution, in addition to Galway County Council, Inland Fisheries Ireland will also be informed immediately. Further details in relation to emergency responses are provided in the **Emergency Response Plan** which accompanies this CEMP in **Appendix A**.

7.7.1 Spill Kits

It is an TWL requirement for spill kits to be provided in/with the following on all of TWL construction sites:

1. in all heavy plant and equipment, 4x4 and commercial vehicles
2. with all refuelling bowsers
3. with all static fuel tanks
4. during all refuelling operations, associated transportation and storage

These kits are used as a first response or for the containment and clean-up of small spills.

In addition, spill kits will be strategically located at sensitive areas on site or where activities are being conducted that have the potential for a spill placing booms across sensitive watercourses downstream of work areas will also be implemented A supply of spill kits will be held on site and stocks constantly replenished.

8 CORRESPONDENCE, RECORDS & REPORTS

8.1 REQUIREMENTS

The Contractors will insert / file all communication records and reports associated with Environmental Management and implementation of this CEMP under this Section 8. As a guide, the following sub-sections of filed information will be required (at a minimum):

5-A) Meeting minutes and attendance record

5-B) Weekly Environmental Reports

5-C) Monthly Environmental Reports

5-D) Environmental Checks

5-E) Audit Reports

5-F) Ecology documentation and monitoring records

5-G) Pollution Prevention, including a Pollution Prevention Measures Register

5-H) Water Quality documentation and monitoring records

5-I) Archaeology documentation and monitoring records

5-J) Ground Risk, including a Geotechnical Risk Register

5-K) Waste Management documentation

5-L) Licensing and Consents: copies of all permissions, consents, licenses and permits and related correspondence. A summary record of all such documents shall also be provided in accordance with **Table 8.1** of this CEMP.

5-M) General Correspondence: all other relevant internal and external communication records relating to environmental management issues and implementation of the CEMP.

5-N) Training Records

5-O) Toolbox Talk Records

5-P) Ecological Clerk of Works Reports

All of these documents and records will be made available for inspection in the site office. The documentation will be maintained and will be reviewed on a regular basis with revisions controlled in accordance with the site quality plan.

8.2 ENVIRONMENTAL AUDITS

The Contractors Ecological Clerk of Works will consult and assist with the Client in evaluating compliance with applicable legislation by means of a monthly Environmental Audit. A blank Environmental Audit Report form is included in the **Emergency Response Plan** (**Appendix A**). All completed audit report forms and records of corrective actions (and close outs) must be filed within this section of the CEMP.

8.3 ENVIRONMENTAL CONSENTS, LICENSES & PERMITS

The Contractors Ecological Clerk of Works (or otherwise nominated responsible person(s)), will complete the summary record for all applicable permissions, consents, licenses and permits obtained for the Site. This record will follow the format provided in **Table 8.1**.

Table 8.1: Record of Environmental Consents, Licenses and Permits Issued

Consents, Licenses & Permits	Governing Legislation	Licensed Activity
Pollution Control & Hydrology		
Biodiversity		
Waste Management / Contaminated Land		
Noise / Vibration		
Archaeology		
Transport		
Other		

8.4 ENVIRONMENTAL MONITORING AND MEASURING

All of the mitigation measures outlined in Section 5.0 will be monitored, where applicable. The Contractors will put in place a program of monitoring for dust, noise, vibration and water sampling in accordance with the requirements of this CEMP.

Copies of all records will be maintained in the site office and will be reviewed by the Contractors.

8.5 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 CEMP are not met, or where there is insufficient control of the activities and processes to the extent that the functionality of the CEMP, is compromised in terms of the policy, objectives and management programmes.

Correction will be required in order to improve the identified non-conformance. The CEMP must conform to its objectives and targets and the requirements of the ISO 14001 management standard. In the event of non-conformance with any of the above, the following must be undertaken:

- Investigate 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.

9 MANAGEMENT PLANS & AVAILABLE INFORMATION

9.1 MANAGEMENT PLANS

Various Management Plans have been prepared. As listed in **Table 9.1**. These are intended to provide a benchmark for best practice and to define Tullaghmore Wind Farm Limited's minimum requirements for environmental management and mitigation.

9.2 CONTRACTORS REQUIREMENTS

The Contractors is required to further develop the Management Plans into detailed site and works specific environmental plans, method statements and procedural documents. **Table 9.1** provides a summary of the content of the Management Plans and the Contractor's obligations for their further development.

Table 9.1: List of Management Plans

No.	Name	Details
1	Emergency Response Plan	The Contractors will further develop the Environmental (Incident and Emergency) Communication Response Plan. This will include procedures for dealing with containment of accidental chemical or fuel spills, potential overload of the drainage system by silt during unforeseen adverse weather conditions etc. The Contractors will prepare a Communication Plan for emergency response in the event of a spillage. Detailed procedures will be outlined in this document. See **Appendix A**.
2	Surface Water Management Plan	The Contractors is obliged to implement the water quality monitoring proposals set out therein. Where changes to the plan are required the Contractors must consult with the Ecological Clerk of Works. See **Appendix B**.
3	Decommissioning Plan	The Contractors will further develop the Decommissioning Plan. Where changes to the plan are required, the Contractors must consult with the Ecological Clerk of Works. See **Appendix C**.
4	Traffic Management Plan	The Contractors will further develop the Traffic Management Plan (contained in Appendix 14.2 of Volume IV of the EIAR). Where changes to the plan are required, it can be amended by the Contractors.

Appendix A - Emergency Response Plan

TULLAGHMORE WIND FARM LIMITED

TULLAGHMORE WIND FARM, MAAM CROSS, CO. GALWAY

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

EMERGENCY RESPONSE PLAN (ERP)

JANUARY 2023

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DOCUMENT APPROVAL

PROJECT	Tullaghmore Wind Farm	
CLIENT / JOB NO	Tullaghmore Wind Farm Limited	6276
DOCUMENT TITLE	Construction Environmental Management Plan (CEMP) Emergency Response Plan	

	Prepared by	**Reviewed/Approved by**
Document Rev0	Name Andrew O'Grady / Aileen Byrne	Name David Kiely
Date October 2022	Signature Andrew O'Grady Aileen Byrne	Signature David Kiely

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Document Final	Name Andrew O'Grady / Aileen Byrne	Name David Kiely
Date January 2023	Signature Andrew O'Grady Aileen Byrne	Signature David Kiely

CONTENTS

1. INTRODUCTION

1.1 Why have an Emergency Response Plan?

Many construction and industrial sites intrinsically have the potential to cause significant environmental harm which could threaten water supplies, public health and wildlife in the event of an environmental incident. The aim of this plan is to see that in the event of an emergency, quick action will limit any impacts on humans and the local environment.

This response plan forms part of the conditions of work for staff, and for every contractor or sub-contractor at the site.

1.2 Outline of this Environmental (Incident & Emergency) Response Plan

The information contained in this plan forms the Emergency Response Plan (ERP), part of the Construction Environmental Management Plan (CEMP) for Tullaghmore Wind Farm.

It contains details of:

- Who should be contacted in an emergency?
- Procedures to be followed in an emergency
- Staff responsibilities in an emergency

1.3 What is an Environmental Incident?

This plan should be instigated once there has been an emergency or environmental incident on site or elsewhere, linked to the construction of Tullaghmore Wind Farm. Such an incident is a discharge to air, land or water that could cause environmental damage. Potential causes of environmental incidents on this site include:

- Leaking plant or equipment
- Containment Failure
- Fire
- Land Slide
- Vandalism
- Overfilling of containment vessels
- Flooding on site
- Leaking Portaloo
- Discharge of raw or partially treated effluent

- Wind-blown waste, litter or dust
- Fuel drips or spills during refuelling
- Leak from fuel or chemical containers
- Contaminated water or sediment/silt entering a water course or drain
- Failure of pumps and pipelines
- Blade throw (results from wind turbine failure and may include the splintering of rotor blades and detachment of debris)

Any of these incidents could affect drainage systems, surface waters, aquatic ecosystems, groundwater and soil. These incidents could also affect air quality by producing toxic fumes and airborne pollutants which may damage human health, wild and domestic animals and ecosystems. The emergency procedures to be followed for each of the incidents listed above ae detailed in **Section 6.1**.

1.4 Reference Documents

Current legislation including the Safety, Health and Welfare at Work Act 2005 and the Safety Health and Welfare at Work (Construction) Regulations 2013, has been taken into account into the production of this Plan and will be complied with in the further development of the Contractor's Construction Management Plan.

2. GENERAL REQUIREMENTS OF AN ERP

As mentioned, environmental incidents may include flooding, spillages (oil and chemicals), contaminated run-off, riverbed disturbance, damage to underground services, damage to habitats, poor waste disposal and storage.

This Emergency Response Plan:

- Identifies key staff and 24-hour contact details to be contacted in the event of an emergency (**Section 6.5**)
- Identifies key external bodies and emergency response numbers who should be contacted in the event of an emergency (**Section 6.4)**
- Details an Inventory of Chemical Products and Waste Inventory on Site (**Section 6.6**)*
- Details an Inventory of Pollution Prevention Equipment (**Section 6.7**)
- Provides details of staff trained in the use of spill kits and booms etc. (**Section 6.8**)

- Provides details of reporting requirements (**Sections 6.3 to 6.9**)
- Provides detailed procedures to be followed in the event of an emergency (**Sections 6.1**)
- Provides a Communication Plan for operatives outlining key actions in the event of an emergency (**Section 6.2**). This will be available to all operatives on site.

**Because of the nature of wind farm construction operations and the nature of works on site, the potential pollutants will vary.*

3. INCIDENT & HAZARD REPORTING

A blank Environmental Incident Report Form for reporting environmental incidents or hazards for the site is attached in **Section 6.9**. A blank Site Environmental Audit Form is attached in **Section 6.10** to record audit results. The details recorded in these forms will be regularly reviewed and will form part of the response plan procedural review.

4. WASTE DISPOSAL AFTER ENVIRONMENTAL INCIDENCES

If spill kits etc. are used in the event of a pollution incident, operatives will carefully dispose of used equipment by carefully placing them in a sealed bag or container. They will then be removed from site by a licensed waste contractor. Contaminated soil also needs to be disposed of as hazardous waste by a permit holder.

5. SITE INDUCTION AND TOOLBOX TALKS

It is imperative that all contractors, sub-contractors and staff on site are fully familiar with this emergency response plan and it will be detailed regularly in Toolbox Talks. During these talks, they will also receive regular reminders of the importance of the local environment and of the necessary environmental controls that are in place on site.

6. PROCEDURE AND COMMUNICATION PLAN IN EVENT OF AN INCIDENT

6.1 Procedures to be followed in the event of an incident:

The following procedures are intended as a guide in dealing with incidents. Health & Safety guidance should be followed at all times applying common sense and ensuring the health & safety of yourself and others:

6.1.1 Spillages/Leaks/Containment Failure

1. Identify the source of the spillage and cut off source, if possible, e.g. by closing valve, righting container etc.
2. Work on site will cease and all operatives will assist in placing spill mats on the affected area. Site Manager/Main Contact must be notified.
3. Identify where spillage may go. If spillage is near a watercourse (drainage/ditch/ river) divert spillage away from the watercourse through the use of absorbent materials from the spill kit.
4. Notify all parties in the order listed in **Sections 6.4 and 6.5**. Notification should be made by one member of staff whilst remainder of staff present deal with the spill/incident.
5. Dig up all contaminated ground as soon as possible/immediately. All contaminated materials should be placed in sealed polythene bags/containers and disposed of appropriately by an appropriate licensed waste contractor.
6. Complete required record of incident and response into reporting system.

6.1.2 Contamination of Watercourse

Suspended Solids

7. If watercourse is at risk of contamination from suspended solids from a slope failure, the Site Manager/Main Contact must be notified and the following actions must be implemented:
   a) Place straw bales wrapped in geotextile or sand/gravel bags with geotextile curtains **immediately** in the watercourse(s) at regular intervals downstream from the incident. These sand/straw bags and bales will be removed and replaced with stone filters once water quality is stabilised.
   b) Stone check dams faced with a layer of geotextile will be constructed at critical points along the watercourse.

c) Small sumps will be formed intermittently between the check dams to reduce the amount of suspended solids contained in the water.

Oil Spill in Watercourse

8. If spill has reached the watercourse the Site Manager/Main Contact must be notified and the following actions must be implemented:

a) Place flexible absorbent booms across watercourse, ahead of the contamination within a quiet stretch of water.
b) Place absorbent cushions in the water immediately upstream of these booms as well as downstream of the booms.
c) Remove and replace saturated absorbent material as required. Ensure removed cushions are placed in sealed polythene bags/containers and disposed of by the principal waste contractor.

6.1.3 Land Slide

9. Please see EIAR Figure 4 Landslide Susceptibility Mapping (of the PSRA) for further detail of flow routes and storage locations for excavated materials to be re-used for reinstatement works. Where the onset or actual detachment of peat (e.g., cracking, surface rippling) occurs:

a) All activities in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.
b) The Site Manager/ Main Contact must be notified
c) All relevant authorities will be notified if a peat slide event occurs on site and this Emergency Response Plan (ERP) followed.
d) Where peat slides do not represent a risk to a watercourse and have stopped moving, they will be stabilised using rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and a stabilisation procedure implemented. The area will be monitored, as appropriate, until movements have stopped.
e) Where possible, check barrages (comprises the placement of rock fill across a watercourse which allows the passage of water but will prevent peat debris from passing through) will be constructed on land using rock fill to prevent a peat slide reaching any watercourse.
f) If peat reaches a watercourse a check barrage will need to be constructed across the watercourse preventing the peat from moving downstream. The check barrage will allow water to flow through it, but the peat will be trapped.

g) The size of the check barrage will depend on the scale of the peat slide to be contained and the geometry of the watercourse at the location of the barrage.

h) All measures to contain the peat slide must be approved by Galway County Council or Inland Fisheries Ireland (IFI).

6.1.4 Fire

10. In the unlikely event of a fire at a turbine or at the substation, all personnel on site will meet at a designated fire point and emergency services will be contacted.

6.1.5 Blade Throw

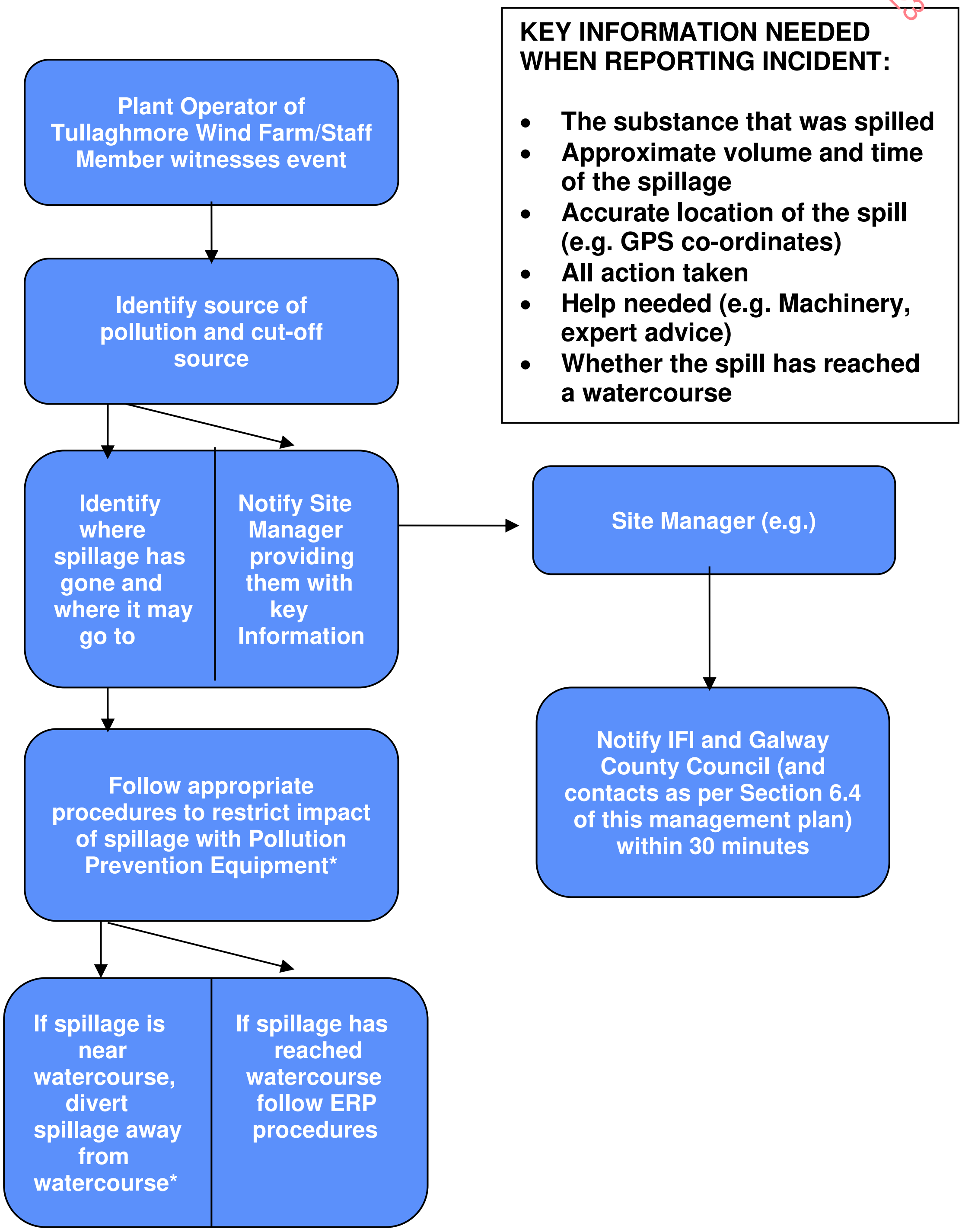
11. In the unlikely event of ice throw from blades, all activities in the area will cease and site personnel will stand clear of turbines where possible until they have been shut down completely.

6.1.6 Vandalism

12. In the event of a vandalism at the site, all personnel on site will be notified and An Garda Síochána will be contacted.

6.2 Communication Plan

A Communication Plan (to be followed in the event of an incident) will be provided by the Contactor, in liaison with relevant stakeholders and will be included in the updated ERP prior to commencement of site development works. A Communication Plan is proposed below:



6.3 Environmental Response Plan for Tullaghmore Wind Farm

INCIDENT RESPONSE PLAN FOR TULLAGHMORE WIND FARM

Based on template provided in GPP 21 – Pollution Prevention Guidelines.

Site Address: Tullaghmore Wind Farm, Tullaghmore, Maam Cross, Co. Galway **Official Company Address:** Tullaghmore Windfarm Limited, C/O EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1, D01 V4A3. **KEY HOLDERS FOR SITE – NAME & CONTACT NUMBERS:** Mr. Michael O'Connor, Tullaghmore Windfarm Limited, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1, D01 V4A3. Tel: 087 993 6673 Email: moc@emp.group	**Middle of Site** **ITM:** 502827 E, 747106N **Site Entrance** **ITM**: 502301 E, 745075 N **Map references:** OSI Discovery Sheet 45 **Link to Map:** https://www.google.com/maps/@53.4687444,-9.4719018,9182m/data=!3m1!1e3
Overview of the activities on site: **Include number of employees at different time of the day:** Daylight Hours: Dusk to Dawn: Weekend Dusk to Dawn: Bank Holidays:	
Date & Version of the plan:	**Name & position of person responsible for compiling/approving the plan:**
Review Date	**Date of next exercise:**
Objectives of the plan: To limit any potential harmful impact to the local environment through swift and appropriate actions in the event of an emergency.	
List of external organisations consulted in the preparation of this plan with contact details	

Distribution list of who has received this plan and which version. *Please note that it is recommended that you review and revise this plan regularly:*

6.4 External Contacts

Contact	Office Hours	Out of Office
Emergency Services (Fire/Police/Ambulance)	999 or 112	999 or 112
Local Garda Station Oughterard	091 557 320	
Local Hospital. University Hospital Galway	091 524 222	
Environment Directorate, Prospect Hill, Co. Galway	091 509 510	
EPA	053 916 0600	1850 365 123
Inland Fisheries Ireland	01 884 2600	**1818 347 424 (24 hours a day)**
Roads Service (Blocked/Flooded Roads)	091 509 000 (Galway County Council customer. service) 353 46 942 2000 (OPW floodinfo) (091) 509 000 (flooding.ie Galway CC)	
ESB- Electricity Company	021 238 6555 (ESB Galway) 1800 372 999 (ESB Emergency) 1800 372 757 (ESB Fault Report)	1800 372 999 **(24 hours a day)**
Telecommunications – Eircom	1800 245 245	

6.5 Internal Contacts

Names and position of staff authorised and trainers to activate and co-ordinate the plan.
Staff to be contacted if need to move or evacuate the site

Other Staff:		
Managing Director		
Site Manager		
Environmental Manager		
Health & Safety Manager		

6.6 Chemical Product & Waste Inventory

Trade name/ substance	Solid/liquid/ gas or powder	UN number	Max amount	Location marked on site plan	Type of Containment	Relevant health & Environmental properties

6.7 Pollution Prevention Equipment Inventory (On/Off-Site Resources)

Type	Location	Amount	Staff contact

For example:

- *Personal protective Equipment (PPE) available that should be worn*
- *absorbents*
- *drain mats/covers*
- *pipe blockers*
- *booms*
- *pumps*
- *sandbags*
- *silt fencing*
- *over drums*

IF ANY OF THIS EQUIPMENT REQUIRES SPECIALIST TRAINING – STATE WHO HAS BEEN TRAINED IN ITS USE AND DATE OF TRAINING (attach evidence where possible).

