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CLOGHERCOR WIND FARM

Natura Impact Statement (NIS)

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Table of Contents

Table of Figures

Table of Tables

Appendices

1.0 INTRODUCTION

1.1 SCOPE AND CONTENT

This report is the Screening Appraisal and Natura Impact Statement for the Cloghercor Wind Farm project. It assesses the potential impact of the wind farm project on habitats and species that are Qualifying Interests of Special Areas of Conservation and Special Protection Areas (collectively referred to as European sites). Qualifying Interests of Special Protection Areas are also referred to in some documentation as Special Conservation Interests.

Special Areas of Conservation are sites of European importance for habitats or species of flora and fauna (excluding birds) that have been designated under the Habitats Directive (92/43/EEC). Special Protection Areas are sites of European importance for bird species that have been designated under the Birds Directive (79/409/EEC and 2009/147/EC).

Qualifying Interests of Special Areas of Conservation are either habitats listed on Annex I of the Habitats Directive or species listed on Annex II of the Habitats Directive. Qualifying Interests of Special Protection Areas are either bird species listed on Annex I of the Birds Directive, or significant concentrations of regularly occurring migratory populations of other bird species. However, not all examples of these habitat types, or species populations, are Qualifying Interests of Special Areas of Conservation of Special Protection Areas.

This Natura Impact Statement is solely focused on habitats and species populations that have been listed as Qualifying Interests of Special Areas of Conservation and Special Protection Areas. The potential impacts of the wind farm project on other habitats and species of conservation importance are assessed in the Environmental Impact Assessment Report.

The proposed project assessed by this Natura Impact Statement comprises the wind farm project, the grid connection, the turbine delivery route, and the lands under the Golden Eagle Habitat Management Plan[1] (Biodiversity Enhancement Lands).

The assessment is structured in two stages.

Stage 1 is a screening assessment, which identifies potential impact pathways from the wind farm project to Special Areas of Conservation and Special Protection Areas. Special Areas of Conservation and Special Protection Areas that are not connected to the proposed wind farm project by any potential impact pathways are screened out from further assessment. Where such impact pathways are identified, it assesses which Qualifying Interests of the Special Area of Conservation or Special Protection Area might be affected by the impacts. These Qualifying Interests are screened in for more detailed assessment. The Qualifying Interests that are not affected by the potential impact pathways are screened out from further assessment. Measures intended to avoid or reduce the harmful effects of the proposed project on European sites (i.e. “mitigation measures”) or best practice measures have not been taken into account in the screening stage appraisal.

Stage 2 is a more detailed assessment, which analyses the potential impacts to the Qualifying Interests that were screened in during the Stage 1 assessment. Each Qualifying Interest is

[1] The Golden Eagle Habitat Management Plan is not being proposed as mitigation or compensation for any impacts relevant to Qualifying Interests of European sites. Rather, in this Natura Impact Statement, it is being assessed as part of the proposed project.

analysed in turn, and all the potential impacts from the wind farm are assessed. Where relevant, mitigation measures are included in the assessment. The effects of the potential impacts on whether the Qualifying Interest will meet its conservation objectives for the site are then assessed.

2.0 METHODS

2.1 ECOLOGICAL SURVEYS AND RESEARCH

2.1.1 Desk reviews

An initial desk review was carried out in 2019/20 at the start of the project. This was updated in August-October 2022.

This review included all records held by the National Biodiversity Data Centre for the hectads (10 km squares) around the wind farm site. The review covered the six hectads around the site for birds, and the two hectads overlapping the site for other species. These hectads include the wind farm site and the grid connection route. A further review was carried out in January 2023 of the tetrads (2 km squares) covering the proposed locations of the hardstanding and turbine changeover area along the turbine delivery route.

The greater spatial coverage for birds was due to the broader range of their potential for interaction with the wind farm site. The data reviewed from this source includes records from the four national bird atlas surveys (Sharrock *et al.*, 1976; Lack, 1980; Gibbons *et al.*, 1993; Balmer *et al.*, 2013).

Where records from National Biodiversity Data Centre are discussed in this chapter they are cited as NBDC records.

Other data sources used included: information from rare and protected species records supplied by the National Parks and Wildlife Service (cited as NPWS records); review of Inland Fisheries Ireland research data; information and data on water catchments from the River Basin Management Plan 2018-2021; and review of previous ecological assessments undertaken within the area[2]. Consultation requests were also made to the National Parks and Wildlife Service for any additional relevant records not contained in the rare and protected species records and to the Golden Eagle Trust and the Irish Raptor Study Group for any relevant data or information.

2.1.2 Consultations

A pre-planning consultation letter was sent to the Development Applications Unit in April 2020, with a follow-up in November 2020. A response was received in August 2021 (Appendix 1). An online meeting with Emmett Johnson (Divisional Ecologist, National Parks and Wildlife Service) was held in September 2021.

A pre-planning consultation letter was sent to Inland Fisheries Ireland in June 2021 (with a follow up in September 2022). Responses were received in July 2021 and October 2022 (Appendix 1).

[2] Including the Straboy Wind Farm project, the Graffy Wind Farm project and the Loughderryduff Wind Farm extension.

2.1.3 Surveys

2.1.3.1 Habitat and vegetation surveys

An initial overall habitat survey of the entire wind farm site was carried out in August 2020. This survey mapped the broad distribution of habitats across the entire wind farm site (Figure 2-1).

A more detailed survey of the section of the site to the south / east of the public road (referred to in this report as the wind farm site) was carried out in September 2021. This covered all of this section of the site (Figure 2-1), with a particular focus on areas around the then proposed wind farm infrastructure layout. A detailed survey of the areas around the final infrastructure layout was carried out in August and November 2022. This covered the footprint of the proposed infrastructure, and a 50 m buffer either side of the footprint (Figure 2-1). This survey is referred to in this report as the infrastructure buffer survey.

The August 2022 survey also included a survey of the aquatic and marginal vegetation of Lough Aneane More. This is the only lake or pond with the potential to be affected by water quality impacts from the wind farm project, due to the layout of the development relative to the catchments of the lakes and ponds.

The habitat survey methods were based on Smith *et al.* (2011). All the habitat surveys classified and mapped habitats to level 3 of the Fossitt classification (Fossitt, 2000). The surveys also assessed affinities with habitat types included in Annex I of the Habitats Directive (92/43/EEC). All the surveys included compilation of lists of characteristic plant species lists for habitats of conservation importance and recorded any rare/scarce plant species and / or stands of invasive species. The detailed survey of the infrastructure buffer included searches for rare / scarce plant species within the infrastructure buffer.

2.1.3.2 Aquatic surveys

Aquatic surveys were carried out of the streams and rivers draining the wind farm site, as these watercourses provide connectivity to the West of Ardara/Maas Road SAC and potential habitat for some of the Qualifying Interest species of that site.

A baseline aquatic ecological assessment was carried out at nine survey sites in selected streams and rivers draining the wind farm site close to proposed turbine locations and road crossings. The surveys were carried out during base flow conditions in September 2021. These surveys included an aquatic assessment of the riverine habitat available to support fish and aquatic species, an assessment of the macroinvertebrate community and an analysis of the biological water quality of the watercourse. The purpose of the surveys was to assess the overall aquatic habitat value of the river downstream of the proposed project, particularly in relation to protected species such as Atlantic Salmon, lampreys and Freshwater Pearl Mussel.

At each survey site, an assessment of the aquatic habitat was carried out based on the UK Environment Agency's River Habitat Survey methodology (EA, 2003). An appraisal / overview of the upstream and downstream fisheries habitat at each site was also undertaken based on the Fishery Assessment Methodology (O'Grady, 2006). An assessment was made on the suitability of the habitat for aquatic species of conservation concern (e.g., Freshwater Pearl Mussel, River Lamprey, Brook Lamprey and Atlantic Salmon). Aquatic surveys were conducted along the selected sites and consisted of kick sampling for invertebrates to assess water quality. Aquatic plants as well as rare and/or protected plant species and non-native flora were recorded at each site where present.

An appraisal / overview of the upstream and downstream habitat at each site was undertaken to evaluate the wider contribution to Freshwater Pearl Mussel and the potential for this species to be present within the development site. Based on the general riverine habitat, topography, steep gradient, substrate and surrounding habitat, the potential for this species to be present was universally poor. Therefore, no Freshwater Pearl Mussel survey was carried out within the streams of the development site.

Full details of the aquatic survey methods are included in Appendix 4.

2.1.3.3 Otter surveys

Searches for Otter signs were carried out along accessible sections of streams and drainage ditches within the wind farm site, as part of the aquatic surveys in September 2021. An Otter survey was carried out as part of a protected species survey of a 50 m buffer around most of the proposed infrastructure and around Lough Aneane More in August 2022. The 50 m buffer distance was considered suitable due to the lack of any evidence of Otter activity from the September 2021 survey. Sightings and signs of protected species were also recorded during the other habitat surveys in 2020 and 2021, and during other survey work.

2.1.3.4 Bird surveys

The scope of, and methods used for, the bird surveys were based on Scottish Natural Heritage's guidance: *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms* (SNH, 2017).

The bird surveys included vantage point surveys to monitor flight activity over the wind farm site and targeted surveys were carried out, focussing on particular species / species groups based on the results of the desk review. These included Red-throated Diver, Golden Eagle and Merlin breeding surveys, breeding wader / Red Grouse surveys, and wintering waterbird surveys.

The overall survey effort included five seasons of vantage point surveys, as well as comprehensive surveys covering all the potential breeding and wintering species of conservation significance. The surveys provide a robust dataset that is more than adequate for the purposes of assessing the occurrence of populations of conservation importance in, and around, the wind farm site and carrying out collision risk modelling.

Full details of the scope and methods of the bird surveys are included in Appendix 4. The full results of the bird surveys are presented in Chapter 7 of the Environmental Impact Assessment Report. The results that are relevant to Qualifying Interests of Special Protection Areas considered in this assessment are included in Section 5.2 of this Natura Impact Statement.

2.2 STAGE 1 ASSESSMENT

2.2.1 General

The general approach to the Stage 1 screening assessment was based on the guidance in EC (2021) and OPR (2021).

2.2.2 Identification of European sites

2.2.2.1 Mapping sources

Special Areas of Conservation and Special Protection Areas were identified from mapping held by the National Parks and Wildlife Service for sites in the Republic of Ireland, and the Department of Agriculture, Environment and Rural Affairs for sites in Northern Ireland[3]. The mapping sources are listed in Table 2-1. Mapping for Special Areas of Conservation in Northern Ireland was not reviewed as there were no potential impact pathways from the wind farm project to non-avian receptors in Northern Ireland.

Table 2-1 Mapping sources for European sites.

Jurisdiction	Site type	URL	Mapping file	Update date
Republic of Ireland	Special Area of Conservation	1	SAC_ITM_2022_10.shp	07/10/202
	Special Protection Area	1	SPA_ITM_2021_10.shp	27/10/2021
Northern Ireland	Special Protection Area	2	Special Protected Areas - Irish National Grid_1.zip	11/11/2022

4.0 URLs: 1 = https://www.npws.ie/maps-and-data/designated-site-data/download-boundary-data, accessed 16/11/2022; 2 = https://www.daera-ni.gov.uk/publications/special-protection-areas-digital-datasets, accessed 16/11/2022.

2.2.2.2 European sites review

It has been common practise to use a 15 km buffer around the proposed project site to define a zone of influence to screen potential off-site impacts to European sites (see DEHLG, 2009). This is an arbitrary limit and, if there is potential for secondary impacts to occur at greater distances, then such impacts must be assessed. However, the 15 km buffer does encompass most potential impact pathways. The main exceptions are seabird species with large foraging ranges from their breeding colonies and hydrological pathways along river systems.

For this screening assessment, all European sites within a 15 km buffer around the proposed project were reviewed. The hydrological pathways that drain the wind farm site and the Golden Eagle Habitat Management Plan lands to the sea are contained within the 15 km buffer.

The wind farm project will also include some minor works at specific locations along the turbine delivery route. These locations were reviewed for any additional European sites that could be affected.

[3] It is recognised that following the United Kingdom's departure from the European Union, SACs and SPAs in the UK are no longer considered "Natura 2000 sites" for the purpose of an assessment pursuant to Article 6(3) of the Habitats Directive. However, pursuant to the UK's Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, those sites still retain the same protection under UK law as they did prior to the UK's exit from the EU. In the circumstances, and consistent with Ireland's obligations as a signatory to the Bern Convention on the Conservation of European Wildlife and Natural Habitats, to which the Birds and Habitats Directives give effect, and in order to ensure the highest level of protection for the species and habitats protected by those Directives, the following assessment includes an assessment of the UK sites formerly forming part of the Natura 2000 network of sites protected under those Directives. This will enable the Board to ensure that there will no adverse effect on the integrity of those UK sites and the UK national site network.

Three seabird species were recorded around / flying over the wind farm site during the breeding season (Cormorant, Lesser Black-backed Gull and Herring Gull). Special Protection Areas within the potential foraging ranges of these species and with breeding populations of these species as Qualifying Interests were reviewed. For Lesser Black-backed Gull, this included Special Protection Areas in Northern Ireland, due to the size of their potential foraging range.

2.2.3 Assessment of impact pathways

2.2.3.1 General

The wind farm project will not involve any work within, or directly adjacent to, any European site. Therefore, the potential impact pathways were either secondary impacts, such as hydrological impacts, or impacts to species populations from the European sites where those populations may use the wind farm site, or commute over the wind farm site.

The wind farm project will only affect part of the wind farm site (Figure 2-1). Therefore, the review of impact pathways focussed on pathways from the wind farm project areas within the site, rather than pathways from the overall site. However, it took into account the spatial scale at which impacts could occur (e.g., the distance over which displacement impacts to bird species can occur).

As part of the wind farm project, a Golden Eagle habitat management plan will be implemented (Appendix 6). This will involve management of 252 ha of lands immediately to the west of the wind farm site. This Golden Eagle habitat management plan was included in the review of potential impact pathways.

The wind farm project will also involve some localised works at specific locations along the turbine delivery route. These works were also included in the review of potential impact pathways.

2.2.3.2 Hydrological impacts

The hydrological connectivity between the wind farm project and European sites was assessed by examining surface water catchments, and potential groundwater connections.

Surface water

European sites that were within the catchment of the wind farm site and downstream of any part of the site were considered to be hydrologically connected to the wind farm project. European sites on the coast that were separated from the catchment of the wind farm project by open marine waters were not considered to be hydrologically connected to the wind farm project, due to the massive dilution factors involved.

Groundwater

Chapter 9 of the Environmental Impact Assessment Report (Hydrology, Hydrogeology and Water Quality) includes a review of the groundwater regime in the vicinity of the wind farm site. The following are the key points from that review relevant to this assessment.

The groundwater flow paths in the Northwest Donegal Groundwater Body are short (30-300) m in length. On a regional scale, the groundwater flow direction is generally a subdued reflection of surface water drainage. On a local site scale, it is assumed that groundwater flow is towards local drains and streams, reflecting the general flow direction of the various river waterbody catchments.

Based on the above, the surface water catchments can be also considered to reflect the potential connectivity between the wind farm project and groundwater dependent Qualifying Interests of European sites.

2.2.3.3 Special Area of Conservation Annex II species Qualifying Interests

The potential connectivity between the proposed project and Annex II species Qualifying Interests of Special Areas of Conservation was assessed in two ways.

Firstly, the Qualifying Interests were reviewed to assess whether they could be vulnerable to the potential surface water quality, or groundwater, impacts identified in the review of hydrological impact pathways.

Secondly, the Qualifying Interests were reviewed to assess whether they occurred, or could occur, close to the wind farm site, and whether they were likely to exploit habitat within, or close to, the areas potentially affected by the wind farm project.

2.2.3.4 Special Protection Area Qualifying Interests

The assessment of the potential connectivity between the wind farm project and bird populations that are Qualifying Interests of Special Protection Areas was based on SNH's *Assessing connectivity with Special Protection Areas (SPAs)* (SNH, 2016). This document covers various upland and wintering waterbird species that are sensitive to wind farm project. It provides guidance on typical foraging distances away from their nest sites (for breeding populations), or night roost sites (for wintering populations).

For most species two foraging distances are given: a core foraging range and a maximum foraging range. The document states that: "in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests". The maximum foraging ranges should only be used in exceptional cases, such as the following example given in the document: "whilst osprey core foraging range is 10km an osprey foraging at a loch well beyond this distance from its SPA may still be connected if there is a lack of other closer foraging sites".

For the present assessment, where the distance from the wind farm site was greater than the core foraging range, but within the maximum foraging range, the landscape and habitats were reviewed to assess whether there were any exceptional circumstances that would warrant use of the maximum foraging range.

There were three seabird species that were recorded commuting across the wind farm site, and which are Qualifying Interests of Special Protection Areas, for which SNH (2016) does not provide any information on foraging ranges. For these species, foraging range information was used from Woodward *et al.* (2019). As recommended by that source, the mean max foraging ranges were used to assess potential connectivity between the wind farm project and the Qualifying Interests. The mean max foraging ranges are species-specific and are based on reviews of data on foraging ranges from their colonies. For each species, the mean max foraging range is the maximum range reported for each colony included in the review, averaged across all colonies.

Where the relevant foraging range distance from the Special Protection Area boundary overlapped the wind farm site, the Qualifying Interest was considered to have potential connectivity with the wind farm project and was screened in for the Stage 2 assessment.

2.2.3.5 Cumulative impacts

All Qualifying Interests that were connected by potential impact pathways to the wind farm project were screened in for the Stage 2 assessment. Therefore, it was not necessary to consider potential cumulative impacts from other projects and plans in combination with the wind farm project in the Stage 1 assessment.

2.3 STAGE 2 ASSESSMENT

2.3.1 General

The general approach to the Stage 2 assessment was based on the guidance in EC (2021).

Due to the nature of the Qualifying Interests involved and their potential interaction with the wind farm site, there were differences between the assessment methods used for the SAC and SPA Qualifying Interests. Section 2.3.2 describes the methods used for the assessment of impacts to the SAC Qualifying Interests. Section 2.3.3 describes the methods used for the assessment of impacts to the SPA Qualifying Interests. Section 2.3.4 and 2.3.5 describe the assessments of replacement of turbine blades, decommissioning and cumulative impacts, where there were common approaches for both the SAC and SPA Qualifying Interests.

2.3.2 SAC Qualifying Interests

2.3.2.1 Hydrological impacts

The assessment of the potential hydrological impacts was based on the assessments in the Aquatic Report (Appendix 2) and the Hydrology, Hydrogeology and Water Quality chapter of the Environmental Impact Assessment Report (Appendix 3).

2.3.2.2 Impacts to species populations

The assessments of the potential impacts to species populations that may use habitats within the wind farm site was based on the results of the aquatic and protected fauna surveys, and an evaluation of the overall habitat quality of the wind farm site for these species. The SAC Qualifying Interest species populations do not make significant use of the wind farm site. Assessments of habitat loss, and construction and operational disturbance impacts are included for the Otter Qualifying Interest as it is likely that they make minor use of the site. These assessments were not required for the other SAC Qualifying Interest species populations.

2.3.3 SPA Qualifying Interests

2.3.3.1 Structure of the assessment

For each of the SPA Qualifying Interests, the Stage 2 assessment considered the following impact types: the habitat loss, construction disturbance, displacement impacts, barrier effects, and collision risk. Habitat loss and construction disturbance are construction phase impacts, while barrier effects and collision risk are operational phase impacts. Displacement impacts can occur in both the construction, operational and decommissioning phases.

2.3.3.2 Habitat loss

The habitat loss impact was assessed using habitat loss mapping and habitat loss data from the Environmental Impact Assessment Report Chapter 6 (Biodiversity).

2.3.3.3 Construction disturbance

The construction disturbance assessment covers short-term impacts that would be limited to the construction-phase with the long-term displacement / barrier impacts from operation of the turbines being assessed separately.

The assessment presented in this Natura Impact Statement differs from the assessments for the same species presented in the Ornithology Chapter of the Environmental Impact Assessment Report as potential construction disturbance to nest sites is not relevant to this Natura Impact Statement. The wind farm site is not part of any Special Protection Area and is over 2 km from the nearest such site. Therefore, by definition, any birds nesting in, or adjacent to, the wind farm site are not part of any Special Protection Area Qualifying Interest.

2.3.3.4 Operational disturbance

Operational disturbance impacts were included within the displacement impacts.

2.3.3.5 Displacement impacts

The assessment of displacement impacts and barrier effects included literature reviews to assess the potential sensitivity of the Qualifying Interest species to these types of impacts. Where Qualifying Interest species were potentially sensitive, the potential displacement rate was quantified where possible using figures from the literature on percentage reductions in population sizes /activity levels within specified distances from turbines.

2.3.3.6 Barrier effects

Most work on the ornithological impacts on barrier effects from wind farms focuses on migrating birds (Humphreys *et al.*, 2015a). For populations of birds that are centred around a wind farm site, it will be difficult to distinguish between displacement impacts and barrier effects. Therefore, for many species, there is no information available that can be used to assess their potential sensitivity to barrier effects, and the assessment of potential displacement impacts is likely to include barrier effects, if they occur.

Assessments of barrier effects were carried out for species which had potential commuting routes through the wind farm site.

2.3.3.7 Collision risk modelling

Collision risk modelling was carried out to assess the potential collision risk for all species recorded flying at potential collision height during the vantage point surveys.

There are eight turbine models that are being considered for this wind farm. These turbine models have rotor diameters ranging from 149-164 m, hub heights ranging from 112-125 m and tip heights ranging from 185-200 m. The collision risk modelling included all eight turbine models. The modelling showed that the variation in ground clearance was the most important factor in determining the variation in collision risk between the turbine models (see Appendix 7). The minimum possible ground clearance, given these ranges is 30 m, which is represented by one of the turbine models (the GE GE-164), while the maximum possible ground clearance is 50.5 m, which is represented by another of the turbine models (the Nordex N149). Therefore, all scenarios within the turbine range have been assessed.

For each Qualifying Interest species, the minimum and maximum collision risks across these eight turbine specifications are presented in the Stage 2 assessment, while the collision risks for all the turbine specifications are included in Appendix 7.

The collision risk modelling included used various modelling techniques to generate predicted transits. These included basic models, which could be applied to all species, and spatially structured models that accommodate heterogeneity in flight activity across the wind farm site, but which require sufficient levels of flight records to distinguish between sampling effects and true spatial structure. The data from the most appropriate model for each species was used for the final collision risk model.

Two variants of the basic models were calculated: one using the data from all the viewsheds, and the other using data from only the viewsheds overlapping the eastern section of the wind farm site where all the proposed turbine locations are.

Declines in detection rates with distance from vantage points is a common issue in vantage point surveys, and the SNH guidance recommends considering corrections for detectability effects. Therefore, the models also factored in detection rate functions to allow for these effects. The detection rate functions were calculated separately for small, medium, and large species. They resulted in an increase of around 1.6-3.1 in the predicted collision risks, compared to models that do not account for this factor. Note that collision risk models for other wind farm projects in Ireland generally do not include corrections for detectability effects.

Full details of the collision risk modelling are included in the collision risk model report (Appendix 7).

2.3.3.8 Collision risk significance

The potential significance of a predicted collision risk to a Qualifying Interest will depend upon its population size and its background mortality rates. A threshold level of a 1% increase in annual mortality has been suggested to determine whether the impact is non-negligible (Percival, 2003). This 1% threshold is widely used in UK wind farms assessments as a threshold for assessing significance. However, this is likely to be a very conservative threshold, and in some cases, such as small populations with low mortality rates, biologically implausible.

The use of a 1% threshold to assess increases in annual mortality appears to originate in European Commission guidance on the interpretation of derogations in the Birds Directive (EC, 2008; updated version of earlier guidance). Under Article 9(1)(c) of the Birds Directive, there is a derogation “to permit, under strictly supervised conditions and on a selective basis, the capture, keeping or other judicious use of certain birds in small numbers”. The guidance document (EC, 2008) includes consideration of how to interpret the concept of “small numbers” in the context of Article 9(1)(c). It recommends the use of a threshold of a 1% increase in annual mortality for two reasons:

- the figure must be much lower, by at least an order of size, than those figures characteristic of the taking of birds under Article 7. A figure of 1% meets this condition.

- the taking must have a negligible effect on the population dynamics of the species concerned. A figure of 1% or less meets this condition as the parameters of population dynamics are seldom known to within less than one percentage point and bird taking amounting to less than 1% can be ignored from a mathematical point of view in model studies.

(European Commission, 2008)

Therefore, the original introduction of a 1% threshold for assessing increases in annual mortality was not intended to indicate that all increases above this threshold are significant. The European Commission guidance indicates that sustainable hunting of wild birds can be permitted under Article 7 with an impact on annual mortality which may be an order of magnitude higher. Moreover, if increases of less than 1% are negligible and are within the margin of error in population modelling, then, it follows that, increases that are just above the 1% threshold are extremely unlikely to cause significant impacts. This is reflected in the results of published population modelling that indicate much higher levels of increases in annual mortality are required to cause significant impacts of populations. For example, Bellebaum *et al.* (2013), reported a mortality threshold of 4.0% of the population size for the East German Red Kite population. Depending on the age composition of the population, this would represent an 8-10% increase in annual mortality, based on the annual survival rates for Red Kites given by Saether (1989; as quoted by BirdFacts, www.bto.org/understanding-birds/birdfacts).

The European Commission hunting guidance (EC, 2008) also allows for exceedances of the 1% threshold, up to a maximum of 5%, for abundant species with a favourable conservation status. This use of a 5% threshold has been followed in wind farm assessments in Flanders, which are quoted as a case study in recent European Commission guidance on wind farm assessments (EC, 2020).

Therefore, the Percival criterion of a 1% increase in annual mortality does not represent a threshold for assessing significance but, instead, should be used as a threshold for indicating where more detailed assessment is required. Where an increase in annual mortality is around 1% it is unlikely that it will have a significant impact on the population trend, but some further consideration of the potential impact may be required for Key Avian Receptors of high conservation importance (e.g., a review of published population viability analyses on the species concerned, or on comparable species). However, when the increase in annual mortality is substantially greater than 1%, then further detailed assessment may be required, such as development of a population viability analysis for the specific population of concern (depending on the conservation importance of the population).

Consideration should also be given to the level of uncertainty in the collision risk prediction: i.e., what is the likely upper bound of the confidence interval around the predicted collision risk. For example, collision risk models for four species that incorporated uncertainty in the estimation of flight activity levels, produced upper limits of the confidence intervals around 44-136% higher than the mean predicted collision risk (Gittings, 2020). Conversely, the actual collision risk could be lower than the predicted collision risk.

Finally, all the assessments of potential increases in mortality assume that the collision mortality is additive: i.e., it occurs in addition to the existing background mortality. However, in practise, some level of collision mortality may be compensatory: e.g., the birds that die due to collisions reduce the level of overwinter mortality due to competition for food resources, etc.

2.3.4 Replacement of turbine blades and decommissioning

If replacement of turbine blades is required during the operational phase, the work would take approximately one month on-site with the work occurring intermittently throughout that month and likely intensifying for one week where the majority of the changeover work would take place. The work would be localised to a specific turbine. Any impacts from replacement of turbine blades would similar in nature to the construction phase impacts but much smaller in magnitude.

Decommissioning impacts will be similar to the construction phase impacts.

2.3.5 Cumulative impacts

Where non-negligible potential impacts were identified, assessments were carried out of the potential cumulative effects of the wind farm project in combination with other relevant projects and plans.

The projects and plans included in the cumulative assessments included: planning applications from 2010-2022 on the Donegal County Council planning register within 10 km of the wind farm site; all operational wind turbines in Donegal[4]; proposed wind farm projects within 20 km of the Cloghercor Wind Farm site; and ongoing forestry operations in the Cloghercor Wind Farm site.

Details of the cumulative assessment of water quality impacts are included in the Hydrology, Hydrogeolgy and Water Quality chapter of the Environmental Impact Assessment Report, which is included as Appendix 3 of this report.

2.4 PERSONNEL

The scoping, design and management of the general biodiversity surveys and assessment (excluding the aquatic ecology and bat surveys) was carried out by Tom Gittings. The overall habitat survey was carried out by surveyors from TOBIN Consulting Engineers (John Sherry, Sophia Couchman and Jason Cahill), with some assistance from Tom Gittings. The surveys of the infrastructure buffer and Lough Aneane More were carried out by Cian Ó Ceallaigh. The aquatic ecology surveys and assessments were carried out by Sinead O'Reilly.

The scoping, design and management of the bird surveys was carried out by John Meade in the winter of 2019/20, and Tom Gittings from the summer of 2020 onwards. The vantage point surveys, moorland surveys, Red-throated Diver and gull surveys were carried out by various surveyors from TOBIN Consulting Engineers (John Sherry, Sophia Couchman, Jason Cahill and Jack Glennon), Bella Terra Environmental Consultants (Nicholas Duff and Jamie Bliss), Ryan Ecology (Conor Ryan, Michael Hogan, Jamie Wood and David Miley), and Daniel Moloney. The

[4] Mapping of turbine locations was obtained from OpenStreetMap (© OpenStreetMap contributors, www.openstreetmap.org/copyright). This mapping was reviewed against aerial imagery and other sources, and additional turbines were added from those sources.

Merlin survey in 2022 was carried out by Jamie Duff. The Golden Plover survey in 2022 was carried out by David Miley.

Tom Gittings has a BSc in Ecology, a PhD in Zoology and is a member of the Chartered Institute of Ecology and Environmental Management. He has 27 years' experience in professional ecological consultancy work and research. Tom specialises in ecological surveying, monitoring and evaluation, ecological impact assessment, habitat management, and avian, invertebrate, wetland and woodland ecology. He is currently working as an independent ecological consultant. His previous experience includes working for the RPS Group (a multi-disciplinary environmental consultancy) and carrying out research into forest and wetland biodiversity in the Department of Zoology Ecology and Plant Science at University College Cork. Tom was the recipient of the Distinguished Recorder Award 2014 from the National Biodiversity Data Centre in recognition of his contribution to invertebrate recording in Ireland.

John Sherry has a BSc in Wildlife Biology and holds the title of Project Ecologist with TOBIN. John has over three years post-graduate experience in ecology and environmental consultancy, where he has mainly been involved in the surveying and reporting of large-scale infrastructure projects where he has carried out AA Screenings, NIS reports, EIARs and Ecological Management Plans. John has a proven knowledge of field skills and has been involved with the planning and implantation of a variety of surveys including habitat surveys, non-volant mammal surveys and bat assessments. He has mainly been focused on ornithological surveys, involving winter and breeding bird surveys associated largely with proposed wind farms or other large infrastructure developments.

Sophia Couchman has a BSc (Hons) Ecology and Environmental Biology and has been part of the TOBIN Environment & Planning team since 2018. Her experience includes baseline ecology surveys (including Q value), habitat surveys, habitat mapping, mammal surveys, undertaking Ecological Impact Assessments (EcIAs), contributing to EIS's and compiling Appropriate Assessments reports on a wide range of development types.

Jason Cahill is a Project Ecologist in TOBIN's Environment & Planning Division. He graduated from IT Tralee with a BSc (Hons) in Field Biology with Wildlife Tourism. Jason has experience with ornithological surveys and ecological clerk of works, including bat, badger, and amphibian surveys.

Cian Ó Ceallaigh is an Associate member of the Chartered Institute of Ecology and Environmental Management (ACIEEM) who has extensive botanical and habitat knowledge (FISC Level 4, 2018) and has worked as a professional ecologist in Ireland and Britain since 2017.

Sinead O'Reilly (M.Res.) is a Senior Ecologist with TOBIN Consulting Engineers. She holds an honours degree in Zoology from University College Dublin and Research Masters in Science in Freshwater Ecology from University of Glasgow. Ms O Reilly has over 14 years of professional experience in scientific research in freshwater ecology and environmental consultancy specialising in fisheries. Sinead has prepared and delivered annual research reports, research papers, preparation of screenings for Appropriate Assessment (AA), Natura Impact Statements (NIS), Invasive Species reports, mammal survey reports and other relevant documents. Sinead has a strong technical background as a freshwater ecologist and has extensive field survey experience in all freshwater habitats, terrestrial habitats, bats and mammal activity across Ireland.

Jack Glennon is a Graduate Ecologist within TOBIN's Environment and Planning section. Jack is responsible for producing ecological reports on complex topics such as sensitive bird species monitoring reports and habitat management plans. Jack's skills include ecological assessments & ecological surveying.

Nicholas Duff has a BSc in Ecology and has been working in nature conservation and ecological consultancy for over 40 years. He was formerly the Head Park Ranger at Glenveagh National Park and has carried out numerous ecological assessments for wind farms and other developments.

Jamie Bliss is an experienced ornithological fieldworker who has conducted numerous surveys for large windfarm developments including preconstruction ornithological studies and construction/post construction ornithological monitoring for compliance reporting. He is fully au fait with breeding raptor survey methodologies and specifically for Merlin and took part in the 2018 National Merlin Census and training given by John Lusby.

Conor Ryan is a Consultant Ecologist and holds an MSc in Ecological Assessment and a BSc in Marine Science. He has accrued 12 years' experience in professional ecological consultancy work and research. His skillset includes expertise in ornithological surveying and he has worked on various ornithological surveys for windfarm projects in the west of Ireland over the past 6 years. Conor also has extensive experience in habitat surveying, impact assessment and the provision of ecological clerk of work services. He has been a lead and contributing author to numerous EIAR and NIS reports for a wide range of projects.

Michael Hogan holds an Advanced National Cert in Marine & Countryside Guiding/marine Interpretation (received from G.M.I.T in 2002). He has been an active member of Birdwatch Ireland since 1999 and is a founding member of Birdwatch Mayo, which was formed in 2003. He has actively participated in voluntary bird survey work for Birdwatch Ireland and National Parks and Wildlife every year since 2003. He has worked in a professional ornithological capacity on a wide variety of ornithological surveys for projects including wind farms, ESB projects and motorway developments in the West of Ireland since 2017.

Jamie Wood has a Degree in Environmental Science and a Master's Degree in Environmental Management. Jamie is a full member of the Institute of Environmental Science and the Association of Ecological and Environmental Clerk of Works. Jamie is also Chartered with the Society for the Environment holding the postnominal C.Env. Over the past 20 years, working as an Environmental / Ecological Consultant, Jamie has gained extensive experience in a vast range of ecological surveys and assessment techniques; particularly bird, bat and mammal survey work. Jamie has over 12 years of experience working in the renewables industry, involved at all stages of project development from feasibility through planning and construction to post construction monitoring. In this period Jamie has worked for many of the wind industries largest players.

David Miley has a BSc in Marine Science, and a MSc in Applied Environmental Science. He has eight years of ornithological experience having worked in conservation (terns, breeding waders, seabirds), the agri-environment sector (The Hen Harrier Project, The Irish Breeding Curlew EIP), monitoring rare breeding waders in Ireland (Shannon Callows, Lough Corrib), survey coordination and fieldwork for the National Red Grouse Survey 2021/2022 and provide and coordinated and carried out various ornithological surveys for wind energy projects in Ireland (Vantage Point Surveys, Breeding Bird Surveys, Waterbird Surveys, Hen Harrier Roost Watches, Red Grouse Call-back Surveys, other species-specific surveys). Contributions to support planning applications has variously included survey field work, avian impact and mitigation advice, GIS shapefiles and attribute tables, inputs for EIS/EIAR and NIS reports.

Daniel Moloney has been conducting bird surveys since 2006 for wind farm impact assessments and other construction works across a range of projects and consultancy companies in the Republic of Ireland, Northern Ireland, and Scotland. Daniel has been working with BirdWatch Ireland for over 15 years across a range of projects and species including the Corncrake Conservation project on behalf of the NPWS, Curlew in the borders counties as part of the Halting Environmental Loss project in conjunction with the RSPB, a project manager on the INTERREG VA Cooperation Across Borders for Biodiversity project on waders in the border counties and more recently a bird specialist on the ACRES Co-operation Project in Donegal.

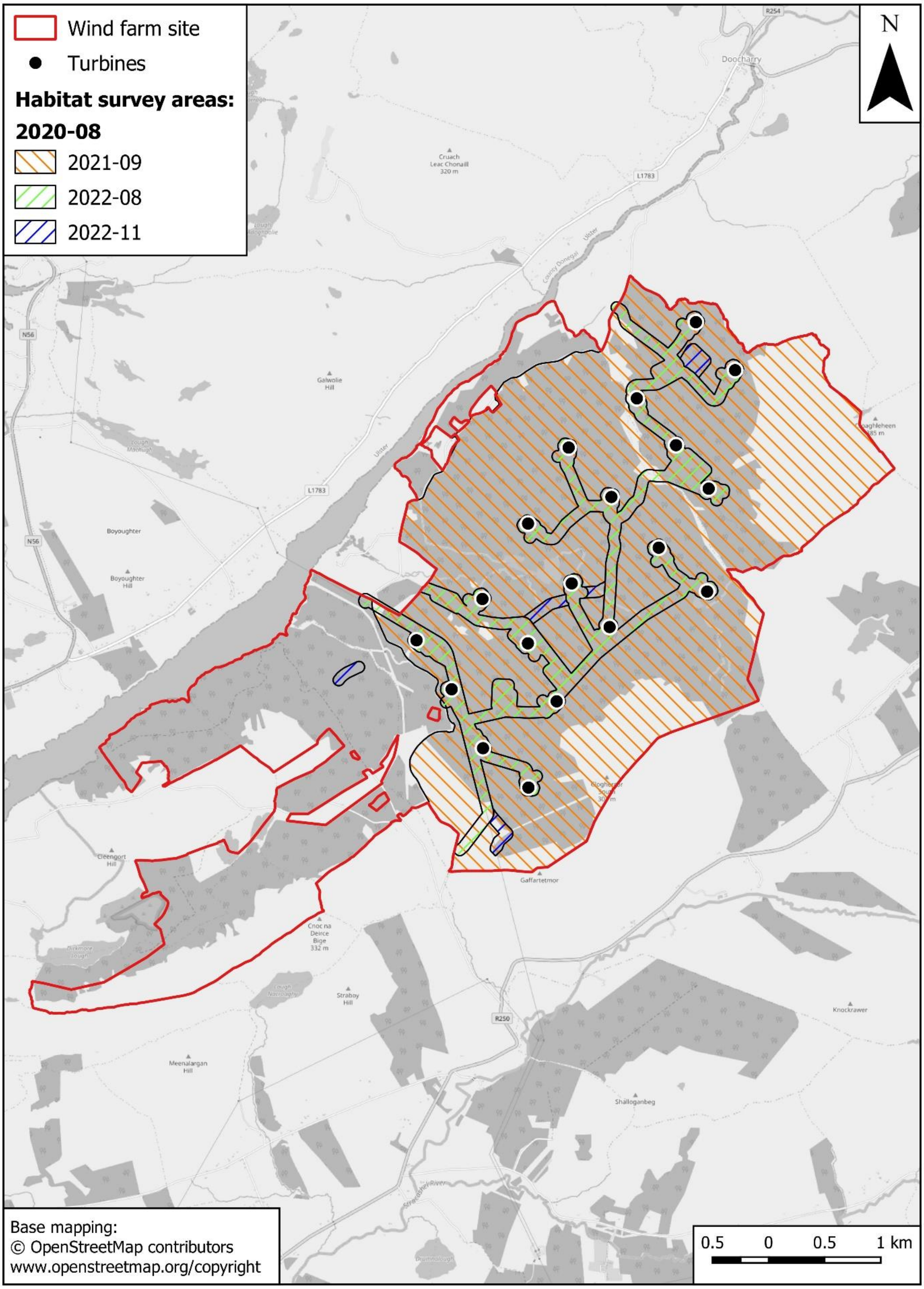

Figure 2-1: Habitat survey areas.

3.0 PROJECT DESCRIPTION

3.1 THE WIND FARM PROJECT

- Erection of 19 no. wind turbines with an overall blade tip height range from 18 5m to 200 m, a rotor diameter range from 149 m to 164 m, a hub height range from 112 m to 125 m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100 m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36 km of internal access roads) to the existing 110 kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, and soil excavation;

- Forestry felling to facilitate construction and operation of the proposed project and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

A detailed project description is included in Chapter 2 of the Environmental Impact Assessment Report, which is included as Appendix 5 of this Natura Impact Statement. The Golden Eagle habitat management plan is included as Appendix 6 of this Natura Impact Statement.

3.2 MITIGATION

3.2.1 Overview

The mitigation measures included in the proposed project that are relevant to the assessments in the Natura Impact Statement include: mitigation of water quality impacts; and a pre-construction Otter survey and associated mitigation.

3.2.2 Water quality mitigation

The water quality mitigation measures that will be implemented as part of the proposed project are described in Hydrology, Hydrogeology and Water Quality chapter of the Environmental Impact Assessment Report, which is reproduced as Appendix 3 of this report.

Water quality mitigation techniques are well established and, if properly implemented, are very effective. There are no special features of this site that are likely to limit the effectiveness of the proposed mitigation measures in reducing water quality impacts to the Gweebarra Estuary.

3.2.3 Otter mitigation

No evidence of Otter use of the lakes and streams within the wind farm site was found during the surveys carried out for this project. However, animal populations are dynamic, so it is possible that Otter use of the site could increase by the time development of the wind farm starts.

A pre-construction Otter survey will be carried out no more than 10 months in advance of the start of construction work. If any breeding holts are found, no works will take place within 150 m of the holts while they are occupied by breeding females or cubs. If any active, but non-breeding holts are found, no works involving wheeled or tracked vehicles will take place within 20 m of such holts, and no light works (e.g., digging by hand or scrub clearance) will take place within 15 m of such holts. The prohibited working areas will be fenced prior to any works in the vicinity of these areas. These measures comply with the *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA, 2006) and are, therefore, considered to be effective in preventing disturbance from construction work to Otter holts.

4.0 SCREENING

4.1 SPECIAL AREAS OF CONSERVATION

4.1.1 Special Area of Conservation review

There are 12 Special Areas of Conservation within 15 km of the wind farm site (Figure 4-1). The Qualifying Interests of these Special Areas of Conservation are listed in Table 4-1. Some of the locations of proposed works along the turbine delivery route are outside the 15 km buffer around the wind farm site, but there are no additional Special Areas of Conservation close to these locations (Figure 4-2). There are no additional Special Areas of Conservation, not included in Table 4-1, which are connected to the proposed wind farm project by potential impact pathways.

Table 4-1: Special Areas of Conservation within 15 km of the wind farm site.

Special Area of Conservation	Distance (km)	Qualifying Interests
West of Ardara/Maas Road SAC	0	Northern Atlantic wet heaths with Erica tetralix; Alpine and Boreal heaths; Blanket bog (*active only); Alkaline fens; Juniperus communis formations on heaths or calcareous grasslands; Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Fixed coastal dunes with herbaceous vegetation (grey dunes); Decalcified fixed dunes with Empetrum nigrum; Dunes with Salix repens ssp.argentea (Salix arenariae); Humid dune slacks; Shifting dunes along the shoreline with Ammophila arenaria (white dunes); Atlantic decalcified fixed dunes (Calluno-Ulicetea); Large shallow inlets and bays; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi); Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis); Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)(*important orchid sites); Machairs (* in Ireland); Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae); Estuaries; Mudflats and sandflats not covered by seawater at low tide; Depressions on peat substrates of the Rhynchosporion; Large shallow inlets and bays *Salmo salar*; *Lutra lutra*; *Margaritifera margaritifera*; *Euphydryas aurinia*; *Vertigo geyeri*; *Najas flexilis*; *Petalophyllum ralfsii*; *Vertigo geyeri*
Coolvoy Bog SAC	0.3	Blanket bog (*active only)
Gannivegil Bog SAC	0.5	Blanket bog (*active only)
River Finn SAC	2.1	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae); Blanket bog (*active only); Transition mires and quaking bogs; Reefs *Salmo salar*; *Phoca vitulina*
Cloghernagore Bog and Glenveagh National Park SAC	2.2	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae); Northern Atlantic wet heaths with Erica tetralix; European dry heaths; Alpine and Boreal heaths; Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae); Blanket bog (*active only); Old sessile oak woods with Ilex and Blechnum in British Isles; Depressions on peat substrates of the Rhynchosporion; Blanket bog (*active only) *Salmo salar*; *Margaritifera margaritifera*; *Trichomanes speciosum*; *Drepanocladus vernicosus*
Lough Nillan Bog (Carrickatlieve) SAC	5.2	Blanket bog (*active only); Northern Atlantic wet heaths with Erica tetralix

Special Area of Conservation	Distance (km)	Qualifying Interests
Meenaguse Scragh SAC	9.7	Northern Atlantic wet heaths with Erica tetralix
Meenaguse/Ardbane Bog SAC	11	Blanket bog (*active only)
Rutland Island and Sound SAC	11	Reefs; Annual vegetation of drift lines; Embryonic shifting dunes; Shifting dunes along the shoreline with Ammophila arenaria (white dunes); Fixed coastal dunes with herbaceous vegetation (grey dunes); Humid dune slacks; Coastal lagoons; Decalcified fixed dunes with Empetrum nigrum *Phoca vitulina*
Slieve Tooey/Tormore Island/Loughros Beg Bay SAC	11	Decalcified fixed dunes with Empetrum nigrum; Blanket bog (*active only); Shifting dunes along the shoreline with Ammophila arenaria (white dunes); Embryonic shifting dunes; Vegetated sea cliffs of the Atlantic and Baltic coasts; Alpine and Boreal heaths; Coastal lagoons *Halichoerus grypus*; *Vertigo angustior*; *Salmo salar*
Meentygrannagh Bog SAC	12	Blanket bog (*active only); Alkaline fens; Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) *Drepanocladus vernicosus*
Termon Strand SAC	12	Coastal lagoons

Most of these Special Areas of Conservation can be screened out as there are no potential impact pathways from the proposed wind farm project to the Special Area of Conservation (Table 4-2).

Table 4-2: Special Areas of Conservation within 15 km of the wind farm site that have been screened out due to lack of potential impact pathways.

Special Area of Conservation	Distance (km)	Reason
Coolvoy Bog SAC	0.3	Blanket bog SAC upstream of the wind farm site; no hydrological connection
Gannivegil Bog SAC	0.5	Blanket bog SAC on north side of Gweebarra Estuary; no hydrological connection
River Finn SAC	2.1	River system / bog SAC in separate catchment from wind farm site
Cloghernagore Bog and Glenveagh National Park SAC	2.2	Large SAC upstream from wind farm site
Lough Nillan Bog (Carrickatlieve) SAC	5.2	Blanket bog / wet heath SAC in separate catchment from wind farm site. The nearby turbine delivery route works on the R262 are downslope from the SAC.
Meenaguse Scragh SAC	9.7	Wet heath SAC in separate catchment from wind farm site
Meenaguse/Ardbane Bog SAC	11	Blanket bog SAC in separate catchment from wind farm site
Rutland Island and Sound SAC	11	Coastal / marine SAC separated by open sea from the Gweebarra Estuary
Slieve Tooey/Tormore Island/Loughros Beg Bay SAC	11	Coastal SAC separated by open sea from the Gweebarra Estuary

Special Area of Conservation	Distance (km)	Reason
Meentygrannagh Bog SAC	12	Blanket bog SAC in separate catchment from wind farm site
Termon Strand SAC	12	Coastal SAC separated by open sea from the Gweebarra Estuary

The only Special Area of Conservation that is connected by potential impact pathways to the proposed wind farm project is the West of Ardara/Maas Road SAC and the Coolvoy Bog SAC.

4.1.2 West of Ardara/Maas Road SAC

The West of Ardara/Maas Road SAC is a large site with 23 Annex I habitats and eight Annex II species that are Qualifying Interests.

The site includes the Gweebarra Estuary, extending upstream as far as Doochary. The boundary along the southern side of the Gweebarra Estuary follows the shoreline of the estuary and runs alongside the wind farm site boundary in the sections where the wind farm site reaches the Gweebarra Estuary. There are no terrestrial habitats included within the Special Area of Conservation along the southern side of the Gweebarra Estuary.

The Gweebarra Estuary is the only section of the Special Area of Conservation that is adjacent to the wind farm site. However, the proposed wind farm project will take place to the south of the public road. Therefore, no work will take place adjacent to the Special Area of Conservation. However, there is potential for secondary water quality impacts from the wind farm project, reaching the Gweebarra Estuary via the watercourses that drain the development site.

The West of Ardara/Maas Road SAC also includes the sections of the Owenea River catchment to the south of the wind farm site. This is in a separate catchment from the wind farm site. The turbine delivery route will cross this section of the Special Area of Conservation, but no widening work is required for the turbine delivery route within the Owenea River catchment.

The largest sections of the West of Ardara/Maas Road SAC occur to the west of Glenties, where it includes inland areas of peatland and lake habitats, and coastal habitats. These areas are physically separated from the wind farm site and have no hydrological connection with the site. However, there is a possible connection between widening work along the R262 for the turbine delivery route and coastal areas of the Special Area of Conservation in Loughros More Bay via a 7 km length of the Owenlocker River, which drains into the bay.

From the review above, the only possible impact pathways from the wind farm project to the West of Ardara/Maas Road SAC are hydrological impacts to the Gweebarra Estuary, and, in theory, the Loughros More Bay sections. Therefore, the only Qualifying Interests that could be affected are coastal / marine habitats and species.

The screening considerations for the Qualifying Interests of the West of Ardara/Maas Road SAC are shown in Table 4-3. The marine (1130, 1140 and 1160) and saltmarsh (1330 and 1440) Annex I habitats and the three Annex II species are all screened in. The sand dune habitats (2120, 2130, 2140, 2150, 2170 and 2190) were screened out. While these are coastal habitats, they do not occur along the section of the Gweebarra Estuary adjacent to the wind farm site, and they are not vulnerable to water quality impacts from marine waters. The other Annex I habitats all occur in the inland sections of the Special Area of Conservation to the west of Glenties and there are no hydrological connections or other potential impact pathways from the proposed wind farm project to these Qualifying Interests.

Table 4-3: Screening of the Qualifying Interests of the West of Ardara/Maas Road SAC.

Code	Name	Screening
1130	Estuaries	√
1140	Mudflats and sandflats not covered by seawater at low tide	√
1160	Large shallow inlets and bays	√
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	√
1410	Mediterranean salt meadows (Juncetalia maritimi)	√
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)	X
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	X
2140	Decalcified fixed dunes with Empetrum nigrum	X
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	X
2170	Dunes with *Salix repens* ssp. *argentea* (Salix arenariae)	X
2190	Humid dune slacks	X
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	X
4010	Northern Atlantic wet heaths with *Erica tetralix*	X
4030	European dry heaths	X
4060	Alpine and Boreal heaths	X
5130	Juniperus communis formations on heaths or calcareous grasslands	X
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites)	X
6410	Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)	X
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	X
7130	Blanket bog (*active only)	X
7150	Depressions on peat substrates of the Rhynchosporion	X
7230	Alkaline fens	X
1106	*Salmo salar*	√
1365	*Phoca vitulina*	√
1355	*Lutra lutra*	√

4.2 SPECIAL PROTECTION AREAS

4.2.1 Special Protection Areas within 15 km of the wind farm site

There are five Special Protection Areas within 15 km of the wind farm site (Figure 4-3). The Qualifying Interests of these Special Protection Areas are listed in Table 4-4. Some of the locations of proposed works along the turbine delivery route are outside the 15 km buffer around the wind farm site, but there are no additional Special Protection Areas close to these locations (Figure 4-4). The turbine delivery route works on R262 near the northern boundary of the Lough Nillan Bog SPA are too small-scale to have any effect on any of the Qualifying Interests of that site.

Table 4-4: Special Protection Areas within 15 km of the wind farm site.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging ranges
Derryveagh and Glendowan Mountains SPA	2.2	*Calidris alpina schinzii* *Falco columbarius* *Falco peregrinus* *Gavia stellata* *Pluvialis apricaria*	500 m 5 km 2 km 8 (11-13.5) km 3 km
Lough Nillan Bog SPA	5.2	*Anser albifrons flavirostris* *Calidris alpina schinzii* *Falco columbarius* *Pluvialis apricaria*	5-8 km 500 m 5 km 3 km
Sheskinmore Lough SPA	9	*Anser albifrons flavirostris*	5-8 km
Inishkeel SPA	9.1	*Branta leucopsis*	15 km
West Donegal Coast SPA	12	*Alca torda* *Falco peregrinus* *Fulmarus glacialis* *Larus argentatus* *Phalacrocorax aristotelis* *Phalacrocorax carbo* *Pyrrhocorax pyrrhocorax* *Rissa tridactyla*	88.7 km 2 km 542.3 km 58.8 km 13.2 km 25.6 km no data 156.1 km
Roaninish SPA	14	*Branta leucopsis* *Larus argentatus*	15 km 58.8 km

Foraging ranges are the mean max foraging ranges from Woodward *et al.* (2019) for the seabird species, and the core ranges from SNH (2016) for the other species.

Table 4-4 also shows the foraging ranges of the Qualifying Interest species, where this data is available. These are the core foraging ranges for the species included in SNH (2016), and the mean max foraging ranges for the seabird species from Woodward *et al.* (2019). These foraging ranges are the distances from nest sites / breeding colonies for Qualifying Interests listed for their breeding populations, and the distances from night roosts for Qualifying Interests listed for their non-breeding populations.

The SNH (2016) guidance states that: “in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying interests”, but that “in exceptional cases distances up to the maximum foraging range may be considered; for example, whilst osprey core foraging range is 10km an osprey foraging at a loch well beyond this distance from its SPA may still be connected if there is a lack of other closer foraging sites”.

There are seven Qualifying Interests of the Special Protection Areas listed in Table 4-4, where the minimum distance of the Special Protection Area from the wind farm site is greater than the core foraging range (Table 4-5). In three of these cases, the distance is only a little greater than the core foraging range: the Peregrine Qualifying Interest of the Derryveagh and Glendowan Mountains SPA; the Merlin Qualifying Interest of the Lough Nillan Bog SPA and the Greenland White-fronted Goose Qualifying Interest of the Sheskinmore Lough SPA. However, the distances measured are between the nearest points of the SPA and wind farm boundaries. In practice, the nest sites, or night roost sites, will usually be some distance inside the Special Protection Area boundary[5], while the wind farm project does not extend up to the wind farm

[5] The Special Protection Area boundary will usually be drawn to include buffers around sensitive features such as nest sites and night roosts.

site boundary. In the cases of the Lough Nillan Bog SPA and the Sheskinmore Lough SPA, the minimum distances are to the western section of the wind farm site, where no development work will take place. For these SPAs, the distances to the nearest proposed wind farm infrastructure are 6.1 km, and 12.4 km, respectively.

The Qualifying Interest species listed in Table 4-5 are associated with open bog / heath habitats. The landscapes between the relevant Special Protection Areas and the wind farm sites are dominated by these habitats. Therefore, there are no exceptional circumstances that would warrant using the maximum foraging range, instead of the core foraging range, to assess the potential connectivity between these Qualifying Interests and the wind farm site. Therefore, these Qualifying Interests have all been screened out from further assessment.

Table 4-5: Special Protection Area Qualifying Interests screened out due to foraging range distances.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging ranges
Derryveagh and Glendowan Mountains SPA	2.2	*Calidris alpina schinzii* *Falco peregrinus*	500 m 2 km
Lough Nillan Bog SPA	5.2	*Calidris alpina schinzii* *Falco columbarius* *Pluvialis apricaria*	500 m 5 km 3 km
Sheskinmore Lough SPA	9	*Anser albifrons flavirostris*	5-8 km
West Donegal Coast SPA	12	*Falco peregrinus*	2 km

Foraging ranges are the core ranges from SNH (2016).

A further seven Qualifying Interests can be screened out due to lack of ecological connectivity with the wind farm site. These include four seabird species that forage in open marine waters: Razorbill, Fulmar, Shag and Kittiwake. A further two species are associated with coastal habitats such as sand dunes, coastal grasslands and islands, which do not occur in the vicinity of the wind farm site: Barnacle Goose and Chough. In addition, while foraging range data is not available for Chough, their typical foraging ranges will be a lot less than the minimum distance from the West Donegal Coast SPA to the wind farm site[6]. Apart from a single record of a migrating Barnacle Goose, none of these species were recorded around, or overflying, the wind farm site.

Table 4-6:Special Protection Area Qualifying Interests screened out due to lack of ecological connectivity.

Special Protection Area	Qualifying Interests	Rationale
Inishkeel SPA	*Branta leucopsis*	Coastal species
West Donegal Coast SPA	*Alca torda* *Fulmarus glacialis* *Phalacrocorax aristotelis* *Pyrrhocorax* *Rissa tridactyla*	Marine species Marine species Marine species Coastal species Marine species
Roaninish SPA	*Branta leucopsis*	Coastal species

Two other Qualifying Interests can be screened out due to lack of regular occurrence around the wind farm site. Greenland White-fronted Goose (*Anser albifrons flavirostris*) and Red-throated Diver (*Gavia stellata*) were not recorded in any of the surveys carried out for this wind

[6] Based on observations of the distribution of foraging Choughs along the East Cork coastline in relation to the distribution of their nest sites (T. Gittings, personal observations).

farm project. These included surveys of potential goose foraging habitat and surveys of potential goose night roost sites, and surveys of potential diver breeding habitat, as well as vantage point surveys recording bird movements across the site. The lack of records during these surveys provides sufficient evidence to rule out any potential connectivity between the wind farm site and these Qualifying Interests.

Table 4-7: Special Protection Areas Qualifying Interest screened out due to lack of regular occurrence around the wind farm site.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging range
Derryveagh and Glendowan Mountains SPA	2.2	*Gavia stellata*	8 (11-13.5) km
Lough Nillan Bog SPA	5.2	*Anser albifrons flavirostris*	5-8 km

The foraging range is the core range from SNH (2016).

This leaves five Qualifying Interests of the Special Protection Areas within 15 km of the wind farm site that have potential connectivity with the wind farm site. These Qualifying Interests involve four species: Merlin, Golden Plover, Herring Gull, and Cormorant. These species were all recorded within / around the wind farm site during the surveys for the wind farm project.

Table 4-8: Special Protection Area Qualifying Interests within 15 km of the wind farm site that are screened in for further assessment.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging ranges
Derryveagh and Glendowan Mountains SPA	2.2	*Falco columbarius* *Pluvialis apricaria*	5 km 3 km
Lough Nillan Bog SPA	5.2	*Falco columbarius*	5 km
West Donegal Coast SPA	12	*Larus argentatus* *Phalacrocorax carbo*	58.8 km 25.6 km
Roaninish SPA	14	*Larus argentatus*	58.8 km

Foraging ranges are the mean max foraging ranges from Woodward et al. (2019) for the seabird species, and the core ranges from SNH (2016) for the other species.

4.2.2 Other Special Protection Areas

There are three seabird species that were recorded within / overflying the wind farm site that have typical foraging ranges greater than 15 km: Cormorant, Lesser Black-backed Gull and Herring Gull. The Special Protection Areas with these species as Qualifying Interests and which are within their mean max foraging ranges of the wind farm site are listed in Table 4-9 and shown in Figure 4-5. These include two Special Protection Areas that were covered by the review of the Special Protection Areas within 15 km (the Roaninish and West Donegal Coast SPAs). There are another three Herring Gull Qualifying Interests and two Lesser Black-backed Gull Qualifying Interests that occur at Special Protection Areas which are more than 15 km from the wind farm site, but within the mean max foraging range distances for these species. There are no additional Cormorant Qualifying Interests that occur at Special Protection Areas which are more than 15 km from the wind farm site but are within the mean max foraging range distance for the species.

Table 4-9: Special Protection Areas with Cormorant, Lesser Black-backed Gull and Herring Gull Qualifying Interests and within the mean max foraging range distances for these Qualifying Interests of the wind farm site.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging ranges
West Donegal Coast SPA	12	*Larus argentatus* *Phalacrocorax carbo*	58.8 km 25.6 km
Roaninish SPA	14	*Larus argentatus*	58.8 km
West Donegal Islands SPA	22	*Larus argentatus*	58.8 km
Inishbofin, Inishdooey and Inishbeg SPA	31	*Larus fuscus*	127 km
Lough Derg (Donegal) SPA	32	*Larus argentatus* *Larus fuscus*	58.8 km 127 km
Inishmurray SPA	49	*Larus argentatus*	58.8 km

Foraging ranges are the mean max foraging ranges from Woodward et al. (2019).

4.2.3 Special Protection Area screening conclusion

The Special Protection Area Qualifying Interests that were screened in for further assessment are listed in Table 4-10.

Table 4-10: Special Protection Area Qualifying Interests that are screened in for further assessment.

Special Protection Area	Distance (km)	Qualifying Interests	Foraging ranges
Derryveagh and Glendowan Mountains SPA	2.2	*Falco columbarius* *Gavia stellata* *Pluvialis apricaria*	5 km 8 (11-13.5) km 3 km
West Donegal Coast SPA	12	*Larus argentatus* *Phalacrocorax carbo*	58.8 km 25.6 km
Roaninish SPA	14	*Larus argentatus*	58.8 km
West Donegal Islands SPA	22	*Larus argentatus*	58.8 km
Inishbofin, Inishdooey and Inishbeg SPA	31	*Larus fuscus*	127 km
Lough Derg (Donegal) SPA	32	*Larus argentatus* *Larus fuscus*	58.8 km 127 km
Inishmurray SPA	49	*Larus argentatus*	58.8 km

Foraging ranges are the mean max foraging ranges from Woodward et al. (2019) for the seabird species, and the core ranges from SNH (2016) for the other species.

4.2.4 Overall screening conclusions

It is concluded that it can be excluded, on the basis of objective information, that the proposed project, individually or in combination with other plans or projects, will have a significant effect on the following European sites: Cloghernagore Bog and Glenveagh National Park SAC, Coolvoy Bog SAC, Gannivegil Bog SAC, Inishkeel SPA, Lough Nillan Bog (Carrickatlieve) SAC, Meenaguse Scragh SAC, Meenaguse/Ardbane Bog SAC, Meentygrannagh Bog SAC, River Finn SAC, Rutland Island and Sound SAC, Sheskinmore Lough SPA, Slieve Tooey/Tormore Island/Loughros Beg Bay SAC, and Termon Strand SAC.

It is concluded that it cannot be excluded, on the basis of objective information, that the proposed project, individually or in combination with other plans or projects, will have a significant effect on the following European sites: Derryveagh and Glendowan Mountains SPA, Inishbofin, Inishdooey and Inishbeg SPA, Inishmurray SPA, Lough Derg (Donegal) SPA, Lough Nillan Bog SPA, Roaninish SPA, West Donegal Coast SPA, West Donegal Islands SPA, and West of Ardara/Maas Road SAC.

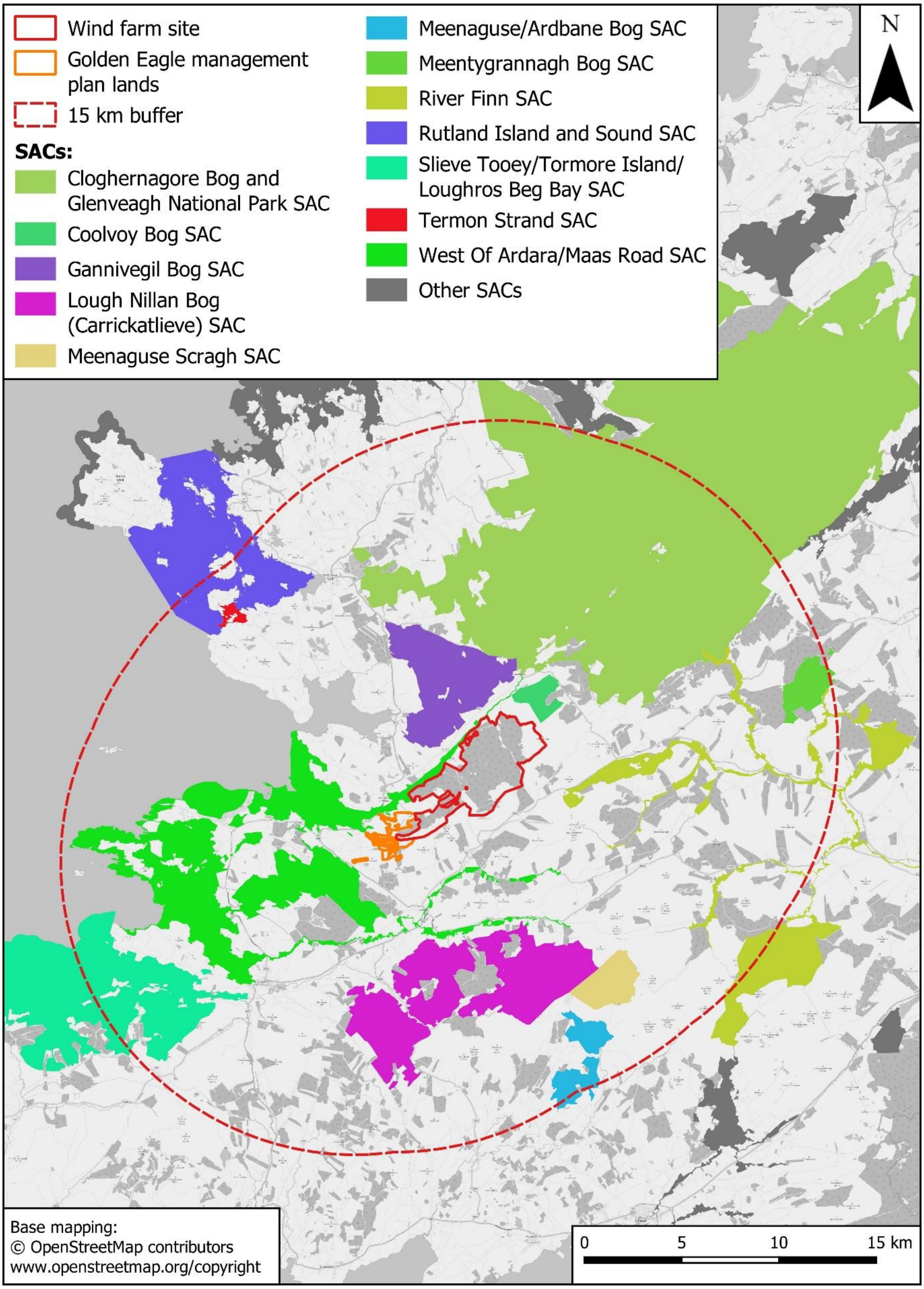

Figure 4-1: Special Areas of Conservation within 15 km of the wind farm site.

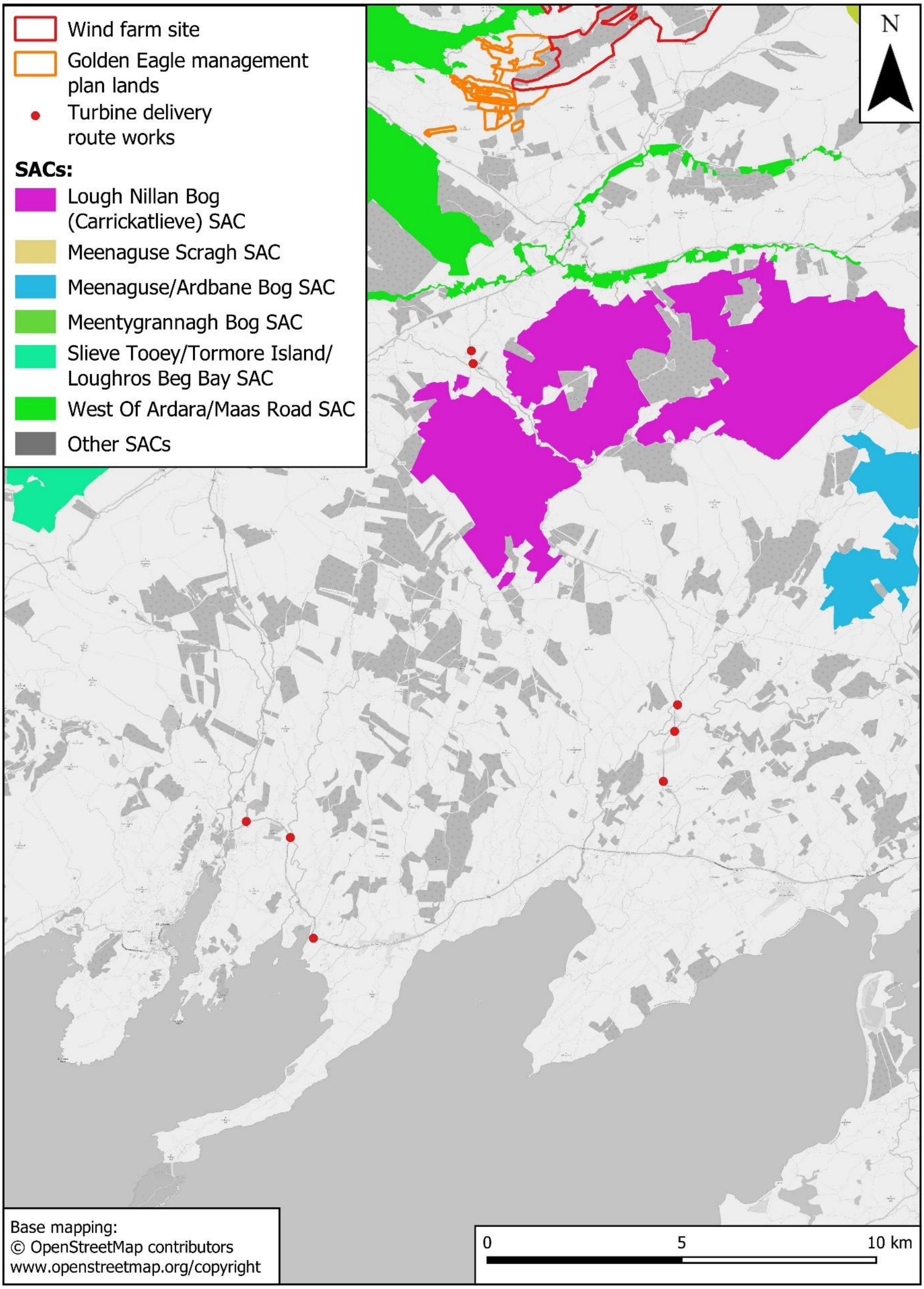

Figure 4-2: Special Areas of Conservation in the vicinity of the proposed works along the turbine delivery route.

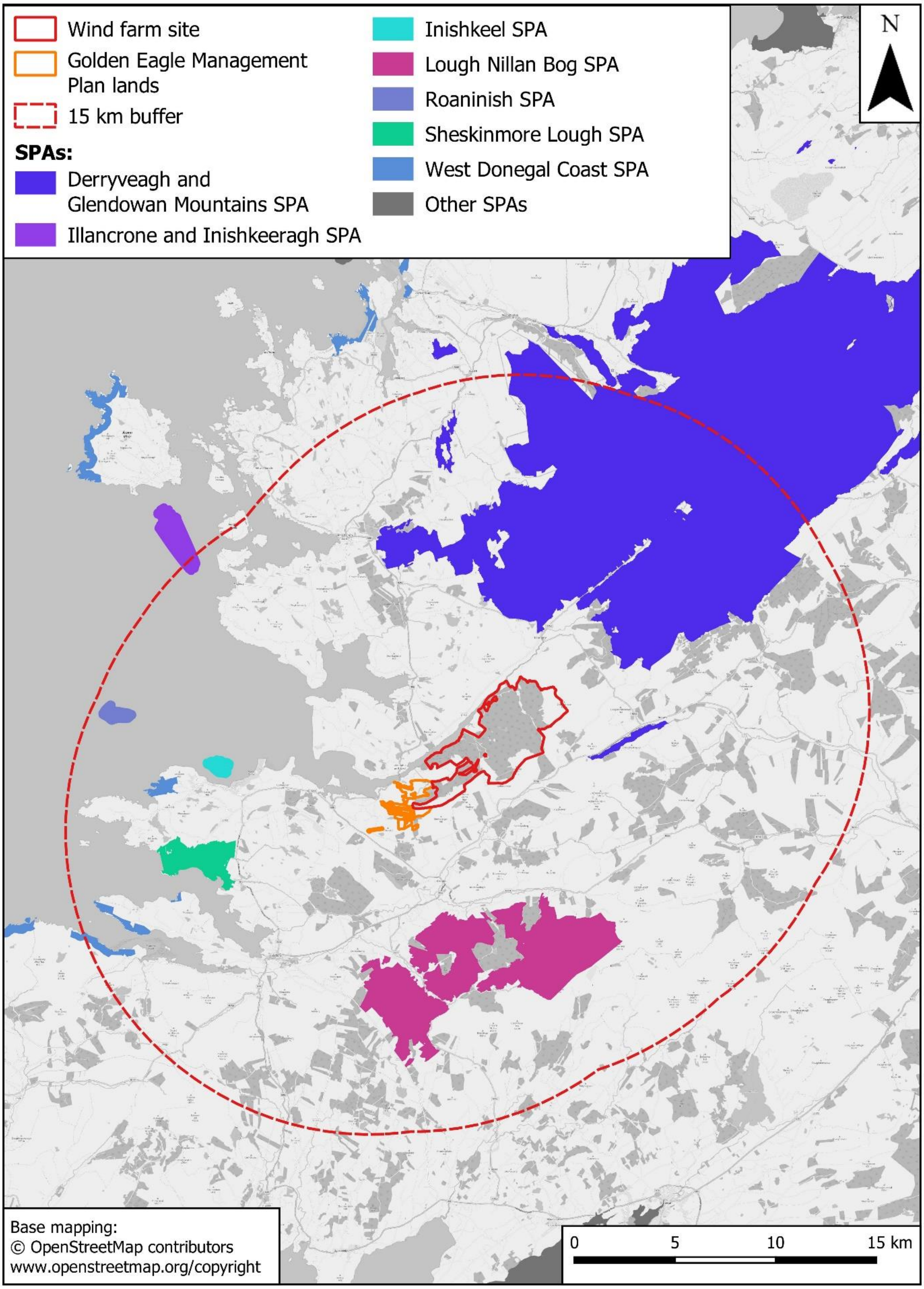

Figure 4-3: Special Protection Areas within 15 km of the wind farm site.

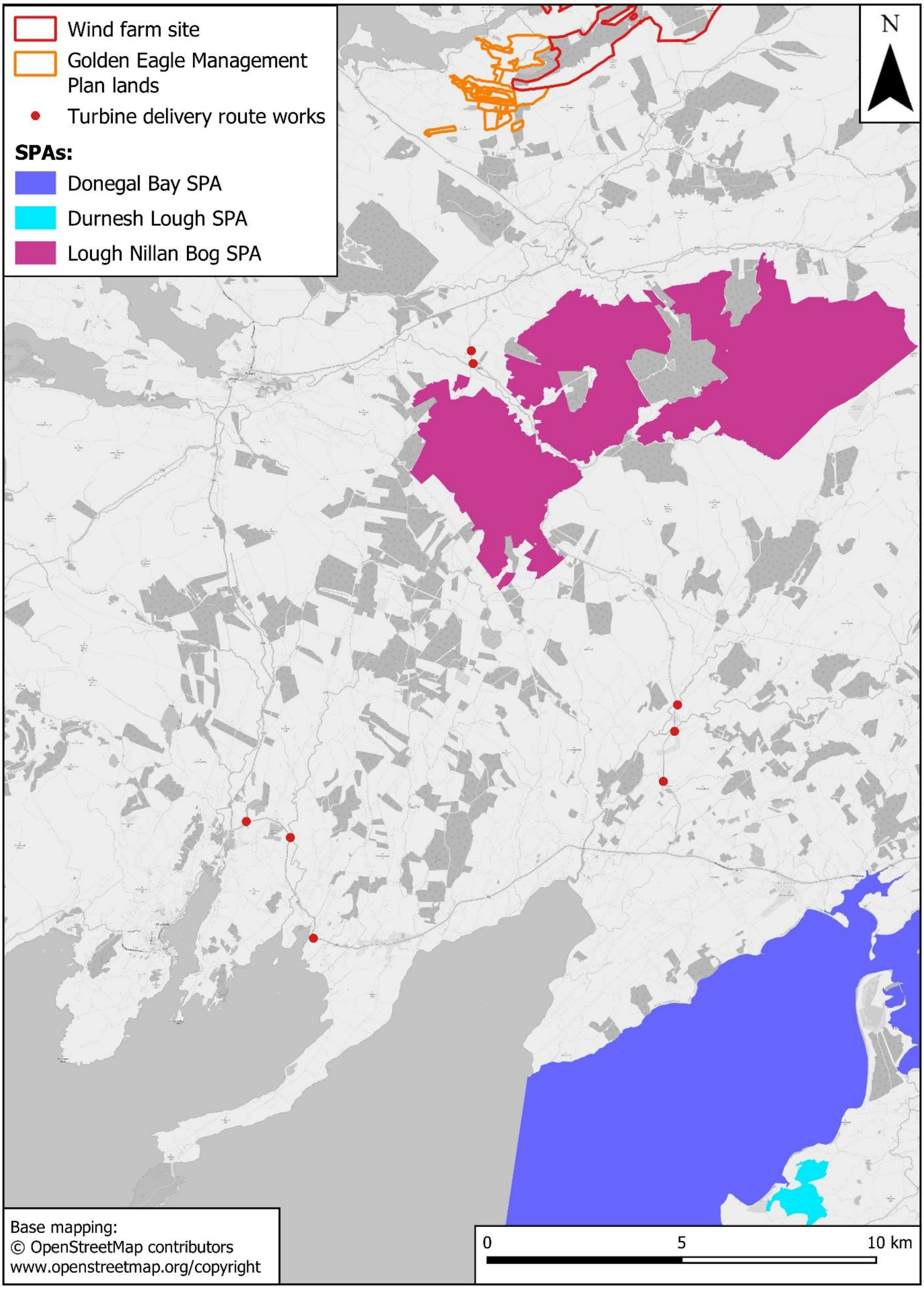

Figure 4-4 : Special Protection Areas in the vicinity of the proposed works along the turbine delivery route.

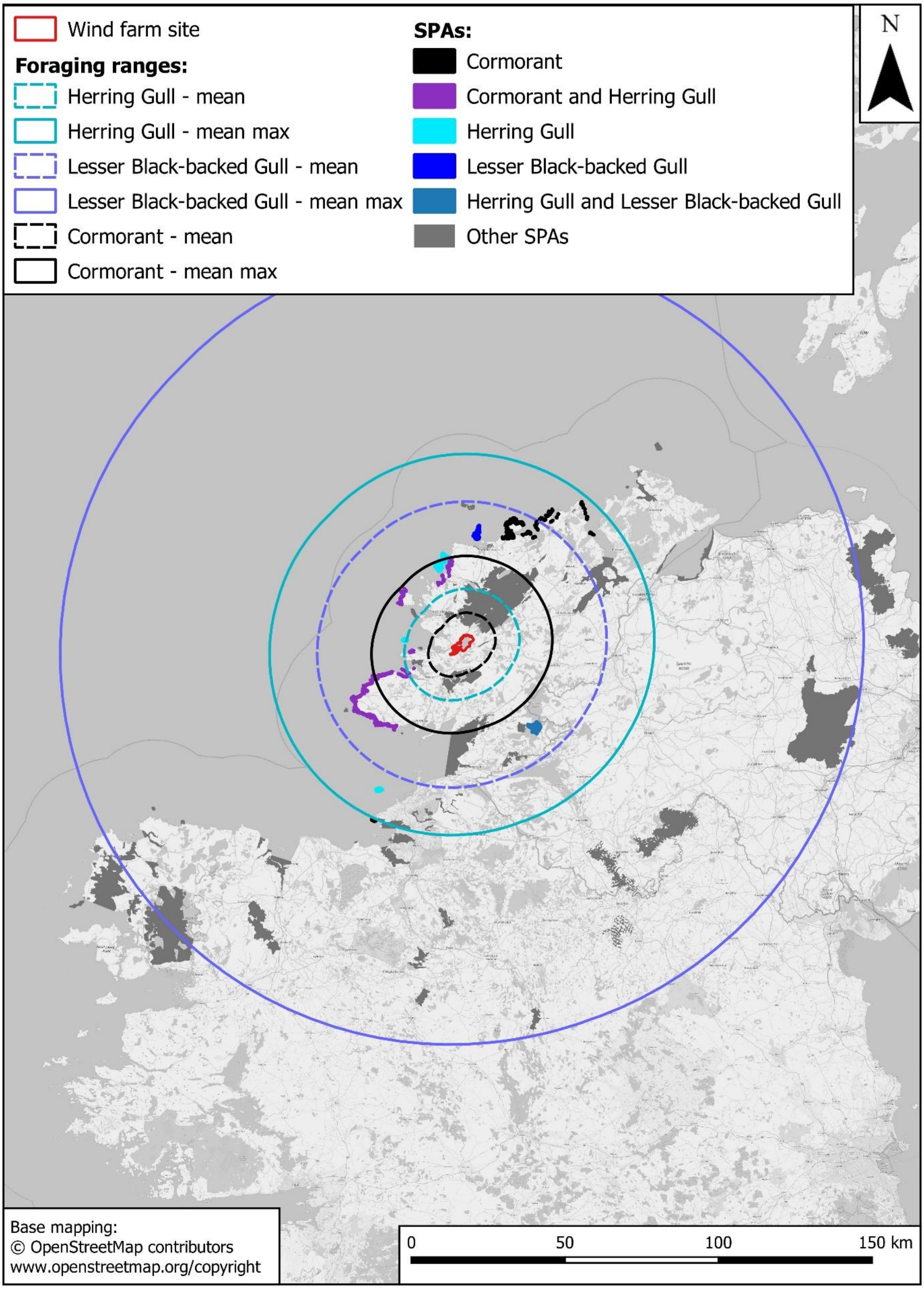

Figure 4-5: Special Protection Areas with Cormorant, Lesser Black-backed Gull and Herring Gull Qualifying Interests with potential connectivity with the wind farm site.

5.0 NATURA IMPACT STATEMENT

5.1 SPECIAL AREAS OF CONSERVATION

5.1.1 Water quality impacts

Surface water runoff from the wind farm site will drain to the watercourses in the wind farm site, which in turn drain to the Gweebarra Estuary. These watercourses are part of the MULNAMIN_BEG_010 waterbody, as defined for the Water Framework Directive. They are referred to in this Natura Impact Statement as the Mulnamin Beg watercourses (Figure 5-1).

5.1.1.1 Construction phase water quality impacts

Impact on Mulnamin Beg watercourses

During the construction phase, site clearance, excavation activities, instalment of clear span bridges, culverts and the stockpiling of material have the potential to result in sediment laden runoff, if not appropriately managed. The runoff of sediment can result in the sedimentation of nearby watercourses. Excavation works along the riverbanks will be undertaken when installing the bridges. Increased silt loading in watercourses can stunt aquatic plant growth, limit dissolved oxygen capacity and reduce the overall ecological quality of watercourses, with the most critical period associated with low flow conditions.

There is potential for the release of sediment and pollutants to surface water via surface water runoff from the proposed project site during soil stripping and installation of access routes, fencing and bridges during the construction phase, rainfall events or accidental release/mobilisation of pollutants during the operation phase. The concentration of suspended solids and nutrients in the water column could increase and cause excessive fine silt deposition and degrade water quality of these rivers.

Movement and maintenance of vehicles and machinery associated with the construction work has the potential for spillages of oils, fuels or other pollutants which could be transported to surface water, particularly during high rainfall events. The surface water runoff of contaminated surface water can result in the degradation of water quality and impacts to aquatic fauna and flora, particularly when concrete is present.

The storage of materials adjacent to any dry or wet surface water drainage features also has the risk for run-off or slippage during rainfall events.

The pouring of concrete will be required to facilitate the foundation works associated with the development. The transportation, pouring of concrete onsite and washing of concrete lorry flume creates a risk for entry into ground and surface water. Flooding of the construction site has potential to result in the release of increased volumes of pollutants, particularly suspended solids.

Further details about the assessment of impacts to aquatic habitats in the Mulnamin Beg watercourses is included in the Aquatic Report (Appendix 2).

Impact on Gweebarra Estuary

Any water quality impacts to the Mulnamin Beg watercourses could be transmitted downstream to the Gweebarra Estuary. However, the impacts on the Gweebarra Estuary will be ameliorated by the distance of the drainage pathway from the wind farm site, the much greater volume of the receiving waters in the Gweebarra Estuary, and the lower sensitivity of estuarine waters to siltation, etc.

Construction phase mitigation

Details of the mitigation measures that will be implemented to prevent negative water quality impacts during the construction phase are included in Chapter 9 of this Environmental Impact Assessment Report. This is reproduced as Appendix 3 in this Natura Impact Statement.

Construction phase residual impacts

The residual impacts to the Gweebarra Estuary are negative, short term, unlikely and not significant.

5.1.1.2 Operational phase water quality impacts

There will be no significant direct discharges to surface waters during the operational phase due to the nature of the development. Occasional vehicle access will be required which may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause localised contamination of site drainage channels. However, due to the periodic nature of visits, the risk of surface water pollution during operation is considered to be low (see Appendix 3).

The presence of occasional maintenance workers at the proposed substation will lead to the generation of foul sewage from toilets and washing facilities. This foul sewage will be collected and tankered off-site for disposal at a licensed wastewater treatment facility (see Appendix 3).

5.1.2 Annex I habitat Qualifying Interests of the West of Ardara/Maas Road SAC

5.1.2.1 Impact assessment

The following Annex I habitat Qualifying Interests of the West of Ardara/Maas Road SAC were screened in for Stage 2 assessment: estuaries; mudflats and sandflats not covered by seawater at low tide; large shallow inlets and bays; Atlantic salt meadows (Glauco-Puccinellietalia maritimae); Mediterranean salt meadows (Juncetalia maritimi).

While the wind farm boundary extends up to the edge of the West of Ardara/Maas Road SAC along the Gweebarra Estuary, there will be no construction work within 500 m of the estuary. Therefore, the only potential impact pathways from the wind farm project to these Qualifying Interests are water quality impacts to the Mulnamin Beg watercourses (Figure 5-1), which could be transmitted by the Mulnamin Beg watercourses to the estuary. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary (see Section 5.1.1). Therefore, there will be no impacts to the estuaries, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, Atlantic salt meadows (Glauco-Puccinellietalia maritimae), and Mediterranean salt meadows (Juncetalia maritimi) Qualifying Interests of the West of Ardara/Maas Road SAC.

5.1.2.2 Annex I habitat conservation objectives

The impacts of the proposed wind farm on the attributes and targets of the conservation objectives for the estuaries, mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, Atlantic salt meadows (Glauco-Puccinellietalia maritimae) and

Mediterranean salt meadows (Juncetalia maritimi) Qualifying Interests of the West of Ardara/Maas Road SAC are summarised in Table 5-1 - Table 5-8.

Table 5-1: Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the estuaries (1130) Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes	The wind farm project will not affect the area of the estuaries habitat in the SAC, as it will not have any physical impact on this habitat.
Community distribution	Conserve the following community types in a natural condition: Sand with amphipods, polychaetes and *Tellina tenuis* community complex; Estuarine sand with oligochaetes community complex	The wind farm project will not cause any significant residual water quality impacts and will, therefore, not affect the distribution or condition of the listed community types in the SAC.

Attributes and targets from NPWS (2015).

Table 5-2:Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the mudflats and sandflats not covered by seawater at low tide (1140) Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes	The wind farm project will not affect the area of the mudflats and sandflats not covered by seawater at low tide habitat in the SAC, as it will not have any physical impact on this habitat.
Community distribution	Conserve the following community type in a natural condition: Sand with amphipods, polychaetes and *Tellina tenuis* community complex.	The wind farm project will not cause any significant residual water quality impacts and will, therefore, not affect the distribution or condition of the listed community type in the SAC.

Attributes and targets from NPWS (2015).

Table 5-3:Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the large shallow inlets and bays (1160) Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes	The wind farm project will not affect the area of the large shallow inlets and bays habitat in the SAC, as it will not have any physical impact on this habitat.
Community distribution	Conserve the following community types in a natural condition: Sand with amphipods, polychaetes and *Tellina tenuis* community complex; reef community complex.	The wind farm project will not cause any significant residual water quality impacts and will, therefore, not affect the distribution or condition of the listed community types in the SAC.

Attributes and targets from NPWS (2015).

Table 5-4 Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (1330) Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession	The wind farm project will not affect the area of this habitat type
Habitat distribution	No decline or change in habitat distribution, subject to natural processes	The wind farm project will not affect the area of this habitat type
Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Physical structure: creeks and pans	Maintain creek and pan structure, subject to natural processes, including erosion and succession	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Physical structure: flooding regime	Maintain natural tidal regime	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Vegetation structure: zonation	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: vegetation height	Maintain structural variation within sward	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: vegetation cover	Maintain more than 90% area outside creeks vegetated	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation composition: typical species and subcommunities	Maintain range of subcommunities with typical species listed in SMP (McCorry and Ryle, 2009)	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: negative indicator species – *Spartina anglica*	There is currently no common cordgrass (*Spartina anglica*) in this SAC. This species should be prevented from establishing	The wind farm project will not involve any work in, or near, any of the SAC saltmarsh habitats.

Attributes and targets from NPWS (2015).

Table 5-5: Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Mediterranean salt meadows (Juncetalia maritimi) (1410) Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession	The wind farm project will not affect the area of this habitat type
Habitat distribution	No decline, subject to natural processes	The wind farm project will not affect the area of this habitat type
Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Physical structure: creeks and pans	Maintain creek and pan structure, subject to natural processes, including erosion and succession	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Physical structure: flooding regime	Maintain natural tidal regime	The wind farm project will not cause physical impacts to any saltmarsh habitat within the SAC.
Vegetation structure: zonation	Maintain range of saltmarsh habitats including transitional zones, subject to natural processes including erosion and succession	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: vegetation height	Maintain structural variation within sward	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: vegetation cover	Maintain more than 90% area outside creeks vegetated	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation composition: typical species and subcommunities	Maintain range of subcommunities with typical species listed in SMP (McCorry and Ryle, 2009)	The wind farm project will not affect the vegetation of any saltmarsh habitat within the SAC.
Vegetation structure: negative indicator species – *Spartina anglica*	There is currently no common cordgrass (*Spartina anglica*) in this SAC. This species should be prevented from establishing	The wind farm project will not involve any work in, or near, any of the SAC saltmarsh habitats.

Attributes and targets from NPWS (2015).

5.1.3 Atlantic Salmon Qualifying Interest of the West of Ardara/Maas Road SAC

5.1.3.1 Occurrence in the vicinity of the wind farm site

Gweebarra Estuary

The Gweebarra catchment provides prestige spawning habitat for Atlantic Salmon. The salmon use the Gweebarra Estuary as a migration route to the Gweebarra River to spawn and feed. It also contains nursery habitat.

The Gweebarra River is a 32 km long stretch of spate river flowing from Lough Barra to Gweebarra Bay and includes 16 km of estuarine water. The River Barra rises between the Glendowan and Derryveagh mountains and flows for approximately 32 km in a south-westerly direction through Lough Barra. The Gweebarra River flows out of Lough Barra and continues in a south-westerly direction through the village of Doocharry and meets the sea at Gweebarra Bay. The main tributaries are the Owenwee, Cloghernagore and Croagheen rivers.

The Gweebarra River receives a good run of late spring salmon at the end of April and May, as they migrate up from the estuary, with grilse running from the end of June and good-sized summer salmon running from August onwards.

Fish stock surveys were carried out by Inland Fisheries Ireland in Gweebarra catchment in 2019 to determine the status of their fish stocks. Fish species composition in the Gweebarra River catchment survey showed that Atlantic Salmon was the most abundant species captured (65% of total catch). The salmon ranged in age class from 0+ to 2+ and ranged in length from 2.2 to 12.9 cm.

Mulnamin Beg watercourses

The aquatic survey sites in the Mulnamin Beg watercourses had little value as salmonid habitat due to the upland, high energy nature of the watercourses. There was very little spawning gravel present across all nine sites, with the largest percentage of gravels being 20% at Sites 1 and 5.

There was no visual evidence of fish present within any of the nine sites surveyed. Fish access was poor due to the upland location. While trout can sometimes occur at steep gradients, the small size of the cascading boulder-pool profile within these streams was not considered suitable for resident fish. There was limited holding habitat due to the high energy flows of the streams. Site 4 had a large percentage of holding pool (40%), but the site was dominated by large boulders. Access for salmonids from downstream was difficult given the natural high gradients and large boulders preventing migration upstream. Spawning and nursery habitat in the lower reaches, for example at Site 1, was impacted by siltation, filamentous algae and bedded gravels due to the adjacent peat and forestry influences.

Overall, the upland eroding streams located with the development site hold poor quality spawning and nursery habitat for salmonids. There was no evidence of good spawning habitat that would be found in deeper glides and in pools where mixed gravels and small cobbles would be present. There was no evidence of holding pools or suitable boulders for larger fish.

Based on the very low numbers of macroinvertebrates present within these streams, there is a low abundance of fish food present within these streams to sustain salmonid populations.

The Mulnamin Beg watercourses are not included in the West of Ardara/Maas Road SAC and do not provide suitable spawning or nursery habitat for Atlantic Salmon. Therefore, they do not form part of the habitat complex that supports the Atlantic Salmon population of the West of Ardara/Maas Road SAC.

5.1.3.2 Impact assessment

The Mulnamin Beg watercourses are not part of the habitat complex that supports the Atlantic Salmon Qualifying Interest of the West of Ardara/Maas Road SAC. While the wind farm boundary extends up to the edge of the West of Ardara/Maas Road SAC along the Gweebarra Estuary, there will be no construction work within 500 m of the estuary. Therefore, the wind farm project will have no direct impacts on the habitats that support the Atlantic Salmon Qualifying Interest.

The only potential impact pathways from the wind farm project to the Atlantic Salmon Qualifying Interest are water quality impacts to the Mulnamin Beg watercourses, which could be transmitted by the Mulnamin Beg watercourses to the Gweebarra Estuary. If there is a decline in water quality of the Mulnamin Beg watercourses during the construction phase, this could cause adverse impacts to water quality in the Gweebarra Estuary. Any such adverse impacts could affect the Atlantic Salmon population on the estuary. However, with mitigation, no significant residual water quality impacts are predicted to the Gweebarra Estuary (see Section 5.1.1).

5.1.3.3 Atlantic Salmon conservation objectives

The impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Atlantic Salmon Qualifying Interest of the West of Ardara/Maas Road SAC is summarised in Table 5-8

Table 5-6 Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Atlantic Salmon Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	The wind farm project will not create any barriers to fish movement along the Mulnamin Beg watercourses
Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded	The wind farm project will not affect any Atlantic Salmon breeding habitat
Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	The wind farm project will not affect any habitat that is important for Atlantic Salmon fry.
Out-migrating smolt abundance	No significant decline	The wind farm project will not cause estuarine pollution or increases in predation or sea lice.
Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	The wind farm project will not affect any Atlantic Salmon breeding habitat.
Water quality	At least Q4 at all sites sampled by EPA	The wind farm project will not cause significant residual water quality impacts.

Attributes and targets from NPWS (2015).

5.1.4 Harbour Seal Qualifying Interest of the West of Ardara/Maas Road SAC

5.1.4.1 Occurrence in the vicinity of the wind farm site

The section of the Gweebarra Estuary adjacent to the wind farm site is mapped as Harbour Seal habitat by NPWS (2015). Harbour Seal is a marine species, so the Mulnamin Beg watercourses in the wind farm site are not suitable habitat.

5.1.4.2 Impact assessment

While the wind farm boundary extends up to the edge of the West of Ardara/Maas Road SAC along the Gweebarra Estuary, there will be no construction work within 500 m of the estuary. Therefore, the only potential impact pathways from the wind farm project to this Qualifying Interest are water quality impacts to the Mulnamin Beg watercourses, which could be transmitted by the Mulnamin Beg watercourses to the estuary. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary (see Section 5.1.1). Therefore, there will be no impacts to the Harbour Seal Qualifying Interest of the West of Ardara/Maas Road SAC.

5.1.4.3 Harbour Seal conservation objectives

The impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Harbour Seal Qualifying Interest of the West of Ardara/Maas Road SAC is summarised in Table 5-7.

Table 5-7: Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Harbour Seal Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use.	The wind farm project will not create any artificial barriers within the SAC.
Breeding behaviour	Conserve the breeding sites in a natural condition.	There are no breeding sites in the section of the SAC adjacent to the wind farm site.
Moulting behaviour	Conserve the moult haul-out sites in a natural condition	There are no moult haul-out in the section of the SAC adjacent to the wind farm site.
Resting behaviour	Conserve the resting haul-out sites in a natural condition	There are no resting haul-out in the section of the SAC adjacent to the wind farm site.
Disturbance	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	There will be no human activity generated by the wind farm project adjacent to the Gweebarra Estuary, or any other Harbour Seal habitat within the SAC.

Attributes and targets from NPWS (2015).

5.1.5 Otter Qualifying Interest of the West of Ardara/Maas Road SAC

5.1.5.1 Occurrence in the vicinity of the wind farm site

The section of the Gweebarra Estuary adjacent to the wind farm site is mapped as Otter commuting habitat by NPWS (2015).

There is an old Otter record from Doo Lough in the western part of the wind farm site in 1980 (NPWS records). Otters have also been recorded at three locations along the Gweebarra Estuary between Gweebarra Bridge and Doochary Bridge (NBDC records).

During the aquatic survey, Otter signs were searched for along the streams and drainage ditches within the development site, where accessible. No Otter signs (tracks, slides and spraints) or holts/resting sites were found. No Otter signs were recorded in the protected species survey of the infrastructure buffer and Lough Aneane More in August 2022. There were no incidental records of Otter signs or sightings during other survey carried out for the wind farm project.

It is likely that there is an Otter population in the Gweebarra Estuary, and they may use watercourses and other habitats within the wind farm site at times. However, the low productivity of the aquatic habitats in the wind farm site and the lack of significant fish populations are likely to limit Otter usage of the site.

5.1.5.2 Impact assessment

Water quality impacts

Water quality impacts could affect any Otter usage of the Mulnamin Beg watercourses. If the water quality impacts reach the Gweebarra Estuary they could affect the more significant Otter habitat in the estuary.

No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary (see Section 5.1.1). Therefore, there will be no water quality impacts to the Otter Qualifying Interest of the West of Ardara/Maas Road SAC.

Habitat loss

There will be minor loss of bankside habitat at locations where proposed access roads cross watercourses within the wind farm site. This will have no impact on the potential of these watercourses to support Otter populations.

Construction disturbance

The proposed construction works will result in an increase in noise levels during the construction phase due to the presence of construction vehicles and machinery. In general, plant machinery will be designed to ensure that the maximum noise level 10 m outside the site boundary do not exceed an equivalent continuous sound level beyond what is recommended in the BSI British Standards (BS5228-1:2009+A1:2014). The construction phase of the proposed project is anticipated to generate relatively low levels of noise, and only during permitted construction hours. Rock breaking and potentially blasting will be undertaken during the construction phase.

A temporary increase in noise levels within the site will result in disturbance to wildlife within the immediate vicinity of the construction work. The presence of construction personnel, machinery and traffic movement will also cause visual disturbance to wildlife.

The surveys carried out for the wind farm project found no evidence of Otters in the infrastructure buffer, or along watercourses and around lake margins in the development site. However, a gap of a few years will occur between these surveys and the start of construction. Therefore, a pre-construction Otter survey will be carried out. If any Otter breeding holts are found within 150 m of the proposed works, or any non-breeding holts are found within 20 m of the proposed works, appropriate mitigation measures will be implemented based on Smal (2006).

Operational disturbance

During the operational phase, the proposed project will function as a wind farm. Noise will be generated by the operation of the turbines. Minor noise disturbance may arise from traffic relating to site visitations and the maintenance of the site. The presence of operational personnel and of people walking along the recreational trails will also cause some visual disturbance. Apart from obstruction lighting on the turbine nacelles, there is no artificial lighting proposed for the proposed project.

The impact of operational disturbance on any Otter usage of the wind farm site will be negligible.

5.1.5.3 Otter conservation objectives

The impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Otter Qualifying Interest of the West of Ardara/Maas Road SAC is summarised in Table 5-8

Table 5-8: Assessment of the impact of the proposed wind farm on the attributes and targets of the conservation objectives for the Otter Qualifying Interest of the West of Ardara/Maas Road SAC.

Attribute	Target	Assessment
Distribution	No significant decline in percentage positive survey sites	The wind farm project will not affect the distribution of Otters within the West of Ardara/Maas Road SAC.
Extent of terrestrial habitat	No significant decline	The terrestrial habitat includes a 10m buffer along the shoreline. The wind farm project will not affect any terrestrial habitat within the SAC.
Extent of marine habitat	No significant decline	The wind farm project will not affect any marine habitat within the SAC.
Extent of freshwater (river) habitat	No significant decline	The wind farm project will not affect any freshwater (river) habitat within the SAC.
Extent of freshwater (lake/lagoon) habitat	No significant decline	The wind farm project will not affect any freshwater (lake/lagoon) habitat within the SAC.
Couching sites and holts	No significant decline	The wind farm project will not affect any couching sites and holts within the SAC. No couching sites or holts were found in surveys of the wind farm site. A pre-construction survey will be carried out. if any new couching sites or holts are found in the vicinity of the wind farm project, the required mitigation specified in the *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes* (NRA, 2006) will be implemented.
Fish biomass available	No significant decline	The wind farm project will not have any significant residual impacts on water quality or fish populations.
Barriers to connectivity	No significant increase	The wind farm project will not create any barriers to connectivity along the commuting routes identified in Map 12 of the conservation objectives.

Attributes and targets from NPWS (2015).

5.2 SPECIAL PROTECTION AREAS

5.2.1 Cormorant Qualifying Interest of the West Donegal Coast SPA

5.2.1.1 Cormorant impact assessment

Cormorant is a Qualifying Interest of the West Donegal Coast SPA. The minimum distance of this Special Protection Area from the wind farm site is 12 km, which is well within the mean max foraging range of Cormorant (25.6 km).

Cormorant breeding season occurrence around the wind farm site

During the bird surveys for the wind farm project, Cormorants were occasionally seen commuting across the wind farm site, or on lakes within the wind farm site, and were more frequently seen along the section of the Gweebarra Estuary adjacent to the wind farm site.

There were two records of Cormorant on lakes within the wind farm site during the bird surveys. One of these records was in the western section of the wind farm site, while there was a single record from Lough Aneane More in the eastern section of the wind farm site. Therefore, Cormorant usage of lakes within the wind farm site was very rare.

Construction disturbance

Cormorants do not regularly use lakes within the wind farm site. The nearest proposed wind farm infrastructure is over 500 m from the Gweebarra Estuary. Therefore, construction disturbance will have negligible impacts on Cormorant use of habitats around the wind farm site.

Habitat loss

The wind farm project will not remove any habitats used by Cormorants.

Displacement impacts

Cormorants do not regularly use lakes within the wind farm site. The nearest proposed turbine location is over 1 km from the Gweebarra Estuary. Therefore, any displacement impacts will have negligible effects on Cormorant use of habitat around the wind farm site.

Barrier effects

Cormorant was assessed as having medium sensitivity to barrier effects from wind farms by Humphreys *et al.* (2015a).

During the vantage point survey, there were only three Cormorant flightlines recorded crossing the wind farm site. Therefore, as there are no regular commuting routes across the wind farm site, any barrier effects will have negligible impacts.

Collision risk

The Cormorant collision risk was assessed as 0-0.006 collisions / year, which amounts to less than one collision every 160 years. This collision risk is negligible, so there is no potential for collisions with turbines to affect the Cormorant Qualifying Interest of the West Donegal Coast Special Protection Area.

Cumulative impacts

All the potential impacts from the wind farm project to the Cormorant Qualifying Interest of the West Donegal Coast SPA are negligible. Therefore, a cumulative assessment is not required.

5.2.1.2 Cormorant conservation objectives

The conservation objective for the Cormorant Qualifying Interest of the West Donegal Coast Special Protection Area is a general objective to maintain or restore its favourable conservation condition (NPWS, 2022e).

The wind farm project will have negligible collision risk, disturbance or displacement impacts to any Cormorants from the West Donegal Coast Special Protection Area commuting across the wind farm site, or foraging in areas within, or adjacent to, the wind farm site. Therefore, the wind farm project will not affect the conservation condition of the Cormorant Qualifying Interest of the West Donegal Coast Special Protection Area.

5.2.2 Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA

5.2.2.1 Golden Plover impact assessment

Golden Plover is a Qualifying Interest of the Derryveagh and Glendowan Mountains SPA. The minimum distance of this Special Protection Area from the wind farm site is 2.2 km, which is within the core foraging range of Golden Plover (3 km).

Golden Plover breeding season occurrence around the wind farm site

A single pair of Golden Plover was recorded breeding in the eastern corner of the wind farm site in 2020-2022. The breeding territory of this pair was around 3.5 km from the Derryveagh and Glendowan Mountains SPA. While this breeding pair is of high conservation significance, due to the national rarity of breeding Golden Plover, it is not part of the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA as the breeding territory is outside the SPA. The potential impacts to this breeding pair are assessed in the Environmental Impact Assessment Report.

It is possible that Golden Plovers breeding within the Derryveagh and Glendowan Mountains SPA commute to foraging areas within, or adjacent to, the wind farm site, or commute across the wind farm site. No Golden Plovers were recorded commuting across the wind farm site during the breeding season vantage point surveys, and there was only a single breeding season Golden Plover record away from the territory of the breeding pair. Nevertheless, given the likely difficulty of detecting commuting or foraging Golden Plovers, further consideration of the potential connectivity of the wind farm site with the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA is required.

Potential connectivity between the wind farm site and the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA

Breeding Golden Plover in Britain typically commute from their moorland breeding sites to grassland foraging areas. There are potential grassland foraging areas along the Gweebarra River and Gweebarra Estuary within 3 km of the Derryveagh and Glendowan Mountains SPA, which include areas adjacent to the wind farm site. These habitats are included within the area classified as land principally occupied by agriculture, with significant areas of natural vegetation in the CORINE land cover map (Figure 5-2).

The single breeding season Golden Plover record away from the territory of the Golden Plover breeding pair was in open bog habitat adjacent to the northern corner of the wind farm site (Figure 5-2). This is within the potential core foraging range of the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA. However, it seems more likely that this record related to a bird from the wind farm site breeding pair. Dusk watches were carried out in the 2022 breeding season to attempt to determine the directions that birds arrived from / departed towards when commuting between the breeding territory and foraging areas. However, these watches indicated that the birds were remaining within the moorland habitat to forage and gradually moving away from the breeding territory. The observation adjacent to the northern corner of the wind farm site is consistent with this pattern of behaviour.

Construction disturbance

The nearest proposed wind farm infrastructure is over 500 m from the Gweebarra Estuary. Therefore, construction disturbance will not have any impacts on any Golden Plovers foraging in grasslands along the Gweebarra Estuary.

Any construction disturbance impacts to Golden Plovers from the Derryveagh and Glendowan Mountains SPA Qualifying Interest foraging in open bog / heath habitat between the SPA and the wind farm will be negligible (see assessment of displacement impacts below).

Habitat loss

The wind farm project will not cause any loss of potential Golden Plover foraging habitat.

Displacement impacts

Pearce-Higgins *et al.* (2009) recorded a 39% reduction in density of breeding Golden Plover within 500 m of turbines, although most of the avoidance probably occurred within 200 m of the turbines. Other studies have reported mixed evidence on the sensitivity of breeding Golden Plover to displacement by turbines.

The nearest proposed turbine is over 1 km from the Gweebarra Estuary. Therefore, the wind farm project will not cause any displacement impacts to any Golden Plovers foraging in grasslands along the Gweebarra Estuary

If breeding Golden Plover do commute from the Derryveagh and Glendowan Mountains SPA to feed in moorland habitat close to the wind farm site, any displacement impact from the wind farm project is likely to be very small. There is 41 ha of open bog / heath habitat within 500 m of the proposed turbine locations along the northern edge of the wind farm, but less than 1 ha of this is within 200 m of the turbine locations. This compares to around 450 ha of open bog / heath habitat in the corridor between the 500 m buffer and the Derryveagh and Glendowan Mountains SPA (Figure 5-2). Therefore, any displacement impacts to Golden Plovers from the Derryveagh and Glendowan Mountains SPA Qualifying Interest foraging in open bog / heath habitat between the SPA and the wind farm will be negligible.

Collision risk

No commuting Golden Plovers were recorded in the vantage point surveys. There are no potential commuting routes from the Derryveagh and Glendowan Mountains SPA to potential Golden Plover foraging habitat within 3 km of the SPA that cross the wind farm site.

Cumulative impacts

All the potential impacts from the wind farm project to the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA are negligible. Therefore, a cumulative assessment is not required.

5.2.2.2 Golden Plover conservation objectives

The conservation objective for the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains Special Protection Area is a general objective to maintain or restore its favourable conservation condition (NPWS, 2022a).

The wind farm project will have negligible collision risk, disturbance or displacement impacts to any Golden Plovers from the Derryveagh and Glendowan Mountains Special Protection Area commuting across the wind farm site, or foraging in areas within, or adjacent to, the wind farm site. Therefore, the wind farm project will not affect the conservation condition of the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains Special Protection Area.

5.2.3 Lesser Black-backed Gull Qualifying Interests of the Inishbofin, Inishdooey and Inishbeg SPA and the Lough Derg SPA

5.2.3.1 Lesser Black-backed Gull impact assessment

Lesser Black-backed Gull is a Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg SPA and the Lough Derg (Donegal) SPA. However, the Lough Derg population is now extinct (Cummins, 2019). The minimum distance of the Inishbofin, Inishdooey and Inishbeg Special Protection Area from the wind farm site is 31 km (Figure 5-3), which is well within the mean max foraging range of Lesser Black-backed Gull (127 km).

The only available information on the population size of the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg SPA is the range reported in Cummins (2019) of 11 to 100 pairs. A data request was made to the National Parks and Wildlife Service for more detailed information, but this request has not been fulfilled yet due to significant quality assurance work that is being carried out on the breeding seabird datasets. Therefore, the minimum and maximum values of this range have been used in this assessment.

Lesser Black-backed Gull occurrence around the wind farm site

The vantage point survey flightlines show a broad pattern of movement of Lesser Black-backed Gulls across the wind farm site during the breeding season (Figure 5-4). This mainly occurred in a NW-SE corridor through the middle of the eastern part of the wind farm site, and to the west of Derkbeg Hill in the western part of the wind farm site. Most flightlines only involved one or two birds, with a maximum of nine birds on one flightline.

The movement corridor across the eastern part of the site would be consistent with Lesser Black-backed Gull commuting to/from a breeding colony at Lough Finn. However, most of the flightlines involved birds commuting north-west in the evening. As Lesser Black-backed Gulls are generally not active at night, this direction of flight in the evening would not be expected for birds breeding at Lough Finn. Therefore, it seems more likely that the breeding season Lesser Black-backed Gull flightlines across the eastern part of the site involved birds commuting from coastal breeding colonies to the north-west of the site. The peak movement occurred in June when birds at these colonies would have been provisioning chicks.

The flightlines across the western part of the wind farm site were probably associated with movements to/from a mink farm. This mink farm is located along the Stracashel River, around 4 km east of Glenties. Mink farms provide attractive foraging resources for gull populations, which feed on the fish waste generated by the farms.

Apart from occasional records from the Gweebarra Estuary, there were no breeding season records of Lesser Black-backed Gull on lakes, or on the ground, within, or adjacent to the wind farm site.

Construction disturbance

Lesser Black-backed Gulls do not regularly use habitat within the wind farm site. The nearest proposed wind farm infrastructure is over 500 m from the Gweebarra Estuary. Therefore, construction disturbance will have negligible impacts on Lesser Black-backed Gull use of habitats around the wind farm site.

Habitat loss

The wind farm project will not remove any habitats used by Lesser Black-backed Gull.

Displacement impacts

Lesser Black-backed Gull do not regularly use lakes within the wind farm site. The nearest proposed turbine location is over 1 km from the Gweebarra Estuary. Therefore, any displacement impacts will have negligible effects on Lesser Black-backed Gull use of habitat around the wind farm site.

Barrier effects

A Lesser Black-backed Gull commuting route passes through the middle of the wind farm site. If Lesser Black-backed Gull are sensitive to barrier effects, the wind farm project could prevent Lesser Black-backed Gulls from using this commuting route. However, Lesser Black-backed Gull are considered to have low sensitivity to barrier effects (Humphreys *et al.*, 2015a). At a breeding colony in Belgium, Lesser Black-backed Gulls were observed regularly flying between onshore turbines on their commuting routes to/from their offshore feeding areas (Everaert *et al.*, 2003).

The Inishbofin, Inishdooey and Inishbeg SPA is over 30 km from the wind farm site. This means that any increase in the length of Lesser Black-backed Gull commuting routes to / from this colony due to barrier effects would be negligible.

Collision risk

The predicted collision risk is 0.03-0.05 collisions/year (around one collision every 22-32 years). This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 2.6).

There are 16 Lesser Black-backed Gull colonies mapped in Cummins *et al.* (2019) whose potential mean max foraging ranges include the Cloghercor Wind Farm site. The sizes and distances of all these colonies from the wind farm site were used to estimate their potential contributions to the adult Lesser Black-backed Gull flight activity observed during the vantage point surveys. This was based on an analysis carried out for the Castlebanny Wind Farm project of GPS tracking data from three North Sea Lesser Black-backed Gull colonies (Gittings, 2020), which indicated the percentage of activity during Lesser Black-backed Gull foraging trips that occurred in 10 km distance bands from each colony. The percentage of adults from the Inishbofin, Inishdooey and Inishbeg SPA colony was then estimated using an equation which combines the observed data of the distribution of Lesser Black-backed Gull activity in distance bands from Lesser Black-backed Gull colonies, and the distances and population sizes of all the Lesser Black-backed Gull colonies with potential connectivity to the Cloghercor Wind Farm, as follows:

Equation 1: $p_{III} = (p_{db(III)} \times n_{III}) / \text{sum}_i{=}1 \text{ to } 25(p_{db(i)} \times n_i)$

where p_{III} is the estimated proportion of Lesser Black-backed Gull flight activity at the Cloghercor Wind Farm that represents gulls on foraging trips from the Inishbofin, Inishdooey and Inishbeg SPA colony; $p_{db(III)}$ is the proportion of Lesser Black-backed Gull activity from the analysis of GPS tracking data which occurred in the 10 km distance band representing the distance of the Cloghercor Wind Farm from the Inishbofin, Inishdooey and Inishbeg SPA colony; n_{III} is the population size of the Inishbofin, Inishdooey and Inishbeg SPA colony; $p_{db(i)}$ is the percentage of Lesser Black-backed Gull activity from the analysis of GPS tracking data which occurred in the 10 km distance band representing the distance of the Cloghercor Wind Farm from colony i; and n_i is the population size of colony i. The index was calculated separately for the minimum and maximum of the population size range for the Inishbofin, Inishdooey and Inishbeg SPA colony given by Cummins *et al.* (2019). The population sizes for the other colony were taken as the midpoint of the colony size range given by Cummins *et al.* (2019). The proportions of Lesser Black-backed Gull flight activity in each distance band were the means of the values in Table 2.3 of Gittings (2020).

The above calculation gives a value of 0.17 for the proportion of Lesser Black-backed Gull flight activity at the Cloghercor Wind Farm that represents gulls on foraging trips from the Inishbofin, Inishdooey and Inishbeg SPA colony. This value will be an overestimate as it does not allow for non-breeding or immature birds.

The predicted collision risk was adjusted by a factor of 0.17 to estimate the collision risk to birds from the Inishbofin, Inishdooey and Inishbeg SPA colony. The impact of the collision risk on the Inishbofin, Inishdooey and Inishbeg SPA colony was then assessed by calculating the percentage increase in annual mortality that would occur because of this collision risk. This calculation took account of the fact that not every adult gull breeds each year. Based on Calladine and Harris (1997), APEM (2013) adjusted population figures by 1/0.66 to allow for this intermittent breeding in their assessment of the impact of the East Anglia ONE wind farm on the Alde-Ore SPA Lesser Black-backed Gull colony, and this adjustment has been followed in the present assessment.

The assessment is shown in Table 5-9. The predicted increase in annual mortality is over an order of magnitude below the 1% threshold value that Percival (2003) suggested for determining whether the impact is non-negligible, while this threshold value is very conservative (see Section 2.3.3).

Table 5-9 Potential increase in mortality to the Inishbofin, Inishdooey and Inishbeg SPA Lesser Black-backed Gull colony.

Parameter	Description	Source	Minimum	Maximum
pop	population size (adults)	1	33	303
surv	adult survival rate	2	0.913	0.913
m_1	annual background mortality	pop × (1-surv)	2.9	26.3
m_2	predicted annual collision mortality	3	0.03-0.05	0.03-0.05
M_3	predicted annual collision mortality to birds from the Inishbofin, Inishdooey and Inishbeg SPA Lesser Black-backed Gull colony	4	0.001-0.002	0.008-0.01
Δm	increase in annual mortality due to collisions	m_3 / m_1	0.04-0.06%	0.03-0.05%

1 = the population sizes are the minimum and maximum of the range in Cummins *et al.* (2019), adjusted by a factor of 1/0.66 to allow for the occurrence of intermittent breeding in Lesser Black-backed Gull populations (Calladine and Harris, 1997; APEM, 2013). 2 = Wanless *et al.* (1996), as quoted by BirdFacts (www.bto.org/understanding-

birds/birdfacts). 3 = predicted collision risk from the collision risk model; 4 = collision risk adjusted by factors of 0.04 (minimum) or 0.26 (maximum) to reflect the estimated proportion of birds from the Inishbofin, Inishdooey and Inishbeg colony.

Cumulative impacts

The predicted collision risk from the Cloghercor Wind Farm is small. However, there are a large number of operational turbines within the potential foraging range of the Inishbofin, Inishdooey and Inishbeg colony. Therefore, an assessment is required of the potential cumulative impact of the collision risk from the Cloghercor Wind Farm in combination with the collision risk from other wind farms within the foraging range.

While the Lesser Black-backed Gull mean max foraging range is 137 km, the review of Lesser Black-backed Gull GPS tracking data by Gittings (2020) indicated that around 90% of Lesser Black-backed Gull activity on foraging trips occurs within 50 km of their colonies. Therefore, the assessment was carried out on the potential cumulative impact from wind farms within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA.

There are 18 other wind farms with a total of 184 turbines within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA. Apart from a single turbine on Tory Island, the nearest wind farm is the Mount Cronalaght / Cronalaght II wind farm around 14 km south of the SPA (Figure 5-5). Most of the operational turbines are in a cluster of several wind farms around 35-40 km south-east of the SPA (Figure 5-5).

As most of these wind farms were constructed prior to 2010, the available ornithological information available about these wind farms is limited. However, information on Lesser Black-backed Gull flight activity is available relating to two of these wind farms.

Table 5-10: Number of operational turbines in distance bands from the Inishbofin, Inishdooey and Inishbeg SPA.

Distance band	Number of wind farms	Number of turbines	Proportion of Lesser Black-backed Gull foraging activity
0-20 km	2	14	44%
20-30 km	1	1	20%
30-40 km	6	97	15%
40-50 km	9	72	11%

The number of turbines is derived from the turbines mapped on OpenStreetMap. The proportion of Lesser Black-backed Gull foraging activity is the predicted percentage of Lesser Black-backed Gull foraging activity in the relevant distance band from the Inishbofin, Inishdooey and Inishbeg SPA (0-20 km, 20-30 km, 30-40 km and 40-50 km), based on analysis of GPS tracking studies of three North Sea Lesser Black-backed Gull colonies (see Gittings, 2020).

A planning application was submitted for repowering the Cronalaght Wind Farm in 2022. The assessment carried out for this application included two full years of vantage point surveys. No Lesser Black-backed Gulls were recorded during these surveys. Therefore, the collision risk from the Cronalaght Wind Farm to the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg SPA is zero.

A planning application was submitted for a new wind farm (the Maas Wind Farm) adjacent to the Loughderryduff Wind Farm, around 40 km from the Inishbofin, Inishdooey and Inishbeg SPA. The assessment carried out for this application included a single breeding season vantage point survey in the summer of 2020 at two vantage point locations. There were six records of Lesser Black-backed Gull flightlines recorded during the breeding season. There does not appear to have been any collision risk modelling carried out for this wind farm, and information on the numbers of Lesser Black-backed Gulls recorded on each flightline is not presented in the Environmental Impact Assessment Report. Previous vantage point surveys carried out in the 2016 and 2017 breeding season did not record any Lesser Black-backed Gull flightlines.

The 188 operational turbines within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA are an order of magnitude higher than the number of turbines proposed for the Cloghercor Wind Farm. Therefore, allowing for uncertainty in the predicted collision risk, it is possible that the cumulative impact would cause a potential increase in annual mortality to the Inishbofin, Inishdooey and Inishbeg SPA population that could reach or slightly exceed the 1% threshold. However, the 1% threshold is very conservative, and an increase substantially greater than 1% is likely to be required to have a significant impact.

An order of magnitude increase in the predicted annual collision mortality, to represent the cumulative impact, to 0.05-0.07 adults from the Inishbofin, Inishdooey and Inishbeg SPA colony is around 0.03-0.04% of the total population. By comparison a population viability analysis for the impact of collision mortality from the East Anglia ONE Offshore Windfarm (APEM, 2013) found that annual collision mortality of 20 adults, which represented around 0.4% of the breeding Lesser Black-backed Gull population in the Alde-Ore SPA, would not have any statistically detectable impact on the population. This comparison suggests that even a two order of magnitude increase in the annual collision mortality of adults from the Inishbofin, Inishdooey and Inishbeg SPA colony, compared to the predicted collision risk from the Cloghercor Wind Farm, would not have a significant impact on the colony. Therefore, the effects of the collision risk from the Cloghercor Wind Farm, in combination with the collision risks from other wind farms within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA is not likely to cause significant impacts to the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg SPA.

5.2.3.2 Lesser Black-backed Gull conservation objectives

The conservation objective for the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg Special Protection Area is a general objective to maintain or restore its favourable conservation condition (NPWS, 2022b).

The wind farm project will have negligible disturbance or displacement impacts to any Lesser Black-backed Gulls from the Inishbofin, Inishdooey and Inishbeg Special Protection Area foraging in areas within, or adjacent to, the wind farm site. The effects of the collision risk from the Cloghercor Wind Farm, in combination with the collision risks from other wind farms within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA is not likely to cause significant impacts to the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg SPA. Therefore, the wind farm project will not affect the conservation condition of the Lesser Black-backed Gull Qualifying Interest of the Inishbofin, Inishdooey and Inishbeg Special Protection Area.

5.2.4 Herring Gull Qualifying Interests of the Inishmurray SPA, Lough Derg (Donegal) SPA, Roaninish SPA, West Donegal Coast SPA and West Donegal Islands SPA

5.2.4.1 Herring Gull impact assessment

Herring Gull is a Qualifying Interest of five Special Protection Areas that are within the Herring Gull mean max foraging range distance of the wind farm site (Table 5-11). However, the Lough

Derg Herring Gull population is not included in the map in Cummins *et al.* (2019) and can presumed to be extinct, like the Lesser Black-backed Gull colony (see above).

Table 5-11: Herring Gull Qualifying Interests of Special Protection Areas within the Herring Gull mean max foraging range of the wind farm site.

Special Protection Area	Distance (km)
West Donegal Coast SPA	12
Roaninish SPA	14
West Donegal Islands SPA	22
Lough Derg (Donegal) SPA	32
Inishmurray SPA	49

Herring Gull occurrence around the wind farm site

The Herring Gull flightlines recorded during the vantage point surveys were concentrated almost entirely in the western part of the wind farm site and along the Gweebarra Estuary (Figure 5-6). This is in marked contrast to the pattern of Lesser Black-backed Gull flight activity but is consistent with differences in the ecology of the two species. Unlike Lesser Black-backed Gull, Herring Gulls do not generally commute inland from their breeding colonies to feed on agricultural land. The flightlines across the western part of the wind farm site were probably associated with movements to/from the mink farm.

Most flightlines involved less than ten birds, but several much larger flocks were recorded. These mainly occurred on two vantage point watches in October and November 2020 when four flocks of 35-250 birds, and seven flocks of 10-35 birds, respectively, were recorded. These all involved birds moving north through the valley that forms the boundary between the eastern and western sections of the wind farm site.

Herring Gulls were regularly observed on the Gweebarra Estuary. However, away from the Gweebarra Estuary, there were no records of Herring Gulls on lakes, or on the ground, within, or adjacent to the wind farm site.

Construction disturbance

Herring Gulls do not regularly use habitat within the wind farm site. The nearest proposed wind farm infrastructure is over 500 m from the Gweebarra Estuary. Therefore, construction disturbance will have negligible impacts on Herring Gull use of habitats around the wind farm site.

Habitat loss

The wind farm project will not remove any habitats used by Herring Gull.

Displacement impacts

Herring Gull do not regularly use lakes within the wind farm site. The nearest proposed turbine location is over 1 km from the Gweebarra Estuary. Therefore, any displacement impacts will have negligible effects on Herring Gull use of habitats around the wind farm site.

Barrier effects

A Herring Gull commuting route passes over the wind farm site. The main corridors of flight activity are along the valley between the eastern and western sections of the site, and to the west of Derkbeg Hill at the western end of the site. These corridors avoid the proposed turbine locations. Therefore, the wind farm project will not cause any barrier impacts to commuting Herring Gulls.

Collision risk

The predicted collision risk in the breeding season is 0.01-0.02 collisions/year (around one collision every 66-77 years). These collision risks include corrections for detectability effects (which increase the risks by factors of around 2.6). The collision risk would not result in any collisions during the lifespan of the wind farm.

Cumulative impacts

All the potential impacts from the wind farm project to the Herring Gull Qualifying Interest of the Inishmurray SPA, Roaninish Special Protection Area, West Donegal Coast SPA and West Donegal Islands SPA are negligible. Therefore, a cumulative assessment is not required.

5.2.4.2 Herring Gull conservation objectives

The conservation objective for the Herring Gull Qualifying Interests of the Inishmurray SPA, Roaninish Special Protection Area, West Donegal Coast SPA and West Donegal Islands SPA are, in each case, a general objective to maintain or restore their favourable conservation condition (NPWS, 2022c, d, e, f).

The wind farm project will have negligible collision risk, disturbance or displacement impacts to any Herring Gulls from these Special Protection Areas commuting across the wind farm site, or foraging in areas within, or adjacent to, the wind farm site. Therefore, the wind farm project will not affect the conservation condition of the Herring Gull Qualifying Interests of the Inishmurray SPA, Roaninish Special Protection Area, West Donegal Coast SPA and West Donegal Islands SPA.

5.2.5 Merlin Qualifying Interests of the Derryveagh and Glendowan Mountains SPA

5.2.5.1 Merlin impact assessment

Merlin is a Qualifying Interest of the Derryveagh and Glendowan Mountains SPA. The minimum distance of this Special Protection Area from the wind farm site is 2.2 km, which is well within the core foraging range of Merlin (5 km).

Merlin breeding season occurrence around the wind farm site

Merlin is quite widespread in Donegal. In the BirdAtlas 2007-2011 surveys, breeding evidence was recorded from three of the six hectads around the wind farm site. A breeding pair of Merlin was recorded close to the Graffy Wind Farm site in 2019 and 2020 (RPS, 2021), around 6 km south-east of the Cloghercor Wind Farm site. No records of breeding Merlin have been supplied by NPWS in response to our consultations and data requests. It is a Qualifying Interest of the Derryveagh and Glendowan Mountains SPA, but no information is available on its distribution within the site.

Merlin surveys were carried out in the 2020-2022 breeding season. In 2020 and 2021, these were combined with the moorland surveys and involved searching for Merlin signs, such as pellets and plucking posts. In 2022, a dedicated Merlin survey was carried out which combined searching for Merlin signs with sample vantage point watches in areas of suitable habitat. This comprised 84.5 hours of survey work between late March and early August. There were very few Merlin bird records during the moorland and Merlin surveys: just one record in 2020-21, and two in 2022 (one of which was only considered a probable). In 2020-21 there were a few records of fresh pellets and plucking posts, mainly around the western section of the site, although none were confirmed as referring to Merlin (Figure 5-7). In 2022, some feather plucks were found along the south-eastern side of the site (Figure 5-7), but these were mainly old (either from the non-breeding season or 2021 breeding season). On 29th July, two fresh plucks were found but these could be attributed to a family of Kestrel that were in that area at the time.

There were additional Merlin records during the vantage point surveys, the Golden Eagle surveys, and from incidental sightings. The distribution of breeding season records was concentrated along the south-eastern margins of the site (Figure 5-7). There were no breeding season records from the north-eastern margin of the site, which is the closest section to the Derryveagh and Glendowan Mountains SPA.

Overall, across three years of Merlin surveys, breeding season vantage point surveys, and other survey work, no evidence of breeding Merlin was recorded within the wind farm site, or in the 500 m buffer around the site, and there were very low incidences of Merlin bird detections. There are only small areas of deep heather that would be suitable for ground nesting Merlin and these are mainly in the north-east of the site on the lower slopes of Croaghleheen Hill. The forestry plantations are in neat blocks without many of the outlying groups or single trees that are often favoured by Hooded Crows/Merlin for nesting. There was a notable lack of Hooded Crows on the site which may have an impact on tree nesting opportunities for Merlin.

Construction disturbance

Apart from a short section of access road, the wind farm infrastructure is located in forestry areas. Therefore, construction disturbance will have negligible impacts on Merlin use of foraging habitat around the wind farm site.

Habitat loss

The wind farm will remove around 9 ha of bog / heath habitat. Based on a core foraging range of 5 km, the theoretical foraging range of a breeding Merlin pair is nearly 80 km^2. Therefore, habitat loss will have a negligible impact on the availability of Merlin foraging habitat. Also, forestry clearance to create buffers along access roads and around turbines will create around 18-39 ha of new open habitats, most of which are likely to develop into bog / wet heath habitat.

Displacement impacts

The potential overlap between the core foraging range of the Merlin Qualifying Interest of the Derryveagh and Glendowan Mountains SPA and the wind farm site is shown in Figure 5-8. The potential core foraging range includes the northern third of the wind farm site and around half of the proposed wind farm project. However, this potential core foraging range is drawn from the boundary of the Special Protection Area. In practice, the Merlin nest sites are likely to occur some distance inside the boundary, so the actual overlap will be significantly smaller.

Very little is known about the impact of wind farms on Merlin populations (Humphreys *et al.*, 2015b). However, it is generally assumed that they are likely to be sensitive to displacement impacts. All the turbines are located within forestry, so any displacement impacts would only affect marginal areas of bog/heath close to the forest edge. Displacement impacts result in reduced use of the affected areas, not complete exclusion. Given the low level of Merlin activity recorded around the wind farm site, the distance from the Derryveagh and Glendowan Mountains SPA, and the theoretical foraging range for a breeding pair of nearly 80 km^2 (see above), any displacement impacts are unlikely to significantly affect the availability of a Merlin foraging habitat for any breeding pair in the Derryveagh and Glendowan Mountains SPA whose core foraging ranges include the area around the wind farm site.

Collision risk

The predicted collision risk is negligible (less than one collision every thousand years). This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 3.1).

Cumulative impacts

The Cronalaght Wind Farm is within the 5 km buffer around the Derryveagh and Glendowan Mountains SPA. However, no Merlin were recorded in any of the bird surveys carried out for the Cronalaght Wind Farm repowering planning application. Merlin was recorded in previous surveys at the site, indicating occasional use of the site.

There are no other operational wind farms within the 5 km buffer around the Derryveagh and Glendowan Mountains SPA.

There were no large-scale development proposals likely to affect significant areas of Merlin foraging habitat identified in the review of planning applications.

5.2.5.2 Merlin conservation objectives

The conservation objective for the Merlin Qualifying Interest of the Derryveagh and Glendowan Mountains Special Protection Area is a general objective to maintain or restore its favourable conservation condition (NPWS, 2022).

The wind farm project will have negligible collision risk, habitat loss and disturbance impacts and negligible or very minor displacement impacts to any breeding Merlin from the Derryveagh and Glendowan Mountains Special Protection Area whose core foraging range includes the area around the wind farm site. Therefore, the wind farm project will not affect the conservation condition of the Merlin Qualifying Interest of the Derryveagh and Glendowan Mountains Special Protection Area.

5.3 CONCLUSIONS

The conclusions of the Stage 2 assessment are summarised in Table 5-12.

Table 5-12: Conclusions of the Stage 2 assessment.

Qualifying Interests	Conclusions
West of Ardara/Maas Road SAC	
Mudflats and sandflats not covered by seawater at low tide	Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.

Qualifying Interests	Conclusions
Large shallow inlets and bays	Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Mediterranean salt meadows (Juncetalia maritimi)	Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Atlantic Salmon	Mulnamin Beg watercourses are not part of the habitat complex that supports the Atlantic Salmon Qualifying Interest. Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Harbour Seal	Only potential impact pathways are water quality impacts. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Otter	Otter usage of watercourses and lakes within the wind farm site at most low, so habitat and disturbance impacts within wind farm site will not be significant. No significant residual water quality impacts are predicted to the Mulnamin Beg watercourses, or to the Gweebarra Estuary.
Derryveagh and Glendowan Mountains SPA	
Golden Plover	Negligible habitat loss, disturbance, displacement, and collision risk impacts to any Golden Plovers commuting from the Derryveagh and Glendowan Mountains SPA to feed in moorland habitats around the wind farm site.
Merlin	Negligible habitat loss, disturbance, displacement, and collision risk impacts to any Merlin commuting from the Derryveagh and Glendowan Mountains SPA to feed in moorland habitats around the wind farm site.
Inishbofin, Inishdooey and Inishbeg SPA	
Lesser Black-backed Gull	Negligible habitat loss, disturbance, displacement, and barrier impacts to any Lesser Black-backed Gulls commuting from the Inishbofin, Inishdooey and Inishbeg SPA. Collision risk is not likely to affect the viability of the Inishbofin, Inishdooey and Inishbeg SPA population.
Inishmurray SPA, Roaninish SPA, West Donegal Coast SPA and West Donegal Islands SPA	
Herring Gull	Negligible habitat loss, disturbance, displacement, barrier effects and collision risk impacts to any Herring Gulls commuting from the Inishmurray SPA, Roaninish SPA, West Donegal Coast SPA and West Donegal Islands SPA.
West Donegal Coast SPA	
Cormorant	Negligible habitat loss, disturbance, displacement, barrier effects and collision risk impacts to any Cormorants commuting from the West Donegal Coast SPA.

For the reasons set out in detail in this NIS, in the light of the best scientific knowledge in the field, all aspects of the proposed project which, by itself, or in combination with other plans or projects, may affect the relevant European Sites have been considered.

This Natura Impact Statement contains information which the Board may consider in making its own complete, precise and definitive findings and conclusions and upon which it is capable of determining that all reasonable scientific doubt has been removed as to the effects of the proposed project on the integrity of the relevant European sites.

In the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the Board is enabled to ascertain that the proposed project will not adversely affect the integrity of any European site.

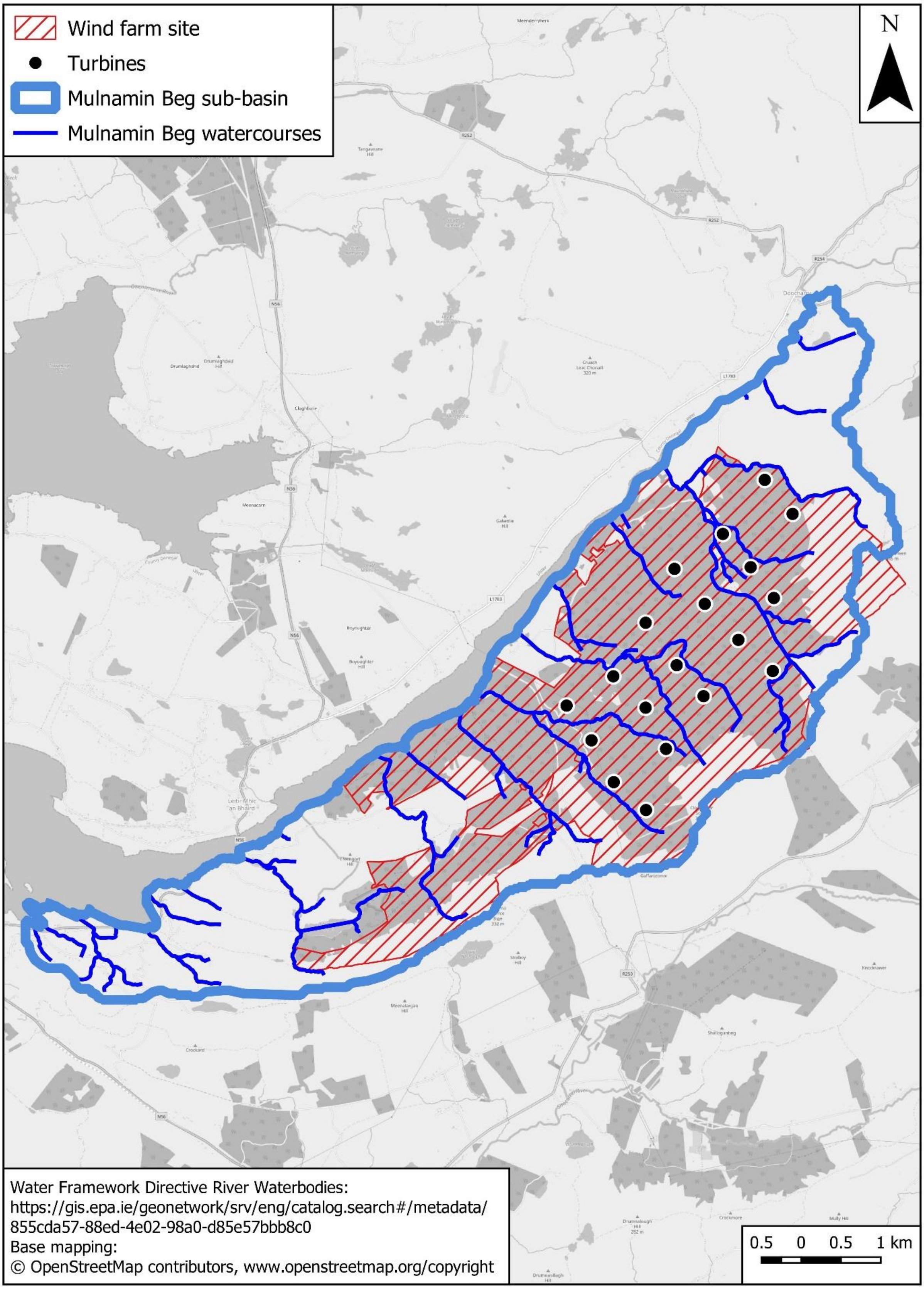

Figure 5-1: The Mulnamin Beg watercourses.