6.8 List of Staff Trained in the Use of Spill kits and Booms

Name	Date of Training

6.9 Site Environmental Incident Report Form

Site		Date	
Time		Weather:	
Report By:		Position:	
Tullaghmore Wind Farm personnel present:		Position:	
Contractor Personnel Present:		Position:	

Description of Incident

Item Spilled	
Estimate of Volume of Spillage	

List of actions followed once incident was noted	Time	Corrective Action By	
		Action	By
Who first observed incident?			
First action			
Next Action			
Time Pollution Hotline was contacted			
Other			

Details of Clean-Up contractor or how contamination was removed from site:

Details of how this could be avoided in future:	
Details of review of internal procedures as result of this incident:	

DATE REPORT COMPLETED____

6.10 Site Environmental Audit Form

Site:		Date:	
Time:		Weather conditions:	
Report by:		Position:	
Tullaghmore Wind Farm personnel present:		Position:	
Contractor personnel present:		Position:	

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
1. Miscellaneous					
1.01	Does the contractor carry out regular internal environment audits on the site? Are recommendations recorded and is corrective action monitored?				
1.02	Have any environment incidents occurred and have these been reported as per on site procedure?				
1.03	Does the site induction contain a section on environmental requirements, including spill procedures, and is this communicated effectively?				
2. Land					
2.01	Are areas of hard standing (excluding bunded and refuelling areas) appropriately drained?				
2.02	Have local roads been inspected and cleaned where necessary?				
2.03	Has all test pitting and soil stripping been monitored by an archaeologist?				
2.04	Have all site clearance works been checked by an ecologist prior to works?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
3. Material and equipment					
3.01	Is there knowledge of the IFI |Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016) and OPW Environmental Guidance: Drainage Maintenance & Construction (2019)				
3.02	Are transformers/ generators located in secondary containment bunds?				
3.03	Are all bunds capable of containing 110% of the volume of the largest container?				
3.04	Is refuelling carried out in a designated refuelling bay?				
3.05	Does all site drainage on hard standing drain to an oil interceptor?				
3.06	Is the designated area for oil, fuel and chemical storage appropriately sited (i.e. on hard standing at least 10m from a watercourse)?				
3.07	Are there procedures in place to monitor bund integrity and mange bund rainwater levels? Are these followed and recorded?				
3.08	Is there awareness that oil or residue from contaminated water removed from bunds should be disposed of as special waste and not discharged to land or the water environment? (oil absorbent materials (pads etc.) should be used first)				
3.09	Are all drums and mobile plant (e.g. generators) placed on drip trays more than 10m from any watercourse?				
3.10	Is all plant maintained in a good state of leaks? Are there records of this?				
3.11	Are there adequate spill kits available and stored in close proximity to potential risks?				
3.12	Are all refuelling browsers double skinned, locked when not in use, and in a good state of repair?				
3.13	Is there evidence of unmanaged/ unrecorded fuel / oil spillages on site?				
3.14	Are dry or wet wheel washing facilities fully operational and effective?				
3.15	If wet wheel washing facilities are required, are these closed systems				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
	with no discharge to the water environment?				
3.16	Are there laboratory certificates (accredited by the Irish National Accreditation Board) to confirm that imported material stone aggregate brought onto site is free from any contamination?				
4. Noise, Dust and Light					
4.01	Are there facilities to dampen stockpiles and site working areas/roads to suppress dust?				
4.02	Are vehicles carrying loose material sheeted at all times?				
4.03	Are construction works, or deliveries of materials to and from the development, audible at noise sensitive premises?				
4.04	Has all external construction lighting received the approval of the planning authority?				
5. Waste					
5.01	Is the site tidy and free from litter?				
5.02	Is there evidence of waste beyond the site boundary?				
5.03	Is waste segregated and kept securely in containers in clearly designated areas?				
5.04	Does all waste leaving the site have the appropriate duty of care paperwork?				
5.05	Is all waste leaving the site being taken to an appropriately licenced site?				
5.06	Does all special/ hazardous waste (e.g. oil contaminated soils, waste oil) have the appropriate Special Waste Consignment Note?				
5.07	Is material re-used/recycled on site where possible?				
5.08	Are waste management practices in line with the site waste management plan?				
5.09	Are relevant Waste Management Exemptions in place for use of waste on site (e.g. use of waste concrete to create foundation sub-base)?				
5.10	Is there any evidence of burning on site?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
5.11	Is there any evidence of unlicensed burial of waste?				
6. Water					
6.01	Do all discharges to land or watercourses have appropriate authorisation from Local Authorities /IFI?				
6.02	Does all watercourse engineering (bank protection, crossing etc.) have the appropriate authorization from Local Authorities / IFI?				
6.03	Do any abstractions from a watercourse or groundwater body have the appropriate authorization from Local Authority / IFI?				
6.04	Has confirmation for the SUDS design for access roads been gained from Local Authority / IFI?				
6.05	Are cut-off ditches installed on the uphill side of the working area to avoid contaminated surface water run-off?				
6.06	Have field drain been diverted where necessary?				
6.07	Is adequate treatment (e.g. settlement tank/lagoons/discharge to land) provided to prevent silt contaminated water entering watercourses and groundwater?				
6.08	Has vegetation removal/ clearance of the site been minimised to avoid unnecessary areas of bare ground?				
6.09	Have buffer-strips been left between working area and watercourses?				
6.10	Is plant operating in the watercourse?				
6.11	Have all culverts been installed at the base of stockpiles situated within close proximity to watercourses?				
6.12	Have silt fences been installed at the base of stockpiles situated within close proximity to watercourses?				
6.13	Are there adequate controls on site construction roads to minimize sediment runoff into watercourses (in particular, are there adequate flow attenuation measures within surface drain)?				
6.14	Are there any sign of decaying straw bales in water courses? (this could lead to organic pollution of the water course)				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
6.15	Are silt traps regularly maintained?				
6.16	Has ease of maintenance been considered in the design of permanent drainage features?				
6.17	Is there evidence of contamination of any watercourse (e.g. with oil, sediment, concrete, waste) in the vicinity of the works?				
6.18	Is monitoring of potential impacts on watercourses carried out on a regular basis and fully recorded?				
6.19	Are dewatering operations being carried out in such a way to minimise sediment contamination?				
6.20	Is drainage and run off in concrete batching areas adequate?				
6.21	Are adequate pollution prevention measures considered and put in place during concrete pours?				
7. Landscape					
7.01	Have earthworks been designed to promote successful re- instatement of vegetation?				
7.02	Are reinstatement and restoration works being implemented in a timely manner as per the requirements of the Contract?				
8. Ecology					
8.01	Have storage sites (soil, plant etc.) been sited on areas of lower quality habitat where possible?				
8.02	Is the ECoW a member of the institute of Ecology and /or Environmental management as required by planning conditions?				
8.03	Have buffer zones been constructed and maintained around designated protected species exclusion areas (e.g. red squirrel dreys, water vole habitats, otter holts, badger holts etc.)?				
8.04	Have toolbox talks on the subject of ecology and environmental responsibilities on site been delivered? Have attendance record been maintained for these?				

Item	Questions	Yes	No	Corrective Action Required	
				Action	By
9. Documentation Check					
9.01	Start-up meeting record				
9.02	Full contacts list in Section 3, Table 3.0 of CEMP				
9.03	Induction records				
9.04	Pollution Prevention Measures Register				
9.05	Geotechnical Risk Register				
9.06	Weekly meeting minutes				
9.07	Records of environmental checks and routine monitoring of mitigation measures				
9.10	Water Quality Monitoring Results				
9.11	Safety and Environmental Awareness Reports (SEARs). Filed and entered on database?				
9.12	Safety and Environmental Audit Reports for the site. (If yes, insert date of last audit_________________)				
9.13	Contractor's Environmental Plans (or Construction Method Statements):				

Appendix B – Surface Water Management Plan

TULLAGHMORE WIND FARM LIMITED

Conceptual Design, EIA & Planning Services

for

Tullaghmore Wind Farm,

Co. Galway.

Surface Water Management Plan

November 2022

Tullaghmore Wind Farm Limited,
C/O Empower Renewables,
2 Dublin Landings,
North Wall Quay,
North Dock,
Dublin,
D01 V4A3.

Jennings O'Donovan & Partners Limited,
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RECEIVED: 26/01/2023

DOCUMENT APPROVAL

PROJECT	Tullaghmore Wind Farm	
CLIENT / JOB NO	Tullaghmore Wind Farm Limited	6276
DOCUMENT TITLE	Surface Water Management Plan	

	Prepared by	**Reviewed / Approved by**
Document Rev. 0	Name Andrew O'Grady	Name David Kiely
Date 18th July 2022	Signature Andrew O'Grady	Signature David Kiely

Document Rev. 4	Name Andrew O'Grady	Name David Kiely
Date 17th November 2022	Signature Andrew O'Grady	Signature David Kiely

TULLAGHMORE WIND FARM
SURFACE WATER MANAGEMENT PLAN

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Overview

This Surface Water Management Plan (SWMP) for the Development describes the site drainage that has been designed for the site using the following principles:

- Ecologically Sensitive Processes
- Sustainable Drainage Systems (SuDS)

This is a live document and where there is a requirement for variation on the ground to provide more ecologically sensitive drainage then the SWMP will be updated to reflect this. The SWMP will be updated by the appointed Contractor and changes to the document will be agreed with the Project Hydrologist and Ecological Clerk of Works (EcoW) before drainage works commence.

The SWMP aims to:

- Describe environmental sensitives of the site and the buffer zones
- Describe how the system will operate to minimise modification and disruption to the existing site hydrology
- Outline the proposed maintenance regime
- Outline the proposed drainage management post-construction

2 BASELINE ENVIRONMENT

2.1 Site Description

The Site is located within an upland bogland landscape between Maam Cross and Oughterard, Co. Galway. The Site is located approximately 30km northwest of Galway City, and 9km west of Oughterard, Co. Galway.

Figure 1: Site Location

2.2 Topography

The topography of the Site is variable, and it is broadly surrounded by or is partially overlapping three elevated areas. These include Knockbrack to the east of the Site (299m OD (metres above Ordnance Datum)) near Lough Beg in the Derroura Forest and Cappanalaurabaun (273m OD) at the northern extent of the Site. Further north beyond the Site boundary is Curraun Hill at 252m OD. The southern and western extents of the Site are low lying areas ranging from 50 – 60m OD. The topography beyond the southern and western extent of the Site is characterised by low lying surface water features such as the Owenwee River, Owenree River, Lough Bofin, Loughanaduff, Loughaunierin and Tawnaghbeg Lough. The N59 road which traverses the southern Site boundary is also generally low lying.

The Site is generally topographically elevated in the north / north-west and generally topographically low lying in the south and east. The steepest incline across the Site occurs at the north-western extent of the Site near the proposed T4 position. A peat stability risk assessment (PSRA) (included in **Appendix 8.1**) and a chapter on Lands, Soils and Geology (Chapter 8 of the EIAR) have been prepared to address the potential risks associated with the positioning of project infrastructure and potential peat failures. Elevations typically range from between 100m and 200m OD across the majority of the Site with areas of relatively flat ground existing within the central areas of the Site between elevations of 110m – 150m OD. The peat storage area and ecological enhancement area is relatively flat with elevations ranging from 41 to 46mOD.

2.3 Hydrology and Geology

The proposed wind farm Site and current grid connection route are located within the Corrib and Galway Bay North catchment areas in Hydrometric Area 30 and 31 respectively. The proposed wind farm Development and grid connection to Screebe are located within three WFD sub-catchments. These include the Corrib and Joyce's subcatchments with a small section of the EIAR boundary overlapping into the Ballycuirke Lough Stream sub catchment. The Ballycuirke Lough Stream sub-catchment is listed as a Margaritifera Sensitive Area in accordance with Annex II and Annex V of the EU Habitats Directive. All of the proposed wind farm Development and grid connection options are located within the National River Basin District (RBD) as defined by the 2nd Cycle of the WFD (2015 - 2021). Maps illustrating the catchment and subcatchments areas relative to the proposed Site and grid connection are illustrated in Volume III of the EIAR.

The proposed Site and its surrounds are located upstream of Lough Corrib Upper which is located approximately 7m from the Site boundary at the closest extent near the proposed T3 turbine position. The proposed Site has indirect hydraulic connectivity to Lough Corrib Upper via the headwaters of the Owenwee and Owenree Rivers which drain the site. Lough Corrib is the second largest lake in Ireland in terms of area ($176km^2$) and is designated as the Lough Corrib SAC. The western portion of the Site is primarily hydraulically characterised by a number of unnamed rivers and streams that are headwaters of the Owenree River which ultimately discharges into Lough Corrib Upper.

3 ENVIRONMENTAL CONSTRAINTS AND MITIGATION MEASURES

There are a number of construction phase mitigation measures that must be adhered to during the installation of the drainage system. The relevant EIA Chapters where mitigation measures can be found are shown in **Table 3.1**.

Table 3.1 Location of relevant mitigation measures

Element	Location of Mitigation Measures
Biodiversity	EIA Chapter 6
Ornithology	EIA Chapter 7
Soils and Geology	EIA Chapter 8
Hydrology and Geology	EIA Chapter 9

4 DRAINAGE SYSTEM OVERVIEW

4.1 SuDS Drainage Design

The design criteria for the SuDS design are as follows:

- To select and install ecologically sensitive drainage.
- To minimise alterations to the ambient site hydrology and hydrogeology.
- To provide settlement and treatment controls as close to the site footprint as possible and to replicate where possible the existing hydrological environment of the site.
- To minimise sediment loads resulting from the development run-off during the construction phase.
- To preserve Greenfield runoff rates and volumes.
- To provide settlement ponds to encourage sedimentation and storm water runoff settlement.
- To reduce stormwater runoff velocities throughout the site to prevent scouring and encourage settlement of sediment locally.
- To manage the problems of erosion and allow for the effective revegetation of bare surfaces.
- To control water within the site and allow for the discharge of runoff from the site within the limits prescribed in the Salmonid Regulations.

4.2 SuDS Design Principles

The approach to treatment and attenuation of storm water is as follows:

- Additional drainage measures will only be added as necessary. The dimensions of these features will avoid intercepting large volumes of water. Any changes to the SWMP must be agreed with the Project Hydrologist and the ECoW.
- Surface water runoff from the proposed Site Access Tracks will be managed with crossfall downslope to mimic the natural drainage patterns of the site.
- Drainage vegetation used will be appropriate to the local area and will be approved by the ECoW.
- Temporary erosion protection together with silt fences may be required until the

vegetation becomes established (coir matting or similar).

- Roads will be constructed from aggregate and will not be surfaced with bitumen materials, thus allowing for permeation and helping to reduce runoff volumes. Therefore, a reduced runoff coefficient of 65% is applicable.
- An additional 20% will be included to take account for climate change.
- Stormwater runoff within the trackside drainage will be treated through the provision of check dams, within a range depending on local slope of the drain.
- The stone used for the construction of the check dams will be washed graded stone with a size range between approximately 5mm and 40mm.
- Discharging directly back into the surrounding area will assist in maintaining the hydrological characteristics of the site.
- Vegetation will be reinstated on slopes as early as possible.
- Under track drainage will be provided with drainage pipes at existing surface water features. The under-track drainage will provide a means for flows to pass and maintain the natural flow throughout the site.
- A sump may be required for trench dewaterings. Water will subsequently be pumped into settlement ponds and allowed to settle. The general location of the small sump will ensure that they pose minimal health and safety risk to site personnel.
- The settlement ponds will be designed to cater for infilling and rehabilitation post construction phase of the project.
- The level of silt runoff during construction will be monitored and if found to be excessive in any area, will subsequently be managed by the provision of additional silt attenuation features such as silt fences or silt traps. If the suspended solids levels remain high, water can be pumped from settlement ponds into tankers and transferred off site to a suitable water treatment facility subject to agreement with the Local Authority. Note that works will be temporarily suspended in the area of the site contributing to elevated suspended solids levels.
- Field drains will be piped directly under the track through appropriately sized drainage pipes.
- Appropriate site management measures will be taken to ensure that runoff from the construction site is not contaminated by fuel or lubricant spillages.
- There will be no discharge of trade effluent, sewage effluent or contaminated drainage into any surface water feature.

4.3 Purpose of a SuDS Drainage Design

There is increased potential for water pollution, in particular sedimentation to local surface water features due to the excavation and generation of spoil and emplacement of stone materials during the construction stage of the project.

The purpose of incorporating a SuDS design is:

- To provide sufficient detail to see that water pollution will not occur as a result of construction activities at the site and to minimise the risk of any such occurrence.
- To regulate the rate of surface water run-off downslope to prevent scouring and to encourage settlement of sediment locally.
- To minimise the quantity of sediment laden stormwater and resulting settlement pond sizes by separating "clean" water from the "dirty" development runoff.

4.4 Design Philosophy

The SuDS design must be managed and monitored at all times and particularly after storm or heavy rainfall and during construction phase environmental auditing. The design rationale is that of an integrated approach where each element is assessed for its potential contribution to sediment suspension and the appropriate mitigation measures integrated into the layout design. The design principles are as follows:

Minimise → Intercept → Treat → Disperse → Dilute

4.4.1 Minimise

The main principle of this SuDS design is to minimise the volume of 'dirty' water requiring treatment through means of informed, integrated and sustainable drainage design. It achieves this by keeping 'clean' water clean by interception and separation, and by collecting the 'dirty' water and treating it by removing the suspended sediments. The resultant outflow is dispersed across vegetation and will become diluted through contact with the clean water runoff in the buffer areas before entering site/ roadside drains.

4.4.2 Intercept

The key sediment control measure is the separation of construction runoff from the clean water runoff that arises in the undisturbed areas of the site and surrounding lands. This significantly reduces the volume and velocity of dirty water that the sediment and erosion control measures need to deal with. To achieve separation, clean water infiltration collector drains or silt fences are positioned on the upslope and dirty water v-drains positioned along the verge, with site surfaces sloped towards dirty water v-drains. The remainder of this clean water will be regularly piped under the site roads and dirty water v-drains to avoid contamination. Piping the clean water regularly under the site roads allows the clean water to follow the course it would have taken before construction thus mimicking the existing surface water sheet flow pattern of the site.

4.4.3 Treat, Disperse and Dilute

The clean water infiltration interceptor drains are positioned upslope of the development footprint, to prevent any mixing of the clean and 'dirty' water. The infiltration interceptor drains redirect the clean water away from the site infrastructure, as best suits the natural topography of each sector. The clean water outflow is then discharged into either, an existing drainage network or dispersed through an area of vegetation where it can percolate into the ground naturally.

In the drawings, 'dirty water' drains, indicated in orange, collect all incident rainwater that falls on the development infrastructure. These then drain to buffered outfalls or into settlement ponds. The treated effluent from the settlement ponds is then dispersed across vegetation (through buffered outfalls) to further filter the discharge. Dispersal in this manner has the effect of allowing the smaller particle sizes to be taken up by the vegetation.

5 DETAILED DESIGN CONSIDERATIONS

5.1 Overview

This SuDS adopts a design for the drainage of the site. The following elements in series are proposed:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates.

These measures provide a surface water management train that will mitigate any adverse impact on the hydrology of the site and surrounds during the construction phase of the project.

5.2 Cut-off Ditches / Collector Drains (Clean Water)

Drainage management will ensure that natural runoff is not permitted to mix with construction runoff from sources such as excavation dewatering or track runoff. Design will ensure that infiltration interceptor drains be installed upslope of development, to intercept and divert clean surface water runoff, prior to it coming in contact with areas of excavation. Design will ensure that natural runoff infiltration interceptor drains are installed ahead of main earthworks wherever practical.

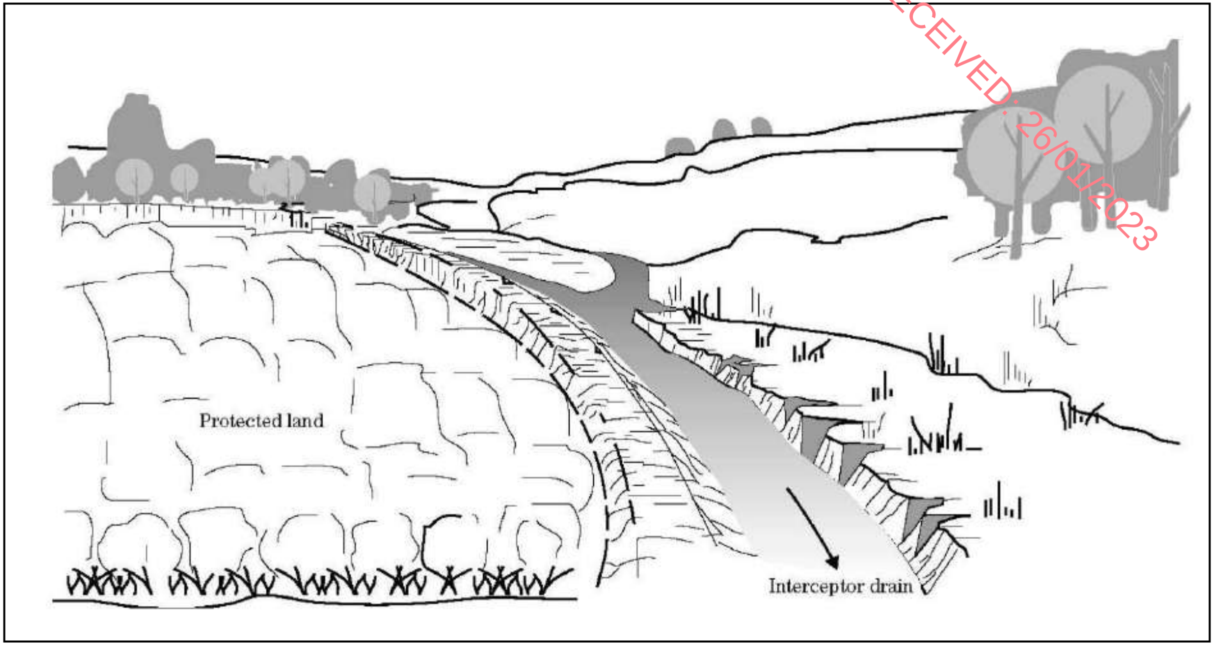

Figure 5.1: Diagram showing interceptor drain (Source: NJWMG, 2007) [1]

This is intended to reduce the flow of natural runoff onto any exposed areas of peat/soil, thereby reducing the amount of potential silt laden runoff requiring treatment. Installed drainage will allow provision for natural runoff water, upslope of the development, to collect in infiltration interceptor drain and directed away from the development. In certain areas it will be required to pass through under track clean water culverts, separate to drainage provided for track runoff, and be discharged downstream of site development.

Temporary silt / pollution prevention and scour protection measures will be provided in artificial natural runoff drainage installed in order to mitigate potential for scouring and transport of sediment from newly excavated channels which will be formed as part of the construction runoff drainage provisions.

Frequency of outflow points are designed to avoid collection and interception of large catchments creating significant point flows, with associated risks due to scour and hydraulic capacity.

The drains will be max 350mm – 500mm in depth.

[1] New Jersey Water Management Guide, 2007. Online: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs141p2_017651.pdf [Accessed 15/02/2022]

5.3 Buffered Outfalls

Dirty water will be discharged to land via buffered outfalls. These drainage outfalls will contain hardcore material of similar or identical geology to the bedrock at the Site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, reducing sediment loading to any adjacent watercourses and avoiding direct discharge to the watercourse. It is recommended that a relatively high number of discharge points are established, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.

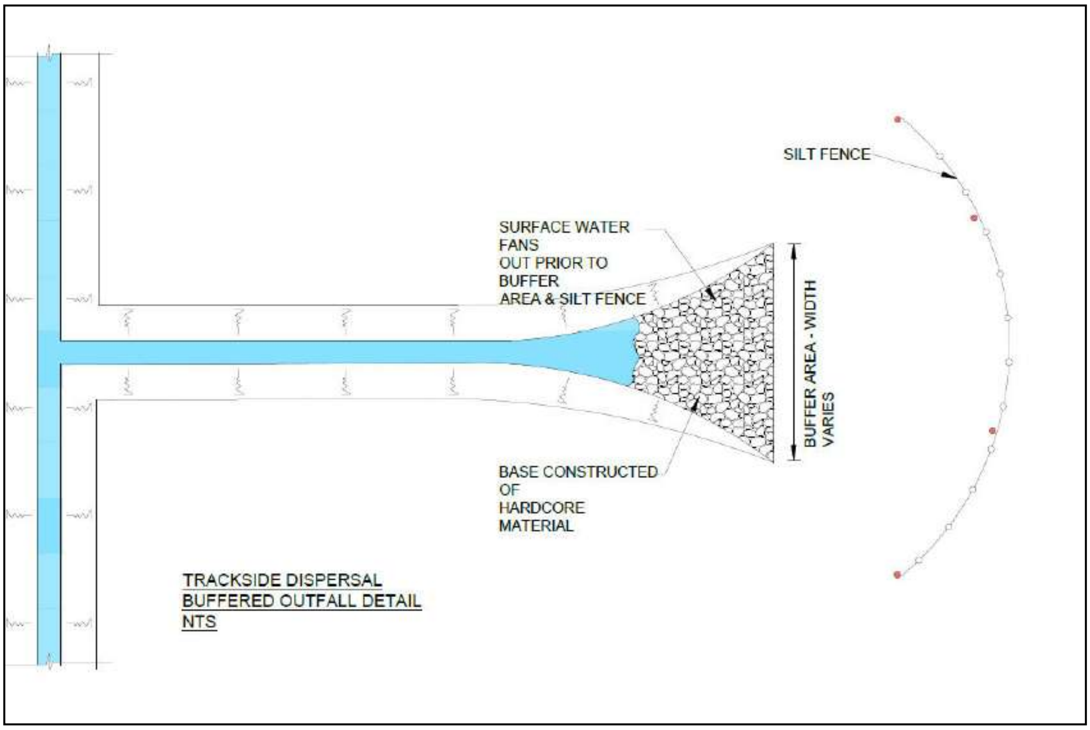

Figure 3: Diagram of Buffered Outfall

5.4 Trackside Drains (Dirty Water)

These are open gently sloping drainage channels to convey dirty water, trap sediment, enhance filtration and slow down the rate and magnitude of runoff that could enter the local watercourses. The drains will be max 350mm – 500mm in depth and the turve will be taken as a single piece and placed on the downslope side of the drain. Therefore, once construction works are complete the turve can be put back in place with minimal ecological damage. These drains will be reinstated following the works.

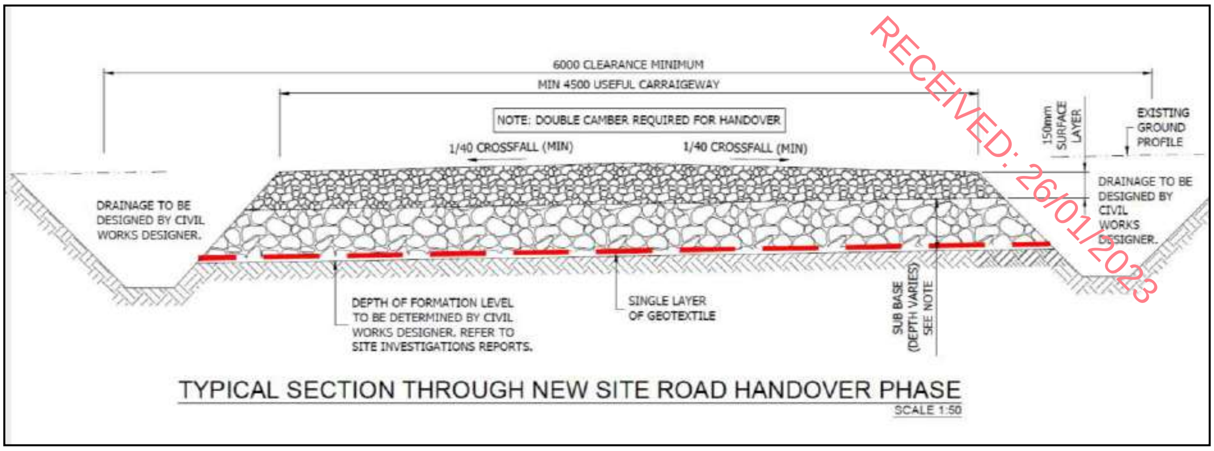

Figure 4: Site Access Track Section

5.5 <u>Silt Fences</u>

Silt Fences are designed in order to effectively filter the water, holding back the silt and allowing the water through, they require to be installed correctly with the lower part of the fence dug into the ground. Silt fences will also be required to be cleaned out on a regular basis, particularly after periods of heavy rainfall. Silt fences are required to be inspected and maintained on a regular basis in order to ensure that silty water is not running under or around the silt fences. Silt fences can also be used to divert clean water away from the development area, minimising the volume of dirty water.

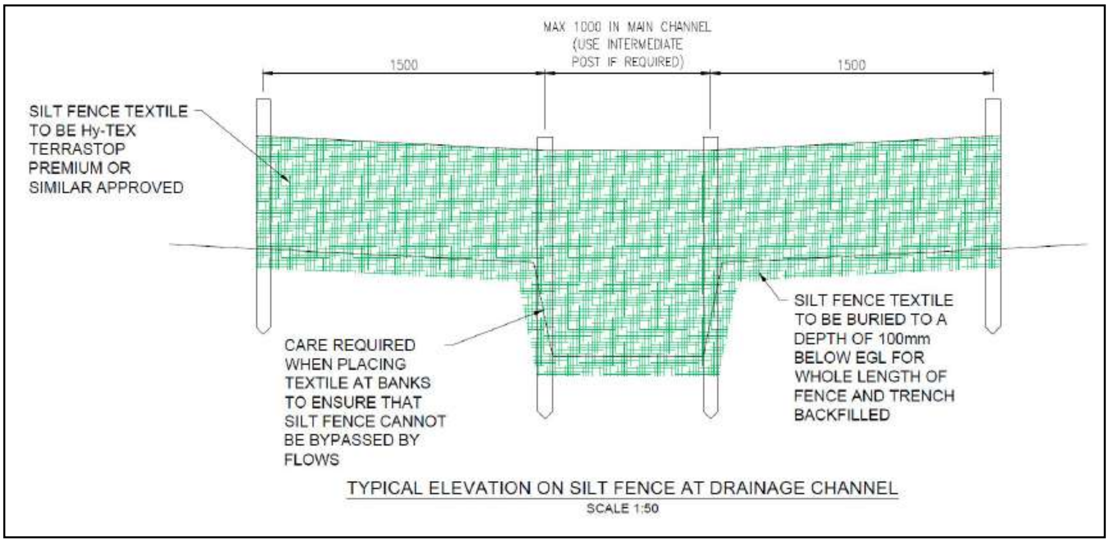

Figure 5: Illustration of Silt Fencing

Plate 1: Photograph of Silt Fencing

5.6 Filtration Check Dams

Check dams (flow barriers or dams constructed across the drainage channel) will be installed at regular intervals within the dirty trackside drains in order to reduce erosion and allow for greater flow control. These check dams are required in order to reduce the velocity of water and therefore allow settlement of coarser sediment particles as well as silt at low flow conditions. Reduction in flow velocity will also prevent scouring of the drainage channel itself. Rock filter bunds may be used for check dams however, stone can also be used if properly anchored. It is recommended that multiple check dams are installed, particularly in areas immediately downgradient of construction areas.

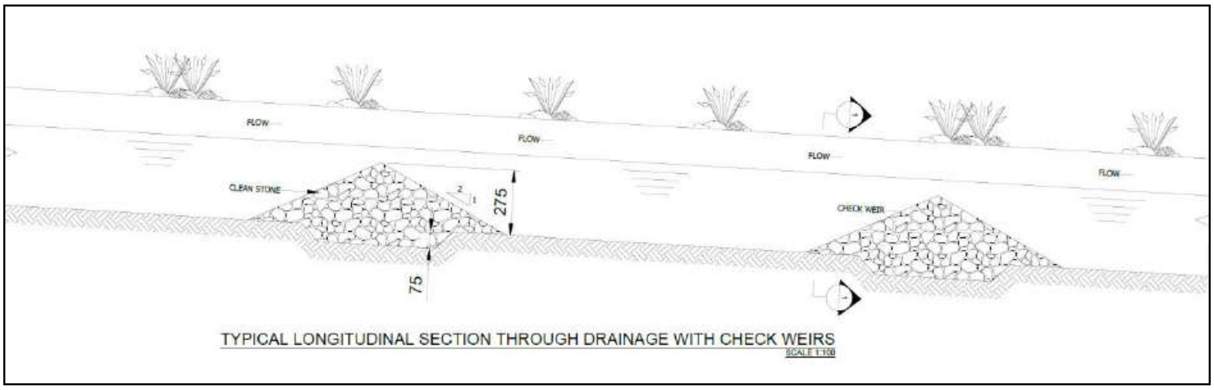

Figure 6: Diagram Showing the Function of Check Dams

Settlement build up will be monitored and cleaned during the construction stage when necessary. The number and location of check dams will be dependent on the slope, flow and volume of water, although the following general rules will be applied:

- The maximum spacing between check dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam;
- The centre of the check dam should be at least 0.2m lower than the outside edges;
- Side slopes should be 1:2 or less;
- A Terram membrane barrier or similar non-woven geotextile membrane placed around check dam
- Check dams should be keyed at least 0.1m into the drainage channel bottom in order to prevent the dam washing out; and
- Check dams will be maintained and monitored on a regular basis. Sediment will be removed before it reaches one half the original dam height.

Worked examples:

The depth of a check dam is 0.3m high: 0.3m x (1 in 100 gradient) = 30m spacing;

For a 0.3m high Check Dam: 0.3m x (1 in 50 gradient) = 15m spacing.

For a 0.5m high Check Dam: 0.5m x (1 in 50 gradient) = 25m spacing.

See **Table 5.1** for recommended spacing, relative to the gradient of drain, for a 0.3m high check dam.

Table 5.1 Check Dam Spacing

Max Spacing (m)	Gradient
3m	10% (1 in 10)
4m	8% (1 in 12)
5m	6% (1 in 17)
6m	5% (1 in 20)
8m	4% (1 in 25)
10m	3% (1 In 33)
15m	2% (1 In 50)
20m	1.5% (1 in 67)
30m	(1 in 100)

5.7 Settlement Ponds

Runoff from the windfarm track surface will be attenuated to mimic natural runoff patterns. To capture runoff generated within the development footprint, it is proposed to use constructed trackside drains. Accumulations of runoff will then be transferred to settlement ponds. See **Figure 7** below and detail drawings (Planning Drawing No. 6276-TWF-JOD-XX-DR-C-0301 to 0304) which displays a diagrammatic cross section through a settlement pond within the drainage regime. All ponds will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Settlement ponds are to be securely fenced to prevent easy access.

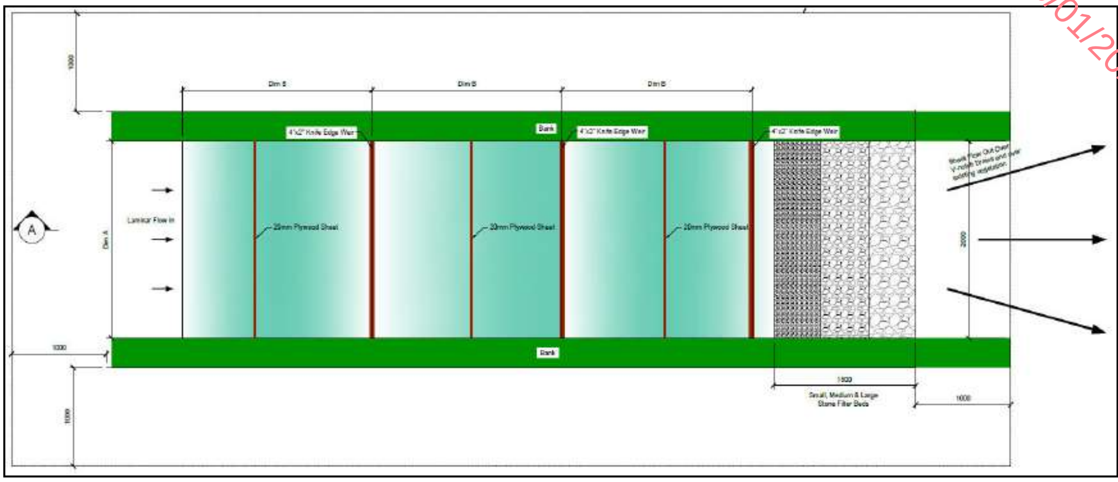

Figure 7: Plan View of Settlement Ponds (with Discharge to Drains where Applicable)

Plate 2: Completed Settlement Pond System

The ponds are utilised to attenuate and to aid the removal of suspended solids from site runoff water. All the pond locations are displayed within the site drainage drawings. Settlement ponds will be emplaced at twenty four (24) locations along the drainage footprint.

Calculation parameters for the determination of storage requirements have been undertaken and are as follows:

- A 1 in 200 year rainfall return over 30 minutes design has been used for the settlement ponds[2] (Source: Met Éireann - Please refer to **Appendix 1**).

- An initial outlet overflow rate is applied of 39.5 l/s/ha (litres per second) which approximates to Greenfield run-off rates for the site. (Source: HR Wallingford – Please refer to **Appendix 2**).
- The rational method is subsequently applied to calculate the flow volumes into each settlement pond over these respective periods.
- A is the area of the hardstanding / catchment, I is the rainfall depth and t is the duration of rainfall occurrence.
- A runoff coefficient of 0.8 (20% for Climate Change, 60% for runoff) is conservatively applied to all footprint areas. The runoff coeeficient of 60% was derived from table of Values of Runoff Coefficient or Impermeability Factor for Different Surfaces (After Kuichling). Surface No. 4 is considered the most appropriate 'Pavements of stones, bricks and wooden blocks with open joints' which has a runoff coefficient of 0.5 to 0.7 and a mid value of 0.6 is considered appropriate for this project. Therefore, the overall runoff coefficient used is 0.72 when a 20% increase in rainfall is added for climate change.

Table 5.2 identifies settlement ponds designed to treat and attenuate each development catchment area. The details in **Table 5.2** are based on calculations found in **Appendix 3.**

Tables 5.2: Settlement Pond Sizing

Pond Ref.	Development Area (m^2)	Residual Volume (m^3)	Pond Dimensions			Overall Volume of Settlement Pond (m^3)
			Dim. Length (m)	Dim. Width (m)	Dim. Height (m)	
SP1	2,105	21.9	7.3	3	1	21.9
SP2	2,387	24.8	8.3	3	1	24.9
SP3	3,000	31.2	9.9	3.2	1	31.68
SP4	3,672	38.2	12.4	3.2	1	39.68
SP5	2,968	30.9	9.9	3.2	1	31.68
SP6	3,430	35.7	10.5	3.5	1	36.75
SP7	2,120	22.0	7.4	3	1	22.2
SP8	9,961	103.6	17.5	6	1	105
SP9	2,030	21.1	7.3	3	1	21.9
SP10	13,450	139.8	20	7	1	140
SP11	3,135	32.6	10.5	3.2	1	33.6
SP12	1,950	20.3	7.8	2.6	1	20.28
SP13	6,010	62.5	14	4.6	1	64.4
SP14	3,367	35.0	10	3.5	1	35
SP15	1,140	11.9	6	2	1	12

[2] The drainage system will be designed for a 1 in 100 year 6 hour return period with the settlement ponds being designed for a 1 in 200 year 30 minute rainfall event.

Pond Ref.	Development Area (m^2)	Residual Volume (m^3)	Pond Dimensions			Overall Volume of Settlement Pond (m^3)
			Dim. Length (m)	Dim. Width (m)	Dim. Height (m)	
SP16	12,550	130.5	20.5	6.5	1	133.25
SP17	2,410	25.1	8.4	3	1	25.2
SP18	17,100	177.8	22.4	8	1	179.2
SP19	2,750	28.6	9.3	3.1	1	28.83
SP20	5,080	52.8	12.4	4.3	1	53.32
SP21	10,915	113.5	18.4	6.2	1	114.08
SP22	3,870	40.2	11.6	3.6	1	41.76
SP23	11,835	123.1	18.9	6.6	1	124.74
SP24	16,050	166.9	22	7.6	1	167.2

6 MAINTENANCE AND MONITORING

Surface water runoff control infrastructure will be checked and maintained on a regular basis and settlement ponds and check dams will be maintained (desludged/settle solids removed) on a regular basis, particularly during the construction phase of the Development. It is important to minimise the agitation of solids during these works, otherwise it will likely lead to an acute significant loading of suspended solids in the drainage network.

Site water runoff quality will be monitored on a continuous basis at a reasonable frequency during both the decommissioning and construction, and operational phases of the Development. A relatively high frequency of monitoring (e.g. daily) is required during the decommissioning and construction phase, similarly the early stages of the operational phase will require a relatively high frequency of monitoring, however the frequency of monitoring can gradually reduce thereafter – presuming there are no issues with the quality of discharging water at that point in time.