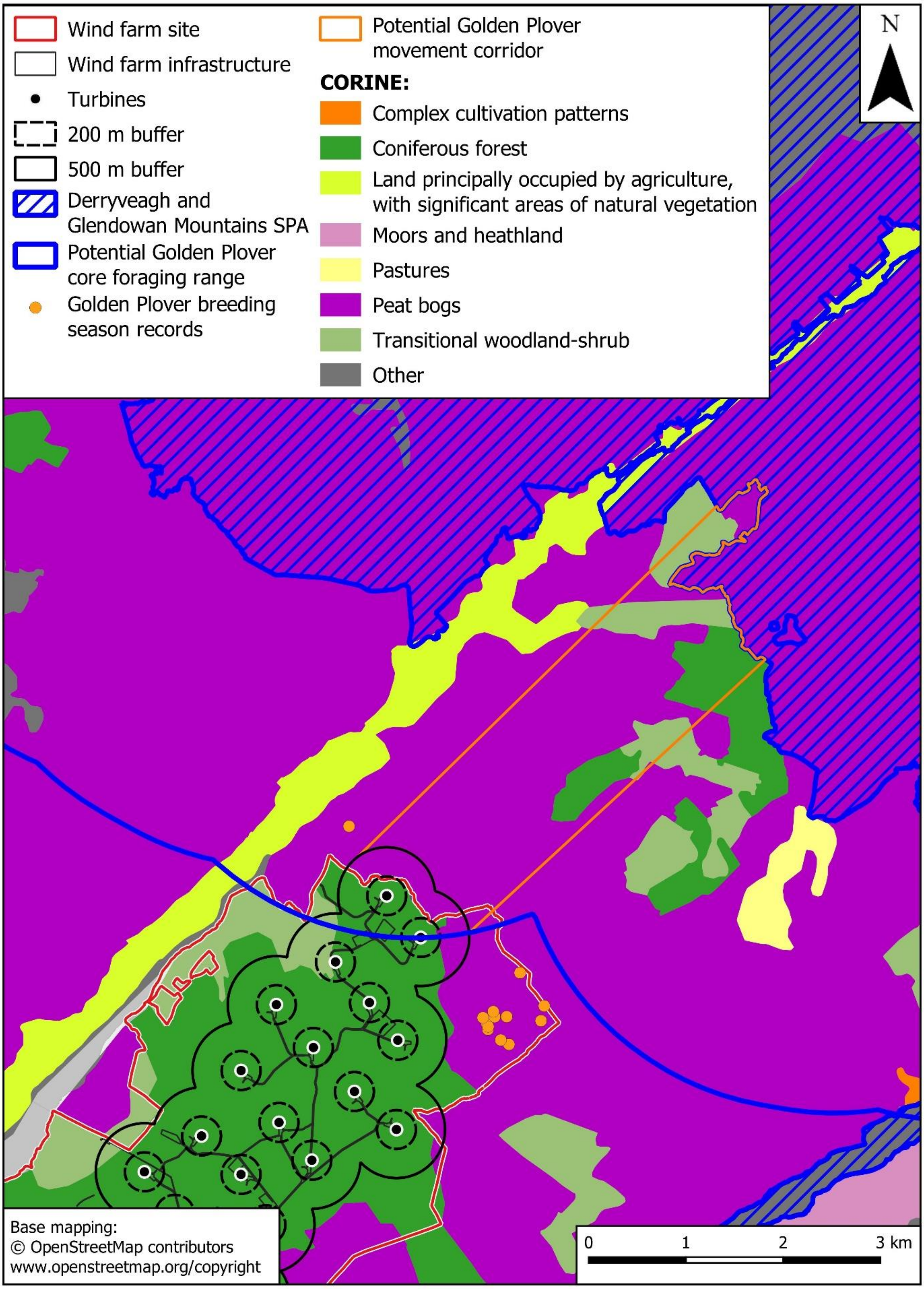

Figure 5-2: Potential connectivity between the wind farm site and the Golden Plover Qualifying Interest of the Derryveagh and Glendowan Mountains SPA.

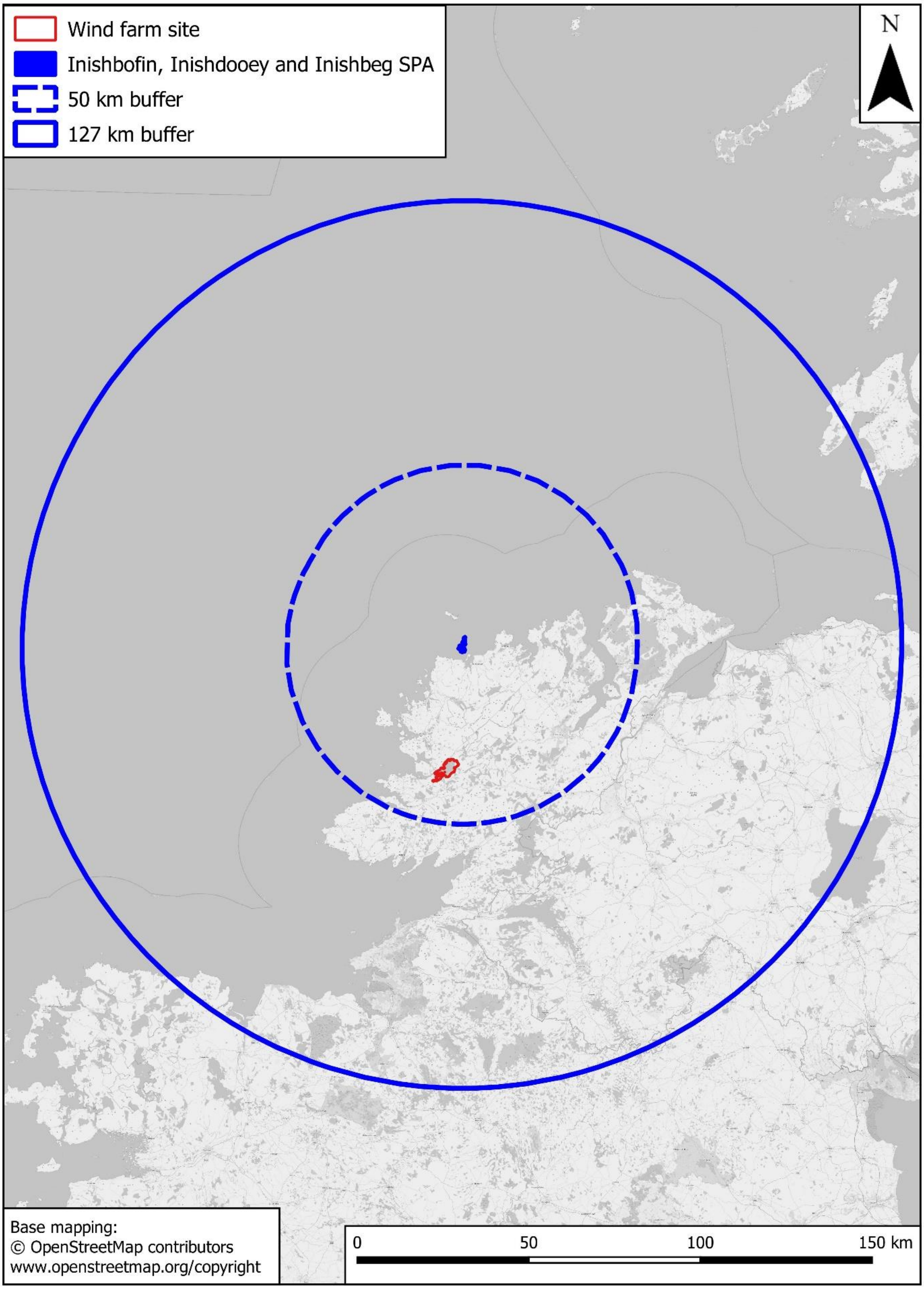

Figure 5-3: Location of the Inishbofin, Inishdooey and Inishbeg SPA, and potential Lesser Black-backed Gull foraging ranges from the SPA, in relation to the Cloghercor Wind Farm site.

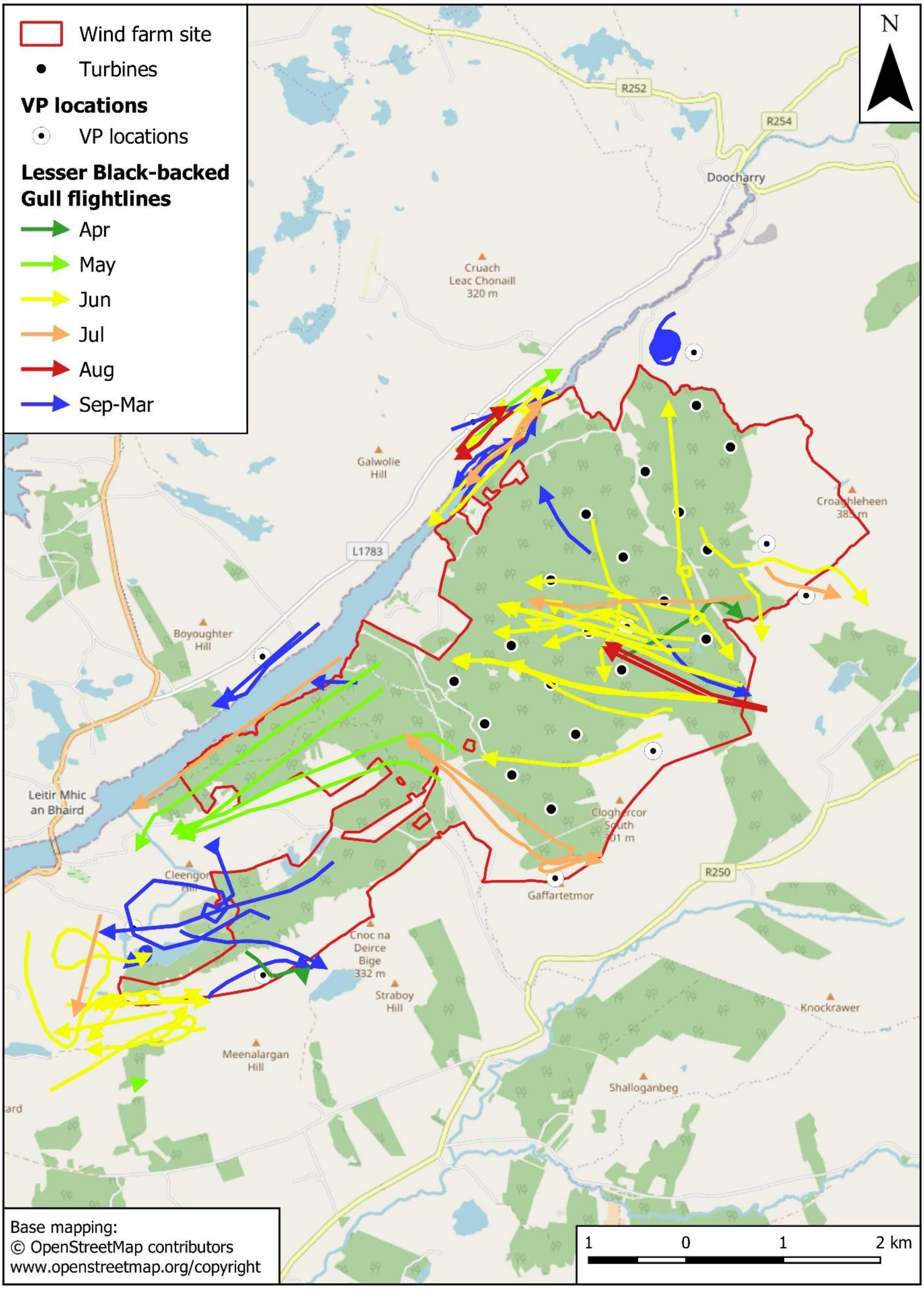

Figure 5-4: Lesser Black-backed Gull flightlines across the wind farm site.

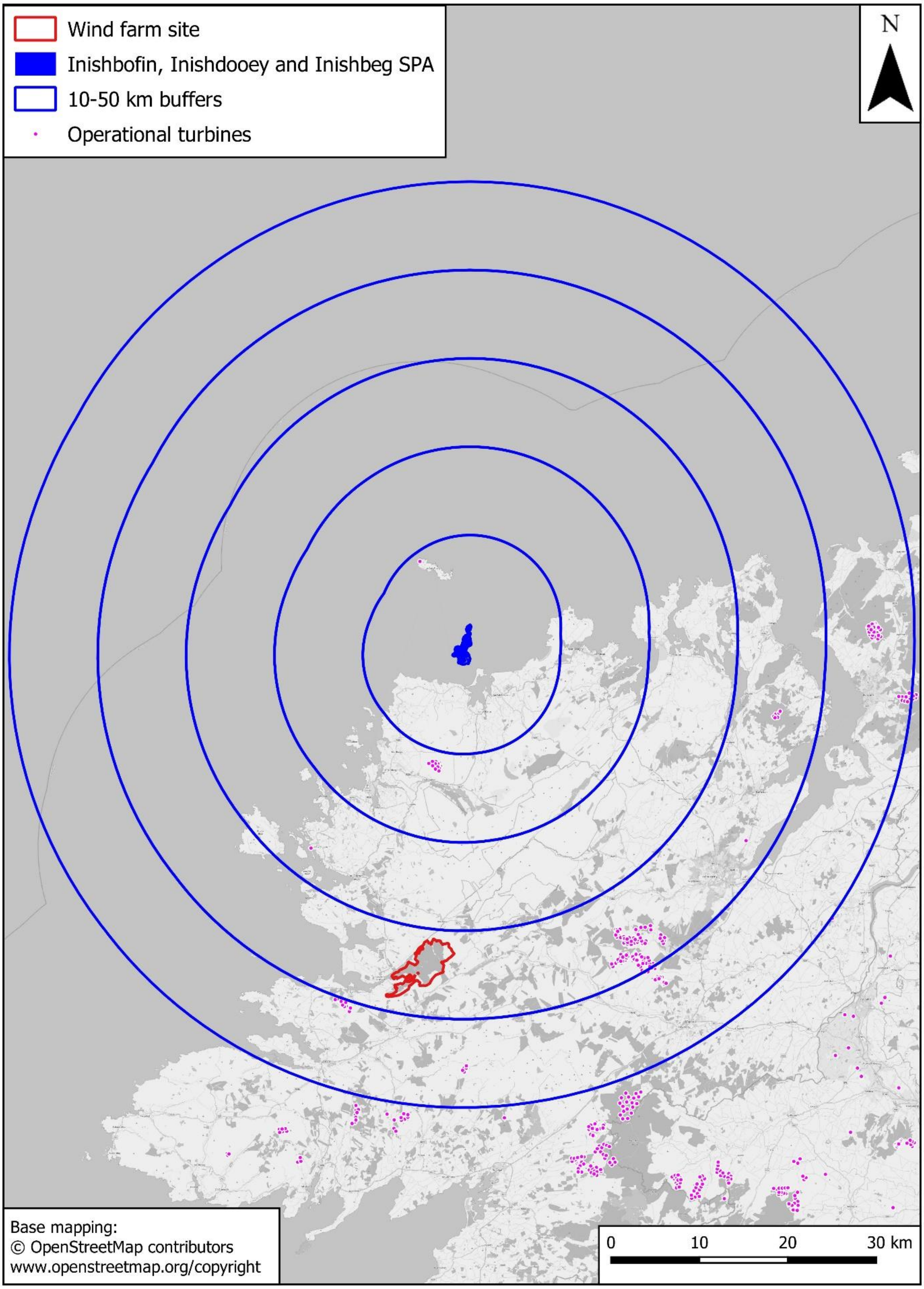

Figure 5-5: Operational turbines within 50 km of the Inishbofin, Inishdooey and Inishbeg SPA.

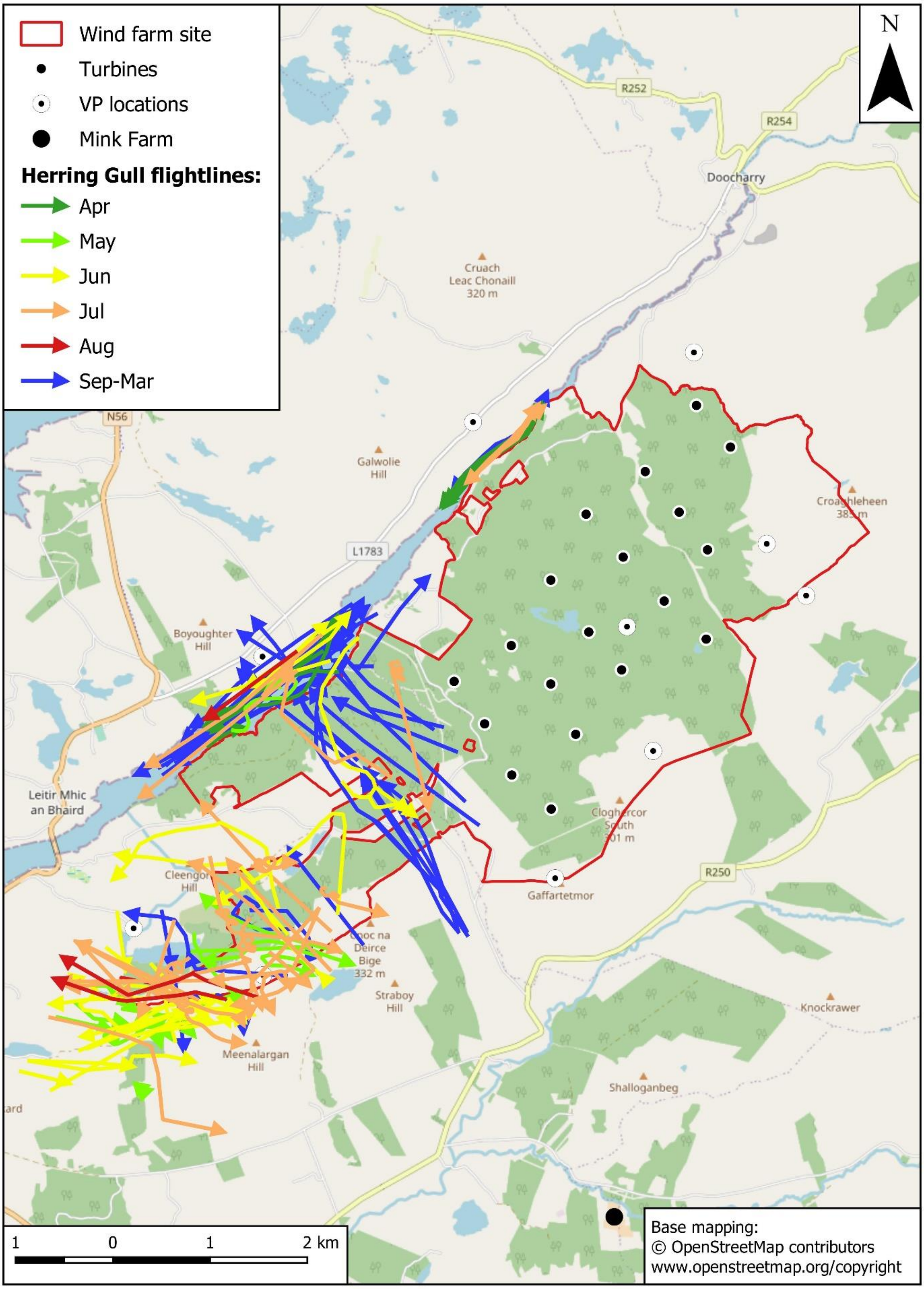

Figure 5-6: Herring Gull flightlines across the wind farm site.

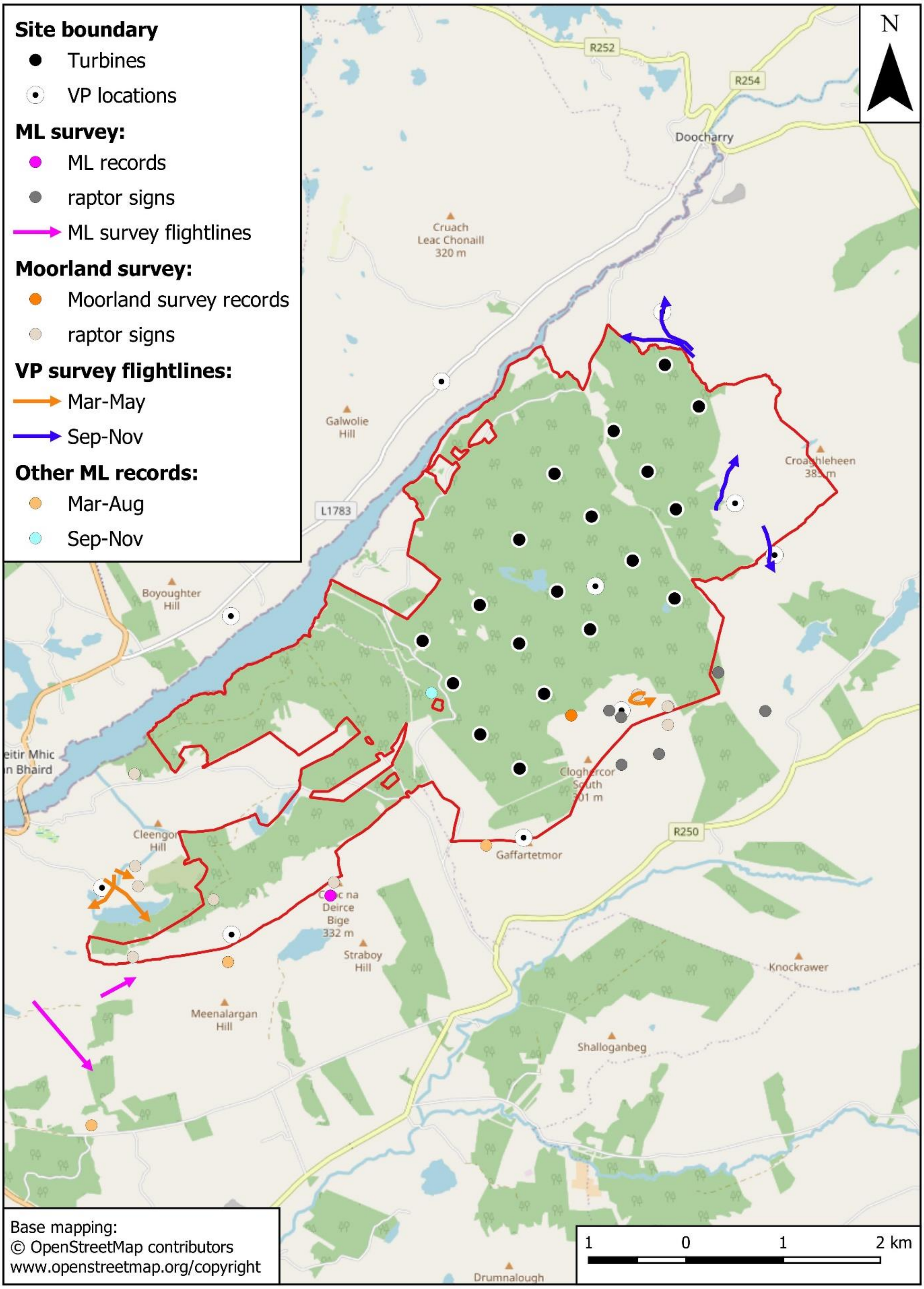

Figure 5-7: Merlin records around the wind farm site.

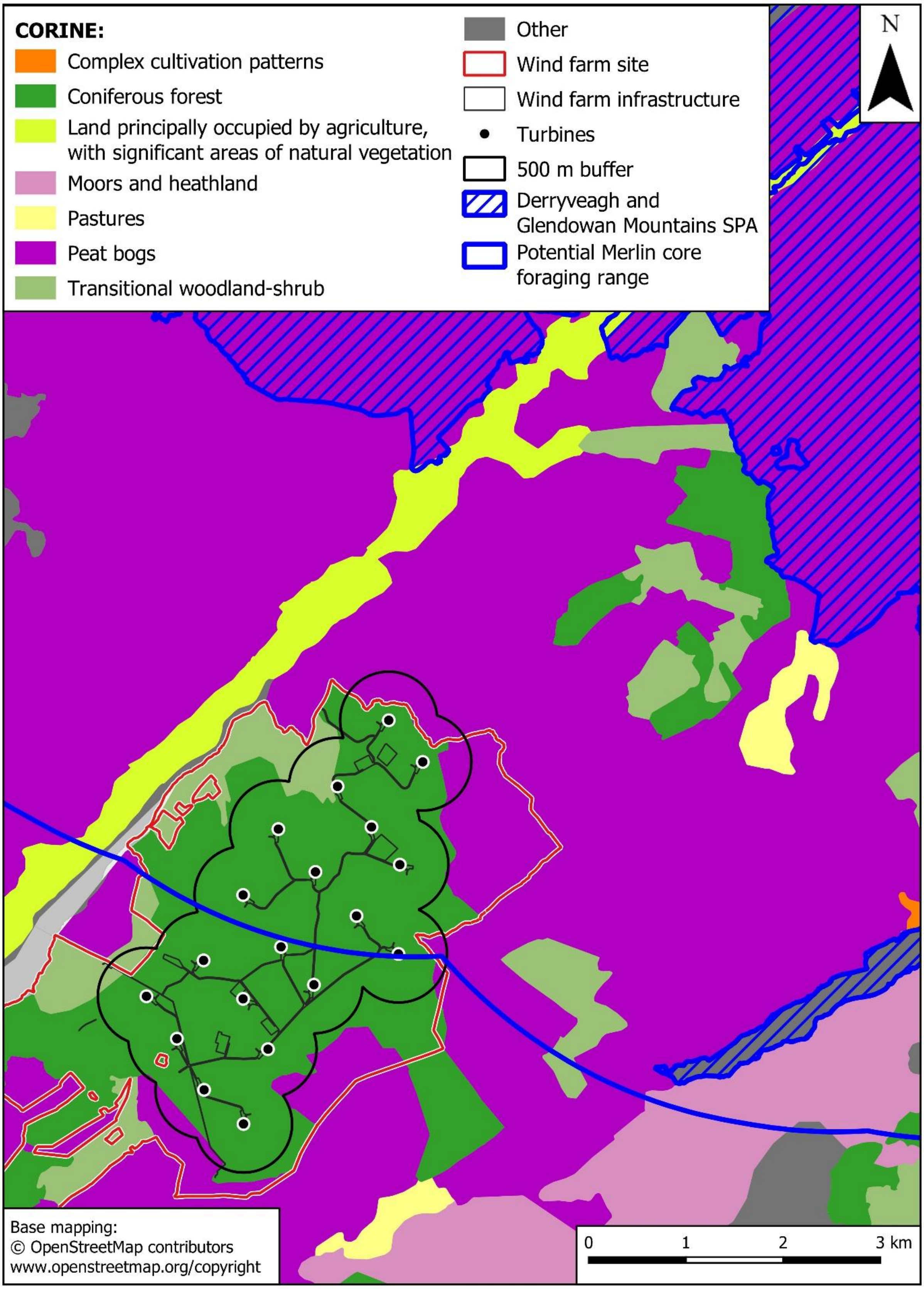

Figure 5-8: Potential connectivity between the wind farm site and the Merlin Qualifying Interest of the Derryveagh and Glendowan Mountains SPA.

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NIS Appendix 1 – Consultation responses

Response received from Inland Fisheries Ireland, July 2021

Should for any reason, oil or fuel be stored in the area it must be kept in a bunded area (providing 110% capacity of the largest stored unit), 100m from any watercourse with appears on an 6" O.S. map of the site. Vehicle maintenance should not occur with 100m of any watercourse and all machinery must be in good working order, free from leakage of fuel or hydraulic fluid.

Roadside drains should not intercept large volumes of water from ground above. Any watercourse, however small that is intercepted by the access routes should be bridged or culverted at that point. The use of fords must be avoided. Culverts should be of a size sufficient to avoid overloading, blocking or washout. The profile of any stream that is crossed must remain the same and any fish movement remain unhindered. Shooting velocities must be avoided. Floating roads must be considered where any peat encountered is one metre or more in depth. Turbine bases at deep peat locations should be piled and these bases should be a minimum 50 metres from watercourses. This separation distance must be increased where fisheries sensitive waters occur.

Erosion of roadside embankments and cuttings should be avoided by using intercepting trenches or terracing. Embankments and cuttings should be kept at no greater slope than the normal angle of repose to encourage re-vegetation, otherwise added stabilisation may be required. It is essential that silt traps and settlement ponds are utilised and are capable of settling out materials prior to discharge off site. These ponds must take into account high precipitation events and designed accordingly, incorporating other treatment measures where necessary. The traps and ponds must be regularly inspected and maintained accordingly.

Existing drainage channels should remain untouched. During the construction period cement and wet concrete must be kept out of all watercourses and drains. Concrete trucks must not wash out on site. These materials are extremely toxic to aquatic life and the construction team must be made fully aware of this. This will be especially important during the construction of the turbine bases.

Track ruttings by machinery movement must be kept to a minimum and no discharge or run off containing high sediment loads must occur from the site. In this regard a contingency plan should be established and strictly adhered to. Any stockpiling of peat or other site materials will require careful management to ensure that slippage or collapse to any adjacent watercourses will not occur. A construction methodology is recommended prior to any works commencing with a view to, among others, minimising the volumes of excavation that will be required.

Consideration should be afforded to the likely increase in surface water flow from the site which has the potential to alter the downstream prevailing hydrological regime and impact on the fisheries resource. In this regard attenuation measures should be identified and implemented in the surface water drainage arrangements.

The monitoring of all surface flows during construction is essential and remote sensing equipment should be considered as a normal precaution and extended into the post construction phase.
. It would be recommended that a suitably qualified person be on site for the duration of works to ensure:

(a) All mitigation measures identified are implemented prior to commencement of works.
(b) Continual assessment to ensure the mitigation measures are effective including assessment of adjacent peats for cracking/instability.
(c) Cessation of works should slippage indicators develop and/or settlement arrangements are inadequate for suspended solid removal in surface waters.
(d) Peat reinstatement is completed according to a detailed restoration plan.
(e) Arrangements are established in relation to a contact protocol of relevant statutory bodies on progress of works.

Response received from Inland Fisheries Ireland August 2022

Iascach Intíre Éireann
Inland Fisheries Ireland

6th of October 2022

TOBIN Consulting Engineers
Galway Office Fairgreen House,
Fairgreen Road,
Galway,
H91 AXK8,
Ireland.

Re: Proposed wind farm, Cloghercor Co. Donegal.

Dear John,

Inland Fisheries Ireland is the statutory authority tasked under section 7(1) of the Inland Fisheries Act 2010 (No. 10 of 2010) with responsibility for the protection, management, and conservation of the inland fisheries resource

In relation to the above development, the following comments are of relevance:

Introduction:

The Gweebarra River catchment is located in north County Donegal within the North Western River Basin District and covers an area of approx. 122 km2 . The River Barra rises between the Glendowan and Derryveagh mountains and flows for approximately 32km in a southwesterly direction through Lough Barra. The Gweebarra River flows out of Lough Barra and continues in a southwesterly direction through the village of Doocharry and meets the sea at Gweebarra Bay. The main tributaries are the Owenwee, Cloghernagore and Croagheen rivers. The catchment has one relatively large lake present, Lough Barra. This is a spate river and includes 16km of estuarine water. This catchment's geology is mixed between granite, slate, shale and schist, with rough pasture and blanket bog as the dominant land uses. The river receives a good run of salmon and sea trout and is well regarded as an angling river. A large proportion of the upper catchment forms part of the Cloghernagore Bog and Glenveagh National Park Special Area of Conservation (SAC) while the lower part of the catchment is situated within the West of Ardara/Maas Road SAC.

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Iascach Intíre Éireann
Inland Fisheries Ireland

The Gweebara catchment area and the surrounding SAC provide prestige habitat and spawning habitat for various species of freshwater fish, these include:

- Atlantic Salmon (Salmo salar) listed in Annex II of the EU Habitats Directive (92/43/EEC),
- Brown Trout (Salmo trutta),
- Sea Trout (Salmo trutta)
- Eel (Anguilla anguilla) which is protected Evaluation of Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel and the Conservation of Eel Fishing Bye-Law No. C.S. 319, 2015

Please Click on links for additional information in relation to the Gweebara fish stock surveys.

http://wfdfish.ie/wp-content/uploads/2020/05/Barra_2020.pdf

http://wfdfish.ie/wp-content/uploads/2020/07/NWIRBD_Gweebarra_2019-1.pdf

The Following Guidance must be followed throughout the lifespan of the development:

1. If it is intended that oil or fuel be stored in or adjacent to the construction site, it must be kept in a bunded area (providing 110% capacity of the largest storage unit), 100m from any watercourse which appears on a 6" O.S. map of the site. Vehicle maintenance should not occur within 100m of any watercourse and all machinery must be in good working order, free from any leakage of fuel, oil or hydraulic fluid.

2. Roadside drains should not intercept large volumes of water from ground above. Any watercourse, however small that is intercepted by the access routes should preferably be bridged or culverted at that point. The use of fords must be avoided. Culverts should be of a size sufficient to avoid overloading, blocking or washout. The profile of any stream that is crossed must remain the same and any fish movement remain unhindered. Shooting velocities must be avoided. Floating roads must be considered where any peat encountered is one metre or more in depth. Piling may be considered for turbine bases at deep peat locations and these bases should be a minimum 50 metres from watercourses. This separation distance must be increased where fisheries sensitive waters occur.

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3. Erosion of roadside embankments and cuttings should be avoided by using intercepting trenches or terracing. Embankments and cuttings should be kept at no greater slope than the normal angle of repose to encourage re-vegetation, otherwise added stabilisation may be required. It is essential that silt traps and settlement ponds are utilised and are capable of settling out materials prior to discharge off site. These ponds must take into account high precipitation events and designed accordingly, incorporating other treatment measures where necessary. The traps and ponds must be regularly inspected and maintained as required.

4. Existing drainage channels should remain untouched. During the construction period cement and wet concrete must be kept out of all watercourses and drains. Concrete trucks must not wash out on site. These materials are extremely toxic to aquatic life and the construction team must be made fully aware of this. This will be especially important during the construction of the turbine bases.

5. Track rutting's by machinery movement must be kept to a minimum and no discharge or run off containing high sediment loads must occur from the site. In this regard a contingency plan should be established and strictly adhered to. Any stockpiling of peat or other site materials will require careful management to ensure that slippage or collapse to any

6. adjacent watercourses will not occur. A construction methodology is recommended prior to any works commencing with a view to, among others, minimising the volumes of excavation that will be required. Site preparation and construction must adhere to best practice and conform to the publication 'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.'

7. Consideration should be afforded to the likely increase in surface water flow from the site which has the potential to alter the downstream prevailing hydrological regime and impact on the fisheries resource. In this regard attenuation measures should be identified and implemented in the surface water drainage arrangements.

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Inland Fisheries Ireland

8. Mitigation measures for the interception of suspended solids must be designed to comply with an upper limit of 25mg per litre for the discharge of Total Suspended Solids (TSS) to surface waters as specified in the Salmonid Waters Regulations, SI 293 of 1988. Buffer zones should not be used for the storage of any materials. Works should be suspended during heavy rains or when there is high risk of pollutants entering adjacent surface waters. Run-off volumes should not exceed the assimilative capacity of the receiving waters.

9. Consideration must be afforded to the possible presence of invasive species and appropriate action taken in eradication utilising current best practice.

It would be recommended that a suitably qualified person as described in the application documentation be on site for the duration of works to ensure:

(a) All mitigation measures identified are implemented prior to and during the construction phase, as appropriate. This is essential in relation to possible peat shear.

(b) Continual assessment to ensure the mitigation measures are effective including assessment of adjacent peats for cracking/instability.

(c) Cessation of works should slippage indicators develop and/or settlement arrangements are inadequate for suspended solid removal in surface waters.

(d) Peat reinstatement is completed according to a detailed restoration plan.

(e) Arrangements are established in relation to a contact protocol for the relevant statutory bodies on progress of works.

Yours sincerely

James Doherty

James Doherty
Environmental Officer, Inland Fisheries Ireland
North-western RBD, Letterkenny District.
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Response received from the Development Applications Unit, August 2021

An Roinn Tithíochta,
Rialtais Áitiúil agus Oidhreachta
Department of Housing,
Local Government and Heritage

Your Ref: **Cloghercor Wind Farm**
Our Ref: **G Pre00186/2021** (Please quote in all related correspondence)

24 August 2021

Tobin Consulting Engineers
Block 10-4
Blanchardstown Corporate Park
Dublin 15

Via email: john.staunton@tobin.ie

Re: Cloghercor Wind Farm Limited - EIAR scoping for the proposed Cloghercor Wind Farm - 23 no. wind turbineswithin a site that extends to approximately 1,962 hectares (ha) of which approximately 299 ha is commercial forest, owned by Coillte and the remaining area is third party property: near Doochary village, County Donegal

A chara

I refer to your pre-planning correspondence received on 23rd June in connection with the above proposed development.

Outlined below are heritage-related observations/recommendations co-ordinated by the Development Applications Unit under the stated headings.

Nature Conservation

The Department welcomes the opportunity to provide observations at this early stage. These observations are intended to assist you in meeting the obligations that may arise in relation to European sites, biodiversity and environmental protection in general in the context of the current application.

The Department has significant concerns regarding the proposed project, due to the presence of sensitive ecological receptors within and or within close proximity to the proposed development site.

Aonad na nIarratas ar Fhorbairt, Oifigí an Rialtais, Bóthair an Bhaile Nua, Loch Garman, Y35 AP90
Development Applications Unit, Government Offices, Newtown Road, Wexford, Y35 AP90
manager.dau@housing.gov.ie
www.gov.ie/housing

The Departments concerns are at this early stage focused on three significant risks to nature conservation arising from the proposed project.

1. Potential impacts to Golden Plover and Merlin populations, a qualifying interest of the Derryveagh and Glendowan Mountains Special Protection Area (SPA) (site code 004039) located <3km distant.
2. Potential impacts to a significant proportion of the national population of breeding Golden Eagle (Annex I Birds Directive species).
3. Potential impacts to Salmon and potentially Fresh Water Pearl Mussel, a qualifying interest for the West of Ardara/Mass road SAC (002301).

1: With regard to impacts to Merlin and Golden Plover populations supporting the Derryveagh and Glendowan Mountains SPA (004039).

The Department suggests that the bird survey areas should be based on the Scottish Natural Heritage guidance (2014) for estimated buffer zones and adopt a 2-4 km turbine buffer for breeding raptors (e.g. Merlin) with an additional 6 km turbine buffer for breeding eagles. This rationale acknowledges the broad zone of influence or likely impact range for wind farm development on raptor species. However, the range of the SNH buffers were selected to broadly determine potential impacts at scales which are likely to influence breeding performance, habitat and nest site selection of a wide range of raptors. In this case, specific considerations need to be given to Merlin because the home range size of breeding Merlin in Western Europe are relatively unknown (Lusby et al., 2017). In Ireland, the 2018 Merlin SPAs Survey (coordinated by Lusby, J.), recorded that the mean distance between Merlin pairs in the Connemara Bog Complex SPA population was 3.2 km, which was comparable to previous estimates for Merlin in Ireland (Lusby et al., 2010). Furthermore, Norriss *et al.* (2010) recorded the mean nearest neighbour distance; which ranged from 2.72 to 5.86 km in five areas where the Merlin population was assessed. Similarly, in Scotland active territories across years that were within 3.5 km of one another were defined as the same territory (Rebecca et al., 1992). This published literature indicates that Merlin territories in Ireland can range from approx. 2km – 6km in scale. In this case, Merlin are an SCI species for the Derryveagh and Glendowan Mountains SPA located in close proximity to the proposed development (<3km).

Likewise, a breeding pair of this species is likely to be vulnerable to aerial noise and visual disturbance at the construction and operational stage of the proposed development. The Department emphasises that collision risk model outputs are only considered to be indicative of the level of risk of fatalities resulting from a proposed wind farm site, and should be considered in conjunction with other discussions within the Avi-fauna section in the Biodiversity Chapter of the EIAR. For instance, the outputs from the model do not take account of potential displacement of birds from the wind farm envelope, which for species breeding within or directly adjacent to the site may be more of a cause for concern, e.g. merlin or eagle. It is also widely acknowledged that the application of CRMs to smaller, evasive species like merlin may not provide an accurate estimate of collision risk, as these species can be difficult to detect over the full extent of the viewsheds for VPs, due diminutive size, cryptic nature and/or flight behaviour'.

Merlin are undergoing declines in population in Ireland (Lusby et al., 2011) with an estimated population of less than 200 pairs (Lusby et al., 2017). There is also a limited understanding of the ecological requirements of the species, factors which impact on the population (lusby et al., 2011). Within this context, the Department adopts a similar stance to NatureScot when assessing impacts to Annex I raptor species and the Department expects developers to devise turbine layouts that avoid the core foraging ranges around recorded nest sites of such species (e.g. Merlin, Eagle). This is particularly important when nest sites are within 6km of European sites for which they are a qualifying Interest/ SCI. In this case the proposed project is within 3km of one of Europe's most important sites for Merlin (range 6-11 pairs). Where this is not possible, the Department expects the developer to provide a clear, full justification for why this is the case, and appropriate long term measures to address this. The Department also expects that none of the habitat management measures proposed should in their own right adversely affect the viability of the relevant raptor populations or of other sensitive bird species.

References:

- *Lusby, John & Corkery, Ilse & Mc Guinness, Shane & Fernández-Bellon, Darío & Toal, Larry & Norriss, David & Breen, Dermot & O'Donaill, Aonghus & Clarke, Damian & Irwin, Sandra & Quinn, John & O'Halloran, John. (2017). Breeding ecology and habitat selection of Merlin Falco columbarius in forested landscapes. Bird Study. 64. 10.1080/00063657.2017.1408565.*
- Scottish Natural Heritage (2014). Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms. SNH Guidance Note (2014 update), SNH.
- *Norriss, D.W., Haran, B., Hennigan, J., McElheron, A., McLaughlin, D.J., Swan, V. & Walsh, A. 2010. Breeding biology of Merlins Falco columbarius in Ireland, 1986–1992. Irish Birds 9: 23–30*
- *Lusby, J., Férnandez-Bellon, D., Norriss, D., & Lauder, A. 2011. Assessing the effectiveness of monitoring methods for Merlin Falco columbarius in Ireland: the Pilot Merlin Survey 2010. Irish Birds 9: 143–154.*
- *Rebecca, G.W., Cosnette, B.L., Hardy, J.J.C. & Payne, A.G. 1992. Status, distribution and breeding biology of the Merlin in Northeast Scotland, 1980–1989. Scot. Birds 16: 165–183.*

With regard to impacts to Golden Plover

The Department has concerns regarding risks associated with the proposed project to breeding Golden plover.

The Departments last Article 12 submission to the European Commission listed <100 breeding pairs of Golden Plover in Ireland. This Annex 1 listed species has undergone a severe decline in recent decades (circa 83% since the early 1970s) and therefore is red listed under BWI & RSPB NI's BOCCI list. The above is a sufficient basis to say that these breeding populations are of high importance in terms of Irish and International bird conservation. This publically available information should provide a useful basis to inform the assessment of the impact of the development on these bird populations. The NIS should assess potential connectivity with and impacts to the Derryveagh and Glendowan Mountains SPA (004039) for which Golden Plover are an SCI. The EIAR should assess risks to the national population and the NIS should also assess risks flowing from this assessment to the potential for SPA sites locally, regionally and nationally to meet their conservation objectives.

2: With regard to potential impacts to a significant proportion of the national population of Annex I (Birds Directive) breeding Golden Eagle.

The Department highlights that these large raptors have low fecundity and as a result even low rates of mortality are likely to result in effects at the national population level. Eagle species are classed as High sensitivity to wind farm developments and avoidance behaviour leading to displacement should be considered in light of best scientific knowledge in the field within the EIAR. The Department highlights that EIA is a scientific process and conclusions must be supported by scientific evidence from data collected during surveys and or peer reviewed literature. Furthermore, the Department notes that outputs from a Collision risk model do not take account of potential displacement of birds from the wind farm envelope, which for species breeding within or adjacent to the site may be more of a cause for concern. Indeed, the Department is aware of a Golden eagle nest site located within 2km of the development site. Until the bird surveys are complete it is difficult to determine the import of the proposed development site for the pair, but it is likely that the development site forms an integral part of the home range /core territory of the pair nesting in such close proximity. This pair constitutes approx. 20% of the national breeding population of this Annex I species and it follows that potential impacts to this breeding pair, must be considered to constitute a potential impact to the national population.

3: Potential impacts to water quality leading to impacts to Fresh Water Pearl Mussel and or Salmon in the West of Ardara/Mass road SAC (002301).

The Department notes that the proposed development site is hydrologically connected to the West of Ardara/Maas Road SAC.
The Department also notes that the proposed development will require the felling of forestry and excavation of peat and topsoil substrates in order to facilitate the construction of the turbine bases, surrounding hard-standing and access roads. The Department recommends that a comprehensive assessment of effects arising from peat slippage events is undertaken and referenced in the NIS and EIAR. The Department highlights the effects of the recent Meenbog Peat Slippage on the River Finn SAC, the River Foyle and Tributaries SAC at considerable distance (>60km). This event indicates that dilution over

distance is not an adequate mitigation technique for preventing impacts to water quality and or habitat deterioration for Salmon. Likewise, streams located upslope of the West of Ardara/Maas Road SAC, are likely to represent important spawning habitat for the populations of salmon that support the downstream European site. On this basis these watercourses, should be considered to be highly sensitive to effects arising as a result of the proposed development.

In summary, the potential risks to Salmon and potentially FWPM associated with project are very high. Potential impacts to FWPM are irreversible and permanent. FWPM are currently classified as in unfavourable condition in West of Ardara/Maas Road SAC due to a combination of compounding pressures (e.g. eutrophication from forestry and effluent as well as silt laden waters resulting from development in upland peaty based sites). The Department is concerned that in combination and or cumulative effects arising from the project will result in adverse impacts to the European sites ability to meet its conservation objectives.

General Comments

The Department notes that maxima sizes not specific sizes are used in the assessment of impacts to nature conservation and highlights the recent judicial review regarding this practice[1].

The NIS should not contain substantial cross referencing to the EIAR this is because EIA and AA are separate assessment processes designed to address independent risks and subjects. Cross referencing should be omitted and overlapping elements of the CEMP and or EIAR should be included within the NIS text or as appendices.

The Department highlights that NPWS has no post consent role and references to liaison and or consultation with NPWS do not constitute mitigation and do not address risks arising to Qualifying Interest species and or habitats that support European sites.
Mitigation must be concise, sufficiently detailed to ensure no adverse impacts occur and proven to be effective (i.e. the efficacy of experimental methods or techniques can only be assessed post competition and their outcome is uncertain).
All stages of a project including the decommissioning must be assessed in the NIS to inform the AA which must contain complete and concise information on the long term effects and impacts of the development.

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[1] **Sweetman v APB [2021] IEHC 390 (High Court (Judicial Review), Humphreys J, 16 June 2021)**

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The Department emphasises that the level of detail provided in the NIS must eliminate reasonable scientific doubt as to the absence of effects[2] to QI and or SCI species for European sites. Moreover, the NIS should be conducted following the Department of the Environment, Heritage and Local Government guidance 'Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities' (DoEHLG, 2010). As stated in that guidance document, the requirement of the AA is not to prove what the impacts and effects will be, but rather to establish beyond reasonable scientific doubt that adverse effects on site integrity will or will not result.

In summary, based on the information supplied, the Department cannot provide a definitive degree of risk but considering what is currently known, NPWS and the Department have significant concerns regarding the proposed development. This is because the Department is of the view that national and European level populations of threatened birds as well as several European sites are at risk from the development.

Finally, the Department highlights that case law indicates that an appropriate assessment (and by implication an NIS) must examine the implications of the project for the QIs, or the SCIs, of the European site concerned, in view of the site's conservation objectives and in light of the best scientific knowledge in the field[3]. The assessment cannot have lacunae or gaps, and must contain complete, precise and definitive findings and conclusions[4]. Competent authorities can authorise a plan or project only if they have made certain that it will not adversely affect the integrity of a European site. This is so when there is no reasonable scientific doubt as to the absence of such effects[5].

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[2] Case 243/15 *Lesoochranárske zoskupenie VLK v. Obvodný úrad Trenčín* EU:C:2016:838
[3] Case 127/02 *Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v. Staatssecretaris van Landbouw, Natuurbeheer en Visserij* EU:C:2004:482
[4] Case 521/12 *T.C. Briels v. Minister van Infrastructuur en Milieu* EU:C:2014:330
[5] Case 243/15 *Lesoochranárske zoskupenie VLK v. Obvodný úrad Trenčín* EU:C:2016:838

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You are requested to send further communications to the Development Applications Unit (DAU) at **manager.dau@housing.gov.ie**, or to the following address:

The Manager
Development Applications Unit (DAU)
Government Offices
Newtown Road
Wexford
Y35 AP90

Is mise, le meas

Diarmuid Buttimer
Development Applications Unit

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NIS Appendix 2 – Aquatic Report

TOBIN
CONSULTING ENGINEERS
BUILT ON KNOWLEDGE

Cloghercor Wind Farm Ltd

Cloghercor Wind Farm, Co. Donegal

Aquatic Report February 2023

Table of Contents

Table of Figures

Table of Tables

Table of Plates

1.0 INTRODUCTION

Cloghercor Wind Farm Ltd. are proposing to develop a wind farm development at Cloghercor, Co. Donegal. It is proposed to supply the power from the Cloghercor Wind Farm to the Irish electricity network via loop-in 110kV underground cables (approximately 4.01km cable length within approximately 3.36km of internal access roads) to the existing overhead 110kV power line in the townland of Cloghercor, Co. Donegal. Further information on the proposed project is provided in Section 3.0 of this report.

This report has been prepared by suitably, qualified ecologists within TOBIN Consulting Engineers (TOBIN) on behalf of Cloghercor Wind Farm Ltd. to accompany a planning application for the proposed project (a Statement of Authority is provided in Section 2.3 of this report). TOBIN undertook freshwater aquatic assessments for the proposed wind farm development.

The proposed wind farm site is comprised of forestry, upland blanket bog and lakes. A number of watercourses flow through the subject site. All the watercourse flow in a north-westerly direction towards the Gweebarra River which flows in a south-westerly direction before discharging to the Atlantic Ocean approximately 7km from the western site boundary. The subject site is mountainous in nature with ground levels ranging from approximately 1mOD at the north-western corner of the subject site up to 275mOD at the southern boundary of the subject site. The site falls in a westerly direction, with the western boundary of the subject site low lying, and the eastern side of the subject site considerably higher.

The purpose of this report is to identify, quantify, and communicate the risks to aquatic species or habitat, if any. The report assesses at the entire land holding including the proposed wind farm, as one subject site.

2.0 METHODOLOGY

2.1 Desk Study and Information Sources

The ecological desktop study completed for the proposed project comprised of a review of the following key datasets and information sources:

- Identification of European sites within the Zone of Influence (ZoI) of the proposed wind farm area through the identification of potential pathways/links from the proposed wind farm area and European sites and/or supporting habitats;
- Review of the National Parks and Wildlife Service (NPWS) site synopsis, Natura 2000 data forms and Conservation Objectives for European sites identified through potential pathways from the proposed upgrade[1];
- NPWS datasets on Annex I habitats and Annex II species;
- Review of available literature and web data. This included a detailed review of the NPWS database of areas designated (and proposed) for nature conservation[2] and National Biodiversity Data Centre (NBDC)[3] websites and database including mapping and

[1] National Parks and Wildlife Service: https://www.npws.ie/protected-sites
[2] National Parks and Wildlife Service: https://www.npws.ie/maps-and-data
[3] National Biodiversity Data Centre (NBDC): https://maps.biodiversityireland.ie/Map

available reports for relevant sites and in particular Qualifying Interests and Special Conservation Interests described and their Conservation Objectives;

- Review of Inland Fisheries Ireland (IFI) research data. This included reviewing research studies carried out for the Habitats Directive and Red Data Book Fish species within the receiving environment[4];
- Information and data on water catchments from the River Basin Management Plan 2018-2021[5];
- GSI Online mapping[6];
- Environmental Protection Agency (EPA) Appropriate Assessment tool[7];
- Information and data on water catchments from the River Basin Management Plan 2018-2021[8];
- Google Maps/Bing Maps;
- Ordnance Survey of Ireland maps;
- Heritage map viewer[9]; and
- Review of previous ecological assessments undertaken within the area.

2.2 Consultations

A pre-planning consultation letter was sent to Inland Fisheries Ireland (IFI) on the 21st of June 2021 (with a follow up in September 2022) to inform the Departments of the proposed project and to discuss potential environmental sensitivities associated with the proposed works.

TOBIN received information from IFI in response to the proposed windfarm development Consultation on the 6th October 2022.

The response highlighted that the proposed site is located within the Gweebarra River catchment. It highlighted its location, size and the rivers and lakes located within it. It also outlined the significant importance of this catchment in relation to fisheries. Links to previous fisheries research reports in relation to the Gweebarra fish stock surveys were provided in the response.

Based on this knowledge and information, it recommended mitigation measures and guidelines to adhere to throughout the lifespan of the development.

An initial email response received on the 23rd July 2021 had contained generic information relating to EIAR considerations for large wind farm projects.

2.3 Statement of Authority

Sinead O'Reilly (M.Res.) is a Senior Ecologist with TOBIN Consulting Engineers. She holds an honours degree in Zoology from University College Dublin and Research Masters in Science in

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4 https://www.fisheriesireland.ie/Projects/habitats-directive-and-red-data-book-fish-species.html
5 https://www.catchments.ie/guide-water-framework-directive/
6 http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228
7 EPA Appropriate Assessment tool: https://gis.epa.ie/EPAMaps/AAGeoTool
8 EPA: www.catchments.ie
9 Data from the Heritage Map Viewer accessed through the heritage map viewer: https://heritagemaps.ie/WebApps/HeritageMaps/index.html

Freshwater Ecology from University of Glasgow. Ms O Reilly has over 14 years of professional experience in scientific research in freshwater ecology and environmental consultancy specialising in fisheries. Sinead has prepared and delivered annual research reports, research papers, preparation of screenings for Appropriate Assessment (AA), Natura Impact Statements (NIS), Invasive Species reports, mammal survey reports and other relevant documents. Sinead has a strong technical background as a freshwater ecologist and has extensive field survey experience in all freshwater habitats, terrestrial habitats and mammal activity across Ireland.

Cian Ó Ceallaigh (BSc (Hons), MSc) of Ó Ceallaigh Ecology is an Associate member of the Chartered Institute of Ecology and Environmental Management (ACIEEM) who has extensive botanical and habitat knowledge (FISC Level 4, 2018) and has worked as a professional ecologist in Ireland and Britain since 2017. Cian has experience undertaking AA Screening reports in Ireland as well as Preliminary Ecological Appraisals (PEAs) and other species-specific survey reports in Britain.

2.4 Aquatic Field Surveys

2.4.1 Lake Survey

An ecological survey of the Lough Aneans More (hereafter referred to as the Lake) was carried out on the 18th of August 2022 by Cian Ó Ceallaigh.

Habitats were described and mapped following the standard scheme for classifying habitats in Ireland. The dominant plant species were recorded, and habitats were classified according to their vegetation types. Where appropriate consideration was given to whether habitats qualify, or could qualify, as corresponding Annex 1 habitats. Relative plant species abundance was estimated using the DAFOR scale[10]. The scientific names for plant species use nomenclature given in An Irish Flora (Parnell, J. & Curtis, T., 2012[11]).

To determine whether the Lake contains Annex I habitat(s) (namely 3110, 3130 or 3160), its margins were walked and species within the benthic zone were identified and recorded. An interpretation of the lakes' plant communities/Annex habitat(s) was then carried out using the species recorded and information on the lakes' physical characteristics. Guidance was taken from O Connor (2015)[12] to aid interpretation of potential Annex habitats within the Lake.

2.4.2 River Surveys

A baseline aquatic ecological assessment was carried out on selected streams and rivers of the Mulnamin Beg_010 throughout the proposed wind farm site where accessible. These steams were all located on the north western side of the proposed wind farm site within proximity to the proposed turbine locations. The biological water quality establishment would provide baseline readings against which future water quality targets could be gauged. These values should not deteriorate as a result of works associated with the project. According to the Water Framework Directive (2000/60/EEC) target 'good status' i.e. Q4 is required in all Irish Rivers.

[10] The DAFOR scale has been used to estimate the frequency and cover of the different plant species as follows: Dominant (D) - >75% cover, Abundant (A) – 51-75% cover, Frequent (F) – 26-50% cover, Occasional (O) – 11-25% cover, Rare (R) – 1-10% cover., The term 'Locally' (L) is also used where the frequency and distribution of a species are patchy and 'Edge' (E) is also used where a species only occurs on the edge of a habitat type.
[11] Parnell J. and Curtis T. (2012) Webb's An Irish Flora. Cork: Cork University Press 8th ed.
[12] O Connor, Á. (2015) Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland

Surveys were conducted by Tobins Senior Ecologist Sinead O' Reilly during base flow conditions between 20th-22nd September 2021. The locations of the survey sites are given in Table 2-1 and also shown in Figure 2-1 below. These surveys included an aquatic assessment of the riverine habitat available to support fish and aquatic species, an assessment of the macroinvertebrate community and an analysis of the biological water quality of the watercourse. The purpose of the surveys was to assess the overall aquatic habitat value of the streams and rivers within and downstream of the proposed wind farm, particularly in relation to protected species such as Atlantic salmon (*Salmo salar*), lamprey (*Lampetra* spp.) and white-clawed crayfish (*Austropotamobius pallipes*).

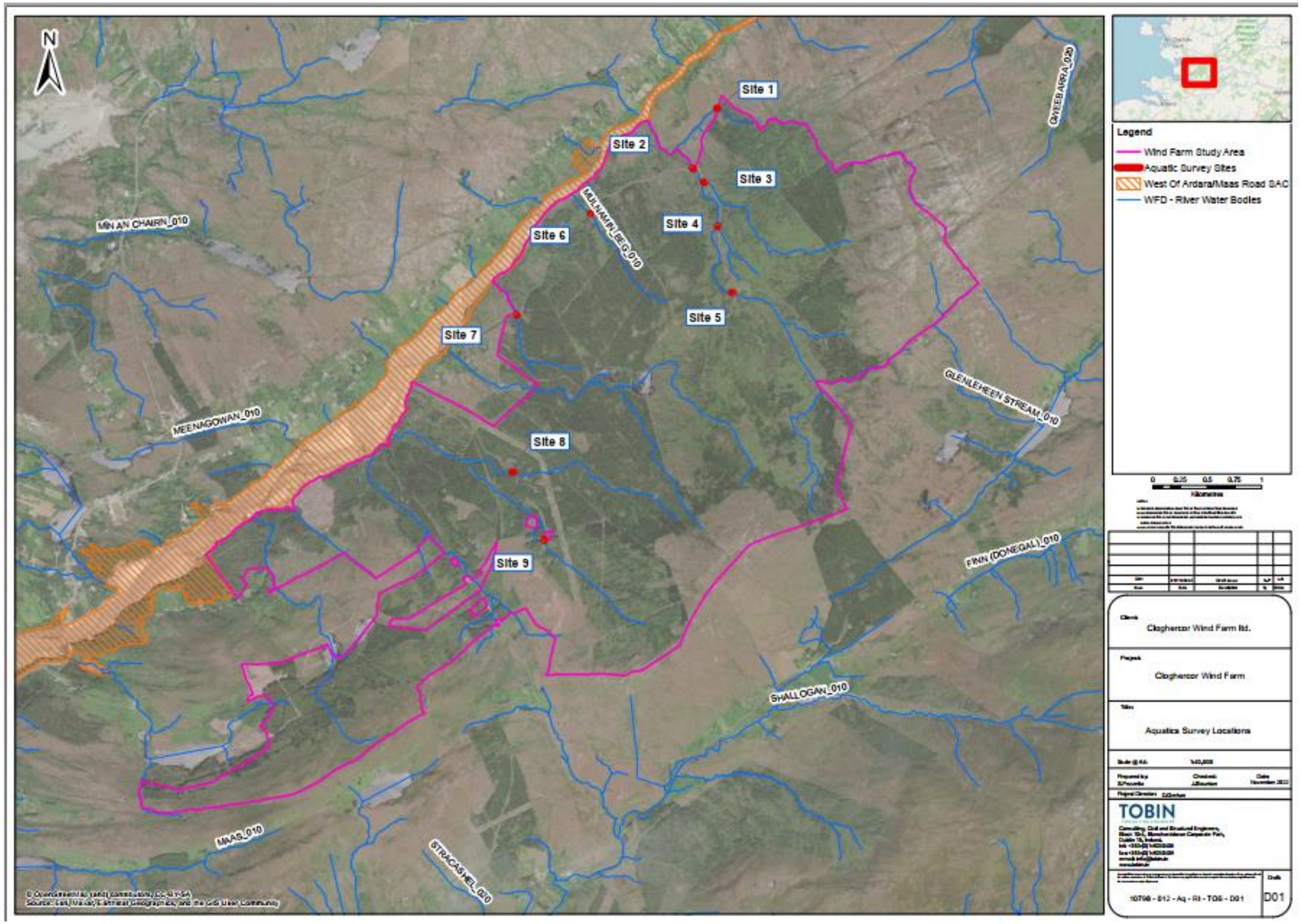
Nine survey sites were, where feasible, selected relevant to the proposed works areas including installation sites for turbines and road crossings. Sites were selected based on their location within and outside the proposed wind farm site boundary, available access, previous Q-Value Status from EPA surveys, and stream order, giving a good representation of the overall aquatic ecology throughout the study area.

Due to the topography of the site and very limited access, it was not feasible to survey sites downstream of the site boundary line. These aquatic survey locations were not directly within the footprint of any proposed turbine. No surveys were conducted in the Gweebarra estuary which is located directly outside the site boundary. Rare / protected / conservation interest aquatic species such as Otter were also searched for at each survey site. The site locations are provided in the table below.

Table 2-1: Location of Sampling Sites within the Proposed Wind Farm Site

Site Number	River Waterbody Code	Catchment	ITM (x)	ITM (y)
Site 1	IE_NW_38M290990	38 Gweebarra-Sheephaven	585618	904456
Site 2	IE_NW_38M290990	38 Gweebarra-Sheephaven	585401	903906
Site 3	IE_NW_38M290990	38 Gweebarra-Sheephaven	585507	903785
Site 4	IE_NW_38M290990	38 Gweebarra-Sheephaven	585625	903374
Site 5	IE_NW_38M290990	38 Gweebarra-Sheephaven	585780	902761
Site 6	IE_NW_38M290990	38 Gweebarra-Sheephaven	584453	903486
Site 7	IE_NW_38M290990	38 Gweebarra-Sheephaven	583787	902560
Site 8	IE_NW_38M290990	38 Gweebarra-Sheephaven	583738	901120
Site 9	IE_NW_38M290990	38 Gweebarra-Sheephaven	584037	900502

Figure 2-1: Location of Sampling Sites Within the Proposed Wind Farm Site



2.4.2.1 Riverine Habitat Survey

A broad aquatic habitat assessment was conducted at the nine selected sampling sites utilising elements of the methodology given in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003[13]) and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000).

All sites were assessed in terms of:

- Stream width and depth and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area.
- In-stream macrophyte, bryophytes occurring and their percentage coverage of the stream bottom at the sampling sites.
- Riparian vegetation composition.

Each sampling site along the watercourse was described in terms of the important aquatic habitats and species recorded (i.e. based on their conservation value). This determined the ecological evaluation of each aquatic survey site and informed site-specific mitigation for the proposed wind farm.

Watercourse characteristics including bankside vegetation, substrate and flow rate were recorded onsite.

A number of physical habitat variables were measured at each site. These included; the percentage of overhead shade present, percentage of substrate type and instream cover, bank height and bank width. The percentage of riffle, glide and pool was also measured over each site surveyed.

2.4.2.2 General Fisheries Habitat

A broad appraisal / overview of the upstream and downstream habitat at each site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fisheries habitat. River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (EA, 2003) and Fishery Assessment Methodology (O'Grady, 2006)[14] to broadly characterise the river sites (i.e. channel profiles, substrata etc.).

An assessment was made on the suitability of the habitat for aquatic species of conservation concern (e.g. White-clawed Crayfish, River Lamprey (*Lampetra fluviatilis)*, Brook Lamprey (*Lampetra planeri*) and Atlantic salmon). Aquatic surveys were conducted along the selected sites and consisted of kick sampling for invertebrates to assess water quality. The data collected was robust and allowed TOBIN to draw accurate, definitive and coherent conclusions on the possible impacts of the proposed wind farm on ecological receptors. During these surveys, areas

[13] Environment Agency (2003). River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual: 2003. Bristol.
[14]O'Grady, M.F. (2006) Channels and challenges: enhancing Salmonid rivers. Irish Fresh- water Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin.

of scientific and/or conservation interest in the vicinity of the proposed wind farm were investigated.

Aquatic plants as well as rare and/or protected plant species and non-native flora were recorded at each site where present. Plant species nomenclature followed '*New Flora of the British Isles*' (Stace 1997)[15]. The results of the physical habitat study were used in conjunction with an advisory leaflet from the Department of Agriculture for Northern Ireland, '*The Evaluation of habitat for Salmon and Trout*' to assess habitat suitability for salmonids. An evaluation of potential lamprey habitats within the study area was made with reference to NPWS Irish Wildlife Manuals lamprey surveys (O'Connor, 2007[16]).

2.4.2.3 Macroinvertebrate Survey

Semi-quantitative sampling of benthic (or bottom dwelling) aquatic macroinvertebrates was undertaken at selected sites using standard EPA kick-sampling methods (EPA 2021). Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected. The Quality Rating (Q) System (Toner *et al.,* 2005)[17] and the Small Streams Risk Score (SSRS) was used to obtain a water quality rating for each site.

The Biological River Classification System (Q-Scheme)

Biological water quality was assessed by the Q-value methodology, following the Standard Operating Procedures of the EPA (2021). The Biological River Quality Classification System (Q-Scheme) has been in use in Ireland since 1971. It has undergone a number of modifications since then and has been included in the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998. It is routinely employed by the EPA.

In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results. For the purpose of this assessment benthic invertebrates have been divided into five indicator groups according to tolerance of pollution, particularly organic pollution (Lucey *et al.*, 1999)[18]. The Biotic Index is a quality measurement for freshwater bodies that range from Q1 – Q5 with Q1 being of poorest quality and Q5 being pristine/unpolluted (see Table 2-2).

Table 2-2: Biotic Index scoring system for the Q-Scheme

Biotic Index	Quality Status	Quality Class
Q5, 4-5, 4	Unpolluted	Class A
Q3-4,	Slightly Polluted	Class B
Q3, 2-3	Moderately Polluted	Class C
Q2, 1-2, 1	Seriously Polluted	Class D

[15] Stace, C.A. (1997). New Flora Of The British Isles, Second edition 1130 pages. Cambridge University Press, Cambridge.
[16] O'Connor, W. (2007) *A survey of juvenile lamprey populations in the Corrib and Suir catchments*. Irish Wildlife Manuals No. 26. National Parks and Wildlife Service.
[17] F, Toner & J, Bowman & J, Clabby & Lucey, J. & Mcgarrigle, Martin & Concannon, C. & Clenaghan, C. & Cunningham, Peter & Delaney, J. & O'Boyle, Shane & MacCárthaigh, M. & Craig, M.. (2005). Water Quality in Ireland 2001-2003.
[18] Lucey, J., Bowman, J. J., Clabby, K. J., Cunningham, P., Lehane, M., MacCarthaigh, M., McGarrigle, M. L. & Toner, P.F. (1999). Water quality in Ireland 1995-1997. EPA. Ireland. 796pp.

Small Stream Risk Score

The Small Streams Risk Score (SSRS) is a biological risk assessment system for identifying rivers that are definitely 'at risk' of failing to achieve the 'good' water quality status goals of the Water Framework Directive (WFD). It was developed by the EPA in association with the Western River Basin District (WRBD) in 2006.

The SSRS method is a rapid field methodology for risk assessment that is based solely on Macroinvertebrate indicators of water quality and their well-understood response to pollution. Importantly the SSRS score indicates whether or not the stream is at risk from pollution and not the ecological health of the stream. The SSRS score ranges from 0-11.2.

In this method, the macroinvertebrates present in the water course are analysed and a grade of water quality is given to the water course based on the numbers and types of macroinvertebrate species present. The system looks at five main groups of macroinvertebrate;

- Ephemeroptera (Mayfly)
- Plecoptera (Stonefly)
- Trichoptera (Caddis Fly)
- G.O.L.D. (Gastropods, Oligochaetes, Leeches, Diptera)
- Asellus

Each group is given a score based on the number of taxa present and their abundance. Species that are more sensitive to pollution (e.g. Mayfly) are given a higher score and those that are more tolerant of pollution (e.g. Asellus) are given a lower score. To obtain the final score, the score associated with each group is added together and divided by 5 to get an average result. This average is then multiplied by two to give the final Small Streams Risk Score (SSRS). Table 2-3 below shows the categories associated with the final score.

Table 2-3: Small Streams Risk Score Categories

SSRS score	Quality Status
<6.5	Stream at Risk
>6.5-7.25	Indeterminate stream may be at risk
>7.25	Probably not at risk

A semi-quantitative, two-minute macroinvertebrate kick-sample was collected from the riverbed, from the faster flowing riffle habitats where possible. A further one-minute hand search was carried out to locate macroinvertebrates that may have remained attached to the underside of the cobbles. This sampling approach is sufficient to achieve a suitable representation of taxa for bioassessment. Occasionally, when the substratum (e.g. bedrock) or flow conditions made kick-sampling difficult, or the abundance of macroinvertebrates collected was extremely low, it was necessary to spend a longer amount of time sampling the river to accumulate a sufficient diversity and abundance of macroinvertebrates. This sampling approach requires avoidance of obvious localized disturbance (e.g. cattle access points) which may adversely influence the sample taken.

Kick sampling involved the use of a standard 500µm mesh D-shaped kick net, which was placed on the riverbed with the mouth of the net directed upstream. The area just upstream of the net was disturbed (with the foot, in a kicking motion) for two minutes in order to dislodge invertebrates, which were subsequently caught in the net. The surveyor moved in a diagonal direction upstream to ensure that different micro-habitats in the waterbody, such as fast moving riffles, glides and pools were included in the sample during the two minutes. The percentage of time allocated to each habitat was estimated based on the percentage each habitat present within the sample area. This ensured that a representative sample of the site was collected. After kick sampling, stone washing and weed sweeping were also carried out at available habitats.

Once a live sample was collected, the macroinvertebrate assemblages of each sample were identified and counted on the river bank. The resulting species list was then used to assign a Biotic Index value (Q-Value, SSRS) to the sampled streams. This involved recording the taxa present at a suitable and attainable taxonomic resolution and their categorical relative abundance determined using approximate counts. Once all taxa and their relative abundance were recorded, the sample was returned to the river.

2.4.2.4 Biosecurity

A biosecurity protocol recommended by IFI was also adhered to during the surveys. All equipment and PPE used was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens between sites, according to standard IFI biosecurity protocols[19].

3.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

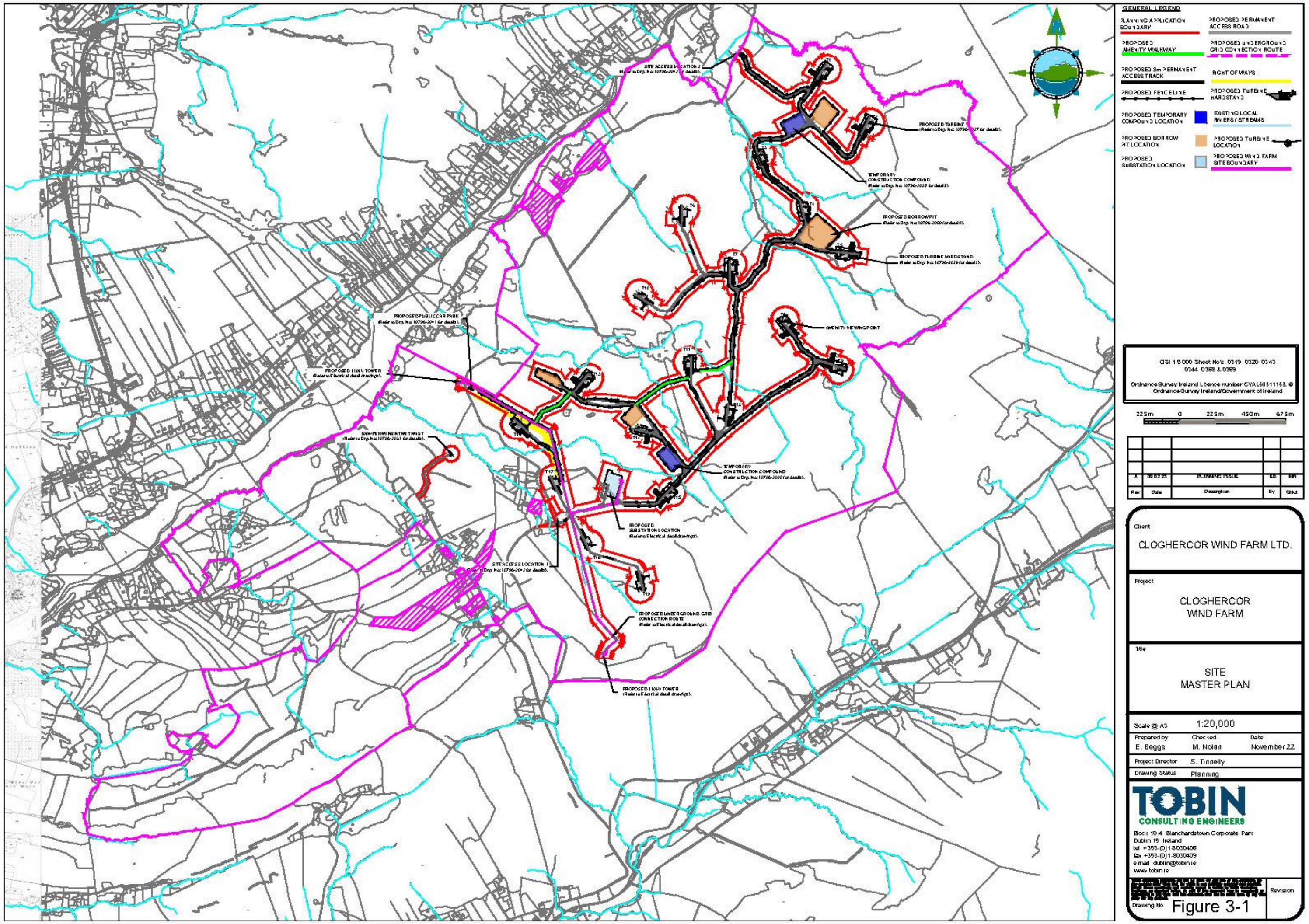
3.1 Site Location

The proposed wind farm infrastructure (see Figure 3-1) is located in the townlands of Clogherachullion,Cloghercor and Derryloaghan, Co. Donegal. The associated works to allow transport of turbines to site are located within the townlands of Cloghercor, Derryloaghan, Aghaveevoge, Cashelreagh Glebe, Darney, Drumard, Drumnacross, Shallogan More, Straboy and Tullycumber Co. Donegal. The proposed grid connection (including the proposed substation and connection masts) is located within the townland of Cloghercor Co. Donegal.

The proposed wind farm site is located within upland blanket bog and conifer plantation lands that is approximately 1945 hectares (ha) (19,450,000m²). The majority of the site boundary is defined by forestry, roads and estuary waters. The L6483 local road travels though the site along the north west from the R252 to the R250 giving the site two entrance locations.

[19] research_biosecurity_biosecurity_for_fieldsurveys_2010.pdf (fisheriesireland.ie)

Figure 3-1: Site Location Map and Site Layout of the Proposed Wind Farm



3.2 Overview of Proposed Project

A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height range from 18 5m to 200 m, a rotor diameter range from 149 m to 164 m, a hub height range from 112 m to 125 m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100 m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36 km of internal access roads) to the existing 110 kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;

- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed project and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

The proposed project, described above, includes all elements of the proposed development (to which this planning application relates) including any works required on public roads to accommodate turbine delivery. The proposed project has been considered and has been addressed as part of the EIAR, with offsite forestry replanting considered within cumulative assessments. These offsite forestry replanting sites will be individually assessed as part of the forestry licencing process.
A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought for the proposed project.

It should be noted that a Construction Environmental Management Plan (CEMP) has been prepared for the proposed project and is included within the planning application submission. A list of construction activities has been provided in the CEMP and is also discussed in the NIS.

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The proposed wind farm development (see

Figure 3-1) is located within a peatland and forested landscape, between Doochary, Lettermacaward and Glenties, in Co. Donegal. The site of the proposed wind farm is located approximately 22km north of Donegal town, and approximately 32km southwest of Letterkenny.

The site of the proposed wind farm is located within townlands of Cloghercor, Clohercullion, Derryloaghan, Cleengort, Derk More and Derk Beg Co. Donegal. The proposed grid connection (including the proposed substation and connection masts) is located within the townland of Cloghercor Co. Donegal.

The proposed wind farm site is located within upland blanket bog and conifer plantation lands that is approximately 1945ha (19450000m²). The majority of the site boundary is defined by forestry, roads and estuary waters. An unnamed local road travels though the site along the north west from the R252 to the R250 giving the site two entrance locations. The solar farm proposed will be located across all of the lands.

A description of the existing aquatic environment, which was informed by desktop assessment and field surveys, is provided hereunder.

4.1 Desktop Assessment

A search of the NBDC database[3] was carried out for species protected under the EU Habitat Directive and for species listed under the Third Schedule of the Birds and Natural Habitats Regulations (2011) within the 10km grid square B80 and G89, which encompasses the entirety of the proposed wind farm site.

4.1.1 Protected Flora and Fauna

With regards aquatic flora, there is no record of protected flora located within this grid squares. There is a record of the protected freshwater fauna species. Freshwater Pearl Mussel (*Margaritifera margaritifera*) has been recorded at three locations, Mullanieran Bridge, West Donegal, Mullanmore, West Donegal and Mullantiboyle, West Donegal. The total abundance recorded from all three sites was 40 molluscs. Further downstream in grid square G79, there is a record of over 2490 molluscs recorded at Site S, Owenea River, West Donegal and another 3350 molluscs recorded at Owenea Bridge, Owenea River, West Donegal. These recordings were all taken during Non-marine molluscs - Northern Ireland survey and recorded into the All Ireland Non-Marine Molluscan Database of 1993 - 1994.

There is a historic record of European Otter (*Lutra lutra*) at grid G822994 located at Lough, east of Cleengort Hill - east inlet recorded in 1980. A more recent record show otter located at G797995 Cleengort, in 2014. This is recorded in Atlas of Mammals in Ireland 2010-2015 database. This recording is located 1.5km downstream from the proposed wind farm site boundary.

4.1.1.1 Previous Inland Fisheries Ireland research surveys:

Lough Barra Fish Stock Survey, July 2019[20]

[20] Corcoran, W., Connor, L., Bateman, A., Cierpial, D., Coyne, J., McLoone, P., Twomey, C., Rocks, K., Gordon, P., Lopez, S., Matson, R., O' Briain, R., and Kelly, F.L. (2020) Fish Stock Survey of Lough Barra, July 2019. National Research Survey Programme, Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24.

A total of three fish species (sea trout are included as a separate 'variety' of trout) were recorded in Lough Barra in July 2019, with 151 fish being captured. These included 131 Brown trout (*Salmo trutta*), one Sea trout (*Salmo trutta*), eight Atlantic salmon, and thirteen Eel (*Anguilla anguilla*).

Brown trout (all varieties) ranged in length from 9.0cm to 21.2cm with three age classes present, ranging from 1+ to 3+, the dominant age class was 2+ indicating reproductive success in three of the previous four years.

One sea trout measuring 23.7cm and aged at 2.0+ was recorded. Eight salmon parr ranging from 6.0cm to 12.8cm were also captured. All salmon that had an age recorded were in the 1+ class. Thirteen eels ranging from 33.0cm to 58.0cm.

Lough Barra has been assigned an ecological status of "Good" for 2019 based on the fish populations present. In previous years the lake was also assigned a fish status of "Good" in 2008 and 2014 and a status of "High" in 2011.

Gweebarra River Catchment survey 2019[21]

A total of 17 sites were surveyed in the catchment between the 23rd of July and 7th of August in 2019 to determine the status of their fish stocks. Three fish species were recorded at seventeen sites surveyed on the Gweebarra River catchment in 2019.

Salmon was the most abundant species captured and was present at 13 sites. Salmon ranged in length from 2.2 to 12.9cm. Brown trout were also common and recorded at most sites (16 sites), ranging in length from 3.5 to 22.2cm. Three age classes for salmon, 0+, 1+, 2+ were recorded and all ages from 0+ to 3+ for both brown trout. Eel was also relatively frequent and recorded at ten sites.

Fives sites were assigned a fish ecological status of high, six sites as Good and the remaining six as Moderate. High status sites were limited to the Gleneheen and Owenwee sub-catchments. Survey sites on the Gweebarra River main channel and three tributaries elsewhere did not achieve the required status of Good. This is related to absence or low densities of juvenile salmonids (age 0+), indicating poor recruitment at those sites.

4.1.2 Invasive Species

There is no record of invasive aquatic species located within the 10km grid square of the proposed wind farm site. Two high impact terrestrial invasive plant species were identified within the proposed wind farm site during field surveys. These were Rhododendron (*Rhododendron ponticum*) and Japanese knotweed (*Reynoutria japonica*). An Invasive Species Management Plan for these has been included in the CEMP.

4.1.3 Surface Water

4.1.3.1 Eroding/Upland Rivers

Across the mountain itself there are two watercourses, the Mulnamin Beg_010 (waterbody code: IE_NW_38M290990) and Glenleheen stream_010 (waterbody code: IE_NW_38G070300). These water courses are part of the Gweebarra_SC_010 subcatchment.

The majority of these are small order streams and rivers of Mulnamin Beg_010 which spans across the proposed wind farm site and also a large number surrounding it. All of these waters are categorised as FW1 Eroding/Upland Rivers (Fossit, 2000). This includes natural watercourses, or sections of these, that are actively eroding, unstable, and where there is little or no deposition of fine sediment.

The Glenleheen stream_010 is located on the south west of the mountain which flows into the Gweebarra River (Gweebarra_020) before it also enters into the Gweebarra Estuary. One stream of the Glenleheen stream_010 is located within the proposed wind farm site.

[21] O'Briain, R., Matson, R., Gordon, P., Lopez, S., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., Gavin, A., McLoone, P., Twomey, C. and Kelly, F.L. (2019) Sampling Fish in Rivers 2019 – Gweebarra River Catchment, Factsheet No. 2019/05. National Research Survey Programme. Inland Fisheries Ireland

4.1.3.2 Transitional waters

The majority of Mulnamin Beg_010 streams and rivers flow northwest, directly into the Gweebarra Estuary (water body code: IE_NW_120_0100) located outside the proposed wind farm site boundary.

The Gweebarra Estuary is part of the designated European site; West of Ardara/Maas Road SAC (site code: 000197) located northwest of the site.

4.1.3.3 Coastal waters

The Gweebarra Estuary flows directly into the Gweebarra Bay (water body code: IE_NW_120_0000). This is water body is located 6.5km west of the proposed wind farm site.

All of these waters are of steep gradient and higher flow rate, representing natural watercourses typical eroding/upland rivers (FW1), that are actively eroding, unstable, where there is little or no deposition of fine sediment. These streams and rivers remain largely unaltered and do not suffer from urban encroachment and associated point sources of pollution.

The Gweebarra River catchment is located in north County Donegal within the North Western River Basin District and covers an area of approx. 122 km². The River Barra rises between the Glendowan and Derryveagh mountains and flows for approximately 32km in a south westerly direction through Lough Barra. The Gweebarra River flows out of Lough Barra and continues in a south westerly direction through the village of Doocharry and meets the sea at Gweebarra Bay. The main tributaries are the Owenwee, Cloghernagore and Croagheen rivers. The catchment has one relatively large lake present, Lough Barra. The Gweebarra River is a spate river and includes 16km of estuarine water. This catchment's geology is mixed between granite, slate, shale and schist, with rough pasture and blanket bog as the as the dominant land uses. The river receives a good run of salmon and sea trout and is well regarded as an angling river. A large proportion of the upper catchment forms part of the Cloghernagore Bog and Glenveagh National Park Special Area of Conservation (SAC) while the lower part of the catchment is situated within the West of Ardara/Maas Road SAC.

The Gweebara catchment area and the surrounding SAC provide prestige habitat and spawning habitat for various species of freshwater fish, these include Atlantic salmon, Brown trout, Sea trout and Eel. The Gweebarra river is known to contain Atlantic salmon, Sea trout, Brown trout and Eel as well as Freshwater Pearl mussel.

4.1.4 EPA Water Quality

A search of the EPA Unified GIS Application[22] and the EPA Catchments database[23] was conducted for this water body and its water quality.

There are no WFD monitoring stations located along the Mulnamin Beg within close proximity to the proposed project to indicate that the overall water quality in this area. The River Waterbody Status of the Mulnamin Beg_010 is 'Good' in the vicinity of the proposed wind farm site. The WFD Risk status is currently unknown. No other biological water quality data is available for the selected tributaries in the survey.

[22] Available at https://gis.epa.ie/EPAMaps/. Accessed in Oct 2022.
[23] Available at https://www.catchments.ie/. Accessed in Oct 2022.

There are two monitoring stations (RS38G020300 and RS38O070250) located on the Gweebarra River (Gweebarra_020) before it enters the Gweebarra estuary. According to the EPA, the biological water quality at station RS38G020300 during 2021 achieved a range Q3-4 and the biological water quality at station RS38O070250 achieved Q4, 'good status' during 2021, which indicates it is meeting the requirements of the WFD (2000/60/EEC). The EPA has assigned WFD River Waterbody Approved Risks to the Gweebarra River and listed it listed as ‘Not at risk’. Data from the most recent EPA water quality monitoring surveys are available online [24]. The River Waterbody Status of the Gweebarra Estuary is ‘Good’ in the vicinity of the proposed wind farm site. The WFD Risk status is currently “At Risk”.

The Waterbody Status of the Gweebarra Estuary is ‘Good’ in the vicinity of the proposed wind farm site. The WFD Risk status is currently “At Risk”.

It has been established the proposed wind farm infrastructure footprint only drains into the Mulnamin Beg_010 WFD river water body. Due to the mixing zone effect of transitional waters, the separation distance and the nature of the proposed project, the hydrological pathway from the proposed project is considered an effective pathway for impacts from the proposed project once the first WFD coastal water body is reached as the Gweebarra estuary is located on the proposed wind farm site boundary.

4.2 Field Survey Results

TOBIN ecologist Sinead O Reilly carried out an aquatic survey across the watercourse within the proposed wind farm site between the between 20th-22nd September 2021, following best practice guidance methodologies (National Road Authority [NRA], 2009)[25] and following the Standard Operating Procedures of the EPA (2021)[26]

An ecological survey of the Lough Aneans More was carried out on the 18th of August 2022 by Cian Ó Ceallaigh.

The sites were searched for evidence of Annex I habitats and Annex II species listed on the EU Habitats Directive (92/43/EEC)). The sites were also searched for the presence of invasive plant species listed in Part 1 of the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations (2011).

The findings of the field surveys were used to inform the AA Screening and NIS Report. The survey area included lands within the zone of influence (ZoI) of the proposed project. The current guidance on ecological assessments (CIEEM, 2018)[27] states that:

“ *The ‘zone of influence’ for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries*” and that “ *The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change.”*

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[24] https://www.catchments.ie/data/#/waterbody/IE_SE_14F010061?_k=1bsic8
[25] National Roads Authority (NRA; now known as Transport Infrastructure Ireland) (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.
[26] EPA (2021). Standard Operating Procedure for River Biological Monitoring Field Sampling Surveys. Version 1.10. EPA internal publication
[27] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine.

The ZoI was therefore defined through desk-based assessment with regard to the sensitivity of habitats and species likely to be present / previously recorded in the locality of the proposed wind farm site, areas with connectivity (physical, hydrological or ecological) to the proposed project, consideration of potential impacts which may arise from the proposed project and reference to relevant scientific papers and guidelines (NRA, 2008; SNH, 2016 & Cutts *et al.* 2013). The ZoI was therefore established as the proposed wind farm site plus a 150m buffer. All findings of the surveys, relative to this assessment, are outlined hereunder.

4.2.1 Lake Survey Results

The following habitats and flora species were recorded and mapped (see Figure 4-1) during the survey:

FL2 Acid oligotrophic lakes

The lake comprised a nutrient poor acid lake which had a brown colour due to it being surrounded by peat-based habitats and having an underlying granite bedrock. A stream flows into the lake from its northern end and is likely to result in some amount of pollution from the nearby forestry habitat.

A stream flows out of the lake at its western most point. The substrate around the margin was a mixture of rocks and organic lake sediment. Its eastern banks were shallower and notably rockier whereas the western banks had a steeper gradient and the substrate was not visible in most instances.

The habitat is largely void of vegetation, however a narrow strip of floating and submerged plants were recorded in places along the lakes margins. The south-western corner, where the lake was shallowest with abundant emergent rocks, had the best examples of the Lakes submerged/floating flora. This included the following species: Jointed rush (*Juncus articulates*), bulbous rush (*Juncus bulbosus*), a bladderwort (*Utricularia intermedia*) and *Sphagnum spp.* which were frequent along the lakes margin.

Floating club-rush (*Isolepis fluitans*), broadleaved pondweed (*Potamogeton natans*), common spike rush Eleocharis palustris, common sedge Carex nigra and another species of bladderwort (either *U. australis* or *U. vulgaris*) were recorded as occasional. Common cotton grass (*Eriophorum angustifolium)* and floating bur-reed (*Sparganium angustifolium*) were also recorded as rare throughout.

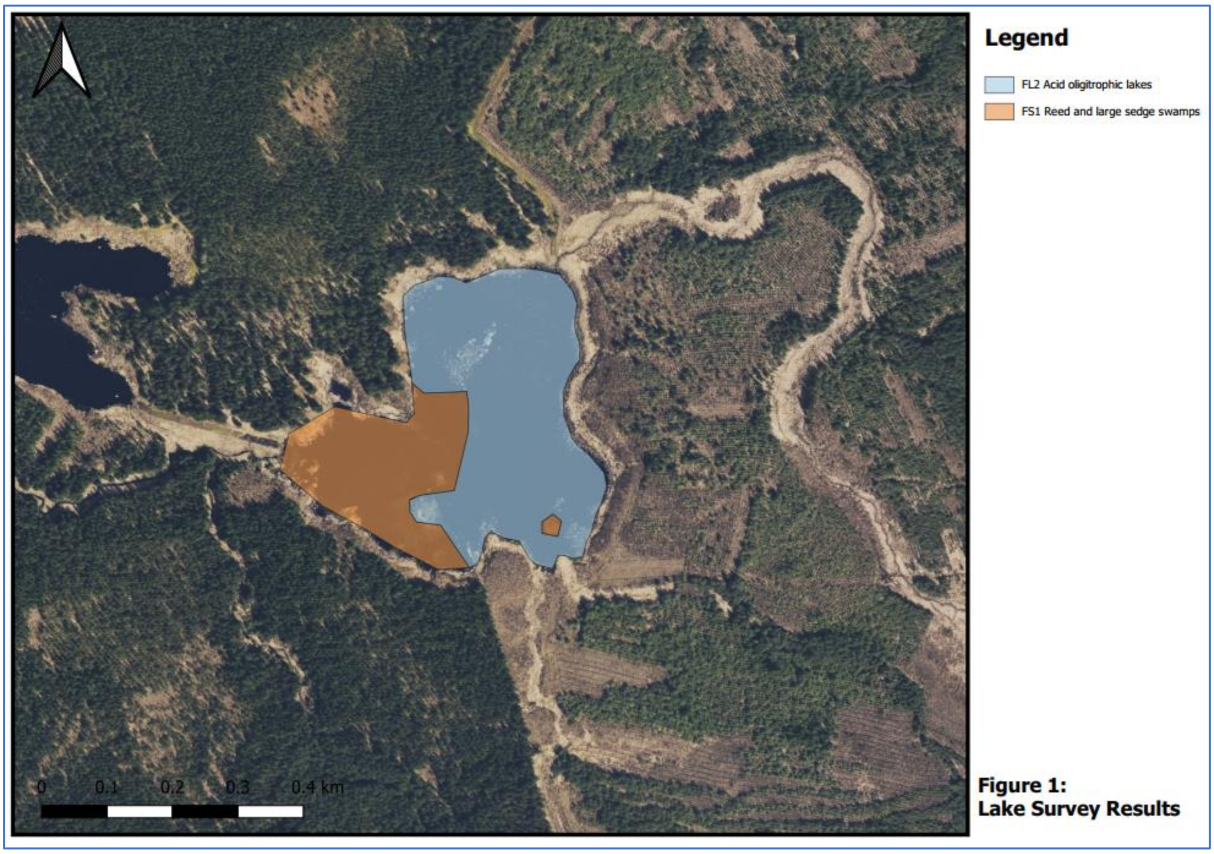
FS1 Reed and large swamp sedges

A large stand of tall (approx. 1m) emergent vegetation was recorded in the eastern half of the lake. It covered nearly one third of the lake and had abundant common reed (*Phragmites australis)* and common clubrush (*Schoenoplectrus lacustris)* (see Plate 4-1). The habitat was species poor but had components of the vegetation described above mixed through it. A smaller stand of this habitat was present in the south-western corner of the Lake, it comprised a mixture of abundant common reed and an unidentified species of sedge (likely a *Carex* sp.), which was frequent.

No Annex I habitats of the EU Habitats Directive were recorded within or in the immediate vicinity of the site, nor Annex II species. No plant species listed under the Flora Protection Order (FPO), or plant species listed as rare or vulnerable were recorded during the surveys. Figure 4-1 displays the habitat map of the study area.

Plate 4-1: FS1 Reed and Large Swamp Sedges Present within Lough Aneans More

Figure 4-1: Habitat Map of Lough Aneans More



4.2.2 River survey results

A brief site summary outlining both instream and adjoining habitats as well as physical characteristics is provided below. Scientific names are provided at first mention only. Habitat codes are given according to Fossit (2000).

Site 1

Site 1 on the Mulnamin Beg_010 represented an upland eroding watercourse (FW1; Fossit, 2000) flowing through an area of blanket bog and conifer plantation. The stream was situated at the base of a gently sloping hill and was cut into a peat based U-shaped channel (see Plate 4-2Plate 4-2). Averaging depth of 5cm, and 2m wide, the site featured 40% boulder, 30% cobble, 20% cobble, 5% sand and 5% mud/silt substrata. The harder substrata was embedded in peat. The stream had a sinuous natural form with bank undercutting present on both sides. Glide habitat dominated (70%) with localised pools (20%). Instream vegetation was limited to rare Potamogeton sp. 5% and Batrachospermum (40%). Peat staining was also present.

The site was bordered by upland blanket bog riparian buffer downstream of a WD4 conifer plantation. Species such as tufted grass (*Deschampsia cespitosa*), ling heather (*Calluna vulgaris*), soft rush (*Juncus effusus*), bramble (*Rubus fructicosus agg.*), devil's bit scabious (*Succisa pratensis*) and bog myrtle (*Myrica Gale*) were common. The riparian vegetation caused light shading (<25%).

Plate 4-2: Site 1, A Small Upland Stream in Upland Blanket Bog

Site 2

Located downstream of a bridge on the local road site 2 is a small upland eroding watercourse (FW1) flowing down into Gweebarra estuary. It flows along the boundary of upland forested area which supports a conifer plantation. The channel was U-shaped and had an average width of 3m and average depth of 11cm and a bank height of 1m on both sides. It was fast flowing and of high energy, flowing over a steep gradient. The channel cascaded over bedrock with (80%) boulders, (10%) cobble, (5%) gravel and (5%) gravel. The substrata was compacted and bedded given the high flows. The stream profile was dominated glide habitat (45%) with pool (35%) and riffle (20%) present. The water was peat stained.

In addition to the conifer plantation on the left bank, the site was bordered by Willow (Salix spp.) and Bracken (*Pteridium aquilinum*) borders on the right bank (see Plate 4-3). Other frequent species included ling heather, bog myrtle, holly (*Ilex aquifolium*), bramble and purple moor grass (*Molinia caerulea*). Instream vegetation included *Marsupella emarginata* moss on top of instream boulders. In addition, due to its high energy nature, there was a reduced capacity for the stream to support macrophytes. There was light shading present at the sampling site and evidence of under cutting on both banks.

Plate 4-3: Site 2, A High Energy Upland Stream Along the Boundary of a Conifer Plantation

Site 3

Located 160m upstream of site 2, site 3 was a small upland eroding watercourse (FW1) and tributary of site 2. The channel was U-shaped and had an average width of 2.5m and average depth of 2cm and a steep bank height of 3m on both sides. It was moderate flowing, flowing over a gradual gradient (see Plate 4-4).

Within this peat stained water course, the substrata contained boulders (70%), cobble (20%) and gravels (10%). Given the gentle gradient of this stream, it was glide dominant (60%) with equal proportions of riffle and pool. The small channel had a sinuous pattern through the upland blanket bog. This habitat supported ling heather, Rowan (*Sorbus subg. Sorbus*), devil's bit scabious, soft rush, tufted grass, willow (*Salix spp.*) and male fern (*Dryopteris filix-mas*). Mosses such as *Sphagnum spp.*, *Polytrichum spp.* and big shaggy-moss (*Rhytidiadelphus triquetrus*) were common on the wet sloping banks adjoining the stream. There was light shading present. There was no instream vegetation present due to the high peat staining and high energy nature of the site with the exception of Sphagnum spp., present on boulders.

Plate 4-4:Site 3 (facing downstream) A Small Upland Stream Flowing Through Upland Blanket Bog

Site 4

Site 4 was located 580m upstream of Site 2 on the same watercourse. Again, this stream was a small upland eroding watercourse (FW1). The channel was cascading in nature, bank height of 2.5m, 6m wide, 6cm deep on average and dominated by riffle and equal proportions of glide and pool habitat with one localized deeper pool in one section (>1.5m deep). The stream flowed over a moderate gradient through a semi-natural V-shaped valley as it bordered the WD4 conifer plantation on the left bank and PB2 upland blanket bog on the right bank (see Plate 4-5Plate 4-5). The riparian habitat contain species including bog myrtle, ling heather, willow, bracken (*Pteridium aquilinum*) and tufted grass. Given the high energy, the substrata were composed primarily of boulder (80%) with cobble (10%) and low fractions of coarse gravels (10%). There was no soft sediment present and the water was peat stained.

Instream macrophyte and bryophyte growth was sparse given the high energy of the channel, although some water feather moss (*Plathyhpnidium ripariodes*) grew on top of instream boulders.

Plate 4-5: Site 4 (facing upstream), A Medium Cascading High-energy Stream

Site 5

Site 5 was an upland eroding channel (FW1) with peat-stained water located 620m upstream form site 4. The channel width and water width were both 1.5m, with average depths ranging 6.5cm. The channel retained a semi-natural profile with 35% riffle, 45% glide and 20% pool habitats flowing through boulder cascade reaches (see Plate 4-6). The bank height was variable between 1.0m and 1.5m but graded into a V-shaped valley downstream. The substrata were dominated by boulder (40%) and cobble (40%) with smaller quantities of coarse, medium and fine gravel (20% combined).

The riparian habitat comprised of ling heather, soft rush and tufted grass. These buffered the Sitka spruce (WD4) plantation for 20-30m on each bank. No macrophytes were present given the heavily peat-stained water. Fountain feather-moss (*Hygroamblystegium tenax*) was locally frequent on submerged boulders with yellow fringed moss on the topsides of boulders. Common water moss (*Fontanalis antipyretica*) was present very locally on large boulders instream. There was a large presence of filamentous algae present within the watercourse indicating a sign of nutrient enrichment from the conifer plantation.

Plate 4-6: Site 5 (facing upstream), A Medium Cascading High-Energy Stream Flowing Through a Conifer Plantation

Site 6

Site 6 was a very narrow upland stream (FW1) with heavily peat-stained water at the time of survey. The channel width and water width were both 0.3m wide and the depth ranging between 2cm. Bank height was variable between 0.5 and 1m and the channel was broadly V-shaped (see Plate 4-7). The stream retained a semi-natural profile flowing through the conifer plantation (WD4) and Upland blanket bog (PB2). the survey section featured a mix of with 20% riffle, 70% shallow glide and 10% pool habitats.

The substrata were dominated by boulder (70%), cobble (30%) and gravel (5%) and small with smaller quantities of sand (5%). The boulders and cobbles were, however, bedded in peat with evident heavy siltation and also moderate compaction. Softer sediment areas were also heavily compacted given the relatively high flows.

The riparian habitat comprised of bog myrtle, gorse (*Ulex europaeus*), rowan, tufted grass, bramble, holly, male fern and hard fern (*Blechnum spicant*). Some Fountain feather-moss was present on the boulders within the stream. There was also some liver worth (*Lumularia cruciate*) present on the banks of the channel.

Plate 4-7: Site 6, A Small Narrow Cascading High-energy Stream

Site 7

Located along the border of a conifer plantation and also along the side of the local access road, site 7 was a small upland eroding watercourse (FW1) flowing in an upland forested area which supported mature Sitka spruce (*Picea sitchensis*) (WD4) upstream (see Plate 4-8). The channel was U-shaped, 0.5 wide with a 0.4m bank height. It was slow flowing and of moderate energy, flowing over a relatively gentle gradient. The stream depth averaged 5cm. The channel cascaded over bedrock with 85% boulder, 5% cobble, 5% coarse gravel and 5% sand. The substrata were compacted and bedded. The stream profile was dominated by pool habitat (60%) with 30% glide and localised riffle (10%). The stream changed into a V-shaped valley downstream of the road crossing. Peat deposits were also present. In addition to Sitka spruce, the site was bordered by soft rush, rowan, tufted grass, holly, bracken and bog myrtle.

Instream growth was limited to Common water moss on top of instream boulders. The high shading (>75%) from steep vegetated banks (many undercut) reduced the capacity of the stream to support macrophytes, in addition to its high energy nature.

Plate 4-8: Site 7, A Small Narrow Cascading High-energy Stream

Site 8

Site 8 was an upland eroding channel (FW1) with peat-stained water (see Plate 4-9). The bank height was 1.0m but graded into a V-shaped valley downstream and the channel width and water width were both 1.0m, with average depths ranging 8.5cm. The channel retained a semi-natural profile with 5% riffle, 85% glide and 10% pool habitats flowing through boulder cascade reaches. The substrata were dominated by boulder (85%) and cobble (10%) with smaller quantities of coarse, medium and fine gravel (5% combined).

The riparian habitat comprised of ling heather, bog myrtle and tufted grass. These buffered the Sitka spruce (WD4) plantation for 20-30m on each bank. No macrophytes were present given the heavily peat-stained water. Common water moss (*Fontanalis antipyretica)* was present very locally on large boulders instream. There was no presence of filamentous algae present within the watercourse considering the potential for nutrient enrichment from the conifer plantation.

Plate 4-9: Site 8 (facing upstream), A Medium Cascading High-Energy Stream Flowing Through a Conifer Plantation

Site 9

The stream was a small upland eroding watercourse (FW1). The channel was cascading in nature, it had a bank height of 1.5m on both banks, it was 2m wide, and 28cm deep on average (see Plate 4-10). The site was dominated by equal proportions of pool and glide habitat with no riffle present. The stream flowed over a moderate gradient through a semi-natural V-shaped valley populated by Sitka spruce. Species including bracken, willow, rowan, Sitka spruce, ling heather and hard fern were abundant along riparian corridors. Given the high energy, the substrata was dominated by large boulders (90%) with cobble (5%) and low fractions of coarse gravels (5%) present. There was no soft sediment present and the water was peat stained.

There was no instream macrophyte and bryophyte growth present given the high energy of the channel and high riparian shading (>75%), although some yellow fringe moss (*Racomitrium aciculare)* grew on top of instream boulders.

Plate 4-10: Site 9 (facing upstream), A High-energy Boulder Dominated Stream Flowing Through a Conifer Plantation

4.2.3 Kick Sampling Results

A detailed list of the macroinvertebrate taxa recorded during the survey in September 2021 with the classification of macroinvertebrate species recorded at each site in terms of their pollution sensitivity is provided in Table 4-1. The Q-value ascribed to each site, together with current ecological status, classified in accordance with the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019) is given in Table 4-2.

Table 4-1: Macroinvertebrates Recorded During the Kick Sampling Surveys

Group/organism	Species	Relative Abundance									EPA Class Pollution sensitivity group
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	
Stoneflies (Plecoptera)											
Perlodidae						2	4			1	A
Leuctridae		1									A
Nemouridae			4	4							A
Chloroperlidae					3						A
Cased caddis flies (Tricoptera)											
Limnephilidae					3	4	5		3	2	B
Rhyacophila sp.	*Ryacophila dorsalis*			1	1						C
Hydropsychidae	*Hydropsyche siltalai*				1						C
Goeridae		1		1							B
Beetles (Coleoptera)											
Hydrophilidae								1			C
Total No. of organisms		**2**	**4**	**6**	**8**	**6**	**9**	**1**	**3**	**3**	

Table 4-2: Biological Sampling Results

Sampling Site	Q-value	SSRS score	SSRS category	Water Framework Directive Ecological Status
1	4-5	3.2	Stream at risk	High
2	5	3.2	Stream at risk	High
3	4-5	2.4	Stream at risk	High
4	4	4	Stream at risk	Good
5	4-5	3.2	Stream at risk	High
6	4-5	4	Stream at risk	High
7	3	0	Stream at risk	Moderate
8	4	1.6	Stream at risk	Good
9	4-5	2.4	Stream at risk	High

Biological water quality data as prescribed by the (EPA; Toner et al. 2005), group invertebrates into classes whereby very pollution intolerant species are denoted class A, and species with greater pollution tolerance fall into successive classes (B through E respectively). As such, the presence or absence of these groups and their relative abundances facilitates an assessment of biological river health. The results from these sites are discussed in this context in order to interpret potential changes in the riverine community composition. Table 4-1 and Table 4-2 list all of the species recorded for each of the sites surveyed (i.e. sites 1-9). and show by colour separation the EPA taxonomic classes as prescribed above.

The Q-values assigned to each site take into account that at this time of year, Group A (highly pollution sensitive) species are far lower in occurrence than at other times, due to several species stonefly (Plecoptera), as well as a few of the indicator species of mayfly (Ephemeroptera) being mainly in the adult or egg stages of their life cycles.

Sites 1-3 were located on the north east of the site. The composition of the samples had low numbers of macroinvertebrates present, however these were dominated by numbers of pollution intolerant class A invertebrates. The class A invertebrates included two stonefly species, *Leuctra hippopus*, and *Nemoura erratica.*

Class B invertebrates (also pollution intolerant) were identified in sites 1 and 3 containing cased cadis *Goera pilosa*. Site 3 also contained one class C invertebrate (more pollution tolerant), the cased cadis *Rhyacophila dorsalis*.

The presence of small numbers of class B and C invertebrates, and the dominance of class A indicated that the samples within sites 1, 2 and 3 were representative of unpolluted Q4-5 and Q5 (high status) water quality.

Site 4-6 contained Class A and B macroinvertebrates (stoneflies and cased caddis) and site 4 also contained Class C cased caddis. These sites were representative of unpolluted Q4 and Q4-5 (good and high status) water quality.

Site 7 only contained one macroinvertebrate. This was a beetle from the family Hydrophilidae. This site had the lowest count of macroinvertebrates from all the sampling sites. This site was representative of moderately polluted Q3 (Moderate status) water quality.

Sites 8 and 9 both had low numbers of macroinvertebrates present. Site 8 only contained Cased caddis (*Limnephilidae sp.)* while site 9 contained Stone fly (*Perlodidae sp.)* and Cased caddis (*Limnephilidae sp*.). These sites were representative of unpolluted Q4 and Q4-5 (good and high status) water quality.

Table 4-3: Results of the General Physical Habitat Assessment at the Nine Sites within the Proposed Development

Site	Mean Dept (cm)	Instream vegetation (%)	Bank Height (m)	Bank Width (m)	Riffle (%)	Glide (%)	Pool (%)	Shade (%)	Boulder (%)	Cobble (%)	Gravel (%)	Sand (%)	Silt (%)
1	5	5	1	2	5	70	25	25	40	30	20	5	5
2	11	0	1	3	20	45	35	25	80	10	5	5	0
3	2	40	3	2	20	60	20	25	70	20	10	0	0
4	6	20	2.5	.6	40	20	40	25	80	10	10	0	0
5	6.5	25	1	1.5	35	45	20	0	40	40	20	0	0
6	2	40	.5	.35	20	70	10	50	60	30	5	5	0
7	5	30	.4	.5	10	30	60	75	85	50	5	5	0
8	8.5	0	1	1	5	85	10	50	85	10	5	0	0
9	28	30	1.5	2.5	0	50	50	75	90	5	5	0	0

4.2.4 Fauna

During the aquatic surveys, signs of otters were searched for along the Mulnamin Beg_010 WFD river water body and Lough Aneans More where accessible, and along drainage ditches located within the proposed wind farm site. No signs of otter (tracks, slides and spraints) or holts/resting sites were found within the study area.

The lamprey survey of the rivers involved assessing the substrate for the percentage of silt, and taking a sample of the silt (at the river banks edge) with a hand net. Due to no silt been present in any of the sampling sites, lamprey scoop surveys could not be carried out.

The survey of the river for its suitability for White-clawed crayfish and salmonid potential entailed assessing the substrate of the river, shading due to vegetation, flow, pools and riffles.

5.0 DISCUSSION

5.1 Lough Aneans More

The margins of the Lake habitat FL2 Acid oligotrophic lakes are considered to correspond with the Annex I Habitat 3110 Oligotrophic isoetid lake habitat. Evidence to support this decision are given below based on descriptions for the Annex I Habitat given by O Connor (2015):

- The physical and chemical characteristics of the Lake fit the description given by O Connor (2015) - *'occurs in soft-water, nutrient poor…. lakes frequently associated with acid bedrock catchments (notably granite and old red sandstone) overlain by peatland'*;

- Plant species of the isoetid growth form are characteristic of the vegetation (the Lake contained some of the example species listed. Namely bulbous rush, pondweed species and floating pondweed; and

- Other species listed for this habitat were present (e.g. floating club rush and bladderwort species).

Although the Annex I habitat 3130 Mixed Najas flexilis lake habitat is considered quite similar to 3110 the absence of the characteristic species slender naiad *Najas flexilis* and the relatively species poor nature of the Lake suggests a better fit with Annex I Habitat 3110 Oligotrophic isoetid lake habitat.

5.2 Macroinvertebrates

Overall it is clear that all nine sampling sites had very poor diversity of macroinvertebrate species present within the proposed wind farm which mostly composed of stonefly and cased caddis. All sites sampled (Sites 1-9) received a range of values from Q3 to Q5 rating indicating a range from unpolluted to moderately polluted water quality and range from "Moderate to High" ecological status. However the SSRS score for all nine sites ranged from 0-4 indicating that these streams are "At Risk" of failing to meet "Good" ecological status. This is due to the very low number of macroinvertebrates present (See Table 4-1).

All nine sites contained a low number of macroinvertebrate species count, macroinvertebrate diversity and richness. Site 7 contained the lowest number of taxa and only one species present.

The steep vegetated banks (many undercut) reduced the capacity of the stream to support macrophytes, and very high energy have limited the diversity and abundance of species present across all sites.

There was no evidence of the macroinvertebrate class Ephemeroptera present through any of the samples. As shown in the results, only Plecoptera were recorded. Plecoptera are herbivores and are generally found in cold, well oxygenated, fast-moving streams[28].

Along with the Plecoptera, both Ephemeroptera and Tricoptera are often good indicators of cool, well oxygenated waters and are sensitive to pollution. In fact, these taxa are used as indicators of high water quality, and their abundance is quantified as the EPT index (Ephermoptera, Plecoptera, Tricoptera)[29]. It is likely that the particularly low abundance of Ephemeroptera and Tricoptera is due to both the river bed and a water quality issues.

5.3 Fisheries

5.3.1 Salmonids

Fisheries suitability and value was taken into account during the aquatic surveys. Suitable spawning and nursery habitat for salmonids, was accessed. Also the potential for lamprey (River and Brook), European eel and White-clawed crayfish presence was also accessed at each surveyed site.

Overall, all nine sites were located within or surrounded by upland blanket bog and conifer plantation habitat. These sites had little value as Salmonids habitat due to the upland, high energy nature of the watercourses present within the proposed wind farm site. The results of the General Physical Habitat Assessment is presented in Table 4-3.

The substrate was largely bedded in peat for Salmonids. There was very little spawning gravels present across all nine sites, with the largest percentage of gravels been 20% and this was at sites 1 and 5.

There was no visual evidence of fish present within any of the nine sites surveyed. Fish access was poor given the high elevation upland location. While trout can sometimes occur at steep gradients, the smaller size of the cascading boulder-pool profile within these sampled streams was not considered suitable for resident fish. There was limited holding habitat given the high energy flows of the streams. Site 4 had a large percentage of holding pool (40%) however the site was dominated by large boulders. Access for Salmonids from downstream was difficult given the natural high gradients and large boulders preventing migration upstream.

Spawning and nursery habitat in the lower reaches, for example at site 1, was impacted by siltation, filamentous algae and bedded gravels due to the adjacent peat and forestry influences. Overall, the upland eroding streams located with this proposed wind farm site hold poor quality spawning and nursery for salmonids given no presences of riffle and glide sequences and or a mixed substrata bed. There was no evidence of good spawning habitat that would be found in

[28] Feeley, H.B., Baars, J-R., Kelly-Quinn, M. & Nelson, B. (2020) Ireland Red List No. 13: Stoneflies (Plecoptera). National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland.
[29] Ecology and Classification of North American Freshwater Invertebrates (Second Edition) 2001, Pages 733-775

deeper glides and in pools where mixed gravels and small cobbles would be present. There was no evidence of holding pools or suitable boulders for larger fish.

Based on the very low macroinvertebrates present within these streams, there is a low abundance of fish food present within these streams to sustain salmonid populations.

In general, smaller more upland watercourses lack or even absence of suitable spawning substrata and nursery habitat resulting from higher gradients, higher- energy flows and spate natures.

Stream gradient is known to be one of the principal determinants of juvenile salmonid production, with medium gradients most optimal in terms of successful recruitment and population persistence (Wood & Budy, 2009[30]; O'Grady, 2006[31]; Amiro, 1993[32]; Kennedy & Strange, 1982[33]). As would be expected in upland catchments exposed to pressures from afforestation and peat escapement. These sites were located in upland areas and invariably featured high-energy flows exposed to regular spate conditions, often flowing over moderate to steep gradients. Upstream fish access for salmonids was difficult or blocked entirely due to such physical characteristics in several cases.

Many of the watercourses surveyed were small, shallow, high-energy, upland eroding streams draining afforested and or blanket bog areas. These featured cobble/boulder-dominated substrata which were often bedded in peat and had a lack (not absence) of finer gravels for spawning. Smaller gravel fractions are vital in structuring salmonid populations (Meredith et al., 2017[34]; Hudy et al., 2010[35]), being necessary for successful spawning and egg development, and there is generally a strong correlation between the availability of spawning substrata and the size of populations (Montgomery et al., 1999[36]). Additionally, peat-based catchments such as that in the vicinity of Croagh wind farm are less productive than those flowing over other geologies (O'Grady, 2006), with reduced primary productivity, reduced macro-invertebrate communities, and, generally speaking, lower fish biomass (Richardson, 1993[37]). This can also be validated from the invertebrate samples collected in the current study that typically had lower overall diversity of species and also densities (pers. obs.). Channels with higher proportions of peat substrata can also suffer from increased siltation and bedding (compaction) of instream gravels and cobbles necessary for salmonid spawning, further limiting local populations. Compacted gravels can no longer function as salmonid spawning areas and it has been shown

[30] Wood, J., & Budy, P. (2009). The role of environmental factors in determining early survival and invasion success of exotic brown trout. *Transactions of the American Fisheries Society*, *138*(4), 756-767

[31] O'Grady, M.F. (2006) Channels and challenges: enhancing Salmonid rivers. Irish Fresh- water Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin.

[32] Amiro, P. G. (1993). Habitat measurement and population estimation of juvenile Atlantic salmon (*Salmo salar*). *Canadian Special Publication of Fisheries and Aquatic Sciences*, 81-97.

[33] Kennedy, G. J. A., & Strange, C. D. (1982). The distribution of salmonids in upland streams in relation to depth and gradient. *Journal of Fish Biology*, *20*(5), 579-591.

[34] Meredith, C. S., Budy, P., Hooten, M. B., & Prates, M. O. (2017). Assessing conditions influencing the longitudinal distribution of exotic brown trout (*Salmo trutta*) in a mountain stream: a spatially-explicit modeling approach. *Biological invasions*, *19*(2), 503-519.

[35] Hudy, M, Coombs, J.A, Nislow K.H. & Letcher B.H. (2010) Dispersal and within-stream spatial population structure of brook trout revealed by pedigree reconstruction analysis. Trans Am Fish Soc 139:1276–1287

[36] Hudy, M, Coombs, J.A, Nislow K.H. & Letcher B.H. (2010) Dispersal and within-stream spatial population structure of brook trout revealed by pedigree reconstruction analysis. Trans Am Fish Soc 139:1276–1287

[37] Richardson, J.S. (1993). Limits to productivity in streams: evidence from studies of macroinvertebrates. *Canadian Special Publication of Fisheries and Aquatic Sciences*, 9-15.

that eggs laid in clean gravels which have subsequently been silted over by peat have failed to hatch (Crisp 1993[38], 2000[39]).

5.3.2 Lamprey

Lamprey spawning and nursery habitat was absent in all nine sites. Generally, survey sites located on upland watercourses not considered suitable for lamprey species. Suitable spawning habitat by way of finer, unbedded gravels were absent from all sites. Finer sediment accumulations suitable for larval (ammocoete) settlement were absent given the high-energy nature of the sites. The majority of sites represented upland eroding watercourses and naturally such sites do not encourage the deposition of fine, organic rich sediment required by larval lamprey (Goodwin et al., 2008[40]; Aronsuu & Virkkala, 2014[41]).

There were no lamprey ammocoete burial areas identified within the survey reach. There was no lamprey value due to the cascading, moderate gradient and bedded substrata and as such, there was little spawning value. There was an overall limit to spawning gravels across all the water courses.

5.3.3 European Eel

While eels are known for their remarkable ability to often climb and navigate even near-vertical structures as juveniles (glass eels), (Watz et al., 2019[42]; Tamario et al., 2019[43]; Podgorniak et al., 2015[44]), many sites were considered sub-optimal or even unsuitable for the species given the often high gradients, high-energy profiles and typically upland nature of the channels.

5.3.4 White-clawed Crayfish

The streams located with the proposed wind farm site did not have potential habitat for White-clawed crayfish due to unsuitable geology, peatland afforested catchments, high energy channels and unsuitable substrate habitat, especially gravels for crayfish hatchlings. There was also a lack of instream vegetation and suitable burrowing habitat required for crayfish. As such there is no suitable availability of refuges for this species.

There was no evidence of instream pressures with the exception of nutrient enrichment from the forestry plantation and there was no invasive species recorded on site. Overall, this site was considered a poor in fisheries value.

[38] Crisp, D.T. (1993) The ability of UK salmonid alevins to emerge through a sand layer. Journal of Fish Biology, 43(4), 656-658.
[39] Crisp, D.T., (2000) Trout and Salmon. Ecology, Conservation and Rehabilitation. Blackwell Science: Oxford; 212
[40] Goodwin, C.E., Dick, J.T.A. & Elwood, R.W. (2008) A preliminary assessment of the distribution of the sea lamprey (*Petromyzon marinus* L), river lamprey (*Lampetra fluviatilis* (L.)) and brook lamprey (*Lampetra planeri* (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy 109B, 47-52.
[41] Aronsuu, K. & Virkkala, P. (2014), Substrate selection by subyearling European river lampreys (*Lampetra fluviatilis*) and older larvae (*Lampetra* spp). Ecology of Freshwater Fish, 23: 644–655
[42] Watz, J., Nilsson, P. A., Degerman, E., Tamario, C., & Calles, O. (2019). Climbing the ladder: an evaluation of three different anguillid eel climbing substrata and placement of upstream passage solutions at migration barriers. Animal Conservation.
[43] Tamario, C., Calles, O., Watz, J., Nilsson, P. A., & Degerman, E. (2019). Coastal river connectivity and the distribution of ascending juvenile European eel (*Anguilla anguilla* L.): Implications for conservation strategies regarding fish-passage solutions. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *29*(4), 612-622
[44] Podgorniak, T., Angelini, A., Blanchet, S., de Oliveira, E., Pierron, F., & Daverat, F. (2015). Climbing experience in glass eels: A cognitive task or a matter of physical capacities? Physiology & behavior, 151, 448-455

6.0 OVERVIEW OF POTENTIAL IMPACTS IN RELATION TO AQUATIC SPECIES AND HABITATS

There are a number of elements associated with the proposed project that may give rise to direct and indirect impacts that have the potential to result in likely significant effects during the Construction, Operation and Decommissioning phases of the development on European sites either alone or in combination with other plans and projects. The significance of these impacts depends on the scale of the impact as well as the ecological condition and the sensitivities of the qualifying interests. Elements of the proposed project that may give rise to impacts which have been considered with regards to potential effects to European sites are discussed hereunder.

Elements of the proposed project that may give rise to impacts, which have been associated with potential effects on European sites are as follows:

- Loss of habitat as a result of the land works and construction of the proposed infrastructure;
- Release of sediment and pollutants which may be discharged into surface water particularly during the installation of bridges and/or high rainfall events;
- Movement of vehicles and machinery associated with construction works and the potential for spillages of oils, fuels or other pollutants which could be transported to the surface water system during rainfall events;
- Transportation, pouring of concrete onsite and washing of concrete lorry flume – risk for entry into surface water;
- Increased silt loading which may stunt aquatic plant growth, limit dissolved oxygen capacity and overall reduce the ecological quality of watercourses, with the most critical period associated with low flow conditions;
- The introduction or spread of invasive alien species due to construction works and during operation activities;
- Disturbance to fauna (e.g. through noise from construction activity and/or human presence) resulting in the displacement of affected species; and
- Accidental mortality of wildlife from construction machinery.

6.1 Establishing the Likely Zone of Influence of Potential Impacts

The current guidance on ecological assessments (CIEEM, 2018) states that:

"The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries" and that "The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change."

Guidance in AA of plans and projects in Ireland notes that a distance of 15km is recommended for the identification of relevant European sites (DEHLG, 2010)[45]. For some projects the distance could be much less than 15km, and in some cases less than 100m, but this must be

[45] https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf

evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects.

Impacts associated with the loss of habitats will be confined to within the proposed wind farm site. The ZoI of habitat loss was therefore defined as all lands within the proposed d wind farm site. Consideration was also made to the proposed electrical connection routes.

With regards potential habitat degradation effects associated with the potential release of sediment and other pollutants to surface water, the ZoI of the proposed wind farm is considered to include receiving surface water bodies adjacent to, or downstream, of the proposed wind farm site during the Construction, Operational and Decommissioning Phases. Considering the sources for likely significant impacts on European sites (Section 6.1, for the definition of the ZoI for impacts associated with water pollution, hydrological connectivity will not be considered effective past the first water body of depositional nature is reached (e.g. lake water body; coastal water body). The hydrological pathway for impacts from the proposed wind farm works will then include all surface water bodies from the proposed wind farm site location until the Gweebarra Bay Coastal water body (Section 4.1.3).

Based on the proposed works in Section 3.0 and the type of construction impacts from proposed proejct, potential impacts from dust were not established for this proposed wind farm site.

Noise during the Construction Phase of the proposed project has the potential to cause disturbance to resting, foraging and commuting Qualifying and Special Conservation Interest species. Individual species will elicit differing behavioural responses to disturbance at different distances from the source of disturbance. Below is a summary of the documented ZoI for varying species:

- Transport Infrastructure Ireland (formally the National Roads Authority) has produced a series of best practice planning and construction guidelines[46] for the treatment of certain protected mammal species (i.e. Otter), which indicate that disturbance to terrestrial mammals would likely not extend beyond 150m for the type of works proposed.
- Cutts *et al.* (2013)[47] notes that different types of disturbance stimuli are characterised by different avifaunal reactions. However, as a general rule of thumb, the authors refer a distance of 300m to be used to represent the maximum likely disturbance distance for waterfowl.

The ZoI for noise/disturbance was therefore established as the proposed project site plus a 300m buffer.

6.1.1 Construction Phase Impacts

There are a number of elements from the construction phase of the proposed project that have potential to result in likely significant effects during the construction phase. The significance of these impacts depends on the ecological condition of the supporting habitats and the sensitivities of the qualifying interests located downstream of the proposed wind farm site.

[46] Ref: http://www.tii.ie/technical-services/environment/

[47] Hull.Cutts, N., Hemingway, K. and Spencer, J. (2013). Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects [Version 3.2]. Institute of Estuarine & Coastal Studies (IECS) University of Hull.

Potential construction phase impacts associated with the proposed project are discussed hereunder.

6.1.1.1 Accidental mortality

There is potential for the accidental mortality of wildlife during construction works. It may be caused by moving vehicles throughout the site on moving wildlife that may have been disturbed.

6.1.1.2 Loss of habitat

The proposed project will include the construction of an access road and access tracks within the upland blanket bog and conifer plantations. Soils will be excavated and exported from the site to facilitate the construction works which will result in a permanent loss of habitats. Hedgerows will be removed to facilitate road crossings and road expansion and some river bank will be removed to facilitate clear span bridge installations to allow for water crossings. This will result in a permanent loss in bankside vegetation.

The construction of the proposed works proposes works beside the Mulnamin Beg_010 to allow for the placement of clear span bridges. This will not result in a permanent loss of instream substrate or permanent loss of aquatic habitat due to the placement of clear span bridges. There will be no loss of habitat to the tributaries/first order streams located within the site boundary.

The habitats within the tributaries were identified as not being suitable spawning habitat for Atlantic salmon, brown trout or lamprey due to the high attitude and lack of spawning gravels. There will be no loss of instream vegetation within any watercourse that will result in a permanent, slight negative effect on biodiversity at a County geographical scale.

6.1.1.3 Runoff of Sediment and/or Construction Pollution

Fish, mollusc, crustaceans and semi aquatic species such as Otter can be affected by pollution events or litter that can lead to death or a reduced level of health or fitness (e.g., through reduced breeding or feeding success) in populations. Pollution events can also effect the habitat they use. The Mulnamin Beg_010 and Glenleheen stream_010 are located with the site boundary of the proposed wind farm site. As mentioned in Section 1.1, the Mulnamin Beg_010 flows towards the Gweebarra estuary which is also part of the West of Ardara/Maas Road SAC (site code: 000197) located north west of the site. The proposed wind farm is hydrologically connected to the West of Ardara/Maas Road SAC.

During the construction phase, site clearance, excavation activities, instalment of clear span bridges, culverts and the stockpiling of material have the potential to result in sediment laden runoff, if not appropriately managed. The runoff of sediment can result in the sedimentation of nearby watercourses. Excavation works along the riverbanks will be undertaken when installing the bridges. Increased silt loading in watercourses can stunt aquatic plant growth, limit dissolved oxygen capacity and reduce the overall ecological quality of watercourses, with the most critical period associated with low flow conditions.

Surface water runoff from the site drains to the Mulnamin Beg_010 WFD river water body via the drainage ditches. There is potential for the release of sediment and pollutants to surface water via surface water runoff from the proposed wind farm site during soil stripping and installation of access routes, fencing and bridges during the construction phase, rainfall events or accidental release/mobilisation of pollutants during the operation phase. The concentration of suspended solids and nutrients in the water column could increase and cause excessive fine silt deposition and degrade water quality of these rivers.

Movement and maintenance of vehicles and machinery associated with construction works has the potential for spillages of oils, fuels or other pollutants which could be transported to surface water, particularly during high rainfall events. The surface water runoff of contaminated surface water can result in the degradation of water quality and impacts to aquatic fauna and flora, particularly when concrete is present.

The storage of materials adjacent to any dry or wet surface water drainage features also has the risk for run-off or slippage during rainfall events.

The pouring of concrete will be required to facilitate the foundation works associated with the development. The transportation, pouring of concrete onsite and washing of concrete lorry flume – risk for entry into ground and surface water. Flooding of the construction site has potential to result in the release of increased volumes of pollutants, particularly suspended solids to the Mulnamin Beg_010 WFD river water body system.

There is no record of salmon present in either the Mulnamin Beg_010 and Glenleheen stream_010 within the proposed wind farm site. Survey results carried out on the water courses of the Mulnamin Beg_010 within the site boundary indicated no potential for salmon, lamprey or White-clawed crayfish presence along this section of watercourses. There is no riverine substrate suitable for spawning or nursery habitat for salmonids or lamprey due to the topography, habitat and high-energy of these upland eroding streams. There is also an abundance of large granite boulders within sections of these streams thus limiting potential for suitable glides or deep holding pools. The presence of the large boulders may act as a barrier to the migration of salmonids. There is also heavy shading present within sections of these upland streams resulting in limited to no instream vegetation been present.

Results from the nine kick sampling sites ranged from a Q3 Moderately polluted to Q5 high status and an SSRS scores range from 0 to 4.0 and which puts this water body “At risk”. The Mulnamin Beg_010 has also recently received an ecological status of “Good” River Waterbody WFD Status 2013-2018 by the EPA and Risk Unknown.

Based on the current status of the waterbody immediately downstream there is no potential to impact salmon, lamprey or White-clawed crayfish during the construction phase due to their absence.

Water quality impacts on this waterbody could result in short-term, negative effects on aquatic biodiversity, at a County geographical scale.

6.1.1.4 Noise and Disturbance

Sensitive species can be disturbed and displaced from suitable habitat locations due to construction-related disturbance. The displacement of fauna species could potentially occur within the vicinity of the proposed project.

For example, otters require lying up areas throughout their territory where they are secure from disturbance (NPWS, 2013h) and construction activities can create disturbance which could reduce the suitability of terrestrial and estuarine habitats for this species.

Transport Infrastructure Ireland (formally the National Roads Authority) has produced a series of best practice planning and construction guidelines for the treatment of certain protected mammal species (i.e. otter), which indicate that disturbance effects to terrestrial mammals would not be expected to extend beyond 150m (NRA, 2006). The proposed wind farm site is set back approximately 50m from the closest European site, the West of Ardara/Maas Road SAC with the nearest proposed works located over 500m from the SAC.

The proposed construction works will result in an increase in noise levels during the Construction Phase due to the presence of construction vehicles and machinery. Disturbance of species can occur as a result of noise emissions and visual disturbance from at the site of works.

The construction works will result in an increase in personnel and traffic movement to and from the site. Rock breaking and potentially blasting will be undertaken during the Construction Phase. The construction works will also result in an increase in personnel and traffic movement to and from the construction works locations. There will be disturbance impacts from these locations.

A temporary increase in noise levels and visual disturbance is expected within the work locations of the proposed wind farm site which may result in disturbance to wildlife within the immediate vicinity of the site. Sensitive species such as Otter can be displaced from suitable habitat locations. There may be temporary avoidance of the site by mammal species in the vicinity of the proposed works as a result of noise and vibrations associated with the works during working hours during the work.

In general, plant machinery will be designed to ensure that the maximum noise level 10m outside the site boundary do not exceed an equivalent continuous sound level beyond what is recommended in the BSI British Standards (BS5228-1:2009+A1:2014). The Construction Phase of the proposed project is anticipated to generate relatively low levels of noise, and only during permitted construction hours.

6.1.1.5 Dust

Excavation activities may also result in the temporary generation of dust in the locality of the works area. The Institute of Air Quality Management provide guidelines (Holman et al. 2014)[48] which prescribes potential dust emission risk classes to ecological receptors. Following the guidelines and considering the size of the proposed project, the scale of the earthworks were considered large (total site area >10,000m²). The guidelines specify that receptor sensitivity is 'High' up to 20m from the source and reduces to 'Medium' at 50m. Dust may also be generated from trackout due to heavy duty vehicle (HDV) movements from the site entrances. It is anticipated that HDV movement will range within 70 outward movements average per day which equates to 'Medium' trackout movement. The guidelines indicate that Medium trackout equates to dust occurring between 50-100m from the site. The construction works associated with the access road and network infrastructure will be at a much smaller scale. The generation of dust is likely to range between 25-50m form the works area.

The spatial limit of dust impacts was therefore determined as a 50m buffer from the proposed works area. The site is less than 50m from the Gweebarra estuary water body which is part of the West of Ardara/Maas Road SAC. The proposed wind farm site is set back approximately 50m from the Gweebarra estuary water body which is part of the West of Ardara/Maas Road SAC with the nearest proposed works located over 500m from the SAC.

[48] Holman, C., Barrowcliffe, R., Birkenshaw, D., Dalton, H., Gray, G., Harker, G., & Vining, L. (2014). IAQM Guidanceon the Assessment of Dust from Demolition and Construction. Institute of Air Quality Management, London (accessed 11.03.14).www.iaqm/wpcontent/uploads/guidance/dust_assessment.pdf.http://iaqm.co.uk/wpontent/uploads/guidance/iaqm_guidance_report_draft1.4.pdf.

6.1.2 Operational Phase Impacts

Potential operational phase impacts associated with the proposed project are discussed hereunder.

6.1.2.1 Noise and Disturbance

During the operational phase, the proposed project will function as a wind farm and thus there will be turbine noise and aviation lighting on the turbines related to the operation of the site. Minor noise disturbance may arise from traffic relating to site visitations and the maintenance of the site. The increase in human presence and noise levels during the operational phase is unlikely to impact the surrounding environment.

There is no artificial lighting anywhere else within the proposed for the proposed projcet. Therefore it is anticipated there will not be a disturbance to aquatic mammals as a result of the turbine noise and aviation lighting.

6.1.3 Decommissioning Phase Impacts

The proposed wind farm is expected to be operational for at least 35 years. On cessation of activities, the wind farm will be removed from site. Impacts during decommissioning are expected to be similar type and magnitude to those anticipated during the construction phase but generally of a shorter duration.

7.0 MITIGATION IN RELATION TO AQUATIC SPECIES AND HABITATS

The appraisal of the proposed project potential for giving rise to likely significant effects to West Of Ardara/Maas Road SAC European site concluded that, in the absence of appropriate mitigation measures, the proposed dproject may result in potential adverse effects on the qualifying interests of the, and also to distant European sites.

In accordance with Article 6(3) of the Habitats Directive, the following Mitigation measures are prescribed hereunder to avoid and/or reduce the significance of the potential impacts from the proposed project (Section 3.0) and prevent the occurrence of likely significant effects on European sites.

The following mitigation measures are set out in accordance with the European Commission (2001) guidance on the 'Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive (92/43/EEC)'. Mitigation is described with respect to:

- How the measures will avoid / reduce the adverse impacts on the site;
- The degree of confidence in their likely success;
- The timescale, relative to the project, when they will be implemented and secured; and
- How and when the measures will be monitored.

The construction works associated with the proposed project, in the absence of appropriate mitigation measures, could result in potential adverse effects on the qualifying interests of the West of Ardara/Maas Road SAC.