7 POST CONSTRUCTION DRAINAGE MANAGEMENT

Following the completion of construction, a full review of construction stage drainage will be undertaken by the appointed Contractor (in conjunction with the EM and the ECoW) with a view to removing drainage infrastructure that is no longer required during the development's operation phase.

APPENDIX 1

TULLAGHMORE RAINFALL DATA

Met Eireann

Return Period Rainfall Depths for sliding Durations

Irish Grid: Easting: 102863, Northing: 246952,

	Interval		Years													
DURATION	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	3.3	4.3	4.8	5.6	6.1	6.4	7.7	9.0	9.8	11.0	11.9	12.7	13.9	14.7	15.4	N/A
10 mins	4.6	6.0	6.7	7.8	8.5	9.0	10.7	12.5	13.7	15.3	16.7	17.7	19.3	20.5	21.5	N/A
15 mins	5.4	7.0	7.9	9.1	9.9	10.6	12.5	14.7	16.1	18.0	19.6	20.8	22.7	24.1	25.3	N/A
30 mins	7.4	9.6	10.7	12.3	13.4	14.2	16.7	19.4	21.1	23.5	25.5	27.1	29.4	31.2	32.6	N/A
1 hours	10.2	13.1	14.6	16.6	18.0	19.0	22.2	25.7	27.8	30.8	33.3	35.2	38.1	40.3	42.1	N/A
2 hours	14.1	17.9	19.8	22.5	24.2	25.5	29.6	33.9	36.6	40.3	43.5	45.9	49.4	52.1	54.3	N/A
3 hours	17.1	21.5	23.7	26.8	28.8	30.3	35.0	39.9	43.0	47.2	50.8	53.5	57.5	60.6	63.0	N/A
4 hours	19.6	24.5	26.9	30.3	32.5	34.2	39.4	44.8	48.2	52.8	56.7	59.7	64.1	67.4	70.0	N/A
6 hours	23.7	29.4	32.2	36.2	38.7	40.6	46.5	52.8	56.7	61.9	66.3	69.6	74.6	78.3	81.3	N/A
9 hours	28.6	35.3	38.5	43.1	46.0	48.2	55.0	62.1	66.6	72.5	77.5	81.2	86.8	91.0	94.4	N/A
12 hours	32.7	40.1	43.8	48.8	52.1	54.5	62.0	69.8	74.6	81.1	86.6	90.7	96.7	101.3	104.9	N/A
18 hours	39.6	48.2	52.4	58.2	62.0	64.8	73.3	82.2	87.7	95.0	101.2	105.8	112.6	117.7	121.8	N/A
24 hours	45.3	54.9	59.5	66.0	70.1	73.2	82.6	92.3	98.3	106.3	113.0	118.1	125.5	131.0	135.4	150.2
2 days	59.4	70.6	76.0	83.4	88.1	91.6	102.1	112.9	119.5	128.2	135.5	141.0	148.9	154.8	159.6	175.2
3 days	71.8	84.4	90.4	98.7	103.8	107.7	119.2	131.0	138.2	147.6	155.4	161.3	169.8	176.1	181.1	197.7
4 days	83.2	97.1	103.7	112.7	118.3	122.4	134.9	147.6	155.2	165.3	173.7	179.9	188.9	195.6	200.9	218.3
6 days	104.6	120.7	128.2	138.5	144.9	149.7	163.8	178.0	186.6	197.8	207.1	213.9	223.9	231.2	237.0	256.1
8 days	124.7	142.8	151.2	162.6	169.7	175.0	190.5	206.1	215.5	227.8	237.9	245.3	256.1	264.0	270.3	290.8
10 days	144.0	163.9	173.1	185.6	193.4	199.1	216.0	232.8	242.9	256.1	266.9	274.9	286.4	294.9	301.6	323.4
12 days	162.8	184.4	194.4	207.9	216.2	222.3	240.5	258.5	269.3	283.3	294.8	303.2	315.5	324.4	331.5	354.6
16 days	199.5	224.2	235.6	250.9	260.3	267.2	287.6	307.7	319.7	335.3	348.1	357.4	370.9	380.8	388.6	413.9
20 days	235.5	263.0	275.6	292.6	302.9	310.5	333.0	355.1	368.2	385.2	399.1	409.2	423.9	434.5	443.0	470.3
25 days	279.8	310.6	324.7	343.5	355.0	363.4	388.2	412.5	426.9	445.5	460.7	471.8	487.7	499.3	508.5	538.1

NOTES:

N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

APPENDIX 2

GREENFIELD RUN-OFF RATE

Print Close Report

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

RECEIVED 26/01/2023

Calculated by:	Andrew O'Grady
Site name:	Tullaghmore
Site location:	Maam Cross

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.46317° N
Longitude:	9.46026° W
Reference:	1871189426
Date:	Aug 25 2022 14:33

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 5.96

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	5	5
HOST class:	N/A	N/A
SPR/SPRHOST:	0.53	0.53

Hydrological characteristics	Default	Edited
SAAR (mm):	1756	1756
Hydrological region:	13	13
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	1.65	1.65
Growth curve factor 100 years:	1.95	1.95
Growth curve factor 200 years:	2.15	2.15

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	109.54	109.54
1 in 1 year (l/s):	93.11	93.11
1 in 30 years (l/s):	180.73	180.73
1 in 100 year (l/s):	213.59	213.59
1 in 200 years (l/s):	235.5	235.5

APPENDIX 3

SETTLEMENT POND CALCULATIONS

Tullaghmore SUDS Drainage Design

(C)Volumetric run-off coefficient 0.8

Catchment Area				
Ref	**A (m^2)**		**A (km^2)**	**Residual Volume (m3)**
SP1	2105		0.0021	21.9
SP2	2387		0.0024	24.8
SP3	3000		0.0030	31.2
SP4	3672		0.0037	38.2
SP5	2968		0.0030	30.9
SP6	3430		0.0034	35.7
SP7	2120		0.0021	22.0
SP8	9961		0.0100	103.6
SP9	2030		0.0020	21.1
SP10	13,450		0.0135	139.8
SP11	3135		0.0031	32.6
SP12	1950		0.0020	20.3
SP13	6010		0.0060	62.5
SP14	3367		0.0034	35.0
SP15	1140		0.0011	11.9
SP16	12,550		0.0126	130.5
SP17	2410		0.0024	25.1
SP18	17,100		0.0171	177.8
SP19	2750		0.0028	28.6
SP20	5080		0.0051	52.8
SP21	10,915		0.0109	113.5
SP22	3870		0.0039	40.2
SP23	11,835		0.0118	123.1
SP24	16,050		0.0161	166.9

Catchment **SP1** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00211	0.054	16.2	11.9	2.5	13.7
M200 10min	10	14.9	0.278	0.72	89.4	0.00211	0.038	22.6	23.7	5.0	17.6
M200 15min	15	17.5	0.278	0.72	70	0.00211	0.029	26.5	35.6	7.5	19.1
M200 30min	30	24.3	0.278	0.72	48.6	0.00211	0.020	36.9	71.1	15.0	21.9
M200 60min	60	33.7	0.278	0.72	33.7	0.00211	0.014	51.1	142.2	29.9	21.2
M200 2hr	120	46.8	0.278	0.72	23.4	0.00211	0.010	71.0	284.5	59.9	11.1
M200 4hr	240	65	0.278	0.72	16.25	0.00211	0.007	98.6	569.0	119.8	-21.2
M200 6hr	300	78.7	0.278	0.72	15.74	0.00211	0.007	143.2	853.5	179.7	-36.4
M200 12hr	600	109.3	0.278	0.72	10.93	0.00211	0.005	198.9	1707.0	359.3	-160.4
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00211	0.003	276.1	3414.0	718.6	-442.5
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00211	0.002	316.3	6827.9	1437.3	-1120.9

Catchment **SP9** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00203	0.052	15.7	11.9	2.4	13.2
M200 10min	10	14.9	0.278	0.72	89.4	0.00203	0.036	21.8	23.7	4.8	17.0
M200 15min	15	17.5	0.278	0.72	70	0.00203	0.028	25.6	35.6	7.2	18.4
M200 30min	30	24.3	0.278	0.72	48.6	0.00203	0.020	35.5	71.1	14.4	21.1
M200 60min	60	33.7	0.278	0.72	33.7	0.00203	0.014	49.3	142.2	28.9	20.4
M200 2hr	120	46.8	0.278	0.72	23.4	0.00203	0.010	68.5	284.5	57.8	10.7
M200 4hr	240	65	0.278	0.72	16.25	0.00203	0.007	95.1	569.0	115.5	-20.4
M200 6hr	300	78.7	0.278	0.72	15.74	0.00203	0.006	138.1	853.5	173.3	-35.1
M200 12hr	600	109.3	0.278	0.72	10.93	0.00203	0.004	191.9	1707.0	346.5	-154.7
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00203	0.003	266.3	3414.0	693.0	-426.8
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00203	0.002	305.1	6827.9	1386.1	-1081.0

Catchment **SP17** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00241	0.062	18.6	11.9	2.9	15.7
M200 10min	10	14.9	0.278	0.72	89.4	0.00241	0.043	25.9	23.7	5.7	20.2
M200 15min	15	17.5	0.278	0.72	70	0.00241	0.034	30.4	35.6	8.6	21.8
M200 30min	30	24.3	0.278	0.72	48.6	0.00241	0.023	42.2	71.1	17.1	25.1
M200 60min	60	33.7	0.278	0.72	33.7	0.00241	0.016	58.5	142.2	34.3	24.2
M200 2hr	120	46.8	0.278	0.72	23.4	0.00241	0.011	81.3	284.5	68.6	12.7
M200 4hr	240	65	0.278	0.72	16.25	0.00241	0.008	112.9	569.0	137.1	-24.2
M200 6hr	300	78.7	0.278	0.72	15.74	0.00241	0.008	164.0	853.5	205.7	-41.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.00241	0.005	227.8	1707.0	411.4	-183.6
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00241	0.004	316.1	3414.0	822.8	-506.6
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00241	0.002	362.2	6827.9	1645.5	-1283.3

Catchment **SP2** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00239	0.061	18.4	11.9	2.8	15.6
M200 10min	10	14.9	0.278	0.72	89.4	0.002387	0.043	25.6	23.7	5.7	20.0
M200 15min	15	17.5	0.278	0.72	70	0.00239	0.033	30.1	35.6	8.5	21.6
M200 30min	30	24.3	0.278	0.72	48.6	0.00239	0.023	41.8	71.1	17.0	24.8
M200 60min	60	33.7	0.278	0.72	33.7	0.00239	0.016	58.0	142.2	34.0	24.0
M200 2hr	120	46.8	0.278	0.72	23.4	0.00239	0.011	80.5	284.5	67.9	12.6
M200 4hr	240	65	0.278	0.72	16.25	0.00239	0.008	111.8	569.0	135.8	-24.0
M200 6hr	300	78.7	0.278	0.72	15.74	0.00239	0.008	162.4	853.5	203.7	-41.3
M200 12hr	600	109.3	0.278	0.72	10.93	0.00239	0.005	225.6	1707.0	407.5	-181.9
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00239	0.004	313.1	3414.0	814.9	-501.8
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00239	0.002	358.7	6827.9	1629.8	-1271.1

Catchment **SP10** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01345	0.346	103.7	11.9	15.9	87.8
M200 10min	10	14.9	0.278	0.72	89.4	0.01345	0.241	144.4	23.7	31.9	112.5
M200 15min	15	17.5	0.278	0.72	70	0.01345	0.188	169.6	35.6	47.8	121.8
M200 30min	30	24.3	0.278	0.72	48.6	0.01345	0.131	235.5	71.1	95.7	139.8
M200 60min	60	33.7	0.278	0.72	33.7	0.01345	0.091	326.6	142.2	191.3	135.3
M200 2hr	120	46.8	0.278	0.72	23.4	0.01345	0.063	453.6	284.5	382.6	70.9
M200 4hr	240	65	0.278	0.72	16.25	0.01345	0.044	630.0	569.0	765.3	-135.3
M200 6hr	300	78.7	0.278	0.72	15.74	0.01345	0.042	915.3	853.5	1147.9	-232.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.01345	0.029	1271.2	1707.0	2295.9	-1024.7
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01345	0.020	1764.3	3414.0	4591.8	-2827.5
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01345	0.012	2021.3	6827.9	9183.6	-7162.2

Catchment **SP18** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01710	0.439	131.8	11.9	20.3	111.6
M200 10min	10	14.9	0.278	0.72	89.4	0.01710	0.306	183.6	23.7	40.5	143.1
M200 15min	15	17.5	0.278	0.72	70	0.01710	0.240	215.6	35.6	60.8	154.8
M200 30min	30	24.3	0.278	0.72	48.6	0.01710	0.166	299.4	71.1	121.6	177.8
M200 60min	60	33.7	0.278	0.72	33.7	0.01710	0.115	415.2	142.2	243.2	172.0
M200 2hr	120	46.8	0.278	0.72	23.4	0.01710	0.080	576.7	284.5	486.5	90.2
M200 4hr	240	65	0.278	0.72	16.25	0.01710	0.056	800.9	569.0	973.0	-172.1
M200 6hr	300	78.7	0.278	0.72	15.74	0.01710	0.054	1163.7	853.5	1459.5	-295.8
M200 12hr	600	109.3	0.278	0.72	10.93	0.01710	0.037	1616.1	1707.0	2918.9	-1302.8
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01710	0.026	2243.1	3414.0	5837.9	-3594.8
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01710	0.015	2569.8	6827.9	11675.7	-9105.9

Catchment **SP3** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00300	0.077	23.1	11.9	3.6	19.6
M200 10min	10	14.9	0.278	0.72	89.4	0.00300	0.054	32.2	23.7	7.1	25.1
M200 15min	15	17.5	0.278	0.72	70	0.00300	0.042	37.8	35.6	10.7	27.2
M200 30min	30	24.3	0.278	0.72	48.6	0.00300	0.029	52.5	71.1	21.3	31.2
M200 60min	60	33.7	0.278	0.72	33.7	0.00300	0.020	72.9	142.2	42.7	30.2
M200 2hr	120	46.8	0.278	0.72	23.4	0.00300	0.014	101.2	284.5	85.3	15.8
M200 4hr	240	65	0.278	0.72	16.25	0.00300	0.010	140.5	569.0	170.7	-30.2
M200 6hr	300	78.7	0.278	0.72	15.74	0.00300	0.009	204.2	853.5	256.0	-51.9
M200 12hr	600	109.3	0.278	0.72	10.93	0.00300	0.007	283.5	1707.0	512.1	-228.6
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00300	0.005	393.5	3414.0	1024.2	-630.7
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00300	0.003	450.8	6827.9	2048.4	-1597.5

Catchment **SP11** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00314	0.081	24.2	11.9	3.7	20.5
M200 10min	10	14.9	0.278	0.72	89.4	0.00314	0.056	33.7	23.7	7.4	26.2
M200 15min	15	17.5	0.278	0.72	70	0.00314	0.044	39.5	35.6	11.1	28.4
M200 30min	30	24.3	0.278	0.72	48.6	0.00314	0.030	54.9	71.1	22.3	32.6
M200 60min	60	33.7	0.278	0.72	33.7	0.00314	0.021	76.1	142.2	44.6	31.5
M200 2hr	120	46.8	0.278	0.72	23.4	0.00314	0.015	105.7	284.5	89.2	16.5
M200 4hr	240	65	0.278	0.72	16.25	0.00314	0.010	146.8	569.0	178.4	-31.5
M200 6hr	300	78.7	0.278	0.72	15.74	0.00314	0.010	213.3	853.5	267.6	-54.2
M200 12hr	600	109.3	0.278	0.72	10.93	0.00314	0.007	296.3	1707.0	535.1	-238.8
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00314	0.005	411.2	3414.0	1070.3	-659.0
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00314	0.003	471.1	6827.9	2140.6	-1669.4

Catchment **SP19** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00275	0.071	21.2	11.9	3.3	17.9
M200 10min	10	14.9	0.278	0.72	89.4	0.00275	0.049	29.5	23.7	6.5	23.0
M200 15min	15	17.5	0.278	0.72	70	0.00275	0.039	34.7	35.6	9.8	24.9
M200 30min	30	24.3	0.278	0.72	48.6	0.00275	0.027	48.2	71.1	19.6	28.6
M200 60min	60	33.7	0.278	0.72	33.7	0.00275	0.019	66.8	142.2	39.1	27.7
M200 2hr	120	46.8	0.278	0.72	23.4	0.00275	0.013	92.7	284.5	78.2	14.5
M200 4hr	240	65	0.278	0.72	16.25	0.00275	0.009	128.8	569.0	156.5	-27.7
M200 6hr	300	78.7	0.278	0.72	15.74	0.00275	0.009	187.1	853.5	234.7	-47.6
M200 12hr	600	109.3	0.278	0.72	10.93	0.00275	0.006	259.9	1707.0	469.4	-209.5
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00275	0.004	360.7	3414.0	938.8	-578.1
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00275	0.002	413.3	6827.9	1877.7	-1464.4

Catchment **SP4** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00367	0.094	28.3	11.9	4.4	24.0
M200 10min	10	14.9	0.278	0.72	89.4	0.00367	0.066	39.4	23.7	8.7	30.7
M200 15min	15	17.5	0.278	0.72	70	0.00367	0.051	46.3	35.6	13.1	33.2
M200 30min	30	24.3	0.278	0.72	48.6	0.00367	0.036	64.3	71.1	26.1	38.2
M200 60min	60	33.7	0.278	0.72	33.7	0.00367	0.025	89.2	142.2	52.2	36.9
M200 2hr	120	46.8	0.278	0.72	23.4	0.00367	0.017	123.8	284.5	104.5	19.4
M200 4hr	240	65	0.278	0.72	16.25	0.00367	0.012	172.0	569.0	208.9	-36.9
M200 6hr	300	78.7	0.278	0.72	15.74	0.00367	0.012	249.9	853.5	313.4	-63.5
M200 12hr	600	109.3	0.278	0.72	10.93	0.00367	0.008	347.0	1707.0	626.8	-279.8
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00367	0.006	481.7	3414.0	1253.6	-771.9
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00367	0.003	551.8	6827.9	2507.2	-1955.4

Catchment **SP5** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00297	0.076	22.9	11.9	3.5	19.4
M200 10min	10	14.9	0.278	0.72	89.4	0.00297	0.053	31.9	23.7	7.0	24.8
M200 15min	15	17.5	0.278	0.72	70	0.00297	0.042	37.4	35.6	10.6	26.9
M200 30min	30	24.3	0.278	0.72	48.6	0.00297	0.029	52.0	71.1	21.1	30.9
M200 60min	60	33.7	0.278	0.72	33.7	0.00297	0.020	72.1	142.2	42.2	29.9
M200 2hr	120	46.8	0.278	0.72	23.4	0.00297	0.014	100.1	284.5	84.4	15.7
M200 4hr	240	65	0.278	0.72	16.25	0.00297	0.010	139.0	569.0	168.9	-29.9
M200 6hr	300	78.7	0.278	0.72	15.74	0.00297	0.009	202.0	853.5	253.3	-51.3
M200 12hr	600	109.3	0.278	0.72	10.93	0.00297	0.006	280.5	1707.0	506.6	-226.1
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00297	0.005	389.3	3414.0	1013.3	-623.9
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00297	0.003	446.0	6827.9	2026.5	-1580.5

Catchment **SP6** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00343	0.088	26.4	11.9	4.1	22.4
M200 10min	10	14.9	0.278	0.72	89.4	0.00343	0.061	36.8	23.7	8.1	28.7
M200 15min	15	17.5	0.278	0.72	70	0.00343	0.048	43.3	35.6	12.2	31.1
M200 30min	30	24.3	0.278	0.72	48.6	0.00343	0.033	60.1	71.1	24.4	35.7
M200 60min	60	33.7	0.278	0.72	33.7	0.00343	0.023	83.3	142.2	48.8	34.5
M200 2hr	120	46.8	0.278	0.72	23.4	0.00343	0.016	115.7	284.5	97.6	18.1
M200 4hr	240	65	0.278	0.72	16.25	0.00343	0.011	160.7	569.0	195.2	-34.5
M200 6hr	300	78.7	0.278	0.72	15.74	0.00343	0.011	233.4	853.5	292.7	-59.3
M200 12hr	600	109.3	0.278	0.72	10.93	0.00343	0.008	324.2	1707.0	585.5	-261.3
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00343	0.005	449.9	3414.0	1171.0	-721.1
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00343	0.003	515.5	6827.9	2342.0	-1826.5