The mitigation measures are described with respect to:

- How the measures will avoid/reduce the adverse impacts on the site;
- The degree of confidence in their likely success;
- The timescale, relative to the project, when they will be implemented and secured; and
- How and when the measures will be monitored.

7.1 Construction Phase Mitigation Measures

Mitigation measures to be implemented during the construction phase of the proposed project are detailed hereunder.

7.1.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been prepared, covering the potential environmental risks and the proposed environmental construction strategies that are to be carried out before and during the Construction Phase of the proposed project. It includes all the mitigation measures prescribed in the NIS, as well as scheduling of works and best practice measures to prevent environmental impacts. The CEMP will be a live document that will be updated according to changing circumstances on the project and to reflect activities on site. It is intended that the CEMP will be finalised by the appointed contractor prior to commencement of construction.

7.1.2 Appointment of Ecological Clerk of Works

A suitably qualified Ecological Clerk of Works (ECoW) will be appointed by the Contractor. The ECoW will ensure that all mitigation measures prescribed in the NIS and, consequently, in the CEMP are implemented during the Construction Phase of the proposed project. The duties of the ECoW will include, but are not limited to:

- Will liaise regularly with the appointed Contractor and will review all Method Statements;
- Will ensure all mitigation measures prescribed herein are implemented correctly and effectively prior to and throughout the duration of the Construction Phase as appropriate. This is essential in relation to possible peat shear;
- Will inspect the installation and removal of all mitigation measures;
- Will undertake regular inspections of all mitigation measures throughout the duration of the construction phase;
- Will carry out continual assessment to ensure the mitigation measures are effective including assessment of adjacent peats for cracking/instability;
- Daily spot checks on the adequacy of cleaning and storage of waste onsite;
- Inspecting compliance with spill kit replacement;
- Will carry out regular inspection of the silt control measures, such as silt fences;
- Will cess all works should slippage indicators develop and/or settlement arrangements are inadequate for suspended solid removal in surface waters;
- Will ensure a Peat reinstatement is completed according to a detailed restoration plan; and
- Have arrangements established in relation to a contact protocol for the relevant statutory bodies on progress of works.

Further responsibilities of the ECoW are detailed within the below mitigation measures.

7.1.3 Mitigation Measures for Water Quality Effects

During the construction phase of the proposed project all pollution control measures will be designed, installed, and maintained in accordance with CIRIA guidance for '*Environmental Good Practice on Site*' (C741), '*Control of Water Pollution from Linear Construction Projects. Technical guidance*' (C648)[49] and with regard to IFI guidance '*Guidelines on the Protection Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*' (IFI 2016)[50] to ensure the protection of watercourses located within the proposed wind farm site. Furthermore, further specific mitigation measures associated with the protection of water quality are outlined hereunder.

7.1.3.1 Sediment control measures

The following mitigation measures are prescribed to ensure the prevention of water quality degradation due to the runoff of construction pollution during the construction works:

- A construction methodology is recommended prior to any works commencing with a view to, among others, minimising the volumes of excavation that will be required. Site preparation and construction must adhere to best practice and conform to the publication *'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.'*
- Interception of suspended solids must be designed to comply with an upper limit of 25mg per litre for the discharge of Total Suspended Solids (TSS) to surface waters as specified in the Salmonid Waters Regulations, SI 293 of1988.
- Buffer zones should not be used for the storage of any materials.
- The welfare facilities will be located within the proposed wind farm site, setback a minimum of 50m from the streams and rivers of the Mulnamin Beg_010 or any drainage ditch.
- A number of CCTV poles will be located within the proposed wind farm site, setback a minimum of 10m from the drainage ditches and the river.
- Silt fences will be erected along any open drainage areas on the proposed wind farm site.
- Silt fencing will also be installed on site where appropriate during the proposed bridge access works, to prevent discharge into the streams and rivers of the Mulnamin Beg_010 and main works area.
- Silt fences will be constructed using a permeable filter fabric (Hy-Tex Terrastop Premium silt fence or similar) and not a mesh. The silt fences will be positioned to allow an appropriate working area, but should not occur within areas prone to flood, or below the high-water mark. Silt fencing will be installed as per the manufacturer's guidelines prior to any ground disturbance works. Silt fences will be installed under the ECoW supervision and will be maintained until all ground disturbance has ceased and vegetation re-established. Once installed, the silt fence should be inspected regularly during construction and more frequently during heavy rainfall events. The ECoW will also supervise the removal of the silt fences following the completion of the works. Silt

[49] CIRIA (2001). Control of water pollution from construction sites. Guidance for consultants and contractors (C532). Available at: https://www.ciria.org//ProductExcerpts/C532.aspx . Accessed: December 2021.
[50] IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters. Available at: http://www.fisheriesireland.ie/fisheries-management-1/624-guidelines-on-protection-of-fisheries-during-constructionworks-in-and-adjacent-to-waters . Accessed: December 2021.

curtains and floating booms will also be used where deemed to be appropriate and this will be assessed separately at each individual location.

- Track rutting's by machinery movement must be kept to a minimum and no discharge or run off containing high sediment loads must occur from the site. In this regard a contingency plan should be established and strictly adhered to.
- Prior to the commencement of excavations, an area for stockpiling excavated material will be identified within the proposed wind farm site, a minimum of 50m of the streams and rivers of the Mulnamin Beg_010 or any drainage ditch. Any stockpiling of peat or other site materials will require careful management to ensure that slippage or collapse to any adjacent watercourses will not occur.
- The amount of excavated material is expected to be small, but stockpiling of large volumes of loose soil material onsite will be avoided, and surplus material removed from the site as soon as work is completed.
- Piling maybe considered for turbine bases at deep peat locations and these bases should be a minimum 50 metres from watercourses. This separation distance must be increased where fisheries sensitive waters occur.
- Excavation activities will not be carried out during or following heavy rainfall (i.e., if there is a yellow weather warning in place or 5mm in a 1-hour period). Excavations will be covered with tarp or similar material, during high rainfall to avoid the creation of surface water with high concentrations of suspended solids that would require dewatering.

7.1.3.2 Pollution control measures

- An emergency plan for the construction phase of the proposed projectto deal with accidental spillages will be drawn up, which all site personnel must adhere to and receive training in.
- If it is intended that oil or fuel be stored in or adjacent to the construction site, it must be kept in a bunded area (providing 110% capacity of the largest storage unit), 100m from any watercourse which appears on a 6" O.S. map of the site.
- Vehicle maintenance should not occur within 100m of any watercourse and all machinery must be in good working order, free from any leakage of fuel, oil or hydraulic fluid.
- The construction compound and parking will be located adjacent to the access road to the site, with wheel-washing facilities present at the site entrance.
- Spill-kits and hydrocarbon absorbent packs will be stored in the cabin of all construction vehicles. All machine operators and site staff will be fully trained in the use of this equipment.
- No material or vehicles will be stored within 10m of drainage ditches.
- All machinery will be regularly maintained and checked for leaks. Services will only be undertaken within the construction compound or offsite.
- Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles / equipment will take place in designated hard surface, bunded areas within the construction compound or off site only. If it is not possible to bring machinery to the refuelling point, fuel will be delivered in a double-skinned mobile fuel bowser. A drip tray will be used beneath the fill point during refuelling operations in order to contain any

spillages that may occur. Refuelling will only occur within the construction compound or off site and under inspection by the ECoW.

- All concrete will be mixed off site and will be brought in as required and poured in place at site. No on-site batching will be permitted within the proposed wind farm site. Precast elements for the bridges, culverts and concrete works will be used.
- All concrete browsers will be washed down in dedicated concrete washout areas onsite located within the construction compound or off site. Concrete washings will not be disposed of onsite to any surface or ground water feature. All washings will be removed offsite and treated at a licensed facility. No chemicals that are deleterious to aquatic organisms will be used in cleaning works. All raw, uncured waste concrete will be cured at a designated location within the construction compound or off site.
- All concrete works will be scheduled during dry weather conditions only to reduce the elevated risk of runoff.
- The welfare facility will be located within the proposed wind farm site, and setback a minimum of 50m from the drainage ditches and rivers. The temporary welfare facilities will not have any discharge to ground or surface waters.
- All wastewater will be collected in a large tank, and will be emptied as required by a licenced waste collector according to the manufacturer's guidelines.
- The temporary welfare facilities will not have any discharge to ground or surface waters. All wastewater will be collected in a large tank and will be emptied as required by a licenced waste collector according to the manufacturer's guidelines.

On completion of the works, all apparatus, plant, tools, offices, sheds, surplus materials, rubbish, and temporary erections or works of any kind will be removed from the site.

7.1.4 Management of Near-stream Works

All near-stream construction work will only be carried out during the period permitted by IFI according to the Eastern Regional Fisheries Board (2004) guidance *document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites",* that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

The following control measures will be implemented during the construction of the proposed development adjacent to the streams and rivers of the Mulnamin Beg_010 as per IFI guidance received:

- Roadside drains should not intercept large volumes of water from ground above. Any watercourse, however small that is intercepted by the access routes should preferably be bridged or culverted at that point. The use of fords must be avoided. Culverts should be of a size sufficient to avoid overloading, blocking or washout. The profile of any stream that is crossed must remain the same and any fish movement remain unhindered. Shooting velocities must be avoided. Floating roads must be considered where any peat encountered is one metre or more in depth. Piling maybe considered for turbine bases at deep peat locations and these bases should be a minimum 50 metres from watercourses. This separation distance must be increased where fisheries sensitive waters occur.

- Erosion of roadside embankments and cuttings should be avoided by using intercepting trenches or terracing. Embankments and cuttings should be kept at no greater slope than the normal angle of repose to encourage re-vegetation, otherwise added stabilisation may be required. It is essential that silt traps and settlement ponds are utilised and are capable of settling out materials prior to discharge off site. These ponds must take into account high precipitation events and designed accordingly, incorporating other treatment measures where necessary. The traps and ponds must be regularly inspected and maintained as required.
- Existing drainage channels should remain untouched.
- Works will not be carried out adjacent to the streams and rivers of the Mulnamin Beg_010 during the Annual Close Season. The timing of works will be considered on a site-specific basis and in agreement with the IFI;
- The Method Statement for the installation of the proposed settlement ponds will be agreed with IFI prior to construction;
- The area of disturbance of the watercourse bank will be the absolute minimum required for the works;
- Sediment control measures as listed above, will be located immediately downstream of the works. These will be inspected daily, maintained and cleaned regularly during the course of site works.
- Consideration should be afforded to the likely increase in surface water flow from the site which has the potential to alter the downstream prevailing hydrological regime and impact on the fisheries resource. In this regard attenuation measures should be identified and implemented in the surface water drainage arrangements.
- The works programme will take account of weather forecasts and predicted rainfall. All large excavations, subsoil and vegetation stripping will be avoided during adverse weather.
- Works should be suspended during heavy rains or when there is high risk of pollutants entering adjacent surface waters. Run-off volumes should not exceed the assimilative capacity of the receiving waters.
- Bank side clearance and riparian vegetation removal will be kept to a minimum.

7.1.5 Management of Invasive Species and Pathogens

In order to comply with Regulations 49 and 50 of the European Communities (Birds and Natural Habitat) Regulations (2011), the appointed Contractor will ensure biosecurity measures are implemented throughout the construction phase to ensure the introduction and translocation of invasive species is prevented.

The following mitigation measures are prescribed to control the translocation or spread of invasive species and / or pathogens.

7.1.5.1 Establishing Good Site Hygiene and a Bio-secure Zone

- Fencing will be established around each working area hosting the invasive species. In this case, the bio-secure zone will be 7m away from the visible plant parts. This will ensure all areas scheduled to be treated are included in the area fenced off. This will inform personnel that access into and out of the area is restricted. Signage should be erected along the fencing to avoid unnecessary contact with the plant or surrounding contaminated soils.

- A RAMS must be provided by the contractor prior to commencement of any works.
- A designated wash-down area is to be created, where material from a power-washed vehicle can be effectively contained, collected and buried/removed off-site along with other contaminated material. The area must have a washable membrane or hard surface.
- Stockpile areas shall be chosen to minimise movement of contaminated soil.
- Any stockpiles must be marked and isolated.
- Using tracked machines within the contaminated area is likely to contribute to the spread of seeds and should be avoided.
- The onsite ECoW will monitor and oversee implementation for the plan.
- In the event of there being difficulty in sealing the area adequately, the contractor shall not move any contaminated soil from the excavation site, but shall refer back to the ECoW or Ecologist, who will consult with an appropriately qualified person to design alternative measures.

7.1.5.2 Decontamination of Vehicles

- Decontaminating will be carried out for vehicles involved with management of invasive species and may only take place within a designated wash-down area.
- Prior to arrival on site and on departure, the contractor’s vehicles and equipment must be thoroughly cleaned. High-pressure steam cleaning, with water >60°C, is recommended for vehicles and equipment where reasonably feasible. If it is not possible to steam clean the equipment, a normal power hose must be used. After cleaning, equipment will be visually inspected to ensure that all adherent material and debris has been removed;
- Vehicles and machinery must be cleaned using stiff-haired brush and pressure washer, paying special attention to any areas that might retain seeds such as wheel tyre threads and wheel arches.
- All vehicles and machinery should be cleaned before and after using them to excavate contaminated material.
- All equipment (including footwear) that has come into contact with water or soils will be visually inspected for evidence of attached plant or animal material, or adherent mud or debris. This should be done before entering and leaving the site. Any attached or adherent material will be removed before entering or leaving the site;
- Run-off from wash-down area must be isolated and treated as contaminated material;
- All contractors will be required to sign a prepared form detailing the nature of the cleaning process carried out and the date on which this was conducted; and
- Please note no vehicles will enter watercourses during the construction or operation of the proposed project.

During construction works, the spread or introduction of alien invasive species and noxious weeds will be avoided by adopting appropriate biosecurity measures, as per guidance issued by the Transport Infrastructure Ireland (TII) (2010)[51], Invasive Species Ireland Best Practice Management Guidelines[52] and Inland Fisheries Ireland (IFI)[53] with respect to the protocols developed for the control of the spread of alien invasive species to both the aquatic and terrestrial environment, including the following measures:

The presence of alien invasive species and requirement for actions (if any new invasive species are found to be present onsite) will be confirmed by a suitably invasive species specialist or qualified ecologist.

The following mitigation measures, are prescribed to control the translocation or spread of invasive species and / or pathogens:

- Biosecurity measures will be employed during the construction works associated with the drainage ditch works. The biosecurity measures will have regard to IFI Biosecurity Protocols including: 'IFI Biosecurity Protocol for Field Survey Work (December 2010)'.
- Site hygiene measures listed above in Section 7.1.5.1 will need to be put in place when managing existing invasive species to ensure that the further spread of invasive species is avoided.

All materials entering site must be checked to ensure their sources are free of invasive species, particularly soil and plant material. All machinery entering site must be cleaned and checked for invasive species prior to arrival onsite.

All machinery and equipment used during the drainage works will be inspected and will be completely dry prior to works commencing to prevent the risk of pathogen translocation. A 'Check, Clean, Dry' protocol will be undertaken with all equipment, machinery and vehicles entering and leaving the proposed wind farm site. All equipment/machinery used within the drainage ditch will checked for living plants and animals. Equipment and machinery used will be washed thoroughly and then allowed to dry for at least 48 hours.

7.2 Operational Phase Mitigation Measures

Mitigation measures which will be implemented during the operational are minimal due to the limited potential Operational Phase Impacts. However during the operation of the wind farm, the pollution control measures stated in Section 7.1.3.2 should be fully adhered to.

7.3 Decommissioning Phase Mitigation Measures

Given the classification of the potential impacts from the proposed project's decommissioning phase (i.e. of same nature as the potential impacts during the construction phase – Section 6.1.1), the mitigation measures proposed for the construction phase of the proposed project (Section 7.1), are also proposed for the proposed project's decommissioning phase.

In addition, all structures proposed to be removed, will be removed offsite, while below ground structures filled with clean and free from invasive species material. Hardstanding areas will be rehabilitated by covering with local topsoil and allowed to revegetate. Road infrastructure will be left in place.

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[51] https://www.tii.ie/tii-library/environment/construction-guidelines/Management-of-Noxious-Weeds-and-Non-Native-Invasive-Plant-Species-on-National-Road-Schemes.pdf
[52] http://invasivespeciesireland.com/wp-content/uploads/2012/01/Himalayan-Balsam-BPM.pdf
[53] https://www.fisheriesireland.ie/Biosecurity/biosecurity.html

7.4 Mitigation Effectiveness

The appointed Contractor will be responsible for ensuring all mitigation measures listed above, including any additional planning conditions, are fully implemented during construction works. The above listed mitigation measures will be implemented prior to the construction works commencing and/or undertaken throughout the duration of the works.

The above mitigation measures are best practice and are proven technologies/methods. These mitigation measures, once correctly applied, will avoid, or reduce the magnitude of potential impacts on the receiving environment, therefore ensuring avoidance of adverse effects on the integrity of the West Of Ardara/Maas Road SAC.

8.0 CONCLUSION

In the absence of mitigation, the potential impacts on the West Of Ardara/Maas Road SAC is potential disturbance of qualifying interest species and/or a potential reduction in water quality from the release of suspended solids, and/or pollutants into the surface water system. However, following the application of mitigation measures, as detailed in Section 7, potential significant adverse effects will be avoided or reduced. Consequently, it is determined that there will be no risk of significant adverse effects on the qualifying interest habitats and species, or on the overall site integrity, nor in the attainment of the specific conservation objectives for the West Of Ardara/Maas Road SAC.

NIS Appendix 3 – Hydrology & Hydrogeology EIAR Chapter

9.0 HYDROLOGY AND HYDROGEOLOGY

9.1 INTRODUCTION

This chapter of the EIAR assesses the effects of the proposed Cloghercor Wind Farm project as described in Chapter 2 (Description of the Proposed Project) on the Hydrology, Hydrogeology and Water Quality environment. Information on the existing hydrological (surface water) and hydrogeological (groundwater) environment is presented as a baseline for the site. The potential effects of the development of the proposed wind farm and associated infrastructure are discussed along with prescribed mitigation measures for each potential effect. Any residual and cumulative effects are also assessed.

9.1.1 Statement of Authority

TOBIN Consulting Engineers (TOBIN) have completed this chapter. TOBIN Hydrologists and Hydrogeologists are intimately familiar with the site characteristics for the Cloghercor Wind Farm, having worked on other wind farms including Castlebanny, Lisheen, Bruckana and Derryadd set in various ground conditions and water environments. This chapter has been completed by John Dillon, Mistaya Langridge and Laura McGrath of TOBIN Consulting Engineers.

John Dillon (BSc., MSc., DIC, MCIWM, PGeo) is a hydrogeologist with 18 years' geological/hydrogeological experience in groundwater development, windfarm and major infrastructure developments. John has authored numerous Hydrology, Hydrogeology and Water Quality chapters for EIARs for a range of projects.

Laura McGrath (BSc., MSc., PGeo) is a hydrogeologist with six years hydrogeological experience in groundwater resources, contaminated land, ground investigation and various infrastructure developments including wind farms. Laura has authored a number of Hydrology, Hydrogeology and Water Quality chapters for EIARs for various projects.

Mistaya Langridge is a hydrologist/engineer with eight years' experience in Flood Risk Assessment (FRA). Mistaya has authored a number of FRAs for EIARs for various renewable projects.

9.2 ASSESSMENT METHODOLOGY

The methodology used to produce this chapter included a review of relevant legislation and guidance, a desktop study, a site walkover, an intrusive investigation, an evaluation of potential effects, an evaluation of the significance of the effects, and an identification of measures to prevent and mitigate the effects.

9.2.1 Guidance and Legislative Review

The EU Water Framework Directive (2000/60/EC) (WFD) established a framework for the protection of both surface water and groundwater. Transposing legislation (S.I. No. 272 of 2009, European Communities Environmental Objective (Surface Water) Regulations 2009 as amended) outlines the water protection and water management measures required in Ireland to maintain high or good status of waters.

The first cycle of the River Basin management Plan (RBMP) ran from 2009-2015, where eight separate plans were devised for all of the River Basin Districts (RBDs) with the objective of achieving at least 'good' status for all waters by 2015 (noting that later dates were set for certain waterbodies noted to be under significant pressures). The second cycle of the River Basin Management Plan: 2018-2021, was published by the Department of Housing, Planning and Local Government in April 2018. The third cycle of the River Basin Management Plan: 2022 – 2027 was published in 2022.

The WFD establishes common principles and an overall framework for action in relation to water protection and developed the overall principles and the structure for protection and sustainable use of water in the European union.

There are three separate objectives that are of particular relevance to the characterisation of water quality, hydrology and hydrogeology (Article 4.1):

- To prevent deterioration of status of all waterbodies;
- To protect, enhance and restore all waterbodies with the aim of achieving 'Good' status by 2015, with some limited exceptions, or by the dates set out in the River Basin Management Plans; and
- To reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity on groundwater.

The European Communities Environmental Objectives (Surface Waters) Regulations, 2009 give effect to the criteria and standards to be used for classifying surface waters in accordance with the ecological objectives approach of the WFD. In accordance with the regulations, waters classified as 'High' or 'Good' must not be allowed to deteriorate. Waters classified as less than good must be restored to at least good status within a prescribed timeframe. In addition, the regulations address certain shortcomings identified by the European Court of Justice in relation to Ireland's implementation of the Dangerous Substances Directive (76/464/EEC), as amended. The regulations set standards for biological quality elements and physico-chemical conditions, supporting biological elements (e.g., temperature, oxygen balance, pH, salinity, nutrient concentrations and specific pollutants), which must be complied with. These parameters establish the 'ecological status' of a water body.

This chapter has been prepared having regard to the legislation quoted below in accordance with policy documents:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act 2000, as amended;
- Planning and Development Regulations 2001, as amended;
- S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy) and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations which implement EU Water Framework Directive (2000/60/EC) establishing a framework for the Community action in the field of water policy and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC) on the protection of groundwater against pollution and deterioration. Since 2000 water management in the EU has been directed by the Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission

Directive 2014/101/EU (WFD). The WFD was given legal effect in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003);
- S.I. No. 684 of 2007: Waste Water Discharge (Authorisation) Regulations 2017, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);S.I. No. 106 of 2007: European Communities (Drinking Water) Regulations 2007and S.I. No. 122 of 2014: European Communities (Drinking Water) Regulations 2014, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and EU Directive 2000/60/EC;
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010 (as amended by S.I. No. 389/2011; S.I. No. 149/2012; S.I. No. 366/2016; the Radiological Protection (Miscellaneous Provisions) Act 2014; and S.I. No. 366/2016); and
- S.I. No. 296 of 2009: The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (as amended by S.I. No. 355 of 2018).

The assessment was carried out in accordance with the following guidance and tailored accordingly based on professional judgement and experience:
- Environmental Protection Agency (EPA) (May 2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports;
- Construction Industry Research and Information Association (CIRIA) (2001): Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001; and,
- Environmental Protection Agency (EPA) (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals);
- Institute of Geologists Ireland (IGI) (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements; and
- (National Roads Authority (NRA) 2008a): Environmental Impact Assessment of National Road Schemes – A Practical Guide
- National Roads Authority (NRA) (2008b): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities on 'The Planning System and Flood Risk; Management' published in November 2009, jointly by the Office of Public Works (OPW) and the Department of Environment, Heritage and Local Government (DEHLG) (now the Department of Housing, Local Government and Heritage (DHLGH)).

9.2.2 Desk Review

A desk study was undertaken in order to collate and review background information of the receiving environment during the assessment. The sources of information obtained is listed below:
- National Peatland Strategy (NPWS, 2015);
- Hydrological features (drains, silt ponds, outfalls) provided by Bord na Móna;
- Geological Survey of Ireland (GSI) online mapping;
- Environmental Protection Agency database (www.epa.ie);
- Teagasc SIS Map Viewer (www.gis.teagasc.ie/soils/map.php);
- Met Éireann Meteorological Databases (www.met.ie);
- National Parks and Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directives Catchments Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet No. 7; Geological Survey of Ireland;
- Geological Survey of Ireland – Groundwater Body Characterisation Reports;

- OPW Indicative Flood Maps (www.floodmaps.ie);
- Environmental protection Agency - HydroTool Map Viewer (www.watermaps.wfdireland.ie/HydroTool);
- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.floodinfo.ie); and
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

9.2.3 Field Survey

A total of six site walkovers were undertaken to review the ground conditions and assess the topography, geomorphology and requirements for further investigations were carried out in November 2021, June 2022, October 2022 and November 2022.

The objectives of the intrusive site investigations conducted in June and July 2022 included mapping the distribution and depth of blanket peat at the site along with assessing the mineral subsoil / bedrock interface beneath the peat at key development locations (i.e., proposed turbine, substation, compound and borrow pit locations. The surveying of several bedrock exposures at the site (not forming part of the project) confirmed the findings of the investigations and allowed the development of an accurate hydrogeological conceptual model of the site.

The hydrological walkover survey involved the following:

- Walkover surveys and hydrological mapping of the proposed project, grid connection route, the Turbine Delivery Route and the surrounding area (including the Biodiversity Enhancement Lands) were undertaken whereby water flow directions and drainage patterns were recorded;
- An assessment of the hydraulic capacity/adequacy of existing stream culverts (those being altered by construction) and design specifications for proposed stream culverts; and
- A flood risk assessment for the proposed project footprint area.

Site surveys relating to the water environment and ground investigations were undertaken from June to August 2022. These included:

- Flow Measurements;
- Water Sampling;
- Logging of the soil layers and sampling of each stratum encountered; and
- Laboratory analyses of the samples collected during the above investigations.

9.2.4 Consultation

The EIAR Scoping and consultation activities were carried out in accordance with all relevant guidance documents as set out in Section 1.8 of this EIAR. The purpose of scoping for the EIAR is to provide a framework for the approach to be taken by the individual specialists in carrying out their evaluations, identifying environmental aspects for which potential significant environmental impacts may arise. It also provides a framework for the consultation process and sets out the intended structure of the EIAR.

Responses were received from GSI, DAU, IFI and Irish Water and included in Appendix 1- 4. The most relevant consultation was with GSI and identified the requirement for the assessment of peat, geohazards and geological heritage sites.

IFI requested the following be addressed:

- Fuel storage,
- Site drainage,
- Erosion control,
- Site management to minimise sedimentation,
- Potential impacts to runoff rates should be considered,
- Construction phase monitoring and ensuring a suitably qualified person is on site during construction to ensure mitigation is used correctly,
- Continual assessment is carried out,
- Works stop should any issue arise,
- Peat reinstatement is carried out correctly and arrangements are in place to contact statutory bodies on works progression.

The considerations have been addressed within this chapter. The content of the scoping is further summarised in Chapter 1.

9.2.5 Impact Assessment Methodology

The importance of the hydrogeological and hydrological receptors was assessed on completion of the desk study and baseline assessment. Using the NRA Guidance presented in Appendix C of the IGI guidelines (2013), an estimation of the importance of the hydrological and hydrogeological environments is set out in Table 9-1 and Table 9-2.

Table 9-1: Estimation of Importance of Hydrology Attributes

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	• River, wetland or surface water body ecosystem protected by EU legislation, e.g., 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale.	• River, wetland or surface water body ecosystem protected by national legislation – NHA status. • Regionally important potable water source supplying >2500 homes. • Quality Class A (Biotic Index Q4, Q5). • Flood plain protecting more than 50 residential or commercial properties from flooding. • Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale.	• Salmon fishery locally important potable water source supplying >1000 homes. • Quality Class B (Biotic Index Q3-4). • Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale.	• Coarse fishery. • Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). • Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale.	• Locally important amenity site for small range of leisure activities. • Local potable water source supplying <50 homes.

Importance	Criteria	Typical Example
		• Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. • Amenity site used by small numbers of local people.

Table 9-2: Estimation of Importance of Hydrogeology Attribute

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	• Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g., SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale.	• Regionally Important Aquifer with multiple wellfields. • Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. • Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale.	• Regionally Important Aquifer Groundwater provides large proportion of baseflow to local rivers. • Locally important potable water source supplying >1000 homes. • Outer source protection area for regionally important water source. • Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale.	• Locally Important Aquifer. • Potable water source supplying >50 homes. • Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale.	• Poor Bedrock Aquifer Potable water source supplying <50 homes.

9.2.5.1 Overview of Impact Assessment Process

The conventional source-pathway-receptor model (Figure 9-1) for groundwater and surface water protection was applied to assess potential effects on groundwater and surface water specifically on downstream sensitive ecological receptors and local groundwater supplies.

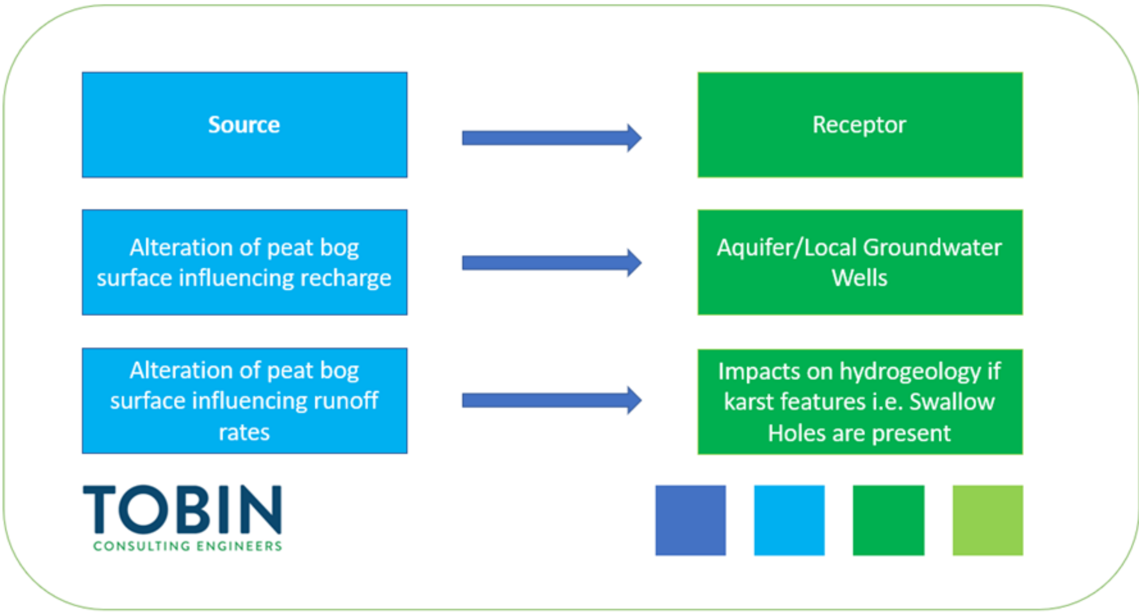


Figure 9-1: Example of a Source Pathway Receptor Model

In this chapter, the potential effects on the water environment resulting from the proposed project are evaluated and mitigation measures are proposed to reduce any significant effects. Based on the mitigation measures proposed, the significance of the residual effects on the water environment is determined.

The significance of effects of the proposed project has been assessed in accordance with the EPA guidance document Guidelines on the Information to be contained in Environmental Impact Assessment Reports (May 2022). The magnitude of any effects takes into account the likely scale of the predicted change to the baseline conditions, resulting from the predicted effect and considers the duration of the effect i.e., temporary or permanent. Definitions of the magnitude of any effects are provided in Table 9-3.

Table 9-3: Definitions of the Magnitude of Effects (Source: Boxes 5.2 and 5.3 from the NRAs Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes)

Magnitude	Criteria	Typical Example
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute	Loss or extensive change to a waterbody or water dependent habitat. Increase in predicted peak flood level >100mm. Extensive loss of fishery. Extensive reduction in amenity value. Removal of large proportion of aquifer. Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems. Potential high risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >2% annually.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm. Partial loss of fishery. Partial reduction in amenity value. Removal of moderate proportion of aquifer.

Magnitude	Criteria	Typical Example
		Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems. Potential medium risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >1% annually.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm. Minor loss or fishery. Slight reduction in amenity value. Removal of small proportion of aquifer. Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems. Potential low risk of pollution to groundwater from routine run-off. Calculated risk of serious pollution incident >0.5% annually.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	Negligible change in predicted peak flood level Calculated risk of serious pollution incident < 0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	Reduction in predicted peak flood level >10mm Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality	Reduction in predicted peak flood level >50mm Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm

Potential effects may have a negative, neutral or positive effects on the water environment. Terms relating to the duration of impacts are described in accordance with the EPA's guidelines on the information to be included in Environmental Impact Assessment Reports (2022) as:

- Momentary Effects – Effects lasting from seconds to minutes;
- Brief Effects – Effects lasting less than a day;
- Temporary Effects – Effects lasting one year or less;
- Short term Effects – Effects lasting one to seven years;
- Medium term Effects – Effects lasting seven to fifteen years;
- Long term Effects – Effects lasting fifteen to sixty years;
- Permanent Effects – Effects lasting over sixty years; and
- Reversible Effects – Effects than can be undone, for example through remediation or restoration.

The likelihood of effects is necessary to know in order to identify a list of effects which are considered likely or unlikely. According to the EPA's guidelines (2022), likely effects are those *"that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented"*. Conversely, unlikely effects are those *"that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented"*

Figure 9-2 below shows how comparison of the character of the predicted effect to the sensitivity of the receiving environment can determine the significance of the effect.

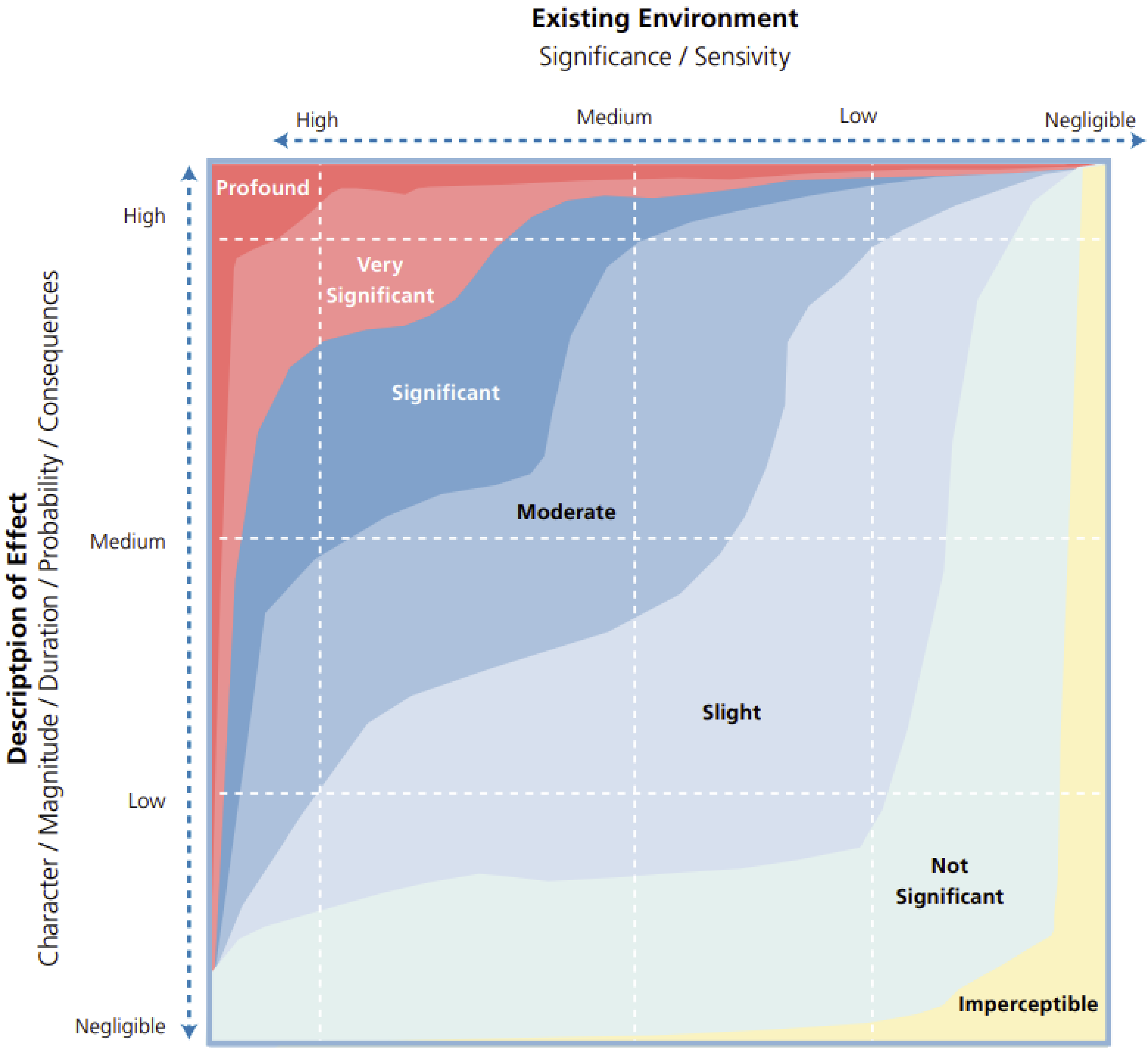


Figure 9-2: Significance of Impacts Matric for EIARs (EPA, 2022)

In order for a potential effect to be realised, three factors must be present. There must be a source of a potential effect, a receptor which can be affected and a pathway or connection which allows the source to affect the receptor (Figure 9-1). Only when all three factors are present can an effect be realised.

9.3 RECEIVING ENVIRONMENT

The existing water environment is discussed in terms of hydrology and hydrogeological conditions.

The regional review of geological conditions covers a zone of minimum 2km from the site boundary as suggested in the Institute of Geologists of Ireland (IGI) guidelines. This recommended minimum distance of 2km has been reviewed in the context of the geological/hydrogeological environment as well as the scale of activities and increased to reflect the sensitivity of the subsurface, for example where karst systems are present, to a maximum distance of 2km from the proposed wind farm site boundary.

9.3.1 Desk Review and Field Surveys

The hydrology, hydrogeology and water quality of the proposed project and the surrounding area was investigated through comprehensive desk studies and field inspections. A walkover survey of the site as described in Section 9.2.3 was carried out in order to identify hydrological features e.g., wet ground, drainage patterns and distribution, exposures and drains etc. Following the field surveys, the results were reviewed using GIS software in conjunction with publicly available hydrological and hydrogeological data from the Geological Survey of Ireland (GSI), Environmental Protection Agency (EPA) and Office of Public Works (OPW).

9.3.2 Site Description

The proposed wind farm site is located in Cloghercor, which is a townland approximately 3.5km south of Glenties, Co. Donegal. The EIAR study area is shown in Figure 1-1 of this EIAR (see Chapter 1 – Introduction), which includes the Biodiversity Enhancement Lands and the Turbine Delivery Route.

9.3.3 Site Topography and Geomorphology

The proposed wind farm site stretches from the Gweebarra River which runs along the northwestern ownership boundary toward the mountainous area in the north, east and south of the site. The area is moderately steep with areas of increase slope associated with granitic rock outcrops.

Cloghercor is located to the north-northeast of Glenties and the landscape is dominated by Croghleheen Mountain along the northwestern proposed wind farm site; Garfarretmoyle (also known as Cloghercor South) and Gaffaretcor Mountains and Derkbeg Hill to the south-eastern; Cleengort Hill along the southwestern of the proposed wind farm site.

The height and slope details for the mountains are as follows:

- Croghleheen Mountain has a peak of 385m AOD (above ordinance datum) which is located approximately 135m east of the site border and an approximate slope of 0.25m/m;
- Garfarretmoyle Mountain (Cloghercor South) has a peak of 301m AOD and an approximate slope of 0.25m/m;
- Gaffaretcor Mountain has a peak of 292m AOD which is located approximately 55m south of the site border and an approximate slope of 0.5m/m;
- Derkbeg Hill has a peak of 332m AOD which is located approximately 50m southeast of the site border and an approximate slope of 0.25m/m; and
- Cleengort Hill has a peak of 236m AOD which is located approximately 235m northwest of the site border and an approximate slope of 0.15m/m.

The site ranges from 0m at the Gweebarra river to a maximum topographic high of approximately 365m in the northeast of the site.

9.3.4 Surface Water Hydrology

The purpose of this section is to describe the surface water environment including the following:

- Catchment Overview;
- Site Surface Water Features and Drainage;
- Surface Water Quality;

- Assessment of Hydrometric Data;
- Surface Water Abstractions; and
- Flood Risk Assessment (FRA).

Catchment Overview

The site is located within the Gweebarra-Sheephaven Water Framework Directive (WFD) catchments (hydrometric area) which covers an area of 1451km^2 in west Donegal. These catchments are further subdivided into sub-catchments with the site located within the Gweebarra_SC_010 WFD sub-catchment and the Mulnamin_Beg_010 WFD river sub-basin which covers an area of 32.4km^2. All of these waters are of moderate to steep gradient and higher flow rate, representing natural watercourses typical eroding/upland rivers (FW1), that are actively eroding, unstable, where there is little or no deposition of fine sediment. Streams are largely unaltered and do not suffer from urban encroachment and associated point sources of pollution.

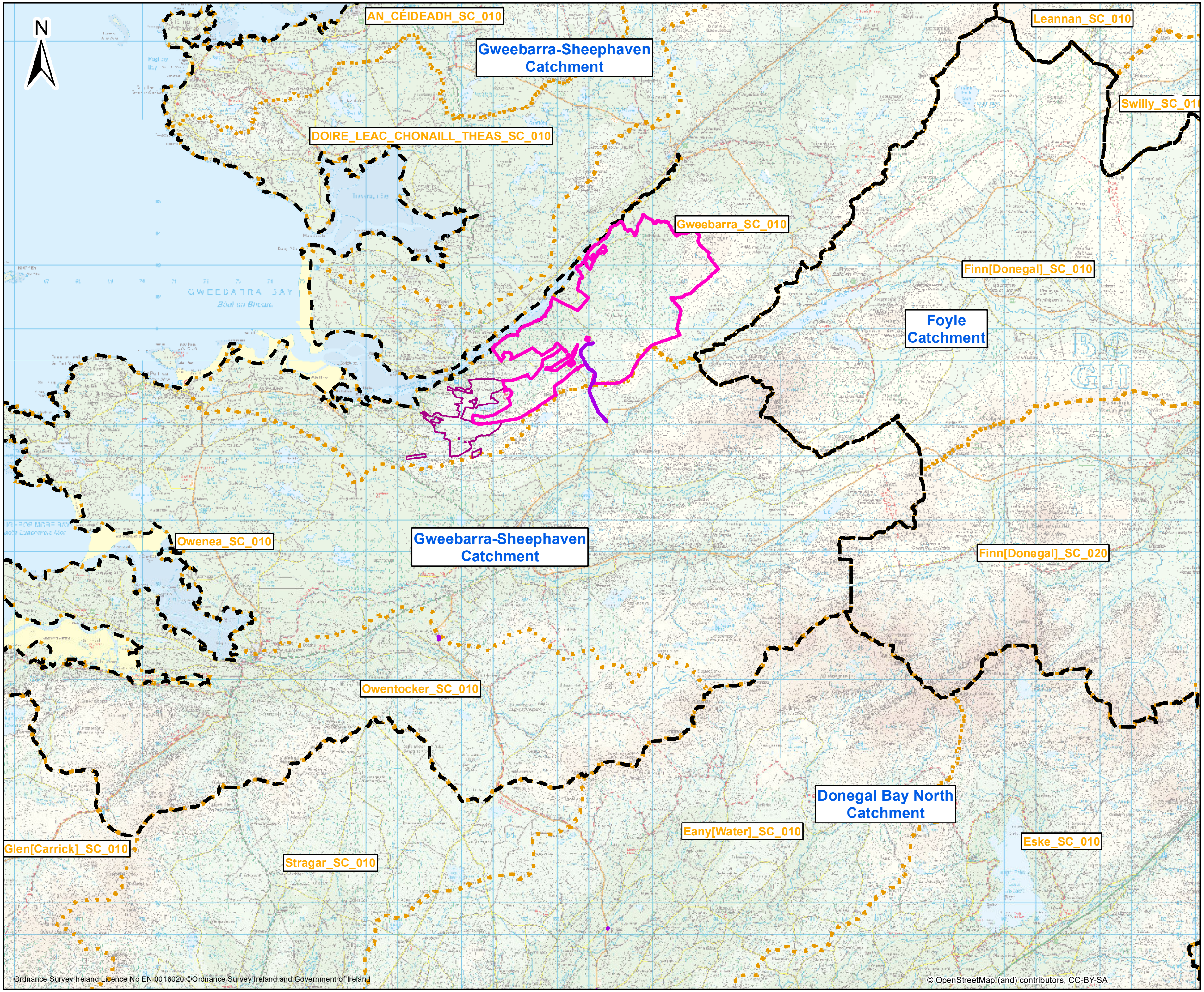
A catchment, also referred to as a drainage basin and watershed, is a topographic area that collects and discharges surface streamflow through one outlet or mouth. The catchment boundary is the dividing land where surface drainage flows toward a given stream from land where it drains into a separate stream. The regional natural surface water drainage pattern, in the environs of the proposed project is shown on Figure 9-3 'Regional Catchment Delineation Overview'.

Minor roadworks are proposed for the TDR route. It is proposed that the turbine components will be delivered to the site via Killybegs Port in southwest County Donegal as shown in Figure 2-3. The route heads north from the port in Killybegs on the R263 to the N56 where it turns eastwards. The route then continues generally eastwards on the N56 to the junction with the R262, where it makes a northerly turn in the direction of Glenties. The current application includes the proposed temporary works along the public road corridor of the turbine delivery route. At the end of the construction phase, all areas which were given temporary hardcore surfaces will be reinstated by being covered in topsoil and reseeded. TDR works are located in the catchments of the Owentocker River (Turbine Changeover), Coastal streams (near Killybegs) and Eany Water (Inver to Glenties road).

Site Surface Water Features and Drainage

During the desk review and site surveys, a number of surface water features were noted on the site. The drainage hierarchy with respect to these features is displayed in

Figure 9-4. These features, and monitoring points in the area of the proposed wind farm are illustrated in Figure 9-5.



Legend*

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands
- WFD - Catchments
- WFD - Subcatchments

*all land identified is within Boundary of the Proposed Project

0 1 2 3 4
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	03/03/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 9-3:
Regional Catchment Delineation Overview

Scale @ A4: 1:150,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: March 2023

Project Director: O.Fitzpatrick

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Draft: A

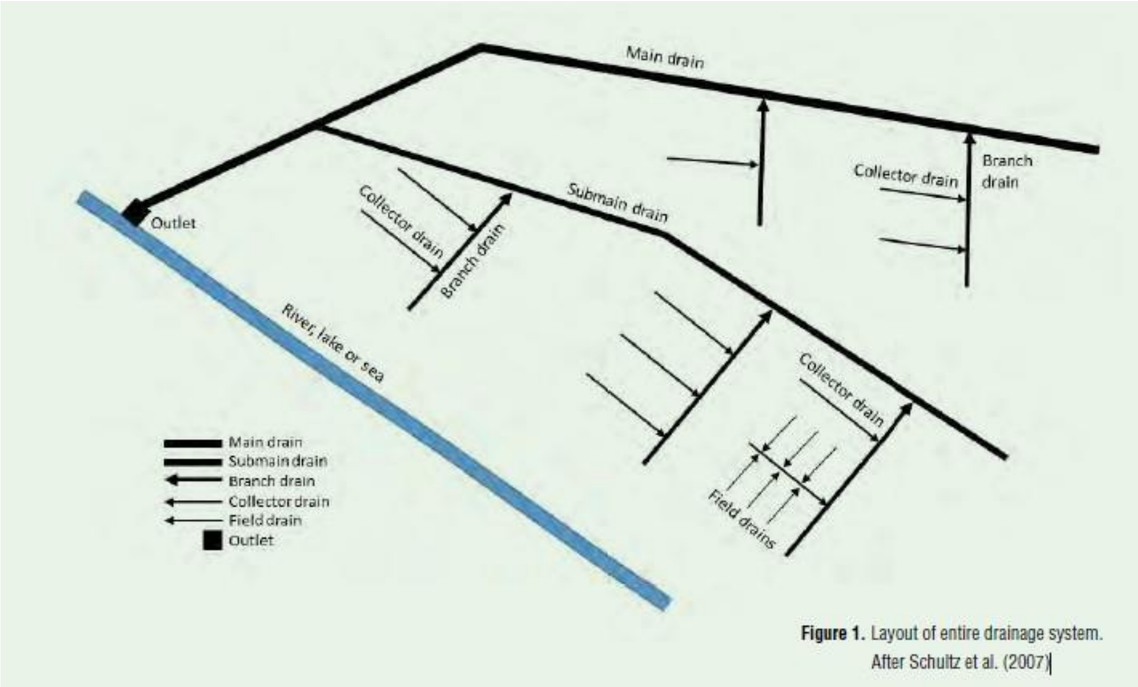


Figure 9-4:Site Drainage Hierarchy

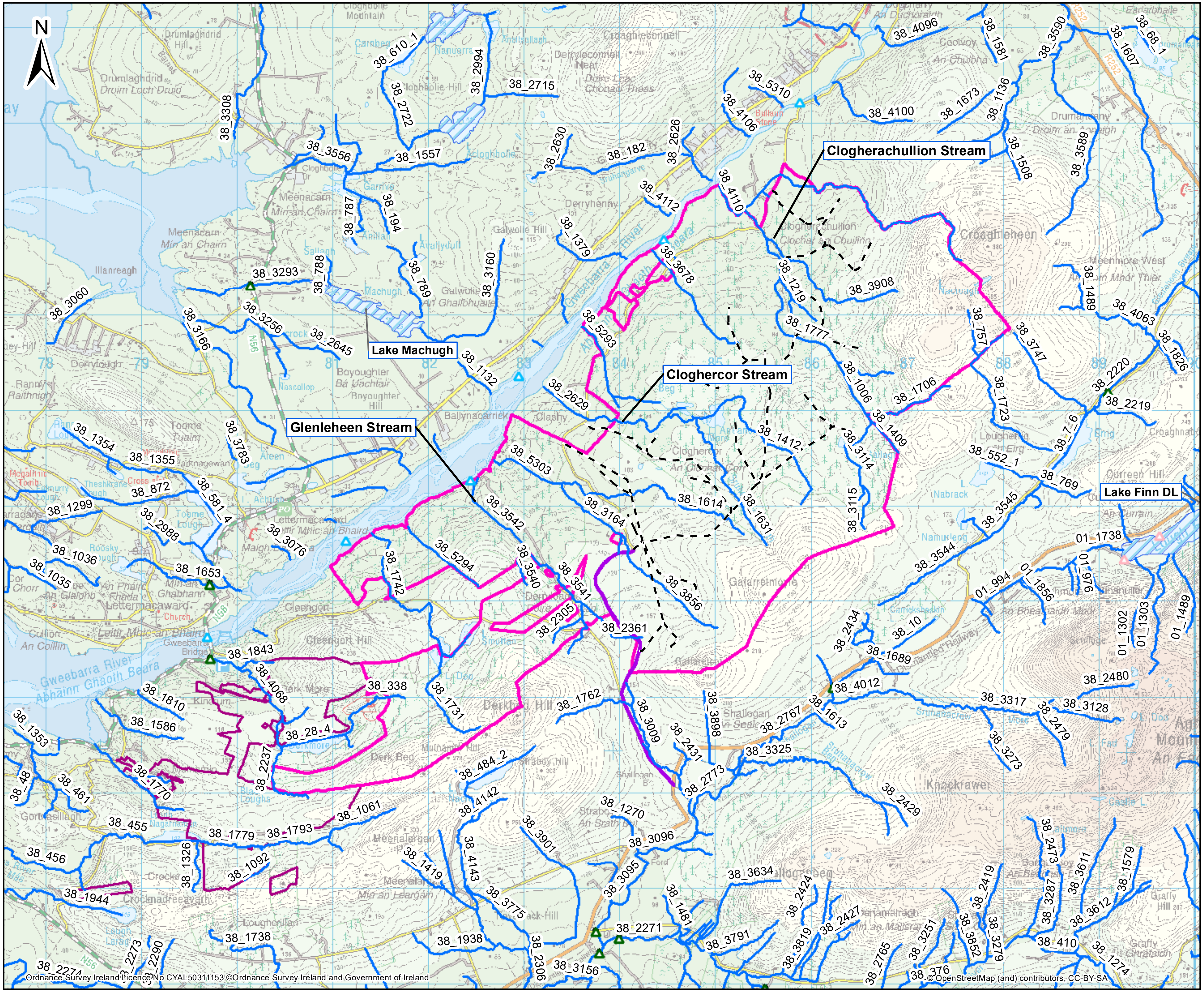
The surface waterbodies present within and alongside the proposed project consist of one transitional waterbody, eight lakes waterbodies and 12 rivers waterbodies with multiple tributaries. These are presented in Figure 9-5 below.

All river waterbodies, except one, flow in a general southeast to northwest direction into the Gweebarra Estuary. An unnamed stream and it's tributary in the north-eastern corner of the site flow in a northwest to south east direction into the Glenleheen (Stream), which flows northwards and meets the Gweebarra river and eventually flows into the Gweebarra Estuary to the north of the site. Although these waterbodies are not within the site boundaries, all rivers and streams downgradient of these unnamed streams are hydraulically connected to the site. It is noted that all the river waterbodies within the site are collectively identified as the Mulnamin Beg 10 subcatchment and the two river waterbodies in the north part of the site are part of the Glenleheen Stream_10 river system.

Derkmore Lough and a smaller unnamed lake are located to the west of the site boundary but are not hydrologically connected to the proposed wind farm site. Golden Eagle habitat enhancement is proposed in the Derkmore Catchment – See Chapter 6 Biodiversity. Aneane More (Lough) and Aneane Beg (Lough) are located downgradient of T6 and T11 towards the centre of the site. A small lake, Lough Sallagh, is located to the south of T9.

Table 9-4: Waterbodies present within and alongside the wind farm site boundary

Transitional waterbodies	Lakes	Rivers
Gweebarra Estuary	Lake Doo Lake Smuttan Nacroagh (Lough) Sallagh (Lough) Aneane More (Lough) Aneane Beg (Lough) 3 unnamed lakes/ponds	River waterbodies which flow northwest from the site into the Gweebarra Estuary – collectively identified as Mulnamin Beg 10: 1 unnamed river with 2 named tributaries (Clochar An Chuilinn and Loch Eirg) and 7 unnamed tributaries 3 unnamed streams 1 unnamed stream with 1 unnamed tributary An Clochar Corr with 3 unnamed tributaries 1 unnamed stream with 2 unnamed tributaries Doire Luacháin with 3 unnamed tributaries Cleengort with 1 unnamed tributary Derk More Mulnamin Beg River waterbodies which flow southeast from the site into the Glenleheen (Stream) – collectively identified as Glenleheen Stream 10: 1 unnamed stream with 1 unnamed tributary



Legend*

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands
- Site Roads
- EPA - Rivers
- WFD - Lake Water Bodies

Surface Water Monitoring Locations

- River Station
- Lake Station
- Transitional Station

*all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2
Kilometres

NOTES
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
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4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Issue	Date	Description	By	Chkd.
A	08/03/2023	Final issue	S.P	J.D

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 9-5:
Existing Surface Water Features and EPA Surface Water Monitoring Locations

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta | Checked: J.Dillon | Date: March 2023

Project Director: O.Fitzpatrick

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Draft:
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The upper reaches of the small streams, particularly in the south east of the site are ephemeral. This means that they are dry during periods of low rainfall i.e., the summer months. Generally, the streams on site are eroding upland streams in their youthful stages as they are proximal to their sources (Croaghleheen and Garfarretmoyle). Where small streams meet existing road crossings, they are managed using culverts typically between 0.4m and 0.6m in width. The streams on site vary in size but are usually less than 1m in width, and normally c. 0.2 to 0.6m deep.

The afforested proposed wind farm site and adjacent lands also include man-made drains which flow into the watercourses mentioned above. These drains are primarily used to assist in the drainage of agricultural land-use and forestry. A number of streams and drainage ditches will be crossed by the proposed access tracks.

9.3.5 Flow data

According to the online EPA Maps, there are no long-term recording surface water flow gauging stations in or near the site, other than those monitoring the Gweebarra Estuary. Gauging stations that measure the flow of surface water features give an excellent indication of surface water response at the time of monitoring. Given the substantial variation of soils across the site, runoff rates vary.

Flow data for the rivers emerging from the proposed wind farm site were calculated based on the EPA HydroTool data, and these data are presented on Figure 9-6.

Historical hydrometrics data in the wind farm site is limited. There are no active hydrometric stations within the site. A baseline survey and a hydrometric monitoring program were undertaken as part of the EIAR. Equations to estimate low flows based on catchment areas (Martin and Cunnane, 1977, MacCarthaigh, 2002) are available and are calculated as part of the project. These equations are largely guided by the values plotted for the larger catchments, (Brogan and Cunnane, 2005).

The Site monitoring data corresponds to low flow and rainfall data suggests that the 95%ile and Dry Weather Flow (DWF) will be lower for the wind farm site. Applying the methodology as outlined in Mundal and Cunnane (2009) the Standard Annual Average Rainfall depth model (SAAR) and (Mean flow model) MF calculations are included in Table 9-5 below.

Table 9-5: Mean and 95%ile flow estimates

Location	Data source	DTM Area	95 %ile	50%ile	10%ile
Clogherachullion		*[Km2]*	*(m3/s)*	*(m3/s)*	*(m3/s)*
	Area	2.5			
	SAAR		0.005	0.044	0.19
	MF		0.007	0.061	0.14
	Flow Measurements		0.004	0.051	0.015

Flow monitoring was undertaken on the streams in June and July 2022. Variances in mean flow are accounted for by different flow monitoring periods and lower soil moisture deficits in the summer of 2022.

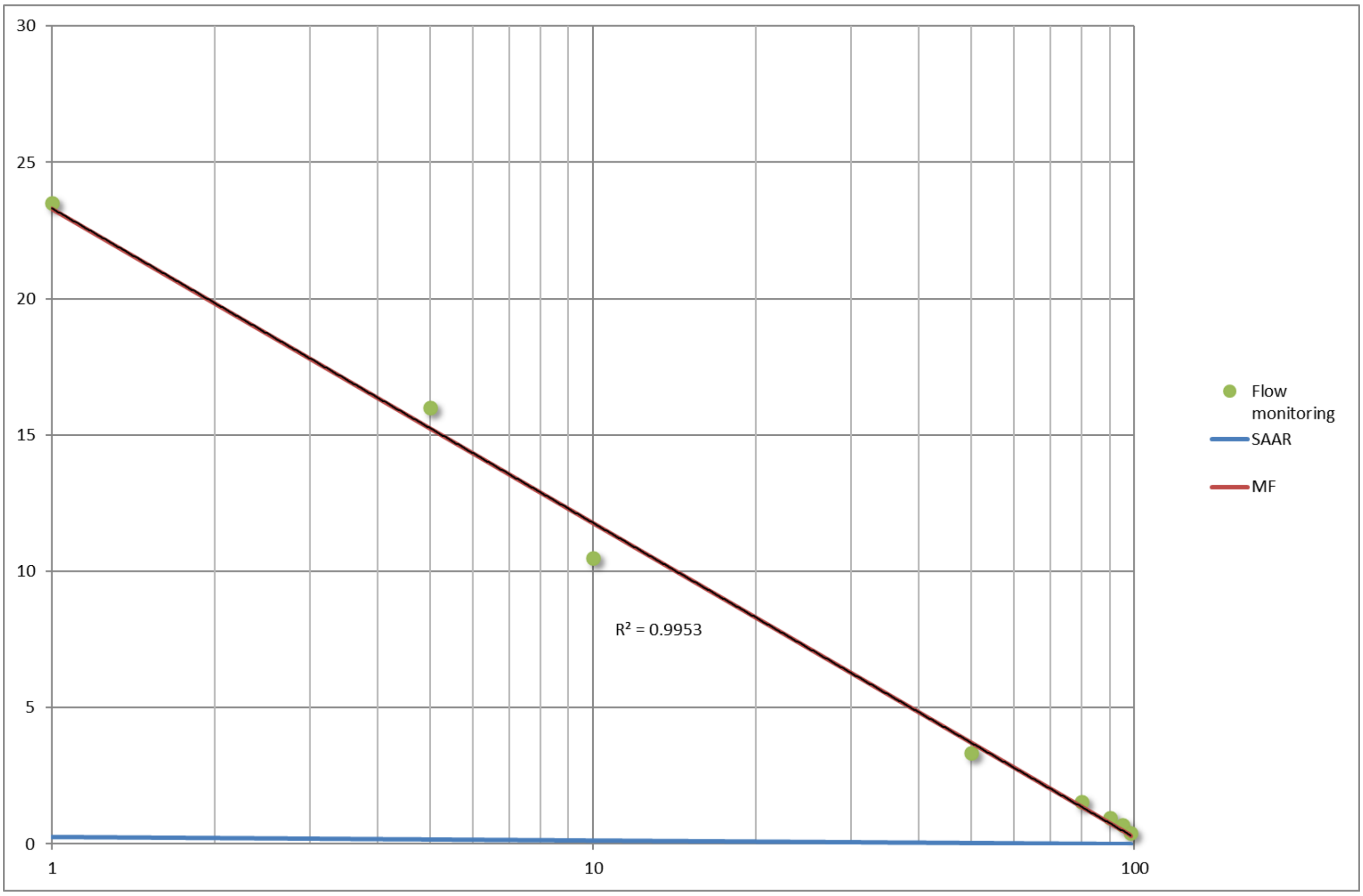


Figure 9-6: Flow monitoring - Downstream of proposed T5-T7 Road

Surface runoff results from rainfall, resulting in an increase in river flow with rainfall and a reduction when rainfall ceases. The baseflow recession is that part of the river flow which comes from groundwater storage. In general, there is a gradual decrease in groundwater discharge during dry periods. The groundwater storage of the bedrock and shallow subsoils (10-7 to 10-8 m/sec) is low. As a consequence, run off from the proposed wind farm site is primarily surface water runoff with a minor component of baseflow. Baseflow increases on the Clogherachullion stream due to the presence of small lakes on site. The main parameters involved in the estimation of recharge/groundwater infiltration are:

- annual rainfall;
- annual evapotranspiration;
- a recharge coefficient.

The recharge coefficient is estimated using Guidance Document GW5, Groundwater Working Group 2005. The recharge over the extreme and high vulnerability areas and moderately permeable till, peat and rock close to or at surface is in the order of 90% surface water runoff.

9.3.5.1 Surface Water Quality

The Environmental Protection Agency (EPA) has carried out biological water quality monitoring on selected watercourses all over Ireland since the early 1970's. In order to gain an understanding of historical water quality in the watercourses hydrologically connected to the proposed Cloghercor Wind Farm a review of the EPA's historical biological water quality monitoring was carried out.

The Environmental Protection Agency (EPA) regularly monitors water bodies in Ireland as part of their remit under the Water Framework Directive (WFD) (2000/60/EC). The WFD requires that the quality of all waterbodies is assessed in terms of five statuses; bad, poor, moderate, good and high, and that every waterbody is maintained at good status level or restored to at least good status level. These water quality statuses are based on:

- The biology of the waterbody i.e., the plants and animals living in the waterbody and within in the area of the waterbody;
- The chemical water quality i.e., the concentration levels of specific nutrients and harmful chemicals;
- The water quantity i.e., the water flow and water level; and
- The hydromorphology i.e., the physical habitat conditions of the waterbody

The water quality monitoring programmes are described in the 2021 EPA publication 'Water Quality in Ireland, 2020' and in the 2022 EPA fact sheet 'How We Assess Water Quality'.

In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macro invertebrate results. The Biotic Index is a quality measurement for freshwater surface waterbodies that range from Q1 - Q5 with Q1 being of poorest quality and Q5 being pristine or unpolluted quality. The criteria used in the assessment of ecological water quality and their relationship to the water quality classes defined above are set out in Table 9-6 below. Subsequently, the Q-values for the rivers relevant to the proposed project based on this criteria are listed in Table 9-7 below.

There are no monitoring points within the proposed wind farm site boundary, however there are three monitoring stations down hydraulic gradient of the site. The first monitoring station is located on the Glenleheen Stream approximately 1.2km east-southeast from the north-eastern corner of the site. The second monitoring station is located on the confluence of the Glenleheen Stream and the Gweebarra River approximately 1km east-northeast from the north-eastern corner of the site. The third monitoring station is located at the confluence of the Gweebarra River and the Gweebarra Estuary approximately 2.15km north of the northern site boundary. All three monitoring stations are on waterbodies hydraulically connected to the proposed project site via two unnamed streams in the north-eastern corner of the site.

Table 9-6: Biotic Index of Water Quality

Biotic Index (Q-Value)	WFD Status	Pollution Status	Condition
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

Table 9-7: Q-Values at various EPA monitoring stations in the study area

<table>
<tr><th colspan="4">Monitoring Station Details</th></tr>
<tr><td>WFD SubCatchments</td><td colspan="3">Gweebarra_SC_010</td></tr>
<tr><td>WFD River Sub Basin</td><td colspan="2">Glenleheen Stream_010</td><td>Gweebarra_020/ Mulnamin_Beg_010</td></tr>
<tr><td>River</td><td colspan="2">Glenleheen Stream</td><td>Gweebarra</td></tr>
<tr><td>Station Name</td><td>Glenleheen Stream - Bridge d/s Lough Errig</td><td>Glenleheen Bridge</td><td>Gweebarra - Bridge in Doocharry</td></tr>
<tr><td>Station Code</td><td>RS38G070200</td><td>RS38G070300</td><td>RS38G020300</td></tr>
</table>

Date	Q-Value		
1973			Q5
1980			Q5
1985			Q5
1990	Q4	Q5	Q4-5
1994		Q4-5	Q4-5
1997		Q4-5	Q5
2000		Q4-5	Q4-5
2003		Q4	Q5
2006		Q4	Q4-5
2009		Q4	Q4
2012		Q4	Q4
2015		Q4	Q4
2018		Q4	Q4
2021		Q4	Q3-4

Based on the data presented in the above tables, the overall water quality in the area surrounding Cloghercor Wind Farm has been of good to high status over the past 50 years, since regular monitoring commenced, with Q-values being consistently between Q4 and Q5.

The rivers, lakes and estuary associated with the proposed project have been assessed in terms of their respective WFD Status 2013-2018. All waterbodies are classified as having 'Good' status.

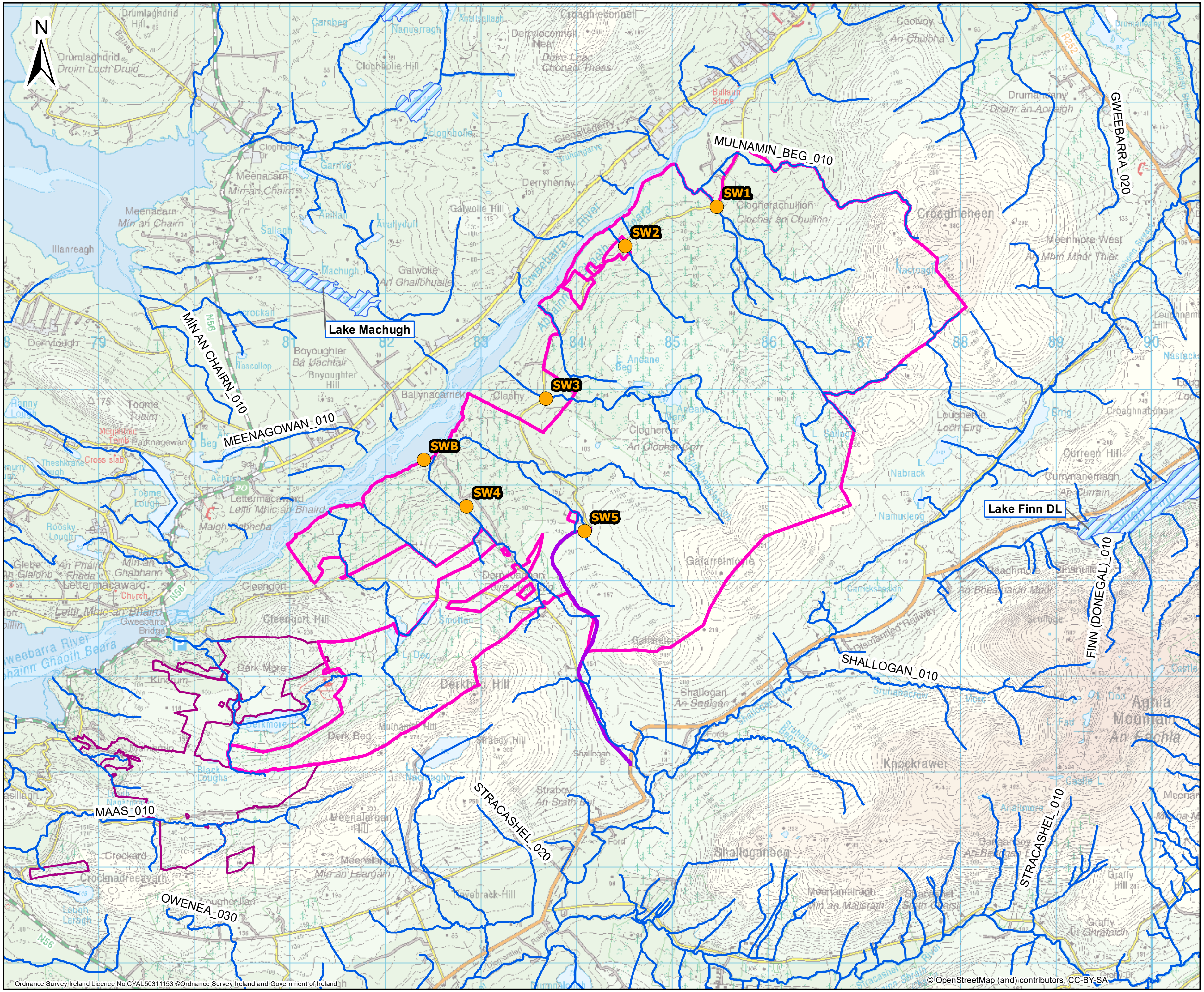
The EPA has also mapped waterbodies based on their risk of meeting WFD objectives by 2027. The risk of WFD objectives was determined by assessment of monitoring data, data on the pressures and data on the measures that have been implemented. Waterbodies that are at risk are prioritised for implementation of measures. This assessment was completed in 2020 by the EPA Catchments Unit in conjunction with other public bodies and was primarily based on monitoring data up to the end of 2018. In relation to the proposed project, all waterbodies within the wind farm site boundaries as well as the Gweebarra Estuary are under 'review' to verify if they will meet the WFD objectives. The Glenleheen Stream, including its unnamed tributaries in the north-eastern corner of the site, and the Gweebarra River are 'not at risk' of meeting the WFD objectives.

Surface Water Quality – Field Studies

Surface water sampling was carried out on the proposed project t on three occasions in 2022. This involved five to six different surface water sampling points (SW1 to SW5, SWA, SWB and SWC) tested on each occasion. The location of each sampling point is shown in Figure 9-7 below. SW1, SW2, SW3, SW4 and SW5 were taken from streams located within the site boundary, while SWA, SWB and SWC were taken at various locations along the Gweebarra Estuary. SWA was taken approximately 0.7km north of the northern r proposed wind farm boundary.

Following collection of the samples on site, they were sent to Eurofins Chemtest Laboratories and ALS Environmental Ltd for testing against a suite of parameters. The results of these sampling programmes are summarised in Table 9-8.

Field hydrochemistry measurements of pH, electrical conductivity (µS/cm), Turbidity, and Dissolved Oxygen (DO, mg/L) were taken at locations across the proposed project site (in November 2021, February 2022, July 2022 and October 2022. The results are listed in Table 9-9 below. Electrical conductivity values for the samples taken range from 69 – 121 µS/cm. This is indicative of surface water, which is mainly derived from precipitation, with limited groundwater input. The pH values at the proposed project site ranged from 6.2-7.3, with most pH values below 7, indicating surface waters which are generally slightly acidic. The pH of the surface waters is typical for an afforested area with peaty soils and underlying granite bedrock, along with limited granitic subsoils. Dissolved oxygen at the proposed project site ranges from 82 to 101% DO saturation typical of unpolluted, well oxygenated surface waters. Turbidity values range from <10 to 21 FNU. Higher values of turbidity are associated with precipitation events.



Legend*

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands
- WFD - River Water Bodies
- WFD - Lake Water Bodies
- Surface Water Sampling Point Locations

*all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2
Kilometres

NOTES

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A	08/03/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 9-7:
Location of Surface Water Sampling Points

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: March 2023

Project Director: O.Fitzpatrick

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Table 9-8:Surface Water Field Monitoring Results (2022)

Parameter	Units	EU Directives for Salmonid Streams	Surface Water Regs (as amended)	SW1			SW2			SW3			SW4		
				01-Feb	01-Jul	01-Oct	01-Feb	01-Jul	01-Oct	01-Feb	01-Jul	01-Oct	01-Feb	01-Jul	01-Oct
pH	**pH**	≥6, ≤9		6.4	6.5	6.5	7.1	6.8	6.7	6.1	6.3	6.3	6.3	6.2	6.2
Electrical Conductivity	**µS/cm**			112	121	101	72	80	76	74	69	80	90	82	95
Turbidity	**FNU**	NA		22	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DO	**% saturation**	80- 120		92	88	93	86	96	94	91	90	87	101	93	90

Table 9-9: Surface Water Sampling Results (2022)

Parameter	Units	EU Directives for Salmonid Streams	Surface Water Regs 2007 (as amended)	SW1		SW2		SW3			SW4	SW5	SWA	SWB
				18/02	29/07	18/02	29/07	18/02	03/05	29/07	18/02	18/02	29/07	29/07
pH	**pH**	≥6, ≤9	Soft(3)Water 4.5< pH < 9.0	6.4		7.3		6.1			6.3	6.5		
Electrical Conductivity	**µS/cm**			110	129	70	82	70		97	90	110	83	586
Suspended Solids @105°C	**mg/l**	≤ 25		18	<5	<5.0	<5	13		<5	<0.5	<5.0	<5	<5
Chemical Oxygen Demand	**mgO₂/l**			28		17		21			17	22		
Chloride	**mg/l**			17		11		9			19	12		
Ammonium	**mg/l**	≤ 1	Good status ≤ 0.065 (mean) and ≤ 0.140 (95%ile)	0.12	0.03	<0.05	0.03	<0.05		<0.03	<0.05	<0.05	0.06	0.06
Nitrate	**mg/l**			2.2	<5.0	1.5	<5.0	<0.50		<5.0	<0.50	3	<5.0	<5.0
Nitrite	**mg/l**	≤0.05			<0.01		<0.01			<0.01			<0.01	<0.01
Total Oxidised Nitrogen	**mg/l**		≤2.6		<0.25		<0.25			<0.25			<0.25	0.68
Phosphorus (Total)	**mg/l**		≤0.025	<0.02		<0.02		<0.02			<0.02	<0.02		
Phosphate	**mg/l**		Lakes -Good status ≤ 0.025 (mean)	<0.20		<0.20		<0.20			<0.20	<0.20		
Orthophosphate as PO_4	**mg/l**		Good status ≤ 0.065 (mean) and ≤ 0.140 (95%ile)	<0.05	0.02	<0.05	0.02	<0.05		<0.02	<0.05	<0.05	0.02	0.04
EH >C10 - C20	**µg/l**								<10					
EH >C20 - C40	**µg/l**								<10					
EH >C6 - C10	**µg/l**								<10					
EH >C6 - C40	**µg/l**								<10					

The above results indicate that pH was mainly acidic across each of the different sampling points. The highest value recorded 7.3 at SW2 and the lowest pH was 6.44 recorded at SW1. Most samples were slightly acidic.

Electrical conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of dissolved substances, chemicals and minerals such as chloride, nitrate, magnesium and calcium. Organic compounds like oil do not conduct electrical current very well and therefore have a low conductivity when in water. Conductivity is also affected by temperature: i.e., the warmer the water, the higher the conductivity. For this reason, conductivity is reported as conductivity at 25°C. Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials that do not ionize (dissolve into ionic components) when washed into the water. On the other hand, streams that run through areas with clay soils tend to have higher conductivity because of the presence of materials that ionize when washed into the water. Ground water inflows can have the same effects depending on the bedrock they flow through.

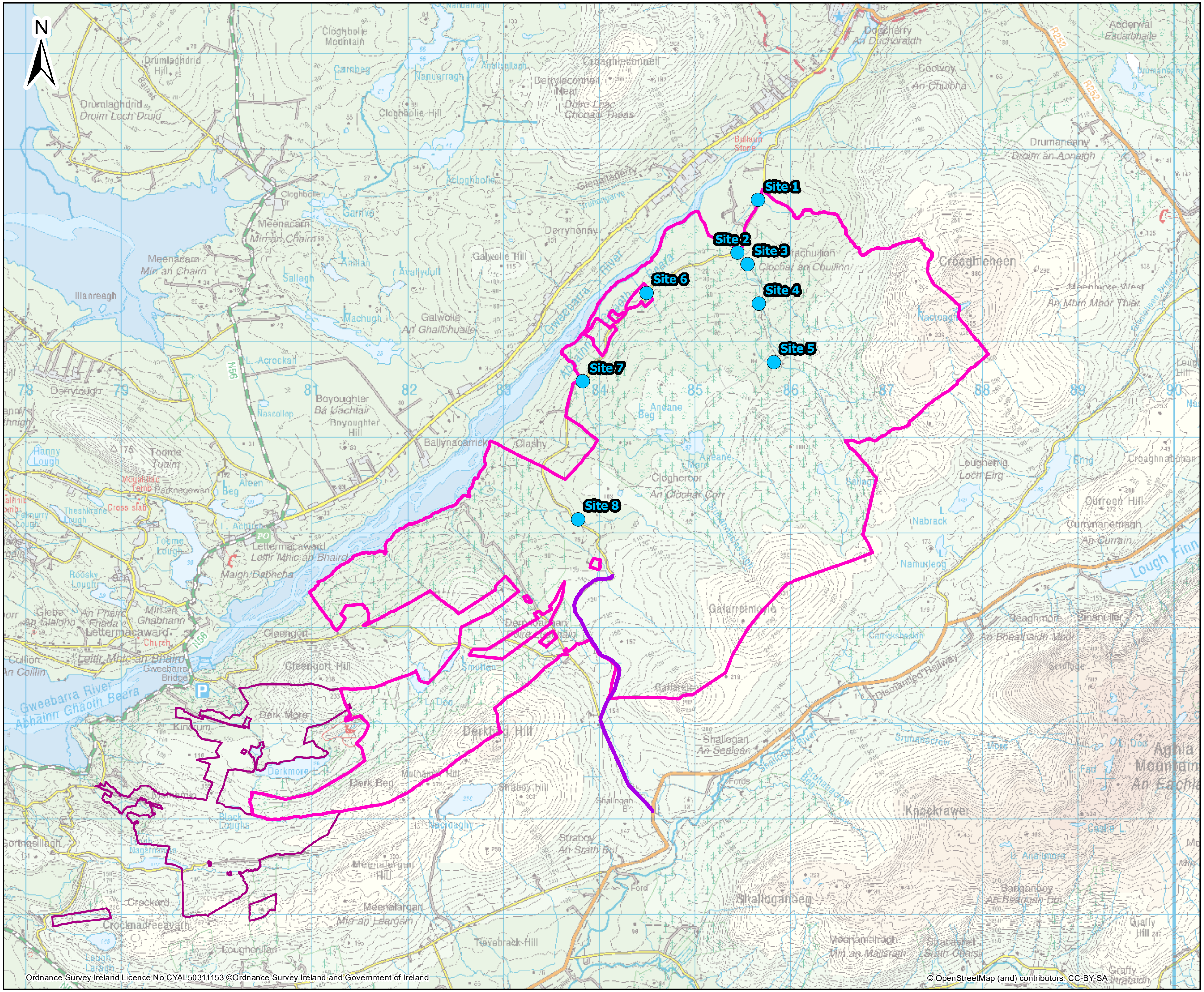
The lowest conductivity was recorded at SW4. SW4 had an electrical conductivity of 82µS/cm. The underlying bedrock at this location is granite which corresponds to the low conductivity values. The highest value was recorded in the Gweebarra where electrical conductivity was 550µS/cm and influenced by the brackish waters.

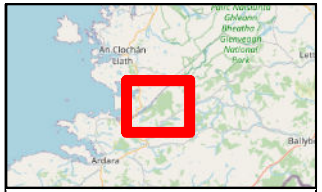
Each sampling location recorded relatively low suspended solid values. They were all within the below 25 mg/l. SW3 and SW4 were below the limit of detection (5mg/l). The highest number of suspended solids were noted in SW1 in the where the value was 18mg/l.

In SW1 Ammonia was 0.14mg/l. Nitrite was also below detection limits in all of the samples. There are no EU Directives listed for the other parameters, but the values recorded indicate no major concern with respect to surface water quality.

Phosphorus was below the detection limits in all samples. Chloride samples were within natural background concentrations.

Surface Water Quality – Aquatic Q value Field Studies
In September 2021, a macroinvertebrate baseline survey was undertaken in the study area – See Figure 9-8 and Appendix 6-2 of the EIAR. The aquatic survey involved the collection of kick samples at eight sampling locations. The collection of these kick samples allowed for the accurate collection of Q-Values as well as classifying the streams with a Small Streams Risk Score (SSRS). The SSRS is a biological risk assessment system for identifying rivers that are definitely 'at risk' of failing to achieve the 'good' water quality status goals of the Water Framework Directive (WFD). It was developed by the EPA in association with the Western River Basin District (WRBD) in 2006.





Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands
- Kick Sample locations

*all land identified is within Boundary of the Proposed Project

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A	08/03/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 9-8:
Kick Sample Locations

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta | Checked: J.Dillon | Date: March 2023

Project Director: O.Fitzpatrick

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The SSRS method is a rapid field methodology for risk assessment that is based solely on macroinvertebrate indicators of water quality and their well understood response to pollution. Importantly the SSRS score indicates whether or not the stream is at risk from pollution and not the ecological health of the stream. The score is less than 6 at all locations. If the score is less than 6.5 the stream is considered to be at risk. The results of the sampling programme are shown in below.

Nine survey sites were, selected relevant to the proposed works areas including installation sites for turbines and road crossings. Sites were selected based on their location within and outside the proposed wind farm site boundary, available access, previous Q-Value Status from Environmental Protection Agency (EPA) surveys, and stream order, giving a good representation of the overall aquatic ecology throughout the study area.

These aquatic survey locations were not directly within the footprint of any proposed turbine. No surveys were conducted in the Gweebarra estuary which is located directly outside the site boundary. Rare / protected / conservation interest aquatic species such as Otter were also searched for at each survey site. The site locations are provided in the Table 9-10 below.

Table 9-10: Location of Sampling Sites within the proposed wind farm site

Sampling Site	Q-value	SSRS score	Water Framework Directive Ecological Status
1	4-5	3.2	High
2	5	3.2	High
3	4-5	2.4	High
4	4	4	Good
5	4-5	3.2	High
6	4-5	4	High
7	3	0	Moderate
8	4	1.6	Good
9	4-5	2.4	High

The macroinvertebrate communities of the site are indicative of good water quality however there is generally limited productivity in the streams due to the lack of suitable ecological niches.
The steep vegetated banks (many undercut) reduced the capacity of the stream to support macrophytes, and very high energy of the stream have limited the diversity and abundance of species present across all sites.

Many of the watercourses surveyed were small, shallow, high-energy, upland eroding streams draining afforested and or blanket bog areas. These featured cobble/boulder-dominated substrata which were often bedded in peat and had a lack (not absence) of finer gravels for spawning.

Assessment of Hydrometric Data
Hydrometric data is information on levels and flow of surface water (e.g., rivers) and groundwater (e.g., springs). Discharge refers to the volumetric flow rate of water that is transported through a given cross-sectional area. Hydrometric data is collected as part of the EPA's Hydrometric Programme at over 1,000 active hydrometric stations around the country.

It is noted that there were no active hydrometric stations located in the immediate environs of the proposed wind farm site. Although hydrometric stations do exist on watercourses down hydraulic gradient of the development, they include flows coming from a number of different tributaries. As such, they are not representative of the actual flows occurring at the site.

Runoff on the site is expected to be higher in the peaty areas. Surface water runoff or overland flow is the flow of water occurring on the ground surface when excess rainwater, stormwater, meltwater, or other sources, can no longer sufficiently infiltrate into the soil. HR Wallingford developed a number of UK Sustainable Drainage System tools (available at www.uksuds.com) including the Greenfield Runoff Rate Estimation Tool which was used to provide an estimation of runoff for the proposed wind farm site. When accessing runoff characteristics of the proposed wind farm site, it can be best described as an area with low infiltration, steep slopes and high rainfall. The Doocharry rainfall monitoring station operated by Met Éireann since 1981 collects daily rainfall levels and is located approximately 0.46km west of the northern section of the site. Data from this station indicates there is an average annual rainfall of approximately 1,600mm/yr.

However, the groundwater recharge dataset from the Geological Survey Ireland (GSI) indicates an effective rainfall (i.e., rainfall minus the amount of water which goes back into the atmosphere through evaporation and transpiration) is approximately 1,120mm/yr and <100mm/yr can infiltrate into the underlying soils and bedrock aquifer.

Surface Water Abstractions

The EPA Map Viewer provides information on the locations of surface water protection areas. These are in the form of:

- Drinking Water – Rivers;
- Drinking Water – Lakes;
- Geological Survey Ireland (GSI) Public Supply Source Protection Areas; and
- National Federation Group Water Schemes (NFGWS) Group Scheme Source Protection Areas.

There is no GSI public supply source protection areas, NFGWS group scheme source protection areas or protected lakes used for drinking water supplied. All the river waterbodies within the Mulnamin Beg 10 river system are protected under an Article 7 abstraction for drinking water license. There are no public supplies located within the river system.

Flood Risk Assessment

The Office of Public Works (OPW) provides information on flood risk throughout Ireland. This includes historical events as well as modelled flood extents for:

- Low probability events i.e., 1-in-1000 chance of occurring or being exceeded in any given year, also known as an Annual Exceedance Probability (AEP) of 0.1%;
- Medium probability events i.e., 1-in-a-100 chance of occurring or being exceeded in any given year, or an AEP of 1%; and
- High probability events i.e., 1-in-a-10 chance of occurring or being exceeded in any given year, or an AEP of 10%.

Based on the information provided by the OPW's publicly available online tool Flood Maps, there are no past flood events within the proposed wind farm site boundary. The nearest historical flood event is a recurring flood from estuarine waters at Doocharry approximately 2.1km north of the northern section of the site.

The GSI winter 2015/2016 surface water flooding maps show areas of fluvial (rivers) and pluvial (rain) floods during the winter 2015/2016 flood event. The flood areas extents within the proposed wind farm site boundary presented in the dataset correspond with the extent of the various lake waterbodies. This indicates that the lakes are in localised topographically low areas and act as a drainage catchment for the surrounding area. The GSI also produced a model which calculated areas at risk of low, medium and high probability flood event. There are no such areas within the site boundary.

Flood extents for the various flood events were modelled under the Catchment Flood Risk Assessment and Management (CFRAM) Programme. Based on the model output, there is no risk of a flood event within the proposed wind farm site boundary, however it is possible that a model was not created for this area. The nearest possible CFRAM modelled flood is located along the Owenea River between Glenties and Ardara approximately 3.7km south of the southern section of the site.

The National Indicative Fluvial Mapping includes data for catchments greater than $5km^2$ for which flood maps were not produced under the CFRAM programme. This model does not show any areas at risk of a medium probability and a low probability flood event in the area of the proposed wind farm site. The closest is a small area along the north-western boundary of the site along the route of the Gweebarra river. There are no works proposed in this area and hence the flood extents will not impact on the proposed project.

Based on these modelled flood maps, it is estimated that the proposed wind farm site is not at risk of fluvial, pluvial or groundwater flooding. The natural topography of the site is such that flood waters would flow away from the site towards lands further downstream that are at lower elevations.

The Planning System and Flood Risk Management Guidelines (OPW/DoEHLG, 2009) classify electricity generating stations as "essential infrastructure" considered appropriate in Flood Zone C. The proposed wind farm has therefore been assessed against a 0.1% AEP MRFS flood (i.e., a 1000-year flood in a likely climate change scenario). The Flood Risk Assessment is provided in the Appendix 2-8.

9.3.6 Groundwater Hydrogeology

The information provided herein relates to the hydrogeology (groundwater) environment. It is provided to give context to the groundwater characteristics and flow patterns within and adjacent to the proposed project site. Groundwater is water that has infiltrated into the ground to fill the spaces between sediments and cracks in rock. An aquifer is an underground layer of groundwater-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand or silt), that can yield a usable quantity of water.

Aquifer Potential and Characteristics

The aquifer potential of a bedrock unit is determined by the groundwater productivity, which in turn is determined based on hydraulic characteristics compiled from borehole data throughout the country. The GSI categorises the aquifer bodies into Regionally Important Aquifers, Locally Important Aquifers and Poor Aquifers. These are then subcategorised to create a total of seven bedrock aquifer categories and two sand and gravel aquifer categories.

Reference to the GSI National Aquifer Map for the study area indicates that the proposed wind farm site is predominantly underlain by a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (Pl). The southern area of the site is underlain by a Poor

Aquifer - Bedrock which is Generally Unproductive (Pu) and a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (LI). The underlying bedrock aquifer map for the wind farm site is shown in Figure 9-9. The subsoil deposits overlying the bedrock are not considered to be of sufficient lateral extent or depth to represent an aquifer body. The aquifer characteristics of the underlying aquifers are summarised in Table 9-11 below. Refer to Chapter 8 Land, Soils and Geology of this EIAR for detailed information on the associated bedrock.

Table 9-11: Bedrock Aquifer Classification and Characteristics

<table>
<tr><th>Aquifer Classification</th><th>Productivity</th><th>Bedrock</th><th>Hydrostratigraphic Rock Unit Group</th><th>Karst Features</th></tr>
<tr><td>Locally Important Aquifer (LI)</td><td>Bedrock which is moderately productive only in local zones</td><td>Falcarragh Limestone Formation</td><td>Precambrian Marbles</td><td>yes</td></tr>
<tr><td rowspan="4">Poor Aquifer (Pl)</td><td rowspan="4">Bedrock which is generally unproductive except for local zones</td><td>Metadolerite</td><td rowspan="3">Precambrian Quartzites, Gneisses and Schists</td><td rowspan="4">No</td></tr>
<tr><td>Sessiagh-Clonmass Formation</td></tr>
<tr><td>Thorr Granite Migmatitic Facies</td></tr>
<tr><td>Main Donegal Granite</td><td>Granites and other Igneous Intrusive rocks</td></tr>
<tr><td>Poor Aquifer (Pu)</td><td>Bedrock which is generally unproductive</td><td>Upper Falcarragh Pelite Formation</td><td>Precambrian Quartzites, Gneisses and Schists</td><td>No</td></tr>
</table>

The Falcarragh Limestone Formation is the most productive bedrock aquifer within the proposed wind farm site boundaries and underlies approximately 0.134km^2 of the site ownership boundary. There is no proposed development in the limestone formation. The remaining bedrock types are classified as poor which is typical for granites and other igneous intrusive rocks.

Groundwater bodies are the groundwater management unit under the Water Framework Directive (WFD). Groundwater bodies are subdivisions of large geographical areas of aquifers so that they can be effectively managed in order to protect the groundwater and linked surface waters. A groundwater body is defined as a distinct volume of groundwater, including recharge and discharge areas with little flow across the boundaries.

The proposed wind farm site is located within the Northwest Donegal groundwater body (GWB). The GSI GWB description (2004) characterises the Donegal Granites and the Precambrian Quartzites, Gneisses and Schists in the GWB as having low yields. These rocks are likely to have low specific capacity, low storativity and low transmissivity in the range of 20 – 30m^2/d, although higher values may be achieved in faulted zones. The Precambrian Marbles are expected to be slightly more productive than the surrounding rocks, but there is no aquifer characteristic data available for these particular marbles.

The Precambrian Marbles elsewhere in Donegal have recorded yields of 2 – 1090m^3/d with an average yield of 202m^3/d from 15 wells, a transmissivity value of approximately 11 to 12 m^2/d and a specific capacity ranging between 0.1 – 165m^3/d/m. The Precambrian Marbles in the Culdaff area in north Donegal have excellent yields and provide 523m^3/d to the Culdaff Water Supply Scheme. Karstification is known to occur in these rocks e.g., a fractured cavity recorded in the Culdaff WSS borehole log and the Pollnapaste Cave which is a Geological Heritage Site located approximately 1.0km west of the south-western site boundary and is not hydraulically connected to proposed project.

Groundwater Quality

The GSI GWB description (2004) for the Northwest Donegal GWB states that there is no hydrochemical data available within this particular GWB. However, hydrochemical data is provided under the national classification for the various hydrostratigraphical rock units within the GWB. This information is summarised in Table 9-12 below. The GSI notes that minerals present in granite are generally acidic and hence corrosion and leaching of metals such as iron and manganese may be problematic. Radon and Uranium are also associated with granitic bodies.

Table 9-12: Rock unit hydrochemical signature data

Rock Unit	Alkalinity (mg/l CaCO3)	Total Hardness (mg/l)	Electrical Conductivity (uS/cm)
Granites and Other Igneous Intrusive Rocks	14 – 400, mean 168	46 – 412, mean 200	160 – 752, mean 446
Precambrian Quartzites, Gneisses and Schists	43 – 298, mean 179	103 – 304, mean 183	317 – 1017, mean 495

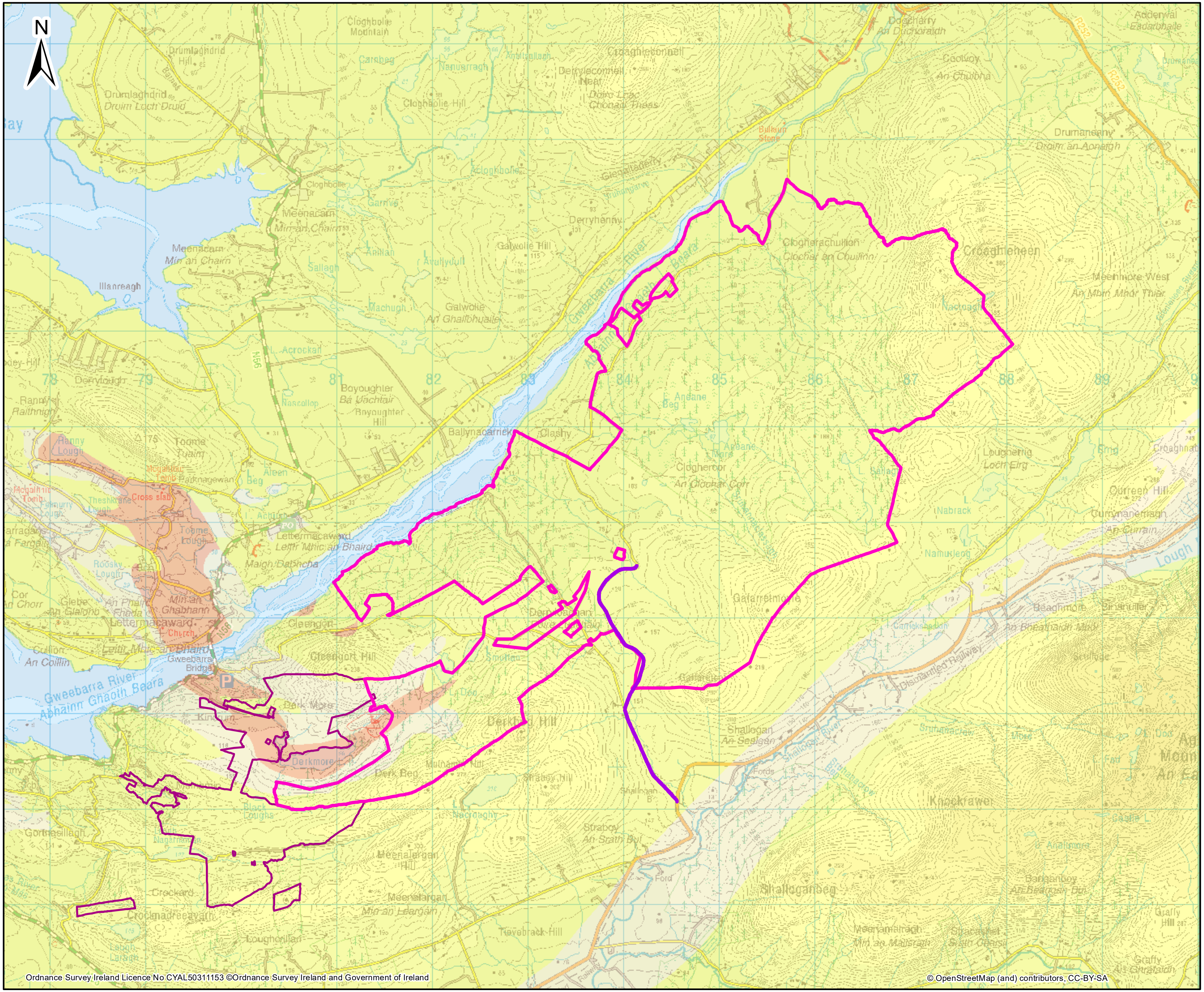
The WFD groundwater quality status classifications are based on an assessment of the point and diffuse sources in the area that may affect groundwater quality. The WFD requires Member States to designate these waterbodies so that each one achieves good chemical and good quantitative status. The Ground Waterbody WFD Status 2013-2018 for the Northwest Donegal groundwater body is described as ‘good’.

The WFD also classifies each groundwater body in terms of its risk of failing to meet the WFD objectives by 2027. The risk of not meeting WFD objectives was determined by assessment of monitoring data, data on the pressures and data on the measures that have been implemented. Waterbodies that are At Risk are prioritised for implementation of measures. This assessment was completed in 2020 by the EPA Catchments Unit in conjunction with other public bodies and was primarily based on monitoring data up the end of 2018. The Northwest Donegal GWB is classified as ‘Not at risk’.

Given that the GWB at the proposed project has ‘Good’ status and is ‘Not at Risk’, overall, based upon the EPA and WFD data the groundwater quality is good. Due to the hydraulic connectivity of the Pollnapaste Cave karst feature and direct access which surface water has to groundwater through this feature, there is a potential for discharge into and subsequent contamination of groundwater outside of the proposed project site boundary.

Groundwater Levels and Groundwater Flow

Water levels in the Northwest Donegal GWB are expected to be shallow (0 – 8m below ground level) and groundwater gradients are expected to be steep. Groundwater flows are expected to occur primarily within the broken and weathered zone in the upper 3m of the bedrock aquifer, in a zone of interconnected fissuring approximately 10m thick and in a zone of isolated poorly connected fissuring typically less than 150m. Groundwater flow paths are considered to be short i.e. 30 – 300m in length and the main discharges from the bedrock aquifers are to rivers and streams crossing the GWB, however baseflow to rivers and streams is relatively low (GSI, 2004). On a regional scale, the groundwater flow direction is generally a subdued reflection of surface water drainage. It is assumed that groundwater flow would mirror topography, and local flows are likely to be varied reflecting the local drainage patterns.



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Aquifer Bedrock

- LI - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
- PI - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
- Pu - Poor Aquifer - Bedrock which is Generally Unproductive

* all land identified is within Boundary of the Proposed Project

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Kilometres

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4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	08/03/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 9-9:
Aquifer Bedrock

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: March 2023

Project Director: O.Fitzpatrick

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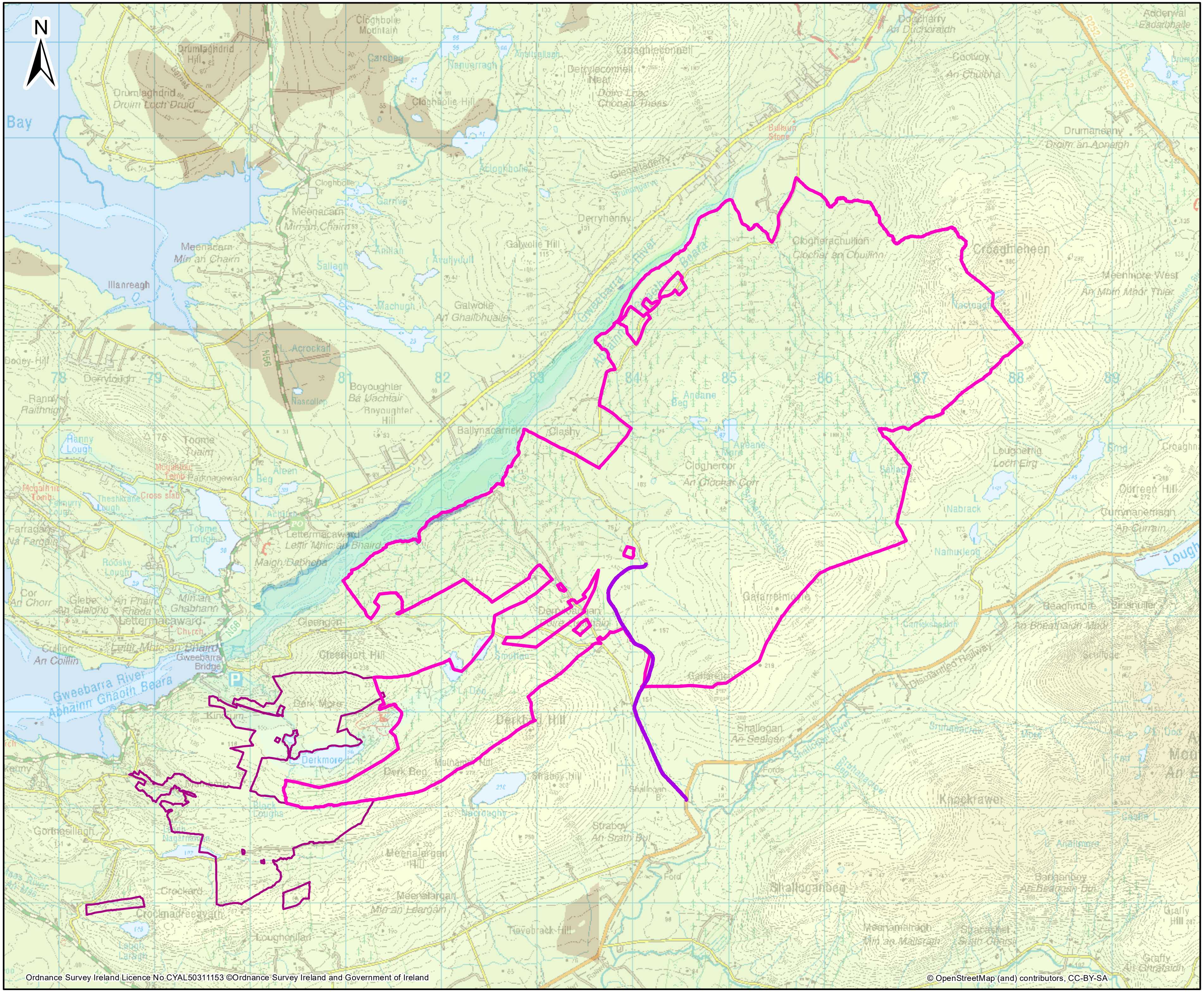
On a local site scale, it is assumed that groundwater flow is towards local drains and streams, reflecting the general flow direction of the various river waterbody catchments.

Groundwater Recharge

The GSI estimates groundwater recharge rates throughout the country which are displayed on the online map viewer. Analysis of these maps provides a good representation of the groundwater recharge for the proposed project. The recharge values vary greatly across the site. The highest recharge rates are found where bedrock is close to the surface or where karst features are present and the lowest recharge rates are found in the peaty areas of the site or where there is low permeability subsoil. Groundwater recharge across the proposed wind farm site is shown in Figure 9-10.

A recharge cap i.e., the maximum amount which the underlying bedrock aquifer can accept, is applied to the full extent of the proposed wind farm site. This is 100mm/yr over the Donegal Granites and the Precambrian Quartzites, Gneisses and Schists and 200mm/yr over the Precambrian Marbles. Consequently, any rainfall greater than this amount will flow overland into the surface waterbodies.



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Groundwater Recharge - Annual Recharge (mm)

- 1001-1400 mm
- 901-1000 mm
- 801-900 mm
- 701-800 mm
- 601-700 mm
- 551-600 mm
- 301-350 mm
- 251-300 mm
- 201-250 mm
- 151-200 mm
- 101-150 mm
- 51-100 mm
- 1-50 mm

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Issue	Date	Description	By	Chkd.
A	08/03/2023	Final issue	S.P	J.D

Client:

Cloghercor Wind Farm ltd.

Project:

Cloghercor Wind Farm

Title:

Figure 9-10:
Groundwater Recharge

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta | Checked: J.Dillon | Date: March 2023

Project Director: O.Fitzpatrick

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Groundwater Vulnerability

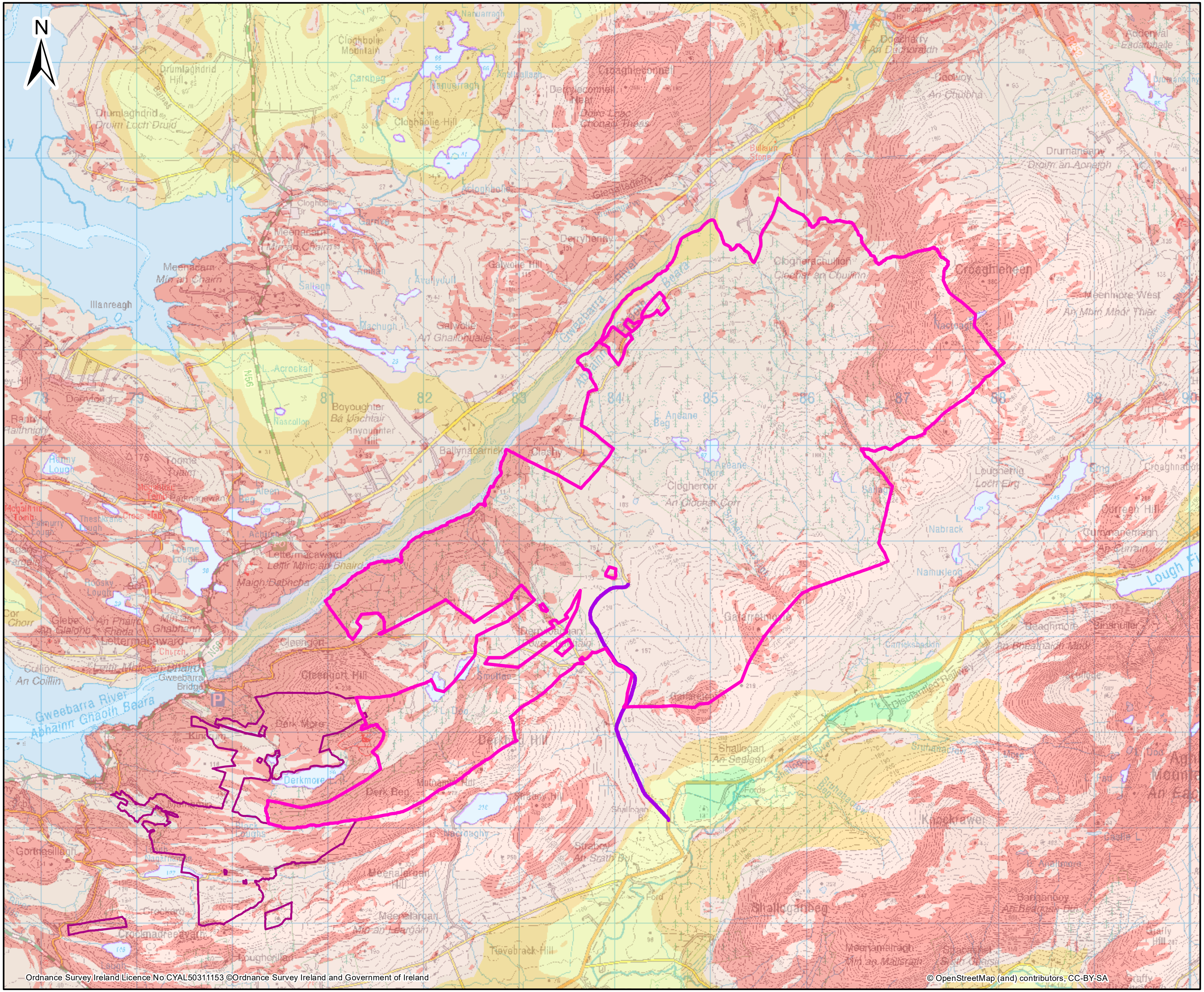
Groundwater vulnerability represents the intrinsic geological and hydrogeological characteristics that determine how easily groundwater may be contaminated by activities at the surface. Vulnerability depends on the quantity of contaminants that can reach the groundwater, the time taken by water to infiltrate to the water table and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the type of subsoils that overlie the groundwater, the way in which the contaminants recharge the geological deposits (whether point or diffuse) and the unsaturated thickness of geological deposits from the point of contaminant discharge.

Groundwater is most at risk where the subsoils are absent or thin and in areas of karstic limestone. The Groundwater Vulnerability Map (Figure 9-11) is based on the type and thicknesses of subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays) and the presence of karst features. Groundwater that readily and quickly receives water (and contaminants) from the land surface is considered to be more vulnerable than groundwater that receives water (and contaminants) more slowly and consequently in lower quantities. Groundwater vulnerability is classified as follows:

- Rock at or near surface or karst (X);
- Extreme (E);
- High (H);
- Moderate (M); and
- Low (L).

A detailed description of the vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1997) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination.

The proposed wind farm site and the majority of the surrounding area is predominantly categorised as having rock at or near surface, extreme groundwater vulnerability. This reflects the thin soil layer and numerous bedrock outcrops throughout the site and is typical for mountainous areas.



Legend ✱

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Groundwater Vulnerability

- Rock at or near Surface or Karst
- Extreme
- High
- Moderate
- Low
- Water

✱ all land identified is within Boundary of the Proposed Project

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Issue	Date	Description	By	Chkd.
A	08/03/2023	Final issue	S.P	J.D

Client: Cloghercor Wind Farm ltd.

Project: Cloghercor Wind Farm

Title: Figure 9-11: Groundwater Vulnerability

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta | Checked: J.Dillon | Date: March 2023

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Groundwater Depth

Trial pits carried out by Ground Investigations Ireland Ltd (GII) in June 2022 to October 2022 encountered water within the subsoils at various depths between 0.2m –4 m below ground level. However, the trial pits remained stable and were only terminated due to obstructions, generally presumed to be boulders or bedrock. Hence, these occurrences are of perched water that has infiltrated into the relatively impermeable peaty subsoils but it is not an indication of groundwater depths. Rotary core boreholes carried out by GII in July 2022 encountered limited groundwater in the underlying bedrock (1.1mbgl).

Groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and a variety of other factors.

Groundwater Usage and Wells

There are a number of small GSI group water schemes and public supplies in County Donegal, all of which are described in the Donegal Groundwater Protection Scheme Report (2004). The nearest scheme to the site is located approximately 40km east-northeast of the northern boundary of the proposed wind farm site. There are also a small number of NFGWS in County Donegal with the nearest one located approximately 18.5km north of the northern boundary of the site. Hence, there are no groundwater dependent drinking water schemes close to the proposed wind farm site which need to be considered.

There are no records of groundwater wells and springs within the extent of the proposed wind farm site included in the GSI database. However, as part of the consultation process a number of domestic use wells/surface water abstractions were identified and are located >800m to the north of the proposed wind farm See Figure 5-3 of the 2004 Report.

9.3.7 Designated Sites

There are a number of Special Areas of Conservation (SACs), Special Protection Areas (SPAs), National Heritage Areas (NHAs) and proposed National Heritage Areas (pNHAs) located within close proximity to the proposed wind farm site. One NHA and one pNHA overlap with the site boundaries. These are Meenmore West Bog NHA (site code: 002453) located in the north-eastern corner of the site on the eastern slopes of Croaghleheen Mountain and Derkmore Wood Nature Reserve pNHA (site code: 000131) located in the south-western area of the site on the southern slopes of Cleengort Hill.

Meenmore West Bog is considered a site of considerable conservation significance for containing a large upland blanket bog, which is a globally scarce resource. However, there are numerous channels and small streams throughout the site as well as an oligotrophic lake, Lough Nacroagh, located at the north-west corner of the site. Derkmore Wood is of interest due to it being one of the few remaining areas of semi-natural woodland in west Donegal.

There are several SACs, SPAs and NHAs which are outside of the proposed wind farm site but are hydraulically connected to the site. These are summarised in Table 9-13 below and include Cloghernagore Bog and Glenveagh National Park SAC and pNHA; Derryveagh and Glendowan Mountains SPA and the West of Ardara/Maas Road SAC and pNHA. Locations of the designated sites are shown on Figure 6-4.

Table 9-13: Natural 2000 sites

Site ID	Site Classification	Site Code	Proximity to site	Connection to site
Cloghernagore Bog and Glenveagh National Park	SAC pNHA	002047	c. 3.4km northeast of northern site boundary	Via Glenleheen Stream
Derryveagh And Glendowan Mountains SPA	SPA	004039	c. 3.4km northeast of northern site boundary	Via Glenleheen Stream
West Of Ardara/Maas Road SAC	SAC pNHA	000197	Adjacent to western site boundary	Via all river waterbodies and Gweebarra Estuary

The Cloghernagore Bog and Glenveagh National Park SAC and pNHA is located to the north of the proposed wind farm site and is connected to the site via the unnamed streams in the north-eastern corner of the site flowing into the Glenleheen Stream which flows into the Gweebarra River and which in turn flows along the southern boundary and through the southern section of the Natura 2000 site. The site is designated an SAC based on a number of habitats and species listed on Annex I/ II of the E.U. Habitats Directive, several of which are water dependent and include oligotrophic waters containing very few minerals, floating river vegetation, wet heath, freshwater pearl mussel, Atlantic salmon and otters.

The Derryveagh and Glendowan Mountains SPA under the E.U. Birds Directive is a habitat for a number of rare species, some of which use the lakes within the site for feeding.

West Of Ardara/Maas Road SAC is located along the western boundary of the proposed wind farm site and incorporates the Gweebarra Estuary, hence it is hydraulically connected to the site via the numerous river waterbodies flowing into the estuary. The site is designated an SAC based on a number of habitats and species listed on Annex I/ II of the E.U. Habitats Directive, several of which are water dependent and include estuaries, tidal mudflats and sandflats, large shallow inlets and bays, oligotrophic waters containing very few minerals, oligotrophic to mesotrophic standing waters, alkaline fens, wet heath, freshwater pearl mussel, Atlantic salmon, otters and seals.

Additional designated sites which are in the area of the proposed wind farm site, but which are not hydraulically connected to it include:

- Coolvoy Bog SAC and pNHA, site code: 001107, located approximately 0.3km north of the northern section of the site on the north-western slopes of Croaghleheen Mountain;
- Gannivegil Bog SAC and pNHA, site code: 000142, located approximately 0.5km west of the western site boundary on the western side of the Gweebarra Estuary;
- Galwolie Bog pNHA, site code: 001132, located approximately 1.4km northwest of the western site boundary on the western side of the Gweebarra Estuary.

Detailed information on these sites is provided in Chapter 6 – Biodiversity Flora and Fauna of this EIAR.

9.4 POTENTIAL EFFECTS

This section provides an assessment of the environmental effects of the proposed project on the Hydrology, Hydrogeology and Water Quality environment within the study area that extends to all of the hydrological links waterbodies.

The potential impacts may comprise direct and indirect effects on the quality of surface waters and groundwater. Thus, the hydrological and hydrogeological assessment identified water sensitive receptors located within the proposed wind farm site area and downstream from the proposed infrastructure works.

The current proposals for all construction activities and operational infrastructure were reviewed to identify activities likely to effect upon identified water bodies including relevant water courses within and remote from the site. Following the identification of sensitive water receptors and potential effects to the water environment at the development stage, the extent and severity of potential construction, operational, decommissioning, and cumulative effects were evaluated, taking into account all proposed control measures included in the project design.

9.4.1 Sensitivity of Receptors

The sensitivity of an environmental receptor is based on its ability to absorb an effect without perceptible change. The hydrological environment is considered to be of moderate to very high sensitivity for receptors draining to the Gweebarra River via hydrological links. Further information on the sensitivity rating for aquatic macroinvertebrates species can be found in Section 6.2 of the Biodiversity Chapter. The onsite lakes are considered sensitive receptors however the rivers appear to limit potential for fisheries due to the low biological production, fish barriers and lack of suitable aquatic habitats. A number of natural fish barriers exist on the Cloghercor and Clogherachullion streams. Where barriers impede or block access of migratory fish to large portions of catchments a direct reduction in the production potential of these systems results. Biodiversity and associated economic value suffer as a result.

As detailed in Section 9.3, a number of lakes are present within the Landownership boundary. The proposed layout has avoided all of these lakes, namely Lake Doo, Lake Smuttan, Nacroagh (Lough) and Sallagh (Lough). As there are no developments located in the lake catchment areas, there is no potential effects. Three small unnamed lakes are located to the south of T13 however there is no proposed development in the catchment areas to the unnamed lakes/ponds. Turbines T10 to T12 are located in the catchment area of Lough Aneane More and Lough Aneane Beg. Mitigation measures are proposed in Section 9.5 of this EIAR.

9.4.2 Do-Nothing Scenario

As outlined in the Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022), the description of Do-Nothing effects relates to the environment as it would be in the future should the subject project not be carried out. If the wind farm development does not take place, the site will most likely continue to look like it does today. There would be no major changes in land-use. Sheep farming, forestry, localised peat cutting/peat harvesting would characterise the region. In a 'do-nothing' scenario there would be no significant effect to the hydrology, hydrogeology and water quality environment.

9.4.3 Potential Effects – Construction Phase

9.4.3.1 Construction Activities

Forestry Felling

The total area of forestry to be felled is estimated to be between approximately 69.8ha and 90.9ha, of which approximately 12.6 ha will be replanted on site at the end of the construction phase (at the temporary construction compounds and reinstated borrow pits). As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not.

The construction phase of the project will involve the following key activities that could have potential effects on surface water and groundwater conditions:

- Earthworks related to:
    - Construction of temporary and permanent infrastructure on site, including turbine foundations, hardstands, site access tracks, substation, construction compounds, and all associated onsite infrastructure;
    - Laying of all underground electrical cabling, both within the proposed wind farm site, and as part of the grid connection;
    - Minor works at a number of locations along the Turbine Delivery Route (TDR);
    - Borrow Pit excavations; and
    - Stockpiling material.
- Handling and storage of hydrocarbons, concrete and other potential pollutants.

The construction of the temporary site compounds, site access tracks, turbine foundations, turbine hardstands, borrow pits, laying of underground electrical cabling and drainage channels will involve the removal of vegetation and forestry, the excavation of mineral subsoil and rock primarily from proposed borrow pits. Exposed and disturbed ground may increase the risk of erosion and subsequent sediment laden surface water runoff. The release of suspended solids is primarily a consequence of the physical disturbance of the ground during the construction phase, if not correctly compacted.

Incorrect site management of earthworks and excavations could, therefore, lead to loss of suspended solids to surface waters as a consequence of the following activities:

- Run-off and erosion from soil stockpiles (prior to reinstatement/profiling/side casting);
- Dewatering of excavations for turbine foundations and met mast foundations. The result of increased sediment loading to watercourses is to degrade water quality of the receiving waters and change the substrate character.

9.4.3.2 Hydrological and Hydrogeological Effects

Based on the construction phase activities outlined above, the potential hydrological and hydrogeological effects can be summarised as follows:

- Surface water quality effects;
- Surface water flow alterations; and
- Groundwater flow and quality effects

The permanent footprint of the wind farm will be 1.4% of the overall proposed project area. There is potential for an increase in runoff due to 27.32ha of permanent additional hardstanding surfaces (e.g., turbine foundations, access tracks and substation buildings).

Hardstand areas and additional access tracks could potentially reduce infiltration capacity of the soils in areas where earthworks are undertaken and increase the rate and volume of direct surface runoff. However, the underlying geology has a low infiltration capacity and therefore limited capacity exists to alter infiltration rates. Surface water control measures are incorporated into the design of the wind farm. The potential for an increase in runoff to streams is limited as surface water runoff will be controlled as part of the project design. Pre-mitigation, this potential construction effect will be a slightly negative short-term effect.

Flood Risk - Pluvial Flooding

There is no record of pluvial flooding at the proposed wind farm site. Surface water arising at developed areas of the site will be managed by a dedicated stormwater drainage system which has been designed in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The natural landscaping and topography of the site will provide safe exceedance flow paths and confine surface water ponding, therefore minimising residual risks associated with an extreme flood event. On this basis, the proposed wind farm is not at risk of significant pluvial flooding and there will be no cumulative effects on flood risk elsewhere based on the Flood Risk Assessment. The proposed wind farm will not significantly alter the drainage regime of the site. Therefore, no cumulative impacts on other projects are anticipated.

Flood Risk – Fluvial Flooding

There are no large streams or rivers located on the site that could lead to significant fluvial flooding. Due to the size of these streams (catchment areas <5km^2), they were not surveyed or modelled as part of the OPW's CFRAM Programme. Based on the indicative flood mapping produced as part of the National PFRA Study, it is considered that the proposed wind farm is not at risk of fluvial flooding from watercourses in the area.

It is calculated that the stormwater management system proposed as part of the project will limit runoff from the site to greenfield runoff rates, therefore mitigating against an increase in flood risk elsewhere. A flood risk assessment is included in Appendix 2-8.

Flood Risk – Groundwater Flooding

There is no evidence from GSI Online Map Viewer to suggest that groundwater is a potential source of flood risk to the proposed wind farm site.

Flood Risk – Coastal Flooding

Given the elevated nature of the proposed wind farm site (10 mOD to 180 mOD), it is considered that there is no risk of coastal flooding.

Overall Flood Risk

Based on the results of the Flood Risk Assessment, it is considered that the risk of flooding to the proposed wind farm will be minimal, and that the project will not increase the risk of flooding elsewhere.

Effects to Water Quality

There is a potential for effect on water quality as a result of the construction of turbine bases and excavation of borrow pits on site. Turbine base areas for example, are 3.5m to bottom of foundation concrete and will be up to 4m deep based on site investigations.

Groundwater inflows may need to be pumped, resulting in short term localised drawdown of the water table and discharges to surface water channels. Due to the low permeability of soils across the majority of the proposed wind farm the potential for groundwater ingress would be low. However, groundwater ingress can occur in the peat and at the interface between soil/peat transition zone. The time that excavations are open will be kept to a minimum to prevent water ingress. Management and treatment of groundwater ingress is detailed in Section 9.5.3.

There are no water supply wells nor any PWS ZOCs within 0.8km of the proposed turbine locations and borrow pits. All works within 50 m of waterbodies kept to minimum, with all significant infrastructure (turbine foundations, site compounds, borrow pits and substation) at a minimum 50 m set-back.

As described in Chapter 2 of this EIAR (Description of the Proposed Project), the wind farm involves the felling of a total of 90.9 ha of onsite forestry in order to facilitate the construction of the wind farm infrastructure. The main potential effects during felling operations are the mobilisation of sediment and nutrient release (See Appendix 2-5 to this EIAR).

During construction of the wind farm, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of oils and fuels stored on site;
- Spillage or leakage of oils and fuels from construction machinery/vehicles;
- Spillage or leakage of wastewater from temporary site facilities;
- Spillage of oil or fuel from refuelling machinery on site; and
- Spillages arising during the use of concrete and cement for turbine foundations and hardstanding areas.

There will be a risk of pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles. Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative effects on water quality. They generate very fine, highly alkaline silt (pH of 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of ≥ 4 ≤ 9 is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of ± 0.5 pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to aquatic environment. The washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution. The pre-mitigation effect is considered as indirect, negative, short-term and likely to effect surface water.

River Crossings

A number of watercourse crossings (See Table 9-14 to Table 9-16) will be required, detailed as follows:

- 2 No. of Existing Piped Culvert upgrades; and
- 10 No. of New Clear Span Watercourse Crossings;

Table 9-14: Existing and Proposed Bridges along windfarm access roads

EPA Segment code	EPA Segment code	Turbines/Infrastructure	Catchment area km2	Flow 1:100 yr	Gradient/Dimensions	Culvert
Clochar An Chuilinn	38_3908	Bridge to T1/T2	0.9	3.3	0.08, 1.3m wide, 1.0m deep, U shaped stream	Proposed Clear span
	38_3908	Northern Access road existing Bridge	1.0	3.6	0.06, 2.1m wide, 2m deep , U shaped stream. 1.2m concrete culvert	Existing, no upgrade required
	38_1777	Spine road between T7 and T5, existing bridge	2.5	9	0.02, 1.8 to 2.3m wide, 1m deep, V shaped stream. 1.5m concrete culvert	Existing, upgrade required
Unnamed Stream	38_3678	Bridge to T6	0.05	0.15	0.01, 1m wide, 0.5 m deep, U shaped drain	Proposed Clear span
An Clochar Corr/ Sruhannaclassagh	38_1412	Bridge to T8/T9	0.45	1.6	0.12, 1.8m wide, 1.3m deep, V shaped stream.	Proposed Clear span
	38_1412	Bridge along spine road N of T12	0.5	1.8	0.09, 2m wide, 1.2m deep, V shaped stream.	Proposed Clear span
	38_1631	Bridge along spine road NE of T15	0.35	1.25	0.034, 2m wide, 0.8m deep. V shaped stream.	Proposed Clear span
	38_1614	Bridge along spine road NE of T15	0.2	0.75	0.069, 2m wide, 0.8m deep, V shaped stream.	Proposed Clear span
	38_1614	Bridge along road N of T17	0.7	2.5	0.013, 1.6m wide, 1.2m deep, U shaped stream.	Proposed Clear span

Table 9-15: Proposed Bridges along cable access roads

EPA Segment code	EPA Segment code	Turbines/Infrastructure	Catchment area km2	Flow 1:100 yr	Gradient/Dimensions	Culvert
An Clochar Corr/ Sruhannaclassagh	38_3856	Bridge S of T18	0.5	1.8	0.09, 2m wide, 1.2m deep, V shaped stream.	Proposed Clear span

Table 9-16: Proposed Bridges along amenity tracks

EPA Segment code	EPA Segment code	Turbines/Infrastructure	Catchment area km2	Flow 1:100 yr	Gradient/Dimensions	Culvert
An Clochar Corr/ Sruhannaclassagh	38_1631	Amenity Bridge – West of T11	0.5	1.8	0.06, 2m wide, 1.3m deep	Proposed Clear span
	38_3856	Amenity Bridge - East of T11	0.75	2.5	0.05, 1.7m wide, 1.2m deep	Proposed Clear span

Construction of structures over water courses has the potential to alter water quality and flows during the construction phase. Mitigation measures are proposed in Section 9.5 of this chapter.

Lakes/Ponds

As detailed in Section 9.3 a number of lakes are present within the Landownership boundary. The proposed layout has avoided the catchment areas to Lake Doo, Lake Smuttan, Nacroagh (Lough) and Sallagh (Lough). As there are no developments located in the lake catchment areas, there is no potential effects. Three small unnamed lakes are located to the south of T13 however there is no proposed development in the catchment areas to the unnamed lakes/ponds.

Turbines T10 to T12 are located in the catchment area of Lough Aneane More.

Excavation and disturbance of soils, subsoils and peat could result in changes in the chemistry of surface water runoff including colour, dissolved organic carbon (DOC), Turbidity and nutrients. As with erosion and sedimentation, this can have implications on both the quality of the aquatic habitat and also the resource potential of the lake.

Construction activities in the catchment area to Lough Aneane More has the potential to alter water quality and flows during the construction phase. Mitigation measures are proposed in Section 9.5 of this chapter.

9.4.3.3 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling)

Construction phase activities of the proposed project will require earthworks resulting in the removal of vegetation cover and excavation of mineral subsoil and are detailed in Chapter 2 (Description of the Proposed Project) and Chapter 8 (Land, Soils and Geology). Peat removal will be required for part for the site for founded roads. Potential sources of sediment laden water include:

- Drainage and seepage water resulting from infrastructure excavation;
- Stockpiled excavated material providing a point source of exposed sediment;
- Construction of the grid connection cable trench resulting in entrainment of sediment from the excavations during construction; and,
- Erosion of sediment from emplaced site drainage channels.

These activities can result in the release of suspended solids to surface watercourses and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies. Potential effects are significant if not mitigated against. The pathways identified for construction earthworks are drainage and surface water discharge routes. The main receptors are downgradient rivers (Gweebarra River, Cloghercor River and Clogherachullion River) and associated dependent ecosystems. The pre-mitigation effect is indirect, negative, significant, temporary and of a medium probability effect.

All proposed stream crossings will utilise clear span structures. For the clear span structures, the existing banks will remain undisturbed and no in-stream excavation works are proposed. Therefore, there will be no direct effect on the stream at the proposed crossing location. Drainage width, side slopes and substrate will be replicated in the proposed drainage channels. Where existing drains need to be rerouted/reprofiled, the original bed material will be reused. The sizing of any new internal drainage crossings will maintain existing depth of flow and channel characteristics. Where required, culverts will be buried at an appropriate depth below the channel bed.

9.4.3.4 Potential Effects on Groundwater Levels during Excavation Works and from Proposed Borrow Pits

Dewatering of borrow pits and other deep excavations (i.e., turbine bases) have the potential to effect on local groundwater levels. Groundwater level effects are not anticipated to be significant due to the local hydrogeological regime, as described below.

Borrow pit areas, where the granite bedrock depth ranges from near surface to 2m below ground level, will be excavated up to a maximum depth of 7m and deep excavations (i.e., turbine bases) up to 5 m deep, and will not encounter actual groundwater. However limited groundwater inflows and rainwater may need to be pumped, treated and discharged to the surface water channels.

Due to the low permeability of the proposed wind farm site, the potential impacts are short term, not significant, likely and negative.

Aquifer Hydraulic Properties

Slug tests were undertaken in BH2 to provide an estimate of the hydraulic conductivity of the bedrock formation. This method consists of measuring the static water level (head) in the borehole, then introducing a near instantaneous change in water level, and measuring the change in water level over time until the water level returns to the original static water level. The instantaneous change in piezometric head (static water level) can be achieved by adding or removing a volume of water from a well.

Typical specific dry weather flows in the bedrock in Donegal are low (0.41 to 1.1 l/s/km2), indicating that this aquifer does not make a significant baseflow contribution to streamflow.

Storativity is also expected to be low, as would also be expected of the Granites rock group. Most groundwater flow is in the uppermost part of the aquifer comprising a broken and weathered zone typically less than 3 m thick.

A slug test provides a very local estimate of hydraulic conductivity or transmissivity in the near vicinity of a well. As for aquifer tests, several analytical methods have been developed for the analysis of slug tests. Hvorslev (1951) was used to analyse the data.

The hydraulic permeability of the unconsolidated material interpreted from the data recorded from the test and interpreted using the mathematical solution by Hvorslev by matching a straight line to water level displacement collected during an overdamped slug test is presented in the Appendix 9-2. The average permeability, based on a number of different interpretations of the data is 0.04m/day.

Based on the permeability recorded within the site the Transmissivity is at the lower range of 1 to 5 m^2/day.

Dewatering Volume

The volume of water and the radius of influence is first estimated by empirical Sichardt Formula for radial flow:

$$R_o = C\ (H - h_w)\sqrt{K}$$

Where *C* is the empirical calibration factor usually taken as 3000 when units are (m) for drawdown and (m/s) for permeability; Where *H* is the initial aquifer piezometric or phreatic level; Where h_w is the piezometric or phreatic level in the equivalent well; Where $(H - h_w)$ is the drawdown in equivalent well (i.e., target drawdown); and where *K* is permeability.

Estimation of Discharge and Drawdown

- Radial Flow – Unconfined Conditions;

$$Q = \pi.k\ \frac{(H^2 - h^2)}{\left\{\ln\left(\frac{R_o}{re}\right)\right\}}$$

Where *re* is the equivalent well radius. This *re* can be taken as the radius of the equivalent well.

Based on the above principles and a Transmissivity value of 1m^2/day to 5m^2/day; required groundwater discharge rates of 100m^3/day to 250m^3/day are obtained. Assuming each borrow pit is reaching a maximum depth of 10m below ground level (BGL), the empirical estimate calculates the 0.1m drawdown at <25m. There are no wells within 800m of the borrow pits or turbine bases.

Dewatering of borrow pits and other deep excavations (i.e., turbine bases) have the potential to effect localised groundwater levels. However, groundwater level effects are not anticipated to be significant, due to low permeability bedrock and the relatively small volumes to be abstracted e.g., 10m^3/day to 250m^3/day. Dewatering will locally depress groundwater levels by 0.1m in the immediate vicinity (25 m) of the pumping regime.

The pre-mitigation effect is considered as not significant, short term and unlikely to affect groundwater wells due to potential effects of dewatering being very shallow and limited to 0.025km from the point of abstraction, resulting in a temporary localised shallow depression in the aquifer.

9.4.3.5 Turbine Delivery Route (TDR) and Cable Route

The excavations for cable route trenches and the temporary alterations for the TDR may have a direct permanent effect on the exposed soils and rock in the form of increased erosion and sediment release that, without mitigation, could also have additional effects on water quality (due to sedimentation of water courses).

No in-stream or riparian works are proposed to facilitate the turbine delivery route road/junction accommodation works. Where any works are proposed within 50m of a watercourse, there is an increased potential for sediment release to the watercourse. The small scale and temporary nature of these works will result in ground conditions similar to agricultural cultivation at these locations. Overall, without mitigation, these works have the potential to have slight negative short-term effect on the surface water environment.

Modifications along the TDR involves the temporary removal of signage and clearing of some vegetation in addition to the temporary local widening at bends/junctions/narrow sections and creation of a blade changeover area using hardcore material. Inappropriate management of the carrying out of these modifications could result in blockages of existing roadside drainage.

Any excavations for the cable route will expose bare soil for a temporary period over a short section of the trench. The trench will be backfilled immediately following the installation of each section of cabling. While the trench is open, there will be a potential effect to the adjacent watercourse of an increase in the concentration of suspended solids.

There are 2 no. watercourse crossings on the proposed grid connection route i.e., across 38_1614 and 38_3856. The locations of these crossings are shown on Figure 9-5. Existing forestry and shallow artificial agricultural field drainage channels were also present, though these are thought to remain dry for the vast majority of the time.

The method for cable crossing two watercourses, is a trenchless crossing as set out in Appendix 2-4 - Outline Construction Methodology. It is proposed that horizontal directional drilling (HDD) under the stream bed will be undertaken to prevent direct effects on the watercourse. HDD involves drilling of a pilot hole from a drilling machine positioned at one side of the obstacle to be crossed. The hole is then reamed to make it larger and once the hole is of sufficient size, a pipe or conduit is pulled into the drilled hole. During the horizontal directional drilling, groundwater may be encountered.

The proposed HDD method carries a risk of indirect effects from sediment laden runoff during the drilling launch pit excavation works. There is also the unlikely risk of frac out and contamination of the watercourse with drilling mud (clay). Mitigation measures to manage silt are included in Section 9.5. Guidance and mitigation measures recommended by Inland Fisheries Ireland (IFI) during the consultation process have been incorporated into the design of the proposed crossings.

The pre-mitigation effect of the TDR/Grid Route is considered as slight, short term and unlikely to effect the surface water due to the use of trenchless technology and the proposed design.

9.4.4 Potential Effects - Operational Phase

The proposed project footprint will comprise of 27.3ha within the proposed wind farm site area of 1,945ha (1.4%). The potential for significant changes in runoff is, therefore, low with a slight potential increase in runoff.

In addition, the greenfield runoff rate has been calculated based on the EPA guidance 'Rainfall Runoff Management for Developments' SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). The SuDS Online Greenfield Runoff Rate Estimation Tool was used to assist in calculations.

The hydrometric gauges used by the EPA have gathered data for SAAR in the region, with values typically in the region of 1,620mm being recorded. The proposed wind farm site is characterised by moderately steep slopes and limited infiltration rates. The areas of the site which have peat have low infiltration rates. The UK SuDS Tool estimates a SAAR for the proposed wind farm site of 1,620mm. The Standard Percentage Runoff (SPR) is 0.53. SPR is assumed to be the proportion of rainfall that contributes to surface water runoff. The mean annual maximum flow rate (Q_{bar}) is calculated to be between 13l/s/ha – 16.8 l/s/ha . Based on climate change and an increase in hardstand surfaces, there is potential for an increase in runoff. The potential for infiltration on the site is limited due to the existing topography and low permeability soils and bedrock. Climate change scenarios suggest fluvial floods in the 2080's increasing by up to 10% (low and medium low scenarios) or by up to 20% (medium high and high scenarios). To address climate change, the present recommendations are to include in the design flow a 20% increase in flood peaks as a result of climate change. The potential for increased runoff is addressed in the SuDS design measures described in Section 9.5.3. Mitigation measures are outlined in Section 9.5 and include the use of swales, settlement ponds and other SuDS measures. Overall runoff is included below in Table 9-17.

Table 9-17: Overall Runoff Calculation Table

Item	Values	Notes
Site Area	1,945ha	Ownership boundary
Development Area for Construction	27.3	Permanent development area
Rainfall	1620mm	IrishSuds
Impermeable Area Before Development	90%	Low permeability soils and bedrock
Impermeable Area After Development	90-95%%	Based on the increase in runoff from 90% to 95% in the development footprint
Increase in Runoff	$57m^3$/day	Increase in runoff from impermeable area
Potential % of Increased Runoff	0.07%	Mitigation included in Section 9.5

With regard to water quality effects, while there will be no significant direct discharges to the surface water environment during the operational phase due to the nature of the development. Occasional access will be required there will be vehicles periodically on the site at any given time. This may lead to occasional accidental emissions, in the form of oil, petrol or diesel leaks, which could cause localised contamination of site drainage channels. However, due to the periodic nature of visits, the risk of surface water pollution during operation is considered to be low.

The presence of occasional maintenance workers at the proposed substation will lead to the generation of foul sewage from toilets and washing facilities. This foul sewage will be collected and tankered off-site for disposal at a licensed wastewater treatment facility.

The pre-mitigation effect is considered as slight, short term and likely to effect on surface waters.

9.4.5 Potential Effects – Decommissioning Phase

Decommissioning of the proposed wind farm will involve the disassembly and removal of the turbines offsite. These effects have been assessed as similar to the Construction Phase and, therefore, the mitigation measures for the Construction Phase will also be implemented during decommissioning. Turbine hardstands will be covered over with soil and allowed to vegetate. It is not proposed to restore the hardstanding areas to commercial forestry after decommissioning.

Potential effects will be minimised by leaving elements of the proposed project in place where appropriate including the site roads, turbine foundations, substation and the grid connection infrastructure. Internal roads and drainage will remain in place for forestry and recreational access and management.

9.4.6 Magnitude and Significance of Effect

The magnitude of an effect includes the timing, scale, size and duration of the potential effect. The magnitude criteria for hydrology/hydrogeology are defined as set out in Table 9-18 to 9-20 below. There will be no direct discharges from the wind farm to any existing lakes or rivers.

Table 9-18:Magnitude and Significance of Hydrological and Hydrogeological Criteria - Construction Phase

Criteria	Description	Duration and Frequency of Effect	Significance of Potential Effect
Runoff Regime	Potential localised increase in surface water runoff may be caused by impermeable areas on site. Impermeable areas may give rise to a slight increase in surface water flow locally but will not have a significant effect on the volumetric flow rate of downstream rivers. Potential increase in runoff is <0.1% from the windfarm area.	Indirect, Short term and rarely	Slight negative
Surface Water Quality	Sedimentation of drainage ditches and streams. Sensitive receptors include the existing streams and Gweebarra transitional waters	Indirect, Temporary and medium probability	Moderate negative
Groundwater Levels	No change in groundwater is expected. No ZOCs or wells within 750m of turbines.	Not applicable	Not significant
Groundwater Quality	Minor leaks or spills during the construction phase.	Indirect, Short term and unlikely	Not significant

Table 9-19: Magnitude and Significance of Hydrological and Hydrogeological Criteria - Operational Phase

Criteria	Description	Duration and Frequency of Effect	Significance of Potential Effect

Runoff Regime	Increased surface runoff caused by impermeable areas on site may increase surface water flow locally but will not have a significant effect on the volumetric flow rate of downstream rivers. Site to be maintained at greenfield runoff rates.	Long term and rarely	Not significant
Surface Water Quality	No significant loss in water quality is expected.	Long term and rarely	Not significant
Groundwater Levels	No significant change in groundwater is expected.	Not applicable	Not significant
Groundwater Quality	No change in groundwater quality is expected.	Not applicable	Not significant

Table 9-20 Magnitude and Significance of Hydrological and Hydrogeological Criteria - Decommissioning Phase

Criteria	Description	Duration and Frequency of Effect	Significance of Potential Effect
Runoff Regime	Potential localised increase in surface water runoff may be caused by impermeable areas on site. Impermeable areas may give rise to a slight increase in surface water flow locally but will not have a significant effect on the volumetric flow rate of downstream rivers. Potential increase in runoff is 1% from the windfarm area.	Short term and rarely	Slight negative
Surface Water Quality	Sedimentation of drainage ditches and streams.	Temporary and unlikely	Slight/moderate negative
Groundwater Levels	No change in groundwater is expected. No ZOCs or wells within 50m of turbines.	Temporary and unlikely	Not significant
Groundwater Quality	Minor leaks or spills during the construction phase.	Temporary and unlikely	Not significant

9.5 MITIGATION MEASURES

As outlined in Chapter 2 of this EIAR (Description of the Proposed Project), the design of the proposed project has considered a range of best practice construction measures which will ensure avoidance and reduction of effects throughout the construction, operational and decommissioning phases. Additional measures have been developed to mitigate the effects identified in the preceding section.

9.5.1 Mitigation by Avoidance

In identifying and avoiding sensitive surface waters, the proposed project has implemented 'avoidance of effect' measures. Mitigation by avoidance is viewed as part of the 'Reasonable Alternatives' outlined in Chapter 3 of this EIAR. Examples include locating fuel storage and construction compounds >50m from surface water streams. No marked streams are crossed by the turbine access tracks. Areas of deeper peat were avoided as part of the site entrance and grid connection.

9.5.2 Mitigation by Prevention and Reduction

A number of mitigation measures are outlined below and are considered as in-built to the design of the project. These mitigation measures are a combination of measures to comply with legislation and best practice construction methods to be implemented in order to prevent water (surface water and groundwater) pollution. Examples of these measures are the storage of potentially polluting materials in fully bunded tanks and controlling / reducing runoff from hardstand areas.

9.5.3 Mitigation Measures – Construction Phase

In order to mitigate potential effects during the construction phase, best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution. A CEMP (Appendix 2-2 of the EIAR) was developed for the project to ensure adequate protection of the water environment. All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

During the construction phase, all works associated with the construction of the wind farm will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016). Groundwater from the borrow pits will be treated in the settlement lagoons. Monitoring of groundwater quality and quantity will be undertaken downgradient of the works during the pre-construction and during the construction phase.

All mitigation and management measures outlined hereunder will be incorporated into the Surface Water Management Plan, which forms part of the CEMP (Appendix 2-2 of the EIAR). Mitigation measures are incorporated into the CEMP and will be incorporated into the specification for the Civil Engineering Works contract. The implementation of the Surface Water Management Plan will be overseen by a suitably qualified ecologist/engineer and will be regularly audited throughout the construction phase. The assigned ecologist/engineer will be required to stop works on site if he/she is of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented.

9.5.3.1 Forestry felling.

The total area of forestry to be felled is estimated to be between approximately 69.8ha and 90.9ha, of which approximately 12.6 ha will be replanted on site at the end of the construction phase (at the temporary construction compounds and reinstated borrow pits). As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not.

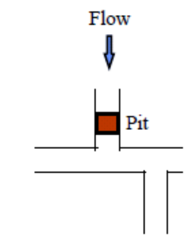
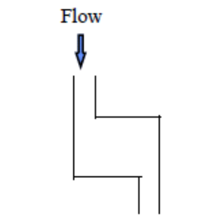
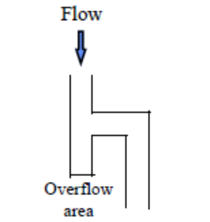
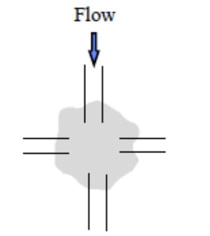
The Felling and Reforestation Standards describe the universal standards that apply to all felling (thinning, clear felling) and reforestation projects on all sites, will be implemented under a felling licence issued by the Department of Agriculture, Food & the Marine.

Buffer zones are also identified and will be marked out on the ground. Correct buffer zone management will help reduce the risk of sedimentation from felling operations. Buffer zone guidelines for planting and felling activities are provided by the *Forestry Service in the Forestry and Water Quality Guidelines (2000).* It is proposed to apply these buffer zone guidelines to construction activities also. Construction activities will be curtailed within buffer zones in order to reduce erosion and sedimentation and, therefore, to protect water quality. Buffer zone widths vary from 10m to 25m, depending on slope and soil erosion classification. Details of buffer zones are included in Table 9-21.

The slopes across the proposed wind farm site are moderate with some steep slopes. As an additional measure, all infrastructure on the proposed wind farm site including for turbines, borrow pits, site compounds, substation and access tracks (excluding grid connection) will maintain a 50m set back from streams and lakes. The construction works will involve some works within 50m of streams (such as site access tracks and clearspan bridges). However, no instream works are proposed, and a suite of measures are in place to avoid any adverse effects on streams. Clear span bridges will be utililsed for stream crossings. Trees will be cut manually inside the 50m buffer. During the near stream construction work, silt traps and a double row silt fences will be placed immediately down-gradient of the construction area for the duration of the construction phase. All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their *Forestry Harvesting and Environment Guidelines* (2000) and the *Forestry and Water Quality Guidelines* (2000). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Brash mats will also be used to support harvesting and forwarding machinery. The brash mats reduce erosion of the surface and will be renewed as they become used and worn over time.

As part of felling works, temporary water crossings are required for forest drains, roadside drains, relevant streamss and aquatic watercourses. The following measures will be adhered to as per the 2019 *Standards for Felling and Reforestation:*

Typical sediment trap designs are illustrated below (source *Forestry Schemes Manual, 2017*):

No. 1 (Pit)	No. 2 (Staggered Type)	No. 3 (Run Off Type)	No 4 (Swamp Type)
			
The end of the mound drain is slightly deepened for c. 0.3 metres before it enters the collector drain.	Forces water to slow down within the trap - more efficient than if the water ran straight through the trap. Minimum 1 metre long.	Caters for runoff events that exceed the design capacity. Useful on slopes. Overflows floods onto vegetation. Do not plant within 4 metres of the lower side in order to conserve dense vegetation.	Many drains may enter a natural depression to create a mini "swamp". Dimensions of the "swamp" depend on the needs of the site. May be c. 20 sq. metres. Do not plant within 4 metres of the "swamp".

Sediment traps will require monitoring and maintenance throughout the construction stage. Sediment traps will be constructed and maintained in line with the requirements of the *Forestry Schemes Manual (2011), the Forest Road Manual and Forest Drainage Engineering – A Design Manual.*

Forest Drains:

- Minimise the crossing of drains during felling and extraction and restrict machine activity to brashed extraction racks and forwarding routes
- Where a drain crossing is needed, based on the size of the forest drain one of the following methods will be selected that prevents the breakdown and erosion of drain sides, namely:
  - For larger drains, deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route.
  - Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, logs will be that approximate the depth of the channel to be crossed.

Aquatic Zones and Larger Relevant Watercourses:

- Minimise the crossing of streams during felling and extraction by choosing alternative routes which avoid the watercourses/aquatic zones.
- Direct crossing over the stream bed will not be permitted.
- Water Feature will be crossed at a right angle to the flow of water.
- Any necessary crossing will be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks.

9.5.3.2 Turbines, Hardstanding, Temporary Construction Compounds, Met Mast and Access Tracks

As stated previously, to maximise the erosion and sediment control benefits of natural vegetation soil cover, stripping of soil is to be kept to a minimum and confined to construction areas only. Where practical, construction works will be staged to minimise the extent and duration of disturbance, e.g., plan for progressive site clearance, only disturbing areas when they are scheduled for current construction work.

To minimise any effect on the underlying subsurface strata from material spillages, all oils and solvents used during construction will be stored within specially constructed dedicated bunded areas, see Photo 1, Section 9.5.3.3 below. Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area of the site, away from surface water gullies or drains. Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. For certain vehicles which are less mobile, refuelling may need to occur elsewhere on site. This will be carried out using a double skinned and bunded bowser, towed behind a jeep (or similar). Refuelling using this will take place only by trained personnel, and only at locations greater than 50m from any stream. A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use. When not in use this will be stored in the designated area of the construction compounds.

All construction waste will be sorted and stored in on-site skips, prior to removal by a licensed waste management contractor.

9.5.3.3 Concrete

Concrete is required for the construction of the turbine bases and foundations. After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute wash out. Wash down and washout of the concrete transporting vehicles will take place at an appropriate facility offsite.

The best management practice objectives for concrete chute washout are to collect and retain all the concrete washout water and solids in leak proof containers or impermeable lined wash out pits, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. The collected concrete washout water and solids will be emptied on a regular basis. Washout will be undertaken at the construction compounds.

Photo 1 Example of a Concrete Washout Site

9.5.3.4 Fuels and Chemicals

With regards to on-site storage and handling of potentially pollutant materials:

- Fuels and chemicals will be stored within bunded areas as appropriate to guard against potential accidental spills or leakages. The bund area will have a volume of at least 110 % of the volume of such materials stored;

- All on-site refuelling will be carried out by a trained competent operative.
- Mobile measures such as drip trays and fuel absorbent mats kept with all plant and bowsers and will be used as required during all refuelling operations;
- A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use;
- No refuelling will take place within 50 m of any stream;
- All equipment and machinery will have regular checking for leakages and quality of performance and will carry spill kits;
- Any servicing of vehicles will be confined to designated and suitably protected areas such as construction compounds; and
- Additional drip trays and spill kits will be kept available on site, to ensure that any spills from vehicles are contained and removed off site.

9.5.3.5 Erosion and Sediment Control

As outlined above, if not correctly managed, earthworks can lead to loss of suspended solids to surface waters. The main factors influencing the rate of soil loss and subsequent sediment release include:

- Climate;
- Length and steepness of slopes;
- Soil erosion potential;
- Soil Vegetation/cover;
- Duration and extent of works; and
- Erosion and sediment control measures.

Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the proposed project will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold rainfall values will allow work

to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if the following is likely to occur:

- >10mm/hr (i.e., high intensity local rainfall events);
- >25mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and
- Provide cover to material storage areas i.e., adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.

9.5.3.6 Fisheries

As a further precaution, near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document *"Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites"* , that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.

It is proposed, that during the ground clearance of the proposed project, the contractor will implement water control measures to limit the effect on water quality using standards measures as set out in the Forestry Report – Appendix 2-5. Brash will be used along harvesting and extraction routes for soil protection. The forwarder will be loaded to the manufacturer's maximum specification and no more to avoid overloading and unnecessary soil compaction.

Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 *Control of water pollution from linear construction projects*.

All temporary and permanent drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following:

- Filtration of water through filter media (sand / stone check dam, silt fence);
- Detention / settlement in settlement ponds or behind check dam in swales; and
- Conveyance of shallow depths of water in vegetated swale.

Interceptor Drains

Interceptor drains/diversion ditches will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. This drainage will integrate into the existing forestry drainage. These drainage ditches will be installed on the upgradient boundary of the areas affected by the access track earthworks operations and installed ahead of the main track construction operations commencing. They will generally follow the natural flow of the ground. The interceptor drains will intercept any storm water surface run-off and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. It will then be directed to areas where it can be redistributed over the ground by means of a level spreader.

Swales

Track edge drainage/swales are required to control run-off from the running surface to lower water levels in the subgrade, to control surface water and to carry this flow to outlet points. Swales along access tracks are to be installed in advance of the main construction phase. On sections of track where there is significant longitudinal gradient, regular surface water interception channels will be employed – these will typically be at 10-20m intervals to collect any surface water that is discharging as sheet flow along the track and discharge the flow into the trackside swale. Swales will provide additional storage of storm water where located along gradient. Drainage details are included in the CEMP and Drawings 10798-2060 to 10798-2065.

Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. Check dams will be constructed from course gravel/ crushed rock. Check dams will have a minimum 0.2m freeboard (from top of check dam) to top of swale level, to prevent overtopping of flows onto the access track. All check dams, etc to be checked at least once weekly via a walkover survey during the full period of construction. All excess silts to be removed and disposed of appropriately. Where check dams have become fully blocked with silt, they will be replaced.

Swales will be re-vegetated by hydro-seeding with indigenous seed mix as soon as is practicable following excavation. This will reduce the flow velocity, treat potential pollutants, increase filtration and silt retention.

Settlement Ponds/Lagoons

Settlement ponds will be located downstream of road swale sections and at turbine/hardstand locations, to manage/buffer volumes of runoff discharging from the drainage system during periods of high rainfall, thereby reducing the hydraulic loading to watercourses. Settlement ponds are designed in consideration of the greenfield runoff rates. The following shall apply to construction of settlement ponds at the site:

- Pond depths generally to be excavated to less than 2m;
- Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and
- Material excavated from the settlement pond should be compacted around the edge of the pond.

Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. Drainage details are included in the CEMP (Appendix 2-2) and Drawings 10798-2060 to 10798-2065, in Appendix 1-1.

The settlement pond design is based on primary settling out of suspended solids from aqueous suspension. The theory behind the design of the settlement lagoons is the application of Stoke's Law. The settlement lagoons will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids of a very small particle size to fall out of suspension prior to allowing the water to outfall to the receiving environment. Flow rates for storm events will be maintained at or below greenfield runoff rates as detailed above.

Settlement lagoons will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and as far as possible from the buffer zones of existing streams. The minimum buffer zone width will be 50m as outlined above.

Settlement lagoons will be regularly cleaned/maintained to provide effective and successful operation throughout the works. Outfalls and drainage ditches will be cleaned, when required, starting up stream with the outfalls blocked temporarily prior to cleaning.

The sediments/silt in the settlement lagoons will be cleaned regularly and removed via the contractor and deposited at suitable locations on site, away from watercourses. Machine access is required to excavate the accumulated sediment. Control measures include:

- Regular inspection and maintenance of settlement lagoons and drains;
- Settlement lagoon maintenance and/or cleaning will not take place during periods of extended heavy rain;
- Settlement lagoons will be fenced off for safety;
- Settlement lagoons will where practicable be constructed on even ground and not on sloping ground and discharge into vegetation areas to aid filtration and dispersion; and
- The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.

All stockpiled material will be side cast, battered back and profiled to reduce rainfall erosion potential. The stockpiling of materials will be carefully supervised as per the mitigation measures listed in Chapter 8 of this EIAR (Land, Soils and Geology).

The surface water management system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out and during excavations at T10 to T12. Where issues arise, such as blockages, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.

Traffic on site will be kept to a minimum. Only the proposed onsite access track will be used for project-related traffic.

Correct buffer zone management will help reduce the risk of sedimentation from felling operations (See Appendix 2-5). Buffer zone guidelines for planting and felling activities are provided by the Forestry Service in the *'Forestry and Water Quality Guidelines'*. It is proposed to apply these buffer zone guidelines to construction activities also. Construction activities will be curtailed within buffer zones in order to reduce erosion and sedimentation and, therefore, to protect water quality. Buffer zone widths vary from 10m to 25m, depending on slope and soil erosion classification. Details of buffer zones are included in Table 9-21.

Table 9-21: Recommended Buffer Zone Widths

Average Slope Leading to Aquatic Zone	Buffer Zone Width on Each Side of the Aquatic Zone	Buffer Zone Width for Highly Erodible Soils
Moderate (even to 1:7 / 0% - 15%)	10m	15m

Steep (1:7 - 1:3 / 15% - 30%)	15m	20m
Very steep (1:3 / >30%)	20m	25m

The slopes across the proposed wind farm site are predominantly moderate (<1:7) with steeper slopes to the southeast and northeast of the proposed project. As the soil type varies across the site, this suggests that a 10m to 20m buffer zone is appropriate. As an additional measure, all infrastructure on the proposed wind farm site including for turbines, borrow pits, site compounds, substation will maintain a 50 m set back from streams.

All associated tree felling will be undertaken using good working practices as outlined in the Forestry Report and CEMP (Appendices 2-5 and 2-2 of this EIAR), the Forest Service in their 'Forestry Harvesting and Environment Guidelines' (2000) and the 'Forestry and Water Quality Guidelines '(2000). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Brash mats will also be used to support harvesting and forwarding machinery. The brash mats reduce erosion of the surface and will be renewed as they become used and worn over time.

Temporary Site Construction

During the construction phase, two temporary site compounds will be required. Temporary on-site toilet facilities (chemical toilets) will be used. These will be sealed with no discharge to the surface water or groundwater environment adjacent to the site.

Surface Water Flow and Stream Crossings

Potential effects on surface water flow during the construction phase of the wind farm are mitigated by the proposed drainage design which has been designed to minimise disturbance to the current hydrological regime by maintaining diffuse flows. Where stream crossings occur (i.e., access tracks), it is proposed to use a clear-span design bridges. Installation of such features will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller forestry drains and streams will be crossed using normal culverts.

A number of ephemeral drainage features (drains) are also present on site. Culverting of these will only take place during dry weather periods. Culverts will be designed to be of a size adequate to carry expected peak flows. Culverts will be installed to conform to the natural slope and alignment of the drainage line. Culverts will be buried at an appropriate depth below the channel bed and the original bed material placed at the bottom of the culvert. The sizing of any new internal drainage crossings will maintain existing depth of flow and channel characteristics.

The CEMP and method statement for stream crossings follows the guidelines set out in the following documents:

- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019

- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

Embedded culverts will be buried to a depth of 0.3m or 20% of their height (whichever is greatest) below the bed. Crossing construction will be carried out, in so far as is practical, with minimal disturbance to the drain bed and banks. If they have to be disturbed, all practicable measures including location of stockpiles away from drainage ditches will be taken to prevent soils from entering any water – see section 9.5.2. Any culverting works at drains will take place only during dry periods when the drains are dry/stagnant. Silt traps will be placed on the downgradient side of the crossing.

Cement and raw concrete will not be spilled into watercourses. No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. Pre-cast elements for bridge, culverts and concrete works will be used. During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. Chute cleaning will be undertaken at lined cement washout lagoons. These lagoons will be cleaned out by a licensed waste contractor. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Weather forecasting will be used to plan dry days for pouring concrete. The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.

A setback distance of 10m to 20m from any stream will be kept clear of brash as far as practicable, to avoid felling of trees into watercourses and removal of them or any other accidental blockages that may occur. Where practicable, crossings should be adequately elevated with low approaches such that water drains away from the crossing point. Earth embankments constructed for bridge approaches will be protected against erosion e.g., by re-vegetation or rock surfacing etc.

9.5.3.7 Substation

The mitigation strategies for the substation foundations follow similar procedures to the excavations for turbine and hardstanding foundations, see Section 9.5. All works will be monitored by a suitably qualified and experienced engineer.

Where existing drainage ditches need to be realigned (e.g., around substation), the new swale will match the profile of the existing ditch in relation to side-slope profile and the material at the base of the channel.

9.5.3.8 Turbine Delivery Route and Grid Connection Route

Silt fencing will be erected at the location of stream crossings along the grid connection route. Silt curtains and floating booms will also be used where deemed to be appropriate and this will be assessed separately at each individual location.

No refuelling of machinery will take place within 50 m of a stream. Excavated material will not be stockpiled or side-cast within 50 m of a stream. Appropriate steps will be taken to prevent soil/dirt generated during the temporary upgrade works to the TDR from being transported on the public road. Silt fences will be located at the toe of the slope to reduce sediment transport.

Road sweeping vehicles will be used to ensure that the public road network remains free of soil/dirt from the location of the TDR works and grid connection when required. This will reduce the potential for sedimentation of surface watercourses locally.

Further mitigation measures in relation to the grid connection cable route and road/junction accommodation works on the TDR are outlined in the CEMP in Appendix 2-2 of the EIAR.

There will be 2 no. natural watercourse crossings along the grid connection route, and 9 no. stream crossing. Directional drilling is the proposed construction method for 2 no. of identified grid crossings.

Where existing drainage ditches need to be realigned, new drainage ditches will match profile of existing drains in relation to width, with shallower side slope profile and material at base of channel will be reused. The sizing of any new culverts will be designed to maintain existing flow characteristics and depth of flow. Within the site development area, culverts will be assessed to ensure no barriers to fish migration occur. Where barriers occur, such culverts will be improved to increase fisheries potential under advice from the ECOW. Based on the existing data, fisheries potential is low due to natural barriers to migration and low aquatic productivity.

Directional Drilling Mitigation Measures:

Horizontal directional drilling (HDD) is used in the construction industry as a convenient way to install cabling with minimum disruption. In order to limit water quality effects and morphological effects, trenchless technology will be carried out to install the cable below two. streams. While the HDD method limits water quality impacts, the following mitigation apply to ensure the correct operation of this cabling technique and are listed below:

- A minimum 50 m vegetative buffer zone will be maintained between the works area and the stream.
- There will be no storage of material/equipment or overnight parking of machinery inside the 50m buffer zone;
- Before any ground works are undertaken, double silt fencing will be placed upslope of the stream channel along the 50 m buffer zone boundary;
- Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the stream;
- Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered;
- The area around the bentonite (clay) batching, pumping and recycling plant will be bunded using terram and sandbags in order to contain any spillages;
- Drilling fluid returns will be contained within a sealed tank/sump to prevent migration from the works area;
- Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized skip before being taken off-site;
- If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e., soil and subsoil exposures created during site preparation works);
- This will be completed using a shallow swale and sump down slope of the disturbed ground; and water will be pumped to a proposed distribution area at least 50 m from the stream;
- The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water;
- Any sediment laden water from the works area will not be discharged directly to a stream or drain;

- Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse;
- If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied;
- On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the earliest opportunity to prevent soil erosion;
- The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated;
- There will be no refuelling allowed within 50 m of the stream crossing; and,
- All plant will be checked for purpose of use prior to mobilisation at the stream crossing.
- The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used);
- The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage;
- Spills of drilling fluid will be cleaned up immediately and transported off-site for disposal at a licensed facility;
- Adequately sized skips will be used where temporary storage of arisings are required;
- The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local stream;
- This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped;
- Any frac-out material will be contained and removed off-site; and
- The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix.

9.5.3.9 Major Accidents/Disasters

This section describes the expected significant effects on the environment arising from the vulnerability of the proposed project to risks of major accidents and/or natural disasters which are relevant the project.

The assessment must consider the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project.

As detailed in Section 9.3, there is no significant risk of flooding on the site based on current climatic conditions and predicted climate change. In this regard, the most likely major accidents or disaster that could occur as a result of the proposed project (and its associated works) include peat slippage. Details of Peat Stability are included in Chapter 8 Land, Soils and Geology.

It can be concluded that the risk of major accidents associated with this development and hydrological/hydrogeological factors is low and would not cause unusual, significant or adverse effects on the hydrological or hydrogeological environment during the construction, operational and decommissioning phases.

9.5.4 Mitigation Measures – Operational Phase

The following mitigation measures will be implemented during the operational stage.

9.5.4.1 Turbines, Hardstanding, Temporary Construction Compounds, Met Mast and Access Tracks

The operational team will carry out maintenance works such as servicing of wind turbine and transmission infrastructure, upkeep of access tracks and any hardstand areas, ensuring the drainage system remains functional throughout the operation of the windfarm.

Mitigation for the operational maintenance works include regular scheduled maintenance works, regular inspections of all project elements with any unscheduled repairs or maintenance arising to be undertaken.

The potential effect of hydrocarbon or oil spills during the operational phase of the windfarm are limited by the size of the fuel tank of vehicles used on the site. Mitigation measures for the potential release of hydrocarbons or oil spills include:

- The plant and vehicles to attend site should be regularly inspected or at least prior to the scheduled site visit to be free from leaks and is fit for purpose;
- Fuels stored on site will be minimised, any storage areas will be bunded appropriately for the fuel storage volume for the time period of the operation;
- Operational team to be competent and trained in an emergency plan for the operation phase to deal with accidental spillages; and
- Spill kits will be available to deal with accidental spillages.

9.5.4.2 Substation

All fuel will be stored in bunded areas. The bund capacity will be sufficient to accommodate 110% of the largest tank's maximum capacity or 25% of the total maximum capacities of all tanks, whichever is the greater. The exception to this being double walled tanks equipped with leak detection, which do not require additional retention.

A hydrocarbon interceptor will be installed at the proposed substation site with regular inspection and maintenance, to ensure optimal performance.

Given the requirement for sanitary facilities during occasional operation and maintenance works, wastewater effluent will be directed to an onsite holding tank, from where it will be tankered off site to a suitably licensed wastewater treatment plant. An automatic alert system will be used to monitor the holding tank to alert the operator if the tank is nearing full capacity. A rainwater harvesting facility will be provided at the substation control building. Potable water will be provided by water dispensers.

9.5.5 Mitigation Measures – Decommissioning Phase

Decommissioning of the proposed project would result in the cessation of renewable energy generation, the removal of all above ground turbine components whilst other infrastructural elements such as turbine foundations. The site access tracks, parking area, cabling and substation will remain in place.

The risks associated with leaving tracks and infrastructural components in situ are relatively low. The decommissioning phase will not require any significant works that will effect the drainage network. A fuel management plan to avoid contamination by fuel leakage during decommissioning works will be implemented as per the construction phase mitigation measures.

Mitigation measures applied during decommissioning activities will be similar to those applied during construction where relevant. Some of the effects will be avoided by leaving elements of the proposed project in place. The turbine bases and hardstanding areas will be rehabilitated by covering with locally sourced topsoil in order to regenerate vegetation which will reduce runoff and sedimentation effects.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures mentioned in Section 9.5.

These effects have therefore been assessed as similar to the construction phase. Mitigation measures for the construction phase will therefore also be implemented during decommissioning.

Monitoring

It is proposed that local surface water features in the immediate vicinity of the site boundary are monitored pre-construction and during construction to take account of any variations in the quality of the local surface water and groundwater environment as a result of activities related to the proposed project.

Inspections of silt control measures are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. A programme of inspection and maintenance is proposed, and dedicated construction personnel assigned to manage this programme.

During the construction phase, field testing and laboratory analysis of a range of parameters will be undertaken at adjacent streams, specifically following heavy rainfall events (i.e., weekly, monthly and event based as appropriate).

Regular visual inspections of all streams (flow conditions, discolouration, collection of debris, fish in distress or floating), presented in a monthly report on water quality, will be carried out by an independent, suitably qualified Environmental Clerk of Works (ECoW) with particular emphasis placed on:

- Streams downstream of site activities;
- At times when heavy traffic is frequenting the site;
- During and after periods of heavy or prolonged rainfall and during winter months;
- During fish migration and spawning periods; and
- Stream crossings to ensure that the existing mitigation measures are effective in preventing any sediment reaching streams.

9.6 RESIDUAL EFFECTS

The potential residual effects on the surrounding water quality, hydrology and existing drainage regime at the proposed wind farm site are considered to be slight and temporary/short term in nature. The existing on-site drainage system will remain active during construction and operation of the proposed project.

The construction timescale of activities within the site will be phased and short-term in duration and, thereafter, the only activities occurring within the site will be associated with maintenance, such as maintaining the wind turbines and existing drains, ongoing maintenance, replacement of turbines and onsite infrastructure and monitoring during the operational phase. There are no significant long-term effects.

The design of the proposed wind farm has taken account of the potential effects of the development and the risks to the surface water and groundwater environment. Measures have been developed to mitigate the potential effects on the water environment. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation. Residual effects post mitigation is outlined in Table 9-22, Table 9-23 and Table 9-24.

Table 9-22: Magnitude and Significance of Hydrological and Hydrogeological Criteria - Residual Effects (Construction Phase) post mitigation

Criteria	Duration and Frequency of Effects	Significance of Potential Effects
Runoff Regime	Short term and rarely	Not significant
Surface Water Quality	Temporary and occasional	Not significant
Groundwater Levels	Short term and rarely	Not significant
Groundwater Quality	Short term and occasional	Not significant

Potential residual effects from the construction phase of the proposed project on the hydrological and hydrogeological environment are considered to be negative, short term and not significant.

Table 9-23: Magnitude and Significance of Hydrological and Hydrogeological Criteria - Residual Effects (Operational Phase)

Criteria	Duration and Frequency of Effects	Significance of Potential Effects
Runoff Regime	Long term and rarely	Not significant
Surface Water Quality	Long term and rarely	Not significant
Groundwater Levels	Long term and rarely	Imperceptible
Groundwater Quality	Long term and rarely	Imperceptible

Potential residual effects from the operational phase of the proposed project on the hydrological and hydrogeological environment are considered to be negative, of an unlikely probability, long term and not significant.

Table 9-24: Magnitude and Significance of Hydrological and Hydrogeological Criteria - Residual Effects (Decommissioning Phase)

Criteria	Duration and Frequency of Effects	Significance of Potential Effects
Runoff Regime	Short term and rarely	Not significant
Surface Water Quality	Temporary and occasional	Not significant
Groundwater Levels	Short term and rarely	Imperceptible
Groundwater Quality	Short term and occasional	Imperceptible

In terms of the hydrological effects, there is no potential for effect on a number of the sensitive receptors as a result of keeping most of the below ground infrastructure. No changes to the internal drainage which could lead to localised erosion are anticipated. The decommissioning phase would have an unlikely and imperceptible effect for the high sensitivity streams.

9.7 CUMULATIVE EFFECTS

The cumulative effects of this project with other developments in the region, as discussed in Chapter 4 - Policy, Planning and Development Context, relate to the indirect effects that may arise due to the use of public roads as haul roads to bring materials to site.

In terms of the potential effects of wind farm developments on downstream surface water bodies, the biggest risk is during the construction phase of the project as this is the phase when earthworks and excavations will be undertaken at the sites.

Potential hydrological cumulative effects arising from the proposed wind farm and proposed grid connection are also not expected to be significant because the cables will be placed within the one trench along existing roads thereby reducing overall excavation requirements. Also, no in-stream works are required along the grid connection route.

The proposed forestry replanting sites are remote from the site of the proposed project (i.e., in different counties and groundwater and surface water catchments). There is no hydrological or hydrogeological connectivity between the replanting sites and the site of the proposed project, and therefore there can be no cumulative effects or interactions at any phase of the development. There are no predicted significant effects of forestry replanting with the implementation of the Forestry and Water Quality Guidelines (Forest Service, 2000).

A review of the ‘other developments’ as described in Chapter 4 (Planning Policy and Development Context) was carried out in Appendix 4-1. There were a number of (hydrologically) relevant planning applications in terms of the 10km zone of influence radius surrounding the proposed project site. A number of windfarms including Loughderryduff Wind Farm and Maas Wind Farm (which was refused by Donegal County Council and is currently being appealed to An Bord Pleanála) are located within 10km however there are located in separate surface water catchments. No other significant developments are proposed within 10km that would result in cumulative/in combination effects.

9.8 CONCLUSIONS

The following conclusions can be drawn in relation to surface water and groundwater:

- The site drains to a number of tributaries surrounding the site boundary. These consist of tributaries of the Gweebarra River;
- The site is underlain predominantly by low permeability soil and peat overlying shallow glacial till on top of granite bedrock;
- Man-made drains are located within the site and will continue to operate as part of the water management system on site;
- The site is generally moderately to steeply sloping and has two topographically higher areas in the south of the site, the moderate slope gradients consequently have a moderate risk due to changes caused by the development on the hydrological regime;
- Water quality in the immediate area of the site is unpolluted and is consistent with the expected natural water quality for a similar environment. The water quality reported by the EPA downstream of the site is of good status; and
- The site overlies a poorly productive aquifer with low groundwater recharge and high groundwater vulnerability.

The residual effects on the surrounding water quality, hydrology, hydrogeology and existing drainage regime at the site are considered to be not significant and mainly short term in nature. The existing on-site drainage system will remain active during the construction and operation of the proposed wind farm and the 110kV cable and will be complemented by the drainage plan that has been designed for this development. Apart from the upgrade of existing roads and stream crossings along the grid connection, most of the proposed project areas are generally away from areas on the site that have been determined to be hydrologically sensitive. The large setback distance from sensitive hydrological features means they will not be impacted on by excavations/ drains or any general construction works. There are no significant long-term effects.

Detailed mitigation measures have been provided with regard to the design, construction, maintenance and decommissioning of the proposed project. The surface water drainage plan will be the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The key surface water control measure is that there will be no direct discharge of wind farm runoff into local streams. This will be achieved by avoidance methods (i.e., stream buffers) and design methods (i.e., surface water drainage plan). Water monitoring will be carried out to alert the applicant to any issues.

In summary, the available information indicates that the proposed project presents no significant long-term effect on water quality, hydrology and hydrogeology, provided that the works are designed, constructed, maintained and decommissioned in accordance with the mitigation measures outlined in this chapter.

No significant cumulative effects on any of the regional surface water catchment or groundwater bodies are anticipated from the proposed project and associated grid connection. The proposed project will not impact upon any surface water or groundwater body, it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of good status.

NIS Appendix 4 – Bird Survey Methods

Table of Contents

Table of Figures

Table of Tables

A7.1.1 INTRODUCTION

This appendix includes full details of the bird survey methods and coverage for all the bird surveys carried out for the Cloghercor Wind Farm project, apart from the Golden Eagle surveys. Details of the latter are included in Appendices 7.4 and 7.5.

A7.1.2 VANTAGE POINT SURVEYS

Objectives

The objectives of the vantage point survey were to achieve thorough coverage of the potential collision height zone across the wind farm site, and to complete at least 36 hours of vantage point survey at each vantage point in each six month summer and winter season over a two year period. An additional objective, where appropriate, was to carry out additional surveys to complete 36 hours of vantage point survey during shorter seasonal periods that were relevant to particular species of conservation concern. The two year survey period was completed between the 2019/20 winter period and the 2021 summer period for the eastern section of the site, where the wind farm development is located. Vantage point surveys were also completed at selected vantage points in two further seasons (the 2021/22 winter period and the 2022 summer period).

Vantage point locations and viewshed coverage

The vantage point locations were identified by a combination of GIS analysis and ground-truthing. The viewshed mapping was carried out using ArcGIS 10.3 for Desktop, Version 10.3.0.4322 with the Viewshed geoprocessing part of Spatial Analyst extension. The analyses used an observer height of 1.5 m, and show the area visible at 25 m above ground level from each vantage point. The viewsheds were initially mapped using ground-level altitude data (derived from a Digital Terrain Model) and then modified by ground-truthing to take account of vegetation impeding views. In November 2021, the viewshed mapping was updated using a Digital Surface Model, which incorporates the effects of vegetation and structures. The Digital Surface Model that was used was supplied by Bluesky, based on imagery acquired on 20/09/2019 and 13/04/2020. This viewshed mapping was used for the remainder of the surveys, and is the mapping shown in this report.

A total of 10 vantage point locations were used for the vantage point surveys across the five seasons, although not all of these vantage points were surveyed in each season. The vantage point locations are shown in Figure A.7.1.1 and the viewshed coverage for each vantage point is shown in Figure A.7.1.2.

Apart from VP3, the vantage point locations were all around the perimeter of the wind farm site and were all at least 500 m from the nearest turbine location. The VP1-VP6 viewsheds covered all the turbine locations.

The position of VP5 was adjusted over the first year of the survey to improve the viewshed coverage. The three positions used are shown are shown in Figure A.7.1.1. VP5.1 was used for from October 2019 to March 2020. VP5.2 was used in June and July 2020. VP5.3 was used in April and May 2020 and from August 2020 for the remainder of the survey work at VP5.

Overall vantage point survey effort

For the purposes of managing the vantage point surveys, the surveys were divided into summer (April-September) and winter (October-March) seasons. The survey target was to complete at least six hours of vantage point survey per vantage point in each month.

Six vantage points were used in the first season (2019/20) covering the initial wind farm site (VP1-VP6). Another four vantage points were added in the second season (summer 2020) to cover some high ground in the south-east corner of the initial wind farm site (VP7), and to cover an extension of the wind farm site to the west (VP8-VP10). All ten vantage points were then surveyed until the end of the fourth season (summer 2021). By the end of the fourth season, two full years of vantage point survey had been completed for the vantage points whose viewsheds covered the turbine locations (VP1-VP6). Therefore, in the fifth season, the vantage point survey effort was scaled back to focus on the vantage points that covered the majority of the turbine locations (VP1, VP2 and VP4) and the vantage points covering the western section of the wind farm site where there was a high level of Golden Eagle activity (VPs 8-10). VP1, VP2 and VP4 cover 15 of the 19 turbine locations. The other four turbine locations are within 200 m of the boundaries of the viewsheds for these vantage points, so the flight activity recorded at these vantage points is likely to be representative of the flight activity at those turbine locations.

The overall vantage point survey effort at each vantage point in each season is shown in Table A.7.1.1. The vantage points covering the turbine locations (VP1-VP6) received at least 36 hours of vantage point surveys in each of the first four seasons, apart from VP4 in the 2019/20 winter where only 35 hours of coverage was achieved. VP7-VP10 were not surveyed in the first season. Surveys at VP8-VP10 began in May 2020 resulting in only 30 hours of vantage point survey in the 2020 summer period.

Only selected vantage points were surveyed in the 2021/22 winter period (VP1, VP21, VP4 and VP8-10). In March and April 2022, vantage point surveys were suspended at some vantage points on the advice of the Golden Eagle surveyor to avoid disturbance to potential eyrie sites. This resulted in only 30 hours of vantage point survey at VP1 and VP9 in the 2021/22 winter period, although additional vantage point surveys were carried out at VP10 (which has a viewshed with a large overlap with the VP9 viewshed).

Table A.7.1.1 Total vantage point survey hours at each vantage point location in each season

Season	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9	VP10
2019/20 winter	36	36	36	35	39	36	0	0	0	0
2020 summer	36	36	36	48	46	36	48	30	30	30
2020/21 winter	36	36	36	36	36	36	36	36	36	36
2021 summer	36	36	36	48	48	36	48	36	36	36
2021/22 winter	30	36	0	36	0	0	0	36	30	42
2022 summer	36	36	0	0	0	0	0	36	0	72

Species-specific vantage point survey effort

Assessments for Irish wind farm projects typically use six month seasons to assess the adequacy of the vantage point survey effort. However, based on the SNH guidance, assessments of the adequacy of the vantage point survey effort should use species-specific seasonal periods relating to species of conservation interest that are relevant to the wind farm project. For the

Cloghercor Wind Farm project, the key species were Whooper Swan, Golden Eagle and Golden Plover.

The general occurrence period of wintering Whooper Swan populations in Ireland is from October to March. The vantage points covering the turbine locations (VP1-VP6) received at least 36 hours of vantage point surveys in the 2019/20 and 2020/21 Whooper Swan wintering seasons, apart from VP4 in the 2019/20 winter where only 35 hours of coverage was achieved (Table A.7.1.2).

Table A.7.1.2 Total vantage point survey hours at each vantage point location in the seasonal occurrence period of Whooper Swan wintering populations (October – March).

Season	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9	VP10
2019/20 winter	36	36	36	35	39	36	0	0	0	0
2020/21 winter	36	36	36	36	36	36	36	36	36	36
2021/22 winter	30	36	0	36	0	0	0	36	30	42

Whooper Swan seasonal occurrence period defined as October – March based on general occurrence patterns of Whooper Swan in Ireland.

The Golden Eagle breeding season is defined as April to August in the SNH guidance. The vantage points covering the turbine locations (VP1-VP6) received at least 42 hours of vantage point surveys in the 2020 and 2021 Golden Eagle breeding seasons (Table A.7.1.3).

Table A.7.1.3 Total vantage point survey hours at each vantage point location in the Golden Eagle breeding season (February – August).

Season	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8	VP9	VP10
2020 breeding season	42	42	42	51	52	42	42	24	24	24
2021 breeding season	42	42	42	54	54	42	54	42	42	42

Golden Eagle breeding season defined as February – August based on Table A.7.1..2 in SNH (2017).

The Golden Plover breeding season is defined as April to July by Douse (2014). As the standard six hours per month vantage point survey effort would not be sufficient to generate 36 hours of vantage point survey effort within this season, additional vantage point surveys were carried out to make up the extra hours. The additional surveys were started in May 2020, following the discovery of a displaying Golden Plover pair in the south-east corner of the wind farm site in late April 2020. The additional vantage point survey effort was focused on the vantage points whose viewsheds covered the location of the breeding Golden Plover pair and potential commuting routes that could be used by the pair (VP4, VP5 and VP7). Totals of 34-36 hours of vantage point surveys were completed at these vantage points in the 2020 Golden Plover breeding season, and 36 hours in the 2021 Golden Plover breeding season (Table A.7.1.4).

Table A.7.1.4 Total vantage point survey hours at each vantage point location in the Golden Plover breeding season (April– July).

Season	VP4	VP5	VP7
2020 breeding season	36	34	36
2021 breeding season	36	36	36

Golden Plover breeding season defined as April – July based on Douse (2014).

Vantage point survey methods

Observations of all waterbird and raptor species, and any other species of potential conservation concern, during the vantage point surveys were recorded using the methodology for focal bird sampling in the SNH guidelines. Flight activity was recorded separately in five height bands: 0-25 m, 25-50 m, 50-160 m, 160-220 m and > 220 m. The durations of all flight in each height band were recorded. Apart from in the first season, and for some surveys in the second and third seasons, these durations were only recorded for flight activity within the mapped viewsheds, as it is only flight activity within the mapped viewsheds that is relevant for collision risk modelling. Details of the adjustments that were made to flight durations recorded in the first season are described in the collision risk modelling report (Appendix 6). All flightlines were mapped as accurately as possible.

Survey coverage

Details of the dates, timings and weather conditions of all the vantage point watches are shown in Table A.7.1.5.

Table A.7.1.5 Dates, timings and weather conditions of the vantage point watches.

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
24/10/2019	2	1	12:45	15:45	NW5	0	4	4	JS
24/10/2019	2	2	16:31	18:30	NE5	0	4	4	JS
25/10/2019	1	1	07:50	10:50	S2	0	8	4	JS
25/10/2019	1	2	11:20	14:20	S0	0	8	4	JS
25/10/2019	4	1	07:50	10:50	SW4	0	7	4	SC
25/10/2019	4	2	11:20	14:20	SW4	3	6	4	SC
29/10/2019	2	1	13:30	14:45	E4	0	3	4	SC
29/10/2019	6	1	11:00	14:00	S2	0	2	4	JS
29/10/2019	6	2	14:30	17:30	SE2	0	2	4	JS
30/10/2019	3	1	10:30	13:30	E1	0	6	4	JS
30/10/2019	5	1	07:00	10:00	NE3	0	4	4	SC
30/10/2019	5	2	10:34	13:34	NE4	0	4	4	SC
31/10/2019	5	1	10:34	13:34	NE4	0	4	4	SC
18/11/2019	3	1	11:00	14:00	W1	0	8	4	SC
18/11/2019	3	2	14:30	17:30	W1	0	8	4	SC
18/11/2019	5	1	10:55	13:55	SW1	0	7	4	JS
18/11/2019	5	2	14:25	17:25	SE1	0	7	4	JS
19/11/2019	1	1	10:20	13:20	W3	0-3	8	4	SC
19/11/2019	1	2	13:54	16:54	W0-2	0	4	4	SC
19/11/2019	4	1	10:24	13:24	SE4	4	8	3	JS
19/11/2019	4	2	13:56	16:56	SE3	0	3	4	JS
20/11/2019	2	1	07:15	10:15	SE3	0	1	4	JS
20/11/2019	2	2	10:45	13:45	SE4	0	5	4	JS
20/11/2019	6	1	07:15	10:15	W1	0	6	4	SC

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
20/11/2019	6	2	10:45	13:45	W1	0	6	4	SC
30/11/2019	3	1	07:00	10:00	E1	0	5	4	JS
09/12/2019	1	1	07:40	10:40	NW4	0	2	4	JS
09/12/2019	1	2	11:10	14:10	W2	0	4	4	JS
09/12/2019	4	1	07:45	10:45	NW4	0	8	4	SC
09/12/2019	4	2	11:15	14:15	W4	0	5	4	SC
11/12/2019	3	1	07:46	10:46	SW3	0	2	4	JS
11/12/2019	3	2	11:15	14:15	W2	2	4	4	JS
11/12/2019	5	1	07:45	10:45	NW4	4	4	4	SC
11/12/2019	5	2	11:15	14:15	NW3	4	4	4	SC
12/12/2019	2	1	10:00	13:00	SW4	0	4	4	SC
12/12/2019	2	2	13:30	16:40	W4	4	6	4	SC
12/12/2019	6	1	10:05	13:05	W1	1	7	4	JS
12/12/2019	6	2	13:35	16:35	W1	0	2	4	JS
20/01/2020	3	1	14:40	17:40	W3	2	7	3	SC
20/01/2020	5	1	14:45	17:45	W2	0	7	4	JS
21/01/2020	3	1	08:50	11:50	W0-3	0-2	8	3	SC
21/01/2020	5	1	09:00	12:00	W1	2	8	3	JS
23/01/2020	1	1	10:35	13:35	W4	0-2	7	3	SC
23/01/2020	1	2	14:05	17:05	W4	0-2	7	3	SC
23/01/2020	4	1	12:00	14:20	SW3	2	8	2	JS
23/01/2020	4	2	14:20	17:20	SW3	1	8	3	JS
24/01/2020	2	1	08:05	11:05	SW2	2	8	2	JS
24/01/2020	2	2	11:35	14:35	SW2	2	8	2	JS
24/01/2020	6	1	07:45	10:45	SW1	0-2	8	3	SC
24/01/2020	6	2	11:30	14:30	SW1	0-2	8	3	SC
17/02/2020	5	1	11:50	14:50	W3	2	7	3	JS
18/02/2020	3	1	15:15	18:15	W4	2	7	3	JS
18/02/2020	5	1	07:20	10:30	SW2	2	7	2	JS
20/02/2020	1	1	11:26	14:26	W7	0	6	4	SC
20/02/2020	1	2	14:55	18:00	W7	0	6	4	SC
20/02/2020	4	1	11:45	14:45	W6	0	3	4	JS
20/02/2020	4	2	15:15	18:15	NW6	0	4	4	JS
21/02/2020	3	1	10:00	13:00	W6	3	8	3	SC
22/02/2020	2	1	07:15	10:15	W7	0	6	4	SC
22/02/2020	2	2	10:45	13:45	W7	0	6	4	SC
22/02/2020	6	1	07:10	10:10	W5	3	8	3	SC
22/02/2020	6	2	10:40	13:40	W6	3	7	3	JS

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
09/03/2020	3	1	14:02	17:02	W4	3	8	2	SC
09/03/2020	5	1	12:25	15:25	W3	5	8	1	JS
09/03/2020	5	2	15:55	18:55	W4	4	8	3	JS
10/03/2020	3	1	06:30	09:30	W4	3	7	3	JS
11/03/2020	1	1	06:25	09:25	W6	3	7	3	JS
11/03/2020	1	2	09:55	12:55	W3	3	6	4	JS
11/03/2020	4	1	06:17	09:17	W5	1	4	4	SC
11/03/2020	4	2	09:47	12:47	W5	1	4	4	SC
12/03/2020	2	1	12:30	15:30	NW4	4	8	3	JS
12/03/2020	2	2	16:00	19:00	W3	2	5	4	JS
12/03/2020	6	1	11:45	14:45	W4	0	7	4	SC
12/03/2020	6	2	16:00	19:00	W3	0	4	4	SC
27/04/2020	1	1	16:30	19:30		1	7	4	JS
27/04/2020	4	1	16:30	19:30	SE3	3	8	4	SC
28/04/2020	1	1	12:00	15:00	SE0-3	0	4	4	SC
28/04/2020	4	1	12:00	15:00	E1	0	6	4	JS
28/04/2020	6	1	07:43	10:43		0	4	4	SC
28/04/2020	6	2	15:50	18:50	SW3	0	6	4	SC
28/04/2020	7	1	07:40	10:40	E3	0	6	4	JS
28/04/2020	7	2	15:50	18:50	E4	3	7	4	JS
29/04/2020	3	1	08:15	11:15	E3	0	7	4	JS
29/04/2020	3	2	17:14	20:14	SW1	0	6	4	SC
30/04/2020	2	1	08:20	11:20	SW1	2	4	4	SC
30/04/2020	2	2	13:40	16:40	NW4	3	4	4	SC
30/04/2020	5	1	08:20	11:20	E2	0	2	4	JS
30/04/2020	5	2	13:37	16:37	NW3	0	7	4	JS
11/05/2020	3	1	15:25	18:25	NE3	0	3	4	JS
12/05/2020	1	1	11:05	14:05	SW5	1	6	4	SC
12/05/2020	1	2	16:15	19:15	SE5	1	6	4	SC
12/05/2020	4	1	11:05	14:05	NE4	0	6	4	JS
12/05/2020	4	2	16:10	19:10	NE4	0	6	4	JS
13/05/2020	2	1	12:15	15:15	NE3	0	7	4	JS, JG
13/05/2020	2	2	17:10	20:10	NE4	0	0	4	JS, JG
13/05/2020	3	1	07:25	10:25	E1	1	6	4	SC
13/05/2020	6	1	12:15	15:15	NE2	0	6	4	SC
13/05/2020	6	2	17:15	20:15	NE4	0	1	4	SC
14/05/2020	5	1	11:00	14:00	NE3	0	4	4	JS, JG
14/05/2020	5	2	16:10	19:10	NE2	0	8	4	JS, JG

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
14/05/2020	5	3	19:10	20:10	NE2	0	8	4	JS, JG
14/05/2020	7	1	11:08	14:08	N2	0	0	4	SC
14/05/2020	7	2	16:15	19:15	N3	0	6	4	SC
15/05/2020	4	1	06:45	10:45	N1	2	8	1	SC
15/05/2020	5	1	10:55	13:55	NE3	0	6	4	JG
15/05/2020	7	1	06:45	09:45	N3	0	8	3	JS
15/05/2020	7	2	09:45	10:45	N3	0	7	4	JS
18/05/2020	8	1	07:00	10:00	SW2	1	8	4	JB
18/05/2020	10	1	10:30	13:30	SSW2	1	8	4	JB
26/05/2020	8	1	08:15	11:15	W2	0	6	3	JB
26/05/2020	10	1	11:45	14:45					JB
29/05/2020	9	1	11:00	17:00	SE3	0	6	4	ND
08/06/2020	3	1	15:50	18:50	W3	0	6	4	SC
09/06/2020	4	1	06:45	09:45	SW1	0	8	4	SC
09/06/2020	7	1	11:35	15:35	SW3	0	8	4	JS, JG
10/06/2020	2	1	06:55	09:55	W1	0	8	4	SC
10/06/2020	2	2	11:25	14:25	W3	1	6	4	SC
10/06/2020	6	1	07:00	10:00	N1	0	7	4	JG
10/06/2020	6	2	12:00	15:00	N1	0	7	4	JG
10/06/2020	7	1	06:35	09:35	NW2	0	7	4	JS
10/06/2020	7	2	10:45	13:45	NW3	2	8	4	JS
11/06/2020	1	1	12:30	15:30	NE4	0	2	4	JS
11/06/2020	1	2	16:45	19:45	NE4	0	6	4	JS
11/06/2020	4	1	11:35	13:35	NE4	0	4	4	SC, JG
11/06/2020	4	2	17:45	19:45	NE4	0	4	4	SC, JG
11/06/2020	8	1	07:35	10:35	E4	0	4	4	JB
11/06/2020	10	1	11:00	14:00	E3	0	3	4	JB
12/06/2020	3	1	10:50	13:50	S3	1	6	4	SC
12/06/2020	4	1	06:55	09:55	NE4	1	7	4	JS
14/06/2020	5	1	11:00	17:00	SE2	0	1	4	ND
23/06/2020	5	1	10:30	13:30					JB
23/06/2020	5	2	14:00	17:00					JB
25/06/2020	8	1	07:45	10:45	NE2	0	6	4	JB
25/06/2020	10	1	11:15	14:15	NE2	0	5	4	JB
06/07/2020	4	1	13:35	17:35	NW5	0	4	4	SC
07/07/2020	2	1	12:40	15:40	S2	0	8	4	JS, JG
07/07/2020	2	2	17:00	20:00	E3	0	8	4	JS, JG
07/07/2020	6	1	12:05	15:05	NW2	0	8	4	SC

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
07/07/2020	6	2	17:30	20:30	NW2	0	8	4	SC
08/07/2020	3	1	07:40	10:40	NE1	0	6	4	JS
08/07/2020	3	2	12:00	15:00		0	8	4	JS
08/07/2020	7	1	08:15	11:15	SE4	0	3	4	SC, JG
08/07/2020	7	2	12:23	15:23	SE3	0	7	4	SC, JG
08/07/2020	9	1	15:00	18:00	SW2	2	8	4	ND
09/07/2020	1	1	08:05	11:05	NE4	0	4	4	SC
09/07/2020	1	2	12:25	15:25	NE5	0	5	4	SC
09/07/2020	4	1	08:00	11:00	NE3	0	4	4	JS, JG
09/07/2020	4	2	12:50	15:50	NE3	0	7	4	JS, JG
10/07/2020	7	1	07:15	11:15	NW3	1	4	4	JS, SC
12/07/2020	5	1	11:45	14:45	SSW3	0	8	4	JB
12/07/2020	5	2	15:15	17:15	SSE3	1	7	4	JB
12/07/2020	9	1	10:00	13:00	SW3	0	6	4	ND
17/07/2020	8	1	17:40	20:40	SW2	0	7	4	JB
17/07/2020	10	1	10:40	13:40	W2	1	8	4	JB
17/07/2020	10	2	14:10	17:10	WSW3	0	5	4	JB
18/07/2020	8	1	17:00	20:00	W3	0	7	4	JB
20/07/2020	5	1	10:30	11:30	SW3	0	7	4	JB
26/07/2020	9	1	12:00	18:00	SW3	0	6	4	ND
10/08/2020	5	1	18:00	21:00	E1	0	8	4	JS
10/08/2020	7	1	10:45	13:45	N1	0	7	4	SC
10/08/2020	7	2	14:15	17:15	NW0	0	7	4	SC
11/08/2020	1	1	08:30	11:30	N0-1	0	0	4	SC
11/08/2020	1	2	12:00	15:00	W2	0	2	4	SC
11/08/2020	4	1	08:25	11:25		0	2	4	JS
11/08/2020	4	2	11:55	14:55	N1	0	1	4	JS
12/08/2020	2	1	07:30	10:30	E2	0	3	4	JS
12/08/2020	2	2	11:15	14:15	SE2	0	2	4	JS
12/08/2020	6	1	07:45	10:45	NE0	0	1	4	SC
12/08/2020	6	2	11:30	14:30	NE1	0	1	4	SC
13/08/2020	3	1	14:40	17:40	NE1	0	3	4	JS
13/08/2020	3	2	18:10	21:10	NE1	0	4	4	JS
13/08/2020	5	1	10:00	13:00	NE2	0	8	4	SC
27/08/2020	8	1	10:45	13:45	SE2	0	8	4	JB
27/08/2020	8	2	14:15	17:15	SE2	1	8	4	JB
28/08/2020	10	1	10:30	13:30	NE3	0	8	4	JB
28/08/2020	10	2	14:00	17:00	N3	0	8	4	JB

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
30/08/2020	9	1	12:00	18:00	W2	2	7	4	ND
07/09/2020	5	1	14:00	17:00	W2	2	8	2	JS
08/09/2020	3	1	07:40	10:40	SW1	1	8	4	SC
08/09/2020	3	2	11:10	14:10	SW1	0	8	4	SC
08/09/2020	5	1	07:30	10:30	W2	2	8	3	JS
08/09/2020	6	1	11:20	14:20	W2	1	8	3	JS
08/09/2020	6	2	16:25	19:25	SW1	1	8	4	SC
09/09/2020	2	1	08:10	11:10	W5	1	8	4	SC
09/09/2020	2	2	11:40	14:40	W6	0	8	4	SC
09/09/2020	7	1	08:05	11:05	W3	0	7	3	JS
09/09/2020	7	2	11:35	14:35	W3	1	8	4	JS
10/09/2020	1	1	13:00	16:00	W3	1	8	4	JS
10/09/2020	1	2	16:30	19:30	W3	1	8	4	JS
10/09/2020	4	1	13:00	16:00	SW6	1	8	4	SC
10/09/2020	4	2	16:30	19:30	SW6	1	8	4	SC
17/09/2020	8	1	15:00	18:00	S2	0	1	4	JB
17/09/2020	10	1	11:30	14:30	S3	0	1	4	JB
20/09/2020	9	1	12:00	18:30	NW2	0	8	4	ND
21/09/2020	8	1	09:40	12:40	SW2	0	8	4	JB
21/09/2020	10	1	13:10	16:10	SW3	0		4	JB
05/10/2020	3	1	16:50	19:50	W1	0	7	4	JS
05/10/2020	5	1	16:45	19:45	NW3	0	6	4	JG
06/10/2020	3	1	09:45	12:45	NW1	0	7	4	JS
06/10/2020	5	1	09:45	12:45	N2	0	6	4	JG
06/10/2020	6	1	13:25	16:25	N1	3	7	2	JG
06/10/2020	6	2	16:25	19:25	NW2	2	8	3	JS
07/10/2020	2	1	07:25	10:25	NW2	0	6	4	JS
07/10/2020	2	2	10:55	13:55	NW2	0	8	4	JS
07/10/2020	7	1	07:25	10:25	NW2	0	5	4	JG
07/10/2020	7	2	10:55	13:55	NW2	0	7	4	JG
08/10/2020	1	1	07:30	10:30	N2	0	7	4	JS
08/10/2020	1	2	11:00	14:00	N4	0	5	4	JS
08/10/2020	4	1	07:30	10:30	NW1	1	8	4	JG
08/10/2020	4	2	11:00	14:00	NW3	1	3	4	JG
26/10/2020	9	1	12:00	15:00	NW6	3	4	4	ND
30/10/2020	10	1	10:00	13:00	SW2	1	4	4	JB
30/10/2020	10	2	13:30	16:30	sw3	0	6	4	JB
04/11/2020	8	1	08:45	11:45					JB

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
04/11/2020	8	2	12:15	15:15					JB
07/11/2020	9	1	10:30	13:30	SE1	0	2	4	ND
09/11/2020	3	1	13:37	16:37	SE3	0	6	4	JS
09/11/2020	5	1	13:40	16:40	S4	0	3	4	SC
10/11/2020	2	1	10:30	13:30	SW4	0	8	4	SC
10/11/2020	2	2	14:00	17:00	SW4	0	6	4	SC
10/11/2020	7	1	12:10	13:40	S4	0	7	4	JS
10/11/2020	7	2	14:10	17:10	S4	0	7	4	JS
11/11/2020	6	1	07:30	10:30	SW4	4	8	2	SC
11/11/2020	6	2	10:50	13:50	S3	1	8	4	JS
12/11/2020	1	1	10:10	13:10	SW6	0	7	4	SC
12/11/2020	1	2	13:40	16:40	SW6	0	7	4	SC
12/11/2020	4	1	10:30	13:30	S5	0	7	4	JS
12/11/2020	4	2	14:00	17:00	S6	0	7	4	JS
12/11/2020	7	1	08:50	10:20	S5	0	7	4	JS
13/11/2020	3	1	07:30	10:30	SW4	1	7	3	SC
13/11/2020	5	1	07:30	10:30	SW5	1	7	4	JS
26/11/2020	9	1	10:50	13:50	SW5	0	8	1	CR
26/11/2020	9	2	14:20	17:20	SW5	0	8	1	CR
30/11/2020	8	1	09:45	12:45	W4-5	1	8	3	MH
30/11/2020	8	2	13:20	16:20	W2-3	1	8	3	MH
30/11/2020	10	1	11:15	14:15	W4	2	2	4	JW
30/11/2020	10	2	14:15	17:15	W4	2	2	4	JW
07/12/2020	3	1	13:30	16:30	NA0	0	1	4	SC
07/12/2020	5	1	13:15	16:15	W1	0	0	4	JS
08/12/2020	2	1	09:05	12:05	N4	1	7	4	JS
08/12/2020	2	2	12:35	15:35	N4	1	6	4	JS
08/12/2020	7	1	09:15	12:15	N4	1	5	4	SC
08/12/2020	7	2	12:45	15:45	N5	1	5	4	SC
09/12/2020	3	1	08:15	11:15	N2	1	8	4	JS
09/12/2020	5	1	08:20	11:20	SE4	1	8	4	SC
09/12/2020	6	1	13:40	16:40	NW2	3	8	3	JS
10/12/2020	1	1	08:40	11:40	S2	0	8	3	JS
10/12/2020	4	1	08:30	09:30	SW3	2	8	2	SC
10/12/2020	4	2	09:30	11:30	SW4	0	6	4	SC
10/12/2020	4	3	12:00	14:00	SW5	0	6	4	SC
10/12/2020	4	4	14:00	15:00	SW5	5	8	2	SC
11/12/2020	1	1	12:10	15:10	S4	0	7	4	JS

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
11/12/2020	6	1	08:15	11:15	SSW1	0	4	4	SC
12/12/2020	8	1	07:30	10:30	W1-2	2	3	4	MH
12/12/2020	8	2	11:20	14:20	SW1-2	2	4	4	MH
16/12/2020	10	1	11:00	14:00	W4	1	8	4	JW
16/12/2020	10	2	14:00	17:00	W4	3	8	2	JW
31/12/2020	9	1	10:40	16:40	N6	3	4-8	1-4	CR
11/01/2021	3	1	13:00	15:00	W4	1	8	2	SC
11/01/2021	3	2	15:00	16:00	W4	3	8	1	SC
11/01/2021	5	1	12:10	15:10	W2	1	8	3	JS
12/01/2021	2	1	08:50	11:50	SE3	0	3	4	JS
12/01/2021	2	2	12:15	15:15	SE2	0	8	4	JS
12/01/2021	7	1	08:45	09:45	E3	0	2	4	SC
12/01/2021	7	2	09:45	10:45	E4	0	3	4	SC
12/01/2021	7	3	10:45	11:45	E4	0	4	4	SC
12/01/2021	7	4	12:15	15:15	E4	0	7	4	SC
13/01/2021	6	1	08:30	11:30	SE2	3	8	3	JS
13/01/2021	6	2	12:25	13:25	SW3	1	8	4	SC
13/01/2021	6	3	13:25	14:25	SW3	2	8	3	SC
13/01/2021	6	4	14:25	15:25	SW3	1	8	4	SC
14/01/2021	1	1	09:46	12:46	NE4	4	4	4	SC
14/01/2021	1	2	13:15	16:15	NE4	4	6	3	SC
14/01/2021	4	1	09:50	12:50	NW2	1	7	4	JS
14/01/2021	4	2	13:20	16:20	NW2	0	4	4	JS
15/01/2021	3	1	08:45	11:45	SE3	0	8	4	JS
15/01/2021	5	1	08:50	09:50	SW1	0	2	4	SC
15/01/2021	5	2	09:50	11:50	SW4	0	8	4	SC
20/01/2021	10	1	09:45	12:45	0	0	0	2	JW
20/01/2021	10	2	12:45	15:45	SW1	0	2	4	JW
28/01/2021	8	1	07:40	10:40	SW4-5	0	8	4	MH
28/01/2021	8	2	14:35	17:35	S4-5	3	8	4	MH
30/01/2021	9	1	09:00	12:00	E7	0	1-2	4	CR
30/01/2021	9	2	12:30	15:30	E7	0	1-2	4	CR
15/02/2021	3	1	13:30	16:30	SW3	1	6	4	SC
15/02/2021	5	1	13:30	16:30	W2	0	6	4	JS
16/02/2021	2	1	10:50	13:50	SSW5	1	5	4	SC
16/02/2021	2	2	14:20	17:20	SSW5	1	5	4	SC
16/02/2021	7	1	10:50	13:50	SW3	0	6	4	JS
16/02/2021	7	2	14:20	17:20	SW3	1	6	4	JS

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
17/02/2021	1	1	07:50	10:50	SW3	1	4	4	JS
17/02/2021	1	2	11:20	14:20	SW3	1	5	4	JS
17/02/2021	4	1	07:50	10:50	SSW7	1	4	3	SC
17/02/2021	4	2	11:20	14:20	SSW7	1	4	3	SC
18/02/2021	6	1	09:00	10:00	SW1	1	2	4	SC
18/02/2021	6	2	10:00	11:00	SW3	1	4	4	SC
18/02/2021	6	3	11:00	12:00	SW4	1	6	4	SC
18/02/2021	6	4	14:45	17:45	SW1	0	7	4	JS
19/02/2021	3	1	08:25	11:25	SSW3	1	8	4	JS
19/02/2021	5	1	08:20	09:20	SSW2	1	6	4	SC
19/02/2021	5	2	09:20	10:20	SSW3	1	6	4	SC
19/02/2021	5	3	10:20	11:20	SSW4	3	8	3	SC
25/02/2021	10	1	09:52	12:52	W5	0	2	4	JW
25/02/2021	10	2	13:52	16:52	W5	0	2	4	JW
26/02/2021	8	1	08:30	11:30	S4	0	6	4	MH
26/02/2021	8	2	12:00	15:00	S5-6	0	2	4	MH
26/02/2021	9	1	08:00	11:00	SW3	0	4	4	CR
26/02/2021	9	2	11:15	14:15	SW3	0	4	4	CR
08/03/2021	3	1	13:42	16:42	SW3	1	8	4	SC
08/03/2021	5	1	14:30	17:30	SW2	1	8	4	JS
09/03/2021	2	1	07:25	10:25	S2	0	8	4	JS
09/03/2021	2	2	10:55	13:55	S3	3	8	3	JS
09/03/2021	7	1	07:20	08:20	SW4	0	8	4	SC
09/03/2021	7	2	08:20	09:20	SW5	1	8	2	SC
09/03/2021	7	3	09:20	10:20	SW5	2	8	2	SC
09/03/2021	7	4	10:50	11:50	SW6	3	8	4	SC
09/03/2021	7	5	11:50	12:50	SW6	4	8	4	SC
09/03/2021	7	6	12:50	13:50	SW7	4	8	4	SC
10/03/2021	6	1	07:10	10:10	SW4	3	8	3	SC
10/03/2021	6	2	11:45	14:45	SW3	3	8	3	JS
11/03/2021	3	1	06:55	09:55	W3	3	8	3	JS
11/03/2021	5	1	06:55	09:55	SW5	4	8	3	SC
15/03/2021	1	1	15:20	16:20	W1	0	8	2	JS
15/03/2021	4	1	15:23	16:23	SW5	0	8	1	SC
16/03/2021	1	1	06:50	09:50	N5	0	4	4	SC
16/03/2021	1	2	09:20	11:20	NW6	0	2	4	SC
16/03/2021	4	1	06:50	08:50	NE2	0	4	4	JS
16/03/2021	4	2	09:20	12:20	NE2	0	6	4	JS

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
21/03/2021	8	1	16:30	19:30	SW2	0	7	4	MH
22/03/2021	8	1	06:10	09:10	S4	0	8	4	MH
30/03/2021	9	1	17:50	20:50	SW4-5	1	8	3-4	CR
31/03/2021	9	1	07:00	10:00	NE4	1	8	3-4	CR
31/03/2021	10	1	08:00	11:00	NW5	5	8	4	JW
31/03/2021	10	2	11:30	14:30	NW5	0	7	4	JW
26/04/2021	3	1	12:15	15:15	W2	0	8	4	SC
26/04/2021	3	2	15:45	17:45	W2	1	8	3	SC
26/04/2021	5	1	11:30	14:30	W3	0	6	4	JS
26/04/2021	5	2	15:00	18:00	NW2	0	8	4	JS
27/04/2021	2	1	11:30	14:30	N3	1	8	4	JS, JG
27/04/2021	2	2	15:45	18:45	N5	0	6	4	JS, JG
27/04/2021	7	1	11:10	14:10	N3	1	4	4	SC
27/04/2021	7	2	15:44	18:44	N3	0	4	4	SC
27/04/2021	8	1	13:40	16:40	NE4	0	5	4	MH
27/04/2021	8	2	16:40	19:40	NE4-5	0	4	4	MH
27/04/2021	9	1	14:00	17:00	NE5	2	2	4	CR
27/04/2021	9	2	17:30	20:30	NE5	2	2	4	CR
28/04/2021	4	1	14:45	17:45	N3	0	6	4	JS
28/04/2021	5	3	10:30	13:30	NE2	0	4	4	SC
28/04/2021	6	1	06:25	09:25	NE1	0	3	4	JG
28/04/2021	6	2	17:40	20:40	NE1	0	3	4	SC
28/04/2021	7	1	10:15	13:15	NE2	0	6	4	JS
29/04/2021	1	1	08:50	11:50	NE2	1	5	4	SC
29/04/2021	1	2	12:40	15:40	NE3	1	6	4	SC
29/04/2021	3	1	16:55	17:55	NE1	1	2	4	SC
30/04/2021	4	2	08:55	11:55	N1	1	6	4	JS
30/04/2021	4	3	12:55	15:55	NE3	1	7	4	JS, JG
30/04/2021	10	1	07:30	10:30	W2	0	2	5	JW
30/04/2021	10	2	11:00	14:00	W2	0	2	5	JW
15/05/2021	5	1	12:50	15:50	E4-5	0	8	4	MH
15/05/2021	5	2	16:10	19:10	E5-6	0	6	4	MH
16/05/2021	8	1	09:00	12:00	NE3-4	0	6	4	MH
16/05/2021	8	2	12:30	15:30	N3	0	5	4	MH
17/05/2021	4	1	17:40	20:40	W3	1	4	4	SC
17/05/2021	5	1	06:25	09:25	W2	3	7	4	MH
17/05/2021	7	1	17:35	20:35	W3	0	6	4	JS
17/05/2021	9	1	17:30	20:30	W4	0	3	4	CR

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
18/05/2021	1	1	08:50	11:50	SW3	1	4	4	SC
18/05/2021	1	2	12:41	15:41	W3	0	2	4	SC
18/05/2021	4	2	09:00	12:00	W3	0	6	4	JS, JG
18/05/2021	4	3	13:20	16:20	NW3	0	2	4	JS, JG
18/05/2021	9	2	09:00	12:00	SW4	2	5	3	CR
19/05/2021	2	1	08:40	11:40	W4	1	6	4	JS, SC
19/05/2021	2	2	12:45	15:45	W4	0	4	4	JS, SC
19/05/2021	7	2	08:45	11:45	W4	1	6	4	JG
19/05/2021	7	3	12:50	15:50	W4	0	4	4	JG
20/05/2021	3	1	09:00	12:00	E4	2	8	4	SC
20/05/2021	3	2	12:30	15:30	E4	3	8	4	SC
20/05/2021	6	1	05:31	08:31	SW2	0	8	4	JG
20/05/2021	6	2	15:50	18:50	E5	4	8	4	JS
20/05/2021	10	1	14:30	17:30	NE6	3	8	5	JW
20/05/2021	10	2	18:00	21:00	NE6	3	8	5	JW
14/06/2021	4	1	17:50	20:50	W5	0	6	4	JC
14/06/2021	7	1	17:52	20:52	W1	0	7	4	JS
15/06/2021	3	1	06:50	09:50	SE1	0	8	4	JS
15/06/2021	6	1	10:45	13:45	S2	2	7	4	JG
15/06/2021	6	2	13:50	16:50	W3	3	8	3	JC
16/06/2021	1	1	15:15	18:15	W2	0	5	4	JS
16/06/2021	1	2	19:00	22:00	W2	0	7	4	JS
16/06/2021	4	1	14:30	17:30	W5	0	4	3	JC, JS
16/06/2021	4	2	19:00	22:00	W5	1	7	3	JC, JS
17/06/2021	2	1	14:25	17:25	W5	0	6	4	JC, JS
17/06/2021	2	2	18:40	21:40	W5	0	7	4	JC, JS
17/06/2021	7	2	14:25	17:25	SW3	0	6	4	JG
17/06/2021	7	3	18:30	21:30	SW2	0	5	4	JG
18/06/2021	3	1	08:55	11:55	0	0	6	4	JS
19/06/2021	5	1	13:30	16:30	SE4	0	4	4	MH
19/06/2021	5	2	16:45	19:45	SE4-5	0	8	4	MH
20/06/2021	5	1	11:50	14:50	S4-5	2	4	4	MH
21/06/2021	8	1	06:55	09:55	N4	0	3	4	MH
21/06/2021	8	2	10:30	13:30	N4	0	4	4	MH
22/06/2021	9	1	14:30	17:30	SW4	2	8	4	CR
23/06/2021	9	2	07:40	10:40	SW4	2	8	1	CR
30/06/2021	10	1	14:00	17:00	N4	0	8	5	JW
30/06/2021	10	2	18:00	21:00	N4	0	8	5	JW

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
14/07/2021	9	1	16:00	19:15	SW3	1	6	2	CR
15/07/2021	9	1	09:00	12:00	SW2	1	8	4	CR
16/07/2021	5	1	10:20	13:20	SW3	0	0	4	MH
17/07/2021	5	1	07:20	10:20	W1	0	0	4	MH
17/07/2021	5	2	11:00	14:00	W4	0	0	4	MH
18/07/2021	8	1	07:35	10:35	NW2	1	8	3	MH
18/07/2021	8	2	11:10	14:10	NW2	0	8	4	MH
19/07/2021	4	1	18:45	21:45	W1	0	1	4	JS
19/07/2021	7	1	18:45	21:45	W1	0	1	4	JC
20/07/2021	1	1	09:05	12:05	0	0	1	4	JG
20/07/2021	1	2	12:35	15:35	NW1	0	1	4	JG
20/07/2021	4	2	08:25	11:25	SE2	0	0	4	JC, JS
20/07/2021	4	3	12:55	15:55	SE1	0	1	4	JC, JS
21/07/2021	2	1	13:40	16:40	W1	0	3	4	JC, JS
21/07/2021	2	2	17:40	20:40	W1	0	1	4	JC, JS
21/07/2021	7	2	13:45	16:45	W1	0	1	4	JG
21/07/2021	7	3	17:40	20:40	W1	0	1	4	JG
22/07/2021	3	1	16:00	19:00	W1	0	6	4	JS
22/07/2021	3	2	19:00	22:00	W0	0	1	4	JC
22/07/2021	6	1	09:00	12:00	0	0	3	4	JG
22/07/2021	6	2	12:30	15:30	0	0	3	4	JG
29/07/2021	10	1	08:00	11:00	N4	0	8	4	JW
29/07/2021	10	2	14:00	17:00	N4	0	8	4	JW
09/08/2021	3	1	18:05	21:05	NE2	0	6	4	JS
09/08/2021	5	1	18:03	21:03	N1	0	6	4	JC
10/08/2021	2	1	08:05	11:05	SW1	0	8	3	JC
10/08/2021	2	2	11:35	14:35	SW1	0	8	3	JC
10/08/2021	7	1	08:05	11:05	0	0	7	4	JS
10/08/2021	7	2	11:35	14:35	W1	0	7	4	JS
11/08/2021	1	1	14:06	17:06	W5	0	3	4	JC
11/08/2021	1	2	17:36	20:36	W4	0	2	4	JC
11/08/2021	4	1	14:20	17:20	W4	0	4	4	JS
11/08/2021	4	2	17:50	20:50	W1	0	4	4	JS
12/08/2021	3	2	11:35	14:35	SW4	1	7	4	JS
12/08/2021	5	2	11:40	14:40	S6	0	5	3	JC
12/08/2021	6	1	08:10	11:10	SE4	0	5	3	JC
12/08/2021	6	2	15:10	18:10	SW4	1	7	4	JS
17/08/2021	8	1	12:35	15:35	SW3-4	1	8		MH

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
17/08/2021	8	2	16:00	19:00	SW4	1	8	3	MH
20/08/2021	10	1	08:00	11:00	SE6	3	8	2	JW
20/08/2021	10	2	11:30	14:30	SE6	3	8	2	JW
23/08/2021	9	1	10:55	13:55	N1-2	0	4	4	MH
23/08/2021	9	2	14:10	17:10	N3	0	5	4	MH
06/09/2021	5	1	17:10	20:10	W2	1	8	2	JC
07/09/2021	2	1	13:30	16:30	SW2	0	1	4	JS
07/09/2021	2	2	17:00	20:00	SW2	0	2	4	JS
07/09/2021	7	1	13:30	16:30	S2	0	3	4	JC
07/09/2021	7	2	17:00	20:00	SW2	0	5	4	JC
08/09/2021	1	1	06:50	09:50	S1	1	8	4	JS
08/09/2021	1	2	10:20	13:20	E1	0	8	4	JS
08/09/2021	4	1	06:50	09:50	SE2	0	8	4	JC
08/09/2021	4	2	10:20	13:20	SE2	0	7	4	JC
09/09/2021	3	1	10:30	13:30	W2	0	6	4	JC
09/09/2021	5	2	10:30	13:30	E1	1	8	4	JS
09/09/2021	6	1	06:55	09:55	S1	1	8	3	JS
09/09/2021	6	2	14:30	17:30	W1	0	8	3	JC
10/09/2021	3	2	07:05	10:05	N0	0	8	3	JS
10/09/2021	10	1	08:00	11:00	NE2	1	8	1	JW
10/09/2021	10	2	12:00	15:00	NE2	1	8	2	JW
16/09/2021	8	1	08:25	11:25	S4	0	6	4	MH
16/09/2021	8	2	12:00	15:00	S4	0	6	4	MH
29/09/2021	9	1	09:00	12:00	W6	3	5	4	CR
29/09/2021	9	2	12:30	15:30	NW6	3	5	4	CR
15/10/2021	2	1	10:00	13:00	W2	0	4	4	JW
15/10/2021	2	2	14:00	17:00	W2	0	4	4	JW
21/10/2021	4	1	08:30	11:30	N5-6	2	6	4	MH
21/10/2021	4	2	11:45	14:45	N6	2	5	4	MH
28/10/2021	8	1	08:20	14:50	S2	0	4	4	DMo
29/10/2021	1	1	08:30	11:30	SW4	0	5	4	CR
29/10/2021	1	2	12:00	15:00	SW5	1	6	4	CR
29/10/2021	10	1	09:10	15:40	S3	0	7	4	DMo
30/10/2021	9	1	08:45	15:15	SW2	2	8	3	DMo
22/11/2021	1	1	09:05	12:05	NW2	0	8	4	MH
22/11/2021	1	2	12:05	15:05	NW2	0	8	4	MH
23/11/2021	4	1	09:10	12:10	W3-4	1	8	2	MH
23/11/2021	4	2	12:10	15:10	W5	0	8	4	MH

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
24/11/2021	8	1	07:25	10:25	W1-2	2	7	4	MH
24/11/2021	8	2	11:30	14:30	W3	3	6	4	MH
24/11/2021	10	1	11:00	14:00	NW6	3	4	3	JW
24/11/2021	10	1	14:30	17:30	NW6	3	4	3	JW
25/11/2021	2	1	09:00	12:00	NW6	3	8	4	JW
25/11/2021	2	2	12:00	15:00	NW6	3	8	4	JW
25/11/2021	9	1	06:10	09:10	N5	3	3	4	MH
25/11/2021	9	2	09:10	12:10	N6	3	5	4	MH
13/12/2021	4	1	08:30	11:30	SW5	2	4	3	JW
13/12/2021	4	2	12:00	15:00	SW5	2	4	3	JW
13/12/2021	8	1	14:10	17:10	SW3-4	0	4	4	MH
14/12/2021	2	1	09:05	12:05	SW5-6	0	8	4	MH
14/12/2021	2	2	12:15	15:15	SW5-6	0	8	4	MH
15/12/2021	8	1	07:45	10:45	SW4	1	8	3	MH
23/12/2021	9	1	10:00	13:00	S5	1	6	4	CR
23/12/2021	9	2	13:30	16:30	S5	0	3	4	CR
28/12/2021	10	1	08:00	11:00	S0	0	5	4	JW
28/12/2021	10	2	11:30	14:30	SW0	0	5	4	JW
30/12/2021	1	1	10:30	13:30	SW4	1	8	3	CR
30/12/2021	1	2	14:00	17:00	SW5	1	8	3	CR
11/01/2022	8	1	14:30	17:30	SW3	2	6	4	MH
12/01/2022	1	1	10:00	16:00	SW3-4	0	6	4	MH
13/01/2022	8	1	07:50	10:50	SW2-3	0	8	4	MH
19/01/2022	10	1	11:00	14:00	NW6	0	2	4	JW
19/01/2022	10	2	14:30	17:30	NW6	0	2	4	JW
20/01/2022	4	1	09:00	12:00	NW3	0	7	4	JW
20/01/2022	4	2	12:30	15:30	NW3	0	7	4	JW
27/01/2022	9	1	11:30	14:30	NW5	0	6	4	CR
27/01/2022	9	2	15:00	18:00	NW2	0	6	4	CR
28/01/2022	2	1	09:00	12:00	SW4	2	8	3	CR
28/01/2022	2	2	12:30	15:30	SW5	0	8	4	CR
02/02/2022	10	1	15:00	18:00	SW5	2	8	3	JW
03/02/2022	10	2	08:00	11:00	SW6	0	7	4	JW
20/02/2022	8	1	15:10	18:10	W6	3	6	4	MH
21/02/2022	4	1	08:20	11:20	W6	2	7	4	MH
21/02/2022	4	2	11:30	14:30	W6	2	8	4	MH
22/02/2022	1	1	08:00	11:00	W6	3	8	3	MH
22/02/2022	1	2	11:20	14:20	W6	3	6	4	MH

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
22/02/2022	2	1	12:30	15:30	W7	3	5	4	JW
22/02/2022	2	2	15:30	18:30	W7	3	5	4	JW
23/02/2022	8	2	06:50	09:50	W6	0	6	4	MH
01/03/2022	9	1	08:00	11:00	SE2	0	2	4	CR
01/03/2022	9	1	11:30	14:30	SE4	0	4	4	CR
22/03/2022	2	1	12:40	15:40	SE4-5	0	2	4	MH
22/03/2022	2	2	16:00	19:00	SE4-5	0	4	4	MH
23/03/2022	4	1	08:10	11:10	SE3-4	0	0	4	MH
23/03/2022	4	2	11:30	14:30	SE5	0	0	4	MH
24/03/2022	8	1	08:00	11:00	SW1-2	0	6	4	MH
24/03/2022	8	2	16:00	19:00	SW1-2	0	9	4	MH
25/03/2022	10	1	07:05	10:05	SW1-2	0	1	4	MH
25/03/2022	10	2	10:45	13:45	SW1-2	0	3	4	MH
29/03/2022	10	1	14:30	17:30	NW2	0	3	4	CR
29/03/2022	10	2	18:00	21:00	NW2	0	3	4	CR
10/04/2022	8	1	17:55	20:55	SE6	0	8	4	MH
11/04/2022	8	2	06:45	09:45	SE4-5	0	5	4	MH
11/04/2022	10	1	10:10	13:10	E6	0	8	4	MH
12/04/2022	10	2	06:40	09:40	SE3-4	0	7	4	MH
23/04/2022	10	1	15:00	18:00	NNE4	0	2	4	DMi
23/04/2022	10	2	18:30	21:30	NNE4	0	1	4	DMi
01/05/2022	4	1	13:40	16:40	W2	0	8	4	DMi
01/05/2022	4	2	17:10	20:10	W1	1	7	4	DMi
02/05/2022	2	1	14:10	17:10	NE1-2	0	8	4	MH
02/05/2022	2	2	17:30	20:30	N2	0	8	4	MH
03/05/2022	1	1	05:45	08:45	NW2	0	7	4	MH
03/05/2022	1	2	10:55	13:55	NW3	1	8	4	MH
12/05/2022	10	1	10:00	13:00	W3	2	8	4	DMi
12/05/2022	10	2	13:30	16:30	W4	3	8	4	DMi
22/05/2022	2	1	15:00	18:00	SW4-5	2	7-8	4	MH
22/05/2022	2	2	18:10	21:10	SW4-5	2	8	4	MH
23/05/2022	1	1	07:10	10:10	W4-5	2	4-6	4	MH
23/05/2022	1	2	10:30	13:30	W4	0	6	4	MH
23/05/2022	4	1	12:00	15:00	W3	2	7	4	DMi
23/05/2022	4	2	15:30	18:30	W3	2	7	4	DMi
24/05/2022	8	1	18:00	21:00	W3-4	0	5-8	4	MH
24/05/2022	10	1	09:20	12:20	W4	2	5-8	4	MH
24/05/2022	10	2	14:25	17:25	W4	0	3-8	4	MH

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
25/05/2022	8	2	09:00	12:00	W4-5	0	8	4	MH
19/06/2022	10	1	12:15	15:15	N3-4	2	8	4	MH
19/06/2022	10	2	15:45	19:10	N3-4	0	8	4	MH
20/06/2022	2	1	09:35	12:35	SW3-4	0	1	4	MH
20/06/2022	2	2	13:00	16:00	SW4	0	0-8	4	MH
21/06/2022	1	1	11:55	14:55	W2	1	8	3	MH
21/06/2022	1	2	15:15	18:15	W2-3	1	8	3	MH
22/06/2022	8	1	05:50	08:50	NW2	2	8	3	MH
22/06/2022	8	2	09:20	12:20	W2	2	8	3	MH
29/06/2022	4	1	15:30	18:30	W3	0	7	4	DMi
29/06/2022	4	2	19:00	22:00	NW3	0	6	4	DMi
30/06/2022	10	1	06:30	09:30	SW1	0	6	4	DMi
30/06/2022	10	2	10:00	13:00	SW1	2	8	4	DMi
11/07/2022	2	1	11:00	14:00	S4-5	0	8	4	MH
11/07/2022	2	2	14:20	17:20	S4-5	0	8	4	MH
12/07/2022	1	1	11:25	14:25	W4-5	0	4	4	MH
12/07/2022	1	2	14:45	17:45	W4-5	0	8	4	MH
13/07/2022	10	1	06:30	09:30	W3-4	0	1	4	MH
13/07/2022	10	2	15:55	18:55	W3	0	8	4	MH
14/07/2022	8	1	05:50	08:50	NW3	1	8	4	MH
14/07/2022	8	2	09:25	12:25	W3	0	6	4	MH
21/07/2022	4	1	14:45	17:45	N2	0	7	4	DMi
21/07/2022	4	2	18:15	21:15	N1	0	5	4	DMi
22/07/2022	10	1	06:15	09:15	S1	0	7	4	DMi
22/07/2022	10	2	09:45	12:45	S0	0	4	4	DMi
14/08/2022	10	1	14:30	17:30	NW1	0	8	4	DMi
14/08/2022	10	2	18:00	21:00	NW1	0	8	4	DMi
18/08/2022	8	1	17:50	20:50	SW3-4	0	8	4	MH
19/08/2022	2	1	09:30	12:30	SW4-5	2	5-7	4	MH
19/08/2022	2	2	12:45	15:45	SW4-5	0	4-6	4	MH
19/08/2022	8	2	17:05	20:05	SW3-4	0	6	4	MH
20/08/2022	1	1	08:10	11:10	SW5-6	0	3-5	4	MH
20/08/2022	1	2	11:30	14:30	SW5-6	0	6	4	MH
27/08/2022	4	1	08:15	11:15	S3	1	8	3	DMi
27/08/2022	4	2	11:45	14:45	S1	1	8	4	DMi
27/08/2022	10	1	07:25	10:25	SE0-3	4	8		MH

Date	VP	Watch	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
27/08/2022	10	2	10:45	13:45	SE3-4	0	8	4	MH

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: CR = Conor Ryan; DMi = David Miley; DMo = Daniel Moloney; JB = Jamie Bliss; JC = Jason Cahill; Jack Glennon; JS = John Sherry; JW = Jamie Woods; MH = Mick Hogan; ND = Nicholas Duff; SC = Sophia Couchman.

A7.1.3 MOORLAND BREEDING BIRD SURVEY

Survey methods

Moorland breeding bird surveys were carried out in the 2020 and 2021 breeding seasons. These targeted Red Grouse and breeding waders. However, all the open moorland habitat within 500 m of the turbine locations was covered with the exception of some areas of cutover bog in the outer part of the buffers around T18 and T19.

The survey methodology and timings were based on the adapted Brown and Sheppard method recommended by the SNH guidelines. This comprised monthly surveys between April and July.

The surveys were carried out by walking transects approximately 200 m apart. This differs from the grid square approach of Brown and Sheppard (1993), but was considered to be a more effective method for the Cloghercor Wind Farm site due to the fragmented nature of the moorland habitat, and the access issues. In any case, it achieved the same spatial coverage, and exceeded the duration intensity of the Brown and Sheppard requirements (20-25 minutes per 25 ha).

Survey coverage

Details of the dates, timings and weather conditions of the moorland breeding bird surveys are shown in Table A.7.1.6. The areas covered on each survey are either described in the table, or are shown in Figure A.7.1.3.

Table A.7.1.6 Dates, timings and weather conditions of the moorland breeding bird surveys.

Date	Survey area	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
28/04/2020	Area 7	10:57	11:50					JS
30/04/2020	Area 2	11:20	13:40	SE-NE3	3	6	4	SC
30/04/2020	Area 5	11:30	13:15	SE3	4	8	3	JS
01/05/2020	S of VP5	08:30						JS
12/05/2020	between VP4 and VP2	14:10	16:00	NE4	0	5	4	JS
13/05/2020	south of VP2	15:20	17:05	NE4	0	2	4	JG
13/05/2020	around VP2 (upper/south)	15:20	16:30	NE3	0	1	4	JS
14/05/2020	around VP7	14:08	16:12	N3	0	4	4	SC
15/05/2020	SE of VP5	14:15	16:12	NE3	1	6	4	JS
29/05/2020	around VP9	08:00	11:00	SE2	0	4	4	ND
29/05/2020	not specified	17:00	19:30	SE2	0	4	4	
09/06/2020	W of VP7	15:40	17:40	SW3	4	8	4	JG

Date	Survey area	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
10/06/2020	N of VP7	09:35	11:45	NE3	2	7	4	JS
10/06/2020	around VP2	09:50	11:20	W3	1	6	4	SC
11/06/2020	S of VP1	15:30	16:45	NE4	0	7	4	JS
11/06/2020	SE of VP4	15:40	17:30	NE4	0	4	4	SC
11/06/2020	NE of VP4	15:40	17:30	NE4	0	5	4	JG
13/06/2020	hill/plateau on south side of estuary to south of VP8	07:55	14:45	E2	0	8	4	JB
23/06/2020	around VP5	07:25	10:20	SW2	0	7	4	JB
03/07/2020	S of Cleengort Hill	15:15	20:40	W1-2	1	8	3-4	JB
04/07/2020	N of Cleengort Hill	09:40	15:55	SW1-2	1	0	4	JB
07/07/2020	SW of VP2	15:40	17:00	E2	0	7	4	JG
07/07/2020	SE of VP2	15:40	17:00	E2	0	6	4	JS
08/07/2020	N of VP7	11:20	12:20	SE3	0	3	4	SC
09/07/2020	N of VP4	11:00	12:50	NE3	0	4	4	JG
09/07/2020	peaks to E of VP4	11:00	12:50	NE3	0	6	4	JS
09/07/2020	not specified	11:10	12:20	NE4	0	4	4	SC
18/07/2020	hill/plateau on south side of estuary to south of VP8	10:30	11:30	W3	0	6	4	JB
19/07/2020	around VP9, VP10 and Loughs Doo and Smuttan	09:15	15:15	W3-4	0	5	4	JB
20/07/2020	around VP5	11:35	14:40	SW3	0	7	4	JB
27/04/2021	Area 5	14:10	15:44	N3	0	4	4	SC
27/04/2021	Area 2	14:13	15:45	NE4	0	7	4	JG
27/04/2021	Area 3	14:30	15:45	N3	0	7	4	JS
28/04/2021	Area 4	13:15	14:40	N2	1	7	4	JS
28/04/2021	Area 9	13:30	15:00	NE2	0	5	4	SC
28/04/2021	around VP9	08:20	15:05	NE4	0	4	4	MH
28/04/2021	around VP9	08:20	15:05	NE4	0	4	4	CR
29/04/2021	Area 1	11:50	12:40	NNE3	1	6	4	SC
30/04/2021	Area 5	11:55	13:00	NE3	3	6	4	JG
30/04/2021	Area 7	11:55	12:55	NE3	1	7	4	JS
17/05/2021	around VP9	12:15	17:30	W4-5	0	6	4	MH
17/05/2021	around VP9	12:15	17:30	W4-5	0	6	4	CR
18/05/2021	Area 7	12:00	13:15	NW4	0	3	4	JG
18/05/2021	Area 6	12:00	13:15	W3	0	2	4	JS
18/05/2021	Area 1	12:00	12:40	SW3	0	4	4	SC

Date	Survey area	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
19/05/2021	Area 2	11:40	12:45	W4	0	3	4	JS
16/06/2021	Area 6	17:30	19:00	W5	0	6	4	JC
17/06/2021	Area 3	17:25	18:50	W3	0	7	4	JC
17/06/2021	Area 2	17:25	18:40	W3	0	7	4	JS
20/06/2021	around VP5	05:30	11:30	NE1	0	4	4	MH
22/06/2021	hill/plateau on south side of estuary to south of VP8	20:00	22:00	SW5	2	8	3	CR
22/06/2021	around VP9	09:25	14:30	SW3	0	8	4	MH
22/06/2021	around VP9	09:25	14:30	SW3	0	8	4	CR
14/07/2021	hill/plateau on south side of estuary to south of VP8	20:00	22:00	SW4	2	8	3	CR
15/07/2021	around VP9	12:45	17:30	SW3	0	8	4	MH
15/07/2021	around VP9	12:45	17:30	SW3	0	8	4	CR
16/07/2021	around VP5	07:00	15:00	SW3	0	6	4	MH
17/07/2021	hill/plateau on south side of estuary to south of VP8	08:30	10:30	W4	0	0	4	CR
20/07/2021	Area 5	11:20	12:55	SE1	0	1	4	JS
20/07/2021	Area 6	11:20	12:55	SW1	0	1	4	JC
21/07/2021	Area 3	16:40	17:35	W1	0	3	4	JC
21/07/2021	Area 2	16:40	17:35	W1	0	3	4	JS

Survey area: numbered areas are shown on Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: CR = Conor Ryan; JB = Jamie Bliss; JC = Jason Cahill; JG = Jack Glennon; JS = John Sherry; JW = Jamie Woods; MH = Mick Hogan; ND = Nicholas Duff; SC = Sophia Couchman.

A7.1.4 WINTER WATERBIRD SURVEYS

Survey methods

In 2019/20, a winter walkover survey was carried out between October and March to assess possible usage of the site by Greenland White-fronted Goose and Golden Plover. Open areas of bog or heath habitat are favoured by these species therefore these areas were targeted. Due to restricted access at this time, only open bog/heath areas within the south and west of the site boundary were surveyed. This survey was not repeated in the winter of 2020/21 as it was considered that that the vantage point surveys provided sufficient coverage to assess any usage of the site by Greenland White-fronted Goose and Golden Plover.

Waterbird surveys of the Gweebarra Estuary were carried out in the winters of 2019/20 and 2020/21. High and low tide counts were carried out in October 2019 and monthly between October 2020 and March 2021. These covered the sections of the estuary upstream of

Lettermacaward Bridge, which includes all the estuary within a 2 km buffer of the site boundary. The surveys were carried out from a number of vantage points along both sides of the estuary.

Between November 2019 and March 2020, a waterbird vantage point survey was carried out monthly to assess connectivity and usage of the river as a commuting corridor. This used two vantage point locations, on the upstream and downstream sides of Lettermacaward Bridge. A single three hour watch was carried out each month during / near high tide.

In the 2020/21 winter, Whooper Swan and Greenland White-fronted Goose dusk roost surveys were carried out. These covered lakes within 1 km of the site boundary, where access was feasible. The surveys were conducted once per month between October 2020 and March 2021.

Survey coverage

Details of the dates, timings and weather conditions of the winter walkover surveys are shown in Table A.7.1.7.

Table A.7.1.7 Dates, timings and weather conditions of the winter walkover surveys.

Date	Location	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
21/11/2019	West of site	10:20	13:32	SE2	1	7	3	JS
21/11/2019	Upper transect	10:16	13:16	SE3	0	8	4	SC
13/12/2019	Lower transect	09:15	12:00	NW4	4	4	4	SC
13/12/2019	South of site	09:30	11:30	SW1	2	8	3	JS
22/01/2020	Lower transect	12:00	13:25	SW2		8	1	JS
22/01/2020	Upper transect	12:10	15:15	na0	0	8	0	SC
19/02/2020	Upper transect	09:00	11:00	W4	2	7	3	JS
19/02/2020	Lower transect	08:00	10:30	SW3	2	8	4	SC
13/03/2020	Lower transect	09:30	13:00	W2	0	3	4	JS
13/03/2020	Upper transect	09:30	12:30	W3	0	2	4	SC

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: JS = John Sherry; SC = Sophia Couchman.

Details of the dates, timings and weather conditions of the waterbird counts of the Gweebarra Estuary are shown in Table A.7.1.8.

Table A.7.1.8 Summary of the waterbird counts of the Gweebarra Estuary.

Date	Tide	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
31/10/2019	LT	12:15	16:15	SE1	0	8	4	SC
07/10/2020	LT	15:55	17:00	NW2	0	8	4	JS, JG
09/10/2020	HT	11:30	13:00	W1	0	6	4	JS, JG
11/11/2020	HT	08:30	09:37	S4	2	8	3	JS
11/11/2020	LT	14:00	15:30	SW4	4	8	2	SC
09/12/2020	HT	13:12	14:30	SW4	1	8	2	SC
11/12/2020	LT	09:05	10:30	S1	0	7	4	JS
11/01/2021	HT	15:16	16:30	SE2	1	8	4	JS
13/01/2021	LT	11:20	12:20	SW1	1	6	4	SC
18/02/2021	LT	15:00	16:15	SW4	1	4	4	SC
18/02/2021	HT	09:15	10:10	0	0	3	4	JS
10/03/2021	HT	15:50	16:54	SW5	1	6	4	SC
10/03/2021	LT	10:00	11:15	S1	1	8	4	JS

Tide: LT = low tide; HT = high tide. Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: JC = Jason Cahill; JG = Jack Glennon; JS = John Sherry; SC = Sophia Couchman.

Details of the dates, timings and weather conditions of the vantage point watches of the Gweebarra Estuary are shown in Table A.7.1.9.

Table A.7.1.9 Summary of the waterbird vantage point watches of the Gweebarra Estuary.

Date	Vantage Point	Start	Finish	Wind	Rain	Cloud	Visibility	Surveyor
21/11/2019	Downstream VP	10:00	13:00	NE5	1	8	4	SC
22/11/2019	Upstream VP	10:00	13:00	SE2	1	8	4	JS
10/12/2019	Downstream VP	13:10	16:10	W5	5	8	3	JS
10/12/2019	Upstream VP	13:15	16:15	NW5	0-4	8	4	SC
21/01/2020	Downstream VP	12:30	15:30	W1	0	8	4	JS
21/01/2020	Upstream VP	12:30	15:30	SW0-2	0-2	8	3	SC
19/02/2020	Downstream VP	12:10	15:15	N4	4	8	3	SC
19/02/2020	Upstream VP	12:15	15:15	W2	4	8	3	JS
10/03/2020	Downstream VP	15:15	18:15	W5	1	6	4	JS
10/03/2020	Upstream VP	15:15	18:15	SW4	3	6	4	SC

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: JS = John Sherry; SC = Sophia Couchman.

A7.1.5 BREEDING RED-THROATED DIVER SURVEY

Survey methods

Breeding Red-throated Diver surveys were carried out in the 2020 and 2021 breeding seasons. These focused on surveying lakes within 1 km of the wind farm site, while some additional lakes within 2 km of the site were also covered (Figure A.7.1.4). The buffer distance for Red-throated Diver surveys recommended by the SNH guidelines is 1 km. The survey effort of the lakes within 1 km of the wind farm turbines and other infrastructure is summarised in Table A.7.1.10. The survey visits for these lakes were carried out between 8th June and 9th July.

Table A.7.1.10 Summary of Red-throated Diver survey effort of lakes within 1 km of the wind farm turbines and other infrastructure.

Lakes	Survey visits		Other survey effort
	2020	2021	
Lough Aneane Beg	2	1	Also checked during moorland surveys in 2021
Lough Aneane More	2	1	Also checked during moorland surveys in 2021
Lough Sallagh	0	0	Visible from VP2 and VP4
Pond 1	0	1	
Pond 2	0	1	

The survey methods followed Gilbert *et al.* (1998). At each lake a suitable vantage point was selected that provided the best coverage of the lake. The surveyor scanned the water and the lake shore for Red-throated Divers. When the surveyor was confident that no divers were present, and if access allowed, the surveyor walked the perimeter of the lake, scanning any islands, to search for signs of Red-throated Diver presence, such as empty nest scrapes, broken eggshells or dead chicks.

Survey coverage

Details of the dates, timings and weather conditions of the Red-throated Diver surveys are shown in Table A.7.1.5.

Table A.7.1.11 Dates, timings and weather conditions of the Red-throated Diver and breeding gull surveys.

Date	Lakes	Start	Finish	Wind	Rain	Cloud	Surveyor
11/05/2020	Lough Mor, Lough Machugh, Lough Smuttan			NE3	0	3	SC
08/06/2020	Lough Smuttan, Lough Errig, Lough Mor, Lough Beg						JS
09/06/2020	Lough Mor, Lough Beg	10:44	12:05	W1	0	8	SC
09/06/2020	Lough Nabrack, Lough Namurleog	15:40	17:40	SW3	4	8	JS
10/06/2020	Lough Machugh	10:15	11:45	N1	0	7	JG
06/07/2020	Lough Mor, Lough Beg, Lough Machugh, Lough Smuttan, Lough	14:30	17:30	W3	0	5	JS

Date	Lakes	Start	Finish	Wind	Rain	Cloud	Surveyor
	Doo, Lough Namurleog, Lough Nabrack, Lough Errig						
08/07/2020	Lough Aneane More, Lough Aneane Beg	10:40	12:00	E1	0	7	JS
09/07/2020	Lough Nacroagh	12:20	12:30	NE3	0	6	JS
18/06/2021	Lough Aneane More, Lough Aneane Beg	13:55	15:04	0	0	4	JS, JG
18/06/2021	Derkmore Lough, Pond 1, Pond 2	12:12	15:03	W1	0	3	JC
19/07/2021	All lakes within study area	11:00	16:00	W1	0	1	JG

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Surveyors: JC = Jason Cahill; JG = Jack Glennon; JS = John Sherry; SC = Sophia Couchman.

A7.1.6 BREEDING GOLDEN PLOVER SURVEY

Survey methods

The moorland breeding bird surveys collected data on breeding Golden Plover in 2020 and 2021. Following consultation with NPWS, a targeted Golden Plovers survey was carried out in the 2022 breeding season. The objective of this survey was to collect data on Golden Plover commuting routes between the breeding area and potential grassland foraging habitat. There is no standard design for this type of survey. Therefore, the survey design was based on a literature review of information about Golden Plover breeding ecology.

Breeding Golden Plover in Britain typically commute from moorland nesting areas to grassland feeding areas. This commuting behaviour mainly occurs during the incubation period. Male Golden Plovers usually incubate during the day and females at night, with most changeovers occurring early in the morning and late in the evening. Once the young have hatched, the adults usually remain with the chicks in the moorland habitat.

The survey started in mid-April before the likely start of the incubation period and finished when observations indicate the end of the incubation period: i.e., both birds of the pair are active in the nesting area at the same time. Surveys were out at weekly intervals during this period. The watches started at dawn, or finished at dusk, when changeovers of incubating birds are most likely to occur. The surveyor watched for the arrival of the non-incubating bird. Based on the behaviour described in the literature, the non-incubating bird was expected to be visible for a period of time, displaying and/or standing on watch, before the changeover occurs. When the changeover occurred, the observer tracked the flight path of the departing bird for as long as possible.

The survey took measures avoid causing undue disturbance to the breeding Golden Plovers and other species of conservation importance. This included using observation positions in the nesting area that did not cause persistent agitation by the plovers, and liaising with the Golden Eagle survey team to avoid disturbance to any eagle nests.

Survey coverage

Details of the dates, timings and weather conditions of all the Golden Plover surveys are shown in Table A.7.1.5. All the surveys were carried out in the open moorland habitat in the eastern corner of the wind farm site. All the surveys were carried out by David Miley.

Table A.7.1.12 Dates, timings and weather conditions of the Golden Plover surveys.

Date	Start	Finish	Wind	Rain	Cloud	Visibility	Type
24/04/2022	06:15	09:15	NW4	0	5	3	VP
24/04/2022	09:15	11:00					B&S
02/05/2022	06:00	11:30	W2	0	7	4	mixed
11/05/2022	16:00	21:30	W5	1	8	4	mixed
17/05/2022	16:30	22:00	SE3.5	1	8	4	mixed
23/05/2022	18:40	22:00	W3	0	7	4	mixed
01/06/2022	14:00	19:00	W1	0	7	4	mixed

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Type: B&S = Brown and Sheppard survey; VP = vantage point watch; mixed = mix of the two survey methods.

A7.1.7 BREEDING GULL SURVEY

Survey methods

The objective of the breeding gull survey was to identify gull colonies on any lakes in the vicinity of the wind farm site. The survey was carried out at the same time as the breeding Red-throated Diver survey and focussed on lakes within 2 km of the wind farm site (Figure A.7.1.4). The buffer distance for breeding gull surveys recommended by the SNH guidelines is 2 km. The survey effort of the lakes within 2 km of the wind farm turbines and other infrastructure is summarised in Table A.7.1.10. The survey visits for these lakes were carried out between 11th May and 9th July. Each lake was checked for the presence of breeding gulls by scanning from a vantage point and / or walking the shoreline. If occupied gull nests had been present at any of the lakes, the population size would have been surveyed using the appropriate method from Gilbert *et al.* (1998). However, no occupied gull nests were present at any of the lakes surveyed, although evidence of probable breeding was recorded at one lake.

Table A.7.1.13 Summary of gull survey effort of lakes within 2 km of the wind farm turbines and other infrastructure.

Lakes	Survey visits		Other survey effort
	2020	2021	
Lough Aneane Beg	2	1	Also checked during moorland surveys in 2021
Lough Aneane More	2	1	Also checked during moorland surveys in 2021
Lough Doo	1	-	Covered by gull survey, or checked during moorland / VP surveys in 2021
Lough Machugh	3	1	Covered by gull survey, or checked during moorland / VP surveys in 2021

Lakes	Survey visits		Other survey effort
	2020	2021	
Lough Nacroagh	1	1	Covered by gull survey, or checked during moorland / VP surveys in 2021
Lough Nacroaghy	0	0	Checked during access to / from VP9 in 2021
Lough Nabrack	2	1	Covered by gull survey, or checked during moorland / VP surveys in 2021
Lough Namurleog	2	1	Covered by gull survey, or checked during moorland / VP surveys in 2021
Lough Sallagh	0	0	Visible from VP2 and VP4
Lough Smuttan	3	1	Covered by gull survey, or checked during moorland / VP surveys in 2021
Pond 1	0	1	
Pond 2	0	1	

Survey coverage

Details of the dates, timings and weather conditions of all the breeding gull surveys are shown in Table A.7.1.10.

A7.1.8 BREEDING MERLIN SURVEY

Survey methods

The SNH guidelines recommends that Merlin surveys cover a 2 km buffer distance around the wind farm site. However, this is not practicable in landscapes like the one around the Cloghercor Wind Farm site, where most of the 2 km buffer is potentially suitable Merlin habitat. An intensive Merlin survey of ten sample 3 x 3 km squares by Lusby *et al.* (2011) involved 845 hours of survey work, which amounts to around nine hours per km^2. This would translate to around 750 hours of survey work to cover the 2 km buffer around the Cloghercor Wind Farm site, while access issues would also have been a major constraint. Instead, as the main sensitivity was considered to be potential disturbance to Merlin nesting close to the wind farm site, the Merlin survey effort focussed on areas within a 500 m buffer around the wind farm site.

The Merlin surveys in 2020 and 2021 were based on the methods used by Lusby *et al.* (2011) and. This involved searching for Merlin signs and then carrying out targeted vantage point surveys in areas of potential Merlin activity were identified from the sign searching. The searches for Merlin signs were incorporated with the moorland surveys and involved checking prominent features, such as boulders, fence posts, peat hummocks, etc., for signs such as plucking remains, moth wings, white wash, pellets, moulted feathers, etc. As the moorland surveys involved walking transects around 200 m apart, the survey coverage exceeded the levels recommended by Hardey *et al.* (2013), and that used by Lusby *et al.* (2011). The intention was that, when areas of potential Merlin activity had been identified from the sign searching, targeted vantage point surveys of potential nesting habitat would be carried out. However, as no areas of potential Merlin activity were identified from the sign searching, there was no requirement for targeted vantage point surveys.

In 2022, a dedicated Merlin survey was carried out. This comprised 84.5 hours of survey work by an experienced Merlin surveyor between 28th March and 10th August. The survey covered all areas of the wind farm site, as well as the 500 m buffer around the site. The surveys consisted of walking accessible forestry edges and some of the tracks and rides, and all the open ground with suitable nesting habitat, to check for evidence of Merlin. Vantage point watches were used to look for displaying, calling, hunting, juveniles, etc., over forestry blocks, into inaccessible areas, rides and over areas of open ground for hunting Merlin. Vantage point watches were also used from the public road to cover areas where there were obvious land access issues.

Survey coverage

Details of the dates, timings and weather conditions of the 2022 Merlin surveys are shown in Table A.7.1.14. The survey routes covered on each date are shown in Figure A.7.1.5. All the surveys were carried out by Jamie Bliss.

Table A.7.1.14 Dates, timings and weather conditions of the Merlin surveys.

Date	Start	Finish	Wind	Rain	Cloud	Visibility
28/03/2022	08:45	17:50	SW-NW2-3	0	1	4
29/03/2022	10:30	13:45	NW2	0	0	4
25/04/2022	07:25	13:25	E2	0	1	4
26/04/2022	10:50	15:10	SE3	0	4	4
07/05/2022	09:40	19:00	W2	0	3	4
08/05/2022	07:45	16:40	S3	0	5	4
14/05/2022	08:50	14:50	SW2	0	7	4
22/06/2022	11:15	17:30	W1	1	8	4
27/06/2022	10:45	17:15	W1	1	8	3
12/07/2022	10:45	18:15	W3	0	8	4
19/07/2022	10:00	15:30	NW2-3	0-3	8	3-4
10/08/2022	09:05	13:35	W3	0	8	4

Wind = compass direction and Beaufort scale. Rain: 0 = none; 1 = drizzle; 2 = light showers; 3 = heavy showers; 4 = heavy rain. Cloud = cloud cover in eighths. Visibility: 0 = no visibility; 1 = limited (< 500 m); 2 = poor (< 1 km); 3 = moderate (1-2 km); 4 = good (> 2 km). Type: B&S = Brown and Sheppard survey; VP = vantage point watch; mixed = mix of the two survey methods.

A7.1.9 REFERENCES

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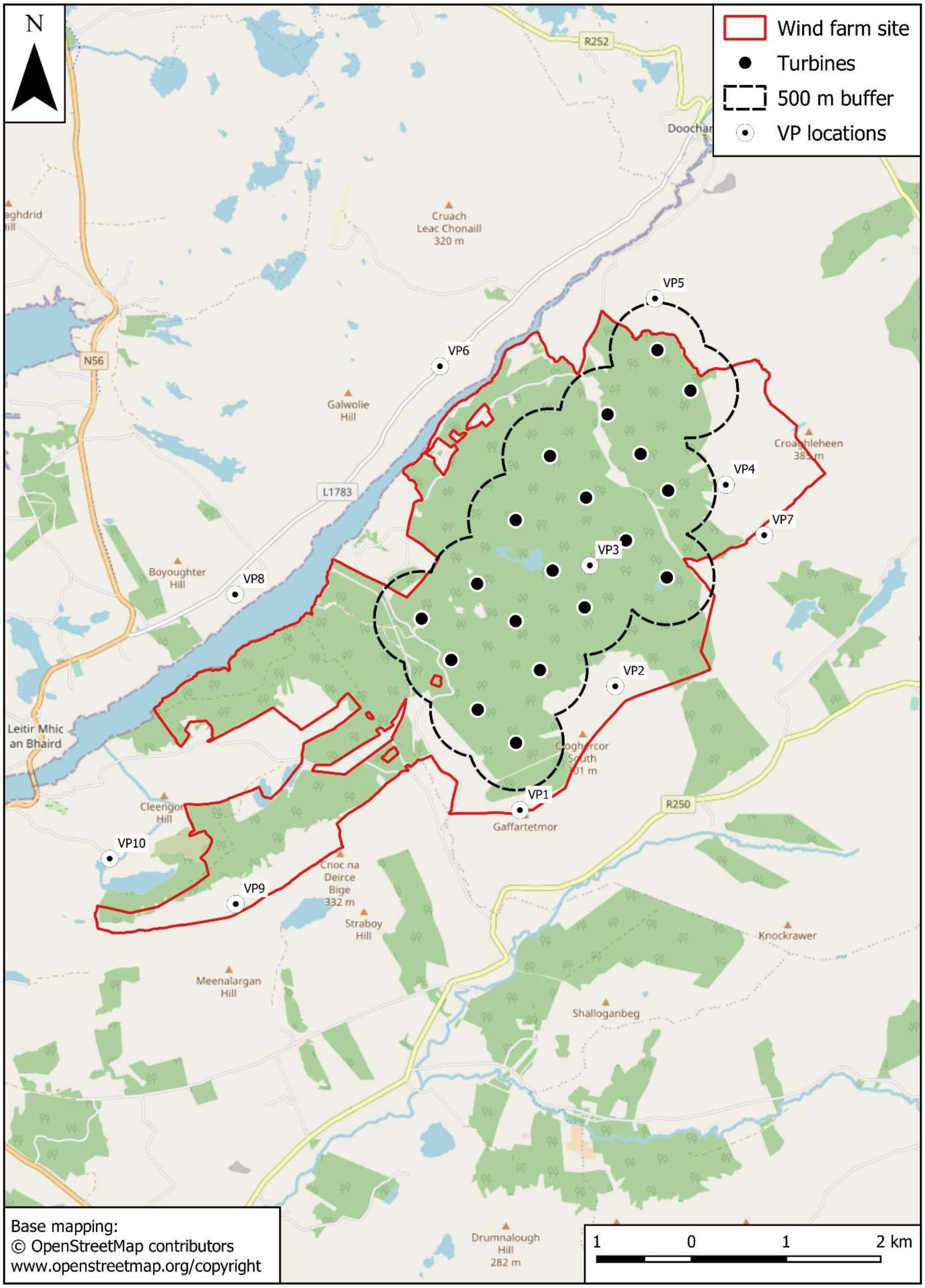

Figure A.7.1.1 - Vantage point locations.

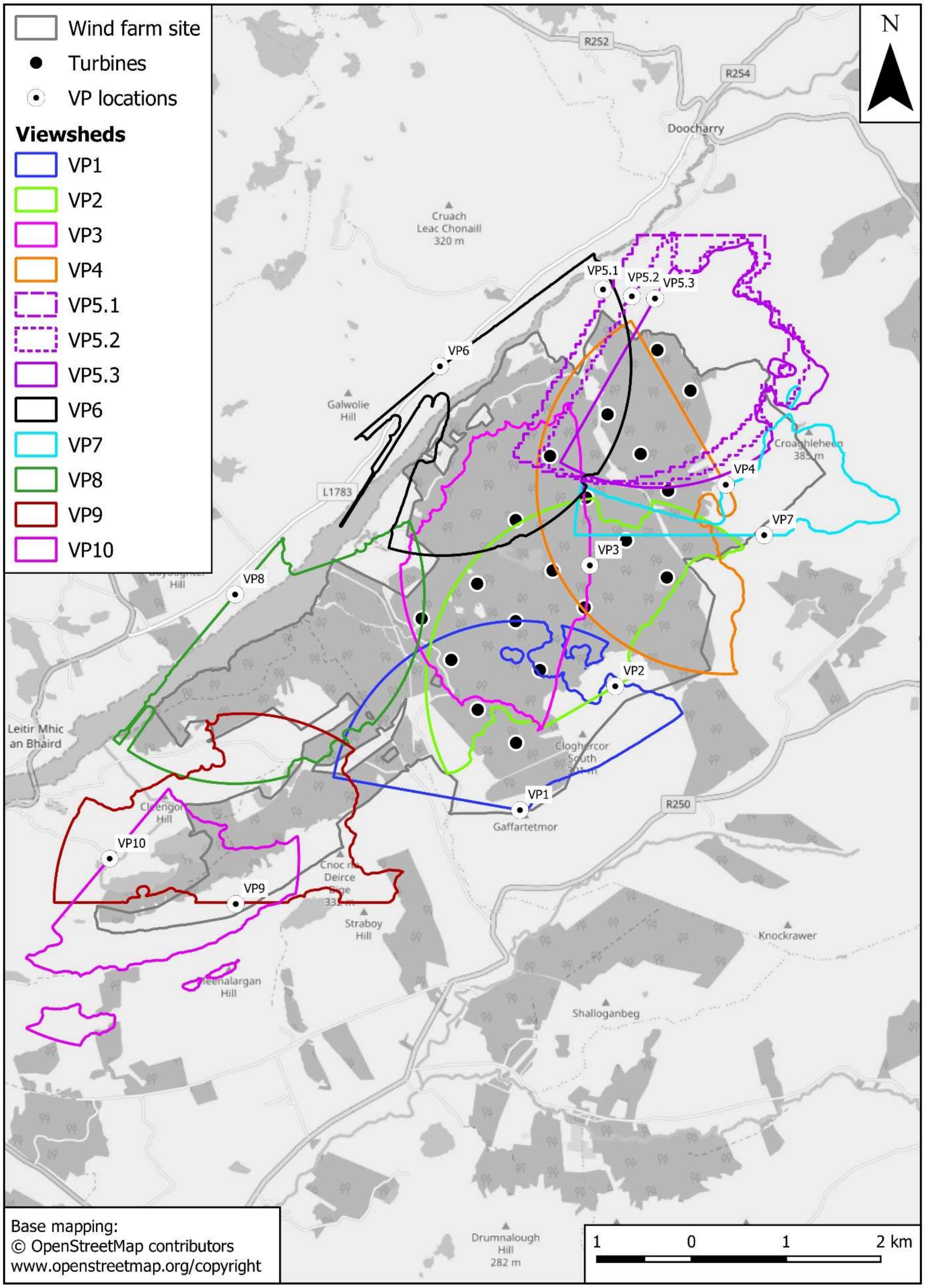

Figure A.7.1.2 - Viewshed coverage for each vantage point.

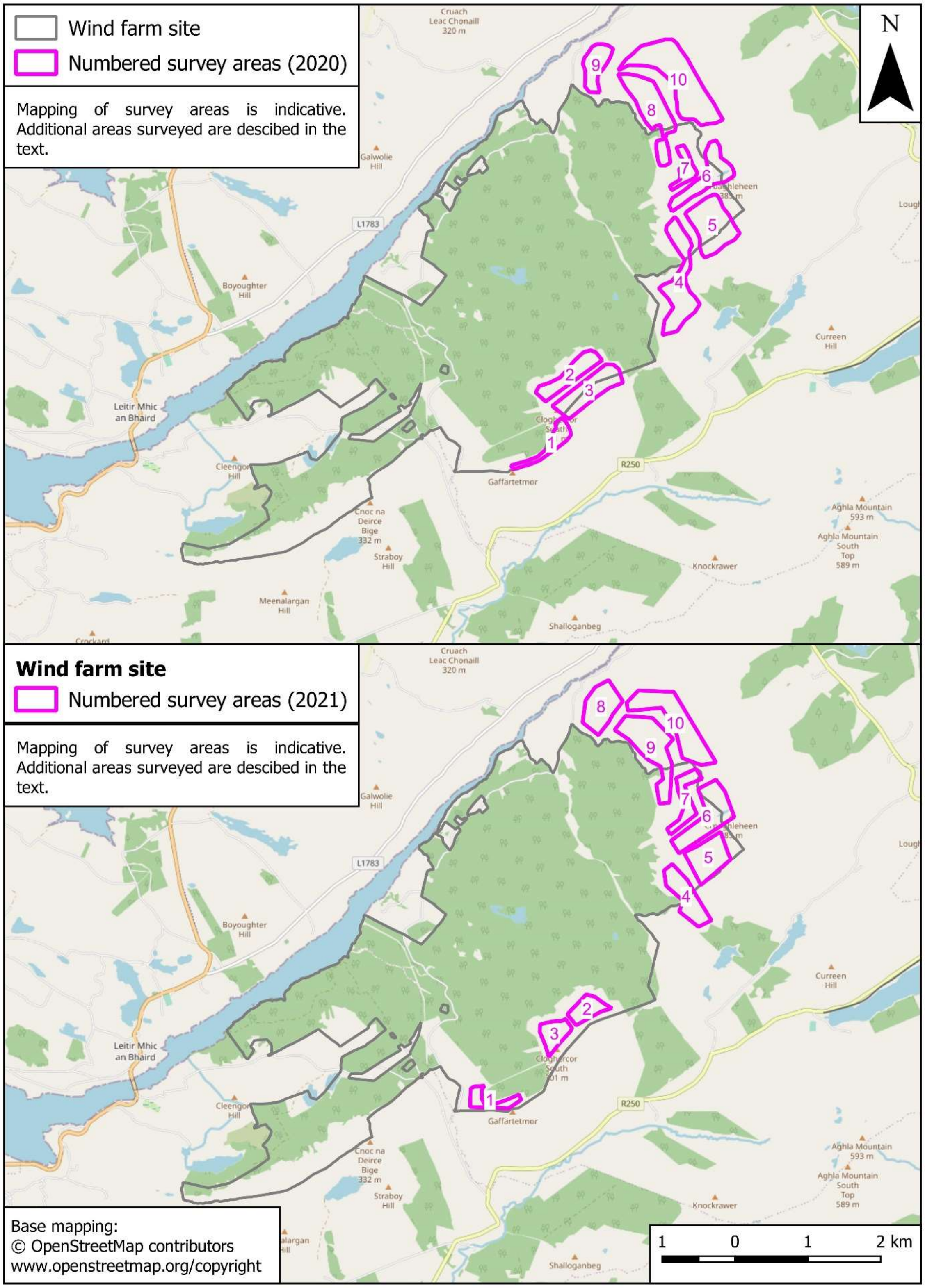

Figure A.7.1.3 - Numbered moorland breeding bird survey areas.

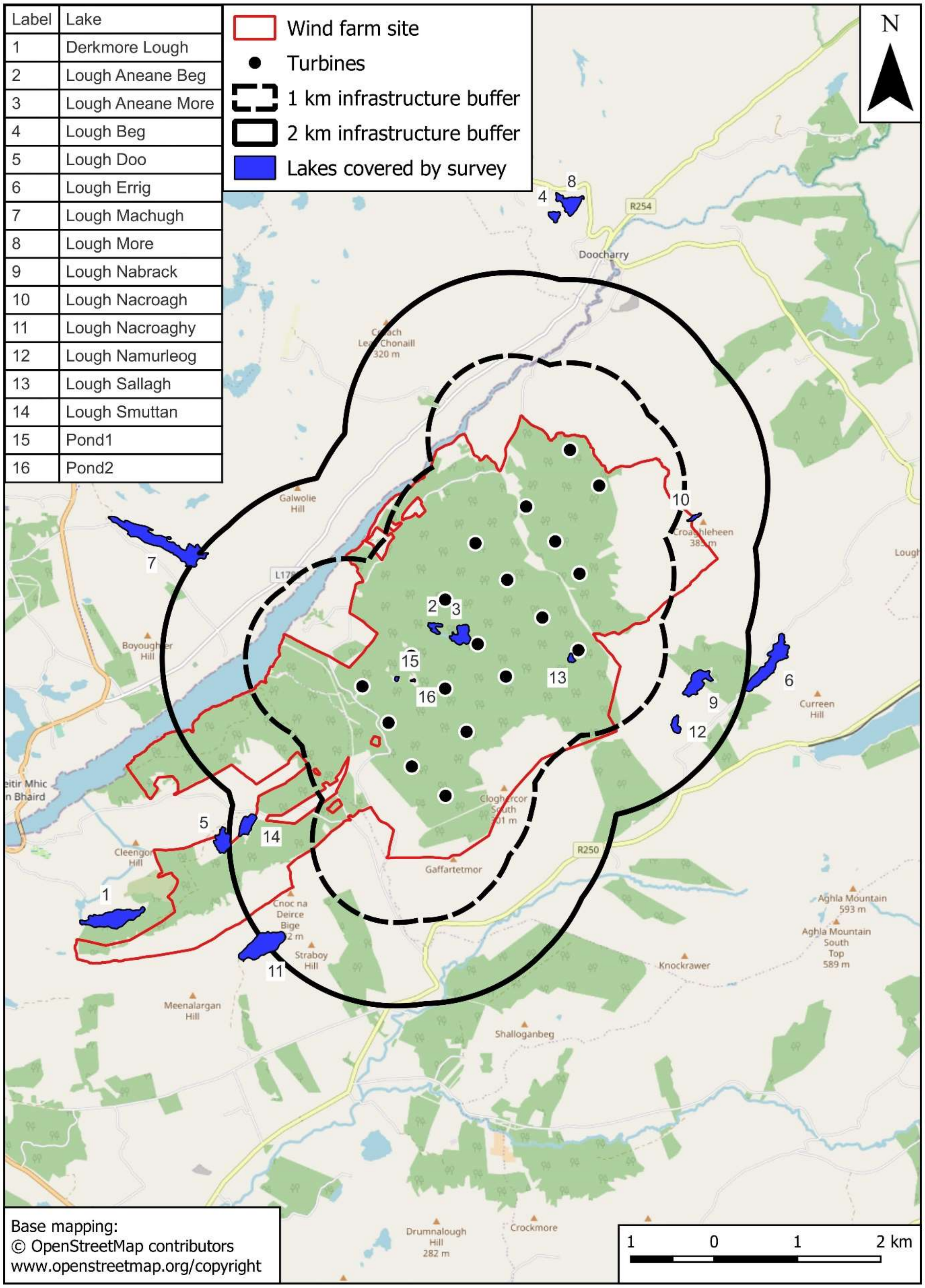

Figure A.7.1.4 - Lakes covered by the breeding Red-throated Diver / gull surveys.

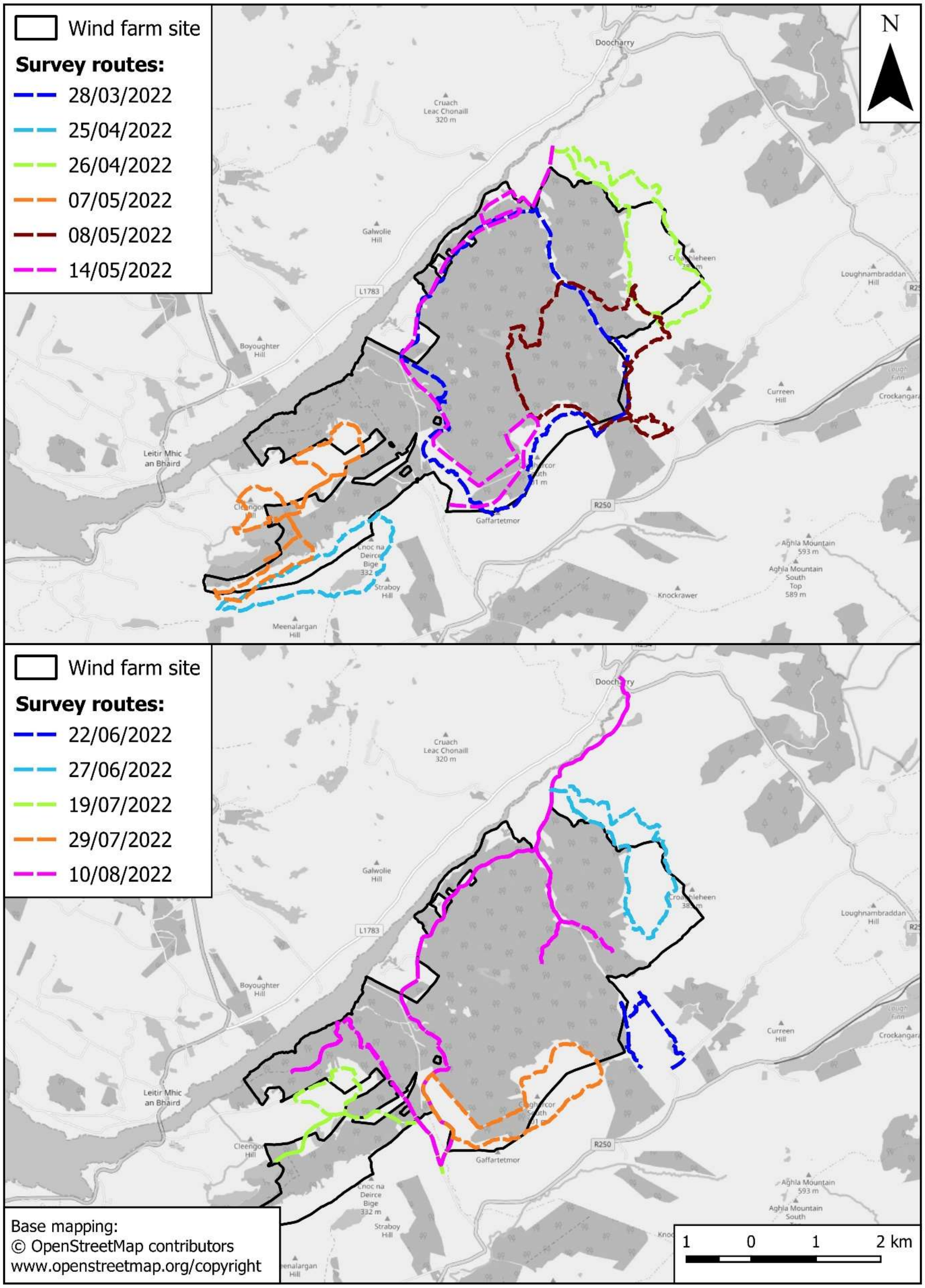

Figure A.7.1.5 - Merlin survey routes.

NIS Appendix 5 – Description of the Proposed Project EIAR Chapter

2.0 DESCRIPTION OF THE PROPOSED PROJECT

2.1 INTRODUCTION & BACKGROUND

This section of the EIAR describes the overall site and the main components of the proposed project and provides details on the construction, operation and decommissioning of the wind farm and associated infrastructure.

Cloghercor Wind Farm Ltd. proposes to develop the Cloghercor Wind Farm in Co. Donegal. It is proposed to supply the power from the Cloghercor Wind Farm to the Irish electricity network via loop-in 110kV underground cables (approximately 4.1 km cable length within approximately 3.36 km of internal access roads) to the existing overhead 110kV power line in the townland of Cloghercor, Co. Donegal.

A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height range from 185m to 200 m, a rotor diameter range from 149 m to 164 m, a hub height range from 112 m to 125 m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100 m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
  - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
  - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
  - All electrical plant and infrastructure and grid ancillary services equipment;
  - Parking;
  - Lighting;
  - Security Fencing;
  - Wastewater holding tank;
  - Rainwater harvesting equipment;
  - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;

- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1 km cable length within trenches on approximately 3.36 km of internal access roads) to the existing 110 kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16 m and 21 m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed project and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3 km from the proposed wind turbines.

The proposed project, described above, includes all elements of the proposed development in addition to any works required on public roads to accommodate turbine delivery. The proposed project has been considered and has been addressed as part of this EIAR, with offsite forestry replanting considered within cumulative assessments. These offsite forestry replanting sites will be individually assessed as part of the forestry licencing process.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought for the proposed development, as described in Section 2.5, and does not include elements of the overall proposed project. There are a number of locations which require temporary additional works to accommodate oversize load delivery to site (for turbine components). The proposed development, under the current application, includes temporary works at 4 no. locations in the townlands of Drumard, Darney, Cashelreagh Glebe and Aghayeevoge Co. Donegal. A number of other temporary works areas/road widening do not form part of the current application but are part of the proposed project and therefore assessed as part of this EIAR and are located within the townlands of Tullycumber, Cloghercor, Shallogan More, Derryloaghan and Straboy, Co Donegal.

2.1.1 The Proposed Project Site

The proposed wind farm site (as presented in Figure 1-2 of this EIAR) is located within a peatland and forested landscape, between Doochary, Lettermacaward and Glenties, in Co. Donegal. The site of the proposed wind farm is located approximately 22 km northeast of Donegal town, and approximately 30 km southwest of Letterkenny. Throughout this EIAR, reference may be made to the EIAR study area. The EIAR study area will be separately defined within each chapter if required, but where this is not the case, it refers to the areas outlined in Figure 1-1 of this EIAR.

The site of the proposed wind farm (Figure 1-2 of this EIAR) has an area of approximately 1,945 ha and comprises a single, slightly elongated land parcel approximately 9.1 km long in the northeast/southwest direction and is approximately 3.7 km wide in a southeast/northwest direction at the widest point. The site lies between the R250 that runs from Glenties to Fintown and the River Gweebarra estuary.

The land use/activities on the site of the proposed wind farm are primarily commercial forestry, with some areas of open peatland that is extensively grazed. The surrounding landscape is a mixture of peatland, forestry, and agricultural land (Plate 2.1).

Plate 2-1: Existing Wind Farm Site (view north east from centre of the wind farm site towards Croaghleheen)

The landscape is predominately hilly to mountainous in the wider area, with the proposed wind farm site being located on an elevated area beside the Gweebarra river estuary with a topography of between 0m and 365 m OD. A number of other areas to the east and south of the site are also elevated. The most significant features in the surrounding landscape are the Gweebarra estuary valley, and the upland areas (including Aghla Mountain) within and around the proposed wind farm particularly to the east of the proposed wind farm, towards Fintown.