Catchment **SP7** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00212	0.054	16.3	11.9	2.5	13.8
M200 10min	10	14.9	0.278	0.72	89.4	0.00212	0.038	22.8	23.7	5.0	17.7
M200 15min	15	17.5	0.278	0.72	70	0.00212	0.030	26.7	35.6	7.5	19.2
M200 30min	30	24.3	0.278	0.72	48.6	0.00212	0.021	37.1	71.1	15.1	22.0
M200 60min	60	33.7	0.278	0.72	33.7	0.00212	0.014	51.5	142.2	30.2	21.3
M200 2hr	120	46.8	0.278	0.72	23.4	0.00212	0.010	71.5	284.5	60.3	11.2
M200 4hr	240	65	0.278	0.72	16.25	0.00212	0.007	99.3	569.0	120.6	-21.3
M200 6hr	300	78.7	0.278	0.72	15.74	0.00212	0.007	144.3	853.5	180.9	-36.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.00212	0.005	200.4	1707.0	361.9	-161.5
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00212	0.003	278.1	3414.0	723.8	-445.7
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00212	0.002	318.6	6827.9	1447.5	-1128.9

Catchment **SP8** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00996	0.256	76.8	11.9	11.8	65.0
M200 10min	10	14.9	0.278	0.72	89.4	0.00996	0.178	106.9	23.7	23.6	83.3
M200 15min	15	17.5	0.278	0.72	70	0.00996	0.140	125.6	35.6	35.4	90.2
M200 30min	30	24.3	0.278	0.72	48.6	0.00996	0.097	174.4	71.1	70.8	103.6
M200 60min	60	33.7	0.278	0.72	33.7	0.00996	0.067	241.9	142.2	141.7	100.2
M200 2hr	120	46.8	0.278	0.72	23.4	0.00996	0.047	335.9	284.5	283.4	52.5
M200 4hr	240	65	0.278	0.72	16.25	0.00996	0.032	466.5	569.0	566.8	-100.2
M200 6hr	300	78.7	0.278	0.72	15.74	0.00996	0.031	677.9	853.5	850.2	-172.3
M200 12hr	600	109.3	0.278	0.72	10.93	0.00996	0.022	941.4	1707.0	1700.3	-758.9
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00996	0.015	1306.6	3414.0	3400.6	-2094.0
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00996	0.009	1497.0	6827.9	6801.3	-5304.3

Catchment **SP12** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00195	0.050	15.0	11.9	2.3	12.7
M200 10min	10	14.9	0.278	0.72	89.4	0.00195	0.035	20.9	23.7	4.6	16.3
M200 15min	15	17.5	0.278	0.72	70	0.00195	0.027	24.6	35.6	6.9	17.7
M200 30min	30	24.3	0.278	0.72	48.6	0.00195	0.019	34.1	71.1	13.9	20.3
M200 60min	60	33.7	0.278	0.72	33.7	0.00195	0.013	47.4	142.2	27.7	19.6
M200 2hr	120	46.8	0.278	0.72	23.4	0.00195	0.009	65.8	284.5	55.5	10.3
M200 4hr	240	65	0.278	0.72	16.25	0.00195	0.006	91.3	569.0	111.0	-19.6
M200 6hr	300	78.7	0.278	0.72	15.74	0.00195	0.006	132.7	853.5	166.4	-33.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.00195	0.004	184.3	1707.0	332.9	-148.6
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00195	0.003	255.8	3414.0	665.7	-409.9
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00195	0.002	293.1	6827.9	1331.4	-1038.4

Catchment **SP13** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00601	0.154	46.3	11.9	7.1	39.2
M200 10min	10	14.9	0.278	0.72	89.4	0.00601	0.108	64.5	23.7	14.2	50.3
M200 15min	15	17.5	0.278	0.72	70	0.00601	0.084	75.8	35.6	21.4	54.4
M200 30min	30	24.3	0.278	0.72	48.6	0.00601	0.058	105.2	71.1	42.7	62.5
M200 60min	60	33.7	0.278	0.72	33.7	0.00601	0.041	145.9	142.2	85.5	60.5
M200 2hr	120	46.8	0.278	0.72	23.4	0.00601	0.028	202.7	284.5	171.0	31.7
M200 4hr	240	65	0.278	0.72	16.25	0.00601	0.020	281.5	569.0	342.0	-60.5
M200 6hr	300	78.7	0.278	0.72	15.74	0.00601	0.019	409.0	853.5	512.9	-104.0
M200 12hr	600	109.3	0.278	0.72	10.93	0.00601	0.013	568.0	1707.0	1025.9	-457.9
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00601	0.009	788.4	3414.0	2051.8	-1263.4
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00601	0.005	903.2	6827.9	4103.6	-3200.4

Catchment **SP14** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00337	0.087	26.0	11.9	4.0	22.0
M200 10min	10	14.9	0.278	0.72	89.4	0.00337	0.060	36.2	23.7	8.0	28.2
M200 15min	15	17.5	0.278	0.72	70	0.00337	0.047	42.5	35.6	12.0	30.5
M200 30min	30	24.3	0.278	0.72	48.6	0.00337	0.033	59.0	71.1	23.9	35.0
M200 60min	60	33.7	0.278	0.72	33.7	0.00337	0.023	81.8	142.2	47.9	33.9
M200 2hr	120	46.8	0.278	0.72	23.4	0.00337	0.016	113.5	284.5	95.8	17.8
M200 4hr	240	65	0.278	0.72	16.25	0.00337	0.011	157.7	569.0	191.6	-33.9
M200 6hr	300	78.7	0.278	0.72	15.74	0.00337	0.011	229.1	853.5	287.4	-58.2
M200 12hr	600	109.3	0.278	0.72	10.93	0.00337	0.007	318.2	1707.0	574.7	-256.5
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00337	0.005	441.7	3414.0	1149.5	-707.8
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00337	0.003	506.0	6827.9	2299.0	-1793.0

Catchment **SP15** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00114	0.029	8.8	11.9	1.4	7.4
M200 10min	10	14.9	0.278	0.72	89.4	0.00114	0.020	12.2	23.7	2.7	9.5
M200 15min	15	17.5	0.278	0.72	70	0.00114	0.016	14.4	35.6	4.1	10.3
M200 30min	30	24.3	0.278	0.72	48.6	0.00114	0.011	20.0	71.1	8.1	11.9
M200 60min	60	33.7	0.278	0.72	33.7	0.00114	0.008	27.7	142.2	16.2	11.5
M200 2hr	120	46.8	0.278	0.72	23.4	0.00114	0.005	38.4	284.5	32.4	6.0
M200 4hr	240	65	0.278	0.72	16.25	0.00114	0.004	53.4	569.0	64.9	-11.5
M200 6hr	300	78.7	0.278	0.72	15.74	0.00114	0.004	77.6	853.5	97.3	-19.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.00114	0.002	107.7	1707.0	194.6	-86.9
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00114	0.002	149.5	3414.0	389.2	-239.7
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00114	0.001	171.3	6827.9	778.4	-607.1

Catchment **SP16** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01255	0.323	96.8	11.9	14.9	81.9
M200 10min	10	14.9	0.278	0.72	89.4	0.01255	0.225	134.7	23.7	29.8	105.0
M200 15min	15	17.5	0.278	0.72	70	0.01255	0.176	158.3	35.6	44.6	113.6
M200 30min	30	24.3	0.278	0.72	48.6	0.01255	0.122	219.8	71.1	89.3	130.5
M200 60min	60	33.7	0.278	0.72	33.7	0.01255	0.085	304.8	142.2	178.5	126.2
M200 2hr	120	46.8	0.278	0.72	23.4	0.01255	0.059	423.2	284.5	357.0	66.2
M200 4hr	240	65	0.278	0.72	16.25	0.01255	0.041	587.8	569.0	714.1	-126.3
M200 6hr	300	78.7	0.278	0.72	15.74	0.01255	0.040	854.0	853.5	1071.1	-217.1
M200 12hr	600	109.3	0.278	0.72	10.93	0.01255	0.027	1186.1	1707.0	2142.3	-956.1
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01255	0.019	1646.2	3414.0	4284.5	-2638.3
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01255	0.011	1886.1	6827.9	8569.0	-6683.0

Catchment **SP20** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00508	0.131	39.2	11.9	6.0	33.1
M200 10min	10	14.9	0.278	0.72	89.4	0.00508	0.091	54.5	23.7	12.0	42.5
M200 15min	15	17.5	0.278	0.72	70	0.00508	0.071	64.1	35.6	18.1	46.0
M200 30min	30	24.3	0.278	0.72	48.6	0.00508	0.049	89.0	71.1	36.1	52.8
M200 60min	60	33.7	0.278	0.72	33.7	0.00508	0.034	123.4	142.2	72.3	51.1
M200 2hr	120	46.8	0.278	0.72	23.4	0.00508	0.024	171.3	284.5	144.5	26.8
M200 4hr	240	65	0.278	0.72	16.25	0.00508	0.017	237.9	569.0	289.0	-51.1
M200 6hr	300	78.7	0.278	0.72	15.74	0.00508	0.016	345.7	853.5	433.6	-87.9
M200 12hr	600	109.3	0.278	0.72	10.93	0.00508	0.011	480.1	1707.0	867.1	-387.0
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00508	0.008	666.4	3414.0	1734.3	-1067.9
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00508	0.004	763.4	0.0	0.0	763.4

Catchment **SP21** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01092	0.281	84.2	11.9	12.9	71.2
M200 10min	10	14.9	0.278	0.72	89.4	0.01092	0.195	117.2	23.7	25.9	91.3
M200 15min	15	17.5	0.278	0.72	70	0.01092	0.153	137.6	35.6	38.8	98.8
M200 30min	30	24.3	0.278	0.72	48.6	0.01092	0.106	191.1	71.1	77.6	113.5
M200 60min	60	33.7	0.278	0.72	33.7	0.01092	0.074	265.1	142.2	155.3	109.8
M200 2hr	120	46.8	0.278	0.72	23.4	0.01092	0.051	368.1	284.5	310.5	57.6
M200 4hr	240	65	0.278	0.72	16.25	0.01092	0.036	511.2	569.0	621.1	-109.8
M200 6hr	300	78.7	0.278	0.72	15.74	0.01092	0.034	742.8	853.5	931.6	-188.8
M200 12hr	600	109.3	0.278	0.72	10.93	0.01092	0.024	1031.6	1707.0	1863.2	-831.6
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01092	0.017	1431.8	3414.0	3726.3	-2294.6
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01092	0.009	1640.3	6827.9	7452.7	-5812.3

Catchment **SP22** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.00387	0.099	29.8	11.9	4.6	25.3
M200 10min	10	14.9	0.278	0.72	89.4	0.00387	0.069	41.6	23.7	9.2	32.4
M200 15min	15	17.5	0.278	0.72	70	0.00387	0.054	48.8	35.6	13.8	35.0
M200 30min	30	24.3	0.278	0.72	48.6	0.00387	0.038	67.8	71.1	27.5	40.2
M200 60min	60	33.7	0.278	0.72	33.7	0.00387	0.026	94.0	142.2	55.1	38.9
M200 2hr	120	46.8	0.278	0.72	23.4	0.00387	0.018	130.5	284.5	110.1	20.4
M200 4hr	240	65	0.278	0.72	16.25	0.00387	0.013	181.3	569.0	220.2	-38.9
M200 6hr	300	78.7	0.278	0.72	15.74	0.00387	0.012	263.4	853.5	330.3	-66.9
M200 12hr	600	109.3	0.278	0.72	10.93	0.00387	0.008	365.8	1707.0	660.6	-294.8
M200 24hr	1200	151.7	0.278	0.72	7.585	0.00387	0.006	507.6	3414.0	1321.2	-813.6
M200 48hr	2400	173.8	0.278	0.72	4.345	0.00387	0.003	581.6	6827.9	2642.4	-2060.8

Catchment **SP23** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01184	0.304	91.2	11.9	14.0	77.2
M200 10min	10	14.9	0.278	0.72	89.4	0.01184	0.212	127.1	23.7	28.1	99.0
M200 15min	15	17.5	0.278	0.72	70	0.01184	0.166	149.2	35.6	42.1	107.2
M200 30min	30	24.3	0.278	0.72	48.6	0.01184	0.115	207.2	71.1	84.2	123.1
M200 60min	60	33.7	0.278	0.72	33.7	0.01184	0.080	287.4	142.2	168.4	119.0
M200 2hr	120	46.8	0.278	0.72	23.4	0.01184	0.055	399.1	284.5	336.7	62.4
M200 4hr	240	65	0.278	0.72	16.25	0.01184	0.038	554.3	569.0	673.4	-119.1
M200 6hr	300	78.7	0.278	0.72	15.74	0.01184	0.037	805.4	853.5	1010.1	-204.7
M200 12hr	600	109.3	0.278	0.72	10.93	0.01184	0.026	1118.5	1707.0	2020.2	-901.7
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01184	0.018	1552.4	3414.0	4040.4	-2488.0
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01184	0.010	1778.6	6827.9	8080.8	-6302.2

Catchment **SP24** water discharge rate (l/s)
Clean water natural flow 39.5 l/s/ha

1 in 200 year return	minutes	Rainfall (mm)		C	i (mm/hr)	A (km^2)	(m^3/s)	Volume (m^3)	Discharge (m^3/ha)	Discharge (m^3)	Residual Volume (m^3)
M200 5min	5	10.7	0.278	0.72	128.4	0.01605	0.412	123.7	11.9	19.0	104.7
M200 10min	10	14.9	0.278	0.72	89.4	0.01605	0.287	172.3	23.7	38.1	134.3
M200 15min	15	17.5	0.278	0.72	70	0.01605	0.225	202.4	35.6	57.1	145.3
M200 30min	30	24.3	0.278	0.72	48.6	0.01605	0.156	281.0	71.1	114.2	166.9
M200 60min	60	33.7	0.278	0.72	33.7	0.01605	0.108	389.7	142.2	228.3	161.4
M200 2hr	120	46.8	0.278	0.72	23.4	0.01605	0.075	541.3	284.5	456.6	84.6
M200 4hr	240	65	0.278	0.72	16.25	0.01605	0.052	751.7	569.0	913.2	-161.5
M200 6hr	300	78.7	0.278	0.72	15.74	0.01605	0.051	1092.2	853.5	1369.9	-277.6
M200 12hr	600	109.3	0.278	0.72	10.93	0.01605	0.035	1516.9	1707.0	2739.7	-1222.8
M200 24hr	1200	151.7	0.278	0.72	7.585	0.01605	0.024	2105.3	3414.0	5479.4	-3374.1
M200 48hr	2400	173.8	0.278	0.72	4.345	0.01605	0.014	2412.0	6827.9	10958.8	-8546.8

Appendix C – Decommissioning Plan

TULLAGHMORE WIND FARM LIMITED.

TULLAGHMORE WIND FARM, MAAM CROSS, CO. GALWAY.

CONSTUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

DECOMMISSIONING & RESTORATION PLAN

July 2022

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DOCUMENT APPROVAL

PROJECT	Tullaghmore Wind Farm, Co. Galway	
CLIENT / JOB NO	Tullaghmore Wind Farm Limited	6276
DOCUMENT TITLE	Decommissioning & Restoration Plan	

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TULLAGHMORE WIND FARM LIMITED

TULLAGHMORE WIND FARM, MAAM CROSS, CO. GALWAY.

DECOMMISSIONING & RESTORATION PLAN

PLANNING

TABLE OF CONTENTS

1.0 INTRODUCTION

This proposed Tullaghmore Wind Farm will consist of 6 wind turbines installed on cast in-situ below ground concrete foundations with adjacent crane hard standing areas at all turbines. A stand-alone 38kV Electric Control Building and compound will be constructed on site and all structures shall be connected via a network of existing and proposed access tracks. Underground electrical and communications cables will also link the turbines to the site control building and the power generated will be exported to the National Grid by underground cables.

This Decommissioning and Restoration Plan outlines the project components to be removed from site, and how disturbed areas are to be restored within the project area on decommissioning of the wind farm.

It is noted that any works to be completed under this Decommissioning and Restoration Plan shall be fully compliant with the methodology and practices outlined in the Environmental Impact Assessment Report (2022) and any subsequent Further Environmental Information submissions of the planning application and planning appeal respectively shall also be adhered to.

In preparing this Decommissioning and Restoration Plan, cognisance has also been given to the Scottish Natural Heritage (SNH) commissioned report no 591 titled *'Research and guidance on restoration and decommissioning of onshore wind farms'* (SNH, 2013), and the guidance document titled *'Decommissioning and Repowering plans for onshore wind farm'*[3]. The SNH Guidance also notes that reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm. Due to the efficiency of modern turbines, it is estimated that their lifespan will be 35 years. The technological advances and preferred approaches to reinstatement are likely to change in the intervening decades.

In this regard, this Decommissioning Plan will be reviewed and updated for the written agreement of the Planning Authority prior to commencement of a decommissioning works. It will take account of the relevant conditions of the planning permission and current health and safety standards in accordance with the approach set out and the principles established in this document.

2.0 WIND FARM INFRASTRUCTURE

The following items will make up the wind farm infrastructure once construction is completed:

- 6 no. wind turbine generators
- 6 no. wind turbine foundations
- 6 no. crane hard-standing areas
- Upgrade of approximately 1,450m of existing Site Access Tracks
- Construction of approximately 5,530m of new Site Access Tracks
- 1 no site 38kV Substation control building and compound
- Underground electrical & communications cables
- Site drainage network
- Biodiversity enhancement measures
- Spoil storage and restoration areas

All access roads and hardstanding areas forming part of a site roadway network which are required for wind farm operation and maintenance staff for ongoing forestry operations will be left in situ for future use. The substation and grid connection are permanent features.
It is intended that all above ground components and underground cabling (ducting left in-situ) will be removed from the Site as part of the decommissioning of the Development. The approach proposed for decommissioning is one of minimal intervention.

The following elements are included in the decommissioning phase:

- Decommissioning works will be limited to action necessary to remove the wind farm structures, i.e., removal of turbines, cabling and the monitoring mast.
- Roads and associated drainage systems will remain in place to serve ongoing forestry and agriculture activity.[1]
- Hardstanding areas will be allowed to revegetate naturally.
- Turbine plinths will be removed, and the hardcore covering turbine foundations will be allowed to revegetate naturally.[2]
- Soil disturbance will be avoided.
- Importing soil is not a preferred option. If this is to be considered, it will be as a last resort only. If it is nonetheless considered necessary to import soil, it will be peat soil.[3]

[1] For a wind farm where the roads are not to be retained, natural revegetation is preferred to reprofiling, or the importation of soil.
[2] The covering of turbine foundations with soil material was discussed, and discounted. Instead, the possibility was discussed of roughening the surface of the concrete foundation, to assist in the initiation and subsequent growth and coalescence of flora. However, the foundations will in fact be covered with hardcore, so this step is unnecessary.
[3] This is because mineral soil will have different properties and different seed banks to peat soil and will not be suitable for transplantation to a bog environment. Natural colonisation of hardcore by local flora is expected to occur quite easily. This is seen from experience at existing wind farms, where regular maintenance is required to keep hardstandings and road verges free from growth.

Mineral soil will not be brought into the Site. Any decision to import peat soil will need to carefully balance any benefits of doing so against the ecological and hydrological impacts of excavating it elsewhere.

3.0 TARGETS AND OBJECTIVES

The key targets are as follows:

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation.
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community. This will relate to transport, particularly of material off site with noise and dust also impacting on receptors at time of decommissioning to a lesser extent.
- Ensure decommissioning works and activities have minimal impact on the natural environment. Disturbance to habitats will be avoided and the use of existing infrastructure and drainage will ensure silt does not enter waterways.
- Adopt a sustainable approach to decommissioning. This means comparing alternative methods for turbine disassembly and taking the approach with the least impact on the natural environment; and,
- Provide toolbox talks, environmental training and awareness of sensitive receptors and waste management within the Site for all project personnel.

The key site objectives are as follows:

- Ensure sustainable sources where possible. This means using sources which have derived from resources that can maintain current operations without jeopardising the energy needs or climate of future generations and implementing the waste hierarchy.
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and have emergency measures in place, in accordance with the Water Quality Management Plan. Similar mitigation measures to the construction phase will be implemented. Please Section 3 for more details.
- Avoidance of vandalism.
- Keeping all watercourses free from obstruction and debris.
- Sustainable drainage system/drainage design principles will be maintained and monitored to ensure efficiency.
- Keep impact of decommissioning works to a minimum on the local environment, namely watercourses, and wildlife through the use of defences such as buffers and

silt fences.

- Correct fuel storage and refuelling procedures to be followed.
- Good waste management and housekeeping to be implemented.
- Air and noise pollution prevention to be implemented.
- Monitoring of the works and any adverse effects that it may have on the environment.

4.0 WIND FARM DECOMMISSIONING PLAN

Prior to the commencement of any decommissioning works on site, a comprehensive Health and Safety Risk Assessment, complete with method statements, shall be developed by the appointed Contractor. These risk assessments and method statements will take on board all updated health and safety legislation and policies which are appropriate to the time in question. A similar review of the EIAR and any Further Information (FI) Responses shall be completed to ensure that all environmental legislation, best practice guidance, etc., which may have been introduced in the intervening years are adopted into the specific construction method statements.

The main components of the wind farm infrastructure are itemised hereunder and addressed individually.