The proposed project is located within townlands of Clogherachullion, Cloghercor, Derryloaghan, Aghaveevoge, Cashelreagh Glebe, Darney, Drumard, Drumnacross, Shallogan More, Straboy and Tullycumber Co. Donegal. The proposed grid connection (including the proposed substation and connection masts) is located within the townland of Cloghercor Co. Donegal.

2.2 COMMUNITY BENEFIT PROPOSAL

The proposed project has the potential to bring significant positive benefit to the local community. The project will contribute annual rates to Donegal County Council and it will provide opportunity for local community investment in the project in line with the Renewable Energy Support Scheme (RESS) estimated at €500,000 per year for the first 15 years of the project. A community benefit fund will be put in place for the lifetime of the project to provide direct funding to those areas surrounding the project.

The RESS Terms and Conditions[1] were published in February 2020 and provide details on the Government requirements for community benefit funds for renewable energy projects that participate in the scheme. A significant annual community benefit fund of €500,000 per year for the first 15 years of the project will be established in line with Government policy which will include funding for both wider community initiatives and a Near Neighbour scheme focused on houses in close proximity to the project.

A recreational facility will be developed at the site as part of the proposed project, as detailed in Section 2.6.13 below. This will also provide a further benefit to the local community and the wider area.

Fund usage and administration

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, our first task will be to form a benefit fund development working group that clearly represents both the closest neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that will administer the Community Benefit Fund. The fund will be operated in accordance with the Government of Ireland's Good Practice Principles Handbook for Community Benefit Funds, which will mean that the Fund will deliver initiatives that are in alignment with the UN Sustainable Development Goals[2].

Community Investment

The proposed RESS sets out that future renewable energy project proposals enable the possibility for local communities to invest in projects in a meaningful way as a means to directly gain from the financial dividends that a project can provide should it be consented, built and operated. In response to this, the Applicant has been working hard with external agencies to develop workable models of Community Investment. This element was not included in the existing RESS scheme but it is expected to form part of later RESS schemes which will apply to this proposed project.

2.3 LAND OWNERSHIP

A large portion of the proposed project is located on lands under the ownership and control of Coillte. The proposed wind farm site measures approximately 1945 ha, of which approximately 1,027 ha is owned by Coillte. The proposed project also has a number of third-party private landowners who have consented to the application and proposed project.

2.4 ON-SITE WIND RESOURCE

The layout of the proposed wind farm project has been designed to minimise the potential environmental impacts of the wind farm, while at the same time maximising the energy yields of the wind resource passing over the site. Available wind speed is a key factor in determining the economic viability of potential wind energy locations. In 2003, the Sustainable Energy Authority of Ireland (SEAI) produced a Wind Atlas with information on wind speed modelled at 50m, 75m and 100m

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[1] https://www.gov.ie/en/publication/36d8d2-renewable-electricity-support-scheme/ [Accessed January 2023]

[2] Renewable Electricity Support Scheme *Good Practice Principles Handbook for Community Benefit Funds* (2021) https://www.gov.ie/pdf/?file=https://assets.gov.ie/140382/b5198da9-c6c7-4af2-bbb5-2b8e3c0d2468.pdf#page=null

height above the ground. With turbine technology innovation, turbine models can now capture more of the wind current and have bigger rotors that radically change the economic viability of wind power. This has been reflected in the updated SEAI 2013 Wind Atlas which re-modelled wind speed data for a much wider range of 30m-150m height above ground level. The 2013 SEAI Wind Speed Atlas identifies the site as having a wind speed of between approximately 7.4 m/s and 8.3 m/s at 100m above ground level. This indicates that the site has a suitable wind resource for a commercial wind energy development.

2.5 PROPOSED DEVELOPMENT

The proposed development accounts for all related works falling under the planning application to An Bord Pleanála. The proposed development will comprise the construction of 19 no. wind turbines and all associated ancillary works.

The proposed development will constitute the provision of:

- Erection of 19 no. wind turbines with an overall blade tip height range from 185m to 200m, a rotor diameter range from 149m to 164m, a hub height range from 112m to 125m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second entrance to the wind farm for the construction phase;
- Improvements and temporary modifications to 4 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Drumard, Darney, Cashelreagh Glebe and Aghayeevoge, Co. Donegal;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery, with associated access to and from the public road R262, in the townland of Drumnacross;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length in underground trenches along approximately 3.36km of site road) to the existing

110kV overhead line in the townland of Cloghercor, Co. Donegal, with 2 no. new 16m and 21m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the 2 no. proposed new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, fencing and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed development and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development with a new entrance on the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads, and associated recreation and amenity signage.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought. Given the recent advances in turbine technology, and the anticipated lifespan of wind turbines, this is considered to be the optimal operational life for the proposed development. The duration of this operational life allows the proposed turbines to be used to generate clean renewable energy until they have reached the end of their life, rather than being removed prematurely.

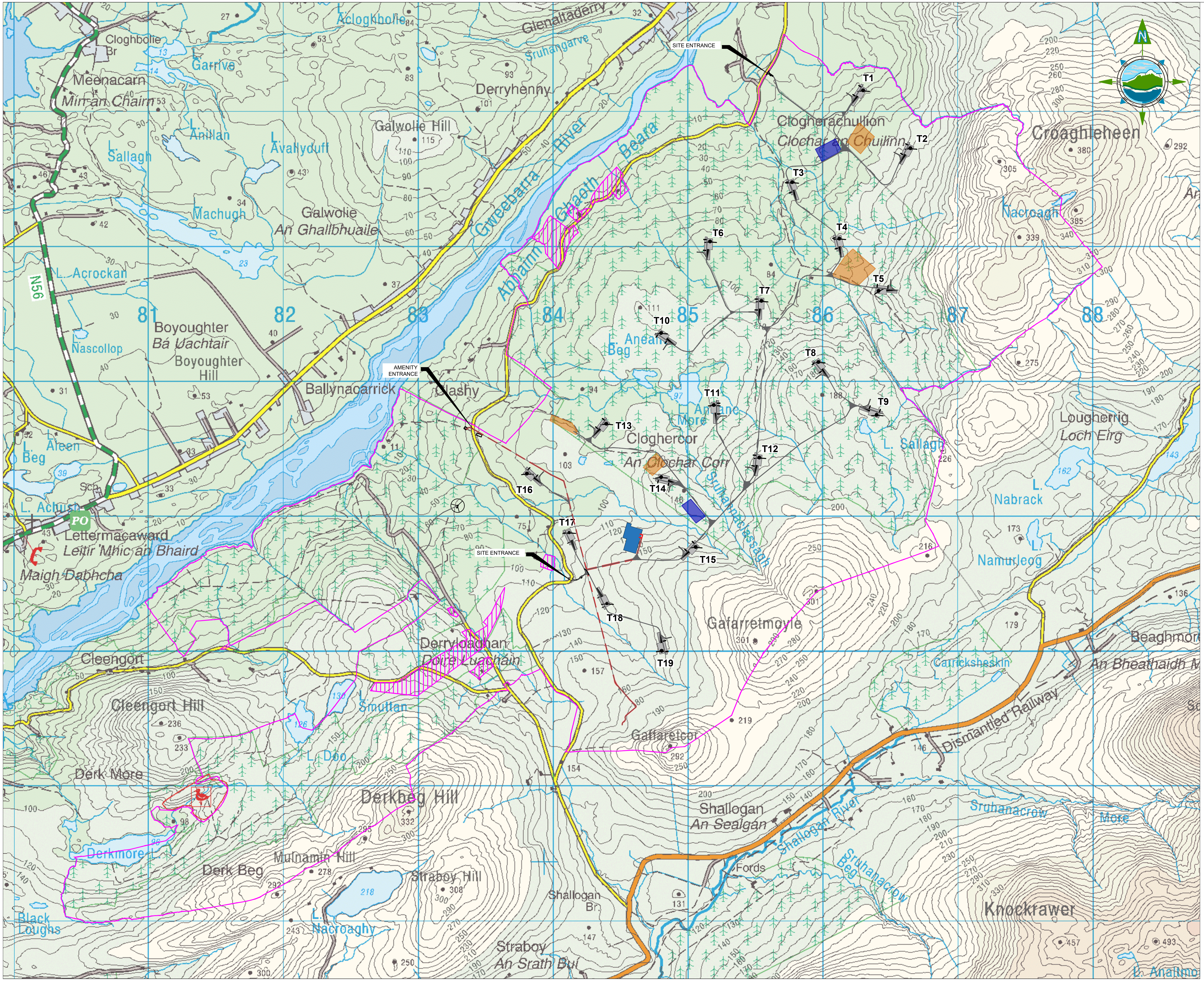
2.6 DEVELOPMENT LAYOUT

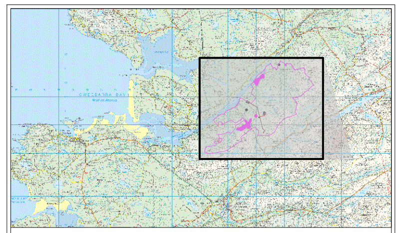
The layout of the proposed wind farm has been designed to minimise the potential environmental effects of the wind farm while at the same time maximising the energy yield of the wind resource passing over the site.

The overall layout of the proposed wind farm is shown in Figure 2-1. This figure shows the proposed locations of the wind turbines and associated hardstanding areas, passing bays, electrical substation, meteorological mast, temporary construction compounds, borrow pits, internal access roads and the main site entrance. Site layout drawings of the proposed development are included as Appendix 1-1 of this EIAR.

The layout reflects the outcome of the iterative design process. Further detail on the design philosophy, constraints and alternative turbine layouts and dimensions considered is detailed in Chapter 3 (Consideration of Reasonable Alternatives) of this EIAR.

The Grid Reference co-ordinates (ITM) of the proposed turbine locations are listed in Table 2-1 below.





LEGEND:

- PROPOSED WIND FARM SITE BOUNDARY
- AREA EXCLUDED FROM BOUNDARY
- ACCESS ROADS WITH PASSING BAYS
- GRID CONNECTION ROUTE
- TURBINE HARDSTAND
- TURBINE LOCATIONS
- TEMP. CONSTRUCTION COMPOUND
- SUBSTATION LOCATION
- BORROW PIT LOCATIONS
- MET MAST LOCATION

OSI 1:50,000 Sheet No's: 1638, 1640, 1838, 1840

Rev	Date	Description	By	Chkd.
A	07.03.22	INFORMATION ISSUE	EB	OF

Client:

CLOGHERCOR WIND FARM LTD.

Project:

CLOGHERCOR WIND FARM

Title:

SITE LAYOUT

Scale @ A3: 1:25,000

Prepared by: E. Beggs | Checked: O. Fitzpatrick | Date: January 23

Project Director: S. Tinnelly

Drawing Status: Information

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Drawing No.: Figure 2.1

Revision: A

Table 2-1: Turbine Location Details (ITM Co-ordinates)

Turbine ID	Easting's (m)	Northing's (m)
T1	586252	904152
T2	586602	903723
T3	585725	903472
T4	586075	903054
T5	586366	902666
T6	585117	903032
T7	585498	902592
T8	585921	902139
T9	586352	901748
T10	584755	902355
T11	585145	901821
T12	585483	901431
T13	584348	901682
T14	584752	901287
T15	585010	900769
T16	583760	901313
T17	584073	900876
T18	584353	900350
T19	584759	900000

2.6.1 Power Output

The proposed wind turbines will have an assumed rated electrical power output of between 5-7.2 MW. This will be determined as a result of procurement of the final turbine type, power output and turbine development over the period leading up to construction. For the purposes of this EIAR, a minimum rated output of 5 MW and a maximum rated output of 7.2 MW has been used to calculate the power output of the proposed wind farm, which will result in an estimated installed capacity of between 95-136.8 MW.

Based on the above, the proposed wind farm has the potential to produce up to between 274,626 and 395,461 MWh (Megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year where:

- A is the number of hours in a year: 8,760 hours
- B is the capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc: 33%
- C is the rated output of the wind farm: minimum 95 MW, maximum 136.8 MW

The capacity factor of a wind farm takes into account the intermittency of the wind and is based on average wind speeds. The capacity factor of 33% is based on an EirGrid study of wind and solar energy in Region A from December 2021[3].

The 274,626 to 395,461 MWh of electricity produced by the proposed wind farm will be sufficient to supply the equivalent of between 56,590 and 81,488 Irish households with electricity per year. This is based on the Sustainable Energy Authority of Ireland *"Energy in Ireland 2021 Report"* from December 2021, which details domestic consumption values for electricity customers in 2020. This report updates the average annual dwelling electricity consumption figure to 4,853 kWh per annum.

2.6.2 Wind Turbine Specification

The proposed turbines will have a tip height of between 185-200m. Detailed drawings, which accompany the planning application, show the parameters of the turbine that may be used for the proposed project, however, the exact make and model of the turbine will be dictated by a competitive tender process of the various turbines on the market at the time, but will have dimensions within the size envelope set out within the development description (i.e. overall blade tip height of between 185-200m, a rotor diameter of between 149-164m, a hub height of between 112-125m).

A drawing of the size envelope of the proposed wind turbine is shown in the detailed drawings in Appendix 1-1 of this EIAR.

Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic details differentiating one from another.

The wind turbines that will be installed on site will be conventional three-blade turbines, geared to ensure that the rotors of all turbines rotate in the same direction at all times. Each discipline

[3] https://www.eirgridgroup.com/site-files/library/EirGrid/ECP-2-1-Solar-and-Wind-Constraints-Report-Area-I-v1.0.pdf

within this EIAR has assessed the full range of various types and sizes of turbines within the above-mentioned envelope to ensure all scenarios within the proposed range have been assessed. The exact combination of rotor diameter and hub height will be dictated by the final selection of the turbine make and model at turbine selection stage/pre-construction. At this stage, new turbine models or variants may be available, due to advancements in technology, that were not on the market at the pre-planning / EIAR stage, but which will fit within the assessed turbine envelope.

The Wind Energy Development Guidelines (2006) are currently in force and are also the subject of a targeted review. The current design has had cognisance of the Draft 2019 guidelines, in particular in relation to:

- Shadow flicker – it is proposed to eliminate shadow flicker;
- Electrical grid connection – grid connection cables are proposed to be underground; and
- Proximity to sensitive receptors – a minimum turbine set-back of 4 times the maximum tip height (200m) is provided.

Further to this, the proposed layout has achieved a high level of separation between dwellings and turbines by providing a minimum separation distance of >800m which is in compliance with the setback requirements in the 2006 and Draft 2019 Guidelines.

2.6.2.1 Turbine Blades and Nacelle

The turbines will be of the generic three bladed, tubular tower model with horizontal axis. The rotor blades are bolted to the central hub, which is connected to the nacelle. The nacelle typically holds the following turbine components:

- Generator
- Electrical components
- Aviation lighting to IAA specifications

The blades of modern turbines are generally made of fibreglass or carbon fibre reinforced polyester and are aerodynamically shaped to improve efficiency and lower noise production.

A turbine blade usually begins generating electricity at wind speeds of 2 to 4m/s with optimum power generation at wind speeds of approximately 9 to 16m/s. Turbines usually shut down at wind speeds greater than 25m/s in order to protect themselves from excessive wear, although some turbines are designed to operate at up to 30m/s. Modern turbines typically turn at between 3 and 20 revolutions per minute (rpm) depending on wind speed and design of turbine.

The entire nacelle (shown in Figure 2-2) and rotor are designed to rotate, or 'yaw', in order to face the prevailing wind. A wind vane located on the nacelle of the turbine controls the yaw mechanism. Rotors of all the proposed turbines will rotate in the same direction. A control unit is located at the base of the turbine and an internal ladder or lift leads up to the nacelle where the shaft, gearbox and generator are located.

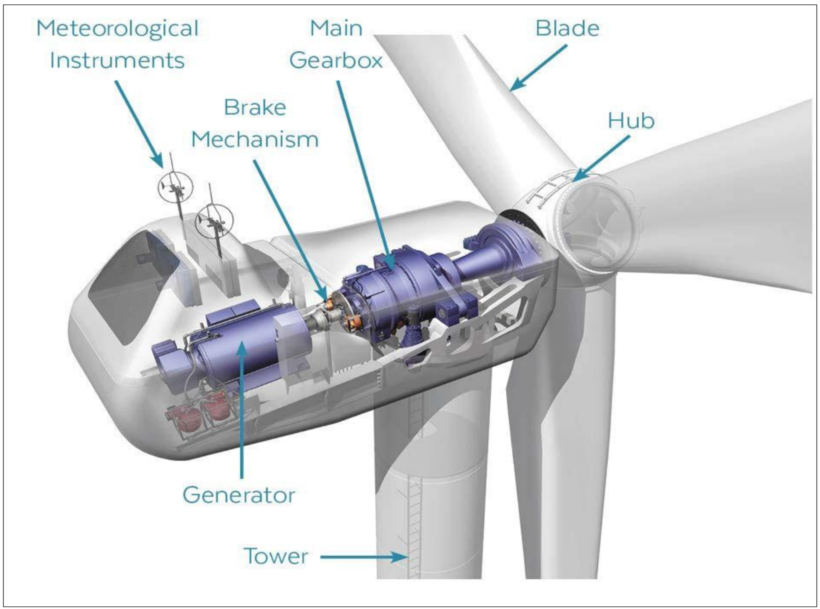


Figure 2-2 Turbine nacelle and hub components

2.6.2.2 Turbine Tower

The turbine tower is a conical steel tube with multiple-layer paint finish. Modern tower design also provides for the use of concrete sections. Towers generally comprise a steel ring at the base of the tower which is assembled on top of the concrete foundations using locally supplied concrete and then pre-stressed. The tower is delivered to site in three to six sections. The first section is bolted to the steel base, which is cast into the concrete foundation. The base of the tower is around 5m in diameter, tapering to approximately 2-3m where it is attached to the nacelle (Figure 2-2). The tower is accessed by a galvanised steel hatch door, which will be kept locked except during maintenance. The nacelle dimensions can vary depending on the final hub height and the model which is used. The exact details of the turbine tower will be dictated by final selection of the turbine make and model, but will be within the design envelope assessed, as described above.

2.6.2.3 Turbine Transformer

When operating, the rotational energy of the blades is utilised to drive the wind turbine generator. The generated power is in the form of low voltage (approximately 660 volts) and connected via low voltage cables to the wind turbine transformer located within the tower or in the turbine nacelle. This transformer steps up the generated low voltage to medium voltage (approximately 33kV) which supports a reduction of electrical losses when transmitting power over large distances. The medium voltage from the wind turbine transformers connects to the proposed on-site substation which again will be stepped up to high voltage for connection to the transmission system.

2.6.2.4 Turbine Foundations

Construction of the turbine bases will require excavation of the surrounding soil from the foundation and crane hardstanding area to founding level with access being provided from adjacent roads at or near the surrounding ground level. The soil will be replaced with granular fill where required.

Each wind turbine will require a reinforced concrete (RC) foundation comprising a base slab bearing onto rock or other competent substrata with a central upstand to support the tower. The foundations for each turbine will be designed by the appointed Civil Designer. The exact size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. It is anticipated to be between approximately 20-26m in diameter with thickness of 3m at the centre tapering towards the edge. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier. For the purposes of assessing the turbine range for this EIAR, a maximum volume of 1000m^3 of concrete and a minimum volume of 550m^3 has been assumed.

The turbine foundation transmits any load on the wind turbine into the ground. After the foundation level of each turbine has been formed on competent strata, the bottom section of the turbine tower or "can" is levelled (Plate 2.2 below). Reinforcing steel is then built up around and through the can (Plate 2.3 below), and the outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete.


Plate 2-2: Levelled turbine tower "can" Plate 2-3: Steel reinforcement being added

2.6.2.5 Turbine Colour

The turbines are multi-ply coated to protect against corrosion. It is proposed that the turbines will be of an off-white or light grey colour to blend into the sky background. This minimises visual impact as recommended by the following guidelines on wind energy development:

- *Wind Farm Development – Guidelines for Planning Authorities* (2006);
- *Draft Revised Wind Energy Development Guidelines* (2019);
- "The Influence of Colour on the Aesthetics of Wind Turbine Generators" – ETSU W/14/005333/00/2000.
- Planning Advice Note 45, Annex 2: Spatial Frameworks and Supplementary Planning Guidance for Wind Farms (2008). The Scottish Office Environment Department
- Planning Policy Guidance Note 22: Renewable Energy Annex on wind energy. (1993) PPG22, Department of the Environment, Welsh Office.
- Technical Advise Note (TAN) 8: Renewable Energy (2005) Welsh Assembly Government

2.6.3 Turbine Delivery Route, Internal Access Roads and Hardstanding

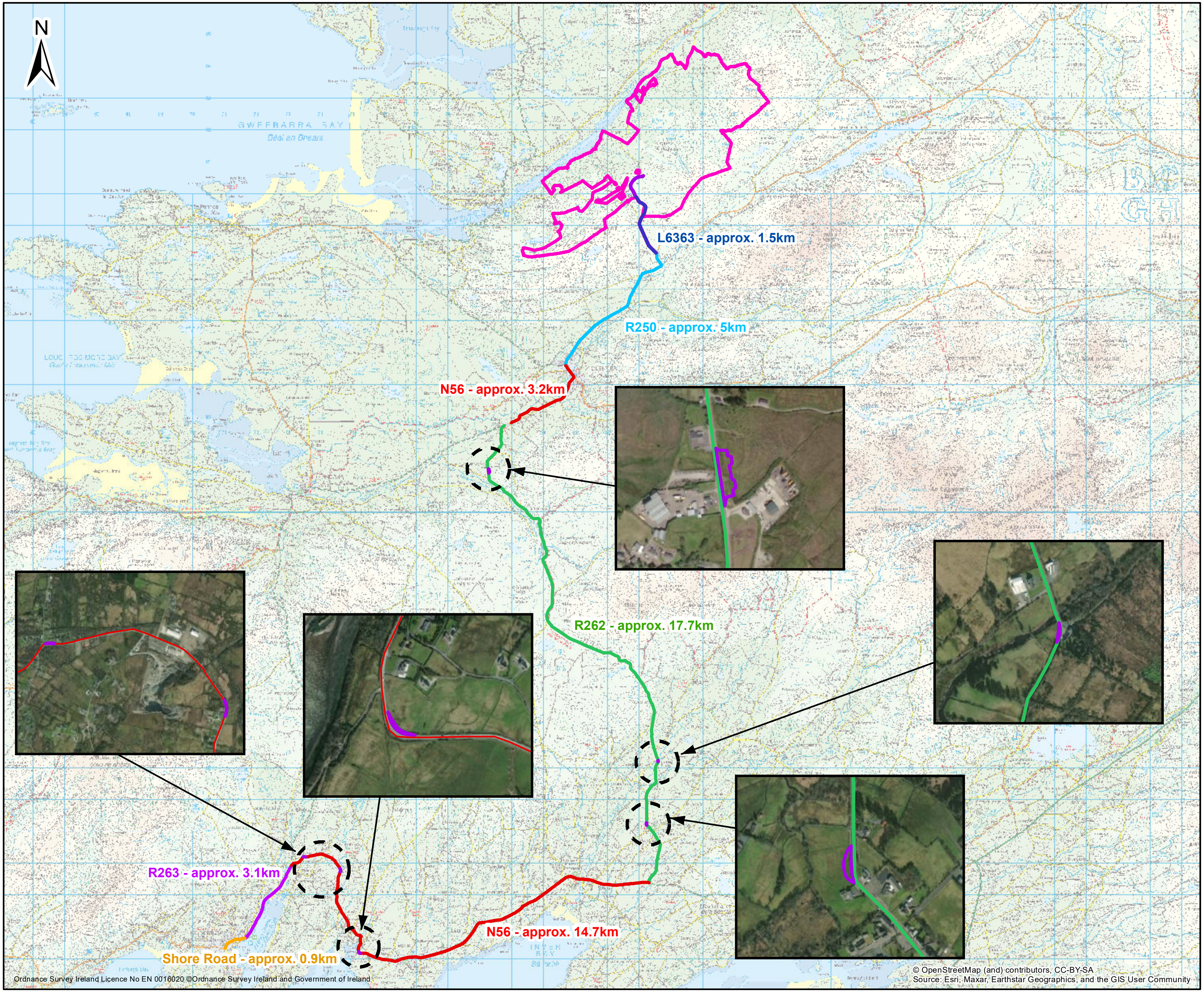
2.6.3.1 Turbine Delivery Route

It is proposed that the turbine components will be delivered to the site via Killybegs Port in southwest County Donegal as shown in Figure 2-3. The route heads north from the port in Killybegs on the R263 to the N56 where it turns eastwards. The route then continues generally eastwards on the N56 to the junction with the R262, where it makes a northerly turn in the direction of Glenties. The route continues northwards to a proposed temporary blade changeover location (where the turbine blades are mounted on a vertical blade transporter for the rest of the route). It then runs north to re-join the N56, where it turns eastwards to Glenties. In the town of Glenties the route joins the R250 and continues traveling in a north-easterly direction until turning to the northwest onto the L6363 local road. It then turns onto the L6483 where it continues to the site entrance for the proposed wind farm.

An assessment of the route between Killybegs Port and the site of the proposed wind farm has been carried out. A number of potential pinch points have been identified and assessed (see the Turbine Delivery Route Assessment Drawings as Appendix 2-1 to this EIAR). An assessment was carried out using site visits and Autotrack to determine what, if any, temporary works are required at these pinch points to allow the turbine components to be moved to the site. The outputs of this autotrack assessment are provided in the drawings of Appendix 2-1. Works range from hedgerow trimming/clearing to facilitate oversail to the temporary placement of hardcore to allow the oversize vehicles pass, or to allow the transfer of turbine blades between different vehicles. The required works at each location are detailed in the drawings within Appendix 1-1.

The current application includes the proposed temporary works along the public road corridor of the turbine delivery route, and further consents/agreements will be obtained for other works areas along the route, as required. All works along the route are assessed as part of this EIAR.

At the end of the construction phase, any areas which were given temporary hardcore surfaces will be reinstated by being covered in topsoil and reseeded. The field drain at the temporary blade changeover area will be restored during the first dry period after the turbines are delivered. Stock proof fences will be erected along the property boundaries. It is not anticipated that there will be any requirement to use these areas in the operational phase of the proposed project, except in the very unlikely event that a turbine requires a large replacement part such as a blade or tower section. This will need to be agreed with Donegal County Council and involved landowners, and relevant consents obtained if required in the unlikely event of such a situation.



Legend *

Proposed Wind Farm Site Boundary

Turbine Delivery Route works

Turbine Delivery Routes

- L6363
- N56
- R250
- R262
- R263
- Shore Road

* all land identified is within Boundary of the Proposed Project

0 1 2 3 4
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:

Cloghercor Wind Farm ltd.

Project:

Cloghercor Wind Farm

Title:

Figure 2-3:
Turbine Delivery Route

Scale @ A4: 1:150,000

Prepared by: S.Pezzetta
Checked: J.Staunton
Date: January 2023

Project Director: O.Fitzpatrick

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Draft: A

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2.6.3.2 Internal Access Roads

The proposed wind farm site will be accessed via the L6483 local road using two access points (See Figure 2-3). Access point one will be used as a main entrance point during the early stages of construction until such time as the internal access roads are constructed as far as access point two. At that stage access point two will be the main site exit and access point one will be the main site entrance. A one-way system will be in place for construction traffic on the local road network, as described in Chapter 16 (Traffic & Transportation).

Access point one will be located in the townland of Cloghercor on the L6483 and will be the single access/egress point for wind farm maintenance vehicles during the operational phase. During the construction phase, access point two will use a permitted, not yet constructed, forest entrance on the L6483, further east in the townland of Clogheracullion. It will not be used during the operational phase for the proposed wind farm and will be used as a forestry entrance only. Internal access roads will be constructed as part of the initial phase of the construction of the wind farm. Material will be sourced from the proposed onsite borrow pits to provide the required base material of the internal roads. The final graded surface material may be sourced from local quarries (such as Glenstone Quarry, Drimkeelan Sandstone Quarry and Mountcharles Sandstone Quarry all located to the south of the site), which are discussed in Chapter 16 (Traffic & Transportation). The internal roads will be permanent (construction/operational) roads.

During the operational phase, there will be a separate public entrance (access point three) in the townland of Cloghercor to easily access the proposed car park and amenity facilities (located at the intersection of the proposed grid connection cable and the L6483).

New roadways will have a running width of approximately five metres (5.5m including shoulders), with wider sections at corners and on the approaches to turbine locations. The proposed new roadways will incorporate passing bays to allow traffic to pass easily while traveling around the site. Soil excavated as part of the construction of the internal access roads will be sidecast, bermed and profiled on either side of the roadway as detailed in the Spoil and Peat Management Plan (Appendix 8-2). It is proposed that the majority of excavated material will be used locally on site for landscaping, with the remainder being used for borrow pit reinstatement.

All new roadways will be constructed with a 2.5% camber to aid drainage and surface water runoff. A drainage design has been provided for the proposed site roads. Road Construction Details and associated drainage design are included in the drawings of Appendix 1-1.

The majority of roads onsite will be of the excavated road type, with some floating roads in areas of peat, as described in Chapter 8 (Land, Soils & Geology) and represented on drawings in Appendix 1-1.

Occasional surface maintenance may be required in the operational phase of the proposed wind farm, but this is anticipated to be very minimal and will be dependent on the level of use on any section.

2.6.3.3 Hardstands

Hardstand areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate large cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The size, arrangement and positioning of hard-standing areas are dictated by turbine suppliers, but for the purposes of this planning application, a worst case design has been used to cover a range of different turbine models, measuring not greater than 168m at the longest point and 60m at the widest point. The turbine hard-standing areas are shown on drawings in Appendix 1-1. The hard-standing area is intended to safely accommodate a large 350-750 tonne SWL crane during turbine assembly and erection.

The hard-standing areas shown on the detailed layout drawings are indicative of the sizes required, but the extent of the required areas at each turbine location may be optimised within the area which has been assessed depending on topography, position of the site access road, the proposed turbine selection and the turbine supplier's requirements. The designs shown represent a worst case based on a number of typical designs from various manufacturers. The hardstands that will be constructed will be smaller than the proposed hardstand areas and will be located within the footprint of this. Occasional surface maintenance may be required in the operational phase of the proposed wind farm, but this is anticipated to be very minimal and infrequent. The EIAR utilises this worst case when determining the quality, significance, extent and duration of potential impacts.

2.6.3.4 Assembly Area

Unbound, levelled assembly areas will be located on either side of each hard-standing area, as shown on Drawings in Appendix 1-1. These assembly areas are required for offloading turbine blades, tower sections and hubs from trucks until such time as they are ready to be lifted into position by cranes. They will be surfaced with clause 804 material or similar.

2.6.4 Electrical Grid Connection

2.6.4.1 Onsite Electricity Substation

It is proposed to construct one onsite 110kV electricity substation within the site, as shown on the site layout drawings in Appendix 1-1. This will provide a connection point between the wind farm and the proposed grid connection point at the existing 110kV overhead line in Cloghercor.

The construction and electrical components of the substation will be to EirGrid and ESB specifications within the parameters assessed[4] (copy available as Appendix 2-3). The dimensions of the proposed substation compound will be up to 202m in length by 125m in width. The substation footprint will include one control building and electrical components necessary to export generated power from the wind to the transmission system. A second smaller building will be required for switching procedure with site offices and welfare facilities.

The main control building will measure up to 18m by 25m and 8.3m in height. A second smaller switchgear building will measure up to 30m by 10m. Layout drawings of the both buildings are shown in the planning drawings in Appendix 1-1.

The substation and compound will be surrounded by steel palisade fencing which will be approximately 2.6m in height. Internal fences will also be provided to segregate different areas within the main substation compound. Lighting will be required on site and this will be provided

[4] EirGrid specification for the underground cabling can be accessed at: https://www.eirgridgroup.com/site-files/library/EirGrid/10-110-kV-Underground-Cable-Functional-Specifications.pdf

by lamp standards located around the substation and exterior wall mounted lights on both buildings.

The main control building and smaller switchgear building will include the (Independent Power Producer) IPP and ESB control room, as well as an office space and welfare facilities for staff during the operational period. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the proposed project, there will be a very small water requirement for occasional toilet flushing and hand washing. It is proposed to install a rainwater harvesting system as the source of water for this, with all potable water being brought onsite in bottles.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off-site by a permitted waste collector to a wastewater treatment plant. It is not proposed to treat wastewater on-site, and therefore the guidelines and legislation surrounding that do not apply.

Such a proposal for managing the wastewater arising on site has become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal. The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. Full details of the proposed tank alarm system will be submitted to the Planning Authority in advance of any works commencing on-site.

The wastewater storage tank alarm will be integrated with the on-site electrical equipment for alarm notification that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site. It is anticipated that this material would be collected by a waste collector in Donegal. It is envisaged (and for the purposes of this EIAR assumed) that any such contractor will access the site via the R250 and L6363.

2.6.4.2 Internal Underground Cabling

Each turbine will be connected to the proposed on-site substation at Cloghercor via underground MV cables. Fibre-optic cables will also connect each wind turbine to the wind turbine control system located within the control building. The electrical and fibre-optic cables running from the turbines to the onsite substation compound will be run in cable ducts approximately 1.5 metres below the ground surface within the proposed internal roads and/or their verges (or within a directional drill bore where a stream is required to be crossed).

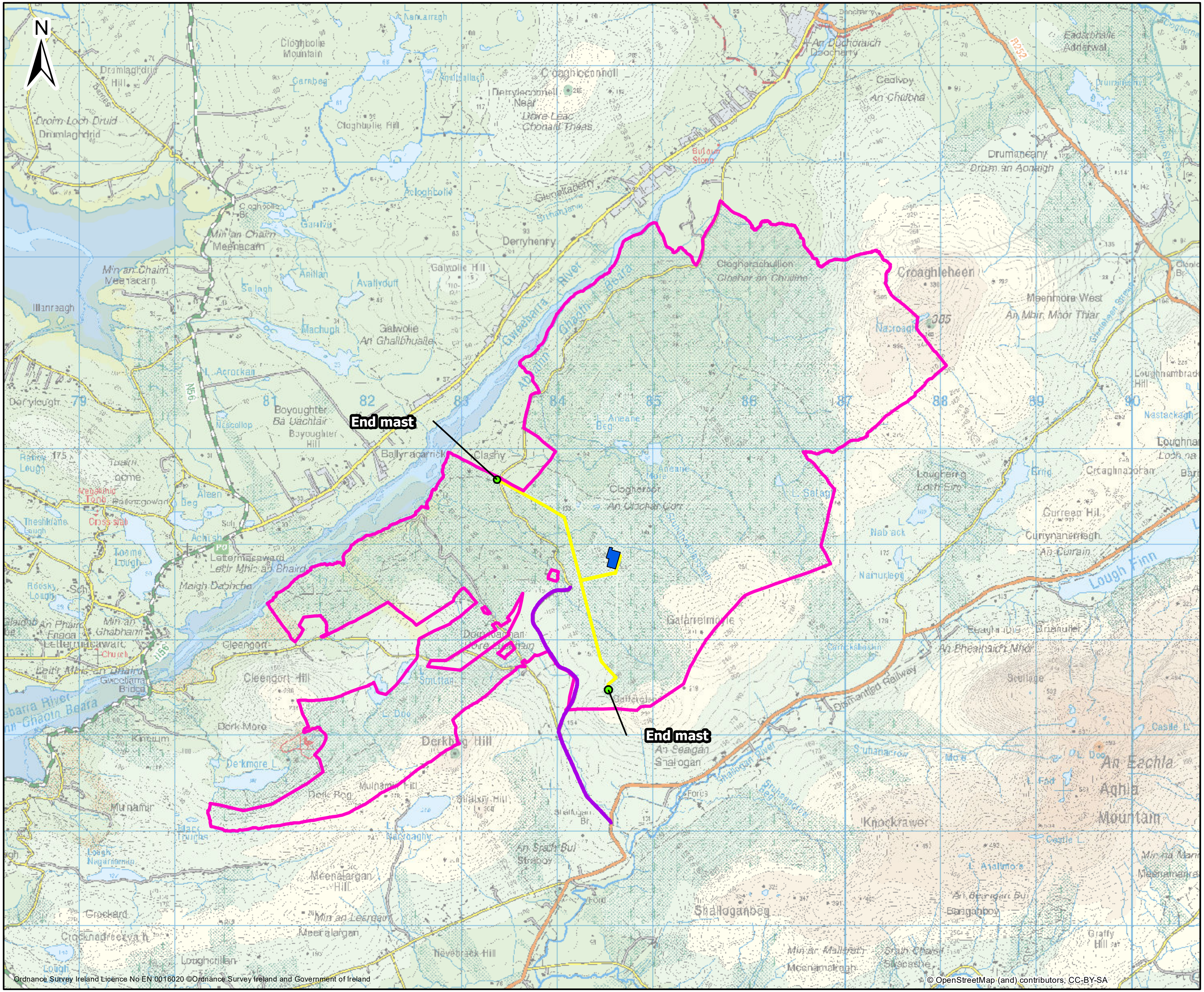
2.6.4.3 Grid Connection Route

Connection will be sought from the grid system operators by application to EirGrid. It is proposed that the proposed onsite substation will connect via 110 kV underground cable to an existing overhead line, though no new sections of overhead lines are required for this connection.

The proposed route of this underground cabling route is provided in Figure 2-4. The overall length of the grid connection between the proposed substation and the existing overhead line is approximately 3.86km, all of which are within the site of the proposed wind farm boundary, with almost no use of public roads apart from a single location where it perpendicularly crosses the L6483. Sections of the underground cabling will double-up within the same trench, resulting in a longer length of cable than length of trench. Two new overhead end masts will be required at the interface points on the existing overhead line, to allow the connection to be made. Twenty six existing wooden polesets and one steel end mast (drawing 05725-DR-100 in Appendix 1-1) will be removed as part of the grid connection works.

The grid connection will cross perpendicular to a section of public road in proximity to the most northern interface end mast (End Mast 147A). Furthermore, the second interface end mast will be located between the existing pole sets 161 and 162 respectively. Further information of these interface end masts can be seen in the drawings of Appendix 1-1.

The grid connection construction methodology is described in Section 2.10.7 below, and a detailed report is provided as Appendix 2-4.



Legend ✱

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Proposed Grid Connection Route
- Substation Location

✱all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 2-4:
Proposed Grid Connection Route

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta
Checked: J.Staunton
Date: January 2023

Project Director: O.Fitzpatrick

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Draft: A

The proposed underground cabling will traverse off-road internal access tracks purposely build for the wind farm. The cables will be laid in trenches as per EirGrid Specification (See Typical Trench Bedding Details in Appendix 2-3). There will be 2 no. stream crossings along the grid connection route. No instream works are proposed for any natural stream. Further information on the grid connection stream crossings can be found in Section 2.10.7 below.

2.6.5 Joint Bays

Joint bays are pre-cast concrete chambers where individual lengths of cables are joined to form one continuous cable. Joint bay locations have been selected to maximise the lengths of cables, following consideration of cable detailed design issues, the space requirements for cable drums and cable pulling equipment as well as the impact on local residents and road users. The joint bays will be located at various points along the ducting route as specified by EirGrid requirements and as shown in the drawings of Appendix 1-1.

A joint bay will be constructed in a pit. The bay will measure up to 6m x 2.5m x 2m deep as shown in the drawings of Appendix 1-1. A reinforced concrete base and sides will be constructed in the bay to accommodate the jointing enclosure.

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

2.6.6 Watercourse Crossings

There are 2 no. watercourse (stream) crossings on the proposed grid connection route. The locations of these crossings are shown on Figure 2-4. A number of minor forestry drainage channels were also present, though these remain dry for the vast majority of the time. Section 2.10.7 below provides further details on the methods proposed to cross each location.

The internal site cabling for power and communication cables will be in trenches within the internal access roads, and where stream crossings are required they will be built into the bridge deck formation, avoiding any in-stream works.

2.6.7 Rural (Local) Electricity Supply

As part of the development, a rural/local supply will be required as a back-up power supply to the proposed substations for light, heat and power purposes, and to the proposed met mast. The rural/local supply will be designed and constructed by ESB Networks.

It is not anticipated that there will be any significant works required for this, and it will be similar to what normally occurs for new house connections. Should permission be granted the details of the connection route and works will need to be determined by ESB Networks prior to construction, but as it will be a local electrical connection, the works will be minimal in nature.

The rural/local supply will have an associated step-down transformer (i.e. MV to LV) and will enter the substation building by underground cable and terminate onto the control building distribution board.

2.6.8 Meteorological Mast

One permanent meteorological mast is proposed as part of the proposed project. The mast will be equipped with wind monitoring equipment at various heights. The mast will be located as shown on the site layout drawing in Figure 2-1 and will be a slender, free-standing lattice structure of 100 metres in height, as shown in the drawing of Appendix 1-1.

The mast will be constructed on a hardstanding area of approx. 25m x 25m and will be used to erect the mast, adjacent to an existing site road.

2.6.9 Forestry

A large portion of the proposed works are located within an area which is currently planted with forestry. Some of this area is located within Coillte lands, while some is located within private lands. As part of the proposed project, there will be a requirement to fell some of this forestry in the areas immediately around the footprint of the wind farm infrastructure. The total area of forestry to be felled is estimated to be between 69.8ha - 90.9ha, as shown in Appendix 2-5. As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not.

For the footprint of the infrastructure, as part of the proposed wind farm, there will be full tree removal to facilitate the windfarm development infrastructure. Due to the fact there are many ages classes that are to be felled i.e. commercial and non-commercial timber, it is envisaged that any commercial timber will be removed from the site for haulage to a timber sawmill. A report detailing the forestry felling is provided as Appendix 2-5.

The proposed project must have obtained planning consent before an application can be made for a felling license from the Forest Service as per their policy on tree felling for wind farms. As part of this process, an area of at least an equivalent size to that which was felled must be replanted. This replanting land can be located anywhere within the state, provided an afforestation license is granted for the land. This replanting will be carried out at a number of suitable technically approved afforestation sites the state, and these will be located in a different county, therefore not having any cumulative impacts with the proposed wind farm (i.e not in the same river catchment, no ecological connections and with no potential for visual/landscape cumulative impacts with the wind farm.

2.6.10 Spoil Management

The use of the borrow pits shall be phased. This will then allow materials to be placed in the first borrow pit thereby minimizing the volume of soils requiring temporary storage. In order to further reduce temporary storage requirements, reinstatement of soils and turves around infrastructure, and in restoration and landscaping works on areas of excavated / disturbed ground, will be carried out during the construction phase or as soon as is practical after the completion of the works in any one area of the site. Approximately 178,000m^3 will be excavated from the borrow pits onsite. A total of 184,000 m^3 will be used to reinstate the borrow pit area as well as for landscaping.

Topsoil and sub-soil are to be stockpiled separately. Turves will be stored turf side up and will not be allowed to dry out. Stockpiles are to be isolated from any surface drains and a minimum of 50m away from watercourses. Measures such as interceptor ditches around the bases of these areas, sediment traps and seeding of the bunds shall be incorporated to prevent runoff of suspended solids laden surface water and soil erosion. No permanent spoil or stockpiles will be left on site.

The method for restoration of excavated or disturbed areas is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface.

To prevent erosion and run-off and to facilitate vegetation reinstatement, any sloped embankment will be graded such that the slope angle is not too steep and that embankments match the surrounding ground profile.

2.6.11 Stone and Fill Requirements

As part of construction of the proposed project, a significant amount of stone and aggregate fill material will be required. This will be used under and around key infrastructure including the turbines, substation, site roads, hardstands and construction compounds. The following are the approximate estimates of the material requirements at the various main infrastructure locations:

- Internal Access Tracks – 40,000m^3 of which 34,000m^3 will come from onsite borrow pits;
- Substation and Construction Compounds – 28,000m^3 of which 24,000m^3 will come from onsite borrow pits;
- Turbine Foundations – 20,200m^3 from external source; and
- Turbine Hardstand, Blade set-down area and vehicle turning area – 144,700m^3 of which 120,000m^3 will come from onsite borrow pits.

By sourcing the majority of the required stone volume from the onsite borrow pits as described above, the volume of traffic that will occur on public roads in the area will be significantly reduced. Further information on the proposed traffic volumes and impacts are discussed in Chapter 16 of this EIAR (Traffic & Transportation).

Hardstands and site roads will be constructed to be above the existing ground level. The lower layer of this will be lower grade stone, with the top 150mm being high quality compacted gravel. Internal cable trenches which connect each turbine to the proposed onsite substation will be up to a maximum of 1500mm deep, with the first 600mm being backfilled with sand. The excavated material will be used to complete the backfilling to the surface.

2.6.12 Borrow Pits

It is proposed that 4 no. borrow pits will be constructed as part of the proposed project, in order to provide a source for the majority of stone material requirements within the site itself. These are located near T13, T14, T4/T5, and T1/T2, with each covering an area of approximately 1.1ha, 1.3 ha, 4.6ha and 2.4ha respectively. The locations of these borrow pits can be seen on the site layout drawings in Appendix 1-1. Having four borrow pits onsite will minimise material transport on site and will minimise the depth to which the borrow pit excavations will be required.

Further details of the site investigations that were carried out and the stone type/suitability are provided in Chapter 8 (Land, Soils & Geology).

Once the required rock has been extracted from each borrow pit, they will be reinstated using any surplus inert material from the site (including peat) and made secure using permanent stock proof fencing.

Rock and fill material may need to be extracted from a number of proposed turbine foundation locations as part of the required excavations there. In that case, this material will be used where possible to replace the material requirements from borrow pits, meaning the figures above may be lower than mentioned above. It is proposed that the onsite borrow pits will be used for the long-term storage of peat which is excavated around the site. Once all of the required stone has been mined from each borrow pit, it will be reinstated using excess spoil from the site, most of which will be peat. As these will be excavated into the ground, peat stability risks associated with storage will be mitigated.

2.6.12.1 Rock Extraction methods

The rock will be extracted from the proposed borrow pits using two main methods: Rock breaking and rock blasting. It is anticipated that the primary method will be rock breaking.

2.6.12.2 Rock Breaking

Rock breaking can be used to extract rock in many situations and is particularly suitable for any brittle rock and rock near the surface. A hydraulic rock breaking attachment is fitted to the arm of a large tracked excavator, and this breaks large pieces of rock from the ground. These large rocks are broken down into smaller pieces using these hydraulic rock breaking attachments, until they are small enough for use or to fit into a rock crusher. At that point, a large loader feeds them into a mobile rock crusher, where they are crushed, graded into various sizes, and removed by the loader for use on site. The potential noise impacts of rock breaking have been assessed in Chapter 12 (Noise & Vibration).

2.6.12.3 Rock Blasting

Rock blasting is an effective way to produce a large volume of broken stone in a very short time, as the blasts only last a number of milliseconds. All parts of the blasting process from drilling to explosives handling to execution of the blast itself will be designed and carried out/overseen by a specialist engineer. In order to carry out a blast, a number of holes are drilled into the rock over several days. Once these are prepared, the required amount of explosives will be brought to the site and installed in the holes. The explosive material will not be stored on site, and the transport and handling of the material, as well as the carrying out of the blast will be carried out with agreement and supervision of An Garda Siochána. The charges will be set, the area will be cleared and the blast carried out by a specialist engineer.

After a blast, the rock will be able to be loaded into a crusher with a loader and processed for use on site.

Based on site investigations undertaken within the proposed project site rock blasting will be required due to the strength and low fracture density of the underlying granite bedrock. In the event when blasting is required, local residents and noise sensitive locations will be notified of the upcoming blast. The potential noise impacts of blasting have been assessed in Chapter 12 (Noise & Vibration).

2.6.13 Recreational Facilities

Cloghercor Wind Farm Ltd. is committed to enhancing the recreation experience currently on offer in the area as part of the proposed project. A summary of the proposed recreation plan is set out below. Further information is provided in the full recreation plan (Appendix 2-6).

The proposed wind farm site is an accessible area with existing forest road infrastructure. A commercial forest, it is already used by some nearby residents for walking. However, there is limited use of the forest for walking by outlying communities possibly due to the absence of signage and insufficient awareness of the opportunities.

Following an examination of the current use of the site and the opportunities for enhancement in consultation with key stakeholders a recreational plan has been incorporated into the proposed project.

The main themes of walking, signage, car parking and associated trail infrastructure identified have been addressed as follows:

- Walking: 2 no. trail loops of different lengths and thus differing degrees of difficulty have been proposed:
  - Loop 1 (circa 8km walking trail)
  - Loop 2 (circa 10km walking trail)
- Car parking: A permanent public car park is proposed at the end of the construction phase of the development at an existing forest entrance on the L6483. This will provide a trailhead/landing point for visitors to the site and enable visitors from the surrounding area to visit the amenity facilities.
- General information and wind farm information signs are also proposed around the site to attract visitors to the site and promote interest in the provision of renewable energy at this location. A general information/welcome sign is also proposed at the above-mentioned car park.
- Directional signs along the internal site roads are proposed at junctions to direct visitors appropriately.
- A viewing area to enjoy the Gweebarra vista, with an information panel and seating area.

2.6.14 Biodiversity Enhancement Lands

It is proposed to ensure that appropriate land management practices are in place for approximately 252 ha of existing extensively farmed land. These land management practices will be prescribed to enhance those lands as suitable habitats for Red Grouse and the Irish Hare, as detailed in Appendix 7-9 (Golden Eagle Habitat Management Plan). Both species are key prey resources for the Irish Golden Eagle population. These lands will be located at least 3km from a proposed wind turbine.

The objective of the habitat management plan will be to enhance populations of Red Grouse and Irish Hare, which are key prey resources for the Irish Golden Eagle population. The habitat management plan for these lands, available in Appendix 7-9, includes details of the range of management measures that will be available to be implemented. A bespoke habitat management plan will be prepared for each landholding, which will select the relevant measures that are applicable to the land, based on the habitats present and their condition.

2.6.15 Site Entrance

The construction of a new site entrance for the proposed wind farm is located along the L6483 road between Doochary and the L6363. This entrance will be the main construction phase entrance to the site. It will facilitate material deliveries to the site (stone, steel and concrete) and staff access, as well as large oversize components such as turbine blades, tower sections and substation components. For further information see Chapter 16 (Traffic & Transportation) and the Traffic Management Plan (Appendix 2-7). This entrance will also be used for wind farm maintenance vehicles during the operational phase of the proposed project as well as ongoing forestry activities. It is also proposed to utilise a permitted forest entrance further north along this same L6483 road as a second/alternative construction phase entrance. A newentrance on the L6483 (northwest of the proposed T16) will be used as the entrance to an operational phase public car park and amenity facilities.

The proposed site entrances on the L6483 will have adequate visibility as also discussed in Chapter 16 (Traffic & Transportation).

2.6.16 Turbine and Construction Material Transport Routes

Turbine and Construction materials will be restricted to the following routes:

- Construction materials coming from all directions will approach along the R250 accessing the site entrance from the south via the L6363 and L6483; and
- Turbine and oversized loads will access the site from the N56 along the R250 accessing the site entrance from the south via the L6363 and L6483.

2.6.17 Traffic Management

As described further in Chapter 16 of this EIAR, Traffic and Transport, the successful completion of this project will require significant co-ordination and a comprehensive set of mitigation measures. As outlined in Section 16.4 of this EIAR, these mitigation measures will be put in place before and during the construction and operational phase of the project in order to minimise the effects of the additional traffic generated by the proposed project. A Traffic Management Plan proposed for the project is included as Appendix 2-7.

2.7 SURFACE WATER MANAGEMENT

2.7.1 Existing Site Drainage

The proposed wind farm is located within the Gweebarra-Sheephaven Water Framework Directive (WFD) catchments (hydrometric area) which covers an area of 1451km^2 in west Donegal. These catchments are further subdivided into sub-catchments with the site located within the Gweebarra_SC_010 WFD sub-catchment and the Mulnamin_Beg_010 WFD river sub-basin which covers an area of 32.4km^2. All of these waters are of moderate to steep gradient, representing natural watercourses typical eroding/upland rivers, that are actively eroding, where there is little or no deposition of fine sediment.

Streams flow in a general southeast to northwest direction into the Gweebarra Estuary. It is noted that all the streams within the site are collectively identified as the Mulnamin Beg 10 subcatchment.

Lough Aneane More and Aneane Beg are located downgradient of T6 and T11 towards the centre of the site. A small lake, Lough Sallagh, is located to the south of T9. Derkmore Lough and a smaller unnamed lake are located to the west of the ownership boundary but are not hydrologically connected to the proposed wind farm.

The afforested site and adjacent lands also include man-made drains which flow into the watercourses mentioned above. These are primarily used to assist in the drainage of forestry and agricultural land-use. Small streams and drainage ditches on site will be crossed by the proposed access tracks.

Further details on the existing and proposed site drainage are provided in Chapter 9 of this EIAR, Hydrology & Hydrogeology.

2.7.2 Drainage Design Concept

The proposed surface water drainage system utilises sustainable drainage devices and methods.

The drainage layout for the operational stage of the proposed project has been designed to collect surface water run-off from roads, crane pads and hardstanding areas for treatment and to maintain the existing site discharge rates. Run-off arising from the development will discharge into settlement ponds specifically constructed for managing surface water from the wind farm. Details and locations of the proposed settlement ponds are shown on the drawings of Appendix 1-1. Once treated in the settlement pond the treated surface water will then be allowed to spread across the adjacent lands via a level spreader /diffuser which will minimise any risk of soil erosion and allow further filtration of any remaining sediment particles. This treated water will ultimately percolate to ground or travel over-ground and be assimilated into the existing drainage network within the boundary of the proposed project at appropriate greenfield run-off rates. There will be no direct discharges from the wind farm to any existing natural watercourse.

During the construction phase, all run-off from construction areas will be controlled and treated to reduce suspended solids concentration prior to being discharged into the existing drainage network or overland. A number of temporary settlement ponds will be established during the construction phase along roadways and in areas of high construction activity to minimise silt laden run-off entering the drainage network. The settlement ponds will be designed to provide sufficient retention time and a low velocity environment to allow suspended solids to fall out of suspension prior to allowing the water to outfall to the receiving environment. Further information on the runoff calculations and site drainage is provided in Chapter 9 (Hydrology & Hydrogeology). The proposed locations of the permanent and temporary settlement ponds, and details of same are shown on the drawings of Appendix 1-1.

A Surface Water Management Plan (SWMP) has been prepared (Appendix 9-1). The purpose of this plan is to ensure that all site works are conducted in an environmentally responsible manner so as to minimise any potential adverse impacts from the proposed project on surface water quality. The plan incorporates the following specific objectives:

- Provide overall surface water management principles and guidelines for the construction phase of the proposed project;
- Address erosion, sedimentation and water quality issues; and
- Present measures and management practices for the prevention and/or mitigation of potential downstream impacts.

During the operational phase of the project, the management of surface water will be carried out in accordance with the proposed design and associated management features such as settlement ponds which will have been installed during the construction phase and will be maintained through the operational phase. The drainage design will ensure that any surface water arising from the proposed wind farm during operation will be contained and treated to ensure it can be dispersed out from the proposed project without any significant impact on existing downstream activities.

The decommissioning phase will not require any significant works that will impact on the drainage network. Works in this phase will primarily involve disassembling the turbines and removing off-site. It is not envisioned that site roads, turbine foundations or the grid connection infrastructure would be removed. The site roads would remain as part of an amenity facility while the hardstand material could be removed and along with the turbine foundations, covered in topsoil and revegetated. The substation and grid connection infrastructure will form part of the permanent national grid network.

The protection of water quality and prevention of pollution events requires a sustained and concentrated input from the Contractor with regard to the provision and maintenance of sediment control structures. The drainage system is described in further detail in Chapter 9 of this EIAR (Hydrology & Hydrogeology).

2.7.2.1 Silt Control

Silt control measures e.g. check dams and silt bags, will be implemented during the construction process.

Dewatering silt bags (See Figure 2-5) allow the flow of water through them while trapping any silt or sediment suspended in the water. The silt bags provide a passive non-mechanical method of removing silt from silt-laden water collected from works areas within a construction site. Silt bags will be disposed of by a licensed waste contractor.

In specific locations, silt fences (See Figure 2-5) will be installed as an additional water protection measure around existing watercourses, particularly where works cannot be avoided within the 50-metre buffer zone of a natural stream. These trap sediment particles in a fine mesh and allow water to pass through. Works within 50m of such streams are avoided where possible.

A mobile silt-buster (See Figure 2-5) can be employed at the site, which uses advanced filtration technology to remove suspended particles from the water. Such a measure is most likely to be deployed in the turbine excavations or borrow pits during periods of activity but can be used at any excavation location) This is very effective, with a small footprint, and is also very mobile with the potential to move around the wind farm site. These units are recommended by the Scottish Environmental Protection Agency (SEPA) and the UK Environmental Agency for use on construction sites for the treatment of pumped dirty water.

Check dams (also known as silt traps) will be used throughout the proposed site drainage system to minimise sediment transport (See Figure 2-5). They will generally be spaced at regular intervals along the proposed drainage network. These will slow down the movement of water in site drains, and thereby reduce the amount of sediment transported by the water. Stones/gravel will be used at each dam to reduce soil erosion, to stabilise the dam and aid in filtration. Settlement ponds (See Figure 2-5) will be constructed at various locations around the site of the proposed wind farm, particularly in areas of high activity as described in further detail in Section 2.7.2 above. Depending on this area being drained and the site conditions, there may be multiple settlement ponds positioned in sequence. These ponds cause the water velocity to slow down significantly, allowing suspended solids to precipitate out, with rock curtains and geotextile membranes positioned to capture any sediments that do not settle out. They are constructed using an excavator, with regular inspections and maintenance to ensure they are operating efficiently. They will be emptied as required to remain effective. They will be constructed and maintained as per the *Good Practice during Wind Farm Construction* document[5].

Level spreaders/diffusers will be used where overland discharge of water is carried out. They prevent soil erosion at these locations by spreading out and slowing down the water.

[5]https://www.nature.scot/sites/default/files/2018-08/Guidance%20-%20Good%20Practice%20during%20wind%20farm%20construction.pdf

Figure 2-5: Examples of Proprietary Silt Control measure Trench Drainage

Trenches will be required as part of the proposed project, primarily for installation of ducting and cables between each wind turbine and the onsite substation, and as part of the grid connection works to connect to the existing 110kV overhead line. It is not anticipated that drainage will be a significant issue in the proposed project trenches, but the following measures will be employed to reduce the potential for water build up in trenches, and to deal with any water that does arise.

- Trenches will be dug in short sections at any one time to avoid potential for water flowing through them.
- Excavation works will not be carried out during periods of heavy precipitation.
- In the event that some surface water does accumulate in the trench, this will be allowed to percolate into the ground naturally. In the unlikely event that this is too slow, the water can be pumped/vacuum tanked out and released into the proposed wind farm drainage system for subsequent treatment.
- Any excavated material which is not transported away immediately will be stored on the up-gradient side of the trench so that the downgradient trench will collect any runoff that does occur. In the event that unusually heavy precipitation is forecast, this will be temporarily covered with a protective plastic sheet.

2.7.3 Culverts & Clear-Span Bridges

Culverts will be required where site roads or hardstands cross minor forest drain networks. The use of culverts will only be employed for minor field/forest drains (which are dry or stagnant) or proposed new site drainage channels and will not be used to cross any streams on site. There are 12stream crossings required for the proposed site road network, for which the proposed crossing methodology is a clear-span bridge. The use of a clear-span bridge here will avoid the requirement for in-stream works. All proposed stream crossings will utilise clear span structures. For the clear span structures, the existing banks will remain undisturbed and no in-stream excavation works are proposed. Therefore, there will be no direct effect on the stream at the proposed crossing location.

Where culverts are required for smaller drains, precast concrete or plastic culverts of between 300-900mm in diameter shall be provided, a typical detail of which is shown in Appendix 1-1. The clear-span bridges will be sufficiently above the stream to allow unrestricted flow of water beneath. The proposed clear-span bridge location and design detail are provided in Appendix 1-1. The construction method for these structures is described in Section 2.10 below.

2.8 CONSTRUCTION MANAGEMENT

2.8.1 Construction Activities and Timing

A CEMP is included as Appendix 2-2 of this EIAR. This sets out the main environmental considerations and mitigation measures to be incorporated into and complied with during each phase of the proposed project and will be referred to by the main contractor onsite. The CEMP will be updated prior to construction to account for any alterations to mitigation measures that may have been added during the planning process and to comply with any conditions.

It is anticipated[6] that 96-139 persons will be employed during the peak construction period (See Chapter 5 – Population and Human Health) and it is estimated that the construction phase will take approximately 24 months from starting onsite to completion of commissioning of the turbines. Where practical, vegetation clearance that is required during construction works will commence outside the breeding birds season, which runs from the 1st of March to the 31st of August.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs weekdays and between 7:00hrs and 14:00hrs on Saturdays.

However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours) or to accommodate delivery of large turbine components along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with Donegal County Council.

The construction phase can be broken down into 5no. main phases as follows (there will be overlap between these):

- 14 months – Civils (including site roads, hardstands, turbine foundations, forestry felling, drainage)
- 6 months – Electrical grid connection/substation installation and commissioning
- 12 months – Site electrical (installing between turbines and substation, pulling cables)
- 4 months – Turbine deliveries and erection
- 2 months – Commissioning

The phasing and scheduling of the main construction task items are outlined in Figure 2-6, where January 2026 has been selected as an arbitrary start date for construction activities. Where there

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[6] http://www.ewea.org/fileadmin/files/library/publications/reports/Wind_at_work.pdf

is overlap between phases, this reflects the anticipated progression of work through the site, with different areas within the site at different stages of completeness

ID	Task Name	Task Description	2026 Q1 Jan-Mar	Q2 Apr-Jun	Q3 Jul-Sep	Q4 Oct-Dec	2027 Q1 Jan-Mar	Q2 Apr-Jun	Q3 Jul-Sep	Q4 Oct-Dec
1	Site Health and Safety									
2	Site Compounds	Site compounds, site access, fencing, gates								
3	Site Roads	Construct roads, install drainage measures, install culvert, install water protection measures								
4	Turbine Hardstands	Excavate base, construct hardstanding areas								
5	Turbine Foundations	Fix steel, erect shuttering, concrete pour								
6	Substation Construction & Electrical Works	Construct substation and grid connection, underground cabling between turbines								
7	Backfilling & Landscaping									
8	Turbine Delivery and Erection									
9	Substation Commissioning									
10	Turbine Commissioning									

Figure 2-6: Indicative Construction Schedule

2.9 CONSTRUCTION METHODOLOGIES

2.9.1 Site Roads (including passing bays)

Site roads will be constructed to each turbine location, and to all proposed site infrastructure as shown in the site layout drawings of Appendix 1-1, with a proposed running width of 5m. Passing bays will be included along roads strategically, as indicated in Appendix 1-1, and there will be a number of site entrances. There are three road construction methodologies to be considered at the proposed project: upgrading of existing site roads; floating new road and excavated new road. These are described below in further detail.

Sections of new roads and upgraded roads are shown on drawings in Appendix 1-1. Where required, the road widths will be increased to a maximum of 9.5m to form the indicated passing bays, as shown in drawings in Appendix 1-1.

2.9.1.1 Excavated New Road

Tracked excavators will carry out excavation for roads with appropriate equipment attached. Any surplus excavated material will be dealt with as set out in the CEMP (Appendix 2-2 of this EIAR), within the spoil management section. Where the proposed project footprint is located on any mineral-based soil, this material can be either side-cast, profiled and bermed as close to the excavation areas as practical, or in the case of peat it will be used to reinstate the borrow pits). Peat has a limited potential for use in site landscaping. The sides of the excavated areas will be battered/sloped sufficiently to ensure that slippage does not occur.

When the topsoil has been removed and/or the formation layer has been reached, stone from the onsite borrow pits shall be placed to form the road foundation. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at subbase level. The sub grade will be compacted with the use of a roller or other approved compaction method. The final top dressing of unbound material will not be provided until all turbine bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. This capping surface may be required to be sourced from local quarries.

Once no further stone material is required from the proposed on-site borrow pits (i.e. at the end of the civil works stage of the project construction phase), any material which had been temporarily stored on the site will be used to re-instate the borrow pits.

All on-site roads will be maintained for the duration of the construction and operational phases of the project.

2.9.1.2 Floating New Road

Monitoring posts will be installed prior to construction to monitor movement of soils in the area around the construction. A base geotextile membrane will be laid directly on top of the peat/soil surface, and a suitable granular fill will be placed on top of this. The stone will be levelled with an excavator or bulldozer and rolled to provide a suitable surface. The stone material will either be tipped over a long area (>10m) or in several small piles rather than being tipped in one location to prevent excess soil loading and compaction.

To ensure a smooth transition between excavated and floating access track, a short (10-20m) length of the access track will have all peat excavated and filled with a suitable fill, which will be graded to allow for an appropriate transition.

The final top dressing of unbound material will not be provided until all turbine bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. This capping surface may be required to be sourced from local quarries. All on-site access tracks will be maintained for the duration of the construction and operational phases of the project.

Sections of a new floating access track are shown on the planning drawings (Appendix 1-1). Access track widths will be increased to form the indicated passing bays, as shown on drawings in Appendix 1-1.

2.9.1.3 Upgrade of Existing Site Road

The site of the proposed project has an existing network of site roads present which have been incorporated into the proposed design as much as possible.

Where an existing road needs to be widened, it will be carried out on one or both sides as required, and the same steps as described in the new road construction above will generally be followed. Tracked excavators will carry out excavation for roads with appropriate equipment attached. Any surplus excavated material will be dealt with as set out in Section 2.10.1.1 above. When the topsoil has been removed and/or the formation layer has been reached, stone from the onsite borrow pits shall be placed to form the road foundation. The foundations will be built up to the same height as the existing road and if appropriate the entire width of the road will be built up to the required level. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at subbase level. The sub grade will be compacted with the use of a roller or other approved compaction method. The final top dressing of unbound material will not be provided until all turbine bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. This capping surface may be required to be sourced from local quarries.

Once no further stone material is required from the proposed on-site borrow pits (i.e. at the end of the civil works stage of the project construction phase), any material which had been temporarily stored on the site will be used to re-instate the borrow pits.

All on-site roads will be maintained for the duration of the construction and operational phases of the project.

Further details of the construction methodology for upgrading existing site roads is provided in the Spoil Management Plan, provided as part of the CEMP in Appendix 2-2.

2.9.2 Proposed Clear-Span Bridge & Culverts

There are 12 proposed stream crossing as part of the proposed works, as shown on the site layout drawings (Appendix 1-1). This crossing method will avoid in-stream works entirely at these stream crossing locations. Firstly, the site access tracks will be constructed as far as possible to allow easy access to the works area. Following this, the topsoil will be stripped from the foundation footprint on either side of the stream, taking care to avoid disturbing any part of the stream bed or banks. Suitable stone fill material (clause 804 or similar) will be added in layers and compacted to form the base of the foundation. The precast clear-span bridge will be placed onto this either as one or more pieces. There will be no requirement for large-scale casting of wet concrete. Following this, barriers will be attached to the sides of the bridge structure, and the site access tracks will be constructed over the structure.

There are 2 no. upgrades needed for existing piped culverts (see Section 9.4 of Chapter 9 (Hydrology and Hydrogeology). Where plastic culverts are required on site, they will be over-sized for the expected water flow rates, and to allow passage of fauna through. They will be installed with a minimum gradient of 1%. The plastic pipe will be placed into the drain bed, and some of the substrate will be placed within the pipe to benefit biodiversity (for further information see Section 6.4.3 of Chapter 6 of this EIAR (Biodiversity). The use of corrugated culverts will aid in the retention of sediment, thereby naturalising the culvert bed. Large stones will be placed at the culvert outfall to dissipate any flow and reduce the potential for erosion. The culverts will be inspected regularly to ensure they do not become blocked.

2.9.3 Proposed Site Drainage

The site of the proposed wind farm will have both temporary (for the duration of the construction phase) and permanent drainage infrastructure installed as part of the proposed site development. These features include site drains and silt control measures (check dams/silt dams) as described in Section 2.8 above.

The site drainage measures will be installed from the outset, being constructed at the same time as the initial civils works (site roads, hardstands, etc.). This will ensure that there is no uncontrolled runoff from the site during proposed works. Excavators will be used to construct the main drainage features (drains, settlement ponds, etc.), while small items such as silt dams/check dams will be constructed manually. Silt fences which trap suspended particles will be erected manually ahead of civil works as required on particularly steep ground, or near streams.

2.9.4 Temporary Compounds

At the commencement of the construction phase, a temporary compound area will be constructed to provide office space, welfare facilities, car parking and hardstands for storing materials. At a later stage of the site development (when the construction works reach the northern end of the site) a second compound area will be constructed there as per the proposed site layout to provide additional facilities onsite. These will cover approximately 1.4 and 1.7ha each, and the 2 no. locations are shown on the site layout drawings (Appendix 1-1). At the end of the construction phase, the compounds will be removed, with any stone being used towards reinstatement of the nearest onsite borrow pits. After removal of the compound, the area will be replanted with forestry as described in Appendix 2-5.

The site accommodation will consist of temporary porta-cabins constructed on a granular platform. The topsoil will be stripped where development of the temporary compounds are proposed. The compounds shall be constructed to heights of up to approximately 0.5m above existing ground level.

2.9.5 Public Car Park & Recreation Area

During the operational phase of the proposed project, a gravel public car park for the proposed amenity trails will be located at a new entrance on the L6483 (See the Drawing

10798-2003, in Appendix 1-1). This will be constructed in a similar way to the site roads, on a granular platform. The topsoil will be stripped where development of the car park is proposed. Stone fill will be used with a well compacted suitable stone for the surface layer. A number of picnic tables will be installed and informational signage, including a site map will be placed adjacent to the car parking area. Further detail on the recreational plan for the proposed project is included as Appendix 2-6 (Recreational Development Plan).

2.9.6 Turbine Hardstand, Foundations and Erection

The topsoil will be stripped where development of the hardstands are proposed. The hardstands shall be constructed to heights of up to approximately 0.5m (on average) above existing ground level.

Ground investigations in the form of trial pitting, probing, and use of augers have been carried out along the proposed turbine locations and hardstanding locations to inform the depth of excavation and upfill required (See Appendix 8-1 (Site Investigation Report)). Following site visits and site design, volume calculations provide an estimation of worst-case fill required for the hardstands.

This is predicted to be up to 144,700m^3 of material. This material volume will be obtained primarily from the onsite borrow pits with only the surface 150mm layer to come from local quarries which are within reasonable proximity to the site.

The geotechnical investigations to date indicate that the foundations at the proposed wind farm will be excavated. Piling is not anticipated to be required.

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator and will be stored as detailed in the CEMP (Appendix 2-2), within the Spoil Management section. The sides of the excavated areas will be sloped sufficiently (2:1 or as determined by a suitably qualified site engineer) to ensure that slippage does not occur. Precise excavation depths and batter requirements will depend on soil types locally and the turbine manufacturer requirements. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation, or for reinstatement elsewhere on site (such as the borrow pits). If the excavated material is peat, it will be brought straight to reinstate the borrow pit. The excavated material will be smoothed with the back of an excavator bucket and surrounded by silt fences to minimise the potential for sediment-laden run-off occurrence.

In the case of gravity foundations, if the formation level is reached at a depth lower than the depth of the foundation, the ground level will have to be raised with clause 804 hardcore material and/or lean mix concrete, compacted in layers as required, with sufficient compaction effort. Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level with the spreader or settlement pond. It is not anticipated that piled foundations will be required.

An embankment approximately 600mm high and a fence or berm will be constructed around the perimeter of each turbine base to prevent construction traffic from driving into the excavated hole and also to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a gangway to a standard 1:12 grade, thereby allowing safe passage into/out of the foundation area.

Approved lifting equipment will be used to unload reinforcing steel to required areas. The bottom matt of steel will be fixed prior to the tower cans, if used, being lifted into position and reinforcing steel will be positioned and fixed in accordance with the turbine suppliers' requirements. The detailed design and exact dimensions will be determined once a turbine manufacturer has been selected following a competitive procurement process.

Formwork to concrete bases will be propped/supported sufficiently to prevent failure. Concrete for bases will be poured using a concrete pump. After a period of time when the concrete has set sufficiently, the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be filled with suitable fill (i.e. hardcore) up to existing ground level. The working area around the perimeter of the foundation will be backfilled with suitable material (hardcore). These hardstand areas around the turbines will be levelled, compacted and finished with a suitable surface material for traffic (clause 804 or similar) as per the site access tracks and remainder of the hardstand areas.

2.9.7 Grid Connection

As stated above, the proposed wind farm will connect to the existing national grid via the onsite substation and associated underground grid connection. The onsite substation and associated grid connection has been assessed in this EIAR, along with the required works to allow connection to the grid at the existing overhead line in Cloghercor.

Once fixed into position, the substation and electrical grid connection will be commissioned and made live to allow removal of the existing wooden polesets, part of the overhead line. The internal site cabling (between turbines and the substation) will remain off until the turbines are being commissioned and the wind farm enters into service.

Full details of the description of the Grid Connection works, and the construction methodologies for each element are provided in Appendix 2-4. The construction methodologies for the various elements of the grid connection are summarised below.

2.9.7.1 110 kV Substation and Electrical Works

The proposed substation will be designed and constructed to meet all the required EirGrid/ESB standards within the parameters assessed in this EIAR. An area will be levelled and built to the required level with stone fill material, capped by high quality compacted stone. Two control buildings will be constructed using traditional techniques for constructing small buildings (i.e. concrete block walls, timber and slate tile roof). Foundations will be built for all of the proposed electrical infrastructure. All the electrical equipment will be installed to EirGrid/ESB requirements. Perimeter fencing will be constructed around the substation compound for security and safety purposes. The substation and electrical infrastructure will be commissioned. Further information and drawings of the substation and electrical infrastructure are provided in Appendix 1-1 while the associated construction methodologies are provided in Appendix 2-4.

2.9.7.2 110 kV Underground Cable Trenches

The number and layout of cables is an important consideration in the design of the site. Minimum safety distances and angles etc. must always be maintained. This has been a fundamental consideration in determining the final location of the substation buildings and electrical infrastructure. Further information and drawings of the underground 110kV cable trenches are provided in Appendix 1-1 while the associated construction methodologies are provided in Appendix 2-4. Copy of EirGrid 110 kV cable installation specifications are provided as Appendix 2-3.

The cables will be installed for the majority within the internal access roads and partly within the existing public road corridor for a perpendicular crossing as indicated on the site layout drawings in Appendix 1-1 and described in Section 2.6.4 above. A section of the route (approximately 1km) will also be located within/adjacent to the proposed main site access road, but an access track will be put in place over the entire route. It should be noted that works within the public road corridor will also be subject to further consents/agreements with local authorities, for example a Road Opening Licence as appropriate.

A Traffic Management Plan (TMP) has been prepared for the proposed project and is included as Appendix 2-7. This is a living document and will be updated ahead of construction to address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Board, in the event planning permission is granted. Also, a confirmatory survey of road condition, including the condition of all road water crossings on the route, will be carried out along the grid connection route in advance of any works.

All cables will be laid in underground ducts. Ducts will be installed mostly by open trenching. The typical sequence of operations for installing ducts in trenches is to firstly strip off the ground material and topsoil (if present). A trench is then formed to the required depth and width. The ducts are generally laid on a bed of lean mix concrete and surrounded with lean mix concrete. Any surplus soil (after trench reinstatement) will be used for local restoration and landscaping or used for borrow pit reinstatement on site. Where contaminants are found (or where bitumen-based materials are present) the material will be removed from site and disposed at an appropriately licenced facility. The top of the trench will generally be finished at ground level with a surface suitable for vehicular use as per EirGrid/ESB specifications. The use of gravel in this instance will ensure the track is permeable and eliminate the potential for surface water runoff.

The underground cable required to facilitate the grid connection will be laid beneath the ground surface and/or public road using the following methodology:

- The area where excavations are planned will be the subject of a confirmatory survey, prior to the commencement of works, with a cable locating tool and all existing underground services will be identified.
- A verification condition survey will be carried out for all parts of the route within the public road. Details of this survey will be agreed with the local authority in advance of the survey.
- A trench will be opened using an excavator to accommodate the formation required.
- The excavated material will be cast to the side to be reused as backfilling material where appropriate. This material will not be stored in the vicinity of any watercourse and will be smoothed with the back of an excavator bucket to minimise runoff. It will be cast on the upgradient side of the trench, so if any runoff did occur it will run into the down gradient trench. Excess material will be used on the site of the proposed wind farm for local landscaping, borrow pit reinstatement.
- Silt fences will be installed alongside the road/works areas as required near streams.

- Clay dams/plugs will be installed at regular intervals (depending on the gradient) to prevent conduit flow of water within the trench.
- Works will not be carried out during periods of heavy precipitation. In the event that some surface water does accumulate in the trench, this will be allowed to percolate into the ground naturally.
- The trench will be surfaced as per the road surface specifications of the local public road, the wind farm road, or (in the case of off-road section) an EirGrid/ESB specification gravel access track capable of supporting maintenance vehicles if required.
- Cable joint pits are normally located at regular intervals as shown in the site layout drawings (Appendix 1-1). Each joint pit will be approximately 2.5m x 6m in size with a communications chamber and an earth link box in close proximity to the joint pit as shown in the detail drawing (Appendix 1-1). They have been located where possible in accessible areas away from watercourses. They will be constructed off the public road. A temporary surface is provided over these for safety and to allow easy access until the cables are pulled, after which time the area will be permanently reinstated/surfaced as appropriate. The location of these joint pits are provided on site layout drawings provided in Appendix 1-1.
- It is anticipated that construction will be carried out by a single team (with plant items likely to include excavators and dumpers) along the route, but there is a possibility to use two separate teams to speed up the construction. It is expected that each team could lay approximately 150m of the route per day.

Further details on the design for the grid connection cable trenches are provided in Appendix 1-1 while the associated construction methodologies are provided in Appendix 2-4.

2.9.7.3 Overhead Line End Masts

Twenty six existing wooden polesets and a single steel lattice angle mast (Drawing 05725-DR-100 in Appendix 1-1) between the two new interface end masts will be removed as part of the grid connection works. Once the new underground cable is energised the wooden polesets and steel angle mast will be removed by an excavator and incorporated back into the stock for further use, in line with ESBN best practise procedures.

The new interface end masts at the northern and southern ends of the proposed grid connection will be constructed by installing the foundations and lower section of the mast first. The upper sections of the masts will only be constructed when the rest of the grid connection infrastructure is ready to become live. This approach will minimise the amount of time the main 110kV line must be switched off. Further details on the design for these end masts are provided in Appendix 1-1 while the associated construction methodologies are provided in Appendix 2-4.

2.9.7.4 Stream Crossings

The proposed grid connection contains 2 no. stream crossings. These are shown in Figure 2-4 and the site layout drawings in Appendix 1-1. Table 2-2 below details the proposed methodologies for crossing the given watercourses shown in Figure 2-4.

Table 2-2: Watercourse crossing details

Watercourse Crossing No.	Crossing details	Proposed crossing methodology	In Stream works required?
1	**Stream**	Directional Drilling	No
2	**Stream**	Directional Drilling	No

The construction methodologies for the crossings are provided below. The route also contains minor forestry drains which are usually dry, and only contain water during periods of heavy rainfall. These will be crossed using open trench crossings during dry periods.

2.9.7.5 Crossing Methodology: Directional Drilling

A launch and reception pit is required for directional drilling, with each measuring approximately 1m wide, 2m long and 1m deep. Two ducts will be required at each crossing location. A specialised directional drill machine will be anchored to the ground and will drill at a suitable shallow angle to allow it to achieve the required depth for the bore. If ground conditions are unfavourable, the drilling process may need to be repeated using progressively larger drill heads until the required size is achieved. The drilling process involves pumping a drilling fluid through the drill head which is inert, natural and biodegradable (e.g. Clear Bore™). This fluid will be used sparingly and only as required to avoid an excess and will be appropriately stored when not in use. This fills voids locally around the drill head and enables the drill to progress without the hole collapsing. Should any excess drilling fluid occur, it will be contained and removed for disposal at a licensed waste facility. The duct will be positioned, and the launch and reception pits will be refilled.

Further details of this crossing method are provided in Appendix 1-1 while the associated construction methodologies are provided in Appendix 2-4.

2.9.8 Turbine Delivery Accommodation Works Areas

Where works are needed along the public road corridor to facilitate deliveries to site, they will be agreed in advance with the local authority and carried out to the appropriate standard (TII, purple book, etc.).

Where a temporary surface is needed for the turbine delivery route (including the blade changeover area), works will start with the clearing of any vegetation, and the topsoil will be stripped and either used locally for landscaping purposes/bermed for later use in reinstatement or used for borrow pit reinstatement onsite. Where local use for landscaping does occur it will be smoothed off with the back of a bucket and seeded with a suitable grass seed mix. Silt control curtains will also be employed within 50m of a surface watercourse. Topsoil material will not be used locally within 50m of a stream, and peat material will not be used if found to be present at any location. It is anticipated that the majority of material will be taken to the wind farm site for borrow pit reinstatement. It may also be taken to a local licensed/permitted waste facility if found to contain any contaminants such as bitumen. Suitable fill material (broken stone and clause 804) will be used to create a firm running area for the passage of turbine delivery vehicles. The areas will be fenced off when the delivery is not occurring. After the delivery of turbines to site, the site will be re-instated to the original condition with removal of the temporary surface, and any removed vegetation will be reseeded/replanted with a similar native species composition.

2.9.9 Permanent Meteorological Mast

The met mast installation works shall be carried out by a small crew and are described as follows:

- An access track shall be extended towards the mast location from the existing forestry track. The access track shall be 3.5m in width. Associated drainage infrastructure shall be extended also.
- A small aggregate crane pad shall be constructed in front of the proposed mast location.
- General construction methods for the above access track and hard standing shall match those described for wind farm access tracks and hard standings however the dimensions and stone depth requirements of the infrastructure will be considerably less than that required for that serving the wind turbine construction.
- The foundation shall be excavated followed by shuttering, steel fixing and finally concrete pouring by ready mix truck. Excavation and concrete operations shall be carried out in accordance with the CEMP (Appendix 2-2). The foundation shall be 10m x 10m x 1.8m in size.
- Following crane setup, the mast sections shall be delivered and unloaded by truck.
- In accordance with an agreed lifting plan, mast sections shall be lifted by crane into place. Wind speeds shall be monitored at all times during lifting operations by the lead climber and crane operator.
- Mast sections shall be bolted together by climbers.
- Following erection of main mast sections, lightning protection and other ancillary components shall be fixed to the mast.

The masts will be decommissioned using a similar methodology as the construction except in reverse.

2.9.10 Biodiversity Enhancement Lands

It is proposed to ensure that land management practices for approximately 252 ha will be prescribed to enhance those lands as suitable habitats for Red Grouse and the Irish Hare. This is discussed in detail in Chapter 7 of this EIAR (Ornithology). These lands are shown in Figure 1-1.

The land management being proposed for this area will involve vegetation management through livestock grazing and/or cutting and will not involve any excavations or construction. Agricultural land management practices for each plot of land will be prescribed and agreed with land owners.

2.10 ENVIRONMENTAL MANAGEMENT

2.10.1 Construction Phase Monitoring and Oversight

The requirement for a Construction and Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any wind farm site and submitted for agreement to the Planning Authority is now well-established.

A CEMP has been prepared for the proposed project and is included in Appendix 2-2. 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.

The construction contractor will be responsible for implementing the mitigation measures specified in the EIAR and CEMP and for communicating the requirements with all staff on-site. Their implementation of the mitigation measures will be overseen by the supervising Ecological Clerk of Works (ECoW), ecologists, archaeologists and/or geotechnical engineers, as appropriate.

The surface water drainage system will require regular inspection during construction works and during operations to ensure that it is working optimally. This is discussed further in the CEMP (Appendix 2-2).

2.10.2 Concrete Deliveries & Pouring

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place. The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area. These residual liquids and solids will be disposed of off-site at an appropriate waste facility (nearest one is located south of Donegal Town). Where temporary lined impermeable containment areas are used, such containment areas are either excavated and lined with an impermeable membrane or involve creating a temporary pool with a ring of straw square bales covered in a heavy gauge plastic sheet. This washout will be located near the site entrance so that it is easily accessed when departing all turbine locations. The location is shown on layout drawings in Appendix 1-1.

Due to the volume of concrete required for each turbine foundation (assumed approximately 1,000 m^3 as a worst case per turbine, but the exact figure will vary according to turbine manufacturers requirements and may be less than this), and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours. Such activities are limited to the day of turbine foundation concrete pours, which are completed in a single day per turbine.

Because of the scale of the main concrete pours that will be required to construct the proposed wind farm, the main pours will be planned weeks in advance, and refined in the days leading up to the pour. Disposing of surplus concrete after completion of a pour will be off-site at the concrete production facility.

The CEMP (Appendix 2-2) provides further details of best practice and environmental considerations in relation to concrete deliveries and concrete pouring.

2.10.3 Refuelling

Any easily manoeuvrable road-going vehicles will be refuelled off-site. For any vehicles which are slow moving or tracked or those for whom regular trips off-site to refuel will not be practical, on-site fuelling will be required.

A limited amount of fuel will need to be stored on the site within the construction compounds for this purpose, and this will be within a double skinned and bunded mobile tank which can be moved around the site using a 4x4 vehicle to refuel. This will be stored in the construction compound when not in use.

A spill kit in the form of a supply of fuel absorbent material and mats and a drip tray will be kept with the tank at all times. The drip tray and fuel absorbent mats will be used at all times during refuelling. Similar spill kits will be stored in each construction compound, and at the on-site substation in case of emergency.

No refuelling will be carried out within 50m of a stream.

Only designated trained and competent operatives will be authorised to refuel plant on site.

In the event of an accidental fuel spill, the source of the spill will be fixed, fuel will be contained and cleaned as quickly as possible using the fuel absorbent material in the spill kits. The incident will be reported to the site manager and Environmental Clerk of Works, and appropriate remediation will be carried out (i.e. soil removal for safe disposal at a licensed waste facility south of Donegal Town, etc.).

The CEMP (Appendix 2-2) provides further details of best practice and environmental considerations in relation to this.

2.10.4 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads and along the site roads to ensure dust does not cause a nuisance. If necessary, water will be taken from settling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this will transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff. The CEMP (Appendix 2-2) provides further details of best practice and environmental considerations in relation to this.

2.10.5 Waste Management

The CEMP (Appendix 2-2) provides an overview of the best practice in waste management during all phases of the proposed project, with a view to reducing, reusing, recycling and recovering waste produced, in that order of preference. Waste disposal will be avoided where possible. The WMP and waste management practices associated with the proposed project will be in accordance with relevant provisions of the Waste Framework Directive (Directive 2008/98/EC on waste), the Waste Management Act 1996 as well as all other Irish and EU legislation.

The main site contractor will appoint a Waste Manager who will ensure that all waste contractors have the correct permits for any waste streams they are removing from site, and that they are taking it to the appropriately licensed/permitted waste facilities. They will also ensure that all parts of the WMP will be implemented onsite.

2.10.6 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. Site roads will be already formed using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

However, in the interest of best practice and to avoid the potential for the transfer of alien invasive plant species into the site, it is proposed to install a self-contained wheel-wash system near the project site entrance (access points one and two). The drawings in Appendix 1-1 include typical details and proposed location of a proposed self-contained wheel-wash system which will be installed as part of the construction phase of works.

A road sweeper will be available if any section of the surrounding public roads becomes soiled by vehicles associated with the proposed project.

The CEMP (Appendix 2-2) provides further details of best practice and environmental considerations in relation to this.

During the operational phase, the onsite access tracks will be maintained in good condition, and any vehicles that need to access the site will be generally keeping on these surfaces. As a result of this, and the low volume of traffic expected on site, it is not anticipated that a wheel washing facility would be required during the operational phase.

2.10.7 Major Accidents and Natural Disasters

A review of the potential for the proposed project to be a source of hazard or interact with other sources of hazard, and that could result in a major accident and/or disaster during its construction and operation was undertaken.

This review looked at the existing design and mitigation measures committed to as part of this EIAR, to determine if adequate controls are in place to control any risk of an unplanned but possible event occurring during construction and operation.

In this regard, possible major accidents that could occur as a result of the proposed project (and its associated works) include:

- Loss of critical infrastructure;
- Significant contamination;
- Turbine collapse;
- Traffic accident;
- Turbine or substation fire or explosion; and
- Wind turbine rotational failure.

Possible natural disasters that might occur and potentially impact the proposed project (and its associated works) include:

- Flooding
- Severe weather;
- Fire;
- Peat stability; and
- Landslide.

The above potential major accidents and natural disasters are considered where relevant throughout the EIAR chapters, as listed below;

- Loss of critical infrastructure resulting in power failure has been addressed in the design measures incorporated into the grid connection of the proposed project;
- Risk of contamination through spillages or leakages onsite is assessed in Chapter 9 (Hydrology & Hydrogeology);
- Risk of fires, explosion and turbine collapse in terms of human health is assessed in Chapter 5 (Population & Human Health). An emergency response plan is included in the CEMP (Appendix 2-2).
- Risk of traffic accident onsite is assessed in Chapter 16 (Traffic and Transportation);
- Risk of wind turbine rotational failure is discussed in Chapter 5 (Population & Human Health);
- Risk of flooding is assessed within the Flood Risk Assessment, provided as Appendix 2-8 to this EIAR;
- Risk of severe weather is assessed in Chapter 14 (Air Quality and Climate);
- Risk of peat instability and landslide is assessed in Chapter 8 (Land, Soils & Geology). A Peat Risk Stability Assessment is provided as Appendix 2-9 to this EIAR.

2.11 HEALTH AND SAFETY

The proposed Cloghercor Wind Farm will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation as described in the CEMP (Appendix 2-2).

Aspects of the development that will present health and safety issues include:

- Health and safety aspects of construction activities;
- General construction site safety (e.g. slip/trip, moving vehicles etc);
- On site traffic safety (during construction and operational phases) associated with localised high road embankments;
- Traffic safety during the transport of oversized loads to the site;
- Lifting of heavy loads overhead using cranes;
- Working at heights; and
- Working with electricity during commissioning.

A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared prior to the construction stage. Further details are provided in the CEMP (Appendix 2-2).

The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Safety, Health and Welfare at Work (Construction) Regulations. The PSDP role has been performed by TOBIN Consulting Engineers up to the end of the planning stage of the project.

The PSDP and PSCS appointed for the project shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations as described in the CEMP (Appendix 2-2).

None of the construction, operational or decommissioning phases of the project are anticipated to cause a significant negative impact to safe practice of agricultural, forestry and commercial activities outside the development footprint.

It is not anticipated that the operation of the wind farm will present a danger to the public and livestock. Rigorous safety checks are conducted on the turbines during design, construction, commissioning and operation to ensure the risks posed to staff, landowners and general public are negligible.

Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.

Signs will be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. Further details are provided in the CEMP (Appendix 2-2).

The emergence of the Covid-19 virus in Ireland in the early part of 2020 has presented a new human health risk and concern amongst the general public across the country and within the proposed project study area. Proposals relating to Covid-19 (which could apply to similar other pandemics) are discussed in Chapter 5 (Population and Human Health).

An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing access for emergency services at all times.

The components of a wind turbine are anticipated to have a useful lifespan up to 35 years or more and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the wind farm regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site's health and safety requirements.

2.12 WIND FARM OPERATION

The proposed wind farm project is expected to have a lifespan of 35 years. This is the anticipated useful lifespan of wind turbines which are being produced for the market today. The lifespan of wind turbines has been increasing steadily in recent years and allowing this duration will improve the overall carbon balance of the development, therefore maximising the amount of fossil fuel usage that will be offset by the wind farm. Leaving the wind turbines in-situ until the end of their useful lifespan would make the most sense from an environmental viewpoint, particularly in relation to carbon savings. During this operational period the wind turbines will generally operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together, and data relayed from the wind turbines to a control centre off site. Each turbine will also be monitored off-site by the wind turbine supplier or Operations and Maintenance (O&M) service provider. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at a control centre 24-hours per day.

Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Typically, maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation components and site roads and drainage will also require periodic maintenance in accordance with appropriate operation maintenance plans, procedures and health and safety plans.

Once operational, it is estimated that the wind farm will support 2-3 full-time long term, high quality technical jobs on site in operation and maintenance as well as a more significant number of jobs in ancillary functions (estimated to be a total of between 29-47 jobs between direct and indirect employment based on research[7]). See Chapter 5 (Population and Human Health) for further information.

2.13 WIND FARM DECOMMISSIONING

As stated previously the wind turbines proposed as part of the proposed project are expected to have a lifespan of 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site will be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning of the proposed wind farm, the wind turbines will be disassembled in reverse order to how they were erected. All above ground turbine components will be separated and removed off-site for recycling. Turbine foundations will remain in place underground and will be covered with earth and allowed to revegetate or reseed as appropriate. Turbine hardstands will be removed, and the areas also allowed to revegetate or reseed as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in potentially significant environment nuisances such as noise, dust and/or vibration. The site roadways may be in use for additional purposes to the operation of the wind farm (e.g. for forest/agricultural and recreational access) by the time the decommissioning of the project is to commence, and therefore it will likely be more appropriate to leave the site roads in situ for future use.

The on-site substation will not be removed at the end of the useful life of the wind farm project as it will form part of the national electricity network. Therefore, the substation will be retained as a permanent structure and will not be decommissioned.

A detailed decommissioning plan will be agreed in advance of works taking place with Donegal County Council. A decommissioning plan is contained within the CEMP (Appendix 2-2).

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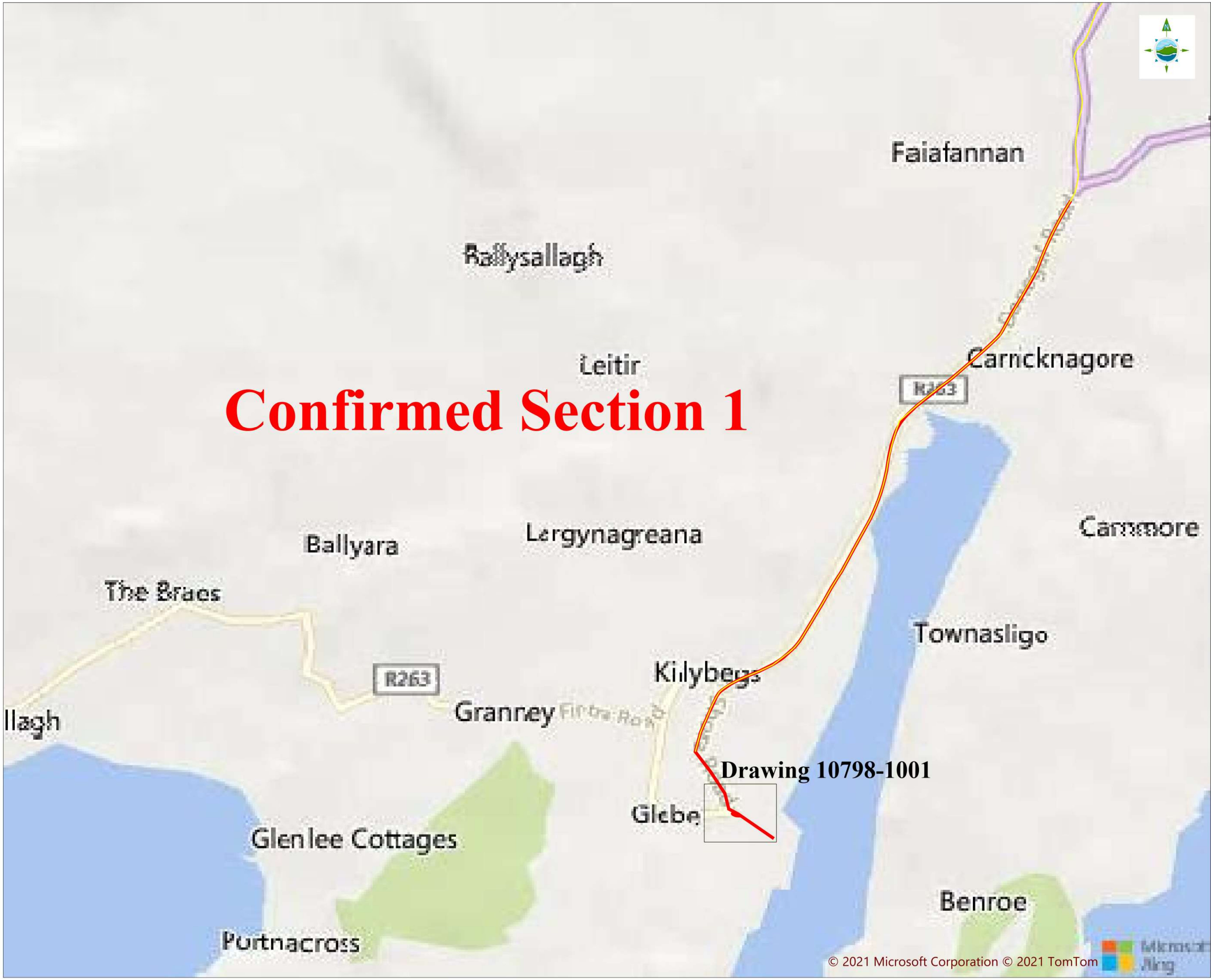
7 https://opus.lib.uts.edu.au/bitstream/10453/43718/1/Rutovitzetal2015Calculatingglobalenergysectorjobsmethodology.pdf

Appendix 2-1 – Turbine Delivery Route Assessment Drawings



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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 1

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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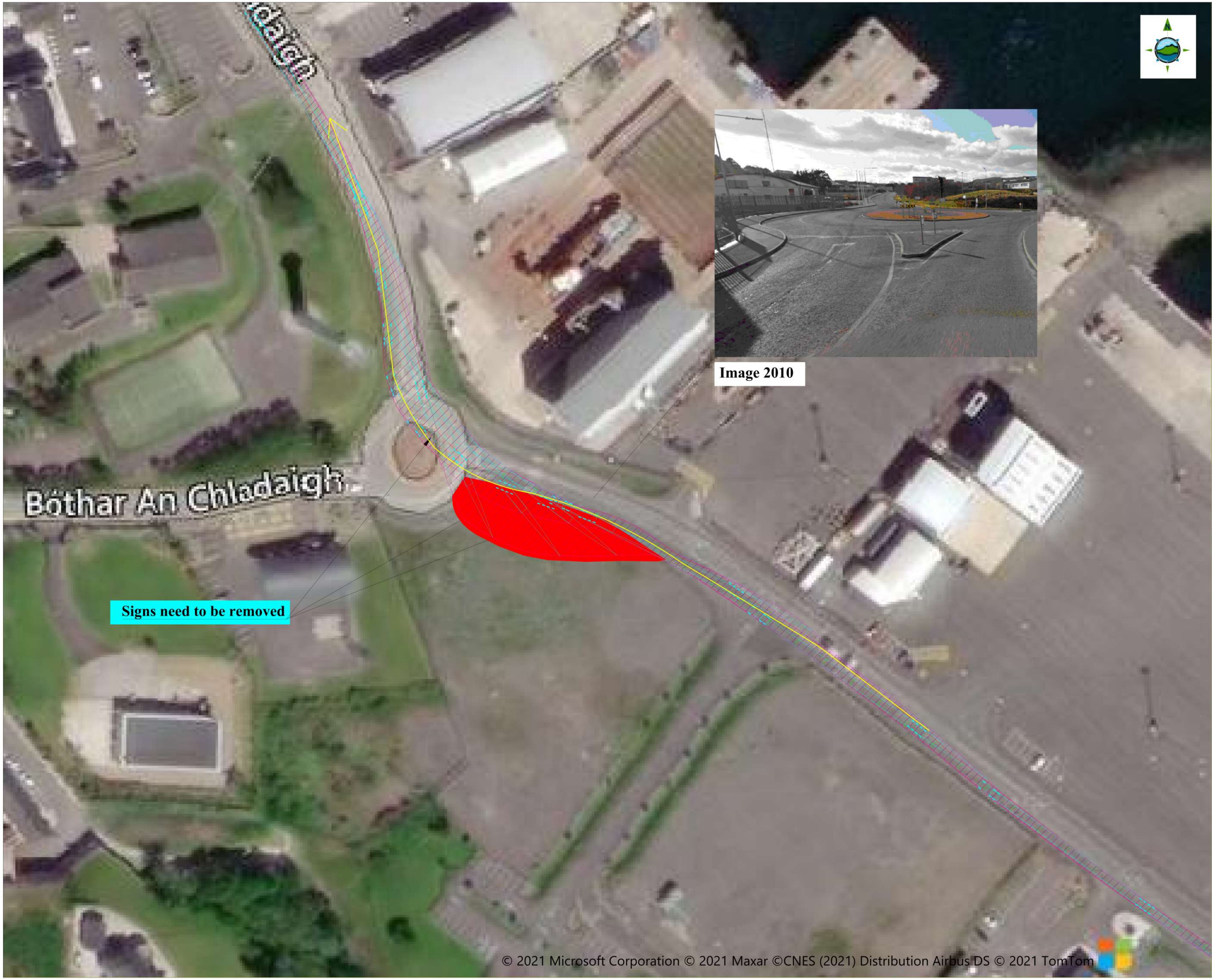

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PROPOSED PAVED AREA

OVERSAIL

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Project
Cloghercor Wind Farm

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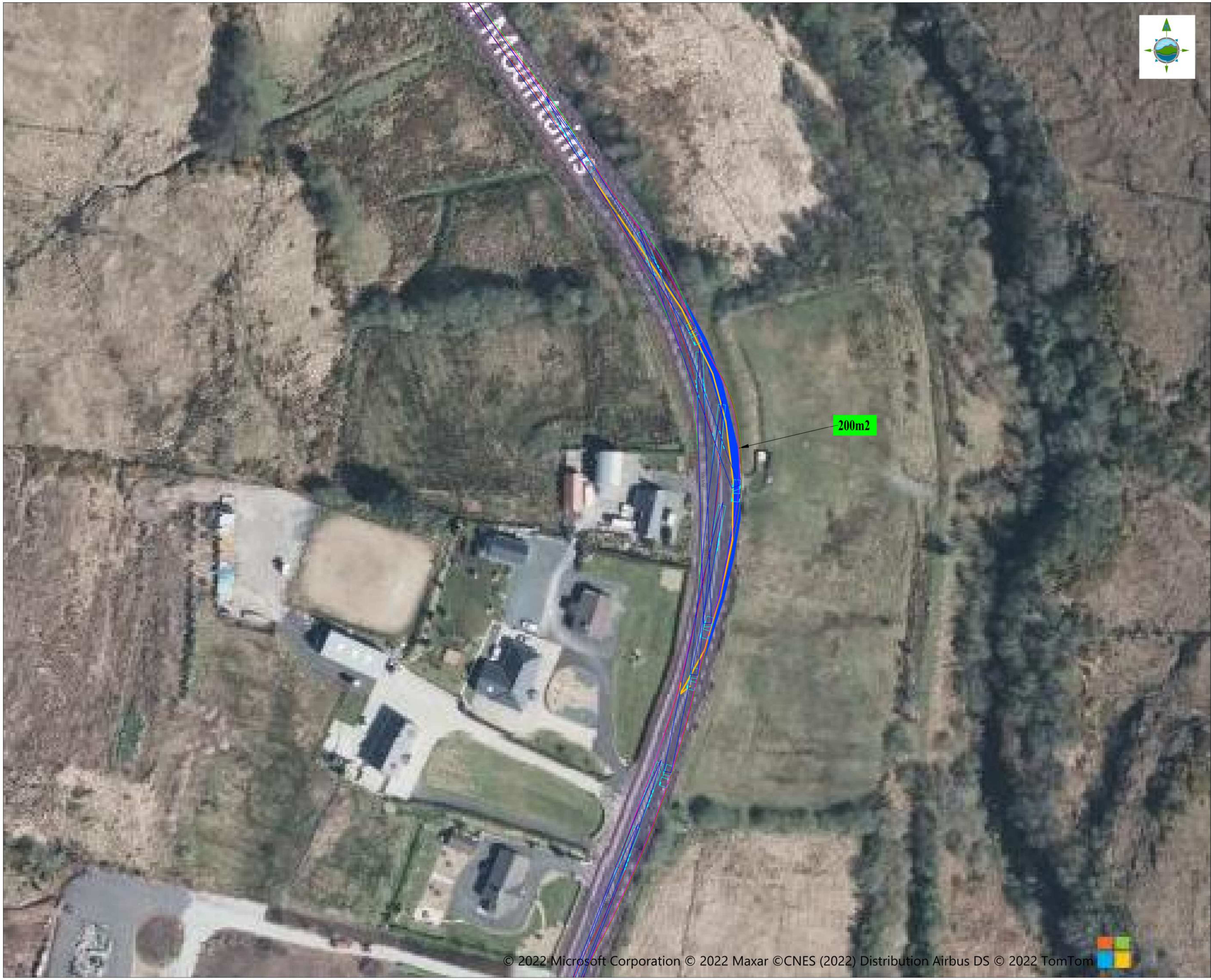

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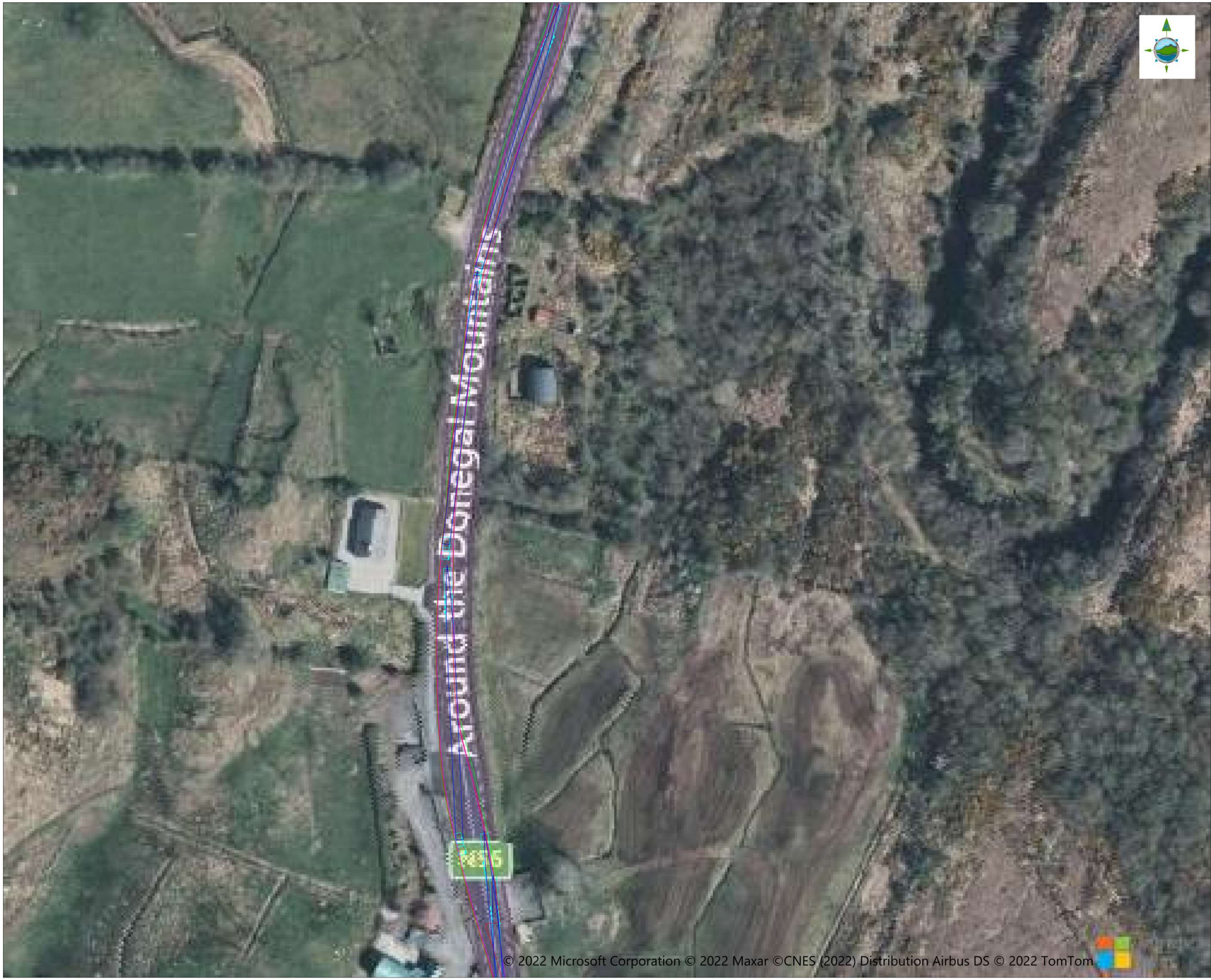

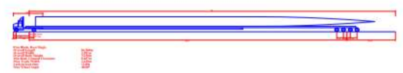

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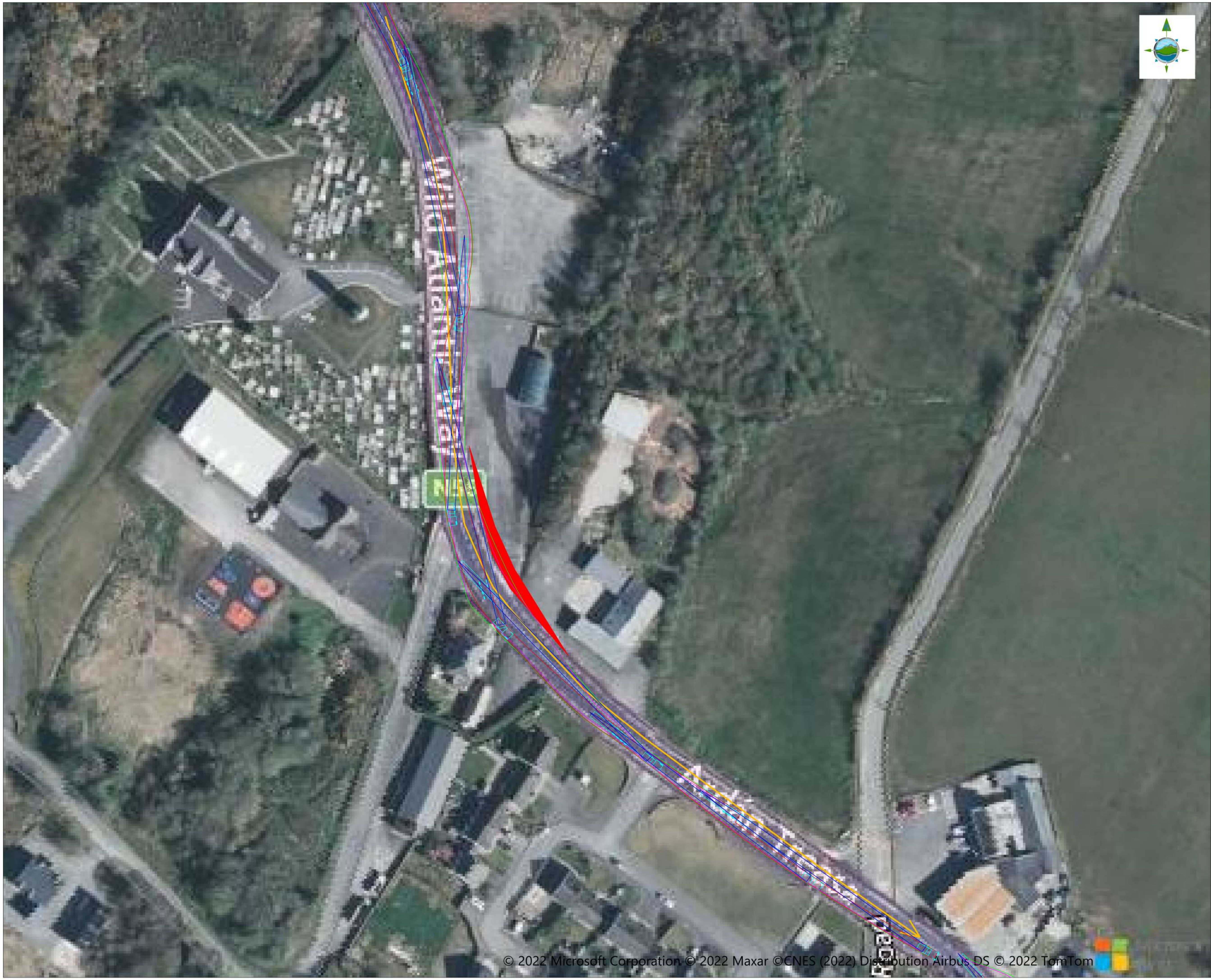

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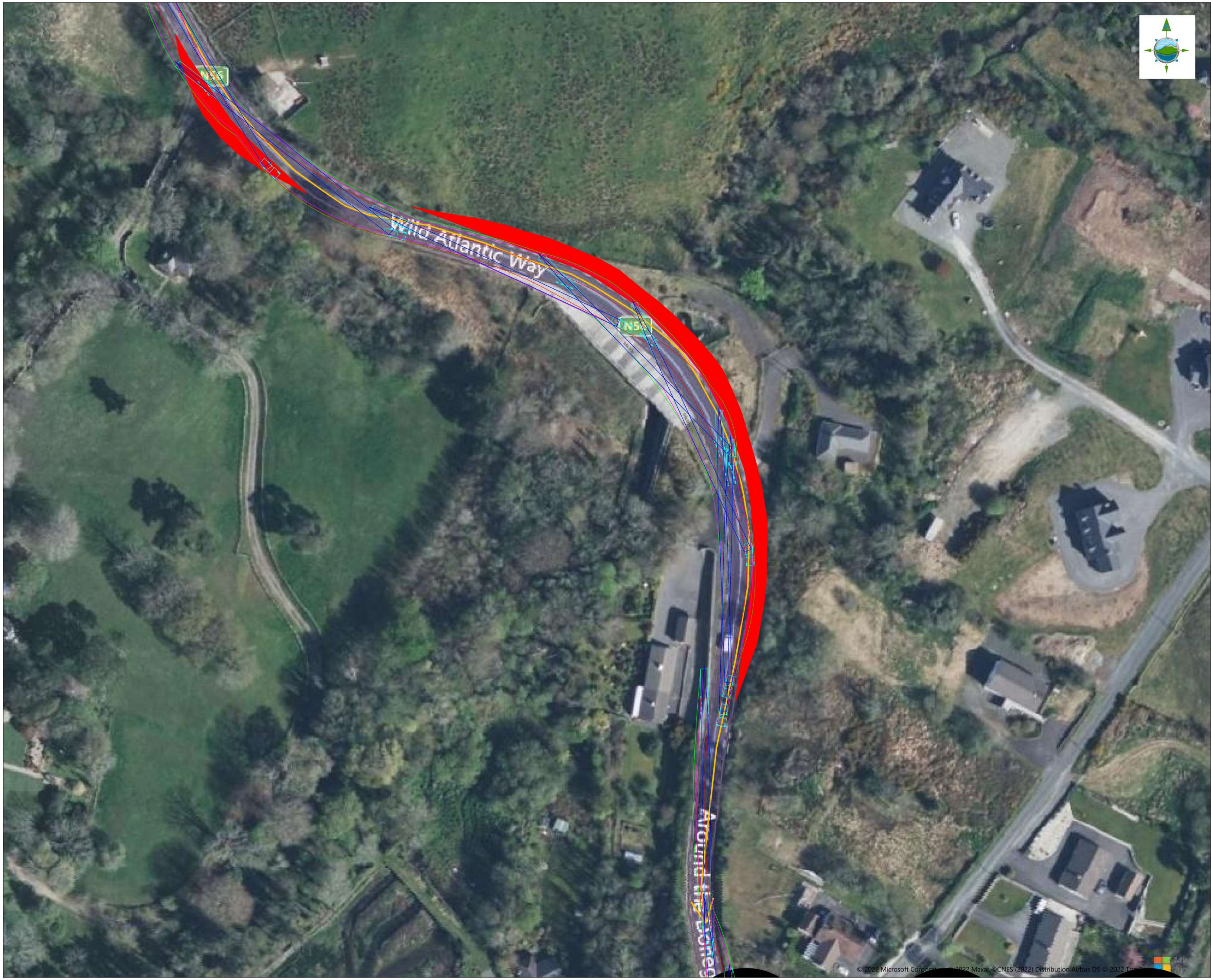

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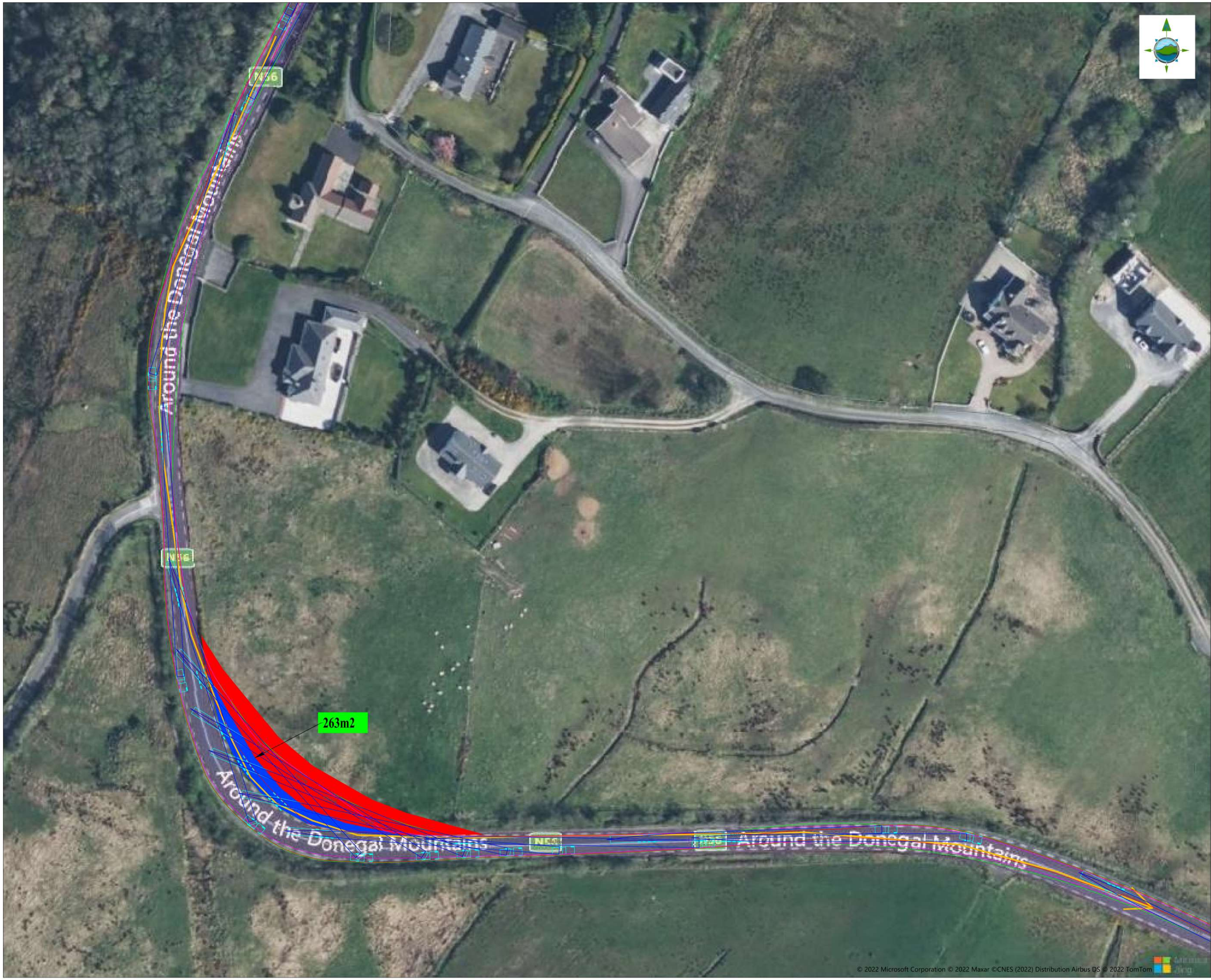

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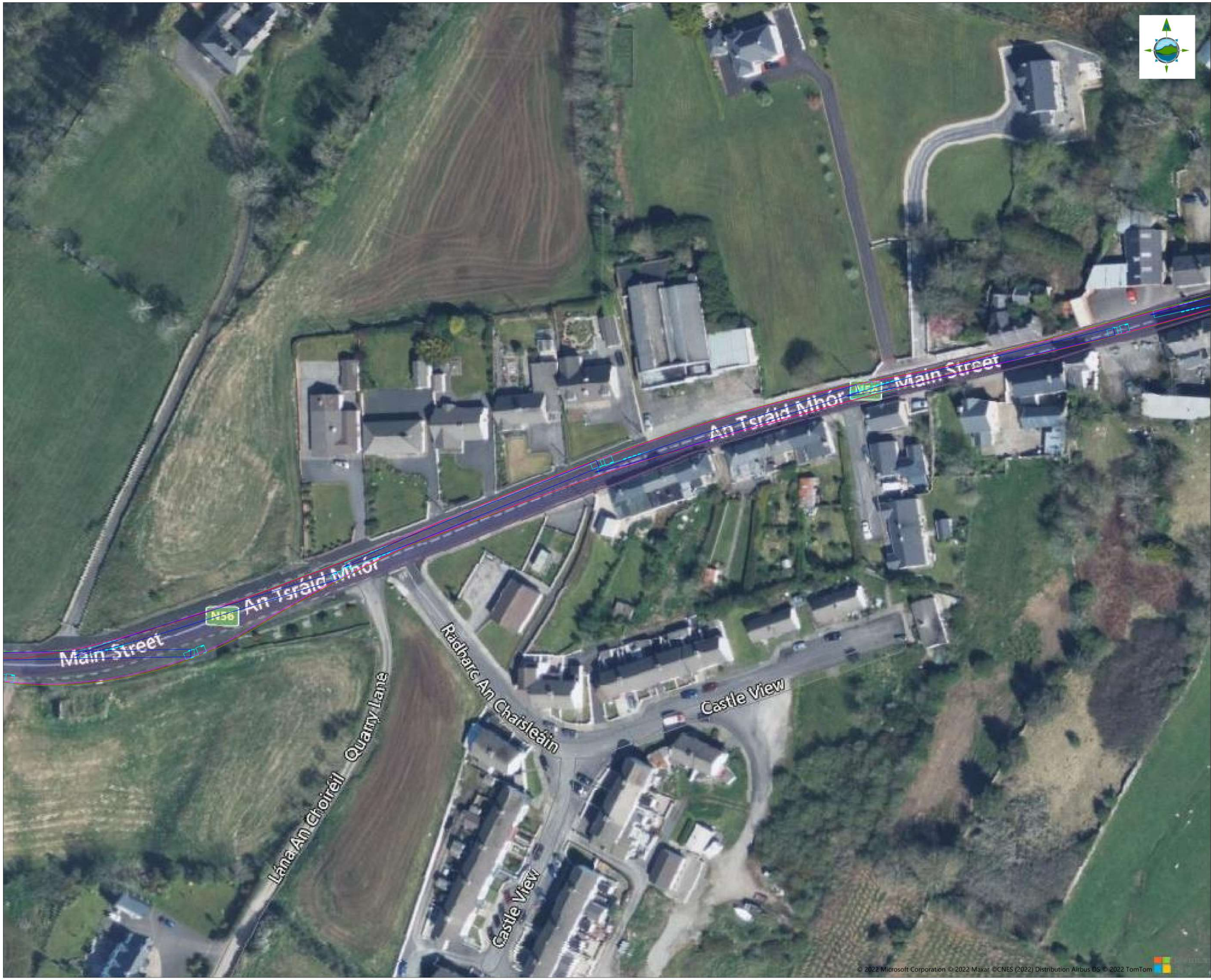

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A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###
Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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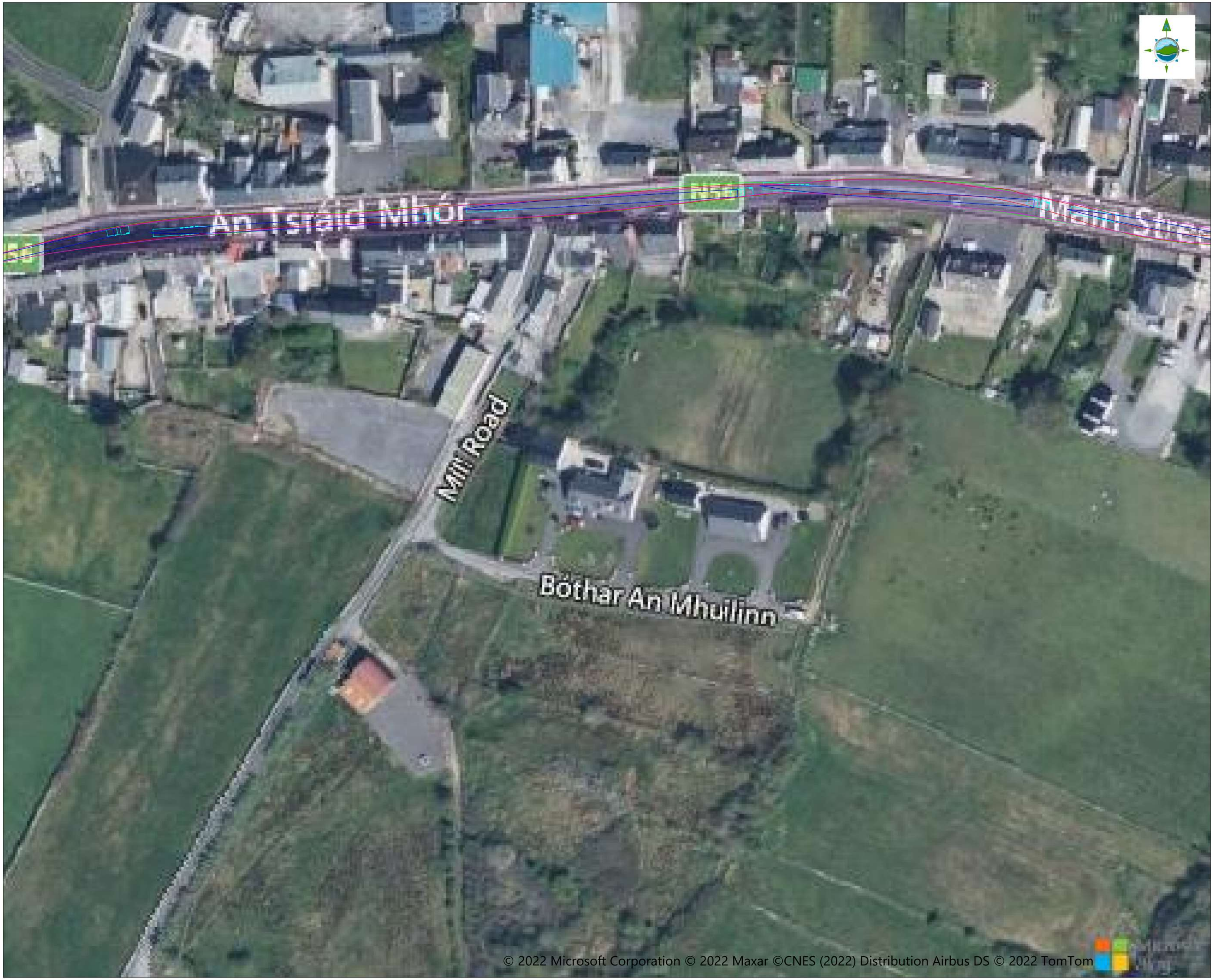
Drawing No. 10798-0009
Issue B



NOTES:

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5. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0010

Issue B

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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0011 | Issue B

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GENERAL LEGEND

HARDSTANDING

OVERSAIL AREA

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###   Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
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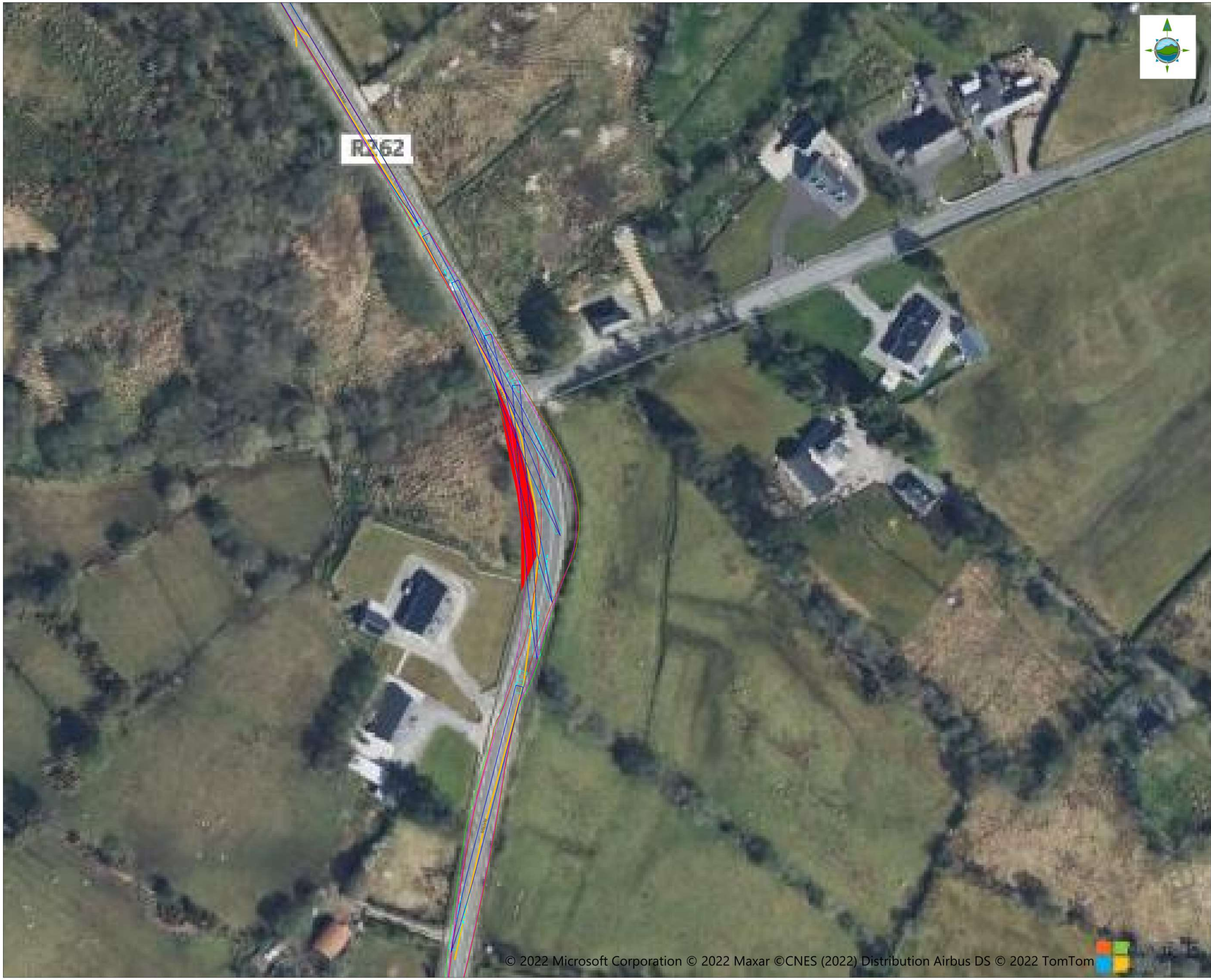
Drawing No. 10798-0012 | Issue B



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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 1 - Option 2

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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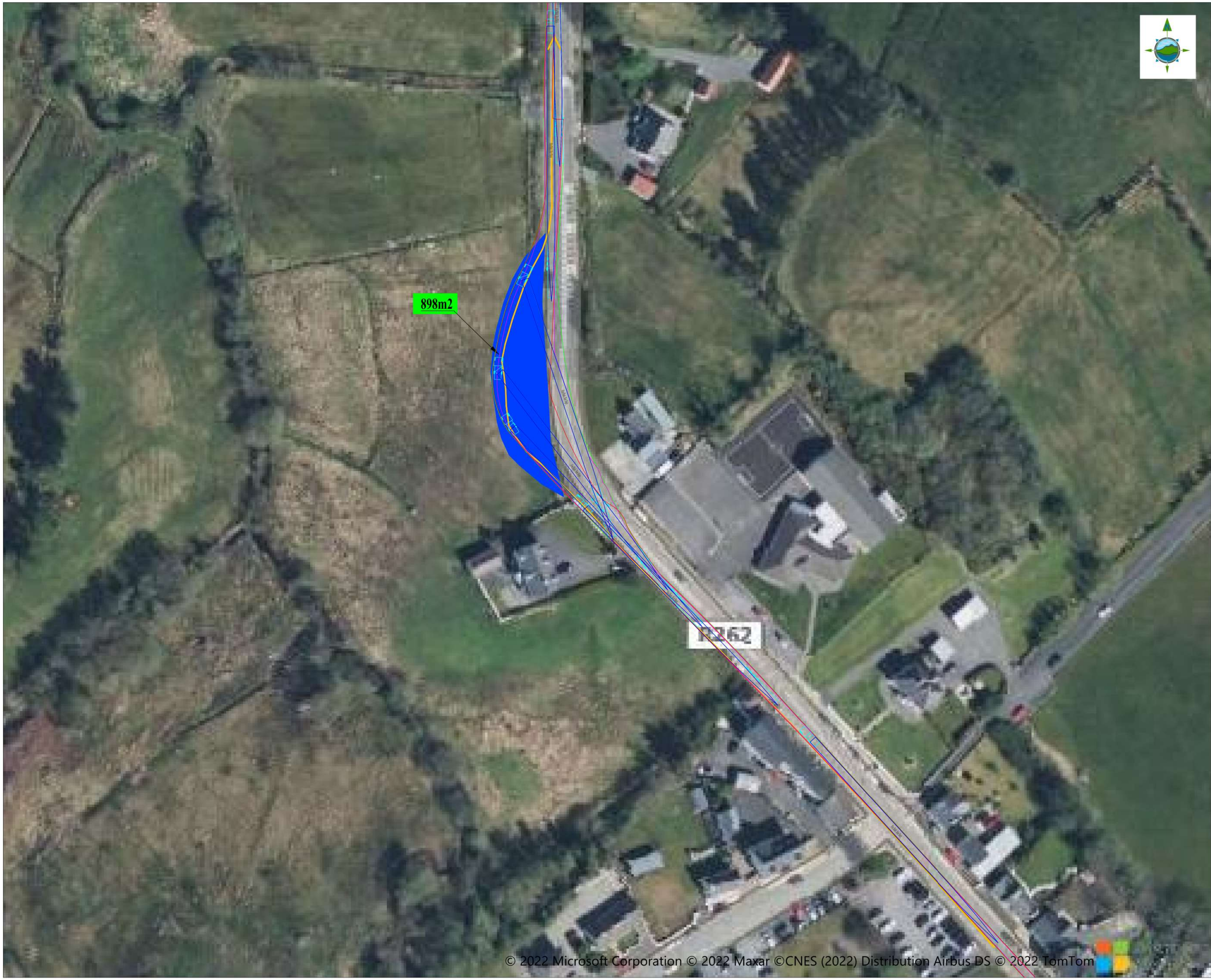
Drawing No. 10798-0013 Issue B



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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0014 | Issue B

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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 1 - Option 2

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0015 | Issue B

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GENERAL LEGEND

HARDSTANDING

OVERSAIL AREA

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
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Drawing Status	TENDER	

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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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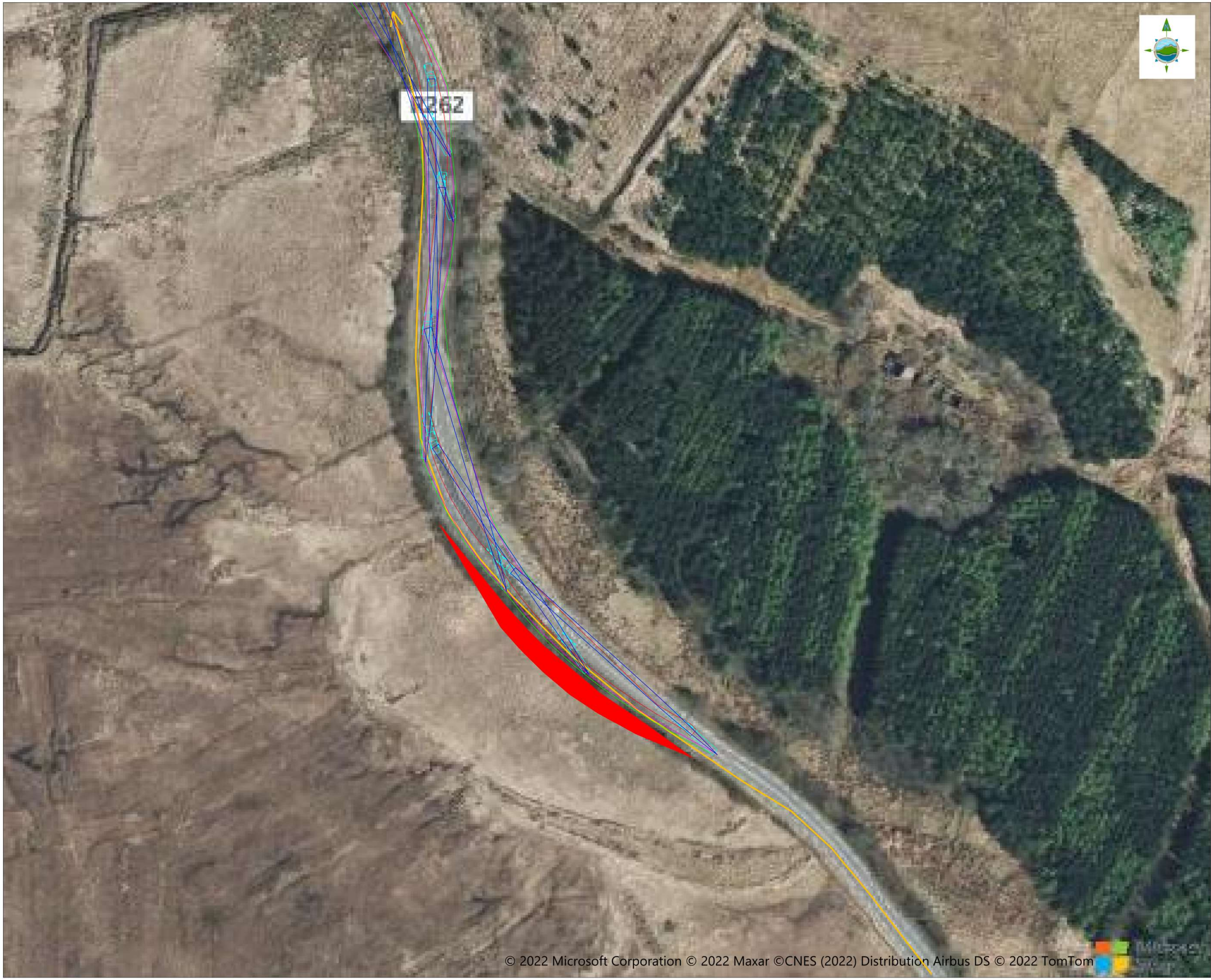
Drawing No. 10798-0017 Issue B



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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0018

Issue B

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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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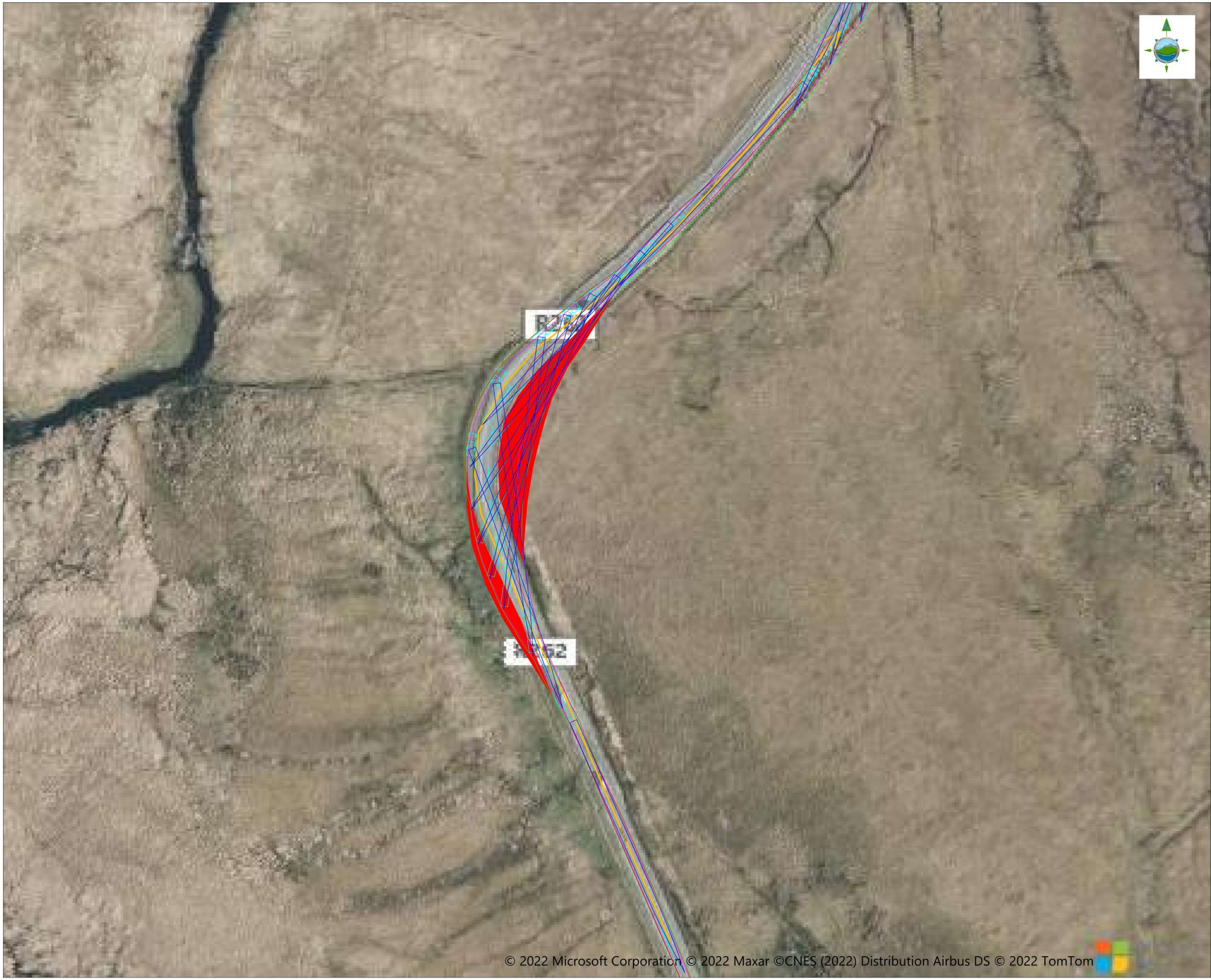
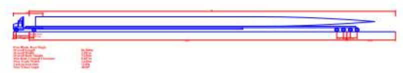
Drawing No. 10798-0019

Issue B





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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack
Stage 1 - Option 2

0m ## ## ## ### ### Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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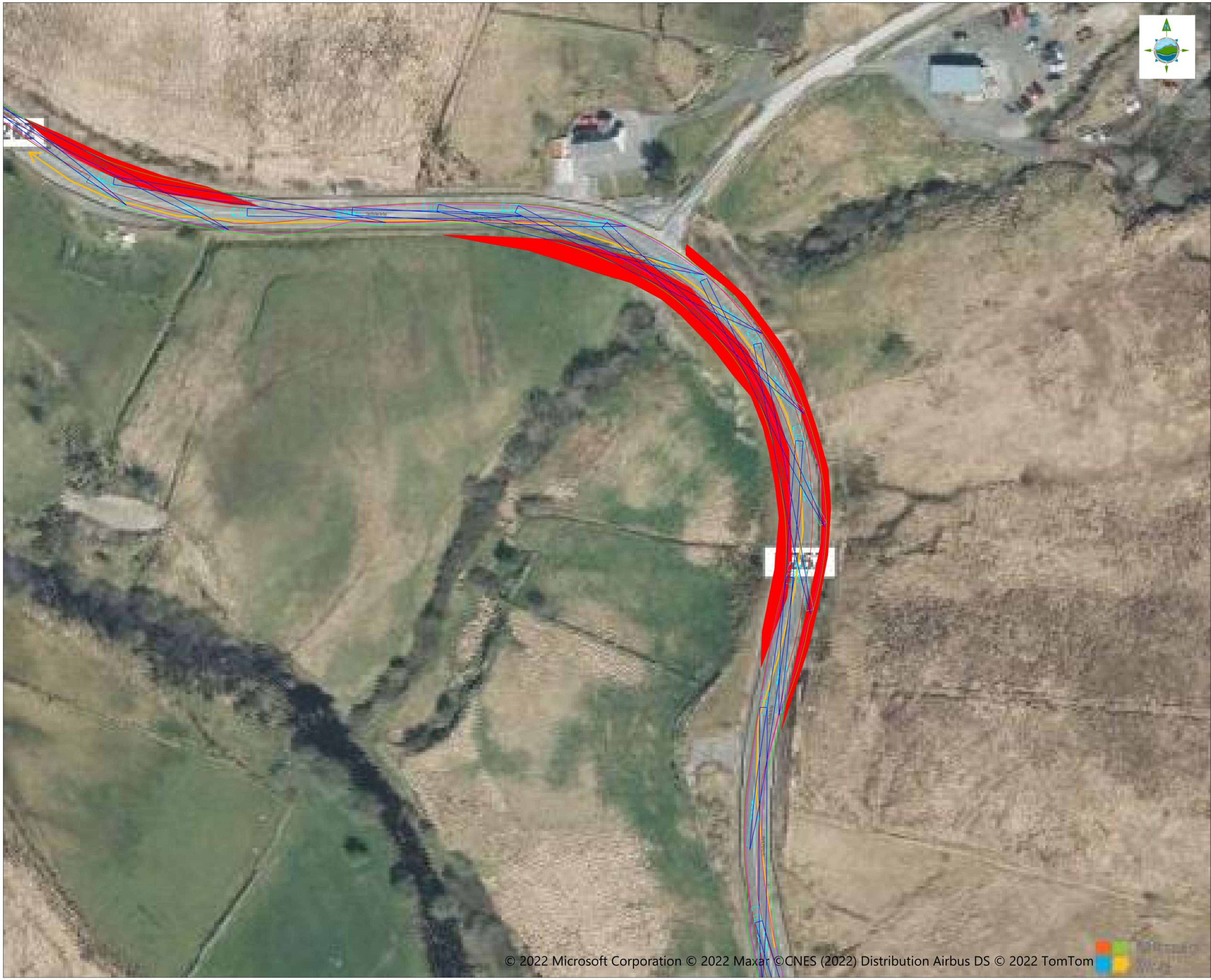
Drawing No. 10798-0020 | Issue B



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GENERAL LEGEND

HARDSTANDING

OVERSAIL AREA

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 1 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0021

Issue B

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GENERAL LEGEND

HARDSTANDING

BODY SWING

Rev.	Date	Description	By	Chkd.
B	SEP'21	Design	TI	JOF
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 1 - Option 2

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-0022 Issue B

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GENERAL LEGEND

HARDSTANDING

Rev.	Date	Description	By	Chkd.