4.1 Wind Turbine Generators

The key wind turbine generator components to be considered in decommissioning include:

Key Element	Components	Constituents
Turbines	i. Blades	Resin / fibre glass (18 No.)
	ii. Blade hub & nose cone	Cast iron, resin, fibre glass (6 No.)
	iii. Nacelle, incl generator & gearbox if appropriate	Iron, steel, copper, resin, silica (6 No.)
	iv. Tower	Steel (18 No. Sections)
	v. Transformer	Electrical components (6 No.)

Prior to any works being undertaken on wind turbines, they will be disconnected from the grid by the site operator in conjunction with ESB Networks and EirGrid. Once a Health and Safety Risk Assessment has been completed and the turbines have been isolated electrically, they will be systematically disassembled and disconnected from their concrete bases, and subsequently removed from site on similar transport vehicles to those which were used to deliver the turbines to Site. The main components of the wind turbines (the tower, the nacelle, blades, etc.) are modular items that allow for ease of construction and disassembly. It is noted that wind turbine components have a significant recycle value in the form of steel, aluminum, copper, etc., (in some instances wind turbines can be refurbished and sold as secondhand turbines), therefore an incentive will always exist to carefully and diligently remove these structures from a non-operating wind farm site.

Suitable cranes, similar to those used for the installation works, shall be required for this operation. All components removed from Site will be sent to a licensed waste management firm and or recycling facility and disposed of in accordance with European Union (Waste Electrical and Electronic Equipment) Regulations 2014 and EU (Environmental Impact Assessment) Waste Regulations 2013 or other applicable legislation which may be in force at the time of decommissioning. As outlined above, it is anticipated that the waste steel turbine towers will be re-cycled and potentially used again for manufacturing and that the generator components will be broken down into their respective components and re-cycled as appropriate.

The transport of disassembled turbines from the site will be undertaken in accordance with a Transport Management Plan which will be issued to and agreed with the competent authority at that time as part of a permit application for the delivery of abnormal loads using the local roads under the Road Traffic (Special Permits for Particular Vehicles) Regulations 2007. The Transport Management Plan will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.2 Wind Turbine Foundations

The key wind turbine foundation components to be considered in decommissioning include:

Key Element	Components	Constituents
Turbine Foundation	i. Backfill above & around base	Suitable engineering fill / crushed rock
	ii. Concrete Foundations	Concrete / steel reinforcement
	iii. Concrete piles	Concrete / steel reinforcement

Each wind turbine will have a reinforced concrete foundation comprising of a concrete base slab (c. 25.5m in diameter, and 3.0m deep) lying on either bedrock, competent substrata, or concrete piles, with a concrete central upstand column (measuring c.6m in diameter and c.650mm tall) which sits c.100mm above finished ground level, and connects to the bottom turbine tower fixing section.

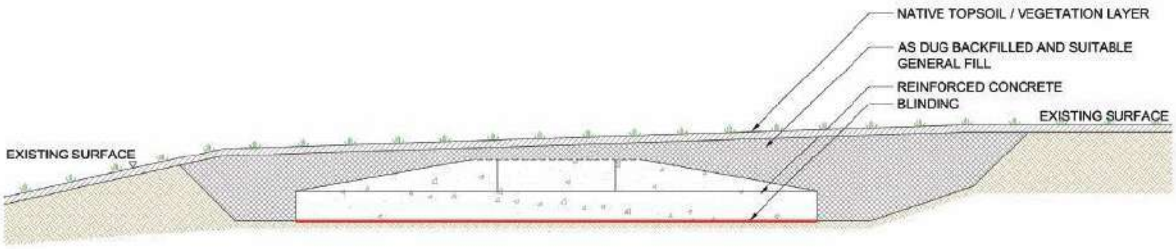
In order to keep the ground disturbances to a minimum, it is proposed that turbine foundations will not be removed in their entirety from the ground, with the concrete demolition works being confined to the central upstand column of the turbine foundation. This shall typically be broken out by mechanical rock hammers and reinforcing steel cut level with the broken concrete which will terminate approximately 400mm below finished ground level. It is envisaged that this work would be completed with a 30 tonne 360^{o} Tracked Excavator with a suitable sized hydraulic hammer. The broken-down rock is loaded into a mobile crusher using a wheeled loading shovel machine and crushed down into the correct grade for use in the civil construction of Site Access Tracks and Turbine Hardstands.

The remaining concrete base slab will be c.3m below finished ground level, and shall be covered over with peat material as appropriate from the project site. The reinstatement of topsoil and the restoration of vegetation will be kept consistent and compatible with surrounding vegetation.

The methodology of all restoration works shall first be agreed with the site Environmental Engineer, and the Engineer shall monitor and supervise the entire restoration works programme.

It is noted that the SNH Commissioned Report no 591 concludes that *"there is a relatively low environmental risk associated with reinforced concrete that is left in situ (The Concrete Society pers comm. 2013), and the noise, ground disturbance and cost (excavation/breaking/processing/transporting), along with associated carbon emissions, may create a larger environmental impact than leaving such concrete in situ on the site".'*

The following figure which is extracted from the SNH commissioned report, shows a typical cross section of a restored turbine foundation.



PARTIAL REMOVAL AND RESTORATION

4.3 Crane Hardstand Areas

The key crane hardstand components to be considered in decommissioning include:

Key Element	Components	Constituents
Crane hard- standing areas	i. Hard-standing Area Approx 3,395m²/ Turbine	Crushed rock / geogrid reinforcement. Weathered & possibly vegetated
	ii. Soils	In-situ soils

In order to reduce the potential impact of excavating and removing the entirety of the crane hardstand areas, it is proposed that the majority of the stone structure of the individual crane hardstands will be left in place, with topsoil and or peat being spread on top of the hardstand to form a vegetated surface layer. The top layer of the crane hardstand areas will have the rock/stone dug out and be left to revegetate naturally. Any reinstatement of topsoil and the restoration of vegetation will be kept consistent and compatible with surrounding vegetation, and shall be agreed with the Environmental Engineer in advance of commencement. The Environmental Engineer shall also supervise the restoration works on site.

By minimising the excavation of stone, and geo-grid etc., which over the lifetime of the windfarm may have become vegetated, the risk of creating sedimentation of watercourses etc. is kept to a minimum.

4.4 Site Tracks

The key site track components to be considered in decommissioning include:

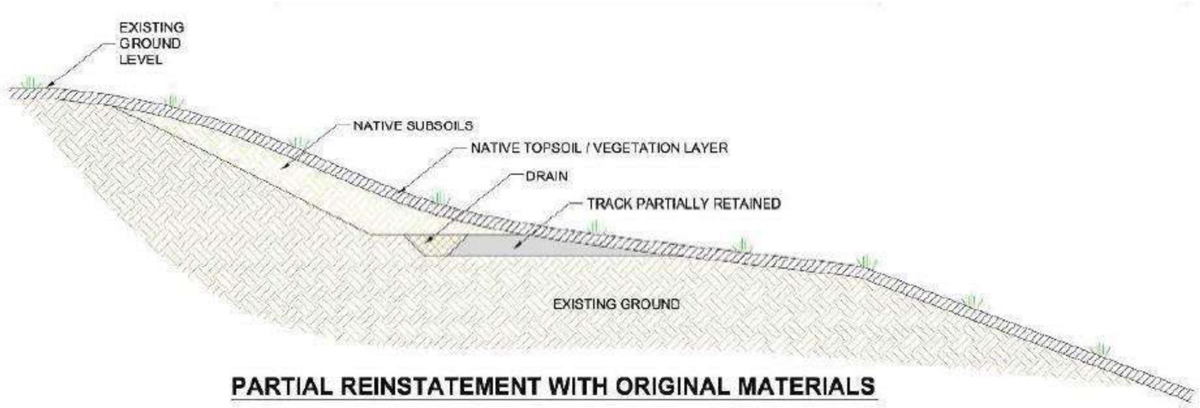
Key Element	Components	Constituents
Site tracks	i. Wind farm spec roads (granular fill) (also floating roads)	Crushed rock / geotextile separators / geogrid reinforcement. Weathered & possibly vegetated.

Approximately 7.0km of Site Access Tracks will be constructed as part of the project.

It is proposed that the Site Access Tracks will be left in situ for use by the landowners. Any localised sections of track which will be required to be reinstated will have a covering layer of topsoil or peat (depending on adjacent vegetation) being placed on top of the track surface, with vegetated sods used where available. These works will also be in accordance with the requirements of the EIAR, and as per all other works on site will be first agreed with, and supervised by the appointed Environmental Engineer.

The SNH commissioned report no 591 notes that the *"risks associated with leaving tracks in situ are relatively low. If the tracks are not required to be re-used, then localised grading of the road to suit the ground profile followed by reinstatement of topsoil/vegetation layer would be a low risk activity. Consideration and sensitive management of the movement of groundwater and surface water would be important. Similarly, the underlying track, once covered, may drain water from the overlying topsoil and vegetation, and therefore reinstatement may not achieve the desired outcome. This can be managed and engineered to mitigate these risks."*

The following figure is extracted from this SNH report and provides a cross section example of the proposed restoration works.



PARTIAL REINSTATEMENT WITH ORIGINAL MATERIALS

4.5 Control Building and Compound

The Control Building and Compound will be owned and operated by the ESB once operational and so will not be decommissioned as part of the works, unless required by ESB.

4.6 Internal Underground Electrical & Communication Cables

The key underground cable components to be considered in decommissioning include:

Key Element	Components	Constituents
Internal Underground cables	i. Underground cables, including electrical, earthing, and fibre optic	Copper, aluminium, fibre optic, plastic and rubber sheaths, HDPE ducting

All internal underground cables installed as part of the wind farm development shall be extracted from the ground and disposed of to a licensed recycling facility.

The associated ground disturbance with the removal of the underground cables should be minimal, however these works, like all others, shall be approved and supervised by the appointed Environmental Engineer. The ducts will remain in-situ.

5.0 ENVIRONMENTAL CONTROLS

5.1 Site Drainage

Prior to any decommissioning or restoration works commencing on site, the site drainage network shall be inspected by a SuDS hydrologist, and any necessary repairs to settlement ponds, check dams, etc., shall all be completed to ensure the drainage system is working adequately prior to ground works commencing.

As turbine foundations, crane hardstand areas, access tracks, etc. are being restored, the respective drainage features shall all be filled in and or blocked to prevent any unnecessary dewatering of the restored area. These works shall all be completed under guidance from the site hydrologist and the appointed Environmental Engineer.

5.2 Refuelling; Fuel and Hazardous Materials Storage

The plant and equipment used during decommissioning will require refuelling during the works. Appropriate management of fuels will be required to ensure that incidents relating to refuelling are avoided. The following mitigation measures, which are the same as those proposed for the construction phase, are proposed to avoid release of hydrocarbons at the Site:

- Road-going vehicles will be refuelled off site wherever possible.
- On-site refuelling will be carried out at a designated refuelling area on the Site. Machinery such as cranes will be refuelled directly by a mobile fuel truck that will come to site as required. Drip trays will be used in such circumstances.
- 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.
- Fuel volumes stored on site will be minimised. The fuel storage areas will be bunded to 110% of the storage volume.
- The plant used will be regularly inspected for leaks and fitness for purpose.
- An emergency plan for the decommissioning phase to deal with accidental spillages will be developed. Spill kits will be available to deal with an accidental spillage in and outside the refuelling area.
- A programme for the regular inspection of plant and equipment for leaks and fitness

for purpose will be developed at the outset of the decommissioning phase.

5.3 Dust Control

Dust is unlikely to be generated in significant amounts from on-site activities during decommissioning. The extent of dust generation will depend on the type of activity undertaken, the proximity of activities to receptors and the nature of the dust, i.e., soil, and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Site traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures, which are the same as those proposed for the construction phase, to control dust include:

- Any site roads with the potential to give rise to dust will be regularly dampened down, 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 inspected daily by the Site Manager for cleanliness and cleaned if deposits are found.
- Material handling systems and material storage areas influenced by convenience and ease of handling, and peat slippage safety.
- Water misting or sprays will be used in dry and windy if particularly dusty activities are necessary during dry or windy periods.
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles.
- Daily inspection of the site to examine dust measures and their effectiveness.
- When in dry and/or windy weather and dirt is visible on the roads, sections of the haul route will be swept using a truck mounted vacuum sweeper.

5.4 Noise Control

The operation of plant and machinery, including site vehicles, is a source of potential impact that will require mitigation at all locations within the site. Proposed measures, which are the same as those proposed for the construction phase, 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 plant and equipment to be used on-site will be modern equipment and will comply with the S.I. No. 359/1996 - European Communities

(Construction Plant and Equipment) (Permissible Noise Levels) (Amendment) Regulations.

- Regular maintenance of plant will be carried out in order to minimise noise emissions. 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 Manager to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.
- Local areas of the haul route will be condition monitored and maintained, if necessary.

5.5 Invasive Species Management

Prior to decommissioning, a suitably qualified ecologist will complete an invasive species survey of the wind farm site to identify invasive species where any minor excavation will be required. Any invasive species encountered will be removed based on the advice of the ecologist.

5.6 Traffic Management

A Traffic Management Plan (TMP) will be prepared in advance of any decommissioning works. The traffic management arrangements for the removal of turbines although similar to those that will be implemented for construction materials delivery as outlined in the EIAR and the TMP in **Appendix 14.2**, will be agreed in advance of decommissioning with the competent authority.

The TMP for the decommissioning phase will also include provision for the removal of underground cables from the underground ducts within the Site. Cables in public roads will be left in-situ as they will be the responsibility of the ESB.

5.7 Waste Management Plan

This waste management plan outlines the best practice procedures during the decommissioning of the Development. The Waste Management Plan will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of decommissioning. Disposal of waste will be a last resort.

5.7.1 Legislation

The Waste Management Act 1996 as amended 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 Tullaghmore Wind Farm development to provide that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to see 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. Waste removal-related traffic volumes during the decommissioning phase, will be similar or less than those anticipated and assessed for the construction phase.

The Department of the Environment provides a document titled, 'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006). No demolition will take place at this site.

5.7.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing waste in the following order:

1. **Prevention and Minimisation:**

   The primary aim of the Waste Management Plan will be to prevent and thereby reduce the amount of waste generated.

2. **Reuse of Waste:**

   No material is likely to be reused on site during the Decommissioning phase. Materials such as cabling will be reused off-site.

3. **Recycling of Waste:**

   There are several established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

4. **Disposal of Waste to Landfill**

   At all times during the implementation of the Waste Management Plan, disposal of waste to landfill will be considered only as a last resort.

5.7.3 Waste Arising from Decommissioning

The relevant components will be removed from site for re-use, recycling or waste disposal. Any structural elements that are not suitable for recycling will be disposed of in an appropriate manner. All lubrication fluids will be drained down and put aside for appropriate collection, storage, transport and disposal. Any materials which cannot be re-used or recycled will be disposed of by an appropriately licenced contractor.

The waste types arising from the decommissioning of the Development are outlined in below.

Waste Types Arising during the Decommissioning Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminum, lead and iron	17 04 07
Fibreglass	Turbine blade component	10 11 03
Hydrocarbons	Oils and lubricants drained from the turbines	13 01 01,13 02 04

5.7.4 Reuse

Many construction materials can be reused several times before they have to be disposed of:

- Electrical wiring can be reused on similar wind energy projects
- Elements of the turbine components can be reused but this will be determined by the condition that they are in.

5.7.5 Recycling

If a certain type of material cannot be reused, then recycling is the most suitable option. The opportunity for recycling during decommissioning will be limited and restricted to components of the wind turbines.

All wastes will be sorted and segregated on-site during the time of decommissioning. The anticipated volume of all waste material to be generated at the Tullaghnmore Wind Farm development is low which provides the justification for adopting small containers as a method of waste storage.

5.7.6 Environmental Monitoring

In advance of any decommissioning or restoration works commencing on site, an Environmental Engineer shall be appointed to assist with the preparation of all Method Statements associated with the works to occur at the site. The Environmental Engineer shall be retained throughout the site works, providing guidance and instruction throughout, and independently supervising the works to ensure they are being completed in an environmentally sensitive manner.

Following the completion of the decommissioning and restoration works the Environmental Engineer will survey the entire site and produce a snag list of outstanding items, all of which will be completed by the appointed contractor under the supervision of the Environmental Engineer.

6.0 PROGRAMME FOR DECOMMISSIONING AND RESTORATION

The following is a proposed Decommissioning and Restoration Programme:

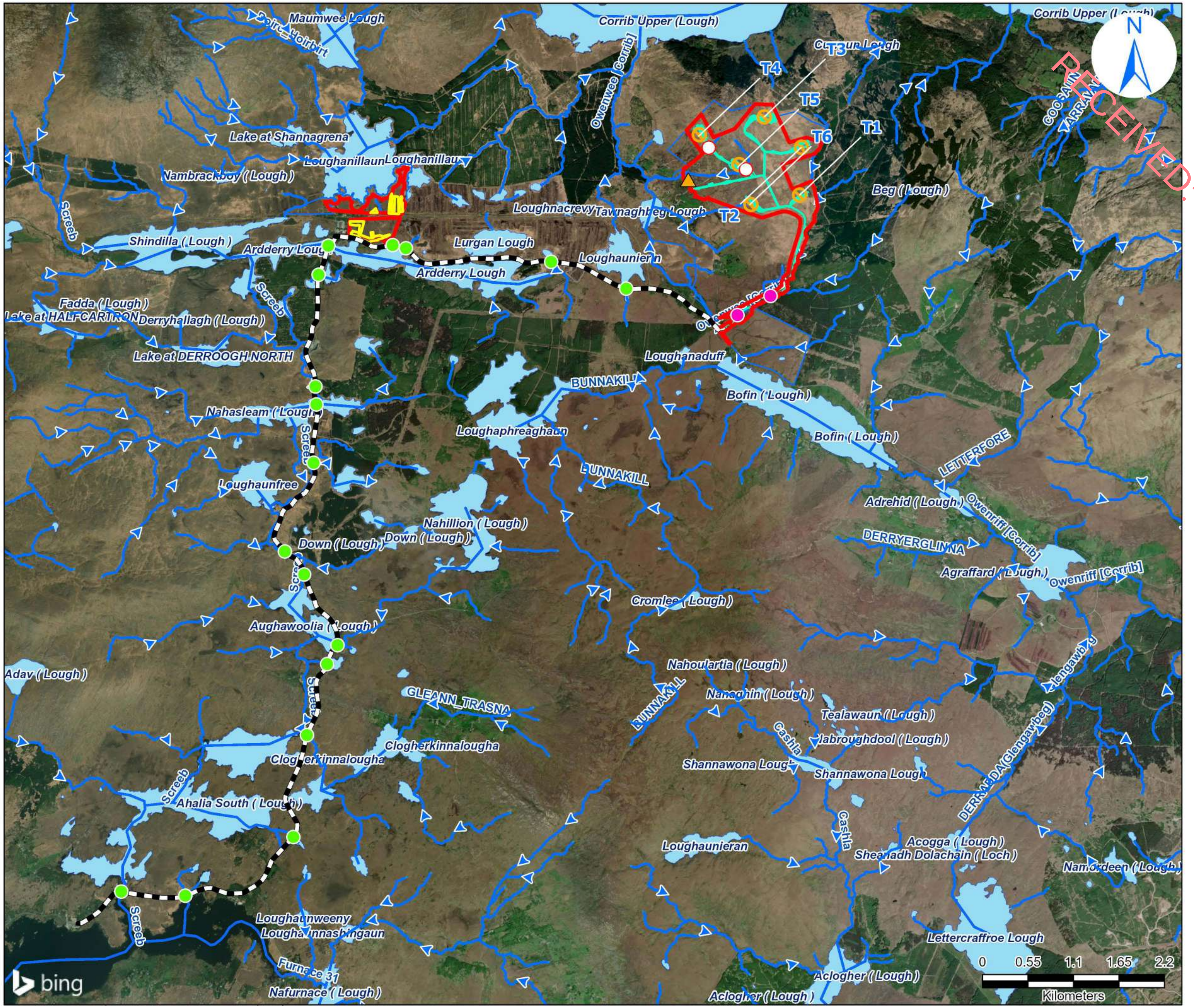
- 6 no. wind turbine generators — 4 Weeks
- 6 no. wind turbine foundations — 4 Weeks
- 6 no. hardstand areas & access tracks — 2 Weeks
- Control building and compound, underground cable, and site drainage — 3 Weeks

Decommissioning and restoration works shall commence following the expiration of a period of 35 years from the commencement of electricity generation, or upon the expiration of a period of 12 months following the cessation of electricity generation at the site.

7.0 DECOMMISSIONING & RESTORATION PLAN REVIEW PERIOD

The Decommissioning & Restoration Plan shall be reviewed prior to the commencement of any decommissioning and restoration works to ensure that all applicable best practice guidance, which may have been introduced in the intervening period, has been considered.