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Final Option

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JS	Date Oct 2022
Project Director	Micheal Mc Donnell	
Drawing Status		

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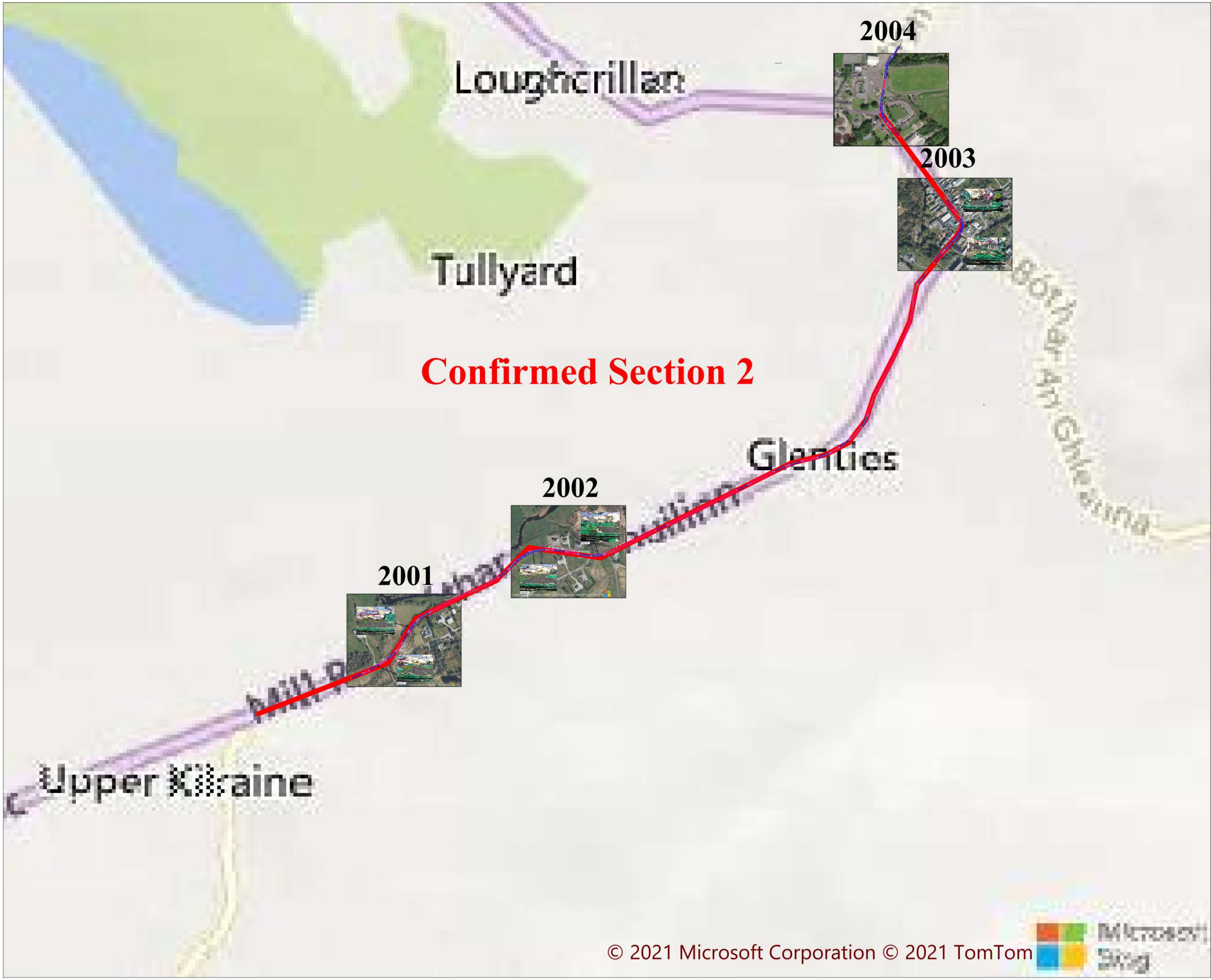
Drawing No. 10798-0023

Issue A



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Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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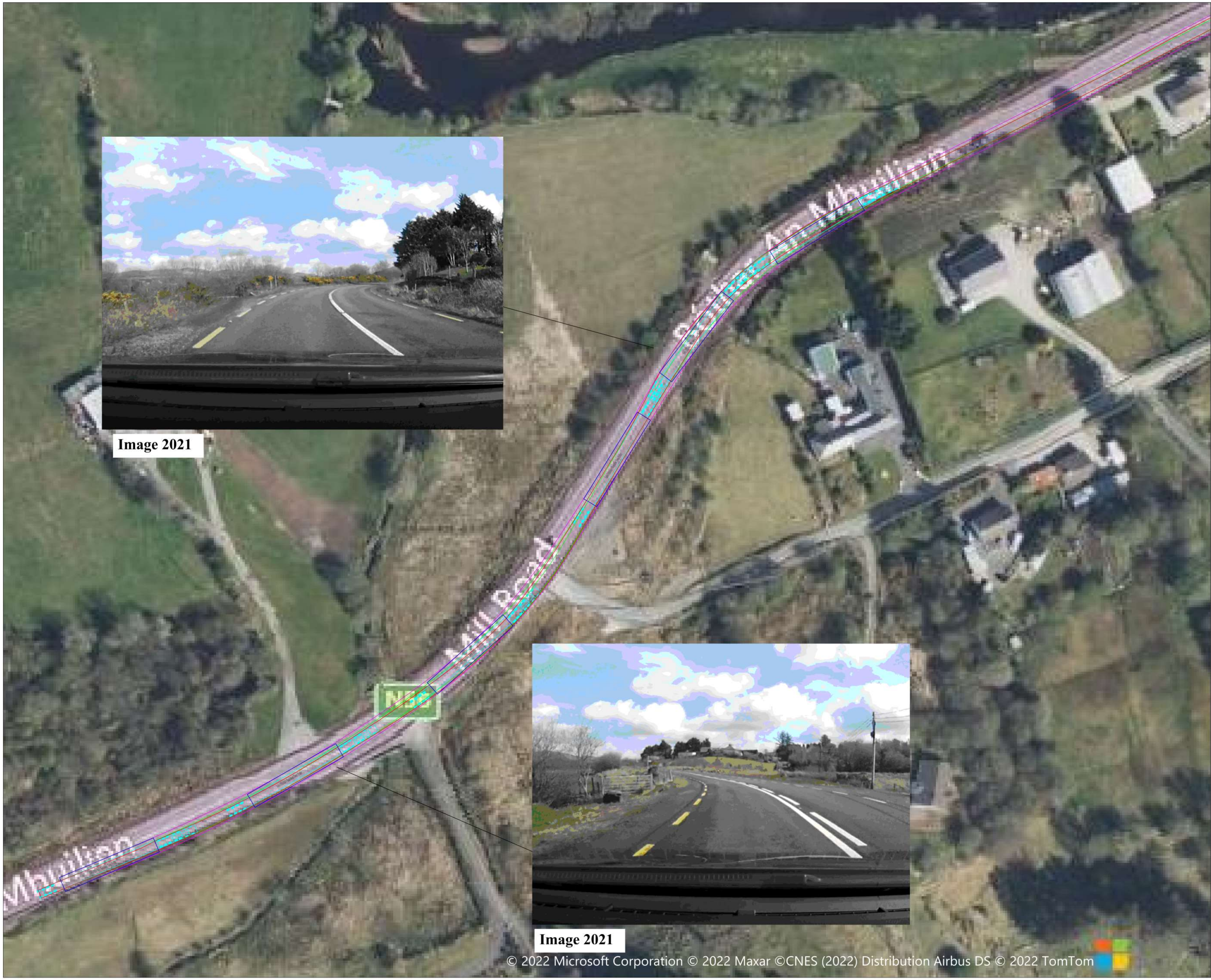
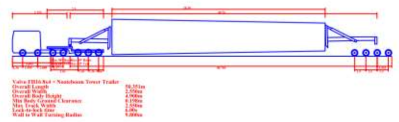
Drawing No. 10798-PLAN

Issue A





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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 2
Tower Sections Haulage

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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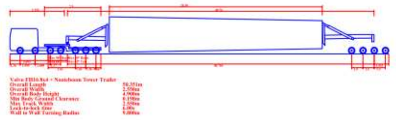
Drawing No. 10798-2001
Issue A



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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 2
Tower Sections Haulage

0m ## ## ## ### ###
Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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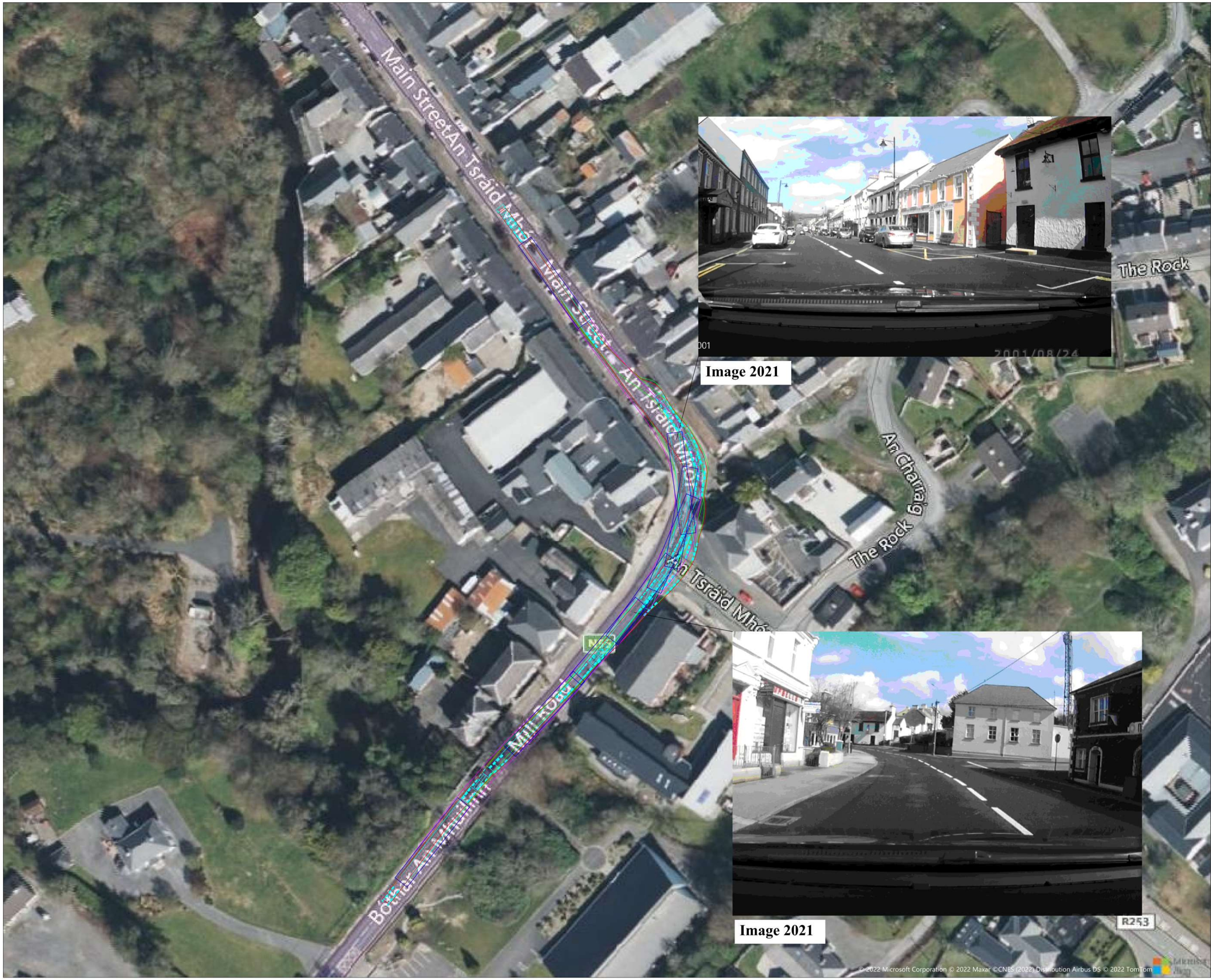
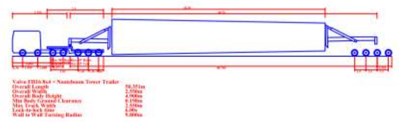
Drawing No. 10798-2002

Issue A





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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack Confirmed Section 2 Tower Sections Haulage

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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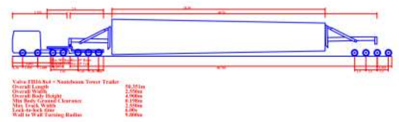

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 2
Tower Sections Haulage

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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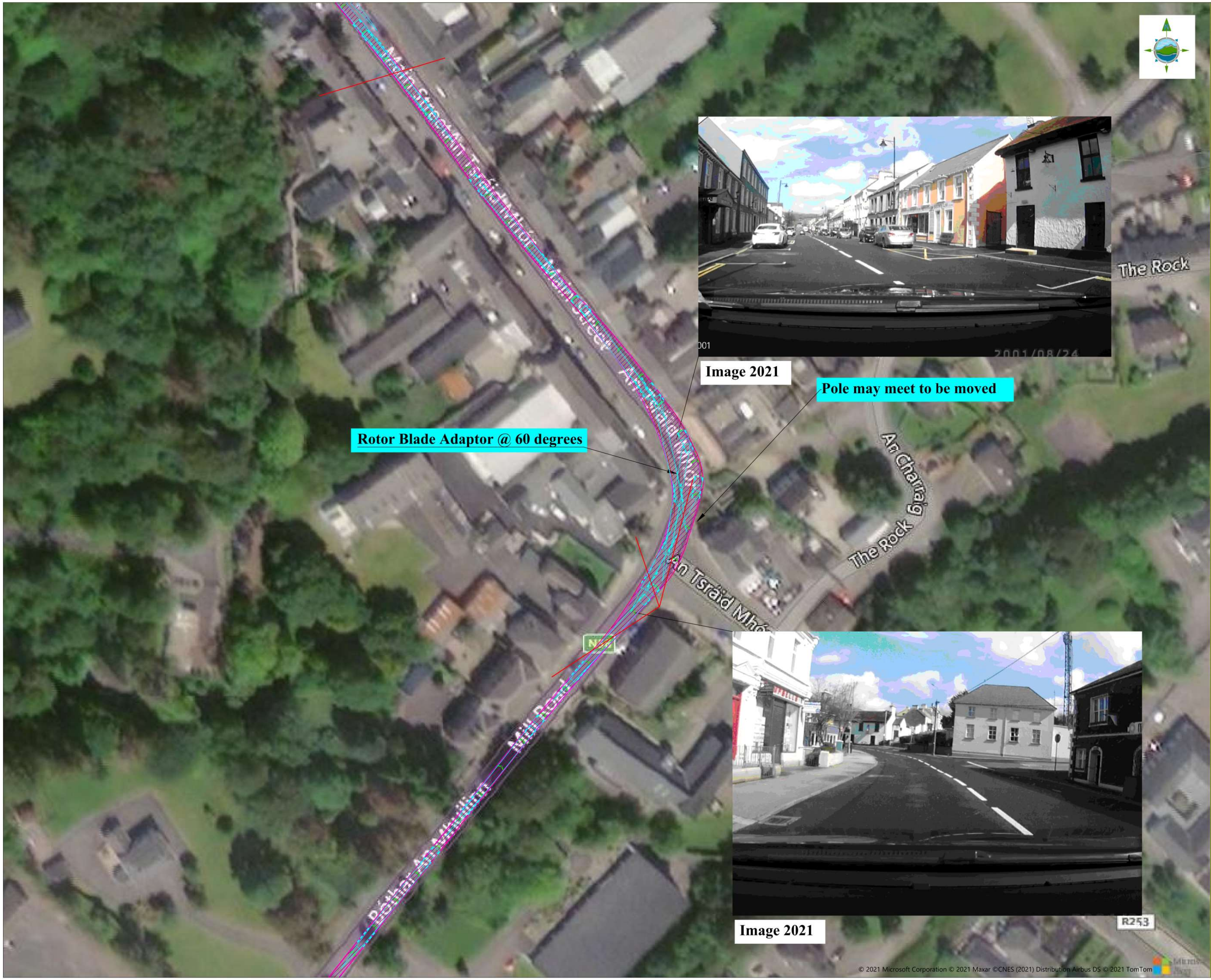
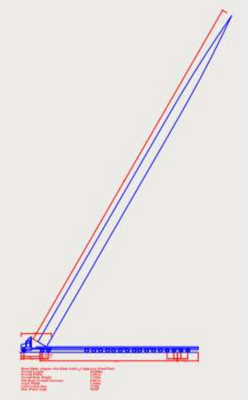
Drawing No. 10798-2004
Issue A





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GENERAL LEGEND

OVERHEAD LINES (Height to be checked)

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 2
Rotor Blade Adaptor
@ 60°

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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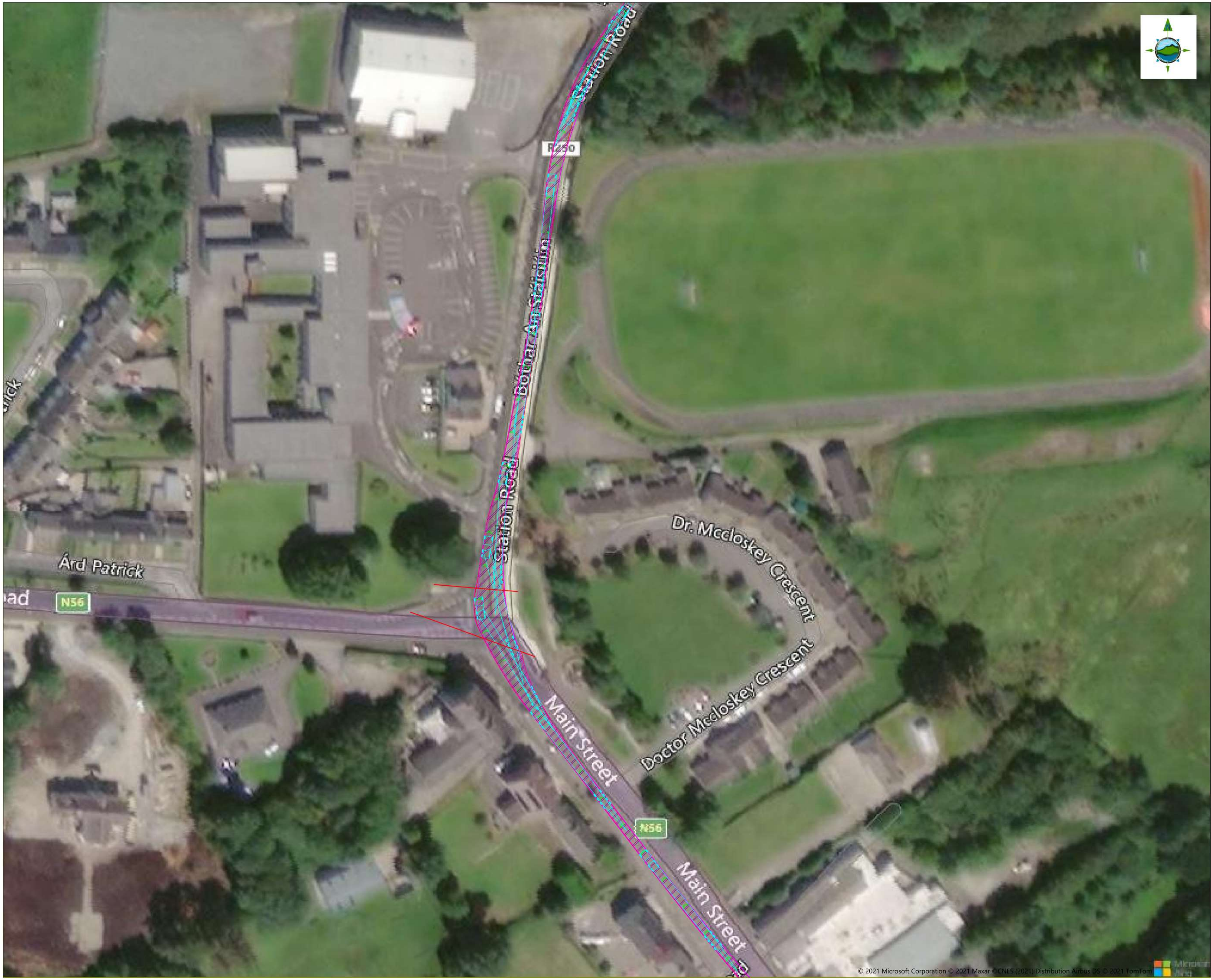
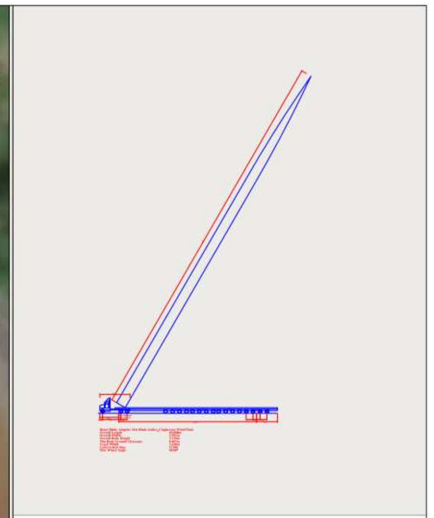
Issue

Drawing No. 10798-2003-1A





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GENERAL LEGEND

OVERHEAD LINES (Height to be checked)

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Confirmed Section 2
Rotor Blade Adaptor
@ 60°

0m ## ## ## ### ###
Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 2 - Option 2

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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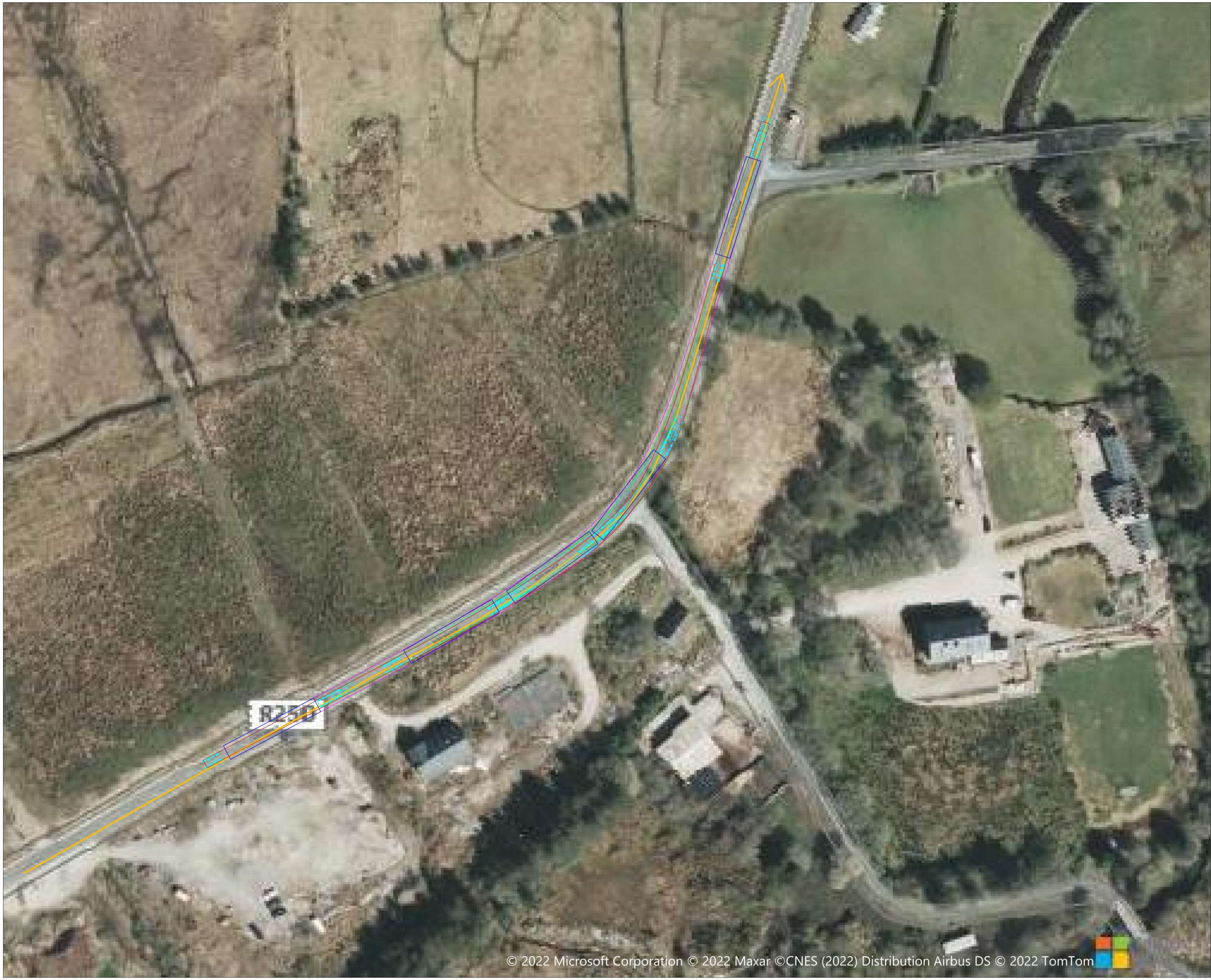

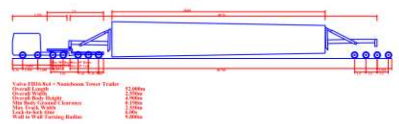

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client

Cloghercor Wind Farm Ltd.

Project

Cloghercor Wind Farm

Title

Autotrack
Stage 2 - Option 2
Tower Sections Haulage

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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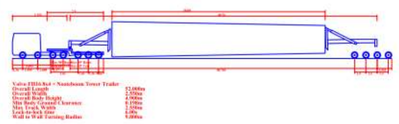
Drawing No. 10798-5001

Issue A



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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack Stage 2 - Option 2 Tower Sections Haulage

0m ## ## ## ### ### Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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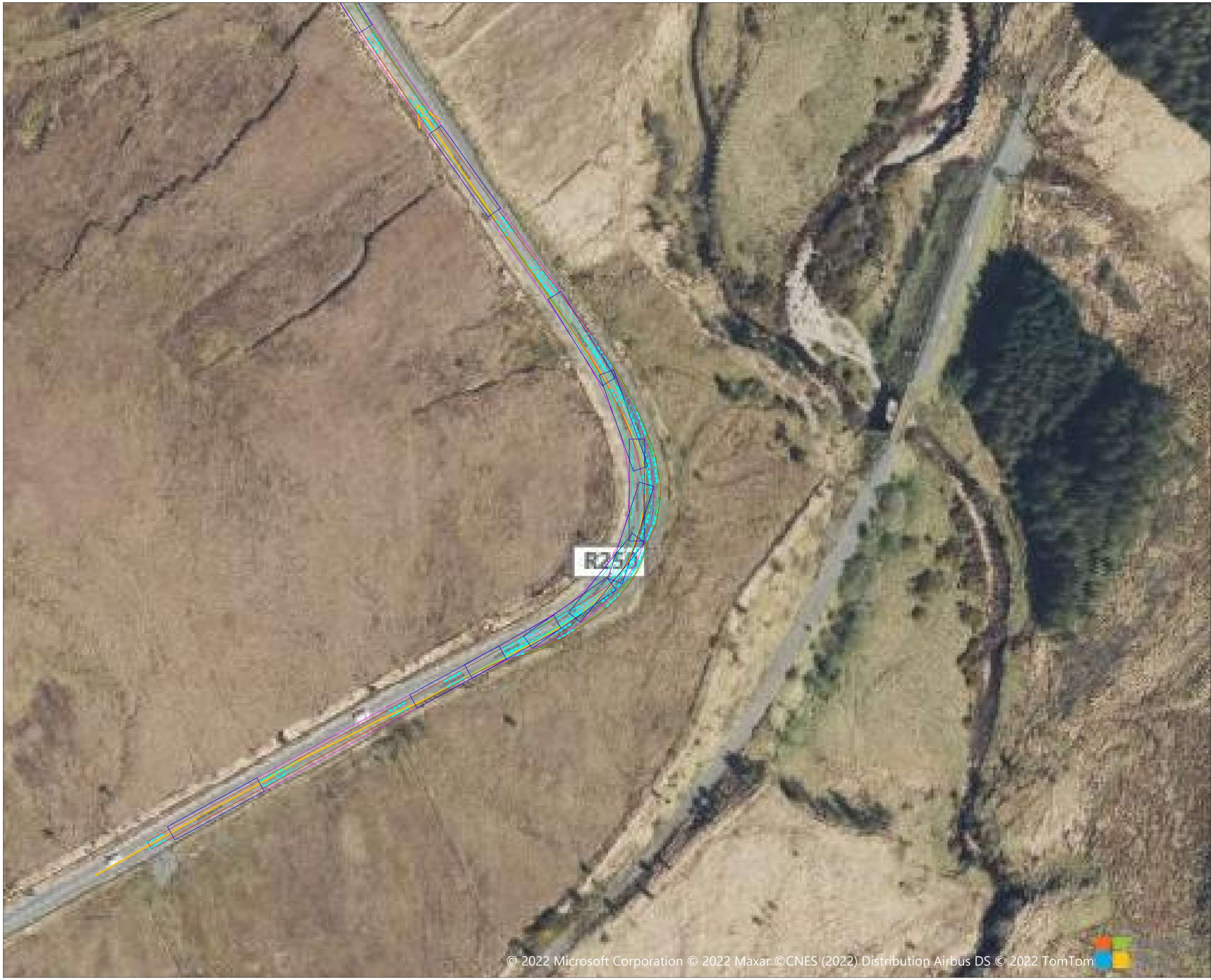
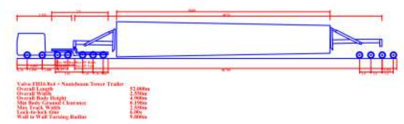
Drawing No. 10798-5002 | Issue A





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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client
Cloghercor Wind Farm Ltd.

Project
Cloghercor Wind Farm

Title
Autotrack
Stage 2 - Option 2
Tower Sections Haulage

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
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Drawing Status	TENDER	

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack
Stage 2 - Option 2
Tower Sections Haulage

0m ## ## ## ### ### Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-5004

Issue A

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GENERAL LEGEND

A	JUNE'21	Design	TI	JOF
Rev.	Date	Description	By	Chkd.

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack Stage 2 - Option 2 Tower Sections Haulage

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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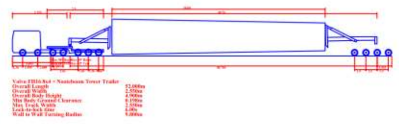

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack
Stage 2 - Option 2
Tower Sections Haulage

0m ## ## ## ### ###

Scale @ A1:NTS

Prepared by: TI	Checked JOF	Date June 2021
Project Director	Micheal Mc Donnell	
Drawing Status	TENDER	

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Drawing No. 10798-5006

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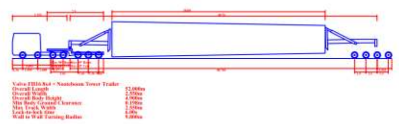

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GENERAL LEGEND

Rev.	Date	Description	By	Chkd.
A	JUNE'21	Design	TI	JOF

Client: Cloghercor Wind Farm Ltd.

Project: Cloghercor Wind Farm

Title: Autotrack
Stage 2 - Option 2
Tower Sections Haulage

Scale @ A1:NTS

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Drawing No. 10798-5007 | Issue A

Appendix 2-2 – Construction & Environmental Management Plan

TOBIN
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BUILT ON KNOWLEDGE

Cloghercor Wind Farm Ltd.

Cloghercor Wind Farm, County Donegal

Construction Environmental Management Plan (CEMP)

70 Years of TOBIN CONSULTING ENGINEERS
Excellence in Engineering

Table of Contents

Table of Figures

Table of Tables

1.0 INTRODUCTION

Cloghercor Wind Farm Limited (hereafter referred to as the Applicant), intend to apply to An Bord Pleanála for planning permission to construct the proposed Cloghercor Wind Farm in County Donegal. The proposed wind farm is located approximately 2 km south of Doochary in west County Donegal. The proposed wind farm will have an electrical output of between 95-136.8 MW.

The proposed project comprises a wind farm of 19 no. wind turbines and all associated infrastructure including turbine foundations, hardstanding areas, borrow pits, access tracks, an on-site 110kV electrical substation, works to facilitate delivery of equipment to site and a grid connection comprising a loop-in connection into the Ardnagappary to Tievebrack 110 kV line. The proposed project refers only to the elements of this for which planning permission is being sought as part of this application.

The overall proposed project comprises the proposed project and any facilitating works required along the public road network and at private properties to accommodate the delivery of turbine components (which includes a temporary turbine component transfer area). A description of the key elements of the proposed project is outlined in Section 2 of this CEMP. A full description of the proposed project is provided in Chapter 2 (Description of the Proposed Project) of the Environmental Impact Assessment Report (EIAR).

The planning application for the proposed project will be submitted to An Bord Pleanála (ABP) under Section 37E of the Planning and Development Act 2000 (as amended). An Environmental Impact Assessment Report (hereafter referred to as the EIAR) and Natura Impact statement (hereafter referred to as the NIS) have been prepared to accompany the planning application and incorporate all elements of the proposed project works including the main wind farm site, the electrical grid connection, the road/junction accommodation works to facilitate the abnormal load deliveries and forestry replanting works.

This Construction Environmental Management Plan (CEMP) has been prepared to present the proposed management and administration of site activities for the construction phase of the proposed project, to ensure that all construction activities are undertaken in an environmentally responsible manner. This CEMP summarises the environmental commitments related to the construction of the project, and the measures to ensure compliance with legislation and the requirements of statutory bodies, all as detailed in the EIAR and NIS.

This CEMP will be a live document and will be reviewed and updated, as necessary. Upon appointment, the Main Contractor for construction of the proposed project shall update this document to produce an updated version of the CEMP (i.e. the Contractor's CEMP) which will account for any additional requirements set out in Planning Conditions.

The CEMP provides a summary of the requirements from relevant guidance, standards, and codes of practice applicable to the work being undertaken as part of the proposed project. The following is a non-exhaustive list of relevant guidance/standards/codes referenced in the preparation of this CEMP:

- Environmental Protection Agency (EPA), Guidelines on the Information to be contained in Environmental Impact Assessment Reports (May 2022);
- Department of Housing, Planning and Local Government (DHPLG), Draft Revised Wind Energy Development Guidelines (December 2019);

- Department of Environment, Heritage and Local Government (DEHLG), Wind Energy Development Guidelines (December 2006);
- EPA Best Practice Guidelines for the preparation of resource & waste management plans for construction & demolition projects (November, 2021);
- Inland Fisheries Ireland (IFI) Guidelines on the Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI, 2016);
- Construction Industry Research and Information Association (CIRIA) C532 publication 'Control of Water Pollution from Construction Sites: Guidance for Consultants and Contractors' (CIRIA, 2001);
- CIRIA C648 publication 'Control of water pollution from linear construction projects' (CIRIA, 2006);
- CIRIA C741 publication 'Environmental Good Practice on Site' (4th Edition) (CIRIA, 2015);
- CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016);
- CIRIA C697 & C753F publications 'SuDS Manual' (CIRIA, 2007 & 2015);
- National Roads Authority (NRA) (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority;
- Irish Working Group on Groundwater (2005) Guidance Document GW5, Groundwater Working Group (WGGW) 2005;
- British Standards Institution (BSI), BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise;
- BSI, BS 5228: Part 1 and the European Communities (Construction Plant and Equipment) (Permissible Noise Levels);
- Scottish Natural Heritage (SNH) (2019) 'Good Practice during Wind Farm Construction' (4th edition). Scottish Natural Heritage;
- The Institute of Air Quality Management (IAQM) publication '*Guidance on the Assessment of Dust from Demolition and Construction*' (2014);
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes published by the NRA (now TII) in 2011;
- The Control of Dust and Emissions during Construction and Demolition published by the Greater London Authority (GLA) in 2014;
- Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites".

1.1 SCOPE OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The purpose of this document is to communicate the key environmental obligations that apply to all Contractors, their sub-Contractors and personnel while carrying out any form of construction activity for the development of the Cloghercor Wind Farm, Co. Donegal.

This CEMP should be read in conjunction with the Planning Documents & Drawings, the EIAR, NIS, and the construction stage elements[1] of the Traffic Management Plan (TMP) (see Appendix 2-7).

This CEMP provides a mechanism for ensuring compliance with environmental legislation and statutory consents. It defines the approach to environmental management at the site during the

[1] See Section 3.0 (Construction Phase) and Section 4.0 (Construction Phase Traffic Management Plan) of the TMP (Appendix 2-7).

construction phase and addresses all relevant environmental aspects of the management of site preparation and construction work within the development works area (as set out in section 2.0 'Project Description' of Chapter 2 (Description of the Proposed Project) of the EIAR).

The scope of the CEMP includes:

- All construction elements of the development;
- The proposed implementation and management of environmental controls and mitigation measures during each phase of construction works; and
- A documented process to ensure measures identified through the planning phase of the development will be applied in practice.

At a minimum, the Contractor's CEMP at construction stage will contain:

- A statement of the environmental aims and policy objectives of the development;
- Roles and Responsibilities of key individuals;
- Environmental management and reporting structure;
- Site management and construction activity details;
- Environmental mitigation measures;
- Environmental awareness training programmes;
- Environmental monitoring programmes and requirements;
- Inspection and auditing programmes; and
- Emergency response plans and procedures for any environmental incidents.

1.1.1 Implementation of the CEMP

In terms of overall environmental responsibility, everyone on site is responsible for ensuring that their actions constitute good environmental practice. All site personnel are charged with following good practice and encouraged to provide feedback and suggestions for improvements. All site personnel are also required to ensure compliance with the requirements of the CEMP.

Compliance with the CEMP, the procedures, work practices and controls will be mandatory and must be adhered to by the Contractor, all site personnel, and sub-contractors employed during the construction phase. The CEMP seeks to:

- Provide a basis for achieving and implementing the construction related mitigation measures identified in the EIAR and NIS; and
- Promote best environmental on-site practices for the duration of the construction phase.

1.1.2 Aims and Objectives of the CEMP

The key aims of the CEMP are:

- To ensure the project is undertaken in accordance with best practice guidance for the management of the environment during construction works;
- To ensure that mitigation measures to protect all aspects of the environment as set out in the EIAR and the NIS are put in place;
- To ensure that construction activities are carried out in accordance with all planning conditions for the development; and
- To carry out the works with minimal impact on the environment.

The primary objectives to ensure the above aims are achieved during the construction phase are:

- Appointment and delegation of responsibility to an individual for monitoring environmental compliance and adherence to the Contractor's CEMP;
- Updating the Contractor's CEMP on a continuous basis in accordance with regular environmental auditing and site inspections. This will confirm the efficacy and implementation of all relevant mitigation measures and commitments identified in the planning application documentation;
- Providing adequate environmental training and awareness to all project personnel;
- Establishing documented schedules and records for monitoring and inspections;
- Establishing reporting procedures for any incidents on site with potential to impact on the environment;
- Providing opportunities for community feedback and submission of complaints; and
- Adopting a sustainable and socially responsible approach to construction.

1.1.3 Revisions to the CEMP

As mentioned above, the CEMP is considered a 'live' document and as such will be reviewed on a regular basis to allow any changes to construction programme, operations or unforeseen issues be incorporated at any stage throughout the project as deemed necessary by the Applicant, their agents or relevant authorities. The CEMP will be subject to continual review to address, for example:

- Any conditions stipulated in the planning approval;
- Any requirements/issues highlighted through consultations prior to works e.g. by the National Parks and Wildlife Service (NPWS), Donegal County Council etc.;
- To ensure it reflects best practice at the time of construction; and
- To ensure it incorporates the findings of any pre-construction site investigations.

This CEMP will be provided to the appointed Contractor who will have responsibility for updating the document as necessary through the construction phase.

The Contractor's CEMP will incorporate the conditions associated with any grant of planning for the proposed project. This CEMP will be subject to ongoing review (throughout the construction phase of the development), through regular environmental auditing and site inspections. This will confirm the efficacy and implementation of all relevant mitigation measures and commitments identified in the application documentation.

The appointed Contractor is required to include further details and/or confirmation in the updated version of the CEMP which will include:

- Details of emergency plan including personnel and contact numbers;
- Site and traffic signage; and
- Method statements.

The appointed Contractor shall also agree and implement monitoring measures to monitor the effectiveness of the CEMP.

2.0 SITE LOCATION AND PROJECT DETAILS

2.1 LOCATION OF THE PROPOSED PROJECT

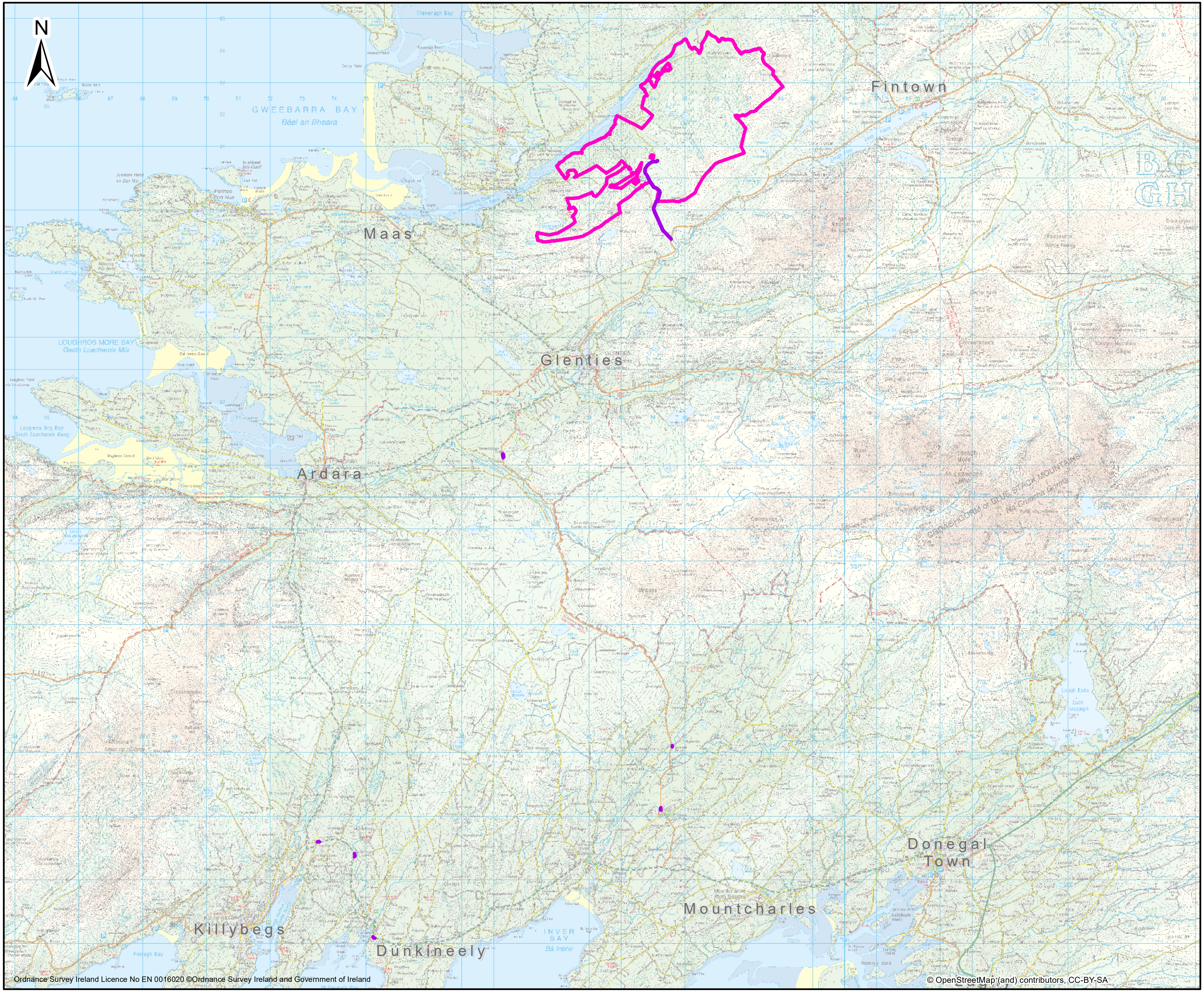
The site of the proposed wind farm (i.e. the no. 19 turbines and associated infrastructure within the proposed wind farm site boundary) is located within a peatland and forested landscape, between Doochary, Lettermacaward and Glenties, which are located 2.1km north, 850m west and 3.5km south of the site of the proposed wind farm respectively and 2.3km north, 3.4km west and 6.2km south of nearest turbine, respectively in Co. Donegal, and is c. 22 km north of Donegal town, and c.31 km southwest of Letterkenny. The site lies between the R250 that runs from Glenties to Fintown and the Gweebarra River Estuary.

The proposed wind farm site is approximately 9.1 km long in the northeast/southwest direction and is approximately 3.7 km wide in a southeast/northwest direction at the widest point; the site covers an area of approximately 1,945 hectares (ha). The site is located on an elevated area beside the Gweebarra River Estuary with a topography of between 0 m and 365 m OD. A number of other areas to the east and south of the site are also elevated. The most significant features in the surrounding landscape are the Gweebarra Estuary Valley, and the upland areas (including Aghla Mountain) within and around the proposed wind farm particularly to the east of the proposed wind farm, towards Fintown.

The Gweebarra River Estuary is located adjacent to the northwest boundary of the wind farm site, although the nearest infrastructure (operational phase entrance) is located approximately 500m from this. The nearest turbine will be approximately 1 km from the estuary, and the entire site drains into the estuary.

The site of the proposed wind farm is situated within the following townlands; Cloghercor, Clogherculllion, Derryloaghan, Cleengort, Derk More and Derk Beg Co. Donegal. The proposed grid connection (including the proposed substation and connection masts) is located within the townland of Cloghercor, Co. Donegal.

There are a number of locations beyond the wind farm site which require temporary additional works to accommodate delivery of abnormal loads to site for turbine components (the Turbine Delivery Route). The proposed project includes temporary works at 5 locations on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge, construction of a temporary area of hard standing to function as a blade transfer area to facilitate turbine delivery in the townland of Drumnacross, and widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines is required in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy. Figure 2-1 below shows the location and extent of the proposed project.



Legend *

Proposed Wind Farm Site Boundary

Turbine Delivery Route works

* all land identified is within Boundary of the Proposed Project

0 1 2 3 4
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	03/03/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 1-1:
Proposed Project Extent

Scale @ A4: 1:150,000

Prepared by: S.Pezzetta
Checked: J.Staunton
Date: March 2023

Project Director: O.Fitzpatrick

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Ver002

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2.1.1 Designated Sites

Full details of the Special Areas of Conservation (SACs), Special Protected Areas (SPAs), Natural Heritage Areas (NHA), proposed Natural Heritage Areas (pNHA) and Nature Reserves within a 15 km Zone of Influence (ZoI) of the wind farm site are outlined in the EIAR and NIS. There are twelve SACs within 15 km of the wind farm site, of these, the following are closest to the proposed project:

- West of Ardara/Maas Road SAC – 0 km;
- Coolvoy Bog SAC – 0.3 km;
- Gannivegil Bog SAC – 0.5 km;
- River Finn SAC – 2.1 km; and
- Cloghernagore Bog and Glenveagh National Park SAC - 2.2 km.

There are five SPAs within 15 km of the wind farm site, of these, Derryveagh and Glendowan Mountains SPA is closest to the proposed project, at c.2.2 km.

Derkmore Wood Nature Reserve occurs adjacent to the western section of the wind farm site. This is a statutory nature reserve and is also a pNHA. The Meenmore West NHA occurs adjacent to the south-east corner of the wind farm site, with a small section extending into the wind farm site. 16 other NHAs / pNHAs are present within 15 km of the wind farm site. However, most of these are included within SAC and / or SPAs. The only NHA / pNHA within 15 km of the wind farm site that is not also included within a SPA or SAC is the Meenybraddan Bog pNHA, c.13 km from the wind farm site.

2.2 DESCRIPTION OF THE PROPOSED PROJECT

The Applicant proposes to develop the Cloghercor Wind Farm in Co. Donegal. It is proposed to supply the power from the Cloghercor Wind Farm to the Irish electricity network via loop-in 110kV underground cables (approximately 4.1km cable length within approximately 3.36km of internal access roads) to the existing overhead 110 kV power line in the townland of Cloghercor, Co. Donegal. A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height range from 18 5m to 200 m, a rotor diameter range from 149 m to 164 m, a hub height range from 112 m to 125 m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100 m;

- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36 km of internal access roads) to the existing 110 kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed project and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

The construction phase includes all elements of the proposed project as listed above, in addition to any works required on public roads to accommodate turbine delivery, including the hard standing area proposed at Drumnacross to accommodate blade transfer.

2.3 KEY ROLES AND RESPONSIBILITIES

At this stage it is envisaged that the following roles will be appointed for the construction phase of the proposed project; Site Manager; Ecological Clerk of Works (ECoW); Safety, Health, Environment and Quality (SHEQ) Advisor; Project Ecologist/Ornithologist; Project Hydrologist; Project Geotechnical Engineer / Geologist; and Project Archaeologist.

Details of these roles are outlined in the following sections. The Contractor's CEMP at construction stage will confirm roles and finalise responsibilities once appointed.

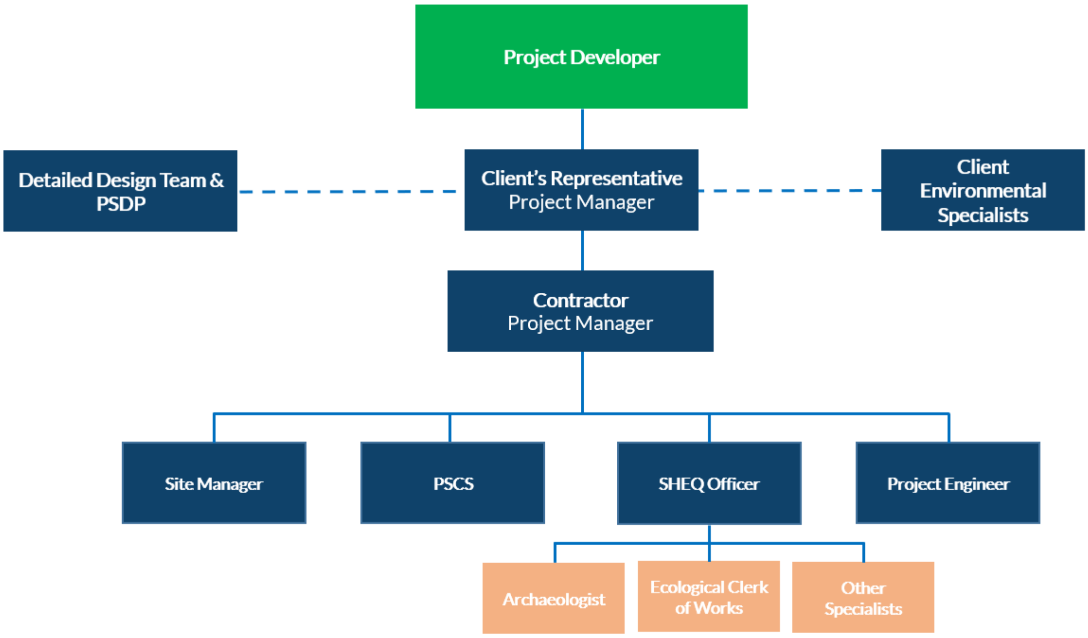

Figure 2.2: Example Project Development Organisational Chart

2.3.1 Construction / Site Manager

A suitably qualified Construction / Site Manager will be appointed by the contractor for the duration of the construction period. The Construction / Site Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements.

2.3.2 Ecological Clerk of Works (ECoW)

A suitably qualified Ecological Clerk of Works (ECoW) will be appointed by the contractor for the duration of the construction period. The Ecological Clerk of Works will ensure that all relevant mitigation measures in this CEMP are implemented. The duties of the ECoW will include review of method statements; supervision of the installation, operation and removal of construction phase mitigation measures such as sediment control traps; supervision of the implementation of the Invasive Species Management Plan, compliance checks; supervision of the peat replacement plan; and liaison with relevant statutory bodies.

2.3.3 Safety, Health, Environment & Quality (SHEQ) Advisor

A suitably qualified Safety, Health, Environment and Quality (SHEQ) Advisor will be appointed by the contractor for the duration of the construction period. The SHEQ will ensure compliance with all relevant Health and Safety regulations, environmental regulations, and quality control on-site during the construction stage. The SHEQ will be on-site full time during the construction phase.

2.3.4 Project Ecologist / Ornithologist

The Project Ecologist / Ornithologist is responsible for the protection of sensitive habitats and species encountered during the construction phase of the project will report to the ECoW. The Project Ecologist will not be full time on site but will visit the site at agreed periods during construction.

2.3.5 Project Hydrologist

The Project Hydrologist will report to the Environmental Clerk of Works and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will regularly visit the site at agreed periods during construction and on a weekly basis during site preparation/groundworks.

2.3.6 Project Geotechnical Engineer / Geologist

The Geotechnical Engineer / Project Geologist will report to the ECoW and is responsible for inspection and review of geotechnical aspects associated with construction stage of the project. The Geotechnical Engineer will be full time on-site during the site preparation and groundworks and will visit site regularly at agreed periods during the construction phase.

2.3.7 Project Archaeologist

The Project Archaeologist will report to the ECoW and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will be full time on site during the site preparation/groundworks and will visit site at least once a month during the remainder of the construction phase.

2.4 FACILTIES, SAFETY AND SECURITY

The proposed Cloghercor Wind Farm will be constructed, in accordance with all relevant Health and Safety Legislation.

Aspects of the development that will present health and safety issues include:

- Health and safety aspects of construction activities;
- General construction site safety (e.g. slip/trip, moving vehicles etc);
- On site traffic safety during construction associated with localised high road embankments;
- Traffic safety during the transport of abnormal loads to the site;
- Lifting of heavy loads overhead using cranes;
- Working at heights; and
- Working with electricity during commissioning.

A (Preliminary) Health and Safety (H&S) Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared prior to the construction stage by the PSDP.

Rigorous safety checks will be conducted on the turbines during construction. Signs will be erected at suitable locations across the site as required. Further details regarding signage is provided in Section 2.4.3 of this CEMP.

2.4.1.1 Safety and Security

All activities carried out by the appointed Contractor on the proposed project will be in accordance with the requirements of the *Safety, Health and Welfare at Work Act 2005* as amended and Regulations made under this Act.

The scale and scope of the proposed project will require the appointment of a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) in accordance with the provisions of the *Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2103)*, as amended. These persons will be appointed by the Applicant and notified to the Health and Safety Authority (HSA) prior to commencement of detailed design works (in the case of the PSDP) and prior to commencement of construction (in the case of the PSCS). As mentioned, the PSDP will prepare a Preliminary H&S Plan which will identify any particular risks, residual risks and particular sequences of work that are envisaged during the design of the works.

Prior to commencement of construction, this Preliminary H&S Plan will be provided to the Contractor and the PSCS will further develop the document to prepare a Construction Stage H&S Plan addressing all aspects of the construction process and providing relevant contact details and emergency response procedures for the project. This H&S Plan will be developed at the procurement stage and developed further at construction stage to the satisfaction of the Applicant. The H&S Plan will identify the potential safety hazards associated with the site and the works and assess the associated risks. Mitigation and control measures will be implemented to minimise the identified risks.

Evidence of completion of construction safety training, typically in the form of a Safepass Card, will be required for all construction personnel prior to commencing on site. A record of Safepass Cards and personnel approved for entrance to site will be completed as part of a site induction process. The Contractor's H&S Plan will detail the site induction and access requirements. Where relevant, equipment operators or specialist works will require personnel to hold a valid Construction Skills Scheme Card. All equipment and machinery used on site will be appropriately certified for its intended purposes. The Applicant will ensure that only competent contractors are appointed to carry out the construction works on the site.

2.4.1.2 Covid-19

The emergence of the Covid-19 virus in Ireland in the early part of 2020 has presented a new human health risk and concern amongst the general public across the country and within the proposed project study area. At a minimum, the prevailing Government public health advice in relation to Covid-19 will be fully adhered to during the construction of the proposed project.

2.4.1.3 Site Access and Public Safety

Public safety will be addressed by restricting site access during construction works and the erection of security fencing as appropriate at construction works areas. The entrance to the wind farm construction site will be controlled by the Contractor. Construction vehicle access to the site will be via the L6483 local road using two access points (See Drawing 10798-2040, Appendix 1-1).

Access point one will be used as a main entrance point during the early stages of construction until such time as the internal access roads are constructed as far as access point two. At that stage access point two will be the main site exit and access point one will be the main site entrance. A one-way system will be in place for construction traffic on the local road network, as described in Chapter 16 (Traffic & Transportation) of the EIAR.

Access point one will be located in the townland of Cloghercor on the L6483 and will be the single access/egress point for wind farm maintenance vehicles during the operational phase. Access point two will use a permitted, not yet constructed, forest entrance on the L6483, further east in the townland of Clogheracullion during construction phase. Internal access roads will be constructed as part of the initial phase of the construction of the wind farm. The internal roads will be permanent (construction/operational) roads.

The site entrance gates from the L6483 will be securely locked outside of construction hours to prevent unauthorised entry and will be monitored during construction hours to regulate access to the site for authorised personnel.

For the duration of the construction works, access rights to the forestry lands for local groups will be restricted during the construction phase to minimise the risks for public health and safety.

2.4.2 Compound and Facilities

At the commencement of the construction phase, a temporary compound area will be constructed to provide office space, welfare facilities, car parking and hardstands for storing materials. At a later stage of the site development (when the construction works reach the northern end of the site) a second compound area will be constructed there as per the proposed site layout to provide additional facilities onsite. These will cover approximately 1.4 and 1.7ha each, and the 2 no. locations are shown on the site layout drawings (Appendix 1-1). At the end of the construction phase, the compounds will be removed, with any stone being used towards reinstatement of the nearest onsite borrow pits. After removal of the compound, the area will be replanted with forestry as described in Appendix 2-5 of the EIAR (Forestry Report).

Site accommodation will consist of temporary porta-cabins constructed on a granular platform. The topsoil will be stripped where development of the temporary compounds are proposed. The compounds shall be constructed to heights of up to approximately 0.5m above existing ground level.

2.4.3 Signage

Warning signs will be erected at the construction works areas clearly stating that construction works are underway. A notice board will be erected at the site entrance and at the construction compound gates with information on the contact details for site management, PPE requirements for the site and any other information deemed necessary in accordance with the H&S Plan.

Signage will be erected on both sides of the L6483 local road both north and south of the site entrance location to warn approaching vehicles of the construction site entrance location and the potential presence of slow-moving vehicles.

On the internal roadways, prior to exit from the site out onto the L6483, signage will be erected to inform construction traffic that they are leaving the site and directing them in the correct direction.

Road signage on the public road will be in accordance with the current *Traffic Signs Manual*[2] (Chapter 8) and associated best practice guidelines. Signage in respect of traffic management is discussed in the TMP in Appendix 2-7 and will be in accordance with the Local Authority recommendations and relevant planning conditions. Within the site, maximum speed signage will be erected along the access roads for construction vehicles and health and safety signage will be erected at borrow pits and where deep excavations, or other areas of increased risk, are occurring. Signage will also be erected as a reminder to concrete delivery drivers that concrete truck wash-out is not permitted on-site and identifying the area(s) where concrete chute wash-out is permitted.

2.4.4 Emergency Response Plan

The Contractor will be responsible for developing a detailed Emergency Response Plan (ERP) for the proposed works, to cover health and safety emergencies as well as environmental emergencies, as part of the H&S Plan. Details related to the ERP are outlined in Section 5.0 (Emergency Response Plan / Procedures) of this CEMP.

Further information relating to the management of spills or leaks and the procedure for responding to a health and safety or environmental incident is outlined in Section 5.3.

2.4.5 Incidents / Complaints

All safety or environmental incidents associated with the project will be reported and investigated in line with the ERP. Details related to the Incidents / Complaints are outlined in Section 5.0 (Emergency Response Plan / Procedures) of this CEMP.

3.0 CONSTRUCTION METHODOLOGY

3.1 CONSTRUCTION PROGRAMME (DURATION AND PHASING OF THE PROPOSED PROJECT)

It is estimated that the construction phase will take approximately 24 months from starting onsite to completion of commissioning of the turbines. Where practical, vegetation clearance that is required during construction works will commence outside the breeding birds season, which runs from the 1st of March to the 31st of August.

The construction phase can be broken down into 5 no. main phases as follows (there will be overlap of these phases):

- 14 months - Civils (including site roads, hardstands, turbine foundations, forestry felling, drainage);
- 6 months - Electrical grid connection/substation installation and commissioning;
- 12 months - Site electrical (installing between turbines and substation, pulling cables);
- 4 months - Turbine deliveries and erection;
- 2 months - Commissioning.

[2] Department of Transport, Tourism and Sport, *Traffic Signs Manual – Chapter 8: Temporary Traffic Measures and Signs for Roadworks* (August 2019)

3.1.1 Construction Hours

The hours of construction activity will be limited to avoid unsociable hours, where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs on weekdays and between 07:00hrs and 14:00hrs on Saturdays.

However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e., concrete pours or to accommodate delivery of large turbine components along public routes), it may be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with the Local Authority.

3.1.2 Employment

It is anticipated that 96-139 persons will be directly employed during the peak construction period.

3.2 OVERVIEW OF THE CONSTRUCTION METHODOLOGY

The proposed construction methodology is summarised in the following sections, however further detail is found in Chapter 2 (Description of the Proposed Project) and drawings in Appendix 1-1 of the EIAR.

3.2.1 Site Roads and Passing Bays

Site roads will be constructed to each turbine location, and to all proposed site infrastructure as shown in the site layout drawings of Appendix 1-1 of the EIAR, with a proposed running width of 5m. Passing bays will be included along roads strategically, as indicated in Appendix 1-1, and there will be a number of site entrances. Sections of new roads and upgraded roads are shown on drawings in Appendix 1-1 of the EIAR. Where required, the road widths will be increased to a maximum of 9.5m to form the indicated passing bays, as shown in drawings in Appendix 1-1 of the EIAR. All on-site roads will be maintained for the duration of the construction phase of the project.

3.2.1.1 Excavated New Road

Tracked excavators will carry out excavation for roads with appropriate equipment attached. When the topsoil has been removed and/or the formation layer has been reached, stone from the onsite borrow pits shall be placed to form the road foundation. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at subbase level. The sub grade will be compacted with the use of a roller or other approved compaction method. The final top dressing of unbound material will not be provided until all turbine bases have been poured.

3.2.1.2 Floating New Road

Monitoring posts will be installed prior to construction to monitor movement of soils in the area around the construction. A base geotextile membrane will be laid directly on top of the peat/soil surface, and a suitable granular fill will be placed on top of this. The stone will be levelled with an excavator or bulldozer and rolled to provide a suitable surface. The stone material will either be tipped over a long area (>10m) or in several small piles rather than being tipped in one location to prevent excess soil loading and compaction. To ensure a smooth transition between excavated and floating access track, a short (10-20m) length of the access track will have all peat excavated and filled with a suitable fill, which will be graded to allow for an appropriate transition. The final top dressing of unbound material will not be provided until all turbine bases have been poured.

3.2.2 Proposed Clear-Span Bridge and Culverts

There are 2 existing stream crossings and 10 no. clear-span bridges proposed as part of the proposed works, as shown on the site layout drawings (Appendix 1-1 of the EIAR). The site access tracks will be constructed as far as possible to allow easy access to the works area. Following this, the topsoil will be stripped from the foundation footprint on either side of the stream, taking care to avoid disturbing any part of the stream bed or banks. Suitable stone fill material (clause 804 or similar) will be added in layers and compacted to form the base of the foundation. The precast clear-span bridge will be placed onto this either as one or more pieces. Following this, barriers will be attached to the sides of the bridge structure, and the site access tracks will be constructed over the structure.

3.2.3 Borrow Pits

4 no. borrow pits will be constructed within the development site in order to fulfil the majority of stone material requirements. These are located near T13, T4/T5, and T1/T2. The locations of these borrow pits can be seen on the site layout drawings in Appendix 1-1 of the EIAR.

Borrow pits will be reinstated using any surplus inert material from the site (including peat) and made secure using permanent stock proof fencing. Rock and fill material may need to be extracted from a number of proposed turbine foundation locations as part of the required excavations there; this material will be used where possible to replace the material requirements from borrow pits.

3.2.3.1 Rock Extraction - Rock Breaking / Blasting

Rock will be extracted from borrow pits using two main methods: Rock breaking and rock blasting. It is anticipated that the primary method will be rock breaking.

The entire blasting process, from drilling to explosives handling to execution of the blast, will be designed, carried out and overseen by a specialist engineer. In order to carry out a blast, a number of holes are drilled into the rock over several days. Once these are prepared, the required amount of explosives will be brought to the site and installed in the holes. Explosive material will not be stored on site. Transport and handling of explosive material and carrying out of any blasts will be carried out with agreement and supervision of An Garda Siochána. Where blasting is required, local residents and noise sensitive locations will be notified of the upcoming blast.

3.2.4 Forest/Tree Felling

There will be a requirement to fell some of the forestry in the areas immediately surrounding the footprint of the wind farm infrastructure. The total area of forestry to be felled is estimated to be between approximately 69.8ha and 90.9ha, of which approximately 12.6ha will be replanted on site at the end of the construction phase (at the temporary construction compounds and reinstated borrow pits).

3.2.5 Peat and Spoil Management

The use of the borrow pits shall be phased. This will then allow materials to be placed in the first borrow pit thereby minimizing the volume of soils requiring temporary storage. In order to further reduce temporary storage requirements, reinstatement of soils and turves around infrastructure, and in restoration and landscaping works on areas of excavated / disturbed ground, will be carried out during the construction phase or as soon as is practical after the completion of the works in any one area of the site. Approximately 178,000m^3 will be excavated from the borrow pits onsite. A total of 184,000 m^3 will be used to reinstate the borrow pit area as well as for landscaping.

Where the proposed project footprint is located on any mineral-based soil, this material can be side-cast, profiled, and bermed as close to the excavation areas as is practical, or in the case of peat it will be used to reinstate the borrow pits). The sides of the excavated areas will be battered/sloped sufficiently to ensure that slippage does not occur.

3.2.6 Crossing Methodology - Directional Drilling

A launch and reception pit is required for directional drilling, with each measuring approximately 1m wide, 2m long and 1m deep. Two ducts will be required at each crossing location. A specialised directional drill machine will be anchored to the ground and will drill at a suitable shallow angle to allow it to achieve the required depth for the bore. If ground conditions are unfavourable, the drilling process may need to be repeated using progressively larger drill heads until the required size is achieved. The drilling process involves pumping a drilling fluid through the drill head, which is inert, natural and biodegradable (e.g. Clear Bore^{TM}). This fluid will be used sparingly and only as required to avoid an excess and will be appropriately stored when not in use. This fills voids locally around the drill head and enables the drill to progress without the hole collapsing. Should any excess drilling fluid occur, it will be contained and removed for disposal at a licensed waste facility. The duct will be positioned, and the launch and reception pits will be refilled.

Further details of this crossing method are provided in Appendix 1-1 of the EIAR. Associated construction methodologies are provided in Appendix 2-4 of the EIAR.

3.2.7 Joint Bays

Joint bays will be located at various points along the ducting route as specified by EirGrid requirements and as shown in the drawings of Appendix 1-1 of the EIAR. Joint bays will measure up to 6m x 2.5m x 2m deep as shown in the drawings of Appendix 1-1 of the EIAR. A reinforced concrete base and sides will be constructed in the bay to accommodate the jointing enclosure. Communication chambers will also be installed at the joint bay locations to facilitate connection of fibre-optic communication cables.

3.2.8 Proposed Site Drainage

Temporary (for the duration of the construction phase) and permanent drainage infrastructure will be installed as part of the proposed site development. These features include site drains and silt control measures (check dams/silt dams). Site drainage measures will be installed from the outset, being constructed at the same time as the initial civils works (site roads, hardstands, etc.). This will ensure that there is no uncontrolled runoff from the site during proposed works. Excavators will be used to construct the main drainage features (drains, settlement ponds, etc.), while small items such as silt dams/check dams will be constructed manually. Silt fences which trap suspended particles will be erected manually ahead of civil works as required on particularly steep ground, or near watercourses.

3.2.9 Temporary Construction Compounds

A temporary compound area will be constructed to provide office space, welfare facilities, car parking and hardstands for storing materials. At a later stage of the site development (when the construction works reach the northern end of the site) a second compound area will be constructed there as per the proposed site layout to provide additional facilities onsite. These will cover approximately 1.4 and 1.7ha each, and the 2 no. locations are shown on the site layout drawings (Appendix 1-1 of the EIAR). At the end of the construction phase, the compounds will be removed, with any stone being used towards reinstatement of the nearest onsite borrow pits. After removal of the compound, the area will be replanted with forestry as described in Appendix 2-5 of the EIAR (Forestry Report).

The site accommodation will consist of temporary porta-cabins constructed on a granular platform. The topsoil will be stripped where development of the temporary compounds are proposed. The compounds shall be constructed to heights of up to approximately 0.5m above existing ground level.

3.2.10 Public Car Park and Recreation Area

A gravel public car park will be constructed for the proposed amenity trails will be located at an existing forest entrance on the L6483 (See the Drawing 10798-2003, in Appendix 1-1 of the EIAR). This will be constructed in a similar way to the site roads. A number of picnic tables and informational signage will be installed.

3.2.11 Turbine Hardstand, Foundations and Erection

The topsoil will be stripped where development of the hardstands are proposed. The hardstands shall be constructed to heights of up to approximately 0.5m (on average) above existing ground level.

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator and will be stored as detailed in Section 3.2.5 (Peat and Spoil Management). The sides of the excavated areas will be sloped sufficiently (2:1 or as determined by a suitably qualified site engineer) to ensure that slippage does not occur. Precise excavation depths and batter requirements will depend on soil types locally and the turbine manufacturer requirements. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation, or for reinstatement elsewhere on site (such as the borrow pits). If the excavated material is peat, it will be brought straight to reinstate the borrow pit. The excavated material will be smoothed with the back of an excavator bucket and surrounded by silt fences to minimise the potential for sediment-laden run-off occurrence.

In the case of gravity foundations, if the formation level is reached at a depth lower than the depth of the foundation, the ground level will have to be raised with clause 804 hardcore material and/or lean mix concrete, compacted in layers as required, with sufficient compaction effort. Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level with the spreader or settlement pond. It is not anticipated that piled foundations will be required.

An embankment approximately 600mm high and a fence or berm will be constructed around the perimeter of each turbine base to prevent construction traffic from driving into the excavated hole and also to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a gangway to a standard 1:12 grade, thereby allowing safe passage into/out of the foundation area.

Approved lifting equipment will be used to unload reinforcing steel to required areas. The bottom matt of steel will be fixed prior to the tower cans, if used, being lifted into position and reinforcing steel will be positioned and fixed in accordance with the turbine suppliers' requirements. The detailed design and exact dimensions will be determined once a turbine manufacturer has been selected following a competitive procurement process.

Formwork to concrete bases will be propped/supported sufficiently to prevent failure. Concrete for bases will be poured using a concrete pump. After a period of time when the concrete has set sufficiently, the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be filled with suitable fill (i.e. hardcore) up to existing ground level. The working area around the perimeter of the foundation will be backfilled with suitable material (hardcore). These hardstand areas around the turbines will be levelled, compacted and finished with a suitable surface material for traffic (clause 804 or similar) as per the site access tracks and remainder of the hardstand areas.

3.2.12 Grid Connection

As stated above, the proposed wind farm will connect to the existing national grid (through an existing overhead line in Cloghercor) via the onsite substation and associated underground grid connection. Once fixed into position, the substation and electrical grid connection will be commissioned and made live to allow removal of the existing wooden polesets, part of the overhead line. The internal site cabling (between turbines and the substation) will remain off until the turbines are being commissioned and the wind farm enters into service.

Thirteen existing wooden polesets and a single steel angle mast (reference 148 to 161 on drawing 05725-DR-100 in Appendix 1-1 of the EIAR) between the two new end masts will be removed as part of the grid connection works. Once the new underground cable is energised the wooden polesets will be removed by an excavator and incorporated back into the stock for further use, in line with ESBN best practise procedures.

The new end masts at the northern and southern ends of the proposed grid connection will generally be constructed by installing the foundations and lower section of the mast first. The upper sections of the masts will only be constructed when the rest of the grid connection infrastructure is ready to become live. This approach will minimise the amount of time the main 110kV line must be switched off.

A full description of the Grid Connection works and the construction methodologies for each element are provided in Appendix 2-4 of the EIAR. The construction methodologies for the various elements of the grid connection are summarised below.

3.2.12.1 110 kV Substation and Electrical Works

Two control buildings will be constructed using traditional techniques for constructing small buildings (i.e. concrete block walls, timber and slate tile roof). Foundations will be built for all of the proposed electrical infrastructure. All the electrical equipment will be installed to EirGrid/ESB requirements. Perimeter fencing will be constructed around the substation compound for security and safety purposes. Further information and drawings of the substation and electrical infrastructure are provided in Appendix 1-1 of the EIAR. Associated construction methodologies are provided in Appendix 2-4 of the EIAR.

3.2.12.2 110 kV Underground Cable Trenches

The cables will be installed for the majority within the internal access roads, with a single crossing point of the existing public road corridor as indicated on the site layout drawings in Appendix 1-1 of the EIAR. A section of the route (approximately 1km) will also be located within/adjacent to the proposed main site access road, and a smaller access track will be put in place over the entire remaining route. It should be noted that works within the public road corridor will also be subject to further consents/agreements with local authorities, for example a Road Opening Licence as appropriate.

The underground cable required to facilitate the grid connection will be laid beneath the ground surface and/or public road using the following methodology:

- The area where excavations are planned will be the subject of a confirmatory survey, prior to the commencement of works, with a cable locating tool and all existing underground services will be identified.
- A verification condition survey will be carried out for all parts of the route within the public road. Details of this survey will be agreed with the local authority in advance of the survey.
- A trench will be opened using an excavator to accommodate the formation required.
- The excavated material will be cast to the side to be reused as backfilling material where appropriate. This material will not be stored in the vicinity of any watercourse and will be smoothed with the back of an excavator bucket to minimise runoff. It will be cast on the upgradient side of the trench, so if any runoff did occur it will run into the down gradient trench. Excess material will be used on the site of the proposed project for local landscaping, borrow pit reinstatement.
- Silt fences will be installed alongside the road/works areas as required near watercourses.
- Clay dams/plugs will be installed at regular intervals (depending on the gradient) to prevent conduit flow of water within the trench.
- Works will not be carried out during periods of heavy precipitation. In the event that some surface water does accumulate in the trench, this will be allowed to percolate into the ground naturally.
- The trench will be surfaced as per the road surface specifications of the local public road, the wind farm road, or (in the case of off road section) an EirGrid/ESB specification gravel access track capable of supporting maintenance vehicles if required.
- Cable joint pits are normally located at regular intervals as shown in the site layout drawings (Appendix 1-1 of the EIAR). Each joint pit will be approximately 2.5m x 6m in size with a communications chamber and an earth link box in close proximity to the joint pit as shown in the detail drawing (Appendix 1-1 of the EIAR). They have been located where possible in accessible areas away from watercourses. They will be constructed off the public road. A temporary surface is provided over these for safety and to allow easy access until the cables are pulled, after which time the area will be permanently reinstated/surfaced as appropriate. The location of these joint pits are provided on site layout drawings provided in Appendix 1-1 of the EIAR.
- It is anticipated that construction will be carried out by a single team (with plant items likely to include excavators and dumpers) along the route, but there is a

possibility to use two separate teams to speed up the construction. It is expected that each team could lay approximately 150m of the route per day.

Further details on the design for the grid connection cable trenches are provided in Appendix 1-1 of the EIAR; associated construction methodologies are provided in Appendix 2-4 of the EIAR.

3.2.13 Turbine Delivery Accommodation Works Areas

Where works are needed along the public road corridor to facilitate deliveries to site, they will be agreed in advance with the local authority and carried out to the appropriate standard (TII, purple book, etc.).

Where a temporary surface is needed for the turbine delivery route (including the blade changeover area), works will start with the clearing of any vegetation, and the topsoil will be stripped and either used locally for landscaping purposes/bermed for later use in reinstatement or used for borrow pit reinstatement onsite. Where local use for landscaping does occur it will be smoothed off with the back of a bucket and seeded with a suitable grass seed mix. Silt control curtains will also be employed within 50m of a stream. Topsoil material will not be used locally within 50m of a stream, and peat material will not be used if found to be present at any location. It is anticipated that the majority of material will be taken to the wind farm site for borrow pit reinstatement. It may also be taken to a local licensed/permitted waste facility if found to contain any contaminants such as bitumen. Suitable fill material (broken stone and clause 804) will be used to create a firm running area for the passage of turbine delivery vehicles. The areas will be fenced off when the delivery is not occurring. After the delivery of turbines to site, the site will be re-instated to the original condition with removal of the temporary surface, and any removed vegetation will be reseeded/replanted with a similar native species composition.

3.2.14 Permanent Meteorological Mast

The met mast installation works shall be carried out by a small crew and are described as follows:

- An access track shall be extended towards the mast location from the existing forestry track. The access track shall be 3.5m in width. Associated drainage infrastructure shall be extended also;
- A small aggregate crane pad shall be constructed in front of the proposed mast location;
- General construction methods for the above access track and hard standing shall match those described for wind farm access tracks and hard standings however the dimensions and stone depth requirements of the infrastructure will be considerably less than that required for that serving the wind turbine construction;
- The foundation shall be excavated followed by shuttering, steel fixing and finally concrete pouring by ready mix truck. The foundation shall be 10m x 10m x 1.8m in size;
- Following crane setup, the mast sections shall be delivered and unloaded by truck;
- In accordance with an agreed lifting plan, mast sections shall be lifted by crane into place. Wind speeds shall be monitored at all times during lifting operations by the lead climber and crane operator;
- Mast sections shall be bolted together by climbers; and
- Following erection of main mast sections, lightning protection and other ancillary components shall be fixed to the mast.

3.2.15 Biodiversity Enhancement Lands

The land management being proposed for this area will involve vegetation management through livestock grazing and/or cutting and will not involve any excavations or construction. Agricultural land management practices for each plot of land will be prescribed and agreed with land owners, and will follow along these principles:

- Encourage the growth of Ling Heather (Calluna vulgaris), of diverse age structure and encourage the growth of wet flushes with tall grasses, rushes and sedges.
- Burning for any reason will not take place.
- Control bracken by cutting/rolling/bruising.
- Where necessary management measures will include predator control, supplementary feeding and control of disturbance.
- Exclusion and reduction of grazing for a 2-5 year period will be employed for restoration of degraded habitat to allow heather to establish.
- Avoid use of weed killer or fertiliser during peak breeding times.
- No permission of hedgerow removal, planting of conifers, land drainage, turf cutting, shooting during bird breeding season, or recreational activities involving road vehicles.

4.0 ENVIRONMENTAL MANAGEMENT

Good construction practice will be implemented throughout the construction phase of the project, which will assist in the management of the risks for this site The following sections detail the approach to good construction practice and environmental management during the construction stage of the proposed project.

4.1.1 Environmental Training and Awareness

In order to ensure that environmental awareness and compliance is communicated effectively at the start and throughout the construction works, this CEMP and its contents will be communicated to all site personnel, including management staff, operatives and sub-Contractors. The key elements of this CEMP will form part of the site induction which will be mandatory for all employees, Contractors and visitors attending the site.

Environmental toolbox talks will be provided to all site personnel and sub-consultants on a regular basis. These will be targeted at particularly sensitive environmental issues such as:

- Protection of sensitive ecological habitats and key ecological receptors;
- Works close to sensitive water bodies - oligotrophic lakes present;
- Area of peat - peat replacement plan;
- Invasive species management;
- BioClass areas;
- Water pollution and silt control;
- Water pollution in relation to cement and concrete handling;
- Spill prevention and control;
- Dust management.

4.1.2 Traffic Management

Traffic management measures will be implemented in accordance with those included in the Chapter 16 (Traffic and Transportation) of the EIAR and a Traffic Management Plan (TMP) (Appendix 2-7 of the EIAR) will be agreed with Donegal County Council.

4.1.3 Noise and Vibration Control

The Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to comply with the recommendations of British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*[3].

The SHEQ Officer, or equivalent, will supervise the works to ensure compliance with the noise and vibration limits set out in the Standards document referred above and the EIAR. The following list of measures will be considered, where necessary, to ensure compliance with the relevant construction noise criteria:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise;
- The best means practicable, including regular and proper maintenance of plant and machinery, will be employed to minimise the noise produced by on site operations;

[3] British Standards Institute (BSI), *BS 5228-1:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites* (2008)

- Plant with low inherent potential for generation of noise and/ or vibration will be selected where practicable;
- Noisy / vibratory plant will be placed as far away from sensitive properties as permitted by site constraints;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated 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.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
- The hours of construction activity likely to create high levels of noise and vibration will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs on weekdays and between 07:00hrs and 14:00hrs on Saturdays. However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e., concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary on occasion to work outside of these hours.
- Channels of communication will be established between the contractor/applicant, Local Authority, and residents;
- A site representative responsible for matters relating to noise and vibration will be appointed;
- Monitoring of typical levels of noise and vibration during critical periods and at sensitive properties will be undertaken;
- The surface of the site access tracks will be kept even to mitigate the potential for vibration from lorries.

During the construction phase of the proposed project, supervision of the works will include ensuring compliance with the limits detailed in Chapter 12 (Noise and Vibration) the EIAR using methods outlined in the aforementioned BS 5228-1. This approach calls for the designation of an Noise Sensitive Location (NSL) into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a NSL during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values recommended by BS 5228-1 are depicted in Table 4.1.

Table 4.1: Example Threshold Potential Significant Effect at Dwellings

Assessment category and threshold value period (T)	Threshold value, in $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.

Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.

Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.

Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

It should be noted that this method is only valid for residential properties. The following method should be followed: For the appropriate period (e.g., daytime) the ambient noise level is determined and rounded to the nearest 5 dB. At some properties, particularly those located close to busy roads, the ambient noise levels are expected to be relatively high. However, given the rural nature of the site in general, daytime noise levels are below 65dB $L_{Aeq,T}$. Therefore, for the purposes of the management of construction noise, as a worst case, all properties will be afforded a Category A designation. If the specific construction noise level exceeds the appropriate category value (e.g., 65 dB $L_{Aeq,T}$ during daytime periods) then a significant effect is deemed to occur.

Vibration from construction activities will managed in accordance with the guidance relevant to acceptable vibration limits within buildings is contained in the following documents:

- BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration (BSI, 1993) (BS7385): BS7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at low frequencies rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.
- BS 5228-2:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BSI, 2014) (BS5228-2): BS5228-2 recommends that, for a soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e., non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above than 15 Hz. Below these vibration magnitudes minor damage is unlikely, although the standard notes that where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004)* also contains information on the permissible construction vibration levels during the construction phase, these levels are depicted in Table 4.2 below.

Table 4.2: Allowable Vibration at Sensitive Properties (NRA, 2004)

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

It should be noted that these limits / levels are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage, these limits may need to be reduced by up to 50%.

Where rock breaking is employed, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities:

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all leaks in air lines are sealed;

- Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured;
- Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.

Methods used to minimise effects of rock blasting may consist of some or all the following:

- Restriction of hours within which blasting can be conducted (e.g., 09:00 – 18:00hrs);
- A publicity campaign undertaken before any work and blasting starts (e.g., 24 hours written notification);
- The firing of blasts at similar times to reduce the 'startle' effect;
- On-going circulars informing people of the progress of the works;
- The implementation of an onsite documented complaints procedure;
- The use of independent monitoring by external bodies for verification of results;
- Trial blasts in less sensitive areas to assist in blast designs and identify potential zones of influence.

If blasting is required, the following mitigation measures will be employed to control the impact during blasts:

- Trial blasts will be undertaken to obtain scaled distance analysis;
- Ensuring appropriate burden to avoid over or under confinement of the charge;
- Accurate setting out and drilling;
- Appropriate charging;
- Appropriate stemming with appropriate material such as sized gravel or stone chipping;
- Delay detonation to ensure small maximum instantaneous charges;
- Decked charges and in-hole delays;
- Blast monitoring to enable adjustment of subsequent charges;
- Good blast design to maximise efficiency and reduce vibration;
- Avoid using exposed detonating cord on the surface.

4.1.4 Dust Suppression / Management

There will be some temporary dust and exhaust emissions from construction activities during the construction phase.

The Contractor will have due regard to relevant guidance such as *The Control of Dust and Emissions during Construction and Demolition* published by the Greater London Authority (GLA) in 2014 and *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* published by the NRA (now TII) in 2011.

During the construction phase, dust or air pollutants generated from the proposed project will typically arise from:

- Movement of construction vehicles;
- Laying hardstanding areas and access tracks (i.e. roads);
- Transportation of turbines and construction materials to and within the site;
- Excavation and crushing of rock for use as a base material for internal roads and hardstanding areas;
- Excavation, movement and placement of soil stockpiles (excavated soils / fill materials); and
- Wind generated dust from stockpiles, exposed unconsolidated soils and roads.

The TA Luft/VDI 2119/Bergerhoff Method of dust emission monitoring has become the most commonly used method. This method involves using a direct collection pot to standardised dimensions of either glass or plastic. The system benefits from being a direct collection method i.e. less transferring of material and consequent reduction in sampling errors. This method is defined as an internationally recognised standard and has been adopted by the Environmental Protection Agency (EPA) as the method of choice for licensed facilities. The compliance threshold limit is 350mg/m^2/day as recommended by the TA Luft/VDI 2119/Bergerhoff Method. Dust monitoring will be carried out pre-construction to establish the baseline dust environment and during construction to monitor any potential increases in dust emissions.

All relevant mitigation measures as described in Chapter 14 (Air Quality and Climate) of the EIAR will be implemented during construction works, the majority of which are related to machinery and vehicles at the site. Vehicles and plant will be routinely serviced to minimise the exhaust emissions during construction and will not be left running unnecessarily. Similarly, emphasis will be put on dust reduction measures and inspections. Potential effects arising from dust and exhaust emissions will be minimised through the provision of the following mitigation measures:

- Minimisation of extent of working areas;
- Stockpiling of excavated materials will be limited to the volumes required to practically meet the construction schedule;
- Drop heights of excavated materials into haulage vehicles will be minimised to a practicable level;
- Daily inspections by site personnel to identify potential sources of dust generation along with implementation measures to remove causes where found;
- Provision of dust suppression measures (e.g. sweeps/covers/water bowsers) will be used on stockpiles and the road surface during periods of extended dry weather
- If necessary, water will be taken from settling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust;
- Silty or oily water will not be used for dust suppression, because this will transfer the pollutants to the haul roads and generate polluted runoff or more dust;
- Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff;
- Traffic coming to site will only use the specified haul routes;
- Onsite borrow pits will be used to minimise quantities of stone material being brought to site;
- Best practice (including industry recognised dust suppression techniques/equipment) will be used to minimise the potential for dust production during the extraction of rock from the borrow pits and excavations elsewhere;
- Vehicles and plant will be routinely serviced to minimise the exhaust emissions during construction;
- Vehicles will not be left running unnecessarily and low emission fuels will be used where possible; and
- A wheel wash will be provided near the main site entrance and used to prevent the transfer of dust from vehicles used during construction works on to public roads - The drawings in Appendix 1-1 of the EIAR include typical details and proposed location of a proposed self-contained wheel-wash system;
- A road sweeper will be available if any section of the surrounding public roads becomes soiled by vehicles associated with the proposed project.

4.1.5 Protection of Water Quality

4.1.5.1 Site Drainage

The site of the proposed wind farm will have both temporary (for the duration of the construction phase) and permanent drainage infrastructure installed as part of the proposed site development. These features include site drains and silt control measures (check dams/silt dams).

The site drainage measures will be installed from the outset, being constructed at the same time as the initial civils works (site roads, hardstands, etc.). This will ensure that there is no uncontrolled runoff from the site during proposed works. Excavators will be used to construct the main drainage features (drains, settlement ponds, etc.), while small items such as silt dams/check dams will be constructed manually. Silt fences which trap suspended particles will be erected manually ahead of civil works as required on particularly steep ground, or near watercourses.

4.1.5.2 Pre-emptive Site-Drainage Management

The works programme for the initial construction stage of the proposed project will take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if the following is likely to occur:

- >10mm/hr (i.e., high intensity local rainfall events);
- >25mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and
- Provide cover to material storage areas i.e., adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.

4.1.5.3 Refuelling - Fuel and Oil Management

Any easily manoeuvrable road-going construction vehicles will be refuelled off-site, wherever possible. This will primarily be the case for road vehicles such as vans and trucks. However, for any construction machinery that will be based on-site continuously, or vehicles which are slow moving or tracked or those for whom regular trips off-site to refuel will not be practical, on-site fuelling will be required and a limited amount of fuel will have to be stored on site.

On-site refuelling of machinery will mainly be carried out using a mobile double skinned fuel bunded fuel tank. A spill kit in the form of a supply of fuel absorbent material and mats and a drip tray will be kept with the tank at all times. The drip tray and fuel absorbent mats will be used at all times during refuelling.

No refuelling will be carried out within 50 m of a stream. The fuel bowser, typically a double-axle custom-built refuelling trailer, will be re-filled off-site, where possible, or at either of the two construction compounds and will be towed as required within the site by a 4x4 vehicle to where machinery is located. It is not practical or preferable for most heavy construction vehicles (such as cranes, excavators, dozers, dumpers etc.) to travel back to the refuelling point in the construction compounds given the size of the proposed wind farm site. The 4x4 vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level impermeable area in either of the construction compounds when not in use.

Oils, lubricants and other hazardous liquids required for maintenance of equipment during the construction phase will be stored on the dedicated impermeable storage platform in the construction compounds. Any additional fuel containers, other than the fuel bowser, used for smaller equipment (such as generators, lights etc.) will be stored within additional secondary containment e.g. bund for static tanks or drip trays for smaller mobile containers. Taps/nozzles for fuels and storage containers for oils will be fitted with locks to ensure their use is controlled. Only designated trained and competent operatives will be authorised to refuel plant on site.

New clean ancillary machinery equipment such as hoses, pipes and fittings required on-site will be contained within a bunded area, however any used or damaged parts will not be stored on-site and will be removed immediately. Any repair works required on machinery involving fuel and oil control will be carried out off-site where practical, or in the construction compounds over an impermeable surface. Unless unavoidable, repair works carried out in the field where machinery is operational will use spill trays and absorbent materials to prevent release of contaminants to the ground. Maintenance and repair works will be carried out at least 50m from any stream.

At least daily checks prior to start-up of plant and machinery will minimise the risk of break-down and associated contamination risks for on-site repairs. Records of daily pre-start checks will be maintained and kept in the site office. A clean site policy and diligent housekeeping will also reduce the potential of hydrocarbon release on-site.

4.1.5.4 Spill Control and Response

Emergency spill kits with oil boom and absorbent materials will be kept on-site in the event of an accidental spill. Spill kits will be stored in each construction compound, and at the on-site substation in case of emergency and with the 4x4 vehicle transporting the fuel bowser, smaller spill control kits will also be kept in all construction machinery. All construction personnel will be notified of where the spill kits are located as part of the site induction and will be trained on the site procedures for dealing with spills.

In the event of a leak or accidental fuel spill in the field, the source of the spill will be fixed, and the fuel will be contained and cleaned as quickly as possible using the spill kits to contain and absorb the pollutant and prevent any further potential contamination. The absorbed pollutants and contaminated materials will be placed into leak proof containers and transferred to a suitable waste container for hazardous materials in the construction compounds. Where a leak has occurred from machinery, the equipment will not be permitted to be used further until the issue has been resolved. The incident will be reported to the site manager and Environmental Clerk of Works, and appropriate remediation will be carried out (i.e. soil removal for safe disposal at a licensed waste facility south of Donegal Town, etc.).

The SHEQ Officer (or equivalent appointed person) will be notified of any spills on-site and will determine the requirement to notify the authorities as set out in Section 5.3.3 (Incidents / Complaints).

4.1.5.5 Forest / Tree Felling

The proposed project must have obtained planning consent before an application can be made for a felling license from the Forest Service as per their policy on tree felling for wind farms.

As part of this process, an area of at least an equivalent size to that which was felled must be replanted. This replanting land can be located anywhere within the state, provided an afforestation license is granted for the land. This replanting will be carried out at a number of suitable technically approved afforestation sites the state, and these will be located in a different county, therefore not having any cumulative impacts with the proposed wind farm (i.e. not in the same river catchment, no ecological connections and with no potential for visual/landscape cumulative impacts with the wind farm.

4.1.5.6 Directional Drilling

Drilling fluid required for the directional drilling process will be used sparingly and only as required to avoid an excess and will be appropriately stored when not in use. The fluid used during the process is inert, natural and biodegradable (e.g. Clear Bore™). Should any excess drilling fluid occur, it will be contained and removed for disposal at a licensed waste facility. The duct will be positioned, and the launch and reception pits will be refilled.

Further details of this crossing method are provided in Appendix 1-1 of the EIAR; associated construction methodologies are provided in Appendix 2-4 of the EIAR.

4.1.5.7 Peat / Spoil Management

Topsoil and sub-soil are to be stockpiled separately. Turves will be stored turf side up and will not be allowed to dry out. Stockpiles are to be isolated from any surface drains and a minimum of 50m away from streams. Measures such as interceptor ditches around the bases of these areas, sediment traps and seeding of the bunds shall be incorporated to prevent runoff of suspended solids laden surface water and soil erosion. No permanent spoil or stockpiles will be left on site.

The method for restoration of excavated or disturbed areas is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface.

A temporary peat deposition area will be set up on site for storage of peat that is excavated on site. It will be mainly used until the first borrow pit is fully excavated. Once all stone has been extracted, then it is proposed to place peat within the borrow pit to reinstate it. The temporary peat deposition area may be used throughout the construction phase of the project while waiting for availability of space in the onsite borrow pits.

To prevent erosion and run-off and to facilitate vegetation reinstatement, any sloped embankment will be graded such that the slope angle is not too steep and that embankments match the surrounding ground profile.

4.1.5.8 Borrow Pits

Borrow pits will be reinstated using any surplus inert material from the site (including peat) and made secure using permanent stock proof fencing.

Rock and fill material may need to be extracted from a number of proposed turbine foundation locations as part of the required excavations there; this material will be used where possible to replace the material requirements from borrow pits. The onsite borrow pits will be used for the long-term storage of peat which is excavated around the site.

Once all of the required stone has been mined from each borrow pit, it will be reinstated using excess spoil from the site, most of which will be peat. As these will be excavated into the ground, peat stability risks associated with storage will be mitigated.

4.1.5.9 Concrete Deliveries and Pouring

Concrete is required for the construction of the turbine bases and foundations. After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute wash out. Wash down and washout of the concrete transporting vehicles will take place at an appropriate facility offsite.

The best management practice objectives for concrete chute washout are to collect and retain all the concrete washout water and solids in leak proof containers or impermeable lined wash out pits, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. The collected concrete washout water and solids will be emptied on a regular basis. Washout will be undertaken at the construction compounds.

The small volume of water that will be generated from washing of the concrete trucks chute will be directed into a temporary lined impermeable containment area, or a concrete wash unit. This type of unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site as waste material. Where temporary lined impermeable containment areas are used, such containment areas will be excavated and lined with an impermeable membrane.

General measures to prevent surface water contamination from concrete pouring on-site will include:

- Using weather forecasting to assist in planning large concrete pours and avoiding large pours where prolonged periods of heavy rain is forecast;
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete;
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets;
- Ensuring that covers/mesh are available for freshly placed concrete to avoid the surface washing away in heavy rain;
- Disposal of surplus concrete after completion of a pour off-site; and
- Discussing arrangements for concrete deliveries with the suppliers before works commence to ensure they are aware of on-site wash-out restrictions.

4.1.5.10 Works Near Waterbodies

The construction works will involve some works within 50m of streams (such as site access tracks and clearspan bridges). However, no instream works are proposed, and a suite of measures are in place to avoid any adverse effects on streams. Clear span bridges will be utililsed for stream crossings. Trees will be cut manually inside the 50m buffer. During the near stream construction work, silt traps and a double row silt fences will be placed immediately down-gradient of the construction area for the duration of the construction phase.

Near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document *"Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites"*, that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.

It is proposed, that during the ground clearance of the proposed project, the contractor will implement water control measures to limit the effect on water quality using standards measures as set out in the Forestry Felling Report – Appendix 2-5. Brash will be used along harvesting and extraction routes for soil protection. The forwarder will be loaded to the manufacturer's maximum specification and no more to avoid overloading and unnecessary soil compaction.

Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 Control of water pollution from linear construction projects.

All temporary and permanent drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following:

- Filtration of water through filter media (sand / stone check dam, silt fence);
- Detention / settlement in settlement ponds or behind check dam in swales; and
- Conveyance of shallow depths of water in vegetated swale.

4.1.5.11 Monitoring

Local surface water features in the immediate vicinity of the site boundary will be monitored at the pre-construction stage and during construction to take account of any variations in the quality of the local surface water and groundwater environment as a result of activities related to the proposed project.

Inspections of silt control measures are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed, and records kept.

During the construction phase, field testing and laboratory analysis of a range of parameters will be undertaken at adjacent watercourses, specifically following heavy rainfall events (i.e., weekly, monthly and event based as appropriate).

Regular visual inspections of all watercourses (flow conditions, discolouration, collection of debris, fish in distress or floating), presented in a monthly report on water quality, is advised by an independent, suitably qualified ECoW with particular emphasis placed on:

- Streams downstream of site activities;
- At times when heavy traffic is frequenting the site;
- During and after periods of heavy or prolonged rainfall and during winter months;
- During fish migration and spawning periods; and
- Stream crossings to ensure that the existing mitigation measures are effective in preventing any sediment reaching streams.

4.1.6 Invasive Species Management

An Invasive Species Management Plan has been prepared (see Appendix 6-6 of the EIAR) and will be reviewed and updated prior to construction and implemented to prevent the construction work from causing the introduction and / or spread of invasive species. Preparation of the plan will include a resurvey of the infrastructure buffer to identify any additional invasive species stands, or spread of existing invasive species stands, that may have developed since the August 2022 survey.

Invasive Species Stands

All invasive species stands will be securely fenced with warning signs and access to these areas will only be permitted for designated personnel. The fencing will be a minimum of 7 m from the invasive species plants. No construction work will take place until an inspection by the Ecological Clerk of Works has confirmed that all the relevant invasive species stands are adequately fenced.

The removal of the Rhododendron, Japanese Knotweed and Montbretia stands identified in this Environmental Impact Assessment Report, and any additional invasive species stands identified from the resurvey will use appropriate methods based on the National Roads Authority's *Guidelines for the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 2010) or other relevant guidance. This may include chemical treatment and/or physical removal.

Any invasive species material removed will be either buried on site at a depth of 2 m, incinerated, or disposed of to an appropriately licensed landfill. Storage of contaminated soil will only take place in designated storage areas. These storage areas will be securely fenced with warning signs and access to these areas will only be permitted for designated personnel.

Appropriate biosecurity measures will be applied to all personnel and machinery involved in the invasive species control work. A designated wash-down area will be created, where material from a power-washed vehicle can be effectively contained, collected and buried/removed off-site along with other contaminated material. The area will have a washable membrane or hard surface.

No construction work will take place within, or adjacent to, areas with invasive species stands until the above measures have been implemented, and the removal has been verified by an inspection by the ECoW.

General Biosecurity Protocols

An Invasive Species Risk Assessment Method Statement will be provided by the contractor prior to commencement of any works. This will include: procedures for inspection and decontamination of vehicles and equipment prior to arrival and on departure from the site; designation and management of wash-down areas; procedures for checking materials entering the site; and biosecurity measures for construction works associated with the drainage ditch near stream works.

4.1.7 Biodiversity Management Plan

A Biodiversity Management Plan (BMP) will be implemented as part of the development and operation of the wind farm. A particular focus of the Plan will be the management of habitat creation and enhancement measures and bat buffer zones. The Plan will include:

- Creation of a wetland buffer zone around Lough Aneane More;
- Protection / restoration of four areas of lowland blanket bog habitat; and
- Management of the corridor of open grassland / heath along the forest road in the northern part of the site.

Additional general biodiversity management measures will be implemented throughout the site. The BMP can be found in Section 6.5.6, Chapter 6 (Biodiversity) of the EIAR. The updated BMP will become part of the Contractor's CEMP for the construction works.

A Golden Eagle Habitat Management Plan (Appendix 7-9 of the EIAR) will be implemented to mitigate or the potential displacement impacts to Golden Eagles.

4.1.8 Waste Management

Best practice in waste management will be employed during all phases of the Proposed Project, with a view to reducing, reusing, recycling and recovering waste produced, in that order of preference. Waste disposal will be avoided where possible. The following sections outline the Waste Management Plan (WMP) and waste management practices associated with the proposed project, which will be in accordance with relevant provisions of the Waste Framework Directive (Directive 2008/98/EC on waste), the Waste Management Act 1996 as well as all other Irish and EU legislation.

4.1.8.1 Waste Management Plan

The main site contractor will appoint a Waste Manager who will ensure that all waste contractors have the correct permits for any waste streams they are removing from site, and that they are taking it to the appropriately licensed/permitted waste facilities. They will also ensure that all parts of the WMP will be implemented onsite.

All waste generated from the Cloghercor Wind Farm development construction phase will be managed in accordance with the provisions of the Waste Management Act 1996 as amended and associated Regulations. The following measures will be implemented on site by the appointed Contractor for the duration of construction:

- The appointed Contractor will ensure all excavated topsoil and subsoils will be reused within the site boundary, insofar as possible, primarily for reinstatement of the borrow pits. Any excess material which cannot be reused in creating berms or reinstating the borrow pits will be transferred off-site to a licensed waste facility. Similarly, any excess or unsuitable rock material which cannot be reinstated in the borrow pits will be transferred off-site. However, it is not anticipated that any excess material will not be suitable for reuse within the site;
- The appointed Contractor will ensure that any excess material which cannot be reused will be transferred off-site to a suitable licensed waste facility. Similarly, any excess or unsuitable soil / rock material which cannot be reinstated will be transferred off-site. However, it is not anticipated that any excess material will not be suitable for reuse within the site;
- The appointed Contractor will ensure typical waste streams (such as metals, paper, cardboard, plastics, wood, rubber, textiles, bio-waste, packaging, WEEE (electronic waste, batteries, accumulators and construction waste) will be managed, collected, segregated and stored in separate area(s) at the site before being removed off site by a licensed waste management contractor at regular intervals for the duration of the construction works;
- The appointed Contractor will provide skips and bins of appropriate sizes onsite in a designated area(s) and used to maximise source segregation of waste materials. This will include food and packaging waste from canteen and welfare facilities. Appropriate control of food waste in the compound will minimise the potential for pests and rodents to visit the area;
- Any contaminated materials used for spills and equipment maintenance works will be separately stored in a suitable container for collection by the appointed authorised hazardous waste contractor(s);
- The appointed Contractor will encourage all staff to minimise waste generation and to maximise the segregation of waste at source. Material wastage will be avoided by delivering only the required quantities of material to site and utilising off-site manufacturing of materials as much as possible;
- The appointed Contractor will establish 'just-in-time deliveries to avoid excess material storage at the site which can lead to waste generation. Delivery drivers will be encouraged to remove any excess packaging from materials delivered to site and remove unused timber pallets where possible;
- Reusable formwork for concrete pouring will be used where possible, in preference of non-reusable options. Other opportunities for material reuse across the site will be sought by the appointed Contractor;
- Due to the current nature / use of the site (commercial forestry / agriculture), it is not anticipated that there will be contaminated soils or materials encountered during the excavation works. No contaminated soils were identified during the site investigation works.

- It is noted that illegal dumping is common in large forestry areas and may be encountered at the time of construction. Where illegal dumping is discovered, appropriate communication and measures will be taken to try and identify the source of the illegal waste. The appropriate authorities will be notified, and the materials will be removed from site by authorised waste collection contractors and transferred to suitably licensed waste facilities:
- The SHEQ Officer, or other appropriate person, will be chosen by the appointed Contractor as the Waste Manager for the duration of the project in accordance with the general guidance set out in the *Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects*[4], published by the EPA in November 2021;
- At the pre-construction stage, the appointed construction and demolition (C&D) Waste Manager will be in a position to require fellow designers to take full advantage of all reasonable C&D waste prevention, reuse and recycling opportunities;
- During construction, the practicalities of waste prevention, salvaging re-useable materials, and the need to synchronise the recycling of waste materials through the timing of their use in the new construction works will be emphasised by the appointed Waste Manager; and

The appointed Waste Manager will be responsible for auditing waste handling and storage throughout the project and for advising construction personnel on best practices. All waste collections and records of waste movement

4.1.9 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. Site roads will be already formed using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

However, in the interest of best practice and to avoid the potential for the transfer of alien invasive plant species into the site, it is proposed to install a self-contained wheel-wash system near the project site entrance (access points one and two). The drawings in Appendix 1-1 of the EIAR include typical details and proposed location of a proposed self-contained wheel-wash system which will be installed as part of the construction phase of works.

A road sweeper will be available if any section of the surrounding public roads becomes soiled by vehicles associated with the proposed project.

[4] EPA *Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction & Demolition Projects* (November 2021) - https://www.epa.ie/publications/circular-economy/resources/CDWasteGuidelines.pdf (26 August 2022)

5.0 EMERGENCY RESPONSE PLAN / PROCEDURES

5.1 HAZARD IDENTIFICATION

In order to establish the type of potential emergencies that may occur, the hazards outlined in Table 5.1 have been identified as being potential situations that may require an emergency response they occur.

Table 5.1: Potential Hazards Identified

Hazard Type	Emergency Incident
Plant / Machinery/tools causing damage	Accident resulting in injury / power failure / loss of critical infrastructure
Spillages / Leaks	Accidental spill / leak leading to significant environmental contamination
Flooding	Accident leading to injury / damage to site infrastructure
Severe Weather	Accident leading to injury / damage to site infrastructure
Fire / Explosion	Accident leading to injury / damage to site infrastructure
Turbine Collapse	Accident leading to injury / damage to site infrastructure
Peat Stability	Excessive movement of peat on-site / onset of peat slide leading to: accident / injury / damage to site infrastructure
Landslide	Accident leading to injury / damage to site infrastructure
On-site/Construction Traffic – plant/machinery and construction vehicle movements	Traffic accident leading to injury / damage to site infrastructure
Wind Turbine Rotational Failure	Accident leading to injury / damage to site infrastructure

5.2 ROLES AND RESPONSIBILITIES

An indicative organisational chart which identifies the typical roles and associated responsibilities for the construction of the proposed project is provided in Section 2.2 of this CEMP. This will be subject to specific contractual agreements upon appointment of a Main Contractor and any additional/further appointments required in compliance with a grant of permission.

The Project Manager will have overall responsibility for environmental management and compliance during the construction works. He/she will be supported in this role by an SHEQ Officer, or Environmental Officer as appropriate, who will liaise directly with the relevant regulatory bodies and stakeholders throughout the construction phase. Additional specialist input will be included from an ecological clerk of works, archaeologist or other disciplines as required.

5.3 EMERGENCY RESPONSE PROCEDURES

Every effort will be made to prevent health and safety emergencies and environmental incidents during the construction and operational phase of the project.

The Contractor will be responsible for developing a detailed Emergency Response Plan (ERP) for the proposed construction works, to cover health and safety emergencies as well as environmental emergencies, as part of the H&S Plan.

This ERP shall be activated in the event of an emergency such as an accident, fire, spillage, collapse etc. and will provide details on who is required to be notified, first aid facilities and closest hospitals. The ERP will also include details of all personnel inducted and authorised to work on the site as well as next of kin contact details and relevant medical information.

In the event of an emergency, the SHEQ Officer and Project Manager will be notified immediately and will determine the scale of the emergency and the requirement for the assistance of emergency services. Works will cease in the area of the incident and contact will be maintained with the emergency services to direct them to the scene of the incident as required.

As part of the ERP, an evacuation drill will be carried out on a regular basis to make all personnel aware of the procedure to be followed in the event of an emergency where a full site evacuation is required. Emergency muster point(s) will be identified at suitable locations in the construction compounds and the ERP will outline the persons responsible for checking names at the safety muster points. Records will be maintained of such drills.

The ERP must include contact names and telephone numbers for the relevant local authorities (all sections/departments) including ambulance, fire brigade, An Garda Siochána and the HSA. Reporting of environmental emergencies to the local authority will be required as well as other relevant stakeholders such as IFI, NPWS or the EPA.

5.3.1 Site Evacuation and Fire Drills

A site evacuation/fire drill procedure will be developed to provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. At induction, all personnel will be made aware of the evacuation procedure. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specific intervals and maintaining records of such drills. The details of this procedure will be finalised in the Contractor's CEMP at construction stage and will include:

- Details regarding the notification of emergency situations to all those on site including use of a siren/horn to notify all personnel;
- Details of assembly point(s) and signage;
- Details of the roll call procedure to account for all personnel on site;
- Communication process between the Site Security Officer and the Site Manager during the procedure (i.e. notification of roll count etc.);
- Course of action to be undertaken by the Site Manager.

5.3.1.1 Spill Response and Control

A detailed spill response and control procedure will be developed and finalised in the Contractor's CEMP at construction stage, outlining the steps that will be followed in the event of an oil / fuel spill occurring, including:

- Identification and blocking of the source of the spill;
- Alerting personnel in the vicinity of the spill and any possible dangers;
- Elimination of any potential ignition sources in the vicinity of the spill;
- Spill containment approach and spill control materials;
- Covering or bunding off of any vulnerable areas where appropriate (i.e. drains, streams, sensitive habitats);
- Clean up using the spill control materials;
- Containment and disposal of used spill control materials;
- Communication with the ECoW – providing relevant information on the location, type and extent of the spill so that they can take appropriate action;
- ECoW actions including inspection of the site, making certain necessary measures are in place to manage the spill and prevent further spillage;
- ECoW notification to the appropriate regulatory body if necessary.

5.3.1.2 Other Environmental Incidents

Environmental incidents are not only limited to spills. Any environmental incident must be investigated and the ECoW notified immediately. If necessary, the ECoW will inform the appropriate regulatory authority depending on the nature of the incident. Details of the incident will be recorded (e.g. cause, extent, actions and remedial measures). Recommendations made to avoid reoccurrence will be recorded also. The ECoW will liaise with the Project Ecologist or Project Archaeologist regarding any incidents as required. A record of all environmental incidents will be kept on file by the ECoW and the Main Contractor. These records will be made available to the relevant authorities if required. Furthermore, the ECoW will be responsible for any outlining corrective actions required and will advise the Main Contractor as appropriate.

5.3.1.3 Excessive Peat Movement

A detailed procedure will be developed and finalised within the Contractor's CEMP at construction stage outlining the steps to be followed in the event of excessive or continuing peat movement being recorded or identified, including details on suspension of construction activities within the affected area, increasing monitoring activity at the identified location; limited construction activity beginning again only once there has been a cessation of movement and a geotechnical risk assessment having been undertaken by a geotechnical engineer.

5.3.1.4 Peat Slide

A detailed procedure will be developed and finalised within the Contractor's CEMP at construction stage outlining the steps to be followed in the event of the onset of or detachment of peat onsite, which will include details regarding, alert of peat slide, cessation of construction, diversion of resources, mitigation procedures, actions to prevent a peat slide reaching watercourses via on-land prevention measures (e.g. installation of check barrages), watercourse check barrages, stabilisation by rock infill where applicable/required. The procedure will also detail assessment requirements to be undertaken by the geotechnical engineer and stabilisation procedures implemented, as well as monitoring, as appropriate, until such time as movements have stopped.

5.3.2 Incidents / Complaints

All safety or environmental incidents associated with the project will be reported and investigated in line with the ERP. Typically, the following procedures will be followed in the event of an incident:

- Works will stop immediately where safe to do so;
- The SHEQ Officer will be contacted;
- The size of the incident will be assessed and determined if it can be controlled by site staff or if emergency services are required to attend;
- The appropriate enforcing authority will be contacted;
- The SHEQ Officer will investigate after the incident;
- The findings will be sent to the appropriate authority; and
- An action plan will be prepared to set out any modifications to working practices required to prevent a recurrence.

This section sets out a procedure to manage and resolve any complaints received from members of the public during the construction phase of the proposed project. The following measures will be adopted and refined, as necessary, taking account of any relevant planning conditions.

The following measures will be implemented to deal with complaints and the Contractor's CEMP will contain more specific details with regard to phone numbers to contact:

- Clearly display a notice board at the site entrance so that the public know whom to contact if they have a complaint or comment;
- Personnel on site, including sub-contractors are required to perform their duties in accordance with this CEMP, and in such a way as to minimise the risk of complaints from third parties;
- All complaints received regarding the construction works will be recorded and categorised (e.g. noise, property damage, traffic, dust etc.) within a central Site Complaints Log. This complaints log will include the following key details:
    - Name, address and contact details of the complainant (with the complainant's permission);
    - Brief outline of the complaint;
    - Date of Complaint;
    - Name of person receiving complaint details; and
    - Agreed timeline for response to complaint.
- All complaints will be communicated to the Project Manager and the Applicant immediately;
- All complaints will be followed up and resolved in so far as is practicable; and
- The complainant, Applicant and other stakeholders will be kept informed of the progress in resolving the complaint.

5.4 EMERGENCY CONTACT DETAILS

A list of emergency contacts is presented in Table 5.2 below. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 5.2: List of Emergency Contacts

Contact	Telephone
Emergency Services – Ambulance, Fire, Gardaí	112 / 999
Local Garda Station – Glenties	074 95 51080
Local Fire Station – Glenties	074 95 51275
Local Doctor / GP Service – Lettermacaward Medical Centre	074 9544147
Local Doctor / GP Service - Dungloe Medical Centre	074 95 21099
Glenties Primary Care Centre	074 95 51330
Letterkenny University Hospital	074 91 25888
ESB Faults / Emergencies	1850 372 999
Gas Networks Ireland 24hr Emergency Line	1850 20 50 50
Site Manager / Construction Manager / Site Supervisor	TBC
Client: Cloghercor Wind Farm Limited	TBC
Ecological Clerk of Works (ECoW)	TBC
Safety, Health, Environment and Quality (SHEQ)	TBC
Project Supervisor Design Stage (PSDS)	TBC
Project Supervisor Construction Stage (PSCS)	TBC
Health and Safety Authority Ireland (HSA)	TBC
Inland Fisheries Ireland (IFI)	TBC
Project Ecologist	TBC
Project Hydrologist	TBC
Project Geotechnical Engineer / Geologist	TBC
Project Archaeologist	TBC

5.5 EMERGENCY COMMUNICATION PROCEDURE

The Contractor's CEMP will be updated with an agreed Emergency Communication Response Procedure following appointment of the Contractor.

5.6 PERSONNEL TRACKING PROCEDURE

All personnel on site will be required to undergo a site induction where they will be required to provide personal contact details (including contact information for next of kin). In the event that a member of personnel is involved in an emergency situation where serious injury has occurred and hospitalisation has followed, the Site Manager, or next in command if unavailable, will be responsible for contacting and informing the next of kin.

5.7 INDUCTION CHECKLIST

Table 5.3 below provides a list of items highlighted in the Emergency Response Procedure (ERP) which must be included in the induction or gathered from all personnel that will work on the Proposed Project during the mandatory site induction. This will be revised throughout the various stages of the project. This list will be updated and expanded on within the Contractor's CEMP.

Table 5.3: Site Induction Checklist

Emergency Response Plan – Site Induction Items TBC	Status
Site Induction (all personnel must undergo the site induction prior to commencing work on-site)	
All personnel must be made aware of site evacuation and fire drill procedures	
All personnel must be made aware of the spill response and control procedure	
All personnel must be made aware of environmental incident procedures	
All personnel must be made aware of procedures relating to peat movement and peat slides	
All personnel must be made aware of incident and complaints procedures	
All personnel must be made aware of the emergency communication procedure and Emergency Contact Details for the project	
All personnel must be made aware and have access to the Site Safety Manual	
All personnel must be made aware of the personnel tracking procedure and provide their contact details at induction	
TBC	
TBC	
TBC	

6.0 MITIGATION PROPOSALS

All mitigation measures relating to the pre-construction and construction phases of the proposed project were set out in the various sections of the EIAR, and NIS prepared as part of the planning application.

This section of the CEMP groups together all of the mitigation measures presented in the EIAR and NIS respectively. The Mitigation Measures are outlined in the table in the following pages.

By presenting the mitigation proposals in this format, it is intended to provide a review list that can be easily checked and reported on during the future phases of the project. The use of a table to present the information be further expanded upon over the course of the Proposed Project to provide a template for use during site compliance audits.

Table 6.1: Table of Mitigation Measures

Ref No.	Related to	Location	Mitigation Measure
			Pre-construction Phase
MM1	Environmental Management	EIAR Chapter 2 / CEMP Section 1.1	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. The construction contractor will be responsible for implementing the mitigation measures specified in the EIAR and CEMP and for communicating the requirements with all staff on-site. Their implementation of the mitigation measures will be overseen by the supervising Ecological Clerk of Works (ECoW), ecologists, archaeologists and/or geotechnical engineers, as appropriate.
MM2	Health and Safety	EIAR Chapter 2 / CEMP Section 2.4	A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail. This will be prepared prior to the construction stage. A Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Safety, Health and Welfare at Work (Construction) Regulations.
MM3	Traffic Management	EIAR Chapter 2 / CEMP Section 4.1.2	A Traffic Management Plan (TMP) has been prepared for the proposed project. This will be updated ahead of construction to address the requirements of any relevant planning conditions. A confirmatory survey of road condition in advance of any works.
MM5	Biodiversity: Otter	NIS	A pre-construction otter survey will be carried out. If any new couching sites or holts are found in the vicinity (150 m) of the proposed works, or any non-breeding holts are found within 20 m of the proposed works, appropriate mitigation measures will be implemented based on Smal (2006).
MM6	Ornithology: Breeding Bird Surveys	EIAR Chapter 7	Pre-construction breeding bird surveys will be carried out. These will be carried out in the breeding season preceding the start of construction, and in every subsequent breeding season across the duration of the construction period. These surveys will include Golden Eagle surveys, Merlin surveys and moorland surveys. If nesting Golden Eagle, Merlin, or Golden Plover are found, no construction work within the following specified distances of their nest sites, or centre of territory until the breeding attempt has been completed: i.e., the young have fledged, or the nest has failed. The distances are: 1.5 km for Golden Eagle; 500 m for Merlin; and 500 m for Golden Plover.
MM7	Underground Services	EIAR Chapter 11	A confirmatory survey of all existing services will be carried out prior to construction to verify the assumptions in this report and identify the precise locations of any services. The applicant will liaise with the service provider where such services are identified. Digging around existing services, if present, will be carried out by hand to minimise the potential for accidental damage.
MM8	Noise	EIAR Chapter 12 / CEMP Section 4.1.3	The Contractor will be obliged to comply with the recommendations of BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*.

MM9	Pre-Construction Pavement Surveys	EIAR Chapter 16	The client will undertake pre-construction visual pavement surveys on the Haul Roads.
Construction Phase			
MM10	Health and Safety	EIAR Chapter 2 and Chapter 5 / CEMP Section 2.4	• The proposed Cloghercor Wind Farm will be constructed in accordance with all relevant Health and Safety Legislation. • The project will employ all of the latest and relevant guidelines and legislation terms of health and safety both for works within the wind farm site as well as for works outside the main wind farm such as those on the TDR. • The required levels of safety (e.g. during road works) will be maintained for all road users as well as pedestrians. • The wind farm site itself will not be open to the public until after the construction phase of the project. • Appropriate health and safety measures as described in the CEMP will be taken for all works areas during the construction phase in the interest of worker safety also. • Should any public health advice be in place during the construction phase (such as the recent Covid-19 public restrictions) these will be implemented on site.
Biodiversity / Ecology			
MM11	Ecological Clerk of Works (ECoW)	EIAR Chapter 6 / CEMP Section 2.3.2	A suitably qualified ECoW will be appointed by the contractor for the duration of the construction period.
MM12	Invasive Species Management	EIAR Chapter 6 / CEMP Section 4.1.6	• An Invasive Species Management Plan has been prepared as part of the EIAR (Appendix 6-6. This will be further developed into a Method Statement and fully implemented prior to and during construction. This will include a re-survey to identify any additional invasive species stands, or spread of existing invasive species stands since the previous (August 2022) survey. • All invasive species stands will be securely fenced with warning signs and access to these areas will only be permitted for designated personnel. Fencing will be a minimum of 7 m from the invasive species plants. No construction work will take place until an inspection by the ECoW has confirmed that all the relevant invasive species stands are adequately fenced. • Removal of invasive species stands identified in the EIAR, and any identified from the re-survey will use appropriate methods based on the National Roads Authority's *Guidelines for the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 2010) or other relevant guidance. • Any invasive species material removed will be either buried on site at a depth of 2m, incinerated, or disposed of to an appropriately licensed landfill. • Storage of contaminated soil will only take place in designated storage areas securely fenced with warning signs. Access will only be permitted for designated personnel. • Appropriate biosecurity measures will be applied to all personnel and machinery involved in the invasive species control work.

			• A designated wash-down area will be created to effectively contain, and collect contaminated material. • To avoid the potential for the transfer of alien invasive plant species into the site, a self-contained wheel-wash system will be installed near the project site entrance (access points one and two). • No construction work will take place within, or adjacent to, areas with invasive species stands until the above measures have been implemented, and removal has been verified by inspection by the ECoW. • An Invasive Species Risk Assessment Method Statement will be provided by the contractor prior to commencement of any works.
MM13	Bats	EIAR Chapter 6	• To reduce the collision risk to bat populations, buffer zones will be established around each turbine within which all trees and other tall woody vegetation will be cleared. As a result, these buffer zones will be maintained as bog / heath type vegetation dominated by low-growing dwarf shrubs and grasses (Buffer Zones are outlined in Chapter 6 of the EIAR). • The Bat Report specifies 100 m buffer for T19 due to high risk to Leisler's Bat. For all turbines a zone of >50m around each proposed turbine (from tip of blade) will be cleared of tall vegetation (shrubs, trees, scrub etc). • The initial clearance work in each buffer zone will be completed at least six months prior to the installation of the turbines. • If any of the deciduous trees identified as Potential Bat Roosts adjacent to the stone ruins are proposed to be felled, a Phase 2 survey will be carried out. This will involve a daytime inspection of trees coupled with dusk/dawn surveys, where appropriate. • A bat box scheme will be implemented to mitigate any felling of Potential Bat Roost trees. This scheme will be implemented in a deciduous or mixed woodland at least 1 km from the proposed project area. One bat box will be provided per Potential Bat Roost tree felled. The bat boxes will be erected by a bat specialist a minimum of six months prior to tree felling. •
MM14	Biodiversity Management Plan	EIAR Chapter 6 / CEMP Section 4.1.7	A Biodiversity Management Plan will be implemented, and will include measures such as below during construction: • A 30 m wide buffer zone will be established around the Lough Aneane More lake. • Areas of lowland blanket bog and dystrophic lake habitat (three to the south of T15, and a fourth to the south of T7) will be designated as biodiversity areas. • The old forestry drains in the lowland blanket bog habitat near T7 will be filled in. These areas will be maintained as open lowland blanket bog habitat. They will be monitored, and any regenerating conifer, or invading Rhododendron will be removed. • A corridor of open grassland / heath occurs along the forest road in the northern section of the project site. This corridor will be managed to maintain and enhance the wet heath, lowland blanket bog and wet grassland habitats. • Monitoring will be carried out and the management regime will be adapted as required, based on the monitoring results. • Non-intervention buffer zones and uninterrupted setback zones will be created along streams and around lakes.

			• Drainage and cultivation operations associated with reforestation will be planned and implemented to minimise flow rates after rainfall. Standards set out in Section 3.7.1 of the Environmental Requirements for Afforestation and in the Forestry Standards Manual will apply. • General biodiversity management / enhancement measures will be implemented throughout the wind farm site where feasible and appropriate to promote plant diversity and provide floral resources for pollinators, including measures recommended by the All-Ireland Pollinator Plan's guidance of *Pollinator-friendly Management of Wind Farms* (NBDC, 2021).
Ornithology			
MM15	Breeding Bird Surveys	EIAR Chapter 7	Construction breeding bird surveys will be carried out. These will be carried out in line with the criteria outlined for pre-construction breeding bird surveys.
MM16	Golden Eagle Habitat Management Plan	EIAR Chapter 7 / NIS	A Golden Eagle Habitat Management Plan will be implemented to mitigate for the potential displacement impacts to Golden Eagles.
MM17	Tree-felling / Scrub Clearance	EIAR Chapter 7	Where possible, tree-felling and scrub clearance will not be carried out during the bird breeding season (1st March - 31st of August).
Land, Soils and Earthworks			
MM18	Permits / Licences	EIAR Chapter 8	It will be a requirement that all permits, and licences are obtained from the regulatory authorities as required by environmental law or regulation and will discharge the relevant conditions of the planning permission to commence site works, or as otherwise appropriate in advance of specific site activities. Replacement replanting of forestry in Ireland is subject to licence in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by statutory instrument S.I. No. 191/2017 Forestry Regulations 2017. As it is proposed to fell between 69.7ha and 90.9ha of coniferous forestry for the proposed project, replant lands of the same area are required. The replacement replanting of forestry can occur anywhere in the State subject to licence.
MM19	Soils / Borrow Pits	EIAR Chapter 8 / CEMP Section 4.1.5.8	Temporary stockpiling from excavations will be avoided near sensitive receptors such as watercourses. All of the excavated soils will be reused for local landscaping or for borrow pit reinstatement.
MM20	Pollution Prevention / Spills	EIAR Chapter 8 / CEMP Section 5.3.1	The general guidance provided by the Environment Agency for England and Wales in their publication entitled 'Pollution Prevention Guideline (PPG6) Working at Construction and Demolition Sites' will be used as a baseline for this purpose. Specific guidance published by Irish regulatory agencies will be used where available. The CEMP will include an oil spill response procedure. Good site practice will be applied to ensure no fuels, oils, wastes or any other substances are stored in a manner on site in which they may spill and enter the ground. Dedicated, bunded storage areas will be used for all fuels or hazardous substances.
MM21	Earthworks	EIAR Chapter 8 / CEMP Section 2.3.6	Excavation works will be monitored by a suitably qualified and experienced geotechnical engineer or engineering geologist. Earthworks will not be scheduled to be carried out during severe weather conditions.
MM22	Land Use	EIAR Chapter 8	In order to minimise the potential impacts to land-use, the following mitigation measures are proposed:

			• Minimising areas for earthworks thereby reducing land take requirements; • Restricting areas for construction works and temporary storage to a minimum; • Retention of all existing perimeter planting and re-generating vegetation where possible and sufficiently protect in areas close to construction works; • Disturbance of existing vegetation will be minimised where possible and proposed planting will help integrate the proposed project into the current land use; • The handling, storage and re-use of excavated materials are of importance during the construction phase of the project. Stockpiles will be located away from the watercourses and drainage ditches. Topsoil and subsoils will be stored near the landscaping and in the reinstatement of borrow pit areas. Topsoil will be stockpiled no higher than 2.5m and follow the recommendations set out in the NRA Guidelines for the Management of Waste from National Road Construction Projects (NRA, 2014); • Turves will be stored turf side up and must not be allowed to dry out; • No permanent spoil or stockpiles will be left on site; • The method for restoration of excavated or disturbed areas is to encourage stabilisation and early establishment of vegetation cover, where available, vegetative sods/turves or other topsoil in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface; and • To prevent erosion and run-off and to facilitate vegetation reinstatement, any sloped embankment will be graded such that the slope angle is not too steep and that embankments match the surrounding ground profile.
MM23	Soil and Excavations Management	EIAR Chapter 8	Every effort will be made 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: • Excavated peat will be used locally for landscaping. Landscaping areas will be sealed and levelled using the back of an excavator bucket to prevent erosion. 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; • Peat, overburden, and rock will be reused where possible on site to reinstate borrow pits and other excavations where appropriate; • Peat soils will be placed in the Peat repositories. The repository will be located away from sensitive receptors. On completion the peat repository surfaces will be stabilised by the establishment of natural peat land vegetation. Peat repository locations will be at the borrow pit locations; • Where mineral soils are encountered in the excavation and construction of site roads, bases, etc, this material will be stockpiled for assessment and subsequent re-use; • The management of geological materials and spoil is an important component of controlling dust and sediment and erosion control; • Excavated soils and bedrock will only be moved short distances from the point of extraction and will be used locally for landscaping; • Landscaping areas will be sealed and levelled using the back of an excavator bucket to prevent erosion;

			• 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 soils. The above measures will prevent the erosion of soil in the short and long term. Soils, overburden, and rock will be reused on site to reinstate any excavations where appropriate. To ensure slope stability, excavations will be battered back (sloped) to between 1:1.5 and 1:2 depending on depth and type of material. Permanent slopes will generally be less than 1:3. The works programme for the construction stage of the proposed project will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecasted. Works should be suspended if forecasting suggests any of the following is likely to occur: • >10mm/hr (i.e., high intensity local rainfall events); • >25mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or • >Half monthly average rainfall in any 7 days. Prior to works being suspended the following control measures should be completed: • Secure all open excavations; • Provide temporary or emergency drainage to prevent back-up of surface runoff; and • Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded. Mitigation measures will be put in place during the construction of the scheme to reduce the likelihood of an excavation collapsing. • Mitigation measures include construction of a granular berm or temporary sheet pile wall to support the soil during construction. Based on the ground investigations undertaken, together with information obtained from other sources, these provide necessary information to assess the suitability of the ground to support the proposed project. Where there is a lower factor of safety, mitigation will be implemented to reduce risk. • Excavation works will be monitored by a suitably qualified and experienced geotechnical engineer or engineering geologist. • The earthworks will not be scheduled to be carried out during severe weather conditions. Subject to landowner permission, selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase.
MM24	Materials and Fuel Management	EIAR Chapter 8 / CEMP Section 4.1.5.3	• Waste concrete and wash waters need to be disposed of in dedicated areas where the waste material can be neutralised and collected for appropriate disposal or reuse. • Fuel storage and any oil storage will be carried out in accordance with the Enterprise Ireland Best Practice Guide BPGCS005 Oil Storage Guidelines. • Fuel and oil storage at fixed locations will be in a fixed tank, undercover and within a steel or concrete bund.

			• An impermeable bunded refuelling area will be constructed adjacent to the fixed fuel storage areas. Double skinned plastic tanks will not be acceptable at the site for any purpose unless they are placed within fixed concrete or steel external bunds. • Each fixed fuel and oil storage bunds shall be sized to hold 110 % of the oil volume of the largest tank therein. The fixed fuel and oil storage bunds shall be blind sumped. • Rainwater pumped from each bund shall be discharged to the surface water drainage system via an oil interceptor. • In the event of a spill, the liquid contained in the bund shall be removed by a liquid waste tanker, as will be the contents of the surface water drainage system and oil interceptor. • Where refuelling is required on site away from fixed storage locations this will only be carried out utilising steel intrinsically bunded mobile fuel bowsers. At site refuelling locations, where possible, refuelling will take place within mobile bunds, but at a minimum fuel line from the bowser to the plant being fuelled will be contained by drip trays. • Generators and associated fuel tanks to be used at the site shall either be placed within bunds as per fuel storage tanks or shall be integrated units (i.e., fuel tank and generator in one unit) that are intrinsically bunded. No external tanks and associated fuel lines shall be permitted on site unless these are housed within a fixed bund with the generator. • The contractor's yard/maintenance yard shall incorporate a bund for the storage of small vehicles and oil filled equipment, such as hand portable generators, pumps, etc. Storage of small volume oils or chemicals, in barrels, IBCs, etc, will be stored in a covered bunded area. Where barrels or other containers are required at work locations these shall be stored in enclosed bunded cabinets, and drip trays shall be used where distribution of the material is required. • The main storage areas for oil filled equipment, vehicles, plant, etc, shall be impermeably surface and the discharge of surface water from these areas will be via oil interceptors. • An oil spill response plan will be developed for the construction works and appropriate containment equipment will be available at work locations in the event of a spillage. Oil spill response will form part of site personnel induction and training at the site. • All wastes generated on site will be segregated so that where possible and appropriate materials are re-used on site. Residual materials will be collected by licensed waste haulier for appropriate sorting, recycling and disposal.
MM25	Transmission Lines & Cabling	EIAR Chapter 8	Construction of internal electricity transmission lines and cables will present risks during construction. Before commencement of construction works the Contractor will draw up detailed Method Statements for the transmission line and cabling works. These method statements will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager, and ECoW where appropriate.
MM26	Slope Stability	EIAR Chapter 8	Based on the recommendations and control measures given in the Peat Stability Assessment report (Appendix 2-9 of the EIAR) being strictly adhered to during construction and the detailed stability assessment carried out for the peat slopes which showed that the site has an acceptable margin of safety, there is a low risk of peat instability/failure at the Proposed project site. The following outlines an overview of the control measures / tasks for the construction phase: • Appointment of experienced and competent contractors;

			• Geotechnical Engineer to provide a Geotechnical Induction to all contractor supervisory staff; • Appoint a Site Geotechnical Supervisor to carry out supervision of site works as required. The Site Geotechnical Supervisor will be required to inspect that works are carried in accordance with the requirements of the PSRA, identifying new risks and ensuring all method statements for works are in place and certified; • Retain a Site Geotechnical Folder which contains all the information relevant to the geotechnical aspects of the site including but not limited to GRR, site investigation information, method statements etc.; • Contractor to develop a Method Statement for the works to be carried out in each of the PSRA areas cognisant of the required mitigating measures; • Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement; • Contractor to provide tool box talks and on-site supervision prior to and during the works; • Daily sign off by supervising staff on completed works; • Implementation of emergency plan and unforeseen event plan by the contractor; • Prevent undercutting of slopes and unsupported excavations; • Maintain a managed robust drainage system; • Prevent placement of loads/overburden on marginal ground as detailed in the peat; • Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement); • Ensure construction method statements are followed or where agreed modified/developed; and • Develop a Geotechnical Risk Register as part of detailed design and revise and amend throughout the construction progresses. The management of peat stability will be ongoing throughout all stages the project and will be managed through the use of a geotechnical risk register.
Water Quality Management			
MM27	Surface Water Drainage	EIAR Chapter 2 / CEMP Section 4.1.5	The surface water drainage system will require regular inspection during construction works and during operations to ensure that it is working optimally.
MM28	Pollution Prevention	EIAR Chapter 9 / CEMP Section 4.1.5	Best practice construction methods will be implemented in order to prevent water (surface water and groundwater) pollution.
MM29	Environmental Management	EIAR Chapter 9	All personnel working on the project will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.
			All works associated with the construction of the wind farm will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015).

MM30	Erosion / Sediment Control	EIAR Chapter 9	• To maximise the erosion and sediment control benefits of natural vegetation soil cover, stripping of soil is to be kept to a minimum and confined to construction areas only. Where practical, construction works will be staged to minimise the extent and duration of disturbance, e.g., plan for progressive site clearance, only disturbing areas when they are scheduled for current construction work.
MM31	Groundwater	EIAR Chapter 9	• Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016). • Groundwater from the borrow pits will be treated in the settlement lagoons. • Subject to landowner permission, selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase. • To minimise any effect on the underlying subsurface strata from material spillages, all oils and solvents used during construction will be stored within specially constructed dedicated bunded areas.
MM32	Surface Water Management	EIAR Chapter 9	• The implementation of the Surface Water Management Plan will be overseen by a suitably qualified ecologist/engineer and will be regularly audited throughout the construction phase. • The assigned ecologist/engineer will be required to stop works on site if he/she is of the opinion that a mitigation measure or corrective action is not being appropriately or effectively implemented.
MM33	Forestry felling	EIAR Chapter 9	• Felling will be undertaken of a 20 m corridor along the access roads, and a 74-100m buffer around the turbines based on ecological considerations. • An additional 5 hectares of felling is proposed around the lake as part of a biodiversity management plan. • A 30 m wide buffer zone will be established around the lake. This buffer will be created by felling the existing areas of conifer plantation within the buffer zone, and by blocking drains to raise the water table. • The Felling and Reforestation Standards (2019) describe the universal standards that will apply to all felling (thinning, clearfelling) and reforestation projects on site undertaken under a felling licence issued by the Department of Agriculture, Food & the Marine. • Buffer zone guidelines for planting and felling activities are provided by the Forestry Service in the Forestry and Water Quality Guidelines (2000) and will apply to construction activities. • Construction activities will be curtailed within buffer zones. Buffer zone widths vary from 10m to 25m, depending on slope and soil erosion classification. • All works within 50 m of waterbodies kept to minimum, with all significant infrastructure (turbine foundations, borrow pits and substation) at a minimum 50 m set-back. • All associated tree felling will be undertaken using good working practices as outlined by the Forest Service in their Forestry Harvesting and Environment Guidelines (2000) and the Forestry and Water Quality Guidelines (2000). The latter guidelines deal with sensitive areas, erosion, buffer zone guidelines for aquatic zones, ground preparation and drainage, chemicals, fuel and machine oils. Brash mats will also be used to support harvesting and forwarding machinery. The brash mats reduce erosion of the surface and will be renewed as they become used and worn over time.

			• As part of felling works, temporary water crossings include forest drains, roadside drains, relevant watercourses and aquatic watercourses. Measures should be adhered to as per the 2019 Standards for Felling and Reforestation.
MM34	Sediment Traps	EIAR Chapter 9	Sediment traps are to be constructed and maintained in line with the requirements of the *Forestry Schemes Manual (2011),* the *Forest Road Manual and Forest Drainage Engineering – A Design Manual.*
MM35	Forest Drains	EIAR Chapter 9	Crossing of drains during felling and extraction and restrict machine activity to brashed extraction racks and forwarding routes will be minimised. Where a drain crossing is needed, based on the size of the forest drain one of the following methods will be selected that prevents the breakdown and erosion of drain sides: • For larger drains , deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route; • Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, select logs that approximate the depth of the channel to be crossed.
MM36	Aquatic Zones & Larger Relevant Watercourses	EIAR Chapter 9	• Minimise the crossing of aquatic zones and streams during felling and extraction by choosing alternative routes which avoid the streams/aquatic zones where possible; • Direct crossing over the stream bed is not permitted. If you must cross an aquatic zone or streams install a temporary crossing point. When installing and removing the temporary crossing, ensure that no work is carried out within the aquatic zone, and that the stream bed and bankside remain undisturbed; • Avoid crossing points in hollows where surface water gravitates towards, or in areas of the site more prone to sediment release, as indicated by terrain classification; • Ensure the feature is crossed at a right angle to the flow of water; • Where needed, any necessary crossing shall be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks; • Typical solutions include the laying down of a bridge comprising logs overlaid with geotextile and brash to intercept soil falling off wheels; • Alternatively, utilise prefabricated concrete drop-in bridging.
MM37	Concrete Management	EIAR Chapter 2 and Chapter 9 / CEMP Section 4.1.5.9	• Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks; • After concrete is poured at a construction site, the chutes of ready mixed concrete trucks must be washed out to remove the remaining concrete before it hardens. • Only the chute of the delivery truck will be cleaned, Concrete trucks will be washed out fully at the batching plant, where facilities are already in place. • Wash out of the main concrete bottle will not be permitted on site; wash out is restricted only to chute of the delivery truck ,using the smallest volume of water necessary, before leaving the site. Wash down and washout of the concrete transporting vehicles will take place at the batching plant / appropriate facility offsite where facilities are already in place;

			• The small volume of water generated from concrete chute washout will be directed to and collected and retained (all concrete washout water and solids) in leak proof containers or impermeable lined wash out pits / containment areas, so that the wash material does not reach the soil surface and then migrate to surface waters or into the ground water. • The collected concrete washout water and solids will be emptied on a regular basis. These residual liquids and solids will be disposed of off-site at an appropriate waste facility. Washout will be undertaken at the construction compounds. • Main concrete pours will be planned weeks in advance, and refined in the days leading up to the pour. • Disposing of surplus concrete after completion of a pour will be off-site at the concrete production facility.
MM38	Fuels & Chemicals (inc. refuelling)	EIAR Chapter 2 and Chapter 9 / CEMP Section 4.1.5.3	• Fuels and chemicals will be stored within bunded areas as appropriate to guard against potential accidental spills or leakages. The bund area will have a volume of at least 110 % of the volume of such materials stored. • Any easily manoeuvrable road-going vehicles will be refuelled off-site. • For certain vehicles which are less mobile, refuelling may need to occur elsewhere on site. This will be carried out using a double skinned bunded mobile tank which can be moved around the site and bunded bowser, towed behind a jeep (or similar) and stored in the construction compound when not in use. • Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated area of the site, away from surface water gullies or drains. • All on-site refuelling will be carried out by trained competent personnel. Only designated trained and competent operatives will be authorised to refuel plant on site. • No refuelling will take place within 50 m of any stream. • A spill kit will be stored with the bowser and the person operating the bowser will be trained in their use. When not in use this will be stored in the designated area of the construction compounds; • Spill kits and hydrocarbon absorbent packs will be stored in this area and operators will be fully trained in the use of this equipment. • Mobile measures such as drip trays and fuel absorbent mats kept with all plant and bowsers and will be used at all times during all refuelling • A spill kit will be stored with the bowser at all times and the person operating the bowser will be trained in their use. • In the event of an accidental fuel spill, the source of the spill will be fixed, fuel will be contained and cleaned as quickly as possible using the spill kits. • All equipment and machinery will have regular checking for leakages and quality of performance and will carry spill kits. • Any servicing of vehicles will be confined to designated and suitably protected areas such as construction compounds. • Additional drip trays and spill kits will be kept available onsite and stored in each construction compound, and at the on-site substation in case of emergency to ensure that any spills from vehicles are contained and removed off site by a licensed waste management contractor. • The incident will be reported to the site manager and ECoW, and appropriate remediation will be carried out.

<table>
<tr><td>MM39</td><td>Pre-emptive Site Drainage Management / Erosion & Sediment Controls</td><td>EIAR Chapter 9 / CEMP Section 4.1.5</td><td>The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:
General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest. Using the safe threshold rainfall values will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.
Works will be suspended if the following is likely to occur:
>10mm/hr (i.e., high intensity local rainfall events);
>25mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
>half monthly average rainfall in any 7 days.
Prior to works being suspended the following control measures will be completed:
Secure all open excavations;
Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded; and
Provide cover to material storage areas i.e., adequate tarpaulin over stockpile areas if material cannot be reinstated prior to suspension.</td></tr>
<tr><td rowspan="2">MM40</td><td rowspan="2">Watercourses</td><td rowspan="2">EIAR Chapter 9 / CEMP Section 4.1.5</td><td>Near-stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall and, therefore, minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.</td></tr>
<tr><td>Runoff will be maintained at Greenfield (pre-development) runoff rates. The layout of the development has been designed to collect surface water runoff from hardstanding areas within the development and discharge to associated surface water attenuation lagoons adjacent to the proposed infrastructure. It will then be managed by gravity flow at Greenfield runoff rates.</td></tr>
</table>

			During the ground clearance of the proposed project, the contractor will implement water control measures to limit the effect on water quality using standards measures as set out in the Forestry Felling Report – Appendix 2-5. Brash will be used along harvesting and extraction routes for soil protection. The forwarder will be loaded to the manufacturer's maximum specification and no more to avoid overloading and unnecessary soil compaction.
			Suspended solid (silt) removal features will be implemented in accordance with CIRIA C697 SuDS Manual, and CIRIA C648 *Control of water pollution from linear construction projects*.
			All temporary and permanent drainage from the site shall be designed to have as a minimum three stages of treatment, as defined in the SuDS Manual. Management of runoff will include the following: • Filtration of water through filter media (sand / stone check dam, silt fence); • Detention / settlement in settlement ponds or behind check dam in swales; and • Conveyance of shallow depths of water in vegetated swale.
MM41	Interceptor Drains	EIAR Chapter 9 / CEMP Section 4.1.5	• Interceptor drains/diversion ditches will be installed ahead of the main earthworks activities to minimise the effects of collected water on the stripped/exposed soils once earthworks commence. • This drainage will integrate into the existing forestry drainage. • These drainage ditches will be installed on the upgradient boundary of the areas affected by the access track earthworks operations and installed ahead of the main track construction operations commencing. • They will generally follow the natural flow of the ground. • The interceptor drains will intercept any storm water surface run-off and collect it to the existing low points in the ground, allowing the clean water flows to be transferred independently through the works without mixing with the construction drainage. • It will then be directed to areas where it can be redistributed over the ground by means of a level spreader.
MM42	Swales	EIAR Chapter 9 / CEMP Section 4.1.5	• Swales along access tracks are to be installed in advance of the main construction phase. • On sections of track where there is significant longitudinal gradient, regular surface water interception channels will be employed – these will typically be at 10-20m intervals to collect any surface water that is discharging as sheet flow along the track and discharge the flow into the trackside swale. Drainage details are included in the CEMP and Drawings 10798-2060 to 2065. • Given the steep longitudinal gradients on some sections of access track, regular check dams will be employed within the trackside swale on these sections to reduce the flow velocity and provide settlement opportunity. • Check dams will have a minimum 0.2m freeboard (from top of check dam) to top of swale level, to prevent overtopping of flows onto the access track. • All check dams, etc to be checked at least once weekly via a walkover survey during the full period of construction. • All excess silts to be removed and disposed of appropriately. • Where check dams have become fully blocked with silt, they will be replaced. • Swales will be re-vegetated by hydro-seeding with indigenous seed mix as soon as is practicable following excavation.
MM43	Settlement Ponds / Lagoons	EIAR Chapter 9 / CEMP Section 4.1.5	Settlement ponds will be located downstream of road swale sections and at turbine/hardstand locations. The following shall apply to construction of settlement ponds at the site: • Pond depths generally to be excavated to less than 2m; • Side slopes to be shallow, nominally at a 1 in 3 side slope (maximum); and

			• Material excavated from the settlement pond should be compacted around the edge of the pond.
			• Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. Drainage details are included in this CEMP and Drawings 10798- 2060 to 2065.
			• Settlement lagoons will be installed concurrently with the formation of the road and will be fenced off for safety. They will be located as close to the source of sediment as possible and as far as possible from the buffer zones of existing streams. The minimum buffer zone width will be 50 m. • Settlement lagoons will be regularly cleaned/maintained to provide effective and successful operation throughout the works. Outfalls and drainage ditches will be cleaned, when required, starting up stream with the outfalls blocked temporarily prior to cleaning.
			The sediments/silt in the settlement lagoons will be cleaned regularly and removed via the contractor and deposited at suitable locations on site, away from streams. Machine access is required to excavate the accumulated sediment. Control measures include: • Regular inspection and maintenance of settlement lagoons and drains; • Settlement lagoon maintenance and/or cleaning will not take place during periods of extended heavy rain; • Settlement lagoons will be fenced off for safety; • Settlement lagoons will where practicable be constructed on even ground and not on sloping ground and discharge into vegetation areas to aid filtration and dispersion; and • The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.
			• The surface water management system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out and during excavations at T10 to T12. • Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. • Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.
			Traffic on site will be kept to a minimum. Only the proposed onsite access track will be used for project-related traffic.
MM44	Temporary Facilities	EIAR Chapter 9	Temporary on-site toilet facilities (chemical toilets) will be used. These will be sealed with no discharge to the surface water or groundwater environment adjacent to the site.
MM45	Surface Water Flow / Watercourse Crossings	EIAR Chapter 9	• Installation of clear-span design bridge or bottomless culverts will take place during dry periods to reduce the risk of sediment entering the watercourse. Smaller forestry drains and streams will be crossed using normal culverts. • A number of ephemeral drainage features (drains) are also present on site. Culverting of these will only take place during dry weather periods. • Culverts will be installed to conform, to the natural slope and alignment of the drainage line. Culverts will be buried at an appropriate depth below the channel bed and the original bed material placed at the bottom of the culvert.

MM46	Surface Water Flow / Watercourse Crossings	EIAR Chapter 9	• Embedded culverts will be buried to a depth of 0.3m or 20% of their height (whichever is greatest) below the bed. • Crossing construction will be carried out, in so far as is practical, with minimal disturbance to the drain bed and banks. If they have to be disturbed, all practicable measures including location of stockpiles away from drainage ditches will be taken to prevent soils from entering any water. • Any culverting works at drains will take place only during dry periods when the drains are dry/stagnant. Silt traps will be placed on the downgradient side of the crossing.
MM47	Surface Water Flow / Watercourse Crossings	EIAR Chapter 9	• Cement and raw concrete will not be spilled into watercourses. • No batching of wet-cement products will occur on site. • Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. • Pre-cast elements for bridge, culverts and concrete works will be used. • During the delivery of concrete on site, only the chute will be cleaned on-site, using the smallest volume of water practicable. • Chute cleaning will be undertaken at lined cement washout lagoons. • These lagoons will be cleaned out by a licensed waste contractor. • No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. • Weather forecasting will be used to plan dry days for pouring concrete. • The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.
MM48	Surface Water Flow / Watercourse Crossings	EIAR Chapter 9	• A setback distance of 10m to 20m from any stream will be kept clear of brash as far as practicable, to avoid felling of trees into streams and removal of them or any other accidental blockages that may occur. • Where practicable, crossings should be adequately elevated with low approaches such that water drains away from the crossing point. • Earth embankments constructed for bridge approaches will be protected against erosion e.g., by re-vegetation or rock surfacing etc.
MM49	Substation	EIAR Chapter 9	• The mitigation strategies for the substation foundations follow similar procedures to the excavations for turbine and hardstanding foundations. All works will be monitored by a suitably qualified and experienced engineer. • Where existing drainage ditches need to be realigned (e.g., around substation), the new swale will match the profile of the existing ditch in relation to side-slope profile and the material at the base of the channel.

MM50	Turbine Delivery Route (TDR) & Grid Connection Route	EIAR Chapter 9	• Silt fencing will be erected at the location of stream crossings along the grid connection route. Silt curtains and floating booms will also be used where deemed to be appropriate and this will be assessed separately at each individual location. • No refuelling of machinery will take place within 50m of a stream. Excavated material will not be stockpiled or side-cast within 50m of a stream. • Appropriate steps will be taken to prevent soil/dirt generated during the temporary upgrade works to the TDR from being transported on the public road. • Silt fences will be located at the toe of the slope to reduce sediment transport. • Road sweeping vehicles will be used to ensure that the public road network remains free of soil/dirt from the location of the TDR works and grid connection when required. • Where existing drainage ditches need to be realigned, new drainage ditches will match the profile of existing drains in relation to width, with shallower side slope profile and material at base of channel will reused. Within the site development area, culverts will be assessed to ensure no barriers to fish migration occur. Where barriers occur, such culverts will be improved to increase fisheries potential under advise from the ECoW.

MM51	Horizontal Directional Drilling (HDD)	EIAR Chapter 9 / CEMP Section 4.1.5.6	• • There will be no storage of material/equipment or overnight parking of machinery inside the 50m buffer zone. • Before any ground works are undertaken, double silt fencing will be placed upslope of the stream channel along the 50m buffer zone boundary. • Additional silt fencing or straw bales (pinned down firmly with stakes) will be placed across any natural surface depressions / channels that slope towards the stream. • Silt fencing will be embedded into the local soils to ensure all site water is captured and filtered. • The area around the bentonite (clay) batching, pumping and recycling plant will be bunded using terram and sandbags in order to contain any spillages. • Drilling fluid returns will be contained within a sealed tank/sump to prevent migration from the works area. • Spills of drilling fluid will be cleaned up immediately and stored in an adequately sized skip before being taken off-site to an appropriate licenced facility. • If rainfall events occur during the works, there will be a requirement to collect and treat small volumes of surface water from areas of disturbed ground (i.e., soil and subsoil exposures created during site preparation works). This will be completed using a shallow swale and sump down slope of the disturbed ground. Water will be pumped to a proposed distribution area at least 50m from the stream. • The discharge of water onto vegetated ground at the percolation area will be via a silt bag which will filter any remaining sediment from the pumped water. • Any sediment laden water from the works area will not be discharged directly to a stream or drain. • Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. All necessary preventative measures will be implemented to ensure no entrained sediment, or deleterious matter is discharged to the watercourse. • If high levels of silt or other contamination is noted in the pumped water or the treatment systems, all construction works will be stopped. No works will recommence until the issue is resolved and the cause of the elevated source is remedied. • On completion of the works, the ground surface disturbed during the site preparation works and at the entry and exit pits will be carefully reinstated and re-seeded at the earliest opportunity to prevent soil erosion. • The silt fencing upslope of the river will be left in place and maintained until the disturbed ground has re-vegetated. • There will be no refuelling allowed within 50m of the stream crossing. • All plant will be checked for purpose of use prior to mobilisation at the watercourse crossing. • The drilling fluid/bentonite will be non-toxic and naturally biodegradable (i.e., Clear Bore Drilling Fluid or similar will be used). • The area around the drilling fluid batching, pumping and recycling plants will be bunded using terram and/or sandbags to contain any potential spillage. • Adequately sized skips will be used where temporary storage of arisings are required. • The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourses. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped. • Any frac-out material will be contained and removed off-site. • The drilling location will be reviewed, before re-commencing with a higher viscosity drilling fluid mix.

Noise & Vibration			
MM52	Noise	EIAR Chapter 12 / CEMP Section 4.1.3	The contract documents shall specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to comply with the recommendations of BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be considered, where necessary, to ensure compliance with the relevant construction noise criteria: • No plant used on site will be permitted to cause an on-going public nuisance due to noise. • The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. • Compressors will be attenuated 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. • Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use. • Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. • During the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 13. 13 using methods outlined in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise. • The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 18:00hrs Mondays to Saturdays. However, to ensure that optimal use is made of good weather period or at critical periods within the programme (i.e., concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary on occasion to work outside of these hours. Where rock breaking is employed, the following are examples of measures that will be considered, where necessary, to mitigate noise emissions from these activities: • Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency. • Ensure all leaks in air lines are sealed. • Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured. • Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation. Further guidance will be obtained from the recommendations contained within BS 5228: Part 1 and the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1988 in relation to blasting operations. The methods used to minimise effects may consist of some or all the following: • Restriction of hours within which blasting can be conducted (e.g., 09:00 – 18:00hrs). • A publicity campaign undertaken before any work and blasting starts (e.g., 24 hours written notification). • The firing of blasts at similar times to reduce the 'startle' effect. • On-going circulars informing people of the progress of the works.

			• The implementation of an onsite documented complaints procedure. • The use of independent monitoring by external bodies for verification of results. • Trial blasts in less sensitive areas to assist in blast designs and identify potential zones of influence.
MM53	Vibration	EIAR Chapter 12 / CEMP Section 4.1.3	As blasting is required, the following mitigation measures will be employed to control the impact during blasts: • Trial blasts will be undertaken to obtain scaled distance analysis. • Ensuring appropriate burden to avoid over or under confinement of the charge. • Accurate setting out and drilling. • Appropriate charging. • Appropriate stemming with appropriate material such as sized gravel or stone chipping. • Delay detonation to ensure small maximum instantaneous charges. • Decked charges and in-hole delays. • Blast monitoring to enable adjustment of subsequent charges. • Good blast design to maximise efficiency and reduce vibration. • Avoid using exposed detonating cord on the surface.
Air Quality / Dust			
MM54	Dust Suppression and Exhaust Emissions Management	EIAR Chapter 2 and Chapter 14 / CEMP Section 4.1.4	• Provision of dust suppression measures (e.g. sweeps/covers/water bowsers) will be used on stockpiles and the road surface during periods of extended dry weather. • Silty or oily water will not be used for dust suppression. Water for dust suppression will be taken from settling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds. • Water bowser movements will be carefully monitored, to avoid increased runoff. • The extent of work areas will be minimised. • Stockpiling of excavated materials will be limited to the volumes required to practically meet the construction schedule. • Drop heights of excavated materials into haulage vehicles will be minimised to a practicable level. • Daily inspections by site personnel to identify potential sources of dust generation along with implementation measures to remove causes where found. • Traffic coming to site will only use the specified haul routes. A wheel wash will be provided near the main site entrance and used to (will prevent the transfer of dust from vehicles used during the construction works on to public roads. • A road sweeper will be available if any section of the surrounding public roads becomes soiled by vehicles associated with the proposed project. • Onsite borrow pits will be used to minimise quantities of stone material being brought to site. • Best practice (including industry recognised dust suppression techniques/equipment) will be used to minimise the potential for dust production during the extraction of rock from the borrow pits and excavations elsewhere. • Vehicles and plant will be routinely serviced to minimise the exhaust emissions during construction. Vehicles will not be left running unnecessarily and low emission fuels will be used where possible.

			• During the construction phase of the proposed project, all contractors will ensure that machinery used on site is properly maintained and is switched off when not in use to avoid unnecessary exhaust emissions from construction traffic.
MM55	Wheel Washing / Road Sweeper	EIAR Chapter 2 / CEMP Section 4.1.9	To avoid the potential for the transfer of alien invasive plant species into the site, a self-contained wheel-wash system will be installed near the project site entrance (access points one and two). A road sweeper will be available if any section of the surrounding public roads becomes soiled by vehicles associated with the proposed project.
Traffic Management			
MM56	Haul Routes	EIAR Chapter 16	Mitigation measures on the haul roads and cable route includes: • Selection of a viable route with the lowest impact on the road network. • Avoidance where possible of sensitive receptors and urban settings o The site access route encourages the use of the strategic infrastructure in the area while avoiding the local road and potential sensitive receptors. o Turbine delivery route along national and regional roads with largest capacity to accommodate the vehicles. o The typical construction traffic haul roads are principally along the national and regional road network, avoiding the local primary and secondary roads. o Restricting HGV movements during peak sensitive times on the road networks (i.e. at school times) o The grid connection route will be laid primarily in forestry and peatlands, avoiding works within the public road with the exception of a single local road crossing. • To mitigate traffic on the national road network, a number of possible routes have been investigated as possible sources of material for delivery. • To mitigate the impact of the AIL delivery on the road network, the advanced works are to be undertaken (i.e. hardstanding, making signs demountable, utility diversions etc). The hardstanding works areas will be temporary in nature and removed once the final turbine is delivered to site.
MM57	Traffic Impact	EIAR Chapter 16	To mitigate traffic impact, liaison with local authorities and the community in advance of foundation pours, as well as minimising other works/deliveries, will be undertaken.
MM58	Abnormal Loads (AIL)	EIAR Chapter 16	• To mitigate the impact of the AIL deliveries these deliveries will be undertaken under garda and traffic management escort during off-peak (i.e. night-time) hours. • The arrangement of the appropriate abnormal load licenses will be obtained by the appointed contractor in a timely fashion on procurement of the AIL. • The appointed contractor will liaise with the relevant road's authorities and an Garda Síochána on the delivery schedule for the AILs.
MM59	Trench Reinstatement	EIAR Chapter 16	• To mitigate the impact of the cable laid within the public road (at the single local road crossing) the reinstatement works will be backfilled and reinstated as soon as practicable. • The reinstatement works will be undertaken in accordance with the "Purple Book" best guidance and practices.

			• The proposed reinstatement and construction details and phasing will be agreed with associated Local Authorities Municipal District Office in advance of the works. • The Contractor will be responsible for arranging for the required road opening licenses.
MM60	Post-Construction Pavement Surveys	EIAR Chapter 16	The client will undertake post-construction visual pavement surveys on the Haul Roads. Where the surveys conclude that damage on the roadway is attributable to the Construction Phase of the proposed project, the applicant will fund the appropriate reinstatement works to bring the road back to pre-construction condition as a minimum, details for which will be agreed with the Roads Authorities.
MM61	Traffic Management Plan (TMP)	EIAR Chapter 16 / CEMP Section 4.1.2	The successful completion of this project will require significant co-ordination and planning and a comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed project. The Traffic Management Plan (TMP) proposed for the Cloghercor Wind Farm is included in Appendix 2-7. Note, the TMP has been included as a separate document. Any changes which may arise from the planning process and in the detailed construction programme can be incorporated. The following mitigation has been incorporated into the TMP: • Haul route selection to avoid sensitive receptors. • Widened approaches to the site accesses within the development to facilitate queuing of construction vehicles off the public road. • Traffic Management Operatives (TMOs) will be provided by the principle contractor in accordance with their Traffic Management Plan at the site accesses during peak construction traffic activities, refer to the TMP. • A wheel wash will be provided within the site. • A one way system in and out of the site will be in place for materials deliveries to avoid conflict between delivery vehicles and ensure the efficient flow of materials and vehicles. • Passing bays on the internal access track to facilitate safe passing of vehicles within the site, vehicles travelling in a forward direction (reducing higher risk reversing manoeuvres).
MM62	Project Delays	EIAR Chapter 16	To avoid delays to the project programme all required road opening licenses, agreements with the Local Authorities and an Garda Síochána to facilitate movement of abnormal loads shall be sought by the appointed Contractor in a timely manner.
Waste Management			
MM63	Waste Management	EIAR Chapter 11 / CEMP Section 4.1.8	• Segregation of waste will be carried out on site to maximise the potential for waste recycling and minimise any potential for impacts on waste services. • A licensed commercial waste collector will be used to remove any waste that does occur on site to one of the local waste processing facilities within Donegal.
MM64	Wastewater Management	EIAR Chapter 11	• Wastewater from the staff welfare facilities will be managed by means of a sealed storage tank, with all wastewater being tankered off-site as required by a permitted waste collector to a wastewater treatment plant. It is proposed to use low volume flush toilets (such as those in commonly used port-a loos) and low volume sink faucets to significantly reduce the volume of waste water produced. • The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying.

			• A confirmatory survey of all existing services will be carried out prior to construction to verify and identify the precise locations of any services. • The applicant will liaise with the service provider where such services are identified. • Digging around existing services, if present, will be carried out by hand to minimise the potential for accidental damage. • Segregation of waste will be carried out on site to maximise the potential for waste recycling and minimise any potential for impacts on waste services. • A licensed commercial waste collector will be used to remove any waste that does occur on site to a local waste processing facilities within Donegal.

7.0 MONITORING PROPOSALS

All monitoring proposals relating to the pre-construction and construction phases of the proposed project were set out in various sections of the EIAR, and NIS prepared as part of the planning application.

This section of the CEMP groups together all of the monitoring proposals presented in the EIAR and NIS. The monitoring proposals are presented in tabular format on the following pages. By presenting the monitoring proposals in this format, it is intended to provide an easy to audit list that can be checked and reported on during the course of the proposed project. This table can be further developed upon and used as a reporting template for site compliance audits across project phases.

Table 7.1: Table of Monitoring Proposals

Ref No.	Related to	Location	Monitoring Measure
Pre-construction Phase			
	Water Quality	EIAR Chapter 9	It is recommended that local surface water features in the immediate vicinity of the site boundary are monitored pre-construction to take account of any variations in the quality of the local surface water and groundwater environment as a result of activities related to the proposed project.
	Bats	EIAR Chapter 6	If more than three years pass between the pre-construction surveys and the construction of the wind turbines, it may be necessary to repeat the pre-construction surveys (EUROBATS, 2014). Full details of the Bat Monitoring Programme are included in Appendix 6-4 of the EIAR.
	Other Fauna	EIAR Chapter 6	A pre-construction protected species survey of the infrastructure buffer will be carried out.
Construction Phase			
	Floating New Road	EIAR Chapter 2	Monitoring posts will be installed prior to construction to monitor movement of soils in the area around the construction.
	Dust	EIAR Chapter 2	Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.
	Water Quality	EIAR Chapter 9	It is recommended that local surface water features in the immediate vicinity of the site boundary are monitored pre-construction and during construction to take account of any variations in the quality of the local surface water and groundwater environment as a result of activities related to the proposed project. Inspections of silt control measures are critical after prolonged or intense rainfall while maintenance will ensure maximum effectiveness of the proposed measures. A programme of inspection and maintenance will be designed, and dedicated construction personnel assigned to manage this programme. A checklist of the inspection and maintenance control measures will be developed, and records kept. During the construction phase, field testing and laboratory analysis of a range of parameters will be undertaken at adjacent watercourses, specifically following heavy rainfall events (i.e., weekly, monthly and event based as appropriate). Regular visual inspections of all watercourses (flow conditions, discolouration, collection of debris, fish in distress or floating), presented in a monthly report on water quality, is advised by an independent, suitably qualified Ecological Clerk of Works (ECoW) with particular emphasis placed on: • Watercourses downstream of site activities; • At times when heavy traffic is frequenting the site; • During and after periods of heavy or prolonged rainfall and during winter months; • During fish migration and spawning periods; and • Watercourse crossings to ensure that the existing mitigation measures are effective in preventing any sediment reaching streams.

	Archaeological Monitoring	EIAR Chapter 15	Excavations associated with construction works, namely topsoil stripping, will be monitored by a suitably qualified archaeologist. In the event that archaeological deposits are discovered, work in the area will cease immediately and the archaeologist will liaise with the National Monuments Service of the DHLGH and the National Museum of Ireland. A suitably qualified cultural heritage consultancy/consultant will be appointed to oversee the effective implementation of the archaeological mitigation measures prescribed in this chapter (Chapter 15 (Archaeology & Cultural Heritage) of the EIAR) for the construction phase of the proposed project. The National Monuments Act, as amended requires that, in the event of the discovery of archaeological finds or remains that the relevant authorities, the National Monuments Service of the DHLGH and the National Museum of Ireland, should be notified immediately. Allowance will be made for full archaeological excavation, in consultation with the National Monuments Service of the DHLGHG, in the event that archaeological remains are found during the construction phase.
	Excavation Works	EIAR Chapter 8	Excavation works will be monitored by a suitably qualified and experienced geotechnical engineer or engineering geologist. The earthworks will not be scheduled to be carried out during severe weather conditions.
	Private Water Supply Wells	EIAR Chapter 8	Selected private water supply wells at representative locations closest to turbine and borrow pit locations around the site will be monitored for water level and quality pre-construction and during the construction phase
	Settlement Lagoons	EIAR Chapter 9	The settlement lagoons will be monitored closely over the construction timeframe to ensure that they are operating effectively.
	Surface Water Management System	EIAR Chapter 9	The surface water management system will be visually inspected on a daily basis during construction works to ensure that it is working optimally. The frequency of inspection will be increased at settlement ponds adjacent to areas where earthworks are being carried out and during excavations at T10 to T12. Where issues arise, construction works will be stopped immediately, and the source of the issue will be investigated. Records of all maintenance and monitoring activities associated with the surface water network will be retained by the Contractor on-site, including results of any discharge testing requirements.
	Substation Foundations	EIAR Chapter 9	All works will be monitored by a suitably qualified and experienced engineer.
	Directional Drilling	EIAR Chapter 9	Daily monitoring of the compound works area, the water treatment and pumping system and the percolation area will be completed by a suitably qualified person during the construction phase. The drilling process / pressure will be constantly monitored to detect any possible leaks or breakouts into the surrounding geology or local watercourse. This will be gauged by observation and by monitoring the pumping rates and pressures. If any signs of breakout occur, then drilling will be immediately stopped.
	Noise	EIAR Chapter 12	Monitoring activity in relation to noise and vibration will include: - Monitoring typical levels of noise and vibration during critical periods and at sensitive properties; - The use of independent monitoring by external bodies for verification of results; - Blast monitoring to enable adjustment of subsequent charges.

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Appendix 2-3 – EirGrid Specification (Typical Trench Bedding Details)

Document Reference: CDS-GFS-00-001-R0

110 kV, 220 kV and 400 kV Underground Cable Functional Specification General Requirements

Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	12.03.2020	First Issue – Supersedes CDS-HFS-00-001-R1 as Functional Specification is Now Applicable to All Voltage Levels and Updated as per Due diligence Tracker. Sections modified: 2, 6, 7, 8, 14, 16, 17.1, 19, 20, 21	Daniele Giustini	Due-diligence process and Conor Farrell	Brendan Murray

Contents

1 Scope

This specification forms part of a suite of documents that describes EirGrid's requirements for underground cables.

This specification outlines the general requirements for the design and construction of 110 kV, 220 kV and 400 kV underground cable systems which will be connected to the 110 kV, 220 kV and 400 kV transmission system operated by EirGrid.

For the purpose of this specification the term 'cable system' encompasses all equipment necessary to provide the required HV electrical connection (e.g. the HV cables, LV cables, fibre optic cable, ducting, joint bays, terminations, C2 chambers and link boxes.)

1.1 Scope of Works

The "works" consist of cable design, manufacture, installation, civil works, pre-commissioning tests and maintenance under guarantee of the proposed cable system complete with the joints, terminations, fibre and accessories necessary for the satisfactory and reliable operation of the circuit including provision and storage of spares prior to handover date to EirGrid and the TAO.

Commissioning of the cable system and final connection to the transmission system will be arranged by EirGrid.

2 General

For all underground cable systems, the design and construction elements shall be in accordance with applicable Irish and EU Health and Safety Regulations and Approved Codes of Practice.

In undertaking the project, the Customer shall at all times be aware of and comply with the applicable Health & Safety legislation, Approved Codes of Practise and Industry Standards and all subsequent modifications or amendments in relation to same.

Where appropriate, the underground power cable components and all associated ancillary materials shall carry the CE Mark in accordance with Direction 93/465/EEC.

The project shall comply with this specification, unless any deviation which has been specifically requested by the Customer is accepted in writing by EirGrid.

Where deviations from the functional specifications are proposed in the design, the Customer shall submit a formal Derogation Request providing a detailed explanation of why the non-compliance is expected and any additional information to support the request for EirGrid to consider and review on a case by case basis. Further information is outlined in EirGrid's Derogation Process XDS-GGD-00-001. Early engagement pre-construction with EirGrid is required for any proposed deviations.

As stated in the EirGrid Connection Agreement or Committed Project Parameters all cable routes shall be agreed with EirGrid prior to Planning Application. Cables shall not be routed through any area likely to flood (areas classified in 1 in 100 year fluvial and pluvial events). Catchment Flood Risk Assessment and Management (CFRAM) mapping should be consulted in this regard.

Equipment and facilities not specifically mentioned here or in this specification, but which are clearly necessary for the construction, satisfactory operation, safety, security and reliability of the underground cable system are also understood to be included in the scope.

EirGrid will not accept any cable system materials which breach the EU Reach Directive. All cable system components which contain chemical compounds shall be declared in the hazardous materials and safety datasheets.

The Customer shall provide Register of materials and a letter declaring the proposed cable system and related spares is in compliance with the EU Reach Directive.

2.1 Minimum Clearances

The spacing of the cable / ducts shall be, at a minimum, in accordance with the requirements in standard drawings and shall comply with Table 1.

Further detailed requirements are outlined in the EirGrid Cable Civil Works Functional Specification CDS-HFS-03-001.

Item	Description	Clearance (mm)
1	Minimum vertical cover to communication or ECC ducts	750[1]
2	Minimum vertical cover to HV power ducts	950[1]
3	Minimum clearances to 3rd party services (in any direction)	300[2]
4	Minimum clearances to High Pressure / explosive 3rd party services	600[2]
5	Shallow crossing minimum vertical cover to HV power ducts	450[3]
6	Minimum horizontal spacing between any duct not in trefoil formation in the duct bank	75

Table 1: Minimum Clearances for HV Cable Ducts

Prior written agreement is required from the road authorities for proposal of shallow crossings. The Purple Book specifies a minimum vertical depth of 600mm is specified in lightly trafficked road carriageways and 750mm for heavy trafficked roads.

The Customer shall also note that where the minimum standard clearance requirements cannot be achieved e.g. bridge crossings, then an alternate route shall be taken or Horizontal Directional Drilling shall be investigated as an option.

[1] This dimension is applicable to standard cross sections (trefoil or flat formations).
[2] Unless additional clearance is specified and agreed by 3rd party service asset owner.
[3] Reduced cover of 450mm may be considered where highly congested areas, bridge crossings are met or the alternative solution is a very deep crossing where ratings may not be achieved. This is subject to prior written agreement with EirGrid and ESBN.

3 Spares

3.1 Engagement Process

The Customer shall consult EirGrid at an early stage to determine the requirements for cables spares.

Cable Spares are required where non–standard cable and cable accessories are proposed. EirGrid will determine, in conjunction with TAO, the requirement for spares based on the Customers submission.

Upon submission of the Customer cable design and cable accessories and in advance of ordering any equipment, the customer shall receive written confirmation from EirGrid if the proposed cable and cable accessories (joints and terminations) are compatible with EirGrid's standard range of stock and spares.

3.2 Spare Requirements

If following consultation with EirGrid cable spares are required, the Customer shall purchase and store cable spares as outlined below.

These spares shall be made available at energisation stage to be transferred to the TAO.

EirGrid shall have full access to the building in which the spare components are housed, and will not accept responsibility for costs incurred as a result of any extended outage as a result of a lack of availability of spare parts.

Where the cable system is non-standard in terms of EirGrid's current range of 110 kV, 220 kV and 400 kV cable accessories, the Customer shall supply the following spares at a minimum.

Item	**Quantity**
Cable	Equivalent to one phase of the longest section
Joints	6
Terminations	6 (for each type used on the project)

Table 2 – Cable Spares Requirements

Please note, the spares requirements referred to above are based on a single circuit, single cable per phase arrangement, based on circuits employing more than two joint bays. Very short or very long cable routes requirements may differ.

3.3 Spares Storage and Packaging

The cable spares and accessories shall be stored indoor in a secure, accessible and weatherproof building.

The spare cable shall be supplied on a long-life galvanised steel drum which shall be covered with suitable material to provide physical protection for the cables during shipment and during storage and handling operations.

The ends of the cable shall be durably sealed before shipment with heat shrink protective covers to prevent ingress of moisture and shall be firmly and properly secured to the drum.

The direction for rolling shall be indicated by an arrow. This is the opposite direction to that of cable pay off.

Spare parts which are liable to deterioration by atmospheric pollution, humidity or ingress of foreign matter shall be totally sealed in polythene bags, suitable for storage.

Spare parts which are subject to deterioration due to condensation shall be protected by packs of silica gel or other approved desiccants.

Packages shall be crated in robust waterproof wooden packing cases. Large items shall be crated separately and shall be securely clamped against movements.

Each packing case shall be clearly labelled, with the label providing the following information:

- Spare part name
- Eirgrid Material Code
- Project number and title
- Description of serial number of contents
- Expiry date of all chemical components and time limited inert components
- Lifting and storage / stacking instructions
- If multiple cases pertain to an individual joint or termination then the relationship must be clearly labelled eg box 2 of 3

The expiry date should be at least five years and shall at a minimum exceed the warranty requirements of the cable system from TAO handover date.

If the case contains fragile parts it should be clearly indicated on the label and on the crate.

The Customer is responsible for replacement of any degradable material provided with spares, e.g. filling compound, and any costs associated with their ongoing replacement once they expire, until the ownership of the asset constructed contestably is passed to the TAO.

All costs associated with the above spares shall be at the expense of the Customer.

One full set of special jointing tools shall be provided to EirGrid where non-standard accessories are used.

4 Training

If the cable system is non-standard in terms of EirGrid's current range of cable and accessories, then the Customer shall provide training for EirGrid nominated staff.

The Customer shall submit a training plan which shall describe in detail how the Customer proposes to train EirGrid nominated staff.

This plan shall be provided at least 8 weeks before the training course and at least 4 weeks before the commissioning of the plant.

The course shall cover cable jointing for any new cable and accessory designs.

Training instructors shall be knowledgeable and experienced in the manufacture, erection, installation, testing and maintenance of the cable system and shall have good communications skills in the English language.

The training shall be provided on site during the construction period or at the manufacturer's factory as appropriate. All costs associated with the above training shall be at the expense of the Customer.

5 Service Experience

The Customer shall submit a reference list of dates, quantities, and clients for each cable and accessory type being offered.

a) General Manufacturing experience

The cable system types (cable, joints, terminations, link boxes etc.) being offered shall have a minimum of a **five years** proven service record. A list shall be provided outlining the projects and clients the manufacture has supplied in the last five years.

b) Specific Manufacturing experience at manufacturing facility proposal

At least five years production experience in the particular cable manufacturing facility proposed by the Customer is required. However, if the particular cable system proposed is new but the workforce working remains substantially the same as in the preceding manufacturing facility, then the combined experience time will be taken into consideration by EirGrid.

c) Service Experience

Service experience shall be minimum **five years** experience associated with installation of over 1000 km for the relevant voltage level of the cable in at least three EU utilities.

The Customer shall ensure the jointers / installers proposed for the project, shall have a minimum of a five years' proven service record and updated training certificate from the manufacturers of the cable system and accessories proposed for the project.

6 Quality Assurance Plan

The Customer shall submit a detailed Quality Plan (as per the latest revision of the EirGrid Safe by Design Methodology XDS-SDM-00-001) prior to the design phase of the project. The Customer shall maintain and submit all quality certification documents relating to the products and systems supplied for the cable system.

The Customer Quality Plan shall demonstrate, to the satisfaction of EirGrid, that the control measures adopted at the design and construction stage will result in successful commissioning and long-term performance of the built circuit.

Each manufacturer and contractor shall have a Quality Assurance System conforming to ISO 9001:2000. The Customer shall ensure that the same requirements are applied to products, systems and services supplied by sub-contractors and suppliers.

The routine tests and inspections for supplied materials and processes shall be specified in the Customer's Quality Plan.

The Customer shall submit a detailed statement of the quality system as applied to design, materials, manufacture, installation, installation supervision and testing, supported with samples of documentation used for quality assurance certification.

The Quality Plan shall address, but not limited to, the elements in the following list:

- Competence of Civil and Electrical Designer, Contractor, Pre-Commissioner. This shall detail the experience and qualification of engineers / contractors and proven track record;
- Details of Quality Assurance Certification;
- Material selection, sampling, handling, testing on site and testing off site;
- Site work Audit and Control Plan (further information in section 13.1);
- Document submittal schedule;
- Legal transactions concerning property transfer and cable route over third party lands;

The Customer shall identify the person responsible for quality assurance, who will engage with EirGrid on material and installation quality.

All test equipment used for testing and recording test results shall be calibrated for accuracy at regular intervals and shall display the date of next calibration and that of last calibration.

All materials and workmanship shall be of a suitable type and quality to ensure that the cable system as a whole will operate satisfactorily in accordance with EirGrid Specifications.

Acceptance by EirGrid of the design of the cable system and its components shall not relieve the Customer of their obligation to supply and install the cable system to a suitable quality capable of meeting the requirements of the EirGrid functional specification and service requirements.

7 Design

This Quality assurance requirements outlined in the EirGrid “General Specification XDS – GFS-00-001” apply to the cable system and shall be met by the customer.

The Customer should be aware that an EirGrid internal stage gate review process is in place to ensure that projects are designed and constructed in accordance with the required specifications and standards.

Further guidance can be found in EirGrid document “Getting Connected, Delivery Phase of Contestable Projects” and EirGrid General Requirements Functional Specification XDS-GFS-00-001 which is provided at project kick off or by request to info@eirgrid.com.

The design produced by the Customer shall meet the requirements of EirGrid functional requirements and shall make adequate provision for:

- Performance to the required underground power cable system requirements including continuous current rating and short circuit rating as per the circuit parameters communicated by EirGrid;
- Safety of operation and maintenance personnel;
- Safety of members of the Public;
- Reliability and continuity in service;
- Ease of inspection and maintenance;
- Ease and clarity of operation;
- Avoidance of spurious alarms;
- Ability to withstand the service conditions specified;

- Freedom from undue vibration and noise;
- Precautions to minimise fire risk;

EirGrid expect that correctly designed and installed ducted underground power cable circuits will operate satisfactorily for at least 40 years. The customer shall issue a certificate of conformity for the 40 year asset life requirement as part of the technical schedule submission.

EirGrid will inform the Customer if a Distributed Temperature Sensing (DTS) system is required for the specific project. DTS system requirements are specified in the Cable Material Functional Specification CDS-HFS-02-001.

The proposed cable design shall be submitted to EirGrid at the following project stages:

- Route selection and survey prior to Planning Permission application;
- Route risk assessment;
- Material selection;
- Detail Design.

7.1 Design log

Any omissions, issues and/or non-compliances identified by EirGrid Client Engineers during the design review and construction phase will be logged in Design Review and Construction Monitoring comments logs. All comments raised during the design phase shall be rectified in advance of construction commencing.

The Customer shall use the latest comments log template which will be included in the contestable works package.

All such items shall be addressed and rectified by the Customer in revised designs submission and / or remedied at site. In any event all issues shall be closed before handover of the assets.

Further detail on the Customers Quality Assurance requirements can be found in the EirGrid General Requirements Functional Specification XDS-GFS-00-001.

8 Prequalification Inspections

EirGrid shall retain the right to carry out prequalification inspections on all of the Customer's proposed material suppliers. In the event that EirGrid are not satisfied with any supplier, then that supplier will not supply any material for the project.

9 Inspections during Manufacture

The Customer shall submit a test programme to EirGrid and shall give at least three weeks' notice of scheduled routine and sample tests.

EirGrid shall retain the right to carry out inspections during manufacture on all of the Customer's proposed material / equipment suppliers. In the event that EirGrid are not satisfied with any material / equipment production, then remedial actions shall be proposed by the Customer. Any consequent delay due to the provisions of this clause shall be the sole responsibility of the Customer.

10 Type Testing

The Customer shall submit a programme to EirGrid showing dates of all Type testing. EirGrid will retain the right to witness all type tests.

The Customer shall submit the results of all type tests to EirGrid for review and acceptance prior to the shipment of material / equipment from the manufacturing plant. The type tests submitted must be those pertaining to the cable, fibre and accessories to be installed.

All materials shall be tested to confirm the suitability of the supplier's design. All type testing shall be in accordance with IEC 60840 and fibre testing in accordance with IEC 60793.

The Customer is responsible for all costs associated with type testing. In the event of material not meeting the specified requirements, the Customer shall be responsible for all costs associated with redesign and material replacement including those incurred by EirGrid.

11 Acceptance Test and Inspection

The Customer shall submit a programme to EirGrid showing dates for acceptance testing. EirGrid shall retain the right to witness acceptance tests and on all proposed material / equipment deliveries.

The Customer shall submit the results of all acceptance tests (i.e. Routine, Sample Type and Special Tests if applicable) to EirGrid for review and acceptance prior to shipment from the manufacturing plant. Acceptance tests and inspections shall be carried out before delivery of any material / equipment from the manufacturing plant. The Customer is responsible for all costs associated with acceptance tests and inspection.

In the event of material / equipment not meeting the specified requirements, the Customer shall be responsible for all costs associated with material replacement, including all associated costs incurred by EirGrid.

12 Installation

The Customer shall submit all installation methods for the cable and fibre system to EirGrid for review before any installation work commences on site.

The information shall be provided in sufficient time to allow a full review by EirGrid.

All cable and fibre installation work shall be carried out in accordance with the manufacturer's approved installation methods.

The Customer shall advise EirGrid well in advance of commencement of any installation work so that a representative may be made available to witness the works.

For additional details on installation requirements see applicable installation specifications and standard drawings which form part of the overall suite of documents.

12.1 Installation records

For duct and joint bay installation works the Customer shall take good quality photographs of the trench and installed duct work materials at 10 metres intervals along the cable route with data logged with GPS coordinates.

At all third party service crossings, bridge crossings, couplers, joint bays and special features of the underground power cable route, additional photographs of special or non-standard construction shall be taken demonstrating compliance with the EirGrid functional design and specifications. These photographs shall be organised in a systematic manner (sequentially numbered) identifying the location using GPS co-ordinates that the photograph was taken and uploaded weekly on a dedicated folder on the EirGrid project extranet site.

These quality assurance records are vital during the construction works in order for the Customer to demonstrate compliance with the design and the EirGrid functional specification.

13 Reinstatement Finishes

The requirements for the reinstatement of trenches, manholes and joint bays shall be agreed in advance by the Customer with the local authority, relevant public body or private landowner.

The agreed reinstatement details shall be in line with agreements made with planning/ local authorities and submitted to EirGrid before the works are carried out.

The Customer shall obtain a statement of confirmation from the relevant party that the reinstatement has been completed to their satisfaction. These confirmations shall be summarised in a document log and submitted as an appendix. This shall be submitted to EirGrid before the ownership of the circuit is transferred to the Transmission Asset Owner.

14 Installation in compliance with Design

The Customer shall declare, in writing, to EirGrid that the construction of the works has been completed in accordance with the Design accepted by EirGrid.

15 Inspections by EirGrid

During the construction of the project, onsite inspections may be carried out by authorised EirGrid Client Engineers or their agents to ensure compliance with statutory provisions and agreed engineering design and / or specifications.

The construction shall be in compliance with the design drawings produced / approved by the Customer and accepted by EirGrid. The design drawings shall be comprehensive and detailed and shall be present for inspection at all times on site.

The Customer shall ensure that the EirGrid Client Engineers and their agents have unrestricted access to the project as required to carry out this role.

EirGrid reserve the right to request Trial Holes or Slit Trenches to be carried out by the Customer on the as installed underground cable or ducting section to audit the construction works, the number of each will be dependent on the installation itself.

Trial holes shall only be required in exceptional circumstances if the customer proceed to construction ahead of EirGrid's knowledge, design non-compliances or quality issues are identified during construction.

In the event of a non-compliant installation being exposed by the trial holes or slit trenches, any additional investigation work, as deemed necessary by EirGrid shall be facilitated by the Customer.

16 Pre-Commissioning

Prior to hand over of the cable to EirGrid for commissioning, the Customer shall carry out pre-commissioning tests in accordance with the provisions of EirGrid Cable Installation Functional requirements (CDS-HFS-04-001).

Such tests shall be carried out by the Customer.

When all pre-commissioning tests have been satisfactorily completed, the Customer shall certify and declare the works are ready for EirGrid commissioning.

The following documents shall be handed over to EirGrid before commissioning starts:

- Material certificates and signed cable pre-commissioning test results sheets;
- Pre-commissioning documents including photographic evidence of compliance;
- As-builts of Cable route.

The Customer shall provide competent test personnel, instrumentation and test rigs together with all auxiliary personnel, electric power and other services necessary for the completion of the tests.

16.1 High Voltage AC Test and PD Monitoring requirements

The Customer shall complete High voltage testing with Partial Discharge (PD) monitoring of the installed cable system and it must take place when the cable is not terminated.

In the case of Gas Insulated Switchgear the cable termination should not be installed in final position prior to testing, rather they should be left supported and protected to facilitate connection to test equipment and GIS insulated dead end canisters. Once testing is finished they can then be installed into GIS cable chambers.

In case of Air Insulated Switchgear (AIS) Cable Sealing Ends the following two scenarios must be considered:

- AIS terminations within station compound can be installed in final position but any connecting conductors or busbar connecting the terminations to overhead lines or equipment should be disconnected.
- CSE on line / cable interface mast, the cable must remain at ground level and not be raised to the mast platform in order not be considered part of the Network to allow for the PD test;

The Customer shall submit the PD test procedure for EirGrid review during the design stage.

The test shall be performed in accordance with IEC 60840 or IEC 62067 and witnessed by EirGrid and / or nominated representatives.

The Customer shall provide a report to EirGrid outlining the PD test records.

The Customer shall discuss details with EirGrid prior to any cable termination.

- In the case of short cable lengths (less than 1km with no Joint Bays), **on line** PD monitoring during the soak test is acceptable and will be performed by EirGrid.
- Cable circuits in excess of this length (1km or with Joint Bays) shall be tested using off line elevated voltage test with PD monitoring for a period of 1 hour as per relevant IEC Standards.

17 Commissioning

The Customer shall provide a certificate to EirGrid detailing all checks carried out and a statement of full compliance of the system with approved drawings and Specifications.

Commissioning of the cable circuit and associated fibre cable will be arranged by EirGrid.

EirGrid may carry out further inspections as deemed necessary. Any such inspections do not absolve the Customer from full responsibility for ensuring the satisfactory completion of the works.

17.1 Commissioning equipment requirements

The Customer is required to provide the equipment for cross bonding checks during commissioning.

The Customer shall provide all required test equipment (portable generator, load bank and leads) to verify operation of the Sheath Voltage Limiters (SVLs) and for the cross-bonding scheme tests.

The Customer shall engage with EirGrid for details of the specific test equipment requirements.

The Customer shall provide commissioning assistance to support EirGrid to enable any immediate remedial works as necessary.

17.2 Cable Parameter Tests:

The Customer shall carry out the following electrical tests in accordance with the relevant IEC Specifications and provide results to EirGrid.

- Zero, positive and negative sequence impedance tests to verify actual as laid values ;
- As laid electrical resistance of the cable

A proposed measurement procedure shall be submitted to EirGrid for review.

18 As-Built Records

Prior to backfilling the trench above the red marker strip covering the telecoms ducts, and prior to covering the joint bays, C2 chambers and link boxes the Customer shall record and document installed locations (including GPS co-ordinates) and levels.

The depths of the duct installed shall be recorded as per Section 7 of CDS-HFS-00-001 Functional Specification. 3rd party service levels and details shall be added to the As Built drawings including GPS co-ordinates of the actual crossing locations.

The Customer shall provide a full as-built record of the installed ducts to EirGrid for review before hand over of the ducts, cable and cable accessories assets.

All ducts shall be clearly labelled power or comms including ownership of duct.

The Customer shall provide the Operations & Maintenance package for the entire cable system to EirGrid. This package should contain all relevant information for the cable, ducts, the fibre, link boxes, C2 chambers, joint bays, cable sealing ends and any other cable accessories.

19 Warranty

The entire cable system asset constructed by the Customer and transferred to TAO shall be fit for purpose as intended and free from defects for a period of 24 months from the Handover Agreement effective date.

All civil works related to the cable system asset constructed by the Customer and transferred to TAO shall be free from defects for a period of 5 years from the Handover Agreement effective date.

The entire cable system asset constructed by the Customer and transferred to TAO shall be free from corrosion for a minimum period of 5 years from the Handover Agreement effective date.

In the event of any defect occurring during the above periods, the Customer shall deliver all components necessary to correct the fault, together with any necessary instructions and specialist assistance, with the cost to be borne by the Customer.

The warranty periods referred to above shall be extended by the same periods as the respective original warranty and to commence from the date of rectification of the default should any defect arise within the original warranty period.

20 Information and Drawings

The project safety file shall be submitted to TAO on completion of the project in accordance with the Construction Regulations and XDS-SDM-00-001 EirGrid Safe By Design Methodology.

20.1 General Information Required

The following documentation shall be submitted by the Customer in accordance with programme agreed with EirGrid:

General Information Required	Check
Outline Works programme for each section of the Works.	
Organisation chart for the project.	
Certification letter of compliance with the specification and any deviations proposed from the specification documents	
Statement of each company’s quality control / assurance policies and procedures	
ISO 9001:2000 series certification for each manufacturer / erector	
Certificate of compliance with the disposal of waste material	

20.2 Detailed Information Required

The following documents shall be submitted by the Customer in accordance with a programme agreed with EirGrid:

Detailed route drawings including all of the following:

Detailed Information Required	Check
Proposed cable route before planning permission submission, cable plans and long section drawings	
Location of all existing services, type, size and depth of installation along the route	
Proposed trench arrangement where cable crosses other services	
Dedicated crossing design for every 3rd party service crossing, bridge, road, river	
Detailed cross and long sections through bridges which clearly illustrate separation from other services, depth of burial of cable ducts and also how ducts enter / exit bridge abutments / deck	
Detailed design including cross sections, long sections, plans where cable routes traverses water crossings	
Proposed joint bay locations (including distances between joint bays)	
Proposed link box chamber locations	
Proposed C2 communication chamber locations	
Future access points / routes for maintenance and repairs	

Consents including all of the following:

Consents Information	Check
Easements / wayleaves details and drawings	
Local authority and other agreements	
Agreements with TII / CIE and any other infrastructure providers	
Statutory Constraints e.g. SAC, NHA	
Work Restrictions	

Civil Works including all of the following:

Civil Works	Check
Detailed programme for Civil Works	
Cable trench cross-section drawings	
Future access Civil Works details and drawings	
Joint bay construction drawings	
Joint bay arrangement drawings	
Communication C2 chambers construction drawings	
Link Box arrangement drawings (including distance from joint)	
Details of proposals to prevent water ingress into joint bays	
Details of proposed ducting and supplier	
Details of proposed thermal sand and supplier (if used)	
Proposed support mechanism for joints in joint bays	
Method statement for civil works	
Programme for submission of as-laid records	
Certificate of As-built records agreement	

Material including the following

Material Information	Check
Cable cross section drawing	
Cable technical schedule (as per format provided)	
Cable pulling tension calculations	
Joint drawings (for each type)	
Joint technical schedules	
Termination drawings (for each type)	
Termination technical schedules	
Link Box design drawings	
Bonding lead cross section drawing and technical schedule	
Sheath voltage limiter technical schedule	
Earth continuity conductor cross section drawing, technical schedule and trench arrangement	
Cable clamp drawings, arrangement and schedules	
Steelwork drawings	
Steelwork loading calculations	
Steelwork galvanisation proposal	

Proposed cable pulling eye / stocking	
Proposed cable lubricant for duct installation (where used)	
Fibre optic cable and accessories details	
Fibre optic cable and accessories details (when required)	

Information for the Installation:

Installation Information	**Check**
Programme of Installation	
Method statement for duct installation / cable pulling	
Details of arrangements to prevent water ingress into cable / joints	
Jointing instructions for joints / terminations	
Jointing certificates	
Duct proving records	
Cable pulling tension records	
Steelwork erection proposals	
HV Cable Installation Record sheet	

Electrical Information as follows:

Installation Information	**Check**
Cable technical schedules	
Bonding / Earthing schematic drawing including phasing	
Sheath standing voltage calculations for the cable route	
Distances between joint bays (where applicable)	
Joint bay earth system drawing (where applicable)	
Cable rating calculations in accordance with IEC standards	
Magnetic field calculations and compliance report with ICNIRP Guidelines	

Testing including the following:

Testing Information	**Check**
Prequalification test results	
Manufacturing test programme	
Type test results	
Acceptance test results	
Programme of cable delivery	
Ducting	
Duct and joint bays surround materials	

After laying sheath test results	
Fibre optic test results (OTDR etc.)	
Steelwork test results	
Records of all tests as per IEC standards	

Safety Information including the following:

Testing Information	**Check**
Safety organisation chart	
Safety file	
Evidence of appointment of Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS)	
Signed certificate / letter stating full compliance with all Irish Construction and Safety regulations and including all risk assessments for the cable system proposed	

References, Warranties, Other

References, Warranties, Other Information	**Check**
Certificate of warranty as per this Specification	
Service experience list of projects	
Service experience list for material manufacturer	
Service experience list for material installers	
Updated manufacturers training certificate for jointers and installers cable system and accessories	
Training plan for EirGrid nominated staff	
Curriculum Vitaes of jointer training instructors	
Details of storage facilities to be provided for spares	
Details of shelf life of spares items	

Document Reference: CDS-HFS-01-001-R2

110 kV Underground Cable Functional Specification

Route Selection, Design and As Built Records

Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	07/02/2012	First Issue – Supersedes CDS-WTS-01-001-R0	ESBI – see page 2	-	Christy Kelleher / Paul Moran
R1	12/01/2017	Updated as per Due diligence Tracker	Daniele Giustini	-	Paul Moran / Kieran French
R2	12/03/2020	Updated as per Due diligence Tracker. Sections modified: 2, 3, 4, 5, 6, 7, 8, 8.6, 8.8.	Daniele Giustini	Due-diligence process and Conor Farrell	Brendan Murray

Contents

1 Scope

This specification describes the requirements for route selection and as-built records for 110 kV underground cables which will be connected to the 110 kV transmission system operated by EirGrid.

For the purpose of this specification the term ‘cable system’ encompasses all equipment necessary to provide the required HV electrical connection (e.g. the HV cables, LV cables, fibre optic cable, ducting, joint bays, C2 chambers and link boxes.)

2 General

The Customer shall submit all Planning Permission designs and cable routes in compliance with the requirements of this specification for EirGrid review and acceptance in advance of submitting to the local authority.

High Voltage cable installation across third party lands is undesirable and only considered in exceptional circumstances.

High Voltage cable installation across peat lands is not acceptable and should only be considered if no other option exists. In case of peat lands additional extensive engineering design and documentation will be required by EirGrid before the Customer proposal can be evaluated, please refer to section 6 for further information.

The Customer shall submit all Construction designs and cable routes in compliance with the requirements of this specification for EirGrid review and acceptance in advance of any civil works or installation works proceeding.

The Customer should be mindful that reviews of non –standard (third party and peatland) routes is resource intensive as significant time may be spent in reviews, further research and meetings between teams which involves various staff across EirGrid and ESBN. The customer shall factor this time in their overall programme and decision making for non-standard designs as this may impact the projects critical path.

The Customer shall provide a detailed cable route map, to a suitable scale, to EirGrid for review. All relevant landscape features, buildings, kerb-lines and other services shall be marked.

The cable route shall avoid changes of line and direction as much as possible. Any changes in direction shall not exceed a radius greater than the minimum installation radius for the cable proposed by the Customer cable manufacturer.

The route of the cable shall follow solid stable ground on flat or gently graded slopes not subject to erosion. Site investigations including trial holes shall be conducted by the Customer in advance to determine the suitability of the route. Results of the site investigations shall be issued as part of the Customers design submission for EirGrid review.

Where the gradient of the route exceed 1 in 6 metres or cannot avoid unstable ground, special measures shall be designed and implemented to achieve satisfactory long term duct and cable performance.

In order to facilitate access for installation and maintenance, the cable route as standard shall follow public roadways, footpaths or green areas under the control of the relevant Local Authority.

Service roads shall be installed along the cable route providing suitable and safe access for maintenance and cable pulling vehicles at all joint bay locations and along any areas the cable route that is not located within the public road.

Direct burial of the cable is not permitted in any circumstance with the exception of the approx final five metres cable run for connection to AIS cable sealing ends.

Fibre optic cable direct burial is not permitted in any circumstance. All communications ducting should terminate in either a C2 Communications Chamber; block ducting within the station compound or within the station building itself.

The Customer shall gain agreement for the proposed route from the relevant Local Authority and all other relevant stakeholders e.g. Transport Infrastructure Ireland, Department of Environment, Heritage & Local Government etc. Formal permission shall be obtained from the relevant authorities for any proposed crossing of railways, navigable rivers, waterways, canals, harbours and docks. Construction cable design details issued to EirGrid for review/acceptance shall have the same specification detailed in Construction and As-Built Design section below.

2.1 Statutory Wayleave

A wayleave and / or an easement may be required by EirGrid. The Customer is responsible for arranging such agreements where the cable is proposed to cross private property.

Any costs associated with the transfer of the wayleave / easement to EirGrid's designated contact will be borne by the Customer.

3 Policy on Underground Cable Routes Through Third Party Lands

EirGrid's policy in relation to the routing of underground cables is that they shall be routed through public roads or public lands.

This approach provides security and protects the integrity of the cable by:

- Limiting the risk of accidental damage
- Prohibiting future development on the route
- Providing access for inspection, maintenance and fault repair as required.

However, with the increased use of underground cable on the network, particularly at 110 kV, situations may arise where it may become necessary to traverse third party lands.

High Voltage cable installation across third party lands is undesirable and only considered in exceptional circumstances. Should a potential requirement for such an installation be proposed, EirGrid shall be consulted at the earliest opportunity.

HV cable route options through third party lands shall only be considered if all other options have been exhausted (to the satisfaction of EirGrid).

If it is absolutely necessary and no other reasonably practical options exists, the Customer may propose routing cables on private land, subject to design review and all necessary wayleaves/easements being obtained and subject to prior EirGrid acceptance.

The Customer shall bear the cost of the transfer of these easements to EirGrid's designate.

In these situations the following provisions will apply:

- Prior written approval from EirGrid must be obtained
- A deed of grant of wayleave in respect of the cable route to ESB must be provided. (min width 4m for 110 kV circuits)
- Proper delineation of the easement area and identification of the cable route must be provided on the marked-up folio
- Durable robust route markers must be provided at agreed positions (line of sight, at bends location and property boundaries) along the route. Route Markers to have the following dimensions:
    - Height 1700mm
    - Width 92mm
    - Weight 3.5kg

For route markers appearance and label please see appendix A.

- No development may take place. Trees should be planted far enough from the easement area so that roots will not encroach into the easement.
- Suitable unrestricted right of way access, both to the route from the nearest public road and along the route, for the purposes of inspection, maintenance and repair shall be marked on the folio. Such access road to be designed and constructed for heavy plant (5t axel loading) movement along the length of the route.
- Joint bays, link boxes and C2 Communication Chambers to be located on public roadways and public property as a standard even if cable route traverses private properties.

The Customer shall submit details of all consents required / agreed along the full route. The Customer shall also provide general arrangement, long sections and cross sectional drawings along the full route.

3.1 Cable Route Crossings

A full survey shall be carried out, including trial holes and bore holes as required before design is finalised to identify all major obstacles, such as major road crossings, rivers or railways and other services.

This survey shall inform the designer on establishing a detailed cable route and installation plans.

All efforts shall be made to minimise conflict with other services, and to facilitate the ease of installation and maintenance. Where the cable crosses other services, this should be clearly identified in the Customer's designs including GPS coordinates.

The Customer shall submit a cross section of the cable route identifying all locations where the cable crosses other services. A minimum standard clearance of 300mm must be maintained between the EirGrid ducts (power or comms) and all other services.

Where other Utilities require greater clearance (i.e. for high pressure gas pipes it is 600mm) the Customer shall ensure these are adhered to.

3.2 Cable De-rating Considerations

Where more than one circuit / two cables per phase is being installed or where one cable is installed adjacent to an existing HV cable, the design shall take due account of cable de-rating due to mutual heating of the cables through HV cable analysis. The mutual coupling effect of other cables and pipelines must also be taken into account.

Where 110 kV underground cables cross lower voltage cables, they shall be routed under the lower voltage cables for safety reasons. If it is necessary to bury the cable at greater depth at any point, then the Customer shall take account of this in the rating of the cable as per IEC 60287.

The Customer shall take note of the presence of existing HV & MV underground circuits.

The Customers design shall model the impact of neighbouring underground circuits in terms of the new cables rating and the impact on the existing cables ratings.

Where it is proposed to cross (over or under) or run in parallel with an existing circuit, the cable system must be designed to ensure that no de-rating of existing circuits occurs as a result of the proposed cable.

Where this scenario arises, the Customer will be required to demonstrate via detailed cable rating calculations that mitigations have been taken to limit potential de-rating of existing underground circuits.

This may include but is not limited to the use of bentonite, the use of a larger cable, the use of Horizontal Directional Drilling to increase thermal separation and thermal independence.

4 Joint Bays, link boxes & C2 Communication Chambers

The following criteria shall apply to the selection of joint bays, link boxes and C2 Communication Chambers:

- Joint bays, link boxes and C2 chambers must be kept away from access points e.g. driveways, entrances etc.
- Adequate room must be provided in front of and behind each joint bay, link boxes and C2 chambers location to accommodate cable drums, vehicle used for maintenance and pulling equipment.
- All proposed joint bays locations must be proven by trial holes and in areas of poor ground conditions the use of bore holes may be necessary.
- The selection of joint bay, link boxes and C2 chambers should take account of the maximum calculated pulling forces and tensions
- Where cross-bonding of the cable sheath is employed, joint bay positions will be constrained and will require that minor sections are of substantially equal length.
- C2 communications chamber and link boxes to be installed at each joint bay. Additional C2 communications chamber will be required if route design exceed the maximum allowable pulling forces and tensions for the installation of fibre cable
- Splicing of fibre optic cable will take place in specific C2 chambers as determined at detailed design stage.

Joint bays should be positioned so as to avoid unnecessary road closures and traffic management during installation and maintenance. Associated communications chambers and link boxes shall be installed off the carriageway where practical. Link boxes and C2 communication chambers positions shall be accepted by EirGrid during the design phase.

The Customer's designer shall consider the maintenance requirements and operators access for opening jointing containers when designing the location of the C2 chambers / link box.

5 Horizontal Direct Drilling

5.1 Trenchless Technology

Should it be necessary to cross obstacles such as bridges, railways, water courses etc. with the cable duct(s), and all infeasible, then the method of installing the cable duct(s) by trenchless technology may proposed for EirGrid review.

Long lengths of ducting outside such areas installed using trenchless technology are not accepted.

The Customer shall submit a design proposal for EirGrid to review.

Any licences or agreements required to carry out this work shall be obtained by the Customer and a copy forwarded to EirGrid.

The following is the size of duct to be used for directional drilling for 110kV power ducting:

- 140 / 180 / 225 mm HDPE with a minimum SDR 11

Communication ducts shall be 125mm OD SDR 11 in trenchless installation.

Transition couplers shall be used to join SDR 11 ducts with standard SDR 21 and 17.6 ducts, for additional duct details please see specification CDS-HFS-03-001.

In exceptional circumstances, a transition pit may be used at both ends of the trenchless technology installation to join trenchless ducts with standard ducts. The transition pit requirements are outlined in standard drawing XDC-CBL-STND-H-013.

6 HV Cable Trench Installation through Peatland

Overhead Lines are the preferred transmission infrastructure to be used through peatland (for both blanket and/or raised bogs).

Cable Trenches crossing through peatland shall be avoided if at all possible.

Any routes identified through peatland must be reviewed and accepted by EirGrid on a case by case basis. Should a potential requirement for such an installation be proposed, EirGrid should be consulted at the earliest available opportunity.

If all other HV cable route options have been exhausted (to the satisfaction of EirGrid) then a design may be considered by EirGrid through peatland. Such design shall be reviewed and accepted by EirGrid before the Customer can submit the planning permission.

The Customer shall submit a detailed feasibility study of the options and their proposal for installation of a short section of the HV cable route in peatland.

The feasibility study shall advise why the other route options are not being progressed and also provide case studies of where a similar peat land cable design has been installed successfully.

For all underground cables constructed in peat, regardless of location (e.g. within or beneath a road or otherwise), the Customer shall include the following in the feasibility:

- A desktop study of the route including a review of all existing geotechnical information, outlining all constraints and geotechnical risks
- An outline of all site investigation carried out along the route
- A peat stability risk assessment/peat landslide hazard risk assessment shall be completed that shall consider the risk of peat slides in blanket bog and bog bursts in raised bog.
- In association with the peat stability risk assessment/peat landslide hazard risk assessment a Materials Management Plan shall also be submitted for review by Eirgrid
- A preliminary peat stability mitigation plan shall also be submitted with the peat stability risk assessment/peat landslide hazard risk assessment outlining how all design, construction and operations risk are to be controlled and/or mitigated
- A feasibility design for the cable route trench

The Customer shall include the following in the design submission:

- An outline of any site investigations carried out and the associated findings
- A detailed peat stability mitigation plan shall also be submitted with the peat stability risk assessment/peat landslide hazard risk assessment outlining how all design, construction and operations risk are to be controlled and/or mitigated
- A demonstration that settlement or differential settlement of the cable shall not occur to the extent to which the cable's function or durability could be compromised over the design life.
- Demonstrations that lateral movement due to downhill creep of peat shall not occur.
- Clear outline of any planned site investigation or ground condition verification during the works
- An outline of the construction supervision during the works
- Flooding risk shall be assessed.

Line / Cable interface towers locations shall be assessed in a similar manner. However this shall include access and egress routes to the locations.

If roads in peatland are proposed to be constructed as "floating roads", the Customer should consider in the design that these are prone to gradual differential settlement leading in time to an undulating surface. Where the cable route is proposed to be constructed in a "floating road", the Customer shall assess whether it will be necessary to replace the floating road with a road founded on mineral soil in order to avoid future settlements or peat instability.

The peat stability risk assessment/peat landslide hazard risk assessment shall be carried out by an experienced geotechnical engineer (min. 10 years' experience, Chartered Geotechnical Engineer). The assessment shall be carried out in accordance with all current legislative requirements and guidelines and at a minimum the Scottish Government Peat

Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments

Specific requirements on the design of any cable route through peatland are listed below:

- A minimum 3 m paved and gated service road designed for heavy traffic will be installed to provide safe access for inspection, maintenance and fault repair along the entire cable route through peatland.
- All materials used must comply with the Transport Infrastructure Ireland (TII) Specification for Road Works and all relevant Irish and European Standards. British Standards may also be used where appropriate and where no equivalent Irish or European Standard is applicable. A maintenance plan listing responsible parties for maintaining the HV cable, trench, road and gates shall be submitted.
- A drainage design for the route must be included with the submission. The drainage design must ensure the continued integrity of the road surface, but it must be demonstrated that the peatland will not be adversely affected by pollution, by siltation or by changes to the hydrological conditions.
- The service road which accompanies the HV cable route should be suitably designed (i.e. if the road is to be used by heavy vehicles or machinery this should reflected in the structural design for the road).
- Peat must be completely excavated to either competent mineral soil or bedrock at the joint bay locations.
- Joint bays and communication chambers are to be located adjacent the service road.

It should be noted that as with any non-standard design, EirGrid should receive early notification pre-construction that a non-standard design is being proposed and a formal derogation submitted.

It should also be noted that the process for seeking acceptance of a non–standard design is more onerous and timely as more stakeholders are involved in the review. Also the design may require additional warranties to mitigate risk if deemed necessary.

Cable drawings included in XDC-CBL-STND-H-007 shall be used for guidance only in determining the construction design.

7 Design Submission

The Design shall be submitted for EirGrid review and acceptance. A period of 15 working days shall be allowed for EirGrid review of any design submission from date of receipt of each submission to date of notification of comments or no comments.

In programming design submission the Customer should allow for the possibility that re-submissions may be necessary before EirGrid will be in the position to accept the design. No site works should start before design is accepted. . The number of re-submissions will be inversely proportional to the quality level of the design submissions.

Design submission schedule shall be submitted and agreed with EirGrid at project kick off meeting.

Each design submission to EirGrid shall be sequentially numbered and dated.

Each submission shall be accompanied by a transmittal sheet which lists the documents comprising the submission. If the submission includes revisions of documents previously submitted the transmittal sheet shall include a reference to the original submission number.

8 Construction and As-Built Design

8.1 Background Mapping

Ordnance survey strip mapping in national grid co-ordinates is required along the proposed cable route. The route design and As Built shall then be overlaid on this OSI mapping. If OSI background mapping is not available or of limited information a topographical survey should be carried out and plotted at a scale of 1:2500 or larger depending on the site in question but not smaller than 1:5000.

8.2 Recording As-Built Record Information

The Customer may use the survey instrumentation of their choice to record the as built record; the chosen method must be capable of recording the information within the tolerances set out below by this specification.

Up to date Vector Ordinance Survey Strip mapping in national Grid co-ordinates shall be used for the entire route to produce As Built records.

The survey shall record points along the top of the centre cable/duct when the cable is installed in trefoil formation and the top of the central power duct when installed in flat formation. A surface ground level shall be recorded adjacent to this point. It is necessary for the surveyor to record hard detail along the route of the cable. A typical example of the hard detail would be kerbs, buildings, footpaths, manholes, fences, bottom of banks etc. This hard detail will be coloured black with a line thickness 0 and shall be suitably annotated.

Drawings relating to vaults (chambers, transition pits and link boxes) and joint bay positions shall be presented in scale 1:25, drawings relating to plans and elevations of non-standard duct cross sections shall be presented in scale 1:100 with vertical and longitudinal cross views.

All drawings shall be on international A3 size unless otherwise agreed.

Drawings shall be complete in all respects, accurate numerically and geometrically correct. The drawings shall be sufficiently detailed to enable construction to proceed without the need for other supporting drawings / documents or interpretations. All Drawings and supporting documentations shall be checked and approved by the Designer before submission to EirGrid for review.

The required electronic format is “.dwg”, “.dgn”, “.pdf” and “.dxf”.

Grid co-ordinates shall be shown from the centre point of all joint bays, C2 Communication Chambers, transition pits, Cable Sheath Link Chambers, Phase Sectionalising Kiosks, 3rd party service crossings etc.

The location of all 3rd party service crossings shall be identified on the drawings using GPS co-ordinates.

Geotag photographs shall be taken along the full length of the route during construction activity.

It is recommend that increased quality assurance photograph evidence is recorded for instances when the design or ducts deviate from the standard trefoil formation to be included in the as-built drawing package.

8.3 Horizontal Accuracy

The cable/ducts shall be surveyed and plotted on the background mapping to an accuracy of +/- 50 mm in the horizontal plane (Easting and Northing). The same accuracy is required for the surveying of all joint bays, transition pits, C2 chambers, fibre joint locations, 3rd party service crossings etc.

The cable shall be represented on the plot by one continuous Smartline / Polyline from joint bay to joint bay. All bends along the cable route shall be reflected accurately as they exist on the ground. This shall be in the form of a continuous curve. The use of tangent lines is not suitable for recording such information.

The minimum number of points necessary to survey a radius bend is three. More points shall be surveyed where necessary.

Points shall be surveyed at 10 m intervals or as necessary to record accurately the true position of the power ducts in the ground.

8.4 Vertical Accuracy

The cable/ducts shall be surveyed and plotted on the background mapping to an accuracy of +/- 20 mm in the vertical plane. All reduced levels shall be orthometric heights to OSI datum, mean sea level at Malin Head. All reduced levels shall be annotated on the as-laid record as per the sample attached.

Points shall be recorded at a maximum of 10 m separation, where the trench installation is as per the standard trench cross section. For standard trench cross section please refer to standard drawings.

Where the trench depth deviates from the standard trench cross section, i.e. deeper or shallower than standard depth, points shall be recorded as often as is necessary to achieve the tolerance as specified above.

8.5 Tie-In Dimensions

Tie-in dimensions shall also be clearly marked on the plot. These shall be at 40- 50 m centres along the cable route or closer as required. The sample as-laid record has some examples of tie-in dimensions.

8.6 Cross Section and Long Section Information

Dedicated cross sections and Long Sections, for each crossing point, are required where the vertical alignment of the cable/ducts deviates from the standard design depth to avoid an obstruction. Typical example of such obstacles would be cables, bridges, culverts, watercourses, transmission gas mains or drainage pipes. The trench cross section shall include details of these.

Cross sections and Long Sections are also required if the formation of the cable / ducts deviates in any way from the standard trench cross section in the specification. These drawings shall be prepared to a standard acceptable to EirGrid and accepted by EirGrid before construction starts.

8.7 Existing Utility Services

All existing services exposed by the trench excavation or in the vicinity must be recorded and plotted on the drawings. The location including GPS co-ordinates and depth of these services shall be recorded to the same tolerances as those outlined for recording the location of the cable / duct.

The drawings shall also be annotated with information detailing the type and size of the service e.g. Water main 125 mm. Refer to the standard drawing XDC-CBL-STND-H-009.

Where there is a change in the detailed design as a result of conflicts uncovered (presence of third party services, restricted depth, width available) during trench excavation, the revised design for the affected section shall be submitted to EirGrid for review before duct installation proceeds on this section of the route.

8.8 Additional requirements

The cable route shall have a continuous chainage reference from end to end shown clearly at 20m interval on the route drawings.

Cable route plan drawing shall include insert photographs showing a red line representing the location of the proposed cable route.

8.9 Plotting

The recorded information shall be plotted on the background mapping provided. The final as-built record shall be produced to the same quality as the sample drawing number XDC-CBL-STND-H-009.

Text shall be 2 mm high when plotted at a scale of 1:500. The text shall also appear horizontal to the sheet and should not obstruct any line work. To achieve this, annotation arrows with a line thickness of ‘0’ may be used. All surveyed detail should be plotted with the attributes in the following table:

Object	Level/ Layer	Colour	Style
ESB 110 kV Cable	2/ESB	5/Magenta	4/DashDot
ESB 220 kV Cable	2/ESB	1/Blue	6/DashDotDot
ESB 400 kV Cable	2/ESB	1/Blue	6/DashDotDot
ESB 38 kV Cable	2/ESB	3/Red	2/Dash
ESB MV/LV	6/Utilities	3/Red	0/Continuous
ESB Fibre Cable	2/ESB	2/Green	2/DashDot
Drainage Foul	6/Utilities	20/Yellow	0/Continuous
Drainage Surface	6/Utilities	20/Yellow	0/Continuous
Gas	6/Utilities	7/Light Blue	0/Continuous
Telecoms	6/Utilities	2/Green	0/Continuous
Water	6/Utilities	1/Blue	0/Continuous
Other	6/Utilities	6/Brown	0/Continuous

Table 1 - Plotting Styles

8.10 Schedule for production of as-built records

The Customer shall submit accurate surveyed electronic drawings in AutoCAD and pdf version to EirGrid

and shall outline their detailed programme for submission to EirGrid.

The Customer shall ensure final As Built drawings are issued to ESB Central Site office before the cable commissioning starts.

9 Appendix A - Route Marker post

Document Reference: CDS-HFS-02-001-R3

110 kV Underground Cable Functional Specification Cable Materials

Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	07/02/2012	First Issue – Supersedes CDS-WTS-02-001-R1	ESBI – see page 2	-	Christy Kelleher / Paul Moran
R1	20/01/2015	Section 2 – Highest voltage for equipment (rms), U_m , amended from 128kV to 123kV	Kieran French	-	Paul Moran
R2	12/01/2017	Updated as per Due diligence Tracker	Daniele Giustini	-	Paul Moran / Kieran French
R3	12/03/2020	Updated as per Due diligence Tracker. Sections modified: 2, 3, 4, 5, 8.	Daniele Giustini	Due-diligence process and Conor Farrell	Brendan Murray

Contents

1 Scope

This specification forms part of a suite of documents that describes the requirements for cable materials for 110 kV underground cable systems which will be connected to the 110 kV transmission system operated by EirGrid.

It covers the design, manufacture, testing and delivery to Ireland of 110 kV (nominal voltage) underground cable materials, together with all accessories needed for their proper and reliable operation.

2 Functional Requirements

2.1 Network Parameters

The cables and accessories shall be rated in accordance with the "Network Parameters" table contained in the EirGrid General Requirements specification XDS-GFS-00-001.

The neutral of the system shall be effectively earthed as per IEC 60071-1.

The cables and accessories shall be designed for operation on the system specified and to comply with the requirements laid down in this specification.

The cable system shall be designed to operate for nominal and short circuit level as specified in the project specific specification document / SLD.

The minimum rating requirement of the cable is dependent on the Customer connection and will be advised by EirGrid.

2.2 Service Conditions

The site climatological conditions shall be taken into consideration when designing the cable system.

The climate in Ireland is moderate and extreme temperatures are very rare.

The cable system shall be capable of operating satisfactorily at the service conditions as specified in the "Service Conditions" section of the latest revision of the EirGrid General Requirements specification XDS-GFS-00-001.

3 Standards

All materials shall comply with and be manufactured and tested according to the current edition of the standards of the International Electrotechnical Commission in so far as they are applicable. Where no IEC standard has been issued to cover a particular subject, then a recognised national standard shall be applied.

The 110 kV cables and associated fibre optic cables, where required, shall be manufactured, installed and tested in accordance with:

IEC 60050	International Electrotechnical Vocabulary
IEC 60060	HV Test Techniques
IEC 60071	Insulation co-ordination
IEC 60228	Conductors of Insulated cables
IEC 60229	Tests on cable oversheaths which have a special protective function and are applied by extrusion
IEC 60287	Electric cables – Calculation of the current rating
IEC 60811	Common test methods for insulating and sheathing materials of electric cables
IEC 60815	Selection and dimensioning of high-voltage insulators for use in polluted conditions
IEC 60840	Power Cables with extruded insulation and their accessories for rated voltages up to 150 kV (Um = 170 kV) – Test methods and requirements
IEC 61238	Compression and mechanical connectors for power cable.
IEC 61300	Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 1: General and guidance.
IEC 61914	Cable Cleats for Electrical Installations
IEC 62271 – 1	High-voltage switchgear and controlgear – Part 1: Common specifications
IEC 62271 – 209	High-voltage switchgear and controlgear – Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV – Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable-terminations
HD 632.2 2008	Power cable with extruded insulation and their accessories for rated voltage above 36kV (U_m=42kV) – Test methods and requirements.
ENA-ER-C55/5	Insulated Sheath Power Cable Systems
IEC 60794-1-1	Optic Fibre Cables – Part 1 Generic Specification – General
IEC 60794-1-2	Optic Fibre Cables – Part 1-2: Generic Specification – Basic optical cable test procedures
ITU-T G.652D	Characteristics of Single Mode Optical Fibre Cable
ITU-T G.655E	Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable

EN 187105	Single Mode Optical Cable (Duct/Direct Buried Installation)
XDS-GFS-17	EirGrid Specification: Galvanised fabricated steelwork
XDS-GFS-18	EirGrid Specification: Hot dip galvanising of iron and steel other than wire
IEC 60794-1-1	Optic Fibre Cables – Part 1 Generic Specification – General
IEC 60794-1-2	Optic Fibre Cables – Part 1-2: Generic Specification – Basic optical cable test procedures
ITU-T G.652D	Characteristics of Single Mode Optical Fibre Cable
ITU-T G.655E	Characteristics of a non-zero dispersion-shifted single-mode optical fibre and cable
BS EN 7912-2	Power cables with XLPE insulation and metallic sheath, and their accessories, for rated voltages from 66 kV (Um=72.5 kV) to 132kV (Um=145kV). Requirements and test methods

In any conflict exists between the standards quoted and this specification, this specification shall take precedence.

4 Equipment Design

4.1 Cable

The cable shall be single core triple-extruded dry cured cross-linked polyethylene insulated design.

The conductor shall be standard compacted aluminium or copper conductor sizes which are longitudinally waterblocked with conductor semi-conducting layer, superclean XLPE insulation with a firmly bonded outer semi-conducting layer, bedding tapes, longitudinal water blocking layers, an HDPE outer sheath overall, with an extruded or graphite coated outer conductive layer.

4.1.1 Conductor

Stranded conductor shall be a fully longitudinally watertight design with all of the individual strands fully water blocked, so that if water enters the cable from any cable end, then water movement is effectively stopped. The water blocking design shall be tested to IEC 60840 standards.

The conductor water blocking material shall be a proven material with regard to long-term water blocking ability and with regard to compatibility with the extruded cable layers.

Any special treatment required for water-block material during jointing of the conductor, including its removal, shall be highlighted by the Customer for agreement with EirGrid.

Solid aluminium conductor may be accepted subject to EirGrid approval.

4.1.2 Conductor Screen

The extruded layer shall be continuous and shall cover the surface of the conductor completely. The conductor screen average thickness and minimum thickness shall be stated in the Technical Schedules.

4.1.3 XLPE insulation

The dielectric layers over the conductor shall be applied by a single pass dry type triple extrusion process.

Cross-linking shall be achieved using a dry-curing method

All cable cores shall be thoroughly degassed prior to application of HDPE cable sheathing. This is a vital Health and Safety issue for EirGrid as the build-up of methane and other gaseous extrusion by products in the fully ducted system could cause explosions and fires both during and after cable installation work.

The insulation layer shall be concentric with the conductor. The insulation ovality shall be a maximum 10%. This shall apply to all cable voltages covered by this Specification.

4.1.4 Insulation Semiconducting Layer

The outer semi-conducting layer shall be extruded non-strippable type. It shall be continuous, be uniformly bonded to the insulation and shall cover the surface of the core completely

The ovality (maximum diameter – minimum diameter) shall not exceed 0.7mm.

4.1.5 Screen-Outer Sheath Separating Layer and Screen-Cable Core Separating/Bedding Layers

These layers, when used as part of the cable design shall be fully compatible with the cable insulation, semiconducting material and sheath and not suffer any changes, when subjected to highest permissible short circuit stress, which would adversely affect the performance of the cable.

4.1.6 Longitudinal Water Barrier in the Screen Area

An effective barrier to longitudinal water movement in the screen area shall be provided. This shall be designed to meet the test requirements set out in IEC 60840 as appropriate. In addition the Test specified in BS7912 (2012) shall be undertaken, on an agreed sample basis, as part of the test on the main conductor longitudinal water barrier test as detailed earlier above.

4.1.7 Cable Metallic Sheath

The metal sheath shall be either copper or aluminium wire screen with foil laminate or welded aluminium.

It shall have an outer sheath of high density polyethylene with graphite or extruded outer conductive layer to facilitate DC testing of the outer sheath.

The metallic sheath, in conjunction with any supplementary copper or aluminium screen wires shall be capable of carrying the full short circuit fault current specified in 2.1 and continuous sheath temperatures of 80°C, throughout the forty year minimum lifetime of the cable. Type test shall include the short circuit test report for the sheath including details of the temperature measurements of the adjoining semi conducting layer and cable insulation.

EirGrid will advise the Customer of any project specific requirements for the conductor and metal sheath.

4.1.8 Polyethylene Outer Sheath

The outer sheath shall be of HDPE grade and shall have a minimum thickness dimensions in accordance with IEC 60840 plus 1mm. The colour of the sheath shall be black. The shore D hardness shall be between 55 and 61.

For all single core cables, it shall be capable of withstanding a DC voltage test of 10 kV for five minutes after installation and an annual DC test of 5 kV for one minute over the cable lifetime on a fully ducted system.

The outer surface of the HDPE/MDPE outer sheath shall have an extruded or coated graphite conductive layer. The surface resistivity of the outer sheath shall be less than 16 kΩ/m length of cable, at ambient temperature, to enable an accurate and effective detection and location of faults or damages in the cable outer sheath layer.

4.1.9 Cable Identification

The extruded protective sheath of cables shall be embossed or laser indented marking on each side, at 180 degree, of the cable with the following information:

- ELECTRIC CABLE
- 110000 Volts
- Manufacturer's name
- Cable type (XLPE)
- Year of manufacture
- Batch number
- Conductor size and material
- Anti-corrosion serving material type

The embossed letters/figures shall be raised and consist of upright block characters with a minimum height of 10mm. The gap between the end of one set of embossed characters and the beginning of another shall not be greater than 150mm.

Identical dimensions as described for embossing shall apply via indentation of the cable sheath.

In addition, the cable outer sheath shall be sequentially marked in metres in a clearly visible colour. Each cable length should be marked from zero up to the specified drum length.

4.2 Joints

Joints shall be designed and tested in accordance with IEC 60840.

Prefabricated joint designs are required. Joints shall be fitted with a casing or surround which shall be completely watertight to the standard of the cable itself.

The connector shall be suitable for jointing by compression or a shearbolt system.

All connection systems shall be of proven design and shall be tested to IEC 61238 or equivalent long term test regime. Each joint shall be supplied complete with a suitable compound-filled glass fibre box or other suitable protection to protect the joint casing from corrosion and also to withstand sheath standing and surge voltages, as well as the annual voltage testing of the cable outer sheath.

4.3 Terminations

Terminations shall be designed and tested in accordance with IEC 60840.

All terminations shall be fluid free type.

The particular requirements for each type are as follows:

4.3.1 Gas Insulated Metal Enclosed Switchgear Terminations

Proven plug and socket switchgear termination designs are required.

Where these terminations are used, they should be provided with insulating glands capable of withstanding the 10 kV DC commissioning test and annual outer sheath test. The Customer should ensure that the cable accessory manufacturer co-ordinates with the supplier of the Gas Insulated Metal Enclosed Switchgear equipment. This is to ensure that the limits of supply are clearly identified as per IEC 62271-209 and that entry and mounting details for the cable termination equipment is agreed.

4.3.2 Outdoor Terminations

Outdoor terminations shall be dry type with polymeric insulator.

The termination design shall take in account the severity of the pollution level that applies to the locality. The Reference Unified Specific Creepage Distance (RUSCD) for the phase to earth insulators shall be in accordance with IEC 62271-1 and IEC 60815 for rated voltage and heavy pollution level 43.3mm / kV. In certain cases a higher RUSCD value for very heavy pollution level 53.7mm / kV may be required where requested by EirGrid. No arcing horns are required.

Outdoor terminations shall be fitted with a copper or tinned aluminium stalk of adequate cross-section for the cable rating and polymeric insulators.

Stand-off insulators will be required capable of withstanding the 10 kV DC commissioning test and annual outer sheath test.

Corrosion failure or UV or overall weathering degradation of the polymeric insulator material shall be addressed using a 5000 hours multiple stress test e.g. IEC 62217 annex B, EDF salt fog test or other suitable test.

4.3.3 Customer transformer terminations

Connection to the Customer transformer can only be done via air insulated termination and overhead conductor to the air insulated transformer bushings.

4.4 Distributed Temperature System

A distributed temperature sensing system (DTS) may be required by EirGrid and communicated at early project stage.

The system will be a Brillouin based system capable of operating in both BOTDR and BOTDA configurations.

The detailed functionality of the DTS system is to be discussed and agreed with EirGrid. This will require at least No.2 additional fibres in the cable with 200% redundancy to be provided within the one phase of the cable (for example at the metallic screen layer of the power cable) to enable accurate conductor temperature measurements to be determined. A multimode, double ended configured DTS system would be required for increased accuracy.

DTS units will be employed in a loop or single ended configuration. The unit should have the ability to be multichannel and the capability to operate in both radial and ring format from a common location such that multiple circuits can be monitored.

The DTS systems shall have the capability of providing Real Time Current Ratings, the ability to generate alarms, maps and provide RTTR within the box or as a server based option, all of which can be linked in with the SCADA system.

This information shall be used to facilitate the validation of the design by EirGrid, the cable thermal designs and to identify any hot spots, GIS capability shall be built into the RTTR to allow the accurate identification of the hotspots.. The system shall also have the capability to enable EirGrid to predict and plan future allowable safe cable current rating based on current loading and immediate past cable loading history, thereby ensuring that cables are operated in a safe and reliable manner.

4.4.1 Fibre Optic Cable

4.4.1.1 Optical Fibre

The optical fibres shall be single mode fibres and conform to the requirements of IEC 61300.

4.4.1.2 Fibre Technology Design

Full details of mounted fibre fittings / fixtures / splice enclosures / joint boxes proposed shall be provided by the Customer to EirGrid for acceptance.

All enclosures, boxes accessories and any other ancillary items related to the fibre element will conform to the IEC 61300 suite of standards.

4.4.1.3 Equipment

Only correctly calibrated and modern equipment shall be used in splicing. Reports and test results will be required and should be maintained and made available in soft and hard copy.

The tools used for optical span line testing are the Optical Time Domain Reflectometer (OTDR) and the Optical Loss Test Set.

The Customer shall provide a list of fibre optic equipment and tools in advance of installation.

The software specification for the OTDR shall be provided by the Customer to EirGrid for acceptance.

4.5 Current Ratings

The current ratings shall be calculated in accordance with the current edition of IEC 60287.

The following parameters shall be assumed for each season:

The ground temperatures to be considered during the year are:

- Winter Ground Temperature; 10°C for months December to February inclusive
- Spring Ground Temperature; 15°C for months March to April inclusive
- Summer Ground Temperature; 20°C for months May to September inclusive
- Autumn Ground Temperature; 15°C for months October to November inclusive

Thermal resistivity of native soil and backfill should be considered as follows:

- Winter Soil Thermal Resistivity = 1.0 K.m/W
- Spring Soil Thermal Resistivity = 1.2 K.m/W
- Summer Soil Thermal Resistivity = 1.2 K.m/W
- Autumn Soil Thermal Resistivity = 1.2 K.m/W

- Winter Concrete (CBGM B) Thermal Resistivity = 0.85 K.m/W
- Spring Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W
- Summer Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W
- Autumn Concrete (CBGM B) Thermal Resistivity = 1.0 K.m/W

The current rating shall be calculated based on the depth, separation distances and type of soil proposed in the appropriate trench cross section. Details of all assumptions shall be provided to EirGrid for review and acceptance.

An internationally accredited software shall be used to perform the rating calculations.

4.6 Overload Rating

The overload ratings for the durations requested in the cable technical schedule shall be provided. The conductor temperatures reached during these overloads shall be stated.

The maximum allowable continuous conductor temperature shall be 90°C.

The maximum allowable one second short-circuit conductor temperature shall be 250 °C.

5 Sheath Bonding / Earthing and Phasing

The sheath bonding arrangement should be taken into account when establishing the current rating of the cable according to IEC 60287.

The sheath bonding and earthing scheme, including bonding leads shall be in accordance with Engineering Recommendation ENA-ER-C.55/5 published by the UK Electricity Association.

The sheath voltage shall not exceed 150V for 110kV cable.

If the sheath voltage limit cannot be achieved the joint bays should be relocated to mitigate the issue or alternatively an intermediate vault equipped with an SVL should be installed with the prior agreement of EirGrid.

Where the cable sheath shall be directly earthed, the Customer shall employ three phase direct earthing link boxes. The Customer shall also install sheath interruption link boxes at every joint bay.

The Customer shall install link boxes at both terminations.

Where the cable sheath shall be single point bonded (mid / end point bonded), the Customer shall use a combination of a single point bonded earthing link box (with sheath voltage limiters) and direct earthing link boxes. Depending on the cable system design solution the Customer may be required to install an earth continuity conductor for single point bonding in accordance with the standard outlined in Engineering Recommendation ENA-ER-C.55/5 published by the UK Electricity Association with an LV copper conductor having minimum size of 240mm^2. The length of cable circuit where single point bonding may be used is limited by the sheath standing voltage. The Cable bonding diagram shall be submitted to EirGrid for review/acceptance.

The earth continuity conductor shall be installed in a dedicated HDPE duct, separate from the Telecoms ducts as per standard drawing XDC-CBL-STND-H-008. The ECC conductor cannot pass through the C2 chambers at the joint bays but shall be connected directly to the link boxes.

Depending on the cable system design solution cross bonding of the cable sheath shall be used along routes which have two or more joint bays. This may be used in combination with the single point bonded sheath earthing method outlined above.

The following non exhaustive list of items is required from the Customer for EirGrid review:

- Full sheath bonding / earthing scheme including phasing
- Sheath standing voltage calculations for the cable route
- Bonding lead cross section drawing and technical schedule
- Distances between joint bays (where applicable)
- Earth continuity conductor cross section drawing, technical schedule and trench arrangement
- Link Box Drawings and general arrangement (including distances from joint)
- C2 communication chamber drawings and general arrangement
- Sheath Voltage Limiter technical schedule

6 Pulling Eye

A pulling eye shall be fitted to the leading end of the cable. This shall be designed and installed so that the pulling forces during installation are transferred to the conductor. The pulling eye shall be completely watertight, with a full metal seal. The pulling eye shall be capable of remaining watertight during cable pulling. The diameter of this pulling eye shall be as small as possible over the diameter of the cable to facilitate pulling into ducts.

The pulling eye arrangement shall be a design which facilitates sheath testing of the cable, without having to remove the heat shrink sealing, whilst on onsite on the drum.

This shall be achieved by connecting the metallic sheath or screenwires to the main conductor at the back of the pulling eye.

The Customer shall provide details of the pulling eye to EirGrid for review.

7 Manufacturing Process

7.1 General

The process of product manufacture shall at all times ensure that sufficient and adequate quality checks are carried out to determine compliance of design and component material with established criteria. For Manufacturer service experience requirements please refer to CDS-GFS-00-001 General Requirements functional specification.

7.2 Handling of Manufacturing Process Deviations

Deviations from these criteria or any occurrence of manufacturing process deviation shall be immediately notified to EirGrid. In the event that remedial action, repair or reworking may be appropriate, such action shall only proceed with the prior approval of EirGrid. Any product which has been repaired, reworked or has been the subject of remedial actions without prior approval may be liable to rejection notwithstanding the results of any tests prescribed by this Specification. Any consequent delay due to the provisions of this Clause shall be the sole responsibility of the Customer and shall not relieve the Customer of their obligations regarding adherence to the works programme.

8 Tests

Records of all tests carried out as requested in this Specification shall be submitted to EirGrid for review and acceptance.

All routine, sample and type tests prescribed by this Specification shall be carried out at the expense of the Customer to the satisfaction of EirGrid, who may elect to have representatives present at any of the tests specified, at a time and date to be mutually agreed.

8.1 Routine Tests

For routine tests refer to CDS-GFS-00-001 General Requirements functional specification.

Routine test reports shall be provided to EirGrid for acceptance before the cable, fibre and accessories are delivered to site.

EirGrid may send a representative to the factory during the manufacturing of any or all of the cable lengths involved. The Supplier should arrange to notify the Purchaser in good time regarding the manufacturing programme for the cables.

8.2 Sample Tests

Sample tests will be carried out on the cable in accordance with IEC 60840 and CDS-GFS-00-001 General Requirements functional specification.

In addition to the test specified in IEC 60840 the cable's water blocking ability shall be tested by applying a 1 meter head of water over an 11 day period; no water shall issue from the 3 meter cable sample at room temperature as specified in BS EN2912-2. This test shall be undertaken as a sample test, once per production run or as agreed between EirGrid and the Customer.

A test shall be undertaken to ensure that the surface conductivity of the outer sheath graphite or extruded semiconductive layer is less than or equal to 16 kΩ / metre at ambient temperature. This test shall be undertaken on the first and last drum of each production run.

Sample test reports have to be provided to EirGrid for acceptance before the cable and accessories are delivered to site.

8.3 Type Tests

Type tests shall be carried out in accordance with IEC 60840 and CDS-GFS-00-001 General Requirements functional specification.

For the electrical tests, the cable length shall be fitted with one of each type of accessory, joint, or sealing end to be supplied. Type test certificates shall be provided to EirGrid for acceptance for the cable and associated accessories. Where type tests have not been undertaken for this material or the material tested is not the same of what is proposed to be installed then EirGrid will decide on whether additional type testing is required or not.

8.4 Tests on Individual Lengths after Laying

A 10 kV DC Test for 1 minute between cable sheath and earth shall be carried out by the Customer after installation and before and after jointing in accordance with IEC 60840, IEC 60229 and CDS-GFS-00-001 General Requirements functional specification. The results of this shall be submitted to EirGrid.

9 Fibre Optic Cable

The optical fibres shall be single mode and conform to the requirements of ITU-T, recommendation G.652, Table 4/G.652.D. Fibre cores shall be contained in thixotropic gel in loose tubes arranged as 4 elements containing 12 optical cores (= 48 fibres). Fibre cores and loose tubes to conform to colour code EIA598-A. UV colour coding is not permitted. The tube arrangement may include fillers where required for mechanical stability. The fibre cable shall be designed and constructed for conventional installation in underground ducting and feature the following properties:

- All Dielectric construction
- UV proof black HDPE outer jacket
- 2no. ripcords
- Glass layer rodent protection
- Water blocking layer
- Central strength member
- Sheath Marking to include: “Optical Cable”, Manufacturer and product identification, manufacturing date, meter marking.

10 Fibre Optic Cable Installation

10.1 Installation

All Fibre Optic cable installation must be in accordance with the manufacturer’s specifications and recommendations.

Tensile Performance	**Parameter**	**Requirement**	**Value**
EN 187105-5.5.4	Long term load	No attenuation increase*	Load: 1000 N
		No fibre strain	
IEC 60794-1-2-E1A and E2A	Short term load, during installation	No changes in attenuation before versus after load	Load: 2700 N
		Max fibre strain 0.33%	
Crush Performance			
EN 187105-5.5.3	Long term load	No attenuation increase*	Load (Plate / Plate): 500 N
IEC 60794-1-2-E3	Short term load	No changes in attenuation before versus after load	Load (Plate / Plate): 2000 N
		No damage**	
Bending Performance			
EN 187105-5.5.1	Handling fixed installed	No attenuation increase*	Bend radius: 10 x D
IEC 60794-1-2-E11	During installation (under load)	No changes in attenuation before versus after load	Bend radius: 20 x D
			D is cable diameter
Temperatures			
	Operation	No attenuation increase*	-40 to +70°C
EN 187105-5.6.1	Installation		-15 to +60°C
IEC 60794-1-2-F1	Storage/Shipping		-40 to +70°C

Table 1 - Fibre Installation

*No changes in attenuation means that any changes in measurement value, either positive or negative within the uncertainty measurement shall be ignored. The total uncertainty of measurement shall be less than or equal to 0.05 dB.

**Mechanical damage – when examined visually without magnification, there shall be no evidence of damage to the sheath.

If the installation causes any defect that impairs the performance (optical or otherwise) of the fibre cable these shall be notified to EirGrid immediately. Following this the Customer shall undertake the appropriate repairs as agreed with EirGrid.

Installed fibre must meet the performance requirements as set out in the relevant specification.

[Eirgrid may require testing of fibres post installation to confirm maintained compliance with designed specifications]

10.2 Route installation considerations

Fibre cable route sections are to be planned carefully such that:

- Installation does not conflict with manufacturer's specifications or recommendations
- Jointing/splicing locations shall be selected from the point of view of safe future maintainability and must be agreed with Eirgrid prior to installation

Document Reference: CDS-HFS-03-001-R2

110 kV Underground Cable Functional Specification

Civil Works

Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	07/02/2012	First Issue – Supersedes CDS-WTS-03-001-R0	ESBI – see page 2	-	Christy Kelleher / Paul Moran
R1	12/01/2017	Updated as per Due diligence Tracker	Daniele Giustini	-	Paul Moran / Kieran French
R2	12/03/2020	Updated as per Due diligence Tracker: Sections modified: 2, 3, 4, 6.	Daniele Giustini	ESB due-diligence process and Conor Farrell	Brendan Murray

Contents

1 Scope

This specification describes the requirements for civil works for 110 kV underground cables which will be connected to the 110 kV transmission system operated by EirGrid.

The Customer shall install a fully ducted solution for the cable civil works/installation.

2 General

All trenching, ducting, cable installation and backfilling works will be carried out in accordance with the latest Safety, Health and Welfare at Work Acts for Construction and General applications. The required trench and duct layout shall be as per the required detailed cross sections outlined in Appendix A of this specification.

All roads will be permanently reinstated to the specification of the relevant authority.

The trench shall be as level as possible in both directions.

The Customer shall submit cross section details of where the trenching works cross other services.

The spacing of the cable / ducts shall be at a minimum, in accordance with the requirements of the drawings in Appendix A of this specification and Table 1.

For safety, constructability, maintenance and de-rating reasons the new cable duct routes shall be designed / installed as far as is practical away from existing services (3rd parties services and HV/MV/LV cables).

Item	Description	Clearance (mm)
1	Minimum vertical cover to communication of ECC ducts	750[1]
2	Minimum vertical cover to HV power ducts	950[1]
3	Minimum clearances to 3rd party services	300[2]
4	Minimum clearances to High Pressure / explosive 3rd party services	600[2]
5	Shallow crossing minimum vertical cover to HV power ducts	450[3]
6	Minimum horizontal spacing between any duct not in trefoil formation in the duct bank	75

Table 1: Minimum Clearances for HV Cable Ducts

When changing the grade of the trench to accommodate crossing other services, the grade change shall be as shallow as possible and not more than 1:6.

The following material shall be used in accordance to Appendix A standard drawings:

- Approved Yellow marker warning tape,
- Approved Red cable protection tape,

[1] This dimension is applicable to standard cross sections (trefoil or flat formations).
[2] Unless additional clearance is specified and agreed by 3rd party service asset owner.
[3] Reduced cover of 450mm may be considered where highly congested areas, bridge crossings are met or the alternative solution is a very deep crossing where ratings may not be achieved. This is subject to prior written agreement with EirGrid and ESBN..

- Approved steel plates with Red protection tape attached,
- A393 steel mesh,
- Duct ties every 3m when duct formation is trefoil,
- Approved marker posts where cable is in private land according to EirGrid specification CDS-HFS-01-001.

Details are to be agreed with EirGrid in advance of installation.

EirGrid and ESBN personnel are available to provide a trenching and ducting workshop to the Customer before the start of the civil works upon request.

3 Manufacturer Service Experience

The duct manufacturer shall have:

- At least 10 years' experience in the production of the range of the ducts and fittings specified i.e. the "product'',
- Service experience:
  - Installation of the product in at least one EU electricity utility
  - with a service experience of the product range of at least 5 years duration in these EU electricity utilities of at least 1,000,000 metres.
- As an alternative to such experience within the EU, similar experience with Japanese, South Korean, Australian or US/Canadian utilities would be considered.
- At least 5 years production in the particular factory proposed is required, although if the particular plant in the proposed factory is relocated existing plant using substantially the same workforce the combined time of both plant and factory would be considered.

3.1.1 Duct Service Conditions

The following service conditions apply to ducted underground cable installation:

Service Condition	Requirement
Soil Temperature Range	-5 °C to 20 °C
Continuous Heat Generation within duct	up to 30 Watt/m run.
Temperature Range	0 °C to 70 °C (within duct)
Soil pH range	1 – 11 (Acidic Bog – Limestone Rock)
Ground water table level	Up to 0.5 m above duct level (worst case scenario) under normal conditions. under normal conditions.
UV Light Exposure	During handling & storage up to 1 year

Table 2: Duct Service Conditions

4 Duct Requirements

4.1 Reporting Requirements

All works shall be continuously supervised by a competent person on behalf of the Customer and detailed weekly reports submitted with photographic evidence and matching GPS co-ordinates of where work is taking place for the duration of the works.

The weekly reports shall be submitted no later than 5:00pm on Monday for the previous week works.

The detailed weekly report shall include the following information:

1. Map of the entire route showing the sections being worked on for that period.
2. Map showing the section from joint bay to joint bay being worked on that week.
    a. This map shall highlight the completed works the previous week and the works scheduled the week at the time of writing.
3. The map in item 2 should also show the location of all service/culvert crossings and they should be appropriately sequentially numbered.
4. A brief summary table.
5. Photographic evidence of the work completed displaying the following:
    - All photos must be taken in sequence in the direction of work from joint bay to joint bay so that the installation process can be clearly seen.
    - The sequence of photos must cover the entirety of the ducting works and shall be taken at suitable intervals (10 meters approximately). GPS co-ordinates should be provided for each photo. Photos shall be geotagged.
    - The photos must show the various sequences of work so that each stage of the installation process can be seen. Predominantly but not exclusively the photos shall be taken after the trefoil power ducts are installed (prior to backfilling with CBGM B) and again prior to backfilling the communications ducts layer. The photos should display all the elements necessary to confirm that the quality of ducting installation is of a high standard i.e. clean trenches, spacer templates, correct depths of CBGM B, compaction equipment being used, correct positioning of ducting and marker tapes, clearances etc.
    - Photos at service/culvert crossings shall be referenced to that crossing number and display all the necessary information to confirm that the installation meets the required clearances and design. Photos of service crossings (under/over) shall clearly display that the minimum clearances are being achieved (using a measuring tape) and the extent of additional protection measures where required.
    - Where services are replaced i.e. stone/piped culverts, a series of photos must show the extent of the works carried out.
6. A summary of the quality testing complete for the week which may include compaction tests, delivery dockets, cube tests which clearly specify type of concrete used etc.

7. Surveyed levels of the monitoring stations along the deep peat/top hat design sections (where required).
8. Cube tests results can be issued when are available.

4.2 Materials

Material for duct bed and surround and trench backfill for standard formation shall be CBGM Category B (Cement Bound Granular Material Category B), 15N/mm^2.To obtain this value a minimum of 7 days curing is required in accordance with Series 1000 of the NRA "Specification of Road Works". The material should conform to the thermal resistivity requirement of this specification. Proof of conformance to the thermal resistivity requirement of this Specification following ASTM D5334-08, namely 1.0 K.m/Watt) at 0% moisture content, is required during duct installation. Proof of conformance to the thermal resistivity requirement of this specification may also be requested by EirGrid at any stage during construction.

Proof of conformance to the thermal resistivity requirement of this Specification for thermal sand used in Joint Bay and approx. five meters direct buried section before Cable Sealing Ends is also required.

Concrete for road reinstatement shall be grade C40/N20 with minimum cement content 350 kg/m^3 in accordance with Series 1000 of the NRA "Specification for Road Works".

Concrete used in the trench for 3rd party service crossings and bridge crossings shall be grade C25/30, wet type, in accordance with Series 1000 of the NRA "Specification for Road Works".

Pea gravel and foam concrete shall not be used for duct surround material.

Concrete for joint bay, link boxes and communication chambers is specified in the relevant standard drawing in Appendix A.

Formed finishes to Joint Bays shall be to class F2 and unformed finishes shall be to class U1 in accordance with Clause 1700 of Series 1000 of the NRA "Specification for Road Works".

4.3 Duct Specification

All ducts and couplers shall be supplied by the Customer. All ducts shall satisfy the criteria given in this section.

All ducts and fittings shall be designed to satisfactorily withstand the service conditions for a period of 40 years minimum.

4.3.1 Duct Testing Requirements

Testing of duct products shall be required to ensure that the ducting shall perform satisfactorily over the expected service life on EirGrid system and the service conditions given above.

All duct products shall pass the programme of impact tests and deformation tests as set out below:

- 200 Joule of impact energy measured when the duct temperature is 15-20 degree C;
- The impact test hammer head dimensions shall be as stated in IEC 61386-24.:

- Deformation reistance shall be greater than 750 N at 5% when measured in accordance with IEC 61386-24.

Type or Sample Tests to perform to other equivalent National or International Specifications or standards may be submitted with the agreement of EirGrid. Certification shall be required to show that the ducting has passed Type and Sample Tests in the Specifications outlined above and conforms to the Test requirements set out in this Specification.

EirGrid shall have the right to inspect work, which is the subject of this Specification at any stage of manufacture and may reject any material which is found to be defective or in any way not in conformity with this Specification. The Customer shall afford all reasonable facilities for such access and inspection. The Customer shall bear the cost of all sample tests.

The Customer shall supply without charge all tools, gauges and other equipment which shall be required for testing the material in accordance with the Specification and shall prepare and supply without charge all test pieces and samples associated with the tests required by this Specification.

4.3.2 Bendability and Weldability of Ducts

Ducts shall have good bendability characteristic so the need for preformed bends is reduced as much as is possible and they will be easy to work in confined trench situations.

When ducts are bended they shall not deform or suffer for an excessive ovalisation, the mandrel shall pass through the ducts even when they are bent.

Ducts of SDR11, used for particular applications, shall be fully weldable. Ducts manufacturer should produce instructions for welding and these needs to be reviewed for acceptance by EirGrid and strictly adhered to during construction activity.

4.3.3 Ducts Packaging design

Normal handling and transport impact loads shall be considered in duct packaging design.

4.3.4 Frictions of Duct wall

When pulling in heavy power cables the achievement of the lowest possible frictional drag between the cable surface and the internal duct wall is fundamentals shall be less than 0.2. This will reduce cable tensile and sidewall forces reducing the number of cable joints in the cable circuit.

The internal surface of the duct shall be designed to minimise the static and kinetic frictions with cable surface.

HV cables used in the Irish transmission system shall be polymeric outer plastic PVC, LDPE, LLDPE, MDPE or HDPE sheaths of 1.8 – 3 mm thickness. The sheaths can be damaged by abrasive contact with rough surfaces and this could lead to failure of expensive power cable, for this reason high smoothness of the duct inner surface and low friction coefficient is very important.

4.3.5 Ovality and Diameter Tolerances

The ovality of coilable and non-coilable ducts shall not exceed the dimensions shown in the following Table 3: Ovality and Diameter Tolerances:

Nominal Diameter	Diameter Tolerance		Maximum Ovality
mm	Positive mm	Negative mm	Mm
≤ 160	1.0	1.0	2.0
> 160	1.5	1.5	3.0

Table 3: Ovality and Diameter Tolerances

4.3.6 Duct colour and lengths.

All ducts shall be coloured in red in accordance with IS 370. The red colour designation is BS 5252:04-E-53 – BS 5252:04-E-56. Minimum 0.3mm thickness of red colour material required throughout length of duct if triple layer extrusion.

All ducts shall have a standard length of 6m, 9m or 12m. Coils can be used for Horizontal Directional Drill.

4.3.7 Duct Marking

HDPE ducts shall be indelibely and clearly marked in white or black with the legend:

- “DANGER ELECTRICITY CABLES”;
- Batch No;
- Manufacturers Name and Date of manufacture;
- Impact test, i.e. “200 J”
- Duct Diameter
- Duct SDR value, i.e. “SDR 21”

Coils used for Horizontal Directional Drilling shall be consecutively marked on the meter at every meter.

Maximum gap between two adjoining legends shall be less than 150mm.

Height of legend to be not less than 20mm and the legend should be write in three lines at 120° apart.

To ensure the ducts ends are pushed fully into position at coupler position a black, visible circumferential mark is required at the plain end of the duct to indicate the correct duct penetration distance.

The insertion depth shall be marked at the end of each duct.

For ducts to be installed in Horizontal Directional Drilling the black, visible, circumferential line shall identify the final installation position within the reducing couplers.

The black line shall be indelible and shall be resistant to UV light degradation.

4.3.8 Duct coupler

Ducts and their associated couplers shall be designed as an integral system.

Coupling systems shall provide a smooth junction between adjoining duct lengths. Coupler designs which result in distortion of adjoining duct lengths; edge protrusions or inadequate centralising of adjoining duct lengths shall not be accepted owing to the risk of:

- Very expensive cable damage.
- Necessity for additional unplanned cable joints.

Coupler design shall:

- Allow manual alignment and assembly for duct length up to 12 m in confined trench bottom conditions without recourse to specialist tools, by installation staff.
- Prevent duct-coupler loosening due to vibration during backfilling operation.
- Prevent ingress of water even where ducts may be buried up to 3 m below water level.
- Prevent ingress of water/slit/grit where ducts are bending away from the coupler, at a bend angle up to 4°
- Eliminate the possibility of grit or other sharp particles ensconcing themselves into any wells or crevices at the centralising stop of PE couplers, particularly during brushing and duct cleaning operations.
- Withstand the bending forces experienced during normal duct laying in operations e.g. assembly and coupling of ducts at ground level and dropping into the trench as the excavated trench section moves along.

For 125 SDR 17.6 and 160 mm and 200 mm SDR21 PE ducting, it is essential that the coupler is able to withstand the bending forces required to bend a HDPE duct section to a radius of 6 m.

All couplers shall be tested for their capability to withstand these bending forces by clamping them in position and subjecting them to the bending forces involved using a length of 125 mm /160 mm / 200 mm HDPE ducting as appropriate.

The minimum dimension between centre of coupler and midpoint of gasket seal for such couplers shall be:

- 130 mm for 125 mm duct sizes
- 160 mm for 160 mm, 200 mm, and 225 mm ducts

A durable indelible label shall be affixed to each coupler with the inscription in large legible print "Always lubricate coupler with approved compound".

4.3.9 Polyethylene Reducing Couplers

Ducts of SDR11 are used in Horizontal Directional Drills (HDD). HDD designs are bespoke designs where ducts of SDR11 may be installed in separate bores or multiple ducts may be installed in the same bore. Regardless of the HDD arrangement, every HDD is expected to eventually transition to a standard Trench arrangement.

Preferred method for transition is to use transition couplings, these transition couplers will match the internal diameter of the two duct types to each other without the need for any Transition Chambers.

Since the safety/security of the power cable is of the utmost importance in all duct installations, the inner diameter (ID) of the two duct types shall be flush together so that no sharp edges will be present inside the transition coupler. The ID of Duct Type 1 (on the HDD side of the coupler) shall match the ID of the corresponding Duct Type 2 (on the Trench side of the coupler) to within 1 mm.

The duct sizes to be matched together are shown in Table 4: Ducting Sizing as Duct Type 1 and Duct Type 2. The SDR11 value may be altered slightly to accommodate this requirement. Adjusting SDR21 or SDR17.6 ducting is not permitted, outside the normal thickness range for SDR21 or SDR17.6.

Duct Type 1 (HDD)	Duct Type 2 (Standard Trench)
225 mm SDR 11 HDPE	200 SDR 21 HDPE
180 mm SDR 11 HDPE	160 mm SDR 21 HDPE
140 mm SDR11 HDPE	125 mm SDR 17.6 HDPE

Table 4: Ducting Sizing

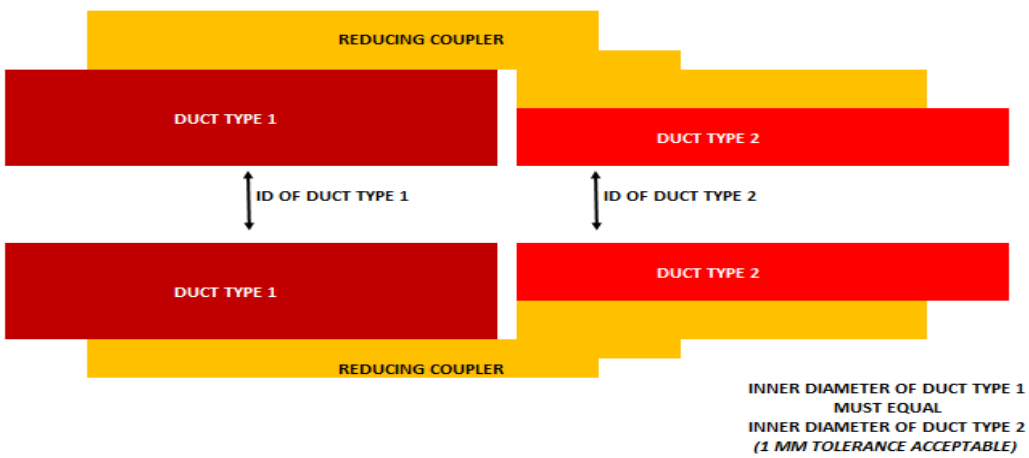


Figure 1

Inner diameter of Duct Type 1 must equal the inner diameter of Duct Type 2 to within a 1mm tolerable difference only.

Where Duct Type 1 and Duct Type 2 meet inside the reducing coupler, it is important that the centre stop position is kept free from dirt, silt or any other debris that may fall into the crack during duct cleaning/proving or cable pulling. In order to do this, both Duct Type 1 and Duct Type 2 should be marked for insertion depth so that no gap occurs. Insertion depth will be dependent on the design of the reducing coupler but shall be of equal length on both sides, must match with the standard insertion depth as marked on the associated ducts and will ensure that both duct types are inserted flush together, reducing the gap to zero.

The ring seal on both ends of these reducing couplers should be the same as is used on the standard straight duct couplers, providing a water tight and secure connection to the duct.

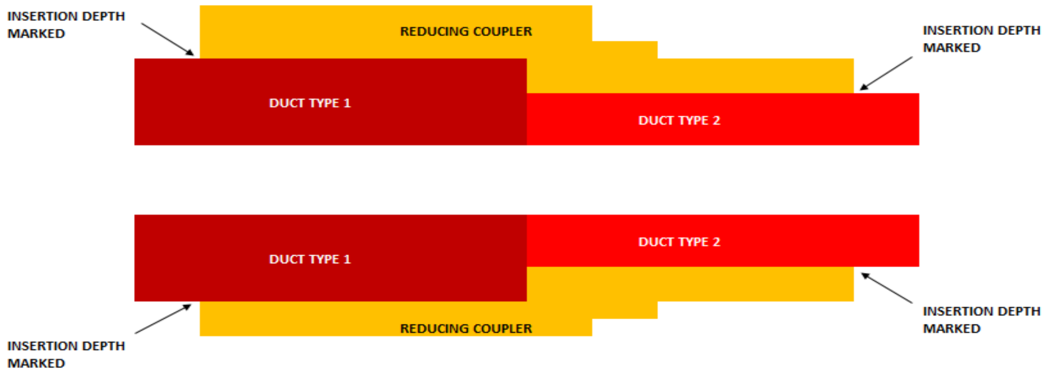


Figure 2

An alternative is to use transition Chambers.Three SDR11 ducts would normally enter the Transition Chamber on one side and three standard ducts would normally be positioned on the opposite side of the chamber, to allow for the Trench arrangement. For transition chamber standard drawing refer to Appendix A.

Communication ducts do not require transition couplers or chambers. the 125mm OD SDR11 can be coupled directly to 125mm OD SDR17.6 by chamfering the internal surfaces of the SDR11 duct (4mm chamfer over 15mm distance). Prior to connecting the communication HDD ducts (SDR11, 90mm diameter mandrel) to the standard communication ducts (SDR17.6, 105mm diameter mandrel) each section shall be proved indipendantly. Finally the communication ducts can be proved C2 chamber to C2 chamber at either side of the HDD section with a 90mm mandrel.

4.3.10 Duct handling and storage

Great care shall be taken while handling ducts to avoid damage. Ducts shall be delivered with caps in place and shall remain in place until installation of the duct to prevent ingress of dirt.

Immediately on delivery of ducts, the Customer shall check that they comply with the specification, in particular in respect of wall thickness, internal and external diameter along full length, straightness etc.

The ducts shall not be stored in places where they are likely to be in contact with surface water or other foreign matter which could make its way into the ducts. The method of stacking used shall be such to avoid distortions of the ducts and the integrity of the ducts shall be maintained throughout their site storage and transport. The bales of ducts should not be stacked over two bales in height.

Duct bales shall be held in position by an appropriate designed system of timber battens and straps.

This design shall ensure ducts are not deformed during handling and transportation. Collapsed bales are a safety hazard; this hazard must be designed out.

Indelible waterproof labels to be placed on each bale of ducting stating ‘‘Approved for ESB Networks / EirGrid use’’ and A4 laminated installation labels to be fixed to each bale of ducting.

The Customer Quality Assurance management system shall include detailed inspection of delivered ducts and accessories. Each delivery of ducts shall be inspected to ensure compliance with this specification to verify the following:

- Correct labelling:
- Correct dimensions including excessive and/or inferior wall thickness:
- Duct ovality;
- Duct damage and distortion
- Duct caps are installed:
- Correct packaging on delivery storage;

Ducts which have become discoloured or deformed shall be marked as defective, discarded and shall not be installed under any circumstances.

4.4 Duct Installation

Each duct, coupler and joint shall be carefully examined for structural integrity and cleanliness immediately before and after installation.

Ducts may be cut provided that they are suitably held, supported in a safe manner and protected during the process. All ends shall be cut square to the longitudinal axis of the area and treated to ensure a smooth finish.

Ducts shall be spaced strictly in accordance with the drawings outlined in the appendices of this specification. Where this is not possible due to spatial constraints clarification should be sought from EirGrid prior to any ducts being installed.

Ducts shall be laid evenly to minimise gradient changes where possible.

If a change in direction is required, bends shall be formed by evenly bending the ducts only and the couplers shall be braced so that there is not bending or stress on the coupler. Pre-formed short-radius bends are not permitted, unless agreed with Customer's Designer and cable manufacturer.

For HV ducts, the radius shall not be less than 6 m. In order to avoid damage when bending ducts, no heat shall be applied to the ducts when joining ducts together via couplers. The Customer shall ensure that collars joining ducts are staggered to ensure that pressure is not placed on a single point across 3 phases.

The diameter of the cable ducts shall be the same throughout the cable route. Transition from one duct size to another which may create a "lip" which could damage the cable sheath on initial installation of the cable or over the lifetime of the cable due to thermal effects / movement of the cable on the "lip" is not acceptable.

Every effort shall be made to prevent dirt ingress into the ducts. Duct caps should not be removed until the duct is in the trench. Once installed the ducts shall be capped with waterproof caps at the end of each day's work and at each joint bay.

Where the ducts enter into the joint bay (i.e. joint bay interface), appropriate waterproof sealing shall be applied.

Proprietary expanding duct bungs shall be installed at the end of each duct laying section.

Note: Any dirt or pebbles trapped in the ducts can cause significant damage to the cables if not removed. During cable pulling, dirt or other sharp objects can be pressed between the duct and the cable resulting in deep scores and gashes on the cable sheath which can result in cable failure.

4.4.1 Use of Templates

Timber templates shall be used for duct installation. The template shall have the correct dimension to achieve the required duct formation as per accepted design. Multiple templates will be required for several types of formations as part of the circuit accepted design.

Duct installation templates shall be used every 3m or less to ensure the required spacing between ducts is achieved.

When dry or wet concrete surround is used ducts spacers shall be used. Spacers to be made of the same type of concrete being used in the trench and left in situ after pouring.