Appendix 2: Watercourse Crossing Drawings



Legend

- Rivers and Streams
- Grid Connection Route
- Met Mast
- Turbine Locations
- Spoil Storage Areas
- Redline Boundaries
- Hardstand and Roads

Existing & Proposed Watercourse Crossings

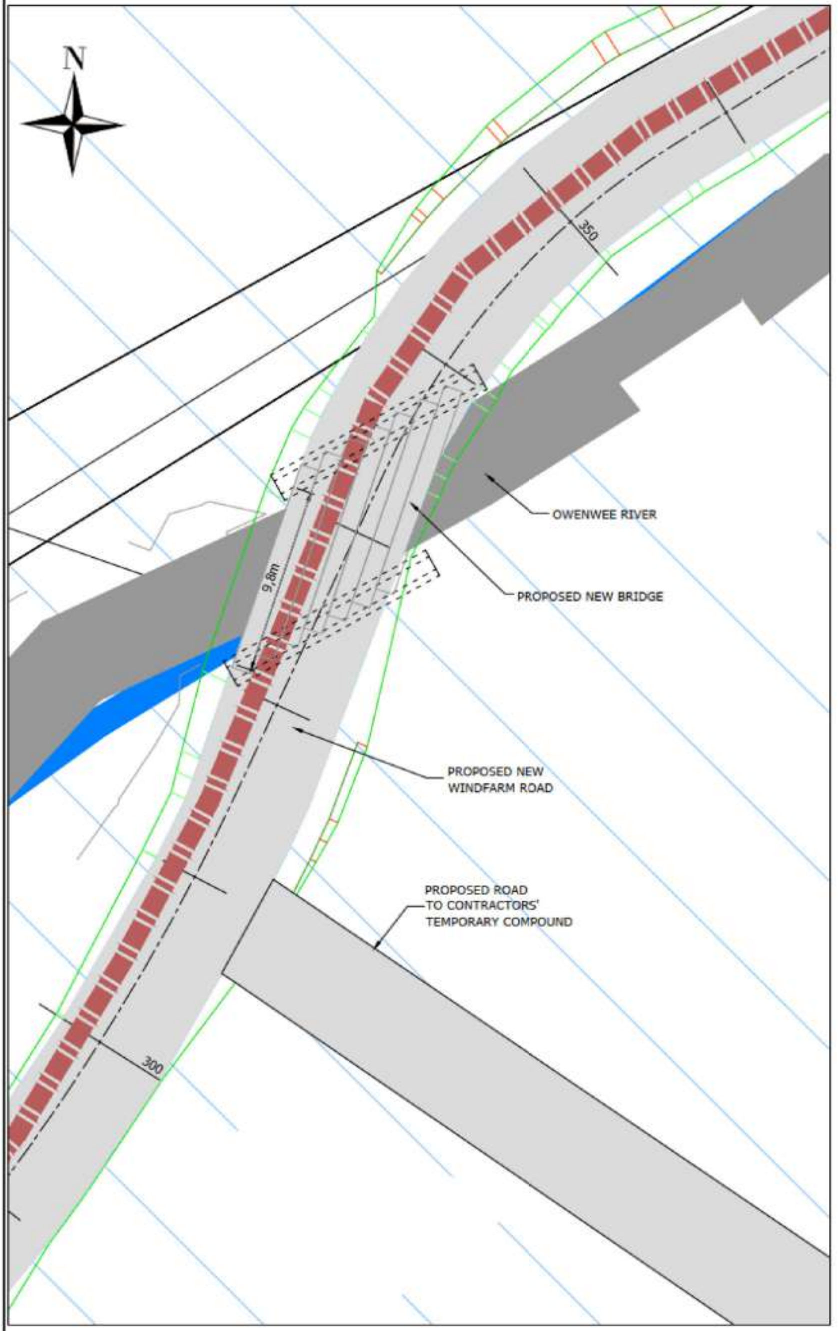
- Existing
- Existing to be Upgraded
- To Be Constructed

Extent Map

Client: Jennings O'Donovan & Partners	
Project: Tullaghmore Windfarm	
Map Title: Proposed and Existing Watercourse Crossings	
Spatial Reference Name: IRENET95 Irish Transverse Mercator	Page Size: A3
Figure No. 9.7	Scale: 1:45,000
Date: 18/8/2022	Prepared By: DP
Revision Number: 3	Checked By: AG
Tel: +353 (91) 897 583	
Email: info@ecoquest.ie	
Web: www.ecoquest.ie	

EcoQuest Environmental

RECEIVED: 26/01/2023



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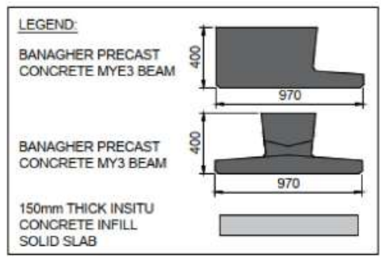

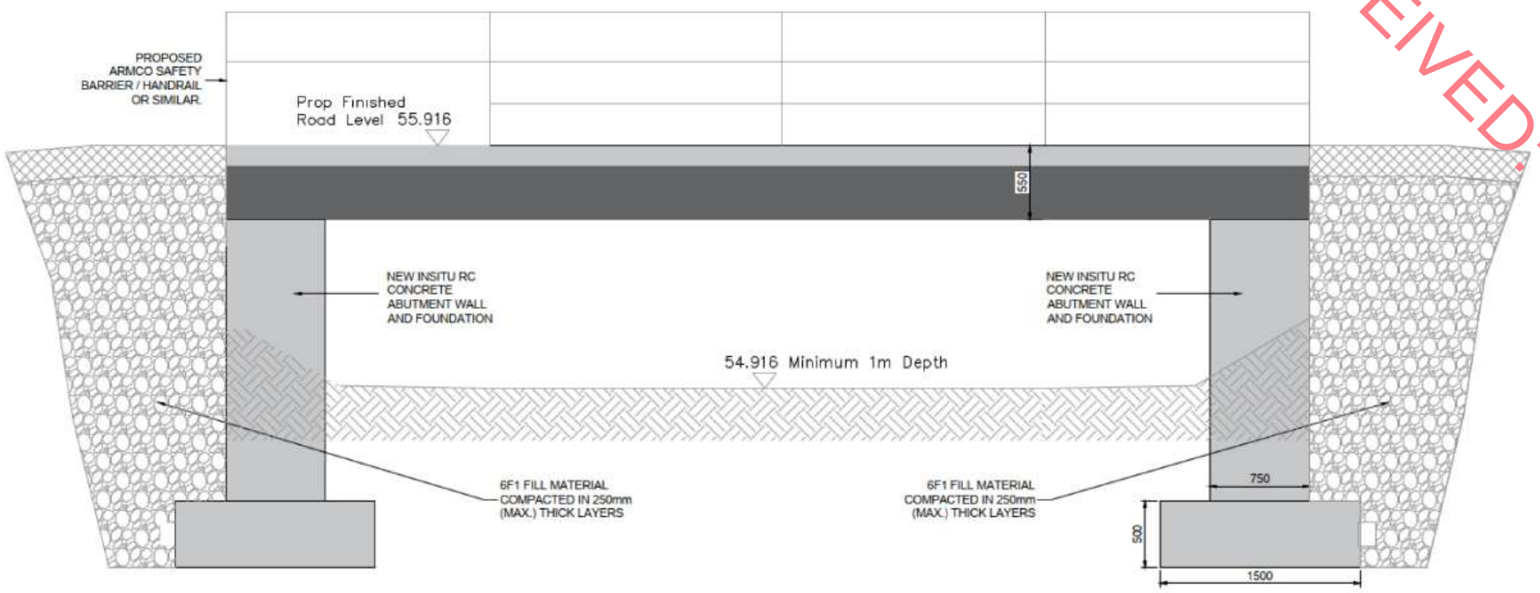

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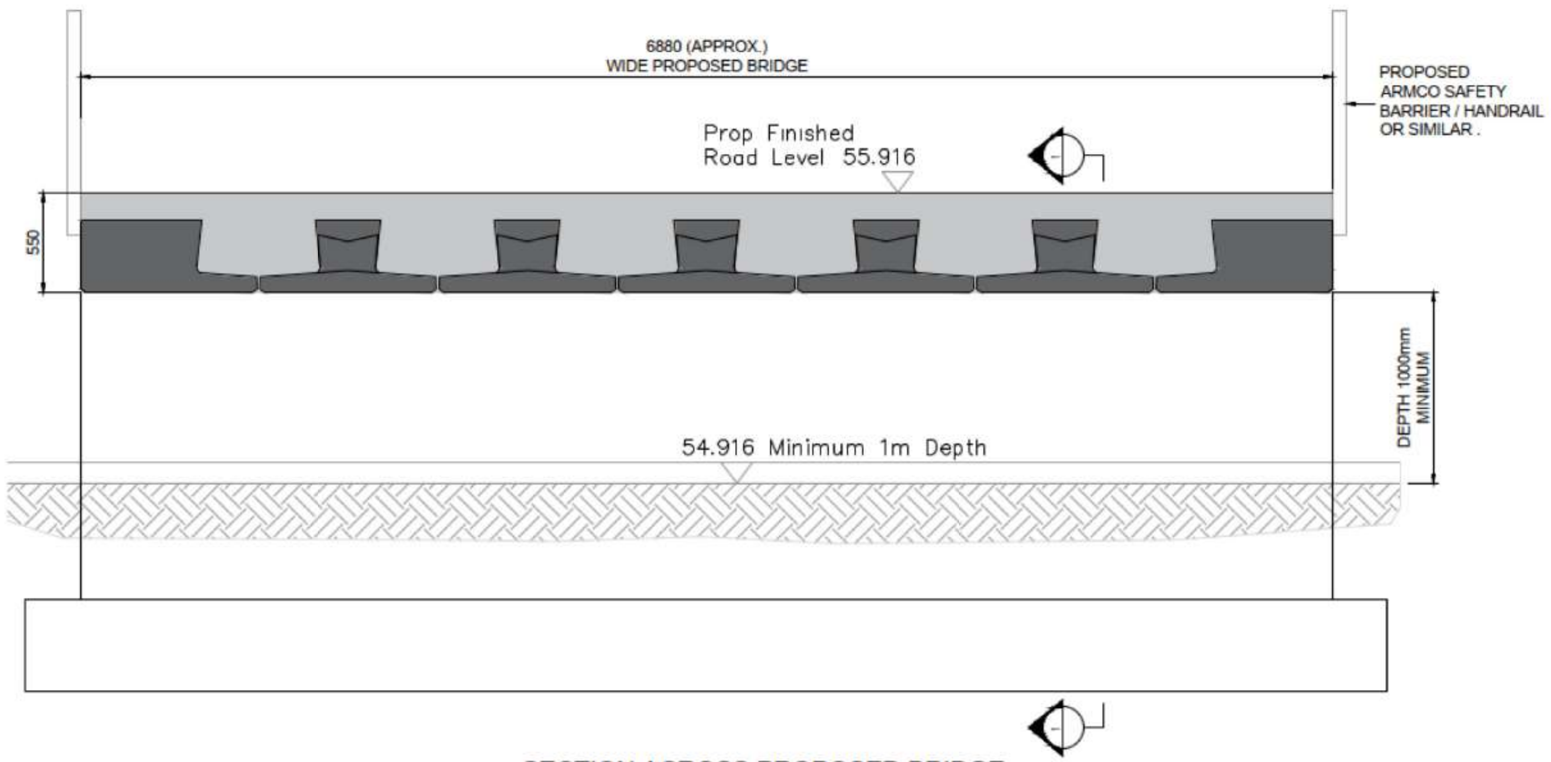


SECTION ACROSS PROPOSED BRIDGE
SCALE 1:25

Legend

Rev	Date	By	Comment

Client

TULLAGHMORE WIND FARM LTD

Client Representative

JENNINGS O'DONOVAN & PARTNERS LIMITED CONSULTING ENGINEERS

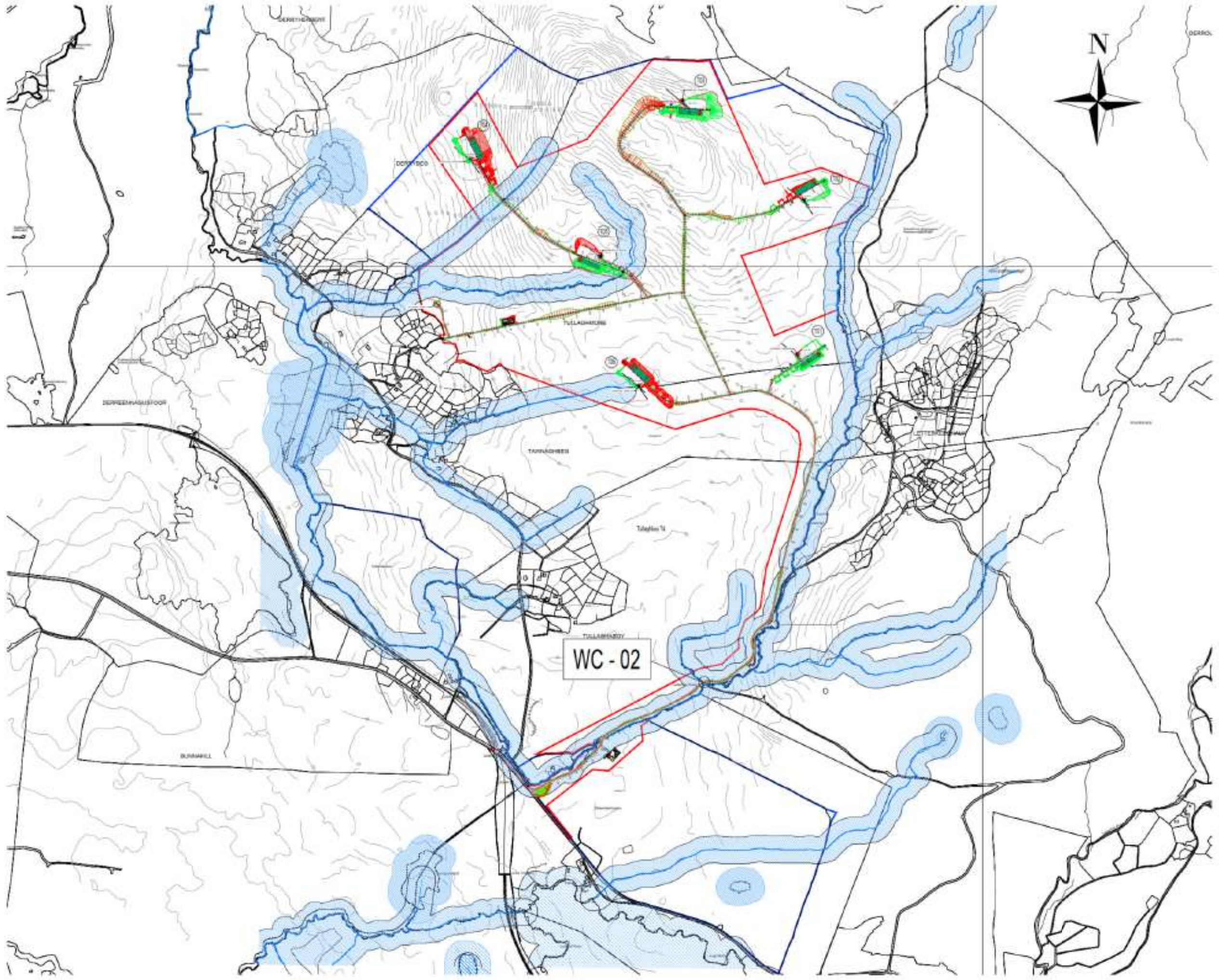
Project

TULLAGHMORE WIND FARM, CO. GALWAY

Title

WATERCOURSE CROSSING 1

Drg. By	SB	Drg No	-
Checked By	AOG	Rev	0
Stage	EIAR	Date	16/12/'22
Scale	NTS (A3)	Figure	2.6a



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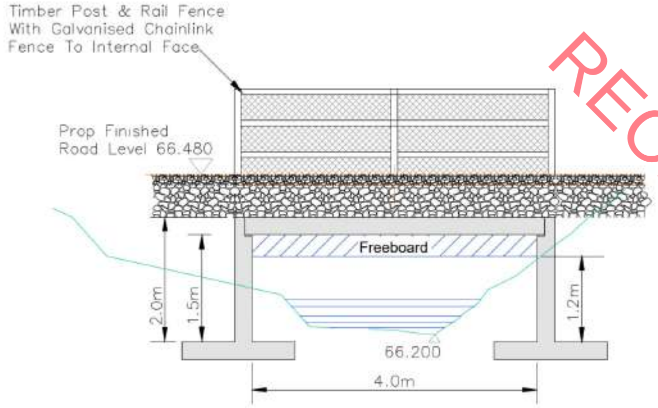

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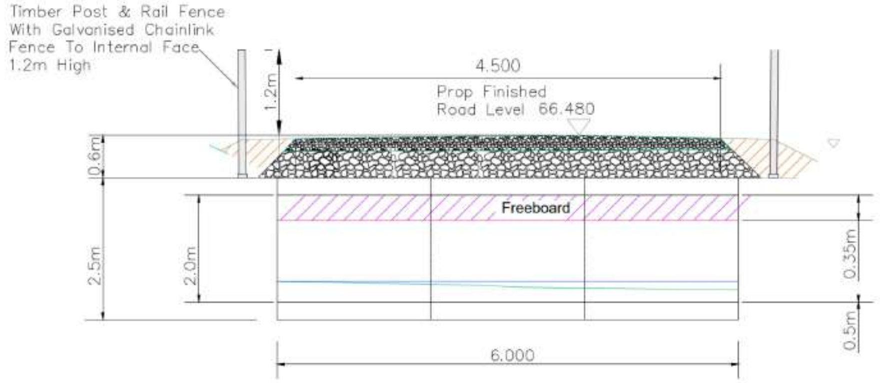
WATERCOURSE CROSSING WC 3
Scale 1:50



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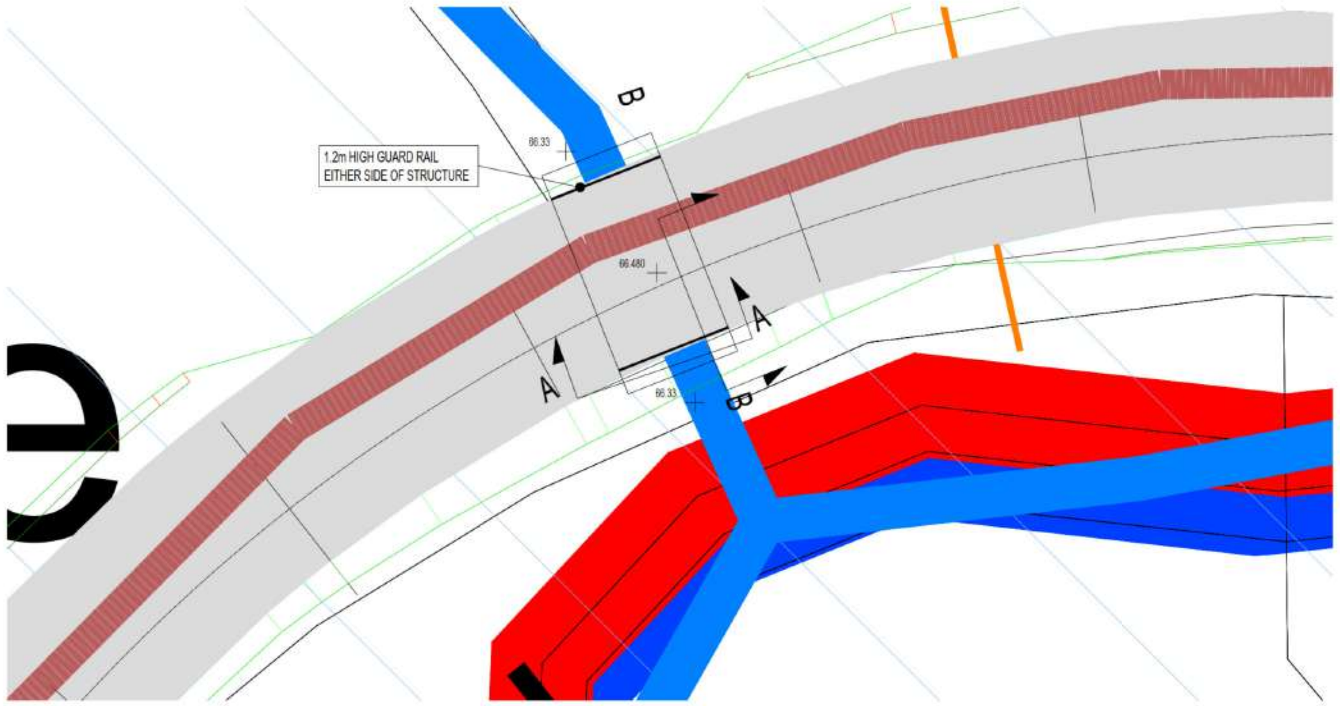
WATERCOURSE CROSSING WC 4 Scale 1:100



Photography of Existing Watercourse
Scale. NTS

Legend

Rev	Date	By	Comment

Client

TULLAGHMORE WIND FARM LTD

Client Representative

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Project

TULLAGHMORE WIND FARM,
CO. GALWAY

Title

WATERCOURSE CROSSING 2

Drg. By	SB	Drg No	-
Checked By	AOG	Rev	0
Stage	EIAR	Date	16/12/'22
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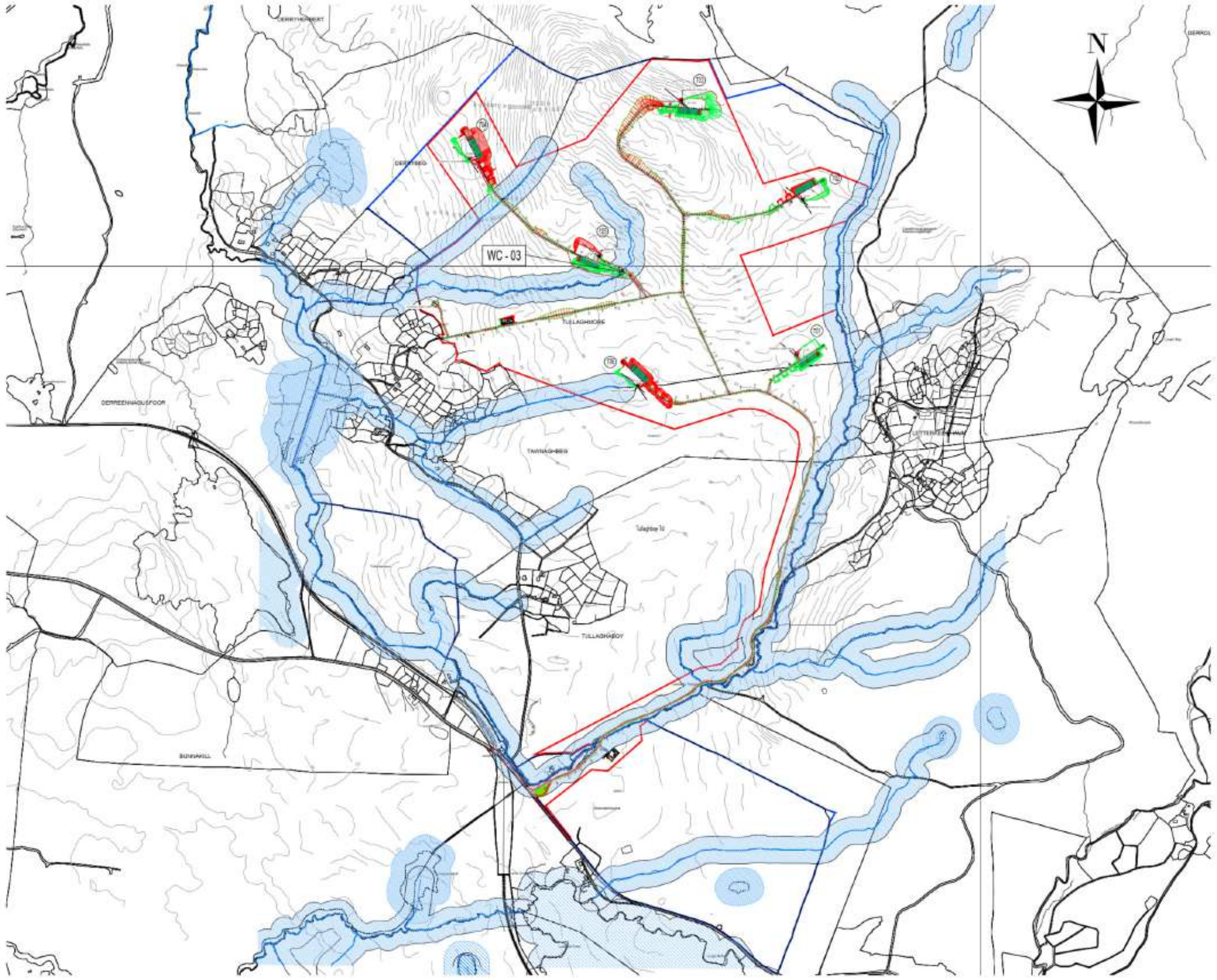

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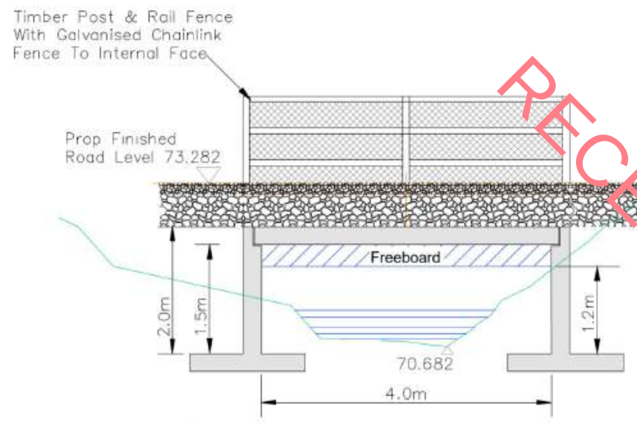

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WATERCOURSE CROSSING WC 3
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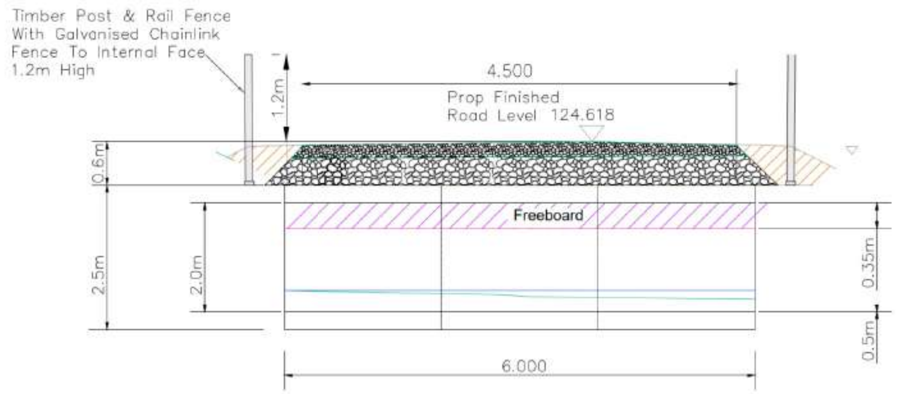

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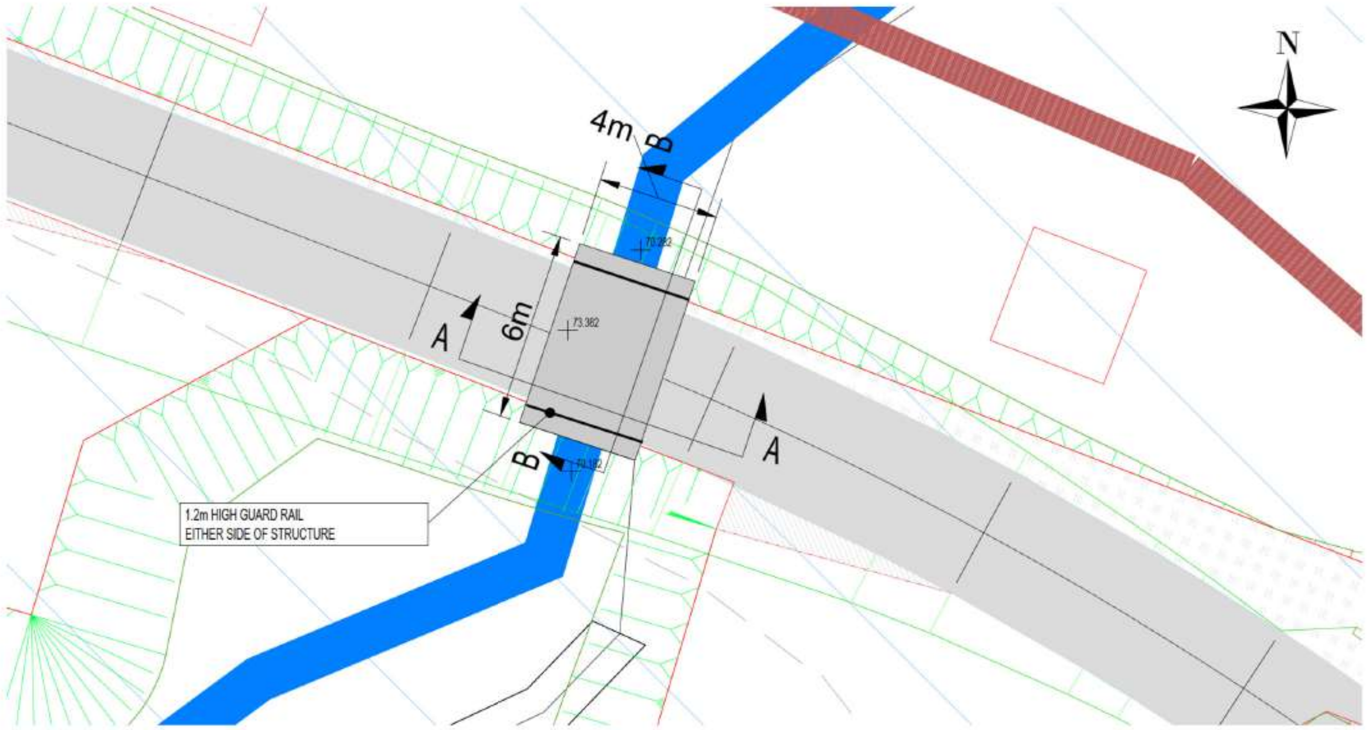


Photography of Existing Watercourse
Scale. NTS

Legend

Rev	Date	By	Comment

Client

TULLAGHMORE WIND FARM LTD

Client Representative

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

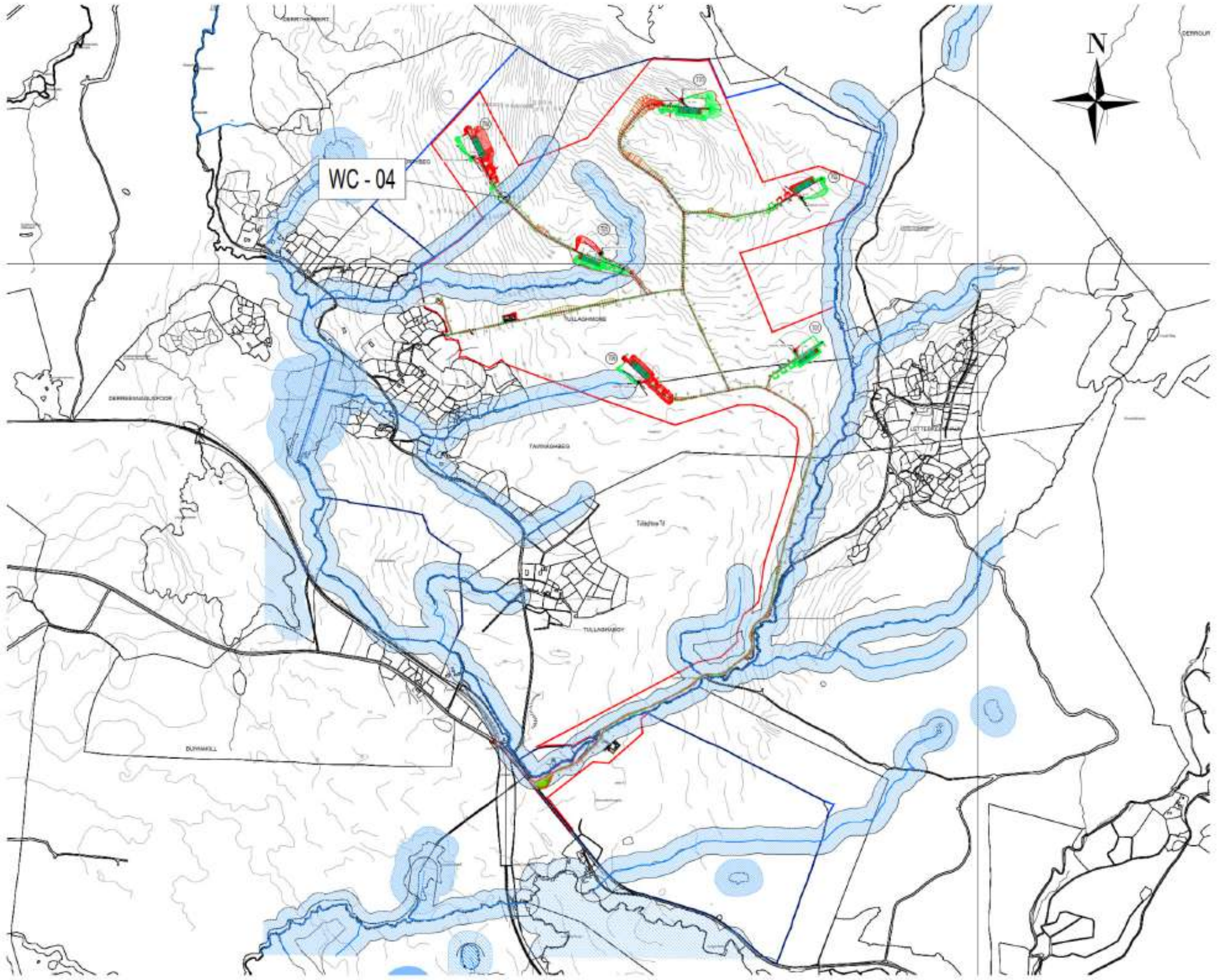
Project

TULLAGHMORE WIND FARM,
CO. GALWAY

Title

WATERCOURSE CROSSING 3

Drg. By	SB	Drg No	-
Checked By	AOG	Rev	0
Stage	EIAR	Date	16/12/'22
Scale	NTS (A3)	Figure	2.6c



Site Layout Plan
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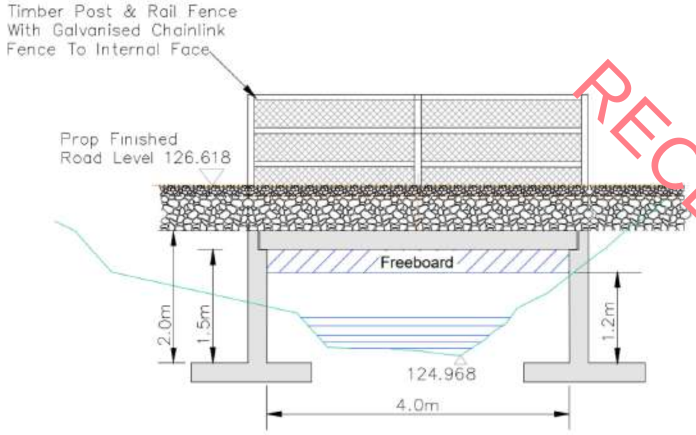

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WATERCOURSE CROSSING WC 4
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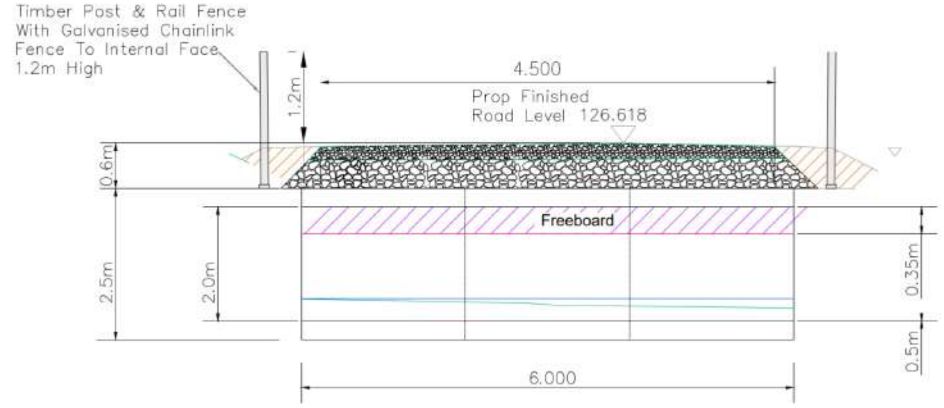

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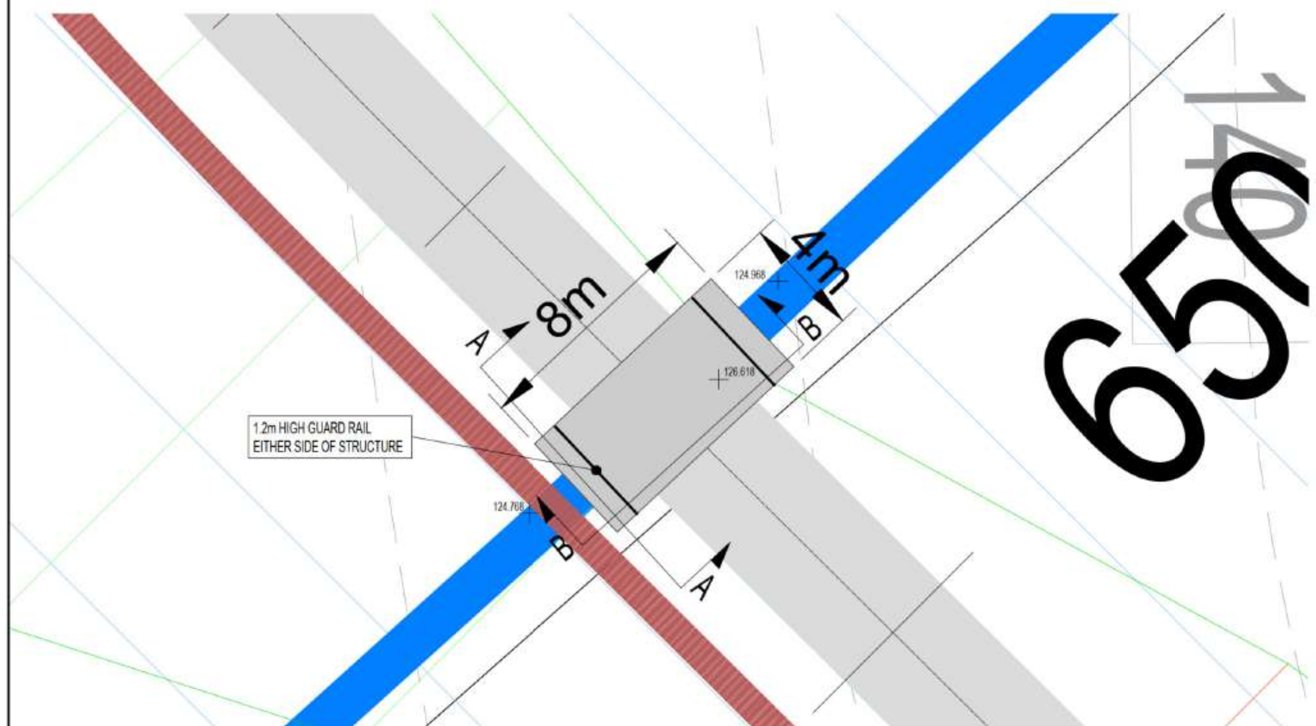
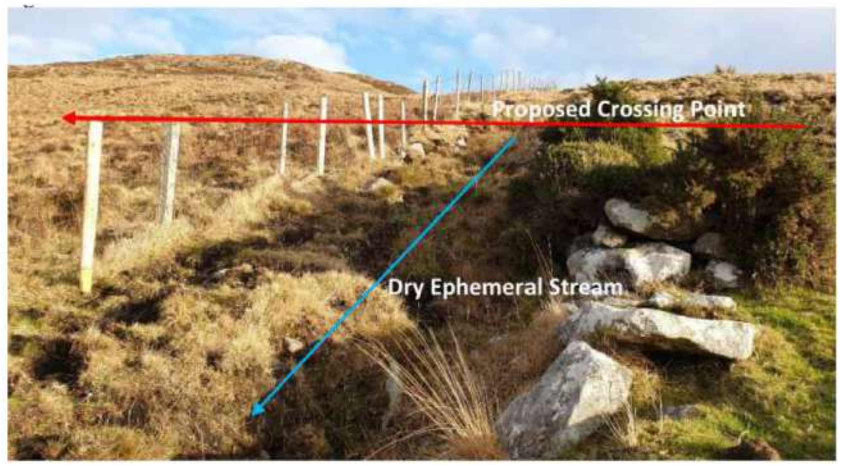
WATERCOURSE CROSSING WC 4 Scale 1:100





Photography of Existing Watercourse
Scale. NTS

RECEIVED: 26/01/2023

Legend

Rev	Date	By	Comment

Client

TULLAGHMORE WIND FARM LTD

Client Representative

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Project

TULLAGHMORE WIND FARM,
CO. GALWAY

Title

WATERCOURSE CROSSING 4

Drg. By	SB	Drg No	-
Checked By	AOG	Rev	0
Stage	EIAR	Date	16/12/'22
Scale	NTS (A3)	Figure	2.6d