4.4.2 Draw Ropes

A 12mm polypropylene draw rope shall be supplied by the Customer and installed in all ducts to facilitate pulling in the cable.

The draw rope shall be fixed to the rear of the proprietary duct bung.

Ropes when spliced must be spliced in approved manner

4.4.3 Tying of Ducts

Ducts that are to be placed in trefoil formation shall be tied evenly at 3 m centres with an appropriate tie.

4.4.4 Shallow Depth Installation

Where the standard formations, trefoil or flat, trench layout and burial depth cannot be achieved due to the type of terrain or presence of other services (bridge crossings etc) the design shall be in accordance with the standard design outlined in Appendix A of this specification.

In any case the minimum shallow trench depth is 450mm from ground level to top of the HV power duct. Please refer to Appendix A of this specification for.

4.4.4.1 Cable Protection - Steel Plates

Galvanised Steel plates having the following dimensions: 750mm long x 200mm wide x 6mm thick with red marker strip fixed to top surface shall be used as outlined in in Appendix A of this specification for bridge crossing or service crossings installations. The plates shall be installed with 10mm gaps to avoid issues related to possible circulating currents.

A393 steel mesh may be required in addition to steel plates as outlined in in Appendix A of this specification.

4.4.5 Surface Cable Plate Markers

Surface cable metallic plate with the following dimensions: 300mm long x 150mm wide with four screw-hole and bolts shall be used on footpaths, fences, bridges, walkways as outlined in Appendix A of this specification. They shall be fitted to solid durable surfaces and shall be fitted flush with their surround.

4.4.6 Trench Layout

The trench layout shall be as per relevant EirGrid standard drawings in the appendices of this functional specification.

The specification relating to the relevant Local Authorities shall be followed for the excavation and reinstatement of the ducted cable trenches.

Where a change in the gradient of the trench is required to accommodate other service crossings or special installations the gradients change shall be as minimal as possible.

Where a change in direction of the trench is required to avoid obstruction the bends shall be formed by evenly bending the ducts themselves only and the couplers shall be braced so that there is no bending or stress on the couplers. Heating of the ducts is not allowed when the bending action is performed. The spacing of the ducts shall be in accordance with the drawings in the appendix of this specification.

Natural bending in the ducts shall be as wide and gradual as possible.

The duct route shall be designed and constructed to ensure that the cable manufacturer's maximum tensile and sidewall pressure pulling forces shall not be exceeded on the cable when pulled in the ducts. The detailed design calculation to confirm this requirement shall be included in the design review submission for EirGrid acceptance.

4.4.7 Joining of Ducts

When joining ducts and couplers adequate quantity and quality of lubricant shall be applied to the coupler for ease of fitting.

Ducts shall be tapped home until the white or black mark on the duct is reached. Duct shall only be tapped with a smooth timber or plastic plank to avoid damages. Ducts shall be staggered by a coupler length as appropriate.

4.4.8 Cutting of Ducts

Where duct cutting is required they shall be suitably held, supported and protected during the cutting process.

Ducts ends shall be square to the duct axis and cleaned out to minimise possibility of abrading cable during pulling. No internal burrs or sharp edges are allowed as a result of end cutting operations.

The Duct plain ends shall be chamfered before coupled together, all duct ends shall have the outside surface chamfered down to a maximum 30% of the wall thickness. The minimum length of the chamfer shall be 10mm to allow easy insertion into other duct lengths or couplers.

Ducts cutting on site shall be done as per instructions issued by duct manufacturer.

4.4.9 Dirt ingress into the Ducts

Dirt ingress into the ducts shall be prevented as any dirt or pebbles trapped in the ducts may lead to cable failure. This is to prevent dirt or other sharp objects pressing between the duct and the cable resulting in deep scores and gashes on the cable outer sheath which may result in cable failure. It is not acceptable to allow dirt ingress into the ducts and attempt to remove it later by cleaning the ducts with brushes.

The ingress of dirt into the ducts shall be prevented by the following measures:

- On delivery from the supplier, the ducts shall be fitted with transport end caps. These shall remain in place during duct storage to prevent dirt entering on the duct bales.
- When the ducts are installed, rubber bungs shall be immediately fitted to exposed installed duct ends and retained in place all times. These bungs shall be fitted with an internal D-ring to facilitate the tying of draw rope.
- Trenches, joint bays etc. shall kept free of water so as to prevent any risk of the cable and other materials to be laid in the trenches joint bays etc. being detrimentally affected.

5 Joint Bays and Communication Chambers

5.1 General requirements

All reinstatement of the cable trench shall be in accordance with the manufacturer's specification, the requirements of the local authority and as per the detailed design in advance of the works.

Installation of joint bays and communication chambers shall be in accordance with standard drawings included as appendices to this document.

5.2 Joint Bays

Joint bays location shall be chosen with suitable terrain and access to facilitate the operation of cable pulling equipment, cable jointing, cable maintenance, fault finding activities and future operation of the installation.

A hard core surface shall be provided at either end of the joint bay to facilitate access and operation of heavy vehicles required to perform activities listed above.

The construction, final backfill and pre-cabling backfill and reinstatement shall comply with the drawings in Appendix A of this specification.

5.3 Communication Chamber

C2 Chambers shall be installed at all joint bays along the cable route.

Communication chambers shall be provided to meet the requirements of standard telecommunication cable drum lengths or as required to limit fibre cable pulling forces.

Communication chambers location shall be chosen with suitable terrain and access to facilitate the operation of fibre cable pulling equipment, fibre cable splicing, fibre cable maintenance, fault finding activities and future operation of the installation.

The construction and reinstatement of communication chambers shall comply with the drawings in the appendix of this specification.

5.4 Link Box Chambers

Link box chambers shall be provided to meet the requirements of cable sheath earthing and connection design.

Link box chambers location shall be chosen with suitable terrain and access to facilitate the operation of cable sheath earthing and connection, maintenance, fault finding activities and future operation of the installation.

The link box chamber shall be in close proximity to the Joint Bay so that the bonding leads connected to the joints will be no longer than 10m.

The construction and reinstatement of link box chambers shall comply with the drawings in the appendix of this specification.

5.5 Lubrication Points

Lubrication points may be required to ensure cable installation can be pulled without exceeding the manufacturer's maximum permissible cable pulling forces of the proposed cable.

Lubrication points shall be installed in cable route in close proximity to area of high bends concentration.

Optimised position shall be chosen e.g. on the crest of steep incline to maximise lubricant dispersion on the route. Lubrication points shall be properly sealed to prevent the ingress of dirt.

Lubrication point locations shall be chosen with suitable terrain and access to facilitate the operation at any phase of the development and future operation of the installation.

6 Construction Supervision

The Customer shall advise EirGrid of the programme of cable civil works so that EirGrid can witness installation works. The Customer shall ensure adequate Quality Assurance is performed on site. Duct installation and cable pulling weekly report shall be prepared and submitted to EirGrid weekly during the works as per Duct Installation section of this Functional Specificaiton.

Report templates to be used by the Customer for weekly installation reports will be provided by EirGrid on request.

All excavations and duct installation may be supervised by an EirGrid representative.

7 Appendix A

Drawing No.	Drawing Title
XDC-CBL-STND-H-001	Standard - 3rd Party Crossing (125mm Above)
XDC-CBL-STND-H-002	Standard - 3rd Party Crossing (160mm Above)
XDC-CBL-STND-H-003	Standard - 3rd Party Crossing (125mm Below)
XDC-CBL-STND-H-004	Standard - 3rd Party Crossing (160mm Below)
XDC-CBL-STND-H-005	Standard - Riverbed Crossing
XDC-CBL-STND-H-006	Standard - Bridge Crossing
XDC-CBL-STND-H-007	Standard - Trench Through Peat
XDC-CBL-STND-H-008	Standard – Trench Cross Section
XDC-CBL-STND-H-009	Standard – As-built Cable Route
XDC-CBL-STND-H-010	Standard – C2 Chamber
XDC-CBL-STND-H-011	Standard – Link Box Chamber
XDC-CBL-STND-H-012	Standard – Pre-cast Joint Bay
XDC-CBL-STND-H-013	Standard – Transition Chamber

Document Reference: CDS-HFS-04-001-R2

110 kV Underground Cable Functional Specification

Cable Installations and Pre-Commissioning

Revision History					
Revision	**Date**	**Description**	**Originator**	**Checker**	**Approver**
R0	07/02/2012	First Issue – Supersedes CDS-WTS-04-001-R0	ESBI – see page 2	-	Christy Kelleher / Paul Moran
R1	12/01/2017	Updated as per Due diligence Tracker	Daniele Giustini	-	Paul Moran / Kieran French
R2	12/03/2020	Updated as per Due diligence Tracker. Sections modified: 1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 17, Appendix A.	Daniele Giustini	Due-diligence process and Conor Farrell	Brendan Murray

Contents

1 Scope

This specification covers the installation requirements of 110 kV underground cables and associated fibre cabling (where applicable) which will be connected to the 110 kV transmission system operated by EirGrid.

The cables and accessories shall be installed and handled in accordance with the instructions of the cable manufacturer and EirGrid standards.

The installation and handling of the cables and accessories shall be undertaken at all times by sufficient numbers of capable and experienced staff, suitably trained and supervised. An EirGrid representative may be on site during all works.

The Customer shall be responsible for the supply of all necessary plant, equipment and tools to ensure that the work is carried out to the required standard and in accordance with the agreed project programme.

The Customer shall ensure that cable and jointing accessories are stored in a secure location.

The Customer shall familiarise themselves with the requirements of the EirGrid 110 kV Underground Cable Standards prior to undertaking any design and installation work.

2 Cable System Configuration

The arrangements of the cables, their relative position to each other, their surroundings and all methods of installation over the whole route length shall be in accordance with the cable system design previously submitted to and accepted by EirGrid.

3 Prevention of Water Ingress

During the installation (between duct proving and ends of commissioning) the Customer shall maintain open trenches, joint bays, cable basements etc. free of water so to prevent any risk of the cables and other materials being damaged.

The Customer shall submit all water management proposals to ensure the cable system does not experience any water ingress during construction works (transportation, storage, installation, jointing/termination and commissioning) and during the cable system lifetime.

4 Cable Handling

Care and attention is required in this area as any mishandling of cable drums will lead to damage of cable or injury to installers or members of the public. Appropriate and safe practices of transportation, loading, unloading and storage on site shall be used at all times.

4.1 Transportation

Cable shall be delivered to site on steel drums on a drum trailer or on a truck trailer.

4.2 Loading / Unloading

To avoid serious injury to personnel and damage to cable drums, an appropriately sized axle shall be used for lifting along with a spreader bar to prevent the lifting gear damaging the drum and crushing the cable. Appropriately rated proprietary lifting hooks that fit into and lock onto the axle hole may be used in place of a steel axle. All lifting equipment shall be rated to lift the gross weight of the drums, with an appropriate factor of safety.

4.3 Storage

All cable ends shall be sealed to stop the ingress of water and future deterioration of the cable. Cable drums shall be stored on hard even surfaces to prevent the flanges from sinking into the ground thereby causing adverse effects to the cable as a result of the drum weight resting on the cable.

5 Cable Pre Pulling Requirements

The Customer shall submit to EirGrid for acceptance the following documents before pulling activities can commence:

- Detailed program for cable installation four week prior to start cable pulling, jointing and termination to allow EirGrid representative to witness site activities.
- Up to date detailed pulling calculation based on as laid route four weeks prior to start cable pulling.
- Design Risk Assessment and Method Statement for cable installation works two weeks prior to start cable pulling.

6 Cable Pre Pulling Checks

Prior to cable pulling, the outer coils on each drum to be installed shall be visually inspected for any mechanical damage / perforations.

All cable drums shall be checked by rotating the drum and visually observing for any bumps / perforations or any other signs of damage.

EirGrid shall be advised if any mechanical damage is found. If mechanical damage is identified a detailed proposal shall be submitted to EirGrid outlining the extent of the damage and Customers plan to remedy the damage.

This inspection shall take place for all cable drums before the cable is pulled. This will reduce the incidence of sheath faults which can be very costly and time consuming to locate and rectify at a later stage when cable is installed along the ducted route.

A 10 kV DC test shall be under taken to assess the conductive properties as outlined in section 12.

7 Cable Installation

No cables or fibre shall be installed until the detailed design and EirGrid review process is complete.

A detailed plan and risk assessment shall be submitted if the Customer wishes to commence cable installation before civil works for the entire route is complete. The risk assessment shall and control measure shall ensure the cable is adequately protected during works.

The Customer shall propose a cable installation plan for review by EirGrid.

7.1 Duct Cleaning and Proving

Each duct shall be cleaned and proven prior to pulling the cable.

Duct cleaning and proving works shall be completed and deemed acceptable to EirGrid prior to the cable being pulled.

Ample notice (>4 weeks) shall be provided to EirGrid to witness this activity.

The ducts shall be thoroughly cleaned internally to ensure no foreign matter including water remains inside. The ducts shall be cleaned and proved using a clean, stiff brush, mandrel and sponge with diameter as outlined in

Table 1 below. A sponge can be used to remove the water from the duct section prior to proving.

Duct dimensions			**Minimum mandrel diameter**	**Minimum brush diameter**	**Minimum sponge diameter**
OD (mm)	ID (mm)	Duct Type			
125	103	HDPE, SDR 11	90mm	110mm	120mm
125	111	HDPE, SDR 17.6	105 mm	120mm	130mm
140	113	HDPE, for directional drilling duct (SDR 11)	105 mm	120mm	130mm
160	145	HDPE, SDR 21	135 mm	155mm	165mm
180	147	HDPE, for directional drilling duct (SDR 11)	135mm	155mm	165mm
200	181	HDPE, SDR 21	170 mm	187mm	197mm
225	183	HDPE, for directional drilling duct (SDR 11)	170 mm	187mm	197mm

Table 1

The cleaning and proving of the ducts shall be carried out under supervision by the Customer's Representative. Cleaning and proving shall be carried out using a winch which has a calibrated dynamometer and printout and pdf file output facility.

The printout should measure speed and tension every 3m and the pdf output file shall record speed and tension every meter. Max speed for duct proving shall be set to 25 m/min.

The dynamometer shall be calibrated annually and certified by an independent calibration tester.

The certification shall be provided to EirGrid before any cleaning and proving activity takes place.

The duct cleaning/proving report (see appendices) shall be completed and submitted to EirGrid for all ducts.

The report shall be signed by the Contractor and counter-signed by the Customer's Representative supervisor who has witnessed the tests. Fully completed reports and print outs for each section of ducting, for every duct, shall be submitted to EirGrid for review and acceptance before cables can be installed.

A minimum of one pass in the cable pulling direction of a suitably sized mandrel, brush and cleaning sponge shall be made to prove the cleanliness of the duct.

If a spike in the pulling force record occurs or dirt is found a second or additional passes will be required.

During the duct cleaning and proving task a sonde can be connected close to the mandrel or brush to help locate a blockage quickly and accurately. The sonde should be for specific use with a C.A.T. or other precise cable location instruments.

Following the duct proving process, approved rubber bungs with internal securing eye shall be fitted to prevent ingress of water, sand or other debris. The ducts shall then be left roped and the ropes secured to the internal securing eye in preparation for cable pulling.

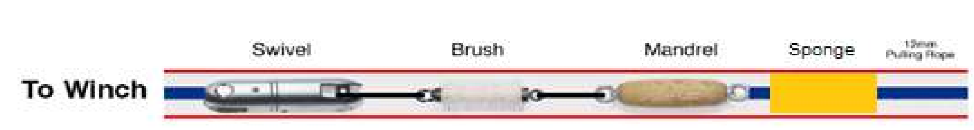


Figure 1 - Set up for Swivel, Brush, Mandrel and Sponge for Duct Proving and Cleaning

7.1.1 Duct Cleaning Issues Encountered

The proving of the ducts will be deemed as failed if:

- The pulling tension exceeds 1 tonne (10 kN)
- Mandrel is stuck
- Mandrel is moving with sudden bursts even if the pulling tension is less than maximum specified
- Rope shoots suddenly up the duct
- Ducts do not maintain the same formation as at the start of the pull
- If the speed exceed 25 m/min.

Should the duct testing and proving fail,

- The Customer shall clean and prove the ducting in the opposite direction to the previous proving direction,
- A camera can be placed down the duct to check the internal integrity of the duct.

If the above steps do not meet the pass criteria then the Customer shall carry out repair works to rectify the fault.

The repair works shall be carried out following the production of a method statement and risk assessment.

Following the repair of the duct or ducts, the Customer shall also retest all the ducts within the circuit section of the repaired duct even if these ducts had been successfully tested and proved prior to the repair works being done.

If repairs are being carried out to a duct or circuit located within 500 mm of an existing bank of ducts, then EirGrid may request the testing of these ducts. The repair and retesting costs shall be borne by the Customer.

7.2 Cable Pulling

7.2.1 Side Wall Force Calculations

Cable pulling shall not take place until such a time that a calculation demonstrating the pulling and sidewall forces for each cable pulling section based on the as laid duct installation has been issued to EirGrid for review and all concerns/comments have been addressed.

When bends are present in a duct run, the typical arrangement (subject to design confirming same) is to position the cable drum at the end closest to where most of the bends lay and the winch shall be positioned at the end furthest from the bends.

This method reduces:

- The tensile and side wall forces on the cable;
- The likelihood of the winch rope sawing through or burning through the ducts at bend positions.
- The pulling forces and wear and tear on the winch and the winch rope.

The winch tensile force limit must be set up so the pulling force will not result in side wall force cable limit being exceeded.

All cables shall be sealed against water ingress and protected and adequately supported after cable pulling.

7.2.2 Ducts Pre - Lubrication during Installation

Cable lubricant is required during the cable pulling activity to reduce cable-duct friction.

For cable installations in ducts, the ducts shall be pre-lubricated using an approved cable lubricant to facilitate cable pulling. Lubrication pits will be used where appropriate to ensure adequate lubrication.

Following the cleaning and proving of the entire duct run and immediately prior to cable pulling, all power ducts shall be pre-lubricated during the operation of pulling back of the winch rope from the winch end. The lubricant (recommended quantity 10 litres per 100m of duct or as recommended by the cable manufacturer) shall be placed in the duct at the winch end and a suitably robust sponge securely attached to the winch rope to spread the lubricant uniformly over the entire length of the duct

A lubrication schedule shall be submitted to EirGrid for review in association with the pulling plan and calculation referred to in the cable pulling and laying section above.

7.2.3 Cable Installation Equipment

The following equipment shall be used for the installation of cable into ducting

- Bell mouth installed on the duct for entry and exit positions
- Rollers to support cable entering and exiting ducts
- The following as specified by the cable manufacturer
  - Cable pulling stocking
  - Cable pulling eye
- Swivel with torque relief winch with force measurement facility, pdf file output and print out facility
- Mandrel
- Brush
- Sponge

Cable rollers shall be used at duct entry and exit positions to guide the cable from the drum into the duct and to prevent abrasion / ripping of the cable via contact with the trench bottom and sides and also to prevent the cable picking up debris before entry into the duct.

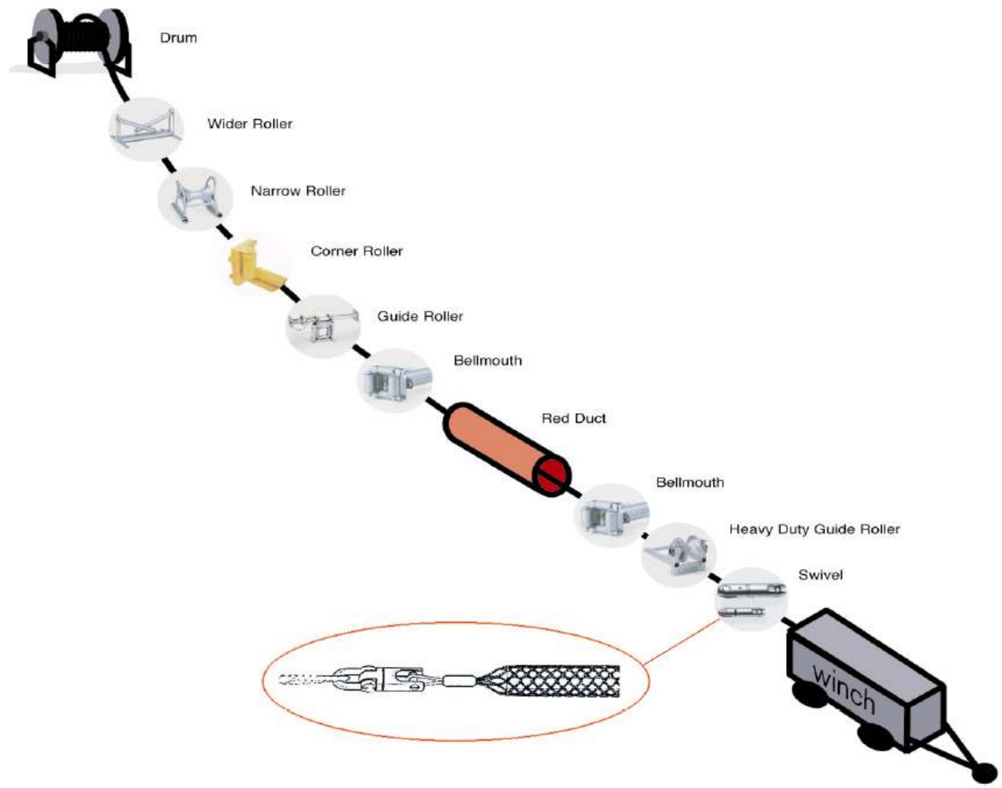


Figure 2 - Set up for Cable Pulling

At the point of cable entry into the pipe or duct, a bell mouth shall be provided to ensure no damage to cable during entry. Where cables leave duct mouths to enter a cable trench, trough, draw-pit, basement, etc. a permanent support of concrete, steelwork, clamps or cement and sand filled bags as appropriate shall be used to reduce the possibility of damage, or movement of the cables. Where site conditions necessitate additional protection, a permanent concrete canopy shall be incorporated over the duct mouths.

For cable pulling a calibrated winch with pulling force print out and pdf file output facility shall be used. Where cable rollers are required, the Customer shall provide calculation to demonstrate compliance with max side wall forces as recommended by the cable manufacturer.

Any deviation from the installation plan must be submitted for review, acceptance and written agreement by EirGrid prior to any work commencing on site.

8 Joint Bays and Terminations

All cable joints and terminations shall be installed in accordance with the material manufacturer's specifications and recommendations.

Cable jointing shall be carried out by trained and experienced cable jointers certified by the accessories manufacturer.

8.1 Sealing of cable ducts

Cable ducts shall be sealed after completion of the cable joint. Details of the sealing method shall be submitted to EirGrid for review.

9 Cables in Basements and Entry to Switchroom

This cable basement layout shall be submitted as part of the detailed design EirGrid for review.

Where cables are installed on the floor of cable tunnels or basements they shall be clamped firmly to the floor at regular intervals not exceeding 1.5m or as recommended by the cable manufacturer.

Where cables are to be installed in basements and are to cross over existing circuits then the circuit being installed shall be supported and clamped on a cable bridge of galvanised steel adequately earthed.

Adequate clear space and cable slack allowance shall be factored for disconnecting and reconnecting of the cable over its life time and also for the installation of future adjacent cables.

All fibre cables, on entry to buildings shall be installed on cable trays/ladders to meet the final transition joint location. This location shall be advised at detailed design phase.

Where cables pass through internal floors or walls or within ducts in a substation building, the openings shall be sealed following cable installation by use of a fire retardant sealant assembly approved by the cable manufacturer and shall prevent water ingress.

10 Precautions after Laying

Care shall be taken during cable installation to ensure that no damage occurs to cables and / or accessories which are laid and exposed, but not protected.

Joint bays, link boxes and C2 chambers should be kept free from water and protection provided to prevent intentional or accidental damage to the cable.

Any damage to the cable, fibre and / or accessories during installation is the responsibility of the Customer. The Customer is responsible for all accrued costs which are as a result of damage during installation.

The Customer shall ensure that, immediately following cable pulling, caps, suitable heat shrinks and tapes are used to prevent ingress of moisture.

11 Repairs to Cable Outer Sheath Layer

If the installation causes any defect to the cable outer sheath layer these shall be notified to EirGrid immediately. Following this, where possible, the Customer shall undertake the appropriate repairs as agreed with EirGrid and the cable manufacturer,

12 Pre-Commissioning

Cable pre-commissioning is the responsibility of the customer.

All cables shall be electrically tested immediately **after each pull is complete**.

All cables shall be tested again prior to and following any jointing activity to ensure that sheath faults are prevented.

Terminations shall not be connected to switchgear during tests.

The following list of tests shall be carried out on two occasions: 1) following cable pulling and 2) after cable jointing on each cable section.

1. Measure Insulation resistance, phase to screen and phase to phase resistances;
2. Check continuity of all phase and screen conductors;
3. Check phasing of conductors;
4. Check phase clearances and phase to earth clearances;
5. Sheath test cables (10kV calibrated Insulation resistance test kit shall be used for this purpose).
6. Perform Partial discharge test @1.7Uo at 50 Hz or 0.1Hz. Results shall be within limits set by the cable manufacturer and have to be accepted by EirGrid.
7. Visual inspection of link boxes connection to ensure the accepted cable bonding diagram is adhered to.
8. Test the joint bays earth grids to ensure compliance with XDC-CBL-STND-H-012 dwg.

These tests may be witnessed by EirGrid. As a result, adequate notice (> 4 weeks) of these tests should be provided to EirGrid to facilitate the witnessing of these tests.

A specific and detailed risk assessment and method statement shall be provided to EirGrid for review before these tests take place.

A pre-commissioning report shall be submitted to EirGrid for acceptance at the end of the pre-commissioning phase.

If the sheath test results do not meet values in Table 2, then jointing works of further sections of the cable circuit shall not commence. Should the results not meet the values in Table 2, the cable shall be repaired or replaced and retested. After each section of cable is jointed to an adjoining section the electrical tests are to be repeated to verify compliance with test values as in Table 2.

All test information shall be recorded included in the 'As-Built' documentation.

All cables shall be sealed / capped after cable testing.

A 10 kV DC test, as per IEC 60229 shall be under taken to assess the conductive properties of the outer jacket. The test results including leakage current / insulation resistance shall be recorded in the HV Cable installation record sheet (in appendix) and all results shall exceed the values stated in the table 2:

HV Cable Test Length (km)	Screen to earth		Core to Earth	
	Minimum Values (Values recorded shall exceed these)		Minimum Values (Values recorded shall exceed these)	
Test Length (km)	Resistance (Mega Ohms)	Leakage Current (Micro Amps)	Resistance (Mega Ohms)	Leakage Current (Micro Amps)
0.25	1	10	4	2.5
0.5	1	10	3	3.3
0.5-1	500	20	2000	5
2	500	20	2000	5
3	340	29	1332	7.5
4	260	38	1000	10
5	200	50	800	12.5
6	166	61	666	15
7	142	70	572	17.4
8	124	80	500	20
9	110	90	444	22
10	100	100	400	25
11	90	110	364	27.4
12	82	121	334	30
13	76	131	308	32
14	72	140	286	35
15	66	150	266	37
16	62	161	250	40
17	58	172	236	42
18	54	185	222	45
19	52	193	210	46
20	50	200	200	50
30	33	333	132	83
40	25	400	100	100

Table 2: 10 kV DC test minimum values

13 Fibre Optic Cable Installation

13.1 Installation

All Fibre Optic cable installation shall be in accordance with table 3 and this specification.

Tensile Performance	Parameter	Requirement	Value
EN 187105-5.5.4	Long term load	No attenuation increase*	Load: 1000 N
		No fibre strain	
IEC 60794-1-2-E1A and E2A	Short term load, during installation	No changes in attenuation before versus after load	Load: 2700 N
		Max fibre strain 0.33%	
Crush Performance			
EN 187105-5.5.3	Long term load	No attenuation increase*	Load (Plate / Plate): 500 N
IEC 60794-1-2-E3	Short term load	No changes in attenuation before versus after load	Load (Plate / Plate): 2000 N
		No damage**	
Bending Performance			
EN 187105-5.5.1	Handling fixed installed	No attenuation increase*	Bend radius: 10 x D
IEC 60794-1-2-E11	During installation (under load)	No changes in attenuation before versus after load	Bend radius: 20 x D
			D is cable diameter
Temperatures			
	Operation	No attenuation increase*	-40 to +70°C
EN 187105-5.6.1	Installation		-15 to +60°C
IEC 60794-1-2-F1	Storage/Shipping		-40 to +70°C

Table 3

*No changes in attenuation means that any changes in measurement value, either positive or negative within the uncertainty measurement shall be ignored. The total uncertainty of measurement shall be less than or equal to 0.05 dB.

**Mechanical damage – when examined visually without magnification, there shall be no evidence of damage to the sheath. The imprint of plates will not be considered as damage.

13.2 Splicing

Splicing shall carried out by ESB Telecoms representatives by fusion of the fibre optic cables in specifically constructed splice canisters. This will be direct splicing between two or more single mode fibre optic cables.

The maximum Wavelength Splice Attenuation requirements (per km) shall be as follows:

- 1310 nm 0.06 dBm
- 1550 nm 0.06 dBm
- 1625 nm 0.06 dBm

The Customer shall measure each splice loss after each splice is made, but before the splice case is closed by the OTDR. The Customer shall test all fibres for attenuation and provide a record of each fibre loss at both wavelengths (1310 and 1550 nm), in both directions.

After the installation of the fibre cable is complete and all splices are made and tested, the Customer shall perform the cable completion test. This consists of measuring the loss of each fibre path in both directions between fibre optic connectors in the patch panel.

OTDR testing:

All traces will be provided in hard and soft copy. This testing will be conducted at 1310 nm, 1550 nm and 1625 nm wavelengths. OTDR testing will be conducted on a bi-directional basis for each fibre in each span at the appropriate wavelengths for the fibre described above.

Power testing:

This end-to-end loss measurement is to be conducted for each fibre in the span and from both directions using an industry-accepted laser source and power meter. The bidirectional average will be used to determine the end-to-end loss of the span at each appropriate wavelength.

This test will be conducted at 1310 nm, 1550 nm and 1625 nm.

This power testing will ensure fibre continuity and the absence of crossed fibres in the span.

14 Damage to Fibre Cable

If the installation causes any defect that impairs the performance (optical or otherwise) of the fibre cable these shall be notified to EirGrid immediately. Following this the Customer shall undertake the appropriate repairs as agreed with EirGrid.

Installed fibre must meet the performance requirements as set out in the relevant specification

15 Installation details required for each Cable Section

The HV cable installation record sheet and duct proving record sheet in the Appendix of this specification must be fully completed by the Customer and supplied to EirGrid.

16 Waste Materials

The Customer shall submit Safety Data Sheets for all hazardous substances used in the cable system. They shall be classified in accordance with European Community SI No. 402/1980 (Safety Signs at places of Work Regulation 1980). This also refers to packing waste that can have associated biological issues such as transmission of disease or introduction of unwanted flora and fauna.

The Customer is required to dispose of any waste in a manner which does not harm the environment and corresponds with the guidelines above.

17 Management of Water on Site

All site water must be managed in accordance with the relevant authority's water management regulations and guidelines.

18 Appendix A – Cable Installation Record Sheet

HV CABLE INSTALLATION RECORD SHEET

CIRCUIT DETAILS

1. Circuit Name:
2. Section Number: _____________ From: __________ To: ___________

CABLE DETAILS

3. Cable Manufacturer: ____________________
4. Cable Description: ____________________
5. Drum Details: ____________________
6. Fibre Cable Manufacturer: ____________________
7. Fibre Cable Description: ____________________
8. Fibre Drum Details: ____________________

Phase	R	S	T
Drum No.			
Length (m)			

9. Total Installed Length (R+S+T) = __________ (metres)
10. Total Fibre length Installed = __________ (metres)

CABLE DESIGN

11. Cable Pulling Calculation. Route Section:

Straight Length (m)	Bend Angle (degree)	Curve Radius (m)	Curve Length (m)	Tension Increased Along Straight (kg)	Bend Tension Mult. Factor (cable)	Forward Cable Tension (kg)	Forward Sidewall Load (kg)	Reverse Cable Tension (kg)	Reverse Sidewall Load (kg)

CABLE INSTALLATION DETAILS

12. Installation Method

Duct: ___________ Nose Pull: __________

Open Trench: ___________ Bond Pull: __________

13. Pulling Tension Record

Maximum Pulling Tension Recorded in kN	R	
	S	
	T	
	Fibre	

14. Installation Data

Phase	R	S	T	Fibre
Date Installed				
Direction Installed				
DC Sheath Test Date pre-installation				
DC Sheath Test Result pre-installation				
DC Sheath Test Date post-installation				
DC Sheath Test Result post-installation				

15. Meteorological Data

Max. Temp _____ °C

Weather _____

Humidity _____ %

Remarks____

____

____

____

____

Signed ____________________________

Date ____________________________

19 Appendix B – Ducting cleaning/proving record sheet

DUCT CLEANING/PROVING RECORD SHEET

CIRCUIT DETAILS

1. Circuit Name: ____________________
2. Section: From: __________ To: ___________
3. Section length: ____________________

DUCT DETAILS

Duct ID	Diameters (mm)			
	Duct inner	Sponge	Brush	Mandrel
1				
2				
3				
4				
5				
6				

DUCT FORMATION & ID SKETCH

Typical	At the start of the pull	At the end of the pull

PROVING DETAILS

Duct ID	Duct designation	Max pulling tension (kN)	Comments
1			
2			
3			
4			
5			
6			

4. Winch serial number: ____________________
5. Winch calibration date: ____________________
6. Direction of proving: From: __________ To: ___________
7. Have the ducts been cleaned and proved successfully? Yes/No
8. Have the ducts maintained the correct formation? Yes/No
9. Have runbber bungs been fitted after proving & cleaning? Yes/No

Note: The proving of the ducts shall be deemed to have failed if any of the following occur:

1. Pulling tension exceeds 10kN.
2. Mandrel moves with sudden bursts (even if the pulling tension is not exceeded).
3. Mandrel becomes stuck.
4. Rope shoots sugddenly up the duct.
5. Ducts do not maintain the same formation as at the start of the pull.
6. Pulling speed exceeds 25 m/min.

Contractor

Name: _______________________

Signature: _______________________ Date: __________

Customer Representative

Name: _______________________

Signature: _______________________ Date: __________

Document Reference: CDS-HTS-01-001-R2

110kV Underground Cable

Technical Schedules

Revision History				
Revision	**Date**	**Description**	**Originator**	**Approver**
R0	07/02/2012	First Issue – Supersedes CDS-WTC-01-001-R1	ESBI – see page 2	Christy Kelleher / Paul Moran
R1	24/06/2015	Document Reference corrected to CDS-HTS-01-001	Kieran French	Paul Moran
R2	12/01/2017	Updated as per Due diligence Tracker	Daniele Giustini	Kieran French / Paul Moran

SCHEDULE A

Physical Characteristics of 110 kV Crosslinked Polyethylene Cable

Note: All dimensions to be filled in where applicable.

Item	Query	Required	Offered
1	Conductor:		
	(a) Material	Cu/Al	
	(b) Type e.g. round, etc.		
	(c) Design e.g. stranded, etc.		
	(d) Nominal diameter (mm)		
	(e) Cross-sectional area (mm^2)		
	(f) Method of water blocking		
2	Inner Semi-conducting Layer:		
	(a) Material	Semiconductive compound	
	(b) Nominal thickness (mm)		
	(c) Minimum thickness (mm)		
3	Insulation:		
	(a) Material	XLPE	
	(b) Nominal thickness (mm)		
	(c) Minimum thickness (mm)	$\leq$10%	
	(d) Diameter over insulation = Ovality of cable Core (mm)	< 0.7	
4	Outer Semi-conducting Layer:		
	(a) Material	Semiconductive compound	
	(b) Nominal thickness (mm)		
	(c) Minimum thickness (mm)		
5	Nominal diameter over core screen (mm)		

SCHEDULE A
(continued)

Physical Characteristics of
110 kV Crosslinked Polyethylene Cable

Item	Query	Required	Offered
6	Radial thickness of insulation including semi-conducting layers		
	(a) Nominal (mm)		
	(b) Minimum (mm)		
7	Bedding Layer/Water Barrier		
	(a) Material		
	(b) Thickness (mm)		
	(c) OD of bedding layer (mm)		
	(d) Method of electrical connection between 4 and 8		
	(e) Method of water blocking		
8	Sheath:		
	(a) Material		
	(b) Type, corrugated or smooth	Lead/Cu/Al	
	(c) Nominal thickness (mm)		
	(d) Mean diameter (mm)		
	(e) Cross-sectional area (mm^2)		
	(f) Diameter over crest of corrugations (mm)		
	(g) OD of sheath if not corrugated (mm)		
9	Outer Sheath:		
	(a) Material		
	(b) Density (kg/m^3)		
	(c) Nominal thickness (mm)		
	(d) Minimum thickness (mm)		

SCHEDULE A
(continued)

Physical Characteristics of
110 kV Crosslinked Polyethylene Cable

Item	Query	Required	Offered
10	Nominal diameter of completed cable (mm)		
11	Weight of finished cable (kg/m)		
12	(a) Normal length per drum (m) (b) Maximum length per drum (m)		
13	(a) Normal gross weight of loaded drum (kg) (b) Max gross weight of loaded drum (kg)		
14	Max. drum dimensions width/height (m/m)		
15	Minimum radius of bend around which cable can be pulled (a) Laid direct (m) (b) In ducts (m) (c) Cable placed in position with former (m) (d) Cable placed in position without former (m)		
16	Permissible pulling force allowed on conductors during installation (kN)		
17	Maximum permissible sidewall forces (kN)		

SCHEDULE B

Electrical Characteristics of 110 kV Crosslinked Polyethylene Cable

Item	Query	Required	Offered
1	Maximum AC/DC resistance of conductor at 20°C Ω/km		
2	Maximum AC resistance of conductor at 90°C Ω/km		
3	Minimum insulation resistance MΩ/km		
4	Maximum phase inductance mH/km		
5	Maximum phase capacitance μF/km		
6	Maximum charging current per phase A	140	
7	Zero phase sequence impedance for 3-phase cable ($R_0 + jX_0$) Ω/km		
8	Maximum permissible continuous temperature of conductor/sheath °C/°C		
9	Maximum permissible continuous current rating when installed as per this specification; Laid in ducts surrounded by material: A Winter Soil Thermal Resistivity = 1.0 K.m/W Spring Soil Thermal Resistivity = 1.2 K.m/W Summer Soil Thermal Resistivity = 1.2 K.m/W Autumn Soil Thermal Resistivity = 1.2 K.m/W Winter Concrete Thermal Resistivity = 0.85 K.m/W Spring Concrete Thermal Resistivity = 1.0 K.m/W Summer Concrete Thermal Resistivity = 1.0 K.m/W Autumn Concrete Thermal Resistivity = 1.0 K.m/W		

SCHEDULE B
(continued)

Electrical Characteristics of
110 kV Crosslinked Polyethylene Cable

Item	Query		Required	Offered
10	Single phase maximum AC/DC sheath resistance at 20°C	Ω/km		
11	Losses:			
	(a) Conductor loss per phase at current in item 9(a)	W/m		
	(b) Dielectric losses per phase at Uo	W/m		
	(c) Sheath loss per phase at current in item 9(a)	W/m		
	(d) Total losses per phase	W/m		
12	Maximum/expected dielectric loss angle at Uo and a conductor temperature of:			
	20°C	%		
	40°C	%		
	60°C	%		
	Maximum operating temperature +5°C	%		
13	Maximum/expected dielectric loss at 20°C and:			
	0.5 Uo	%		
	1.0 Uo	%		
	1.5 Uo	%		
	2.0 Uo	%		
14	Thermal resistance between conductor and metallic sheath	Km/W		

SCHEDULE B
(continued)

Electrical Characteristics of
110 kV Crosslinked Polyethylene Cable

Item	Query		Required	Offered
15	Thermal resistivity of:			
	(a) Insulation and semi-conducting layers	Km/W		
	(b) Anti-corrosion serving	Km/W		
16	Design 1.2/50 μs impulse stress for 1050kV at conductor/core screen	kV/mm		
17	Design Switching Impulse stress for 1050kV at conductor/core screen	kV/mm		
18	Design AC stress for Uo at conductor/core screen	kV/mm		
19	Average design AC stress across insulation	kV/mm		
20	Minimum 50% flashover voltage of sealing end for a 1.2/50μs wave (nominal), positive/negative	kV		
21	Surface conductivity of outer sheath graphite / extruded semiconductive layer at ambient temperature	(ohm/linear m)	≤3kΩ/m	
22	Surface leakage distance of termination insulator (outdoor)	mm		

SCHEDULE B
(continued)

Electrical Characteristics of
110 kV Crosslinked Polyethylene Cable

Item	Query		Required	Offered
23	Relative permittivity of dielectric			
24	Single phase withstand current for the following clearance times			
	0.1s	A		
	0.2s	A		
	0.5s	A		
	1.0s	A		
	3.0s	A		
25	Permissible 1 second short time withstand current, corresponding conductor temperature	kA/°C		

SCHEDULE B
(continued)

Electrical Characteristics of
110 kV Crosslinked Polyethylene Cable

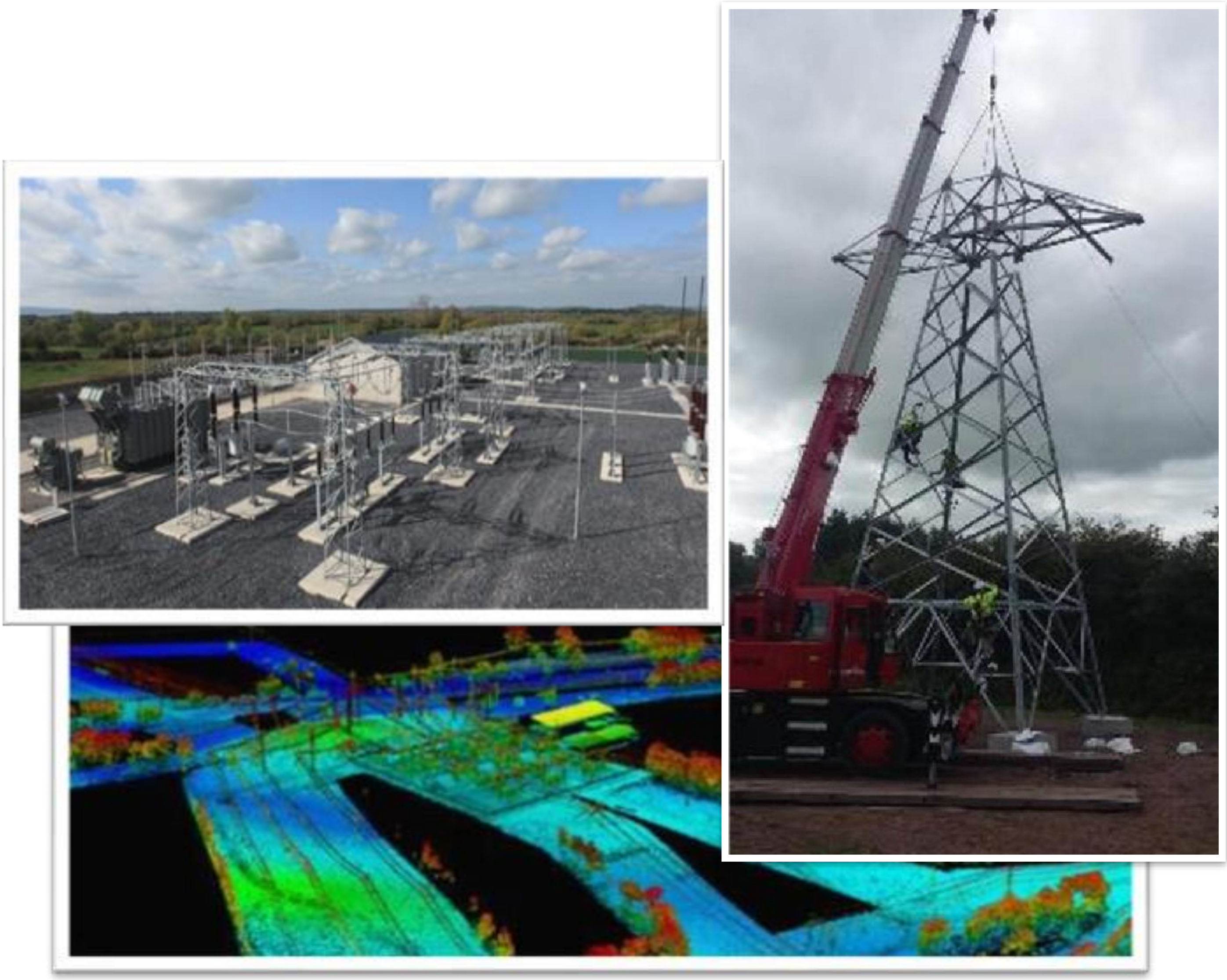
Item	Query	Reply
26	Permissible steady overload and conductor temperature for 0.5/1/2/4 hours after prior continuous loading of:	0.5 1 2 4
	50% of current in Item 9(a)	
	75% of current in Item 9(a)	
	90% of current in Item 9(a)	
	50% of current in Item 9(b)	
	75% of current in Item 9(b)	
	90% of current in Item 9(b)	
27	(a) Is the cable design fully in accordance with the Specification?	
	(b) If not, list all deviations.	
28	(a) Does the specific factory proposed for production of the cable system meet **all** of the Service Requirements set out in Section 6 pages 5/6 of the General Requirements Specification CDS-HFS-00-001-?	
	(b) Are details of such Service Experience under subsections 6(a), 6(b and 6(c) provided in a separate submittal, to demonstrate full compliance with Section 6 to the Client?	

Appendix 2-4 – Outline Construction Methodology

Outline Construction Methodology

Clogherchor Wind Farm

110kVGrid Connection



Report Ref: 05725-R02-02

Clients: Orsted & FEI C/o Tobin Consulting

	Author:	Checked:	Date:	Notes:
00	POS	DB	03.10.22	*Issued for Information*
01	JVDP	DB	15.12.22	*Issued for Information*
02	JVDP	DB	07.02.23	*Final Issue for Planning*

Table of Contents

Table of Figures

1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during construction of the proposed Clogherchor Wind Farm 110kV grid connection to the existing Tievebrack – Ardnagappary 110kV overhead line. The majority of the grid connection will consist of underground cabling (UGC) until it transitions onto the overhead line network via two cable sealing end masts. The 110kV connection will be used to connect the wind farm to the power grid through a 110kV "Loop-In" substation which is to be constructed at the Clogherchor Wind Farm site. The majority of the UGC along with the end masts will be installed in private land along with a small section being installed within the local secondary public road network.

The HV ducting route works will require a double circuit which entails that two trenches in parallel are required for a section of the ducting route with a minimum separation distance of 2000mm required between each circuit. Each trench will consist of the installation of 6 No. ducts in an excavated trench and 1 No. fibre communications cable to allow communications Clogherchor Wind Farm 110kV Substation, Tievebrack 110kV Substation and Ardnagappary 110kV Substation, 1 No. spare communications duct and 1 No. earth continuity conductor duct.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the Planning Application. In addition, this document is in outline form only and will be revised and updated prior to the commencement of any construction activities, detailed Method Statements will be prepared in respect of each aspect of the proposed development.

2.0 EirGrid 110kV AIS 8 Bay (Loop In Substation)

The proposed substation will be designed and constructed to meet all the required EirGrid standards. An area will be levelled and built to the required level with stone fill material, capped by high quality compacted stone. Two control buildings will be constructed using traditional techniques for constructing small buildings (i.e. concrete block walls, timber and slate tile roof). Foundations will be built for all of the proposed electrical infrastructure. All the electrical equipment will be installed to EirGrid requirements. Perimeter fencing will be constructed around the substation compound for security and safety purposes.

This substation will connect via underground cable circuits to accommodate a grid connection via the Tievebrack – Ardnagappary 110kV overhead line (OHL). Clogherchor 110kV substation will be made up of 1 No. Control building, 1 No. IPP MV Switch room, Transformer compound and Busbar compound.

The control building works will consist of foundation works, block work, roofing, low voltage electrical fit out, cladding and building finishing works. The transformer, gantry and structural steelwork will be installed in the transformer compound. Two cable sealing ends will be installed to incorporate the radial underground circuits in and out of the station. The busbar compound structural steelwork will be erected with lightning masts also installed. Substation electrical equipment will be installed once the control building and compound is complete. Fencing will be erected around the compound for security/protection. Permanent access roads will also be installed to allow trafficking in and out of the proposed substation compound, access road to loop in interface mast structures and internal access road for compound use.

The expected duration of works is expected to be approximately 12 months. The proposed construction scope will require the personal, machinery and materials as follows:-

Equipment

- Up to 10 Electrical/Civil Crews
- Excavators
- 360˚ tracked excavators (13 ton normally, 22 ton for rock breaker)
- Tracked dumpers / tractors and trailers
- Crane
- Hoist
- Power Tools
- Generator
- Scaffolding
- Substation Electrical Equipment

Materials:

- Stone
- Geotextile
- Lighting
- Paving.
- Fencing.
- Steel
- Concrete
- Timber
- Cladding
- Doors

The following section outlines the methodology to be followed during construction works of the new Clogherchor 110kV substation which will be constructed adjacent to the existing 110kV overhead line.

1. This new substation will be in a compound of circa 122m x 95m plan area secured by a 2.6m high palisadefence.
2. The substation compound and drainage will be marked out by a qualified engineer.
3. A drainage system will be excavated and installed around the compound area.
4. Topsoil and subsoil will be removed from the footprint of the compound using an excavator. The excavated material will be temporarily stored in adjacent berms for later use during reinstatement works
5. A layer of geotextile material will be laid over the footprint of the compound.
6. Using an excavator, a base layer of Clause 804 material will be laid followed by a 6F2 capping layer which will provide the finished surface.
7. Each layer will be compacted using a vibrating roller.
8. Earthing cable will be laid underground around the substation for connection to the various electricalcomponents during the electrical fit out phase.
9. The construction of an 11590m² substation compound comprising of approximately 450m² single storey 110kV substation control building, 300m² single storey MV building and associated outdoor electrical equipment, including 1 no. 33/110kV transformer, associated internal access road, including 2.6m high station perimeter fencing will be built.
10. Permanent access road will be constructed to allow site vehicular activity in and out of construction area
11. Adequate lighting will be installed around the compound on the lighting masts within the compound.
12. A 110kV cable sealing ends and associated accessories will be required to incorporate the Tievebrack to Ardnagappary 110kV line into the substation. The support structures will be located outdoors.
13. Transformers will be installed in bunded enclosures within the substation compound.

The electrical installation is expected to take 20 weeks and includes the following:

- Delivery and installation of 33/110kV transformer. These are unusually large, and the deliveries will be managed in accordance with regulations governing the movement of large loads.
- Delivery and installation of all other HV equipment.
- Wiring and cabling of HV/LV equipment, protection and control cabinets.
- Commissioning of all newly installed equipment.

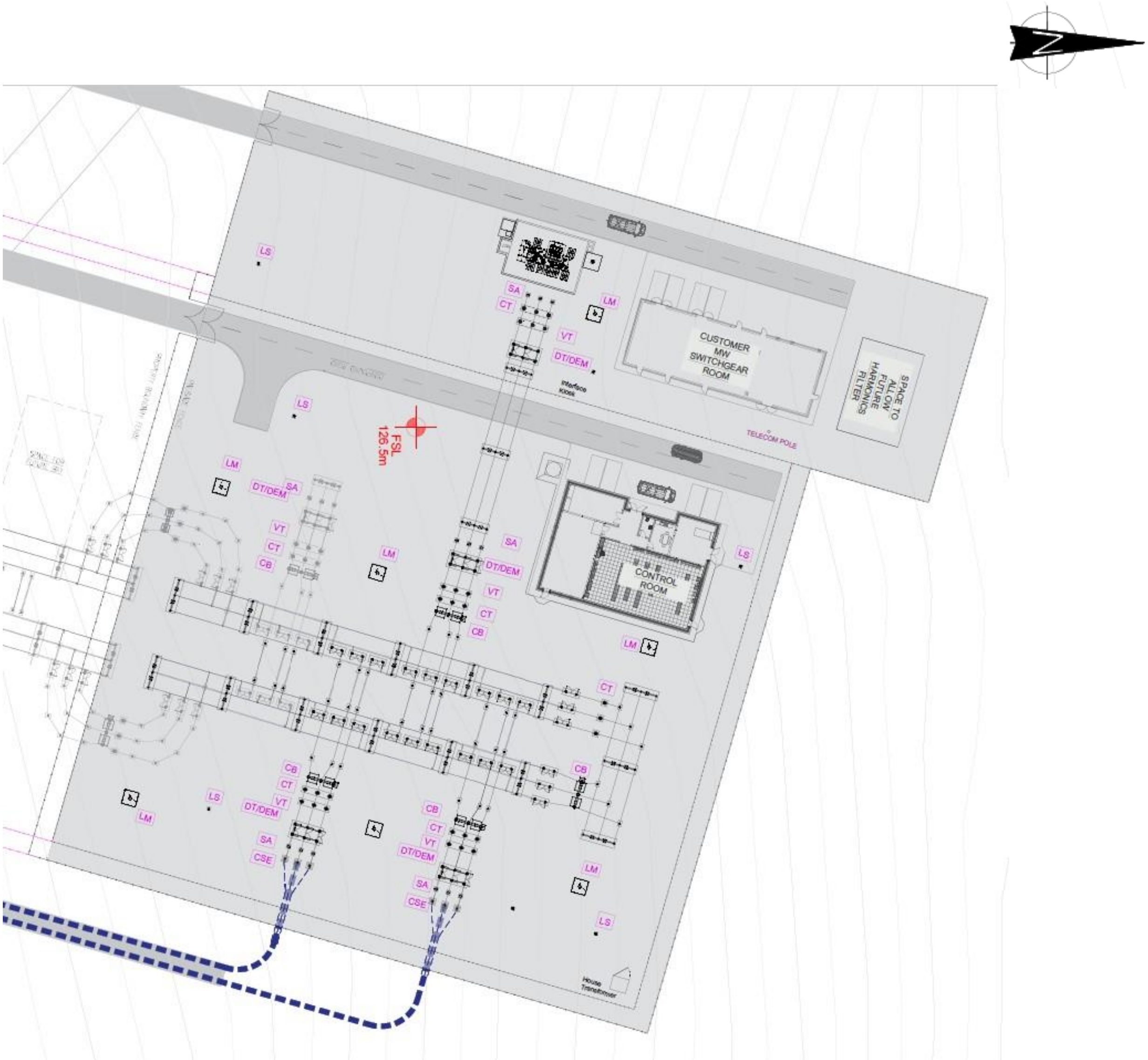


Figure 1 - Proposed 110kV AIS Loop In Station layout

3.0 Cloghercor Wind Farm 110kV Grid Route

The underground grid connection route is approximately 3.9km in length between two radial UGC circuits, from the proposed Cloghercor Wind Farm 110kV Substation location, carrying towards the interface points where the circuits split between Circuit A and Circuit B. It is proposed to transition from an overhead line (OHL) to UGC at two tower locations. These locations have been identified along the Tievebrack – Ardnagappary 110kV overhead line from a technical perspective. The identified locations will be mid span between polesets 147 & 148 respectively and polesets 162 & 163 within the southern periphery of the development site.

The exact location of the underground HV ducting through development lands may be subject minor modification following confirmatory site investigations, to be undertaken prior to construction and following consultation with Donegal County Council and all other relevant stakeholders, having regard to all environmental protection measures outlined in the planning application and accompanying technical reports.

Below (Figure 2) which outlines the underground HV ducting route, with each section of the route being formulated in detail within Table 1.

This underground HV ducting route is shown as an Overall Site Location Map in Drawing No. 05725-DR-100-P00.

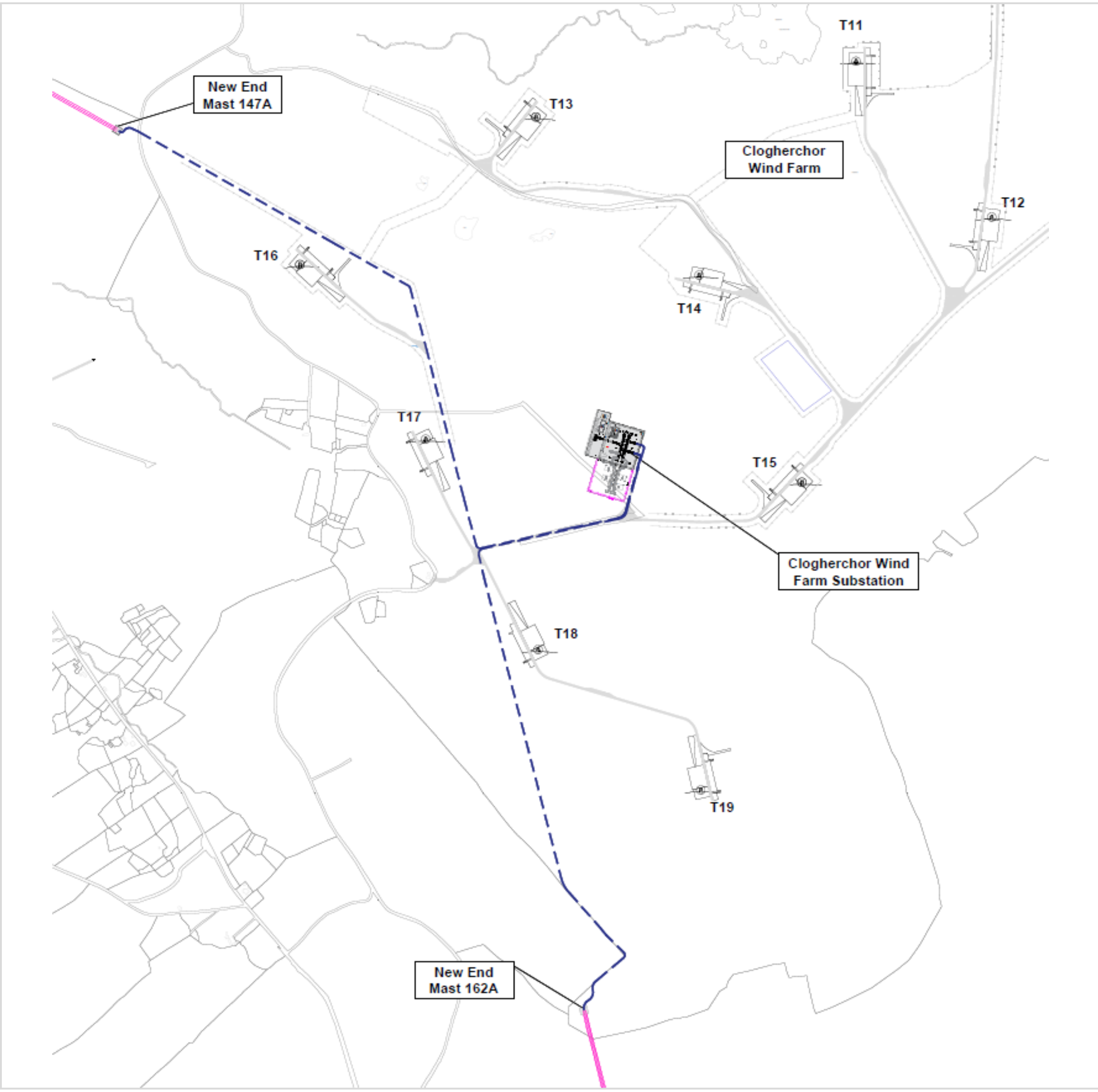


Figure 2 - Overall route location map

Table 1 of this report summaries the route location features of the underground ducting proposed route.

Table 1 – Approximate Route Location of Preliminary Design:	
Wind Farm Site (UGC)	**Public Roads (UGC)**
3878 m	12m

Table 1 -110kV Wind Farm Substation to Loop In Towers – Underground HV ducting Route Location Summary

Table 2 below separates the underground HV ducting route into a number of sections and describes the specific construction requirements of each individual section and identifies access routes to the work areas. All plant and equipment employed on the proposed works will be subject to good site organisation and hygiene, particularly during construction activities.

Table 2 - Summary of Preliminary Underground HV Ducting Design Route	
Section	**Description**
Circuit A 1848m	**UG ducting circuit A from OHL Tie in location to WF Substation location** The Overhead Line (OHL) Tie in Tower is located approximately 127m southeast of pole set 147. From here the OHL transitions to an Underground Cable (UGC). The UGC initially travels in a south-eastern direction for approximately 800m where it then turns and heads south fora further approximately 670m. From here the UGC circuit B is met by UGC circuit A. The two circuits travel in parallel in an easternly direction maintaining a minimum separation between circuits of 2000m for approximately 130m. The double circuit UGC then turns and travels north in parallel with the Clogherchor Wind Farm Substation boundary fence for approximately 160m where the cable is then terminated within the substation. ***<u>Features</u>*** Circuit A contains 2 no. joint bays. Joint bays will be located below ground and finished/reinstated to the local authority's/landowners satisfaction. Joint bays will have associated communication chambers and earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 A (JB-01A) will be located approximately 688m east of the Loop In Tower 147A. • Joint Bay 02 A (JB-02A) will be located approximately 746m south of JB-01A with a remainder of 618m to Clogherchor Wind Farm Substation location. 1 No. watercourse / stream will need to be crossed between JB01 and JB02 respectively. It is proposed to implement Horizontal Directional drilling (HDD) method as the preferred option to mitigate against any fluvial pollutants.

Circuit B 2093m	**UG ducting circuit B from OHL Tie in location to WF Substation location.** The Overhead Line (OHL) Tie in Tower is located approximately 99m north of pole set 162. From here the OHL transitions to an Underground Cable (UGC). The UGC travels in a north-western direction for approximately 270m where it then briefly changes course to the north in order to avoid an area of Deep Peat for approximately 210m. From here the UGC continues northwest for a further approximately 670m. From here the UGC circuit A is met by UGC circuit B. The two circuits travel in parallel in an easternly direction maintaining a minimum separation between circuits of 2000m for approximately 130m. The double circuit UGC then turns and travels north in parallel with the Clogherchor Wind Farm Substation boundary fence for approximately 160m where the cable is then terminated within the substation. ***Features*** Circuit B contains 2 no. joint bays. Joint bays will be located below ground and finished/reinstated to the local authority's/Landowners satisfaction and as per the Purple book road reinstatements specification. Joint bays will have associated communication chambers and earth link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 B (JB-01B) will be located approximately 745m southeast of the Loop In Tower 147A. • Joint Bay 02 B (JB-02B) will be located approximately 745m southeast of JB-02A. • Joint Bay 02 B (JB-02B) will be located approximately 603m west of Clogherchor Wind Farm Substation location. 1 No. watercourse / stream will need to be crossed between Poleset 162A and JB01B respectively. It is proposed to implement Horizontal Directional drilling (HDD) method as the preferred option to mitigate against any fluvial pollutants.
Refer to Figure 1 and to the planning drawings submitted for location details. Note: The precise location of the proposed route within the planning application boundary is subject to change as result of existing services/utility locations, ground conditions and any environmental constraints.	

Table 2 - Summary of underground HV ducting design route.

4.0 Preliminary Site Investigations

It would be proposed to carry out Preliminary site investigations along the ducting route prior to construction toconfirm design assumptions.

The following items may be carried out:

3 No. Boreholes along the UGC route to ascertain ground conditions and thermal resistivity of the soil for HDD locationsand at the substation location to establish a piling design.

Soil conditions in the vicinity of the interface mast locations to be confirmed and recorded on site by contractor byconducting trial holes prior to installation.

Trial holes at all joint bay positions to ascertain ground conditions and thermal resistivity of the soil.

5.0 Loop-In Interface Mast Design Location

5.1 Existing 110kV OHL

The 110kV loop-in option is proposed to be carried out on the existing Ardnagappary – Tievebrack 110kV overheadtransmission line. The loop-in will be completed midspan between Polesets No. 147 and No.148, and Polesets No. 162 and No.163, located entirely within the confines of the development area. The new mast structures shall be referred to as New End Mast 147A and New End Mast 162A, as per drawing no. 05725-DR-100. Polesets surplus to requirement will be removed by ESBN once the UGC is energised. These poles will be recycled as part of Networks best practice procedures. They will be removed by a 13-tonne excavator, with no cutting involved, see Figure 3.

Figure 3 - Poleset removal with 13 Tonne excavator

5.2 Access Routes to Works Area

The proposed interconnector will be a combination of UGC. All of the proposed underground cable route is located on private lands, as such the contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private farm tracks, where appropriate. Prior to the commencement of development, precise access arrangements will be agreed with the respective landowners.

A detailed Traffic Management Plan will be prepared, and agreed with Donegal County Council, prior to the commencement of construction. Temporary access roads on private land (if required due to ground conditions and/or landowner requirements) will consist of timber or aluminum bog mats (see Figure 4 & Figure 5) to spread the weight ofmachinery over a greater area to prevent damage to the ground. If necessary, a low ground pressure excavator may also be utilised. This machine is designed to spread its weight across a wider area thereby reducing the pressure exerted on the ground. No invasive works will be undertaken when placing the matting.

Upon completion of the works, all mats will be removed immediately. Access routes will be carefully selected to avoid any damage to land. Local consultation will be carried out with all relevant landowners to ensure that any potential disturbance will be minimised. Prior to the commencement of construction, the contractor will assess all access routes and determine the requirement for bog mats. Any such requirements will be incorporated into the relevant method statement.

Figure 4 - Temporary Aluminium Panel Track

Figure 5 - Temporary timber roadway (Bog matt)

Construction Equipment Required

- 4x4 vehicle
- Wheeled dumper or Track dumper (6 to 8 tons)
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- Vans
- Chains / hand tools
- Road material delivered by supplier to closest convenient point.
- Crew size: 3 workers
- Timber Bog Mats / Aluminium Panel Tracks

5.3 Loop-In Interface Mast Design

The proposed design for the 110kV Loop-In from the existing OHL will require two new Interface Mast structures which will be constructed under the existing Ardnagappary – Tievebrack 110kV OHL, on the boundary of the proposed Clogherchor Wind Farm 110kV Substation. The existing OHL conductor will be terminated at these two new structures in order to transition from an overhead line to an underground cable arrangement to facilitate the loop into Clogherchor Wind Farm 110kV Substation via cable chairs. The existing conductor will be removed between the Interface Mast structures with the new connection looped through to the new Clogherchor Wind Farm 110kV Substation.

The new interface mast structure locations have been selected based on ground surveys, ground profiles, allowable angles and ruling span checks. The expected duration of works is expected to be approximately 4 weeks. Construction of foundation circa. 7 days each, erection of the Interface masts circa 5 days, weather dependent,

The proposed construction scope will require the relative personal, machinery and materials which is as follows: -

Equipment

- 4x4 vehicle
- Winch
- Tractor and trailer
- Crane
- Teleporter
- Chains / small tools
- Tracked Excavator
- 5 operatives
- Tracked Dumper

Materials:

- Lattice steel tower
- Insulators
- Dropper conductors
- Connection clamps
- Surge Arrestors
- Electrical connections
- Concrete (foundation)
- Aggregate

The following section outlines the methodology to be followed during construction works of the new Interface Mast structures which will be constructed underneath the existing 110kV overhead line in the townland of Clogherchor in Co. Donegal.

- Interface Mast sites are scanned for underground services such as cables, water pipes etc. Consultation with the landowner will help to identify and ensure there are no unidentified services in the area.
- For each leg of 2 No. towers (8 in total) a foundation circa. 3m x 3.6m x 3.6m is excavated and the formation levels (depths) will be checked by the onsite foreman. The excavated material will be temporarily stored close to the excavation and excess material will be used as berms along the site access roads.
- To aid construction, a concrete pipe is placed into each excavation to allow operatives level the mast at thebottom of the excavation. The frame of the reinforcing bars will be prepared and strapped to a concrete pipe with spacers as required. The reinforcing bars will be lifted into each excavated foundation using the excavator and chains/slings. The base and body section of each tower will then be assembled next to excavation.
- Concrete trucks will pour concrete directly into each excavation in distinct stages.
- A third pour for the leg of the tower 1m x 1m and will be 300mm over ground level.
- Once the main concrete pour is cured after circa five days, a preformed metal panel is set in place to contain the concrete called shuttering while it sets. During each pour, the concrete will be vibrated thoroughly using a vibrating poker.
- Once the concrete is set after the five days the shuttering is removed.

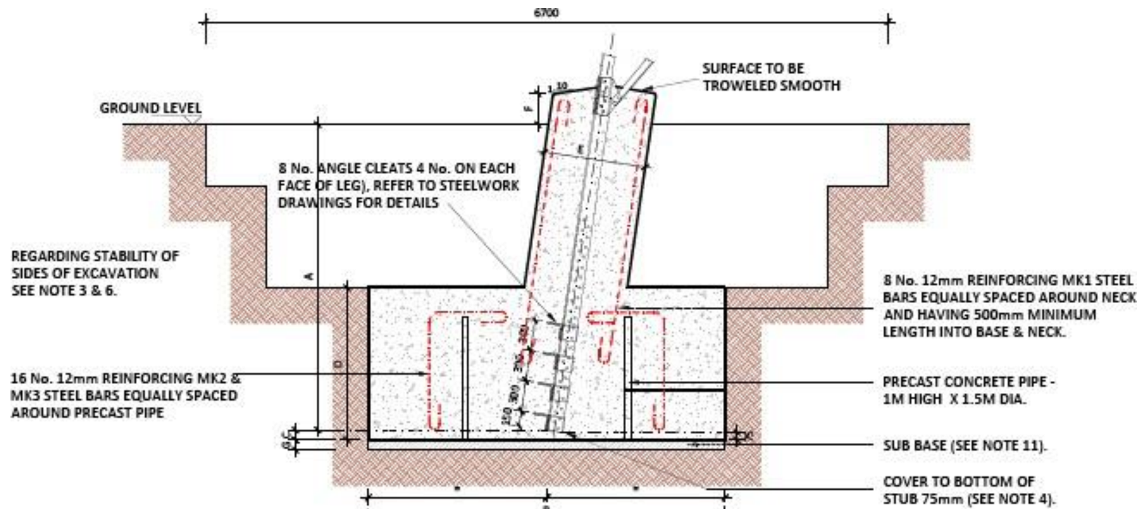


Figure 6 - End mast foundation details

Figure 7 - 110kV Interface Mast foundation complete

- The Interface Mast foundations will be backfilled one leg at a time with the material already excavated at the location. The backfill will be placed and compacted in layers. All dimensions will be checked following the backfilling process. If the excavated material is deemed unsuitable for backfilling other excavated material from the footprint of the Clogherchor Wind Farm 110kV Substation or from the new permanent access road in Clogherchor will be used. All surplus excavated material and removed from the tower locations and stored in berms adjacent to the substation compound

Figure 8 - Base of Interface Mast structure backfilled

- The existing overhead line will be de-energised by ESB so work can commence on the construction of the towers.
- An earth mat consisting of copper or aluminum wire will be laid circa 400mm below ground around thetower. This earth mat is a requirement for the electrical connection of the equipment on the tower structure.
- Once the base section of each tower is completed and the concrete sufficiently cured, it is ready to receive the tower body.
- A hardstand area for the crane will be created by laying geogrid material on the ground surface and overlaying this geogrid with a suitable grade of aggregate.
- A physical barrier (Heras Fence Site Boundary) will be put in place to restrict plant from coming too close tothe OHL.
- The tower will be constructed lying flat on the ground beside the recently installed tower base.
- The conductor will be moved off center using a stay wire and weights to anchor the stay wire to ground.
- The tower section will be lifted into place using the crane and guide ropes.
- The body sections will be bolted into position.
- The conductor will be centered over the towers and held in place. Once the conductor is secured at both ends it is then cut and attached onto each tower. The section of conductor in between the two towers will be removed and utilised as connector wire for the new towers.
- Down dropper conductors (For Electrical Connections, Insulators, Surge arrestors), shackles and all associated accessories required for transition from line to cable will be installed on the interface towers.
- The circuit will be tested in both directions before the line is re-energised.

Figure 9 - Completed Line/Cable Interface Mas

6.0 New Permanent Access Roads – within the Wind Farm

Prior to the construction of any access roads on site a detailed design will need to be carried out. The access roads will be marked out by the Site Engineer. Permanent access roads will have widths of 5m/5.5m to allow all machinery to access all work areas.

6.1 Excavated Road Construction Methodology

Given the flat topography and relatively shallow peat on site, excavated access roads are deemed an appropriate construction technique.

Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m. An excavator will excavate the width of the new access road which will include a roadside drainage channel with silt traps, soakage areas, interceptor drains along the access road alignment which will be designed in accordance with BRE guidelines.

All organic material and soft subsoil will be removed to formation level with excavated material to be reused and stored on site. Layers of geogrid/geotextile will be required at the surface of the competent stratum, a minimum sub-base will be laid on the geotextile membrane which will consist of 200mm of crushed granular material. A surface layer will be laid which will consist of 75mm compacted 40mm material to accommodate HGV traffic.

Figure 10 - Typical Windfarm Access Road.

7.0 Underground HV ducting Construction Methodology

The underground HV ducting will consist of 2 No. trenches, each trench will contain 3 No. 160mm diameter HDPE power ducts and 2 No. 125mm diameter HDPE communications ducts to be installed in an excavated trench, typically 825mm wide by 1315mm deep, with variations on this design to adapt to service crossings and watercourse crossings, etc. The ducts will be installed, the trench reinstated in accordance with landowner/ Donegal County Council specification. Construction methodologies to be implemented and materials to be used will ensure that the underground HV ducting are installed in accordance with the requirements and specifications of EirGrid and ESB.

7.1 Trenching Methodology

The following section outlines the methodology to be followed during trenching works:

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the planning application and accompanying reports and as required by planning conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction.
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the planning application and accompanying reports, the construction contractor will prepare a detailed Construction Environmental Management Plan (CEMP) prior to the commencement of construction, the CEMP will be used to clearly document for construction staff the proposed mitigation, as set out in the application, and any subsequent planning conditions that may be imposed. The CEMP document will be prepared in line with best practice construction methodologies including the following measures;
- Where the ducting routes intersect with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the contractor will liaise with Inland Fisheries Ireland in advance of works;
- Traffic management measures will be implemented in accordance with those included in the Traffic Management Report, and a detailed Traffic Management Plan will be prepared and agreed with Donegal County Council;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles wil be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);

- Excavated material shall be employed to backfill the trench where appropriate and any surplus material willbe transported off site and disposed of at a fully authorised soil recovery site;

- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;

- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;

- Where required, grass will be reinstated by either seeding or by replacing with grass turves;

- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;

- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;

- Where the ducting is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;

Figure 11 - Typical HV Underground Ducting Installation with geotextile membrane

7.2 Ducting Installation Methodology

For the trenching and ducting works the following step by step methodology will apply:

1. Grade, smooth and trim trench floor when the required 1315mm depth and 825mm width have been obtained.
2. Carefully unroll and place the Geotexile membrane and the Tensar geogrid membrane at the base of excavated trench, whilst lining the side walls of the trench,
3. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
4. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
5. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
6. Place protection strips on compacted CBGM B directly over the ducts.
7. Lay the top row of ducts onto the freshly compacted CBGM B including the protection strips above the bottomrow of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.
8. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughlycompact without damaging ducts.
9. Place red protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
10. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified,
11. Carefully unroll and place the SecuGrid 40/40 membrane along the backfilled trench, overlapping the Tensar Geogrid membrane. A layer of granulated crushed stone will form a base for the access road to be exercised above,
12. Place yellow warning tape above the layer of crushed stone at the depth shown on the drawings.
13. A new layer of crushed stone will be placed above the warning tape creating a sub layer before the permanent wearing course layer is instated, in accordance with the local authority and/or private landowners.
14. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

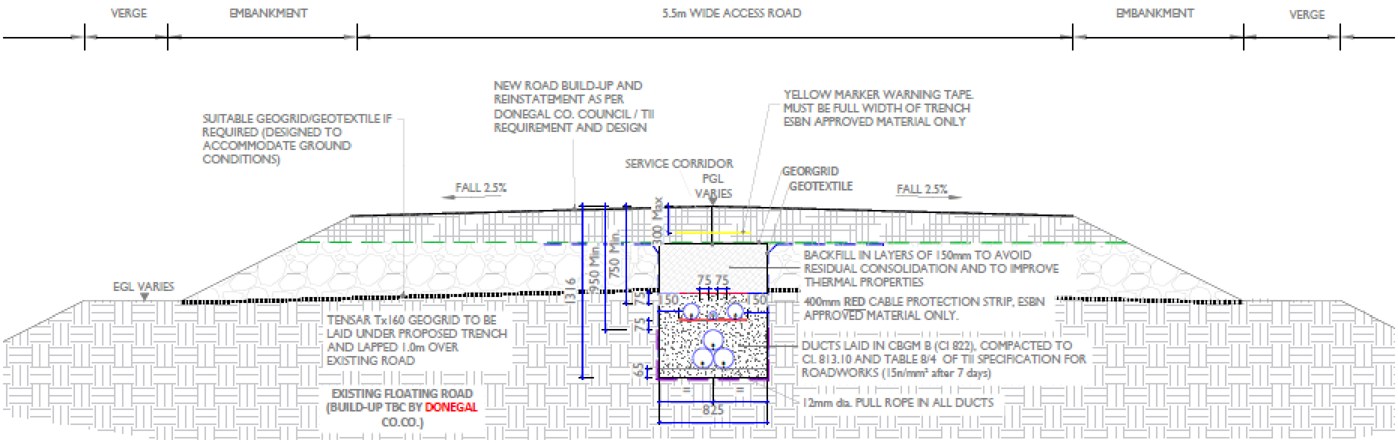


Figure 12- Ducting Through Access Road

Equipment

- Tracked Excavator
- Tracked Dumper or tractor and trailer.

Materials:

- Ready-mix Concrete where necessary(delivered to site);
- Trench backfilling material to relevant specifications;
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- 63mm diameter HDPE ducting
- Temporary Surface Reinstatement

7.1 Windfarm / Forestry / Clogherchor Substation Access Tracks

The majority of the 110kV route is located within existing Coillte lands. with access tracks will be laid or upgraded as part of the proposed development. Where the cable is installed in windfarm / forestry / Clogherchor Substation access tracks, the location where the cable is laid will depend on several factors, width of track, bends along the track and crossings. As per the Coford Forest Road Manual, standard forest tracks are designed to carry vehicles conforming to maximum legal weights and dimensions applicable to public roads. However economic and external factors will sometimes result in the design of a track to less than full standard roadway. In locations where the track needs to be widened, stone will be brought in to build up the area to the same level of the track. The excess material from the track will be used elsewhere on reinstatement works.

New and upgraded tracks should be designed to:

- Comply with the standards;
- Accommodate the anticipated frequency, type and speed of traffic;
- Take cognisance of soil and sub-grade conditions.
- Provide for drainage and water quality requirements; and
- Incorporate landscape and environmental values.

The final design will be designed in conjunction with Coillte guideline requirements and will be evaluated carefully on its merits. The upgrade of internal access roads will be classified by soil type and by cross slope.

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally, or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

7.2 Surface Markers & Marker posts

Surface markers will be placed along the route where duct depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the underground HV ducting. These markers will be metallic plates in accordance with ESB standards.

Marker posts will be used on non-roadway routes to delineate the ducting route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centered lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker posts shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESBN as part of the detailed design process. (Figure 11 - Typical ESB Marker Posts)

Figure 13 - Typical ESB Marker Posts

7.3 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Where excess material exists, it will be disposed of to a licensed facility.

7.4 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the works area or within the temporary construction compound to be located within the Clogherchor Wind Farm construction compound. Oils and fuels will not be stored on site and will be stored in an appropriately bunded area within the temporary storage compound.

7.5 Joint Bays and Associated Chambers

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the proposed Clogherchor Wind Farm 110kV substation and the existing 110kV Tievebrack and 110kV Ardnagappary Substations. Earth Sheath Link Chambers are also required along the duct route. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth Sheath Link Chambers and Communication Chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers is subject to approval by ESBN. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

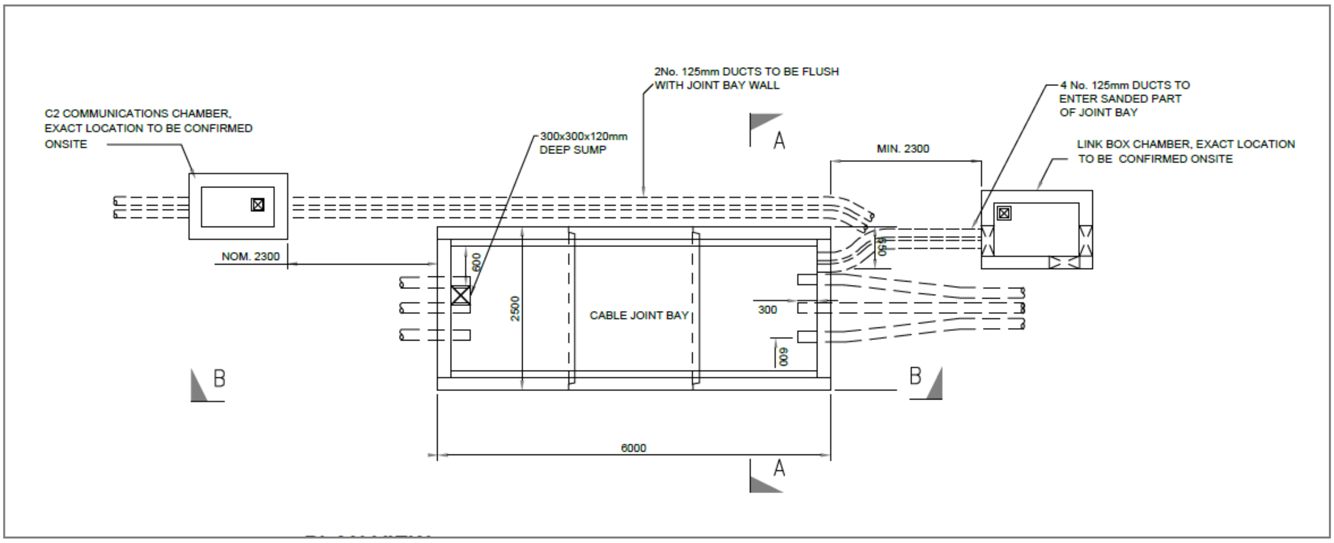


Figure 14 - Joint Bay Plan Layout

7.6 Joint Bay Construction and Installation

Before starting to construct, the area around the edge of the proposed joint bay which will be used by heavy vehicles will be surfaced with a terram cover if required and stone aggregate to minimise ground damage. Any roadside drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or which wash out during the works. If the ground slopes from the working area toward a watercourse or if there is evidence of solids washing off the works area toward nearby watercourses or drains, a silt fence with straw bales, will be interposed between the works area and the watercourse.

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required forreinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant ECM.

If the joint bay needs to be dewatered, this will be pumped to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the dewatering process to comply with the ECM.

The risk of concrete reaching surface waters is considered very low given that all concrete will be poured into the pit excavated for the joint bay so that spills will be contained. The basic requirement therefore is that all pouring operations be constantly supervised to prevent accidental spillages occurring outside the pit.

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 siltfencing to contain any solids in run-off.

The following steps outline the methodology for joint bay construction and reinstatement:

1. The contractor will excavate a pit for joint bay construction, including for a sump in one corner.
2. Grade and smooth floor; then lay a 75 mm depth of blinding concrete or 50 mm thicksand (for pre-cast concrete construction) on 200 mm thick Clause 804 granular material.
3. Construct 200 mm thick reinforced concrete floor slab with sump and starter bars placed for walls as detailed on the drawings.
4. Construct 200 mm thick reinforced concrete sidewalls as detailed on the drawings, see Figure 15 - Typical joint bay under construction (in-situ))

Figure 15 -Typical joint bay under construction (in-situ)

5. Remove formwork and backfill with suitable backfill material in grassed areas or Clause 804 material once ducting has been placed in the bay. Backfill externally with granular material, see Figure 17.

Figure 16 – Typical Joint Bay under construction (pre cast)

Figure 17 - Place pre-cast concrete sections on sand bedding.

6. Where joint bays are located under the road surface the joint bay will be backfilled with compacted layers of Clause 804 and the road surface temporarily reinstated as specified by the local authority.

7. Precast concrete covers may be used as temporary reinstatement of joint bays at off road locations. These covers are placed over the constructed joint bay.

8. Following the completion of jointing and duct sealing works in the joint bay, place, and thoroughly compact cement-bound sand in approximately 200 mm layers to the level of the joint base to provide vertical support. Install additional layers of cement-bound sand and compact each layer until the cement-bound sand is level withthe top of the joint. Install an additional 100 mm cement-bound sand layer.

9. Install protection strip. Backfill with cement-bound sand to a depth of 250 mm below surface and carry out permanent reinstatement including placement of warning tape at 400 mm depth below finished surface.

Equipment:

- 1 Excavator Operator
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Blinding Concrete where necessary
- Clause 804 Material
- 160mm diameter HDPE ducting;
- 125mm diameter HDPE ducting;
- 63mm diameter HDPE ducting
- Precast Chamber Units / Relevant construction materials for chambers
- Earth Link Box

8.0 Design and Construction & Environmental Management Methodology

Before commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, environmental protection measures included within the planning application, any subsequent planning conditions that may be imposed, and the guidance documents and measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager, and ECoW where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures proposed below:-

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacentto Waters*. Inland Fisheries Ireland*, Dublin,*
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of NationalRoad Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap, and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and DevelopmentWorks at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants andcontractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocketbook*. (C762) 4th edition. CIRIA
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The proposed works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures set out in the application documents, and described further in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

All materials shall be stored at the temporary compound within Clogherchor Wind Farm 110kV Substation site and transported to the works zone immediately before construction;

- Where drains or watercourses are crossed with underground ducts, the release of sediment will be prevented through the implementation of best practice construction methodologies;
- Weather conditions will be considered when planning construction activities to minimise the risk of runoff from the site;
- Exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water must be treated before discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during very wet periods;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, and the Contractor is required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the proposed works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted.
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off-site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available.
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within Clogherchor Wind Farm substation site; remote from watercourses, drainage channels, and other surface water features.
- Entry by plant equipment, machinery, vehicles, and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or wastewater into watercourses.
- Cabins, containers, workshops, plant, materials storage, and storage tanks shall not be located near any surface water channels.

9.0 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. The proposed HDD methodology is as follows: -

1. A works area of circa .40m^2 will be fenced on both sides of a crossing.
2. The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. 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
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven, and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESBN, EirGrid and the landowner.
13. A joint bay or transition chamber will be installed on either side of the obstacle following the horizontal directional drilling as per ESBN and EirGrid requirements.

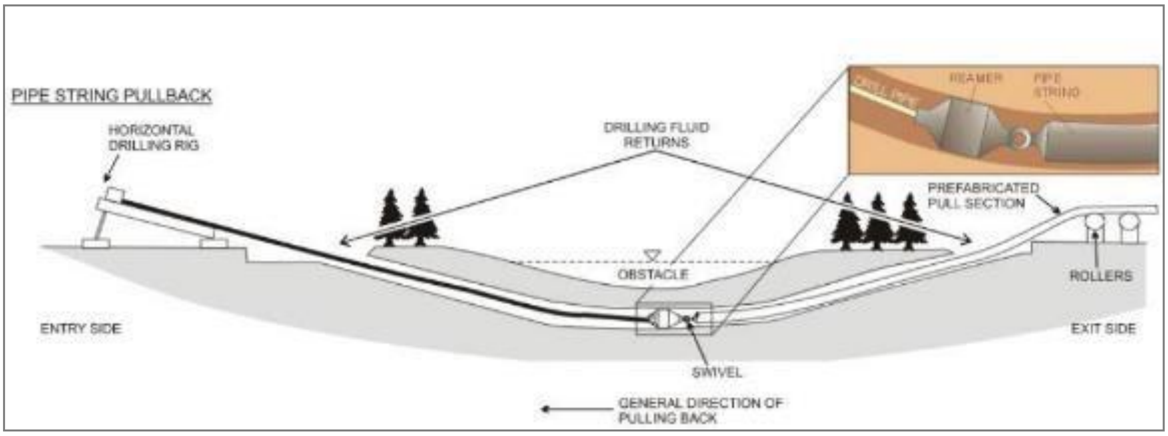


Figure 18 - Typical HDD Installation

Figure 19 - Typical HDD Installation

10.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Donegal County Council. All work on public roads will be subject to the approval of a road opening license application. The contractor will prepare detailed traffic management plans for inclusion as part of the road opening applications. Typically, the underground HV ducting will be installed in 100m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated. Where the construction requires the crossing of a road, works on one carriageway will be completed before the second carriageway is opened, to maintain traffic flows.

All construction vehicles will be parked within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency; steel plates, which will be available on site, can be put in place across the excavation to allow traffic to flow on both sides of the road.

All traffic management measures will comply with those outlined in the accompanying Traffic Management Report and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Donegal County Council, prior to the commencement of development.

11.0 Road Opening Licence

The proposed grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Donegal County Council. A Traffic Management Plan (TMP) will be agreed with Donegal County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Donegal County Council in advance of the preparation of the TMP.

12.0 Construction Hours

Standard working hours for construction will be 8.00am to 8.00pm Monday to Friday and 8.00am to 6.00pm on Saturday (if required), with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency. All site personnel will be required to wear project notification labelling on high visibility vests and head protection so that they can be easily identified by all workers on-site.

13.0 Reinstatement of Land

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in in consultation with the landowner and in line with any relevant measures outlined in the planning application, any subsequent planning conditions that may be imposed.

14.0 Invasive Species Best Practice Measures

Invasive species can be introduced into a location by contaminated plant, machinery and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on site, and best practice measures will be implemented, as follows:

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic / riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

15.0 Waste Management

All waste arising during the construction phase will be managed and disposed of in a way that ensures the provisions of the Waste Management Act 1996 and associated amendments and regulations and the Waste Management Plan. Soil will be reinstated into trenches where possible. In the event, there is excess material with no defined purpose, it will be transported to an authorised soil recovery site.

Appendix 2-5 - Forestry Felling Report

Western Forestry Co-op
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Forestry Report

1.0 BACKGROUND

This report examines the effects of the proposed Cloghercor Wind Farm project across the existing forest area and the potential impact associated with forestry clearfelling for this development. It will describe the existing forest environment and the impact of the proposed wind farm in relation to the ongoing operation of the forest. Environmental impacts associated with forestry clearfelling and replanting e.g. ecology, water quality, landscape, soils etc. is addressed in the relevant technical sections of the EIAR.

1.1 STATEMENT OF AUTHORITY

This report has been prepared by the following staff of Western Forestry Co-op:

Marina Conway is the author of the report and holds a Bachelor and Master's degree in Agricultural Science in Forestry, a postgraduate certificate in Water Pollution Control and is professional Member of the Society of Irish Foresters. Marina has 26 years specialised experience as a professional manager in the field of forestry and environmental development. Her key skills are in forest management from afforestation to harvesting, reforestation, appropriate assessments and biodiversity. Marina has experience in project management, implementation, environment & climate change policy, capacity building, data analysis, auditing and government policy.

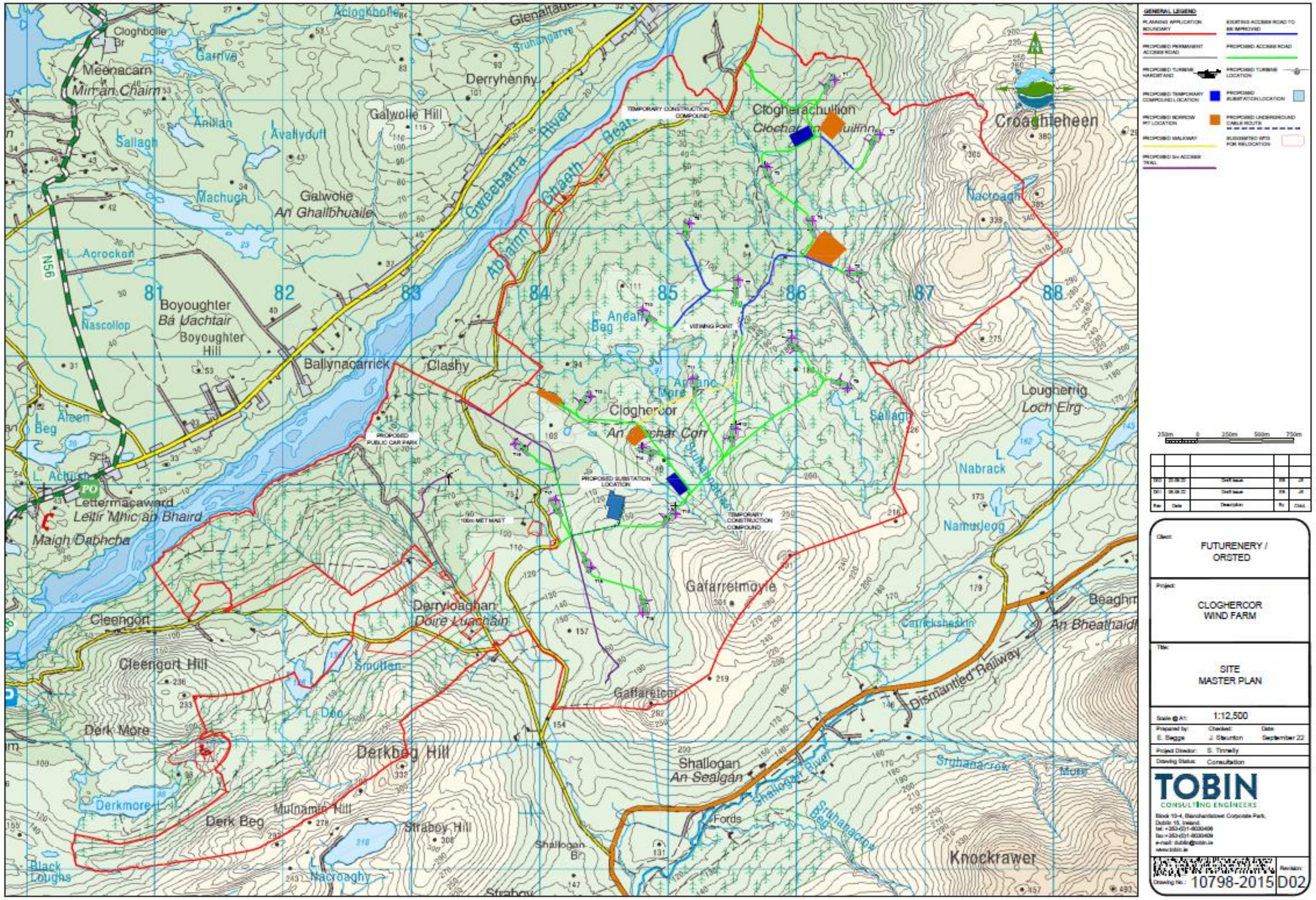
Joseph McManus holds a BSc in Forestry and is professional Member of the Society of Irish Foresters. Joseph has 6 years specialised experience in harvesting, forest inventory, field work, site assessment and mapping for harvest operations and health and safety. Joe assisted with the field work and the mapping.

Kenneth Moore holds a B Agr Sc in Forestry and is professional Member of the Society of Irish Foresters. Kenneth has 2 years specialised experience in forest inventory, field work and mapping for forest operations. Kenneth assisted with the field work and forest measurement data.

1.2 INTRODUCTION

The proposed Cloghercor Wind Farm project includes 19 no. turbines, and all associated infrastructure which is described in detail in Chapter 2 of this EIAR: Description of the Proposed Development. The study area of the proposed wind farm (Figure 1.1) measures 1972.7 ha and is predominantly covered in commercial coniferous forestry plantations and open peatland that is extensively grazed. The majority of the site is owned by Coillte with the remaining area comprising third-party owned areas, mainly of commercial forest. There is an extensive network of existing access roads across the site to facilitate the ongoing forestry operations.

Figure 1 - Site Study Area, Turbine and associated infrastructure layout



The site is located on an elevated area beside the Gweebarra river estuary with a topography between 0m and 265m above ordnance datum (AOD). Approx 12 streams transverse the site and flow in a general southeast to northwest direction into the Gweebarra Estuary.

As part of the proposed development there will be a requirement to clearfell some of this forestry in the areas immediately around the footprint of the wind farm infrastructure. As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not, and within two years of felling the area would be replanted.

Felling is the process of cutting down trees. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done both by manual (chainsaw felling) and mechanical means. For mechanical harvesting this includes a harvesting machine (Plate 1) which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (pulp, stakewood, palletwood, sawlog) and an 8 wheel mounted forwarder machine (Plate 2) that collects the different timber assortments and stacks them at the road for removal by the timber lorries to the sawmill.

Plate 1 - Timber Harvester

Plate 2 - Timber Forwarder

Clearfelling for this proposed development will be in small compartments or coupes within the forest areas. Felling has the potential to impact adversely upon the environment if done in an uncontrolled manner; however, by the adoption of sound planning procedures, operating techniques and control measures as outlined in Section 1.6 below, this will considerably reduce any potential adverse environmental effects.

Subject to receipt of consent for the proposed Cloghercor Wind Farm project, the developer will apply to the Forest Service for a Felling Licence for clearfelling works, in line with the requirements of the Forestry Act, 2014. A felling licence granted by the Minister for Agriculture, Food and the Marine provides authority under the Forestry Act 2014 to fell or otherwise remove a tree or trees and to thin a forest for silvicultural reasons. The proposed development must have obtained planning consent before an application can be made for a felling license from the Forest Service, as per their policy on tree felling for wind farms. As part of this process, an area of at least an equivalent size to that which will be permanently felled must be replanted. This replanting land can be located anywhere within the state, provided an afforestation license is granted for the land.

The regulatory authority in Ireland, the Forest Service, has developed the Code of Best Forest Practice (Forest Service 2000b) which details forestry operations and the manner in which they should be carried out to ensure the implementation of sustainable forest management in our forest ecosystems and a suite of environmental guidelines which prescribe best practice in relation to Forestry and Water Quality and Forest Harvesting and the Environment (Forest Service 2000a, 2000b, 2000c), Felling and Reforestation Policy (2017) and Standards for Felling and Reforestation (2019).

The Coillte forest lands are certified to two forest management certification schemes, namely FSC (Forest Stewardship Council) certification of responsible forest management, and PEFC (Programme for the Endorsement of Forest Certification) certification of sustainable forest management. Both FSC and PEFC forest management certification schemes are independent schemes which audit and inspect forest managers to ensure their work meets strict forest management standards against social, economic and environmental criteria. For more information see https://www.coillte.ie/our-forests/public-goods/certification/.

1.3 METHODOLOGY

The methodology used to produce this report included a review of relevant legislation and guidance documents, a desk study, site walkthrough and field inspection of the proposed development footprint, evaluation of potential effects and an identification of measures to avoid and mitigate effects. Permanent felling requirements, which assume the worst-case scenario and may be less than estimated, while ensuring constructability, should be the minimal possible area and have been determined based on turbine manufacturers requirements and any environmental or other mitigations proposed. The requirements include the felling required for the wind farm to assess impacts in terms of runoff and nutrient mobilisation and present mitigation measures against all impacts.

1.3.1 Relevant Legislation and Guidance Documentation

The following documents have been referenced in the preparation of this report:

- Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017

- Standards for Felling and Reforestation, Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019

- Forestry Act 2014 and the Forestry Regulations 2017 (SI No 191 of 2017) and SI 31 of 2020 - Forestry (Amdmt) Regs 2020 re reg 19AA procedures (pdf 99Kb)

- Forest Service. 2000a. Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

- Forest Service. 2000b. Code of Best Forest Practice – Ireland. Irish National Forest Standard. Forest Service, Department of the Marine and Natural Resources, Dublin.

- Forest Service. 2000c. Forest Harvesting and the Environment Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

1.3.2 Desk Study

A desk study was undertaken in order to collate and review background information in advance of the site survey. The desk study was carried out during September/October 2022. It involved the following:

Examination of the IFORIS (Integrated Forestry Information System) INET online mapping system, Department of Agriculture, Food and the Marine. To include assessment of the site against the following environmental GIS mapping layers:

    - EPA Hydrology
    - High status objectives waterbodies
    - OPW Flood Hazard areas
    - Fisheries Sensitive Areas
    - Landscape Sensitivity
    - Sites, Monuments and Records
    - NPWS Natura Sites
    - ESB Buffers
    - County Development Plan
    - Fresh Water Pearl Mussel
    - Acid Sensitive Areas
- Examination of the EPA Appropriate Assessment mapping
- Coillte Cloghercor Forest Sub-compartment data

1.3.3 Field Work

A detailed site assessment was carried during October 2022 by a project team of Marina Conway, Joseph McManus and Kenneth Moore. The purpose of the field work was to identify the forest type and the impact of the proposed felling on the forest environment. All of the proposed infrastructure locations that occurred within forest areas were visited. During the visit 0.01ha measurement plots were taken in order to verify the standing volume and estimate a yield class for the plots as an assessment of volume to be removed and associated carbon loss as a result of permanent forest removal. The baseline/existing conditions of the forest areas to be felled were assessed for:

- Area of impacted forest (felling area hectares)
- Age of forest
- Species planted
- Standing Volume

1.3.4 Evaluation of Potential Impacts

The significant effect of the proposed windfarm and the associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)

A Site Hazard & Risk Assessment was undertaken to identify hazard and risk factors that have the potential to identify and protect social and environmental features and considerations, these are recorded in the harvest plan in section 1.6.1, potential hazards include:

- ESB/Gas lines
- Water Mains
- Steep banks
- Roadside harvesting
- Deep drains
- Erosion Risk
- Public Access/Rights of Way

1.4 EXISTING ENVIRONMENT (BASELINE DESCRIPTION)

The existing environment is discussed in terms of felling area, tree species, forest age, condition, estimated standing volume (m^3) and Yield Class (where appropriate, i.e. in younger trees it is not possible to take measurements in trees <7cm diameter at breast height), aquatic zones or relevant watercourses (any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone, they are often artificial, and include existing drains and channels and other potential pathways that contain flowing water during and immediately after rainfall).

1.4.1 Description of Forestry plots

1.4.1.1 Area, age & species

The majority of the proposed windfarm site is covered in forestry, most of which is owned by Coillte. As part of the windfarm development, areas of forest will be felled to facilitate both infrastructure and construction felling, as set out in Table 1 Total Area to be felled for Windfarm Development. As per the Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, the Infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and the construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and a temporary construction compound where the land will be replanted once construction is completed (Table 3). Bat felling buffers were taken into account in the calculation of the areas required for permanent tree removal around the turbines (see chapter 6 of this EIAR – Biodiversity, Flora & Fauna).

The total area of forestry to be felled is 90.898 ha, if a smaller bat felling buffer were used (as per Chapter 6) it would be 69.753 ha, as shown in Table 1, Total Area to be felled for Windfarm development and outlined on maps in Figures 1 and 2.

Table 1 - Total Area (ha) to be felled for Windfarm Development

Windfarm Infrastructure & Construction Felling	**Area (ha) LBFB***	**Area (ha) SBFB***
Turbines	54.370	30.490
Turbine Hard Stand	2.076	4.811
Roads	16.435	16.435
Borrow Pits	8.183	8.183
Temporary Construction Compounds	4.453	4.453
Substation	3.015	3.015
Met Mast	0.276	0.276
Biodiversity Felling Area	1.129	1.129
Walkway	0.963	0.963
Total Felling Area	**90.898**	**69.753**

*LBFB (Large bat felling buffer); SBFB (Small bat felling buffer)

Table 2 - Area (ha) to be permanently felled for Windfarm Development

Windfarm Infrastructure	**Area (ha) LBFB***	**Area (ha) SBFB***
Turbines	54.370	30.490
Turbine Hard Stand	2.076	4.811
Roads	16.435	16.435
Substation	3.015	3.015
Met Mast	0.276	0.276
Biodiversity Felling Area	1.129	1.129
Walkway	0.963	0.963
Total Permanent Felling Area	**78.263**	**57.117**

*LBFB (Large bat felling buffer); SBFB (Small bat felling buffer)

Table 3 - Area (ha) to be temporarily felled for Windfarm Construction

Windfarm Construction	**Area (ha)**
Borrow Pits	8.18
Temporary Construction Compound	4.45
Total Temporary Felling Area	**12.63**

Figure 1 – Forest areas to be felled for Turbines, borrow pit, temporary construction compound, roads and biodiversity felling area.

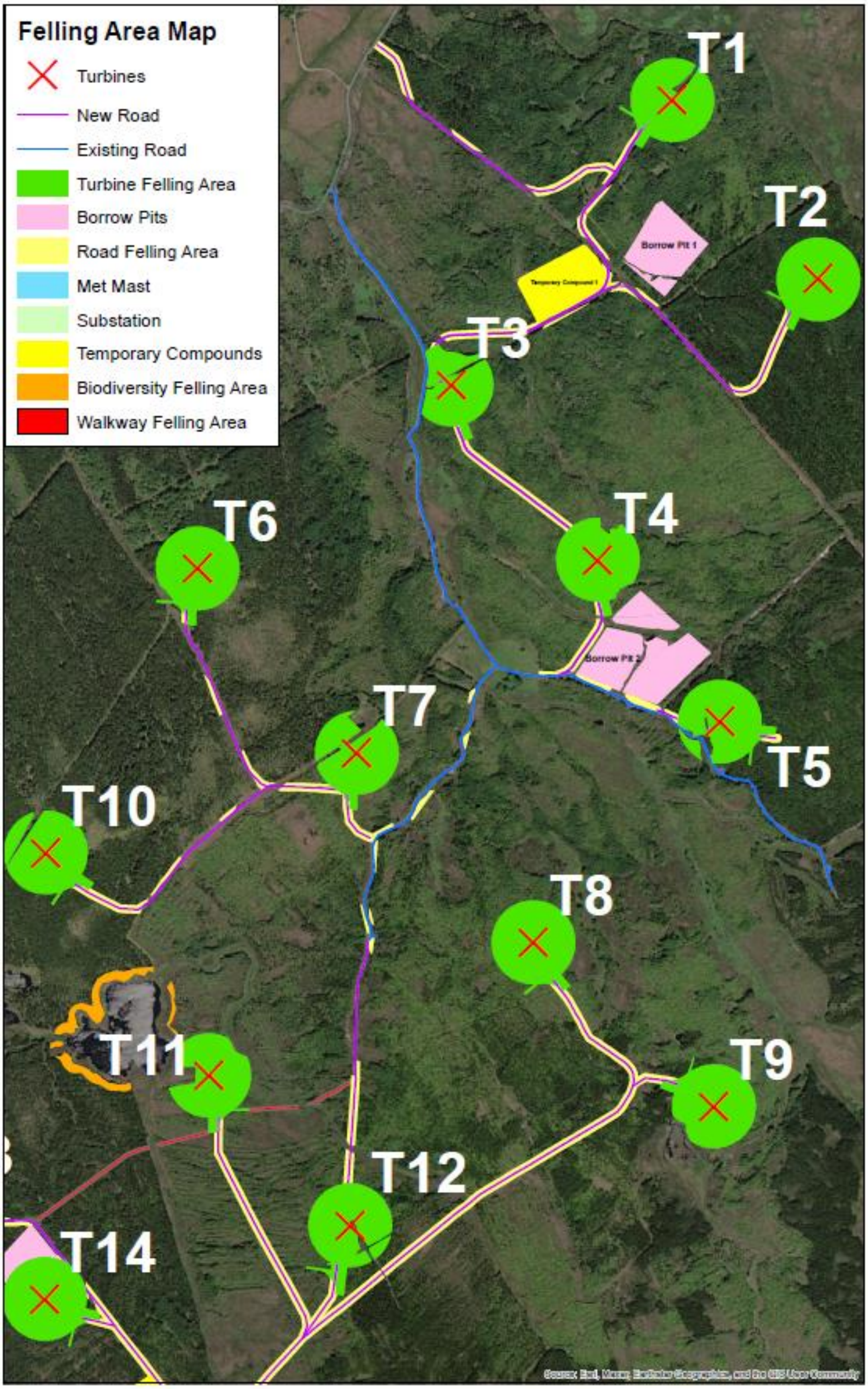
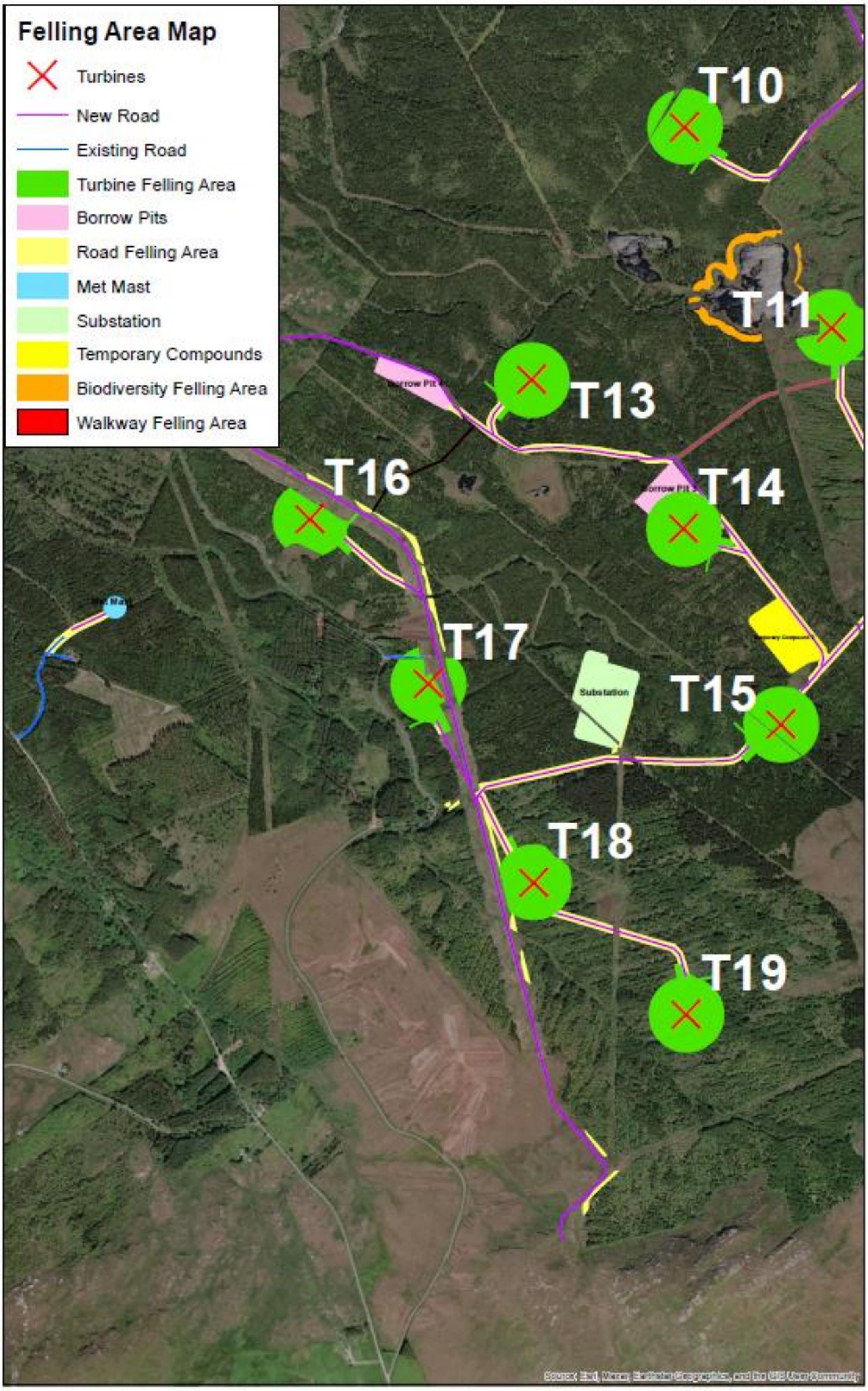


Figure 1 – Forest areas to be felled for Turbines, borrow pit, temporary construction compound, sub-station, roads and met mast.



The Coillte owned and privately owned forests in the proposed study area were planted as commercial forestry. The main tree species present is Sitka spruce planted pure and in mixture with Lodgepole pine (Plate 3). Commercial forestry includes multiple rotations of establishment, final harvest by clearfell and replanting for the forest cycle to start again. The rotation length of the different plots will vary depending on productivity, soil type and exposure. The site productivity is measured in yield class and the prevailing yield class across the site is quite low, averaging at yield class 10. The forests were planted mostly on blanket peat and have not thrived (Plate 4). There is no evidence of any harvesting having occurred, as the stands are simply not productive enough. There was very little evidence of windblow during the site visits, which is expected in a low yielding forest. The age of the forests ranged from 25 years (planted in 1997) to 38 years (planted in 1984). Many of the forest areas were in check (nutrient deficiency due to lack of nitrogen and phosphorus availability in the soil) (Plate 5), pre-thicket forest and thicket[1] (Plate 6) stage, there was very little closed canopy forest areas. The forest species and age in the infrastructural felling areas are shown in Table 4.

Table 4 – Infrastructural felling areas, Forest Tree Species, Area and Age

Infrastructure Type*	Tree Species^	Area (ha)	Planting Year
T1	SS	3.00	1989
T2	SS	3.26	1989
T3	SS	2.46	1991, 1992
T4	SS	3.04	1991
T5	SS	2.98	1992
T6	SS	1.48	1990
T7	LP	3.27	1990, 1991, 1993
T8	SS	3.16	1990, 1993
T9	SS	3.19	1993
T10	LP	4.40	1990, 1996
T11	SS	2.83	1991, 1993
T12	SS	3.18	1991, 1992
T13	SS	3.21	1992
T14	LP	3.27	1991, 1992
T15	LP	3.18	1991, 1992
T16	SS	2.33	1994
T17	SS	1.94	1993, 1994
T18	SS	2.99	1988
T19	SS	3.26	1984
TCC	SS/LP	4.45	1991, 1992
BP	SS	8.18	1989, 1991, 1992
MM	SS	0.28	1997, 1999
Roads	SS/LP	16.43	1984 to 1997
SS	SS/LP	3.01	1992, 1993
Bio	SS/LP	1.11	1990, 1992, 1993
Walkway	SS/LP	0.963	1991, 1992, 1993

* T – Turbine; Sub – Substation; TCC – Temporary Construction Compound; MM – Met Mast; BP – Borrow Pits; Bio – Biodiversity Felling Area. ^SS (Sitka spruce *Picea sitchensis*); LP (Lodgepole pine, *Pinus contorta*)

[1] Densely planted trees

Plate 3 – T17 Sitka spruce/Lodgepole pine planted in mixture

Plate 4 – T8 Unproductive Sitka spruce & Lodgepole pine pre canopy closure

Plate 5 – T5 Sitka spruce in Check (nutrient deficiency)

Plate 6 – Thicket Sitka spruce at T18

1.4.1.2 Standing Volume and Carbon

The standing volume in a forest refers to the volume in cubic metres of the standing trees present at the time of forest measurements. In order to calculate the standing volume, it is necessary to take sample measurement plots, these are laid out as 0.01ha plots. In these plots tree stocking, DBH (diameter at breast height) and Top height of the largest DBH tree is recorded. Forest measurement plots were only taken in areas where the trees were >7cm diameter at breast height as per standard forest practice. Where it was not possible to take measurements, a general yield class was taken from the forest sub-compartment data supplied by Coillte. A yield class is an estimate of the average volume production of a crop in m^3 per hectare per annum that it is estimated an even aged stand can achieve, it is an estimate of the productivity potential of the forest crop. Using the Forestry Commission Forest Yield the volume per hectare was calculated. Based on this the total volume to be removed for the windfarm development is 8,863 m3. Table 5 outlines the different Yield class, area and standing volume for the different forest areas that are to be cleared for the proposed windfarm development.

Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure

Infrastructure Type*	Tree Species	Area (ha)	Yield Class	Total Volume
T1	SS	3.00	10	352.92
T2	SS	3.26	6	383.93
T3	SS	2.46	6	205.09
T4	SS	3.04	6	244.15
T5	SS	2.98	6	247.70
T6	SS	1.48	10	140.31
T7	LP	3.27	10	221.47
T8	SS	3.16	6	219.81
T9	SS	3.19	6	221.82
T10	LP	4.40	10	691.53
T11	SS	2.83	6	151.35
T12	SS	3.18	6	159.81
T13	SS	3.21	6	107.63
T14	LP	3.27	6	160.29
T15	LP	3.18	10	271.65
T16	SS	2.33	6	195.13
T17	SS	1.94	0	59.16
T18	SS	2.99	10	597.65
T19	SS	3.26	6	381.13
TCC	SS/LP	4.45	6 & 12	616.34
BP	SS	8.18	Various	855.86
MM	SS	0.28	14	87.06
Roads	SS/LP	16.43	Various	1801.09
SS	SS/LP	3.01	6	260.80
Bio	SS/LP	1.11	6	152.47
Walkway	SS/LP	0.963	6/8	77.22
Sub-total		**90.898**		**8863.26**

Forest Carbon

The ability of forests to store and sequester atmospheric carbon is well known and established. Indeed, forests represent the largest global terrestrial store of carbon, containing approximately 39% of global soil carbon and 77% of global vegetation carbon (Bolin et al. 2000). Trees absorb carbon dioxide from the atmosphere for growth, convert it to wood and release oxygen back to the atmosphere. Harvesting the trees before they die naturally (and return their carbon to the atmosphere) locks the carbon into the wood and harvested wood products. Replanting the trees then begins the cycle of carbon storage immediately.

The Carbon cycle in forests is characterised by a number of carbon pools. Pools are locations of carbon in the forest, such as the above- and below-ground biomass, forest floor and soil. The above ground biomass consists of stemwood, branchwood, bark and foliage and is the carbon pool that is referred to here.

Carbon sequestration in woodland biomass is restricted to the long-term average carbon stock that is projected to accumulate on the site in the woody biomass. Carbon values are based on those used in the UK Woodland Carbon Code (https://www.woodlandcarboncode.org.uk/), a voluntary standard for woodland creation projects and the amount of carbon dioxide they can sequester based on different types of tree species, yield class, stocking and forest management. The Woodland Carbon Code calculator has been chosen due to the choice of species and management and the similar assumptions and conditions that exist in forest management data in the UK and Ireland, and due to the absence of similar data in Ireland currently. The total forest carbon that would be removed due to the proposed windfarm development is 18,831 tCO^2e, Table 6 - Total Carbon (tCO^2e) in the Above Ground Woody Biomass. Much of this carbon will be locked up in the harvested wood products that are produced from the timber such as fencing material, decking, pallet wood, fibreboards, plywood, laminates or used as wood fuel to displace fossil fuels.

Furthermore, an equivalent area of land is being replanted to account for the permanently felled areas of 78.263 ha. The Temporary felled areas of 12.63ha will be replanted in situ and so the forest carbon cycle starts again, Please note he type of land that will be replanted under a current afforestation licence will not be peat soils, it would be mineral soils which will have higher yields and therefore carbon storage, so the forests planted on replacement lands will have higher carbon storage capacity than the forests to be felled at the proposed Cloghercor Wind Farm Site. Therefore, any loss of forest carbon due to this proposed windfarm development is only a temporary loss of carbon, which would occur at different stages through normal commercial forest management of harvesting and replanting.

Table 6 – Total Carbon (tCO^2e) in the Above Ground Woody Biomass

Infrastructure Type*	Tree Species	Biomass Sequestration (tCO2e/ha)	Total Carbon (tCO2e)
T1	SS	337	606
T2	SS	195	382
T3	SS	195	360
T4	SS	195	445
T5	SS	195	435
T6	SS	337	500
T7	LP	448	1465

T8	SS	195	617
T9	SS	91	289
T10	LP	385	1693
T11	SS	195	276
T12	SS	195	465
T13	SS	195	313
T14	LP	231	378
T15	LP	385	1103
T16	SS	91	211
T17	SS	269	260
T18	SS	337	1006
T19	SS	252	821
TCC	SS/LP	195	607
BP	SS	337	1928
MM	SS	280	55
Roads	SS/LP	337	3872
SS	SS/LP	195	411
Bio	SS/LP	195	152
Walkway	SS/LP	269	180
Total			**18831**

1.5 POTENTIAL EFFECTS

This section addresses the potential impacts on the surrounding environment due to the felling and removal of the trees for the proposed wind farm. The potential impacts include soil disturbance and compaction, carbon loss, water quality (sediment & nutrient) and potential effects on biodiversity from the proposed infrastructure works.

1.5.1 Do Nothing Scenario

In the do-nothing scenario, if the proposed wind farm development for which this EIAR has been prepared does not proceed, the existing practice of commercially managed forest would continue, i.e. it would be harvested in line with sustainable forest management practices on a continuous basis and replanted in line with the requirements of the felling license as per the Forestry Act 2014, on a continuous basis. Felling would normally take place when the crop reaches its MMAI (Maximum Mean Annual Increment) minus 20%. Due to the exposed nature of the site and incidences of windblow some areas may be felled before MMAI. It should be noted that any of the potential impacts in Section 1.5.2.1 Potential Effects Felling and Removal of Trees for the Construction Phase due to clearfelling and subsequent replanting would also occur in the do-nothing scenario under the normal felling cycle.

1.5.2 Construction Phase

1.5.2.1 Felling and Removal of Trees

A number of potential effects can arise from forest harvesting. Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by manual and mechanical means as outlined in Section 1.2.

The associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)
- Biodiversity impact
- Landscape impact

The potential impacts of the proposed felling and onsite replanting activities are assessed in the EIAR.

1.5.2.1.1 Soil Disturbance and Compaction

The movement of harvesting machinery over the soil can contribute to soil disturbance and compaction. Potential adverse impacts include:

- Felling and extraction machines unsuited to the site and material, leading to crop, soil and machine damage
- Excessive haulage distances to roads, leading to site soil damage
- Damage to the soil such as rutting and compaction by extraction machines due to overloading
- Inadequate brash mats, leading to soil damage and sedimentation
- Machine damage to drains
- Site and environmental damage due to poor timing and failure to curtail operations in adverse weather conditions
- Sediment entering aquatic zones
- Brash and debris in aquatic zones
- Rutting and compaction through the overuse of tracks

The main sources of sediment in forest activities due to harvesting are:

- Disruption of the soil surface by harvesting machinery, removal of tree cover causing the soil to be exposed to erosion and eventually the transportation of the finer particles by overland flow.
- Weathering of parent material resulting in particle movement by overland flow.
- The transportation of loose or decaying organic particles.

Due to the fact there are many ages classes that are to be felled i.e. commercial and non-commercial timber, it is envisaged that any commercial timber will be removed from the site for haulage to a timber sawmill. A proportion of construction traffic for the windfarm development will be associated with the haulage of the timber from these felling activities. Based on the volume of timber to be harvested as detailed in Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure, this will involve approximately 300 articulated timber truck movements. Any timber that is not of merchantable quality, i.e. less than 7cm diameter relates to the tops of trees and branches known as lop and top and will be left on site where the trees are felled. This protects the soil and provides deadwood for habitat Where full tree removal is required for infrastructure such as turbine hardstands, substation, met mast, roads etc. smaller trees can be removed by excavator and/or tree shears depending on size. In the bat felling buffer areas, any timber that is not of merchantable value i.e. lop and top will be left on site so as to minimize disturbance.

1.5.2.1.2 Carbon Loss

There will initially be a decrease in the carbon sequestration potential of the forest due to the clearfelling of 90.898 ha for infrastructure and construction felling associated with the footprint of the proposed development. As referred to in section 1.4.1, infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and temporary construction compounds. The maximum total carbon that would be removed due to the felling of the 90.898 ha is 18,831 tCO^2e, if the smaller bat felling buffer area of 69.753 ha was used then the carbon loss would be approx. 13,382 tCO^2e. Some 78.263 ha will involve permanent forest removal for infrastructure felling and an equivalent area of bare land will be afforested as replacement land (this will happen elsewhere in the state, in a different water catchment and county and will be subject to separate consenting and assessment process) in lieu of this within 2 years of clearfelling as required under the Forestry Act 2014. The remaining 12.63 ha that will be temporarily felled will be replanted in the same location as soon as proposed development is completed. Therefore, although there will be a temporary loss of carbon, the overall impact on carbon stock will be neutral.

1.5.2.1.3 Water Quality Impact

Harvesting and associated activities such as extraction have the potential to cause temporary and local damage to soils and adversely impact on water quality, through increased erosion rates, sedimentation and nutrient losses. However, adherence to best practices will minimise this risk. All water and hydrological impacts are assessed in detail in Chapter 9. The main sources of sediment from harvest operations are described in Section 1.5.2.1. The key factors associated with sediment release and potential water quality impact during harvest operations are:

- Soil type, sensitivity and slope – the soil conditions at Cloghercor are peat soils (See Chapter 8 Land, Soils and Geology). As outlined in *Forestry and Water Guidelines* correct buffer zone management will help reduce the risk of sedimentation
- The felling and extraction system and harvesting machinery to be used including number and type of machine passes
- Operation details such as extraction routes, landing bays for harvested material, location of machine maintenance, refuelling and repair areas and storage areas for fuel, motor oils, lubricants and chemicals.
- Availability of brash material (lop and top) for placing under machines to protect the soil. This is more of a concern in forest thinning operations where brash availability is low then in clearfell operations as proposed here and would be a low risk.
- Environmental receptors such as water features, including aquatic zones, relevant watercourses, hotspots, water abstraction points and crossing points.

With regard to the source of nutrients, during clearfelling there is a higher potential for nutrient loss as there are no living tree roots left to take up the nutrients. Any organic matter (particularly recently dead material such as brash or roots) that is left on site to rot will release phosphorus and nitrogen. Decaying brash resulting from the clearfell can generate nutrients which could potentially lead to nutrient enrichment of any small first order streams. The breakdown of brash, roots and other organic matter takes a number of years. Potentially a clearfell site continues to release phosphorus to the aquatic zone for at least three years after clearfelling. The rate of decomposition is influenced by temperature, moisture and humidity. Consequently, phosphorus loss tends to be greatest during the warmer months and may be particularly problematic during a flood event following a prolonged hot and dry period (Cummins & Farrell 1999 & 2003; Rodgers et al 2010)

In addition to sediment and nutrient release, accidental spillage or leakage of chemicals potentially used on site (herbicides and pesticides during reforestation operations and urea sprayed on freshly felled tree stumps to prevent the spread of disease as is a condition of all felling licenses in Ireland), fuel and machine oils (hydraulic, engine, gearbox, lubricant or cutting oils) are detrimental to aquatic flora and fauna and impair water quality; however adherence to best practices will minimise this risk; mitigation measures are outlined under Section 1.6.

It should be noted that potential impacts on water quality as outlined above as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting at Cloghercor.

1.5.2.1.4 Biodiversity Impact

Wildlife habitats can be affected during harvesting, especially the removal of the forest canopy. Mature conifer stands are important wildlife habitats for a variety of birds and other fauna.

In Chapter 6 of the EIAR, Biodiversity, the potential impacts section assesses in detail the potential impacts on habitats from the tree felling associated with the wind farm development.

It should be noted that any potential impacts on biodiversity as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Cloghercor.

1.5.2.1.5 Landscape Impact

The visual effect of the premature harvesting of trees is assessed in Chapter 13 of the EIAR, Landscape and Visual Impact Assessment.

Brash left onsite after clearfelling can be unsightly, particularly if the forest flanks a scenic route. The majority of the areas to be clearfelled for the proposed development occur within commercially managed forestry.

It should be noted that any potential impacts on the landscape as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Cloghercor.

1.6 MITIGATION MEASURES

1.6.1 Construction Phase

Comprehensive planning (as outlined in Section 1.6.1.1 Harvest plan) combined with best practice operating techniques will ensure the protection and enhancement of the environment at the proposed Cloghercor Wind Farm Development. Felling operations associated with this project will adhere to the *Felling and Reforestation Policy (Forest Service), Standards for Felling and Reforestation (Forest Service), Code of Best Forest Practice (Forest Service 2000b), Forest*

Harvesting and the Environment (Forest Service 2000c) and Forest and Water Quality Guidelines (Forest Service 2000a).

Notwithstanding the hydrological distance from the proposed development site to any Natura 2000 site or fisheries sensitive area, the potential sediment and nutrient loss risks will be managed through the application of the mitigation measures outlined hereunder and in the mitigation measures of the EIAR outlined in Chapter 5 Population and Human Health, Chapter 6 Biodiversity: Flora & Fauna, Chapter 7 Biodiversity: Ornithology, Chapter 8 Land, Soils and Geology, Chapter 9 Hydrology and Hydrogeology, Chapter 13 Landscape and Visual Impact and Chapter 14 Air Quality & Climate.

The Harvest Plan (Section 1.6.1.1) and associated Harvest Plan Maps, outline the measures to be implemented with regard to forest harvesting at the proposed development site for Cloghercor Windfarm development.

All forestry operations are to be undertaken in accordance with current best practice guidelines as listed in the Harvest Plan, which details practical measures to protect the existing environment.

Further information on mitigation measures for onsite activity are provided in the various EIAR chapters, as well as the CEMP (Appendix 2 to this EIAR).

1.6.1.1 Harvest Plan

A harvest plan outlines strict environmental guidance to minimise environmental and social disturbance. This harvest plan is specific to forest harvesting operations and is the standard plan used by the felling license authority of the Department of Agriculture, Food and the Marine. It encompasses all possible felling methods, social and environmental considerations and measures to protect same, only those of relevance to the tree felling at Cloghercor Windfarm have been selected.

Harvest Plan for Felling at Cloghercor Windfarm, Co Donegal

Proposed Felling & Reforestation Methods	
Thinning (incl. CCF)	☒ N/A ☐ Harvester ☐ Chainsaw ☐ Forwarder ☐ Tractor/Quad ☐ Skyline ☐ Other (specify):
Clearfelling	☐ N/A ☒ Harvester ☒ Chainsaw ☒ Forwarder ☐ Tractor/Quad ☐ Skyline ☒ Other (specify): Excavator with/without shear grab
Reforestation	☐ N/A ☒ Windrowing ☒ Pit planting ☐ Mounding ☐ Scrap mounding ☐ Scarification ☐ Other (specify):
Site access (i.e. via forest road)	☒ Present ☒ Planned ☐ Not required ☐ Other (e.g. temporary roading/forest track):
Social & Environmental Features & Considerations	

Social	Habitat & Biodiversity	Soil & Water
☐ Recreational usage	☒ Designated area (SAC, SPA, etc.)	☒ Aquatic zone(s) on/adjoining site
☐ Adjoining dwelling(s)	☐ Broadleaves/diverse conifers	☒ Relevant watercourse(s)
☐ Right(s)-of-way present	☐ Hedgerows	☐ Water-related 'hotspots'
☒ Utilities (power lines/water main)	☐ Old/veteran trees	☐ Water abstraction point
☐ Sensitive landscape	☐ Large scale deadwood	☒ Peaty or peaty/gley
☐ Important viewpoint(s)	☐ Badger sett, rookery, etc.	☒ Steep slope(s)
☐ Archaeological site(s) & feature(s)	☐ Protected fauna	☐ Water setback(s) present & intact
☐ Cultural feature(s)	☐ Protected flora	☐ Supply of brash limited
☐ Anti-social (dumping, fire, etc.)	☐ Wetland habitat	☐ Other:
☐ Other (specify):	☐ Other (specify):	☐ Other:

Proposed Measures to Protect Social & Environmental Features & Considerations	
☒ Consult with local residents	☐ Establish excl. zones around arch. sites/features
☒ Erect safety signage	☒ Temporary bridging points (TBPs) required
☒ Onsite briefing of all operators, pre-commencement	☒ Install water setback at refor.
☒ Carefully selected refuelling/repair/storage depot	☐ Install dwelling setback at refor.
☐ Measures to protect right(s)-of-way	☐ Install public road setback at refor.
☐ Measures to protect service features	☐ Install archaeological setback at refor.
☐ Measures to protect habitats & biodiversity features	☐ Install biodiversity setback at refor.
☐ Limit operations to dry weather	☐ Install landscape setback at refor.
☒ Daily visual monitoring of ground conditions	☐ Inclusion of Refor. Objective 'CCF'
☒ Daily visual monitoring of water	☐ Inclusion of Refor. Objective 'BIO'

Proposed Measures to Protect Social & Environmental Features & Considerations (Cont..)	
☐ Water sampling	☐ Forest edge planting
☒ Install silt traps/barriers	☐ Environmental setback planting
☒ Drain blocking/slow-water dams	☐ Other (specify)
☒ Utilise brash mats along extraction routes	☐ Other (specify)

☒ Exclude machinery in areas adjoining aquatic zones, water abstraction points & water-related 'hotspots'	☐ Other (specify)

Ancillary Information (include relevant information to expand on above & to detail important aspects such as the sequencing of operations, the width of environmental setbacks & contingency planning. Ensure accurate cross-referencing and consistency with maps)

The below listed guidelines will be adhered to for harvesting:

Interim Standards for Felling and Reforestation Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019

Forestry and Water Quality Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and the Landscape Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and Archaeology Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Biodiversity Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Harvesting and Environment Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Protection Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017

Electricity at Work: Forestry Irish Forestry Safety Guide (IFSG) 804

Any person entering the site must report to the Forestry Works Manager (FWM), if you cannot contact the FWM then please contact the Site Safety Co-ordinator (SSC), as this is a live working site it is prohibited for any member of the public to access the site without first contacting the FWM or SSC and arranging to meet with them.

All contractors will be briefed prior to operations starting.

All local residents will be contacted to inform them that harvesting is about to commences.

<u>**Harvesting**</u>

Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by mechanical means which includes a harvesting machine which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (namely pulp, stakewood, palletwood, sawlog) and a 8 wheel mounted forwarder to collects the different timber assortments and stacks them at the roadside for removal by the timber lorries to the sawmill.

Low ground pressure harvester and forwarder is to be used for all clearfelling operations. In areas where it is not feasible to cut the trees by harvester due to the trees being too small (i.e. <7cm DBH) an excavator with tree shears will be sufficient to cut and windrow trees and stump removal. The brash will be left to decompose. For the footprint of the proposed infrastructure there will be full tree removal to facilitate the windfarm development infrastructure.

Clearfelling operations should be carried out during suitable weather conditions where feasible. Where felling is to be carried out adjoining any buffer zones or set back areas, the timber should be felled away from these zones. Any timber stacking for removal should also be outside these buffer zones and setback areas.

Maintenance and refuelling area will be stored on a dry elevated site 50 metre from aquatic zones and 20 metres from any relevant water courses. Fuel tanks are to be double bonded and lockable. Fuel, chemical and oil containers must not be rinsed on site. Fuel, chemical and oil are not to be emptied in relevant watercourses drains or sediment traps. All materials used for maintenance will be removed from site when work is completed.

Timber stacks will be no more than 4 metre height.

Brash will be used along harvesting and extraction routes for soil protection. Forwarder will be loaded to manufacturers specifications and not overloaded to avoid overloading and unnecessary soil compaction. On difficult terrain reduced loads will be used to avoid rutting. Brash will be used to repair and maintain extraction routes as required. Excessive tracking to be avoided. Extraction routes to be planned to minimise the number of crossing points. Extraction route marked with black arrows on harvest plan maps.

No harvesting machinery will operate on public roads. Public roads will be kept free of soil and debris.

Silt traps will be installed within the drains along roadside drains and along extraction routes and relevant watercourses as required to intercept sediment and needles. Silts trap will consist of straw bales placed in the drain. The bales will be anchored in place. A channel will be dug in front of the bales. This will allow the water to pool prior to passing through the straw bales.

Where crossing drains is required, this will be done by constructing a crossing point. This will be done by laying logs in the drain length ways so as not to restrict the flow of water (temporary bridging point). Brash (branches) will be placed across the logs. The crossing point will be maintained during its use and removed when works are completed. The crossing point will be monitored for any possible water flow restriction and material deposited in the drain. If any material is deposited in the drain, it is to be removed immediately. The removal of the crossing point will ensure that the banks will remain undisturbed, and the material removed that the sediment remains undisturbed. Crossing points will be at right angles to water flow.

Onsite supervision and checks are necessary to ensure that felling and extraction operations are carried out appropriately and that water protection measures are adequate and remain effective throughout, and also to trigger contingency measures, if necessary (e.g. to cease operations if rainfall creates a risk of sediment mobilisation and runoff).

Relevant water courses crossing will be crossed using a temporary log bridge. This will be done by laying suitable logs across the water course. The logs will be anchored in place with the use of stakes to prevent spreading. The bridge will be layered brash to prevent material failing into the relevant water course. Silt traps will be installed at relevant water course crossing. Where a relevant watercourse is to be in permanent use, a culvert will be installed.

Machine exclusion zones will be located on all aquatic zones adjoining area to be felled. There areas will be clearly marked on the ground. Trees within the exclusion zone will be felled by reaching in the harvester boom head into the exclusion zone and felling and removing the tree. Processing will take place outside the exclusion zone. Trees outside the reach of the harvesting boom will be felled by chainsaw to within reach of the harvesting machine boom for removal and processing. Trees that cannot be felled within reach of the harvester boom will be felled to waste.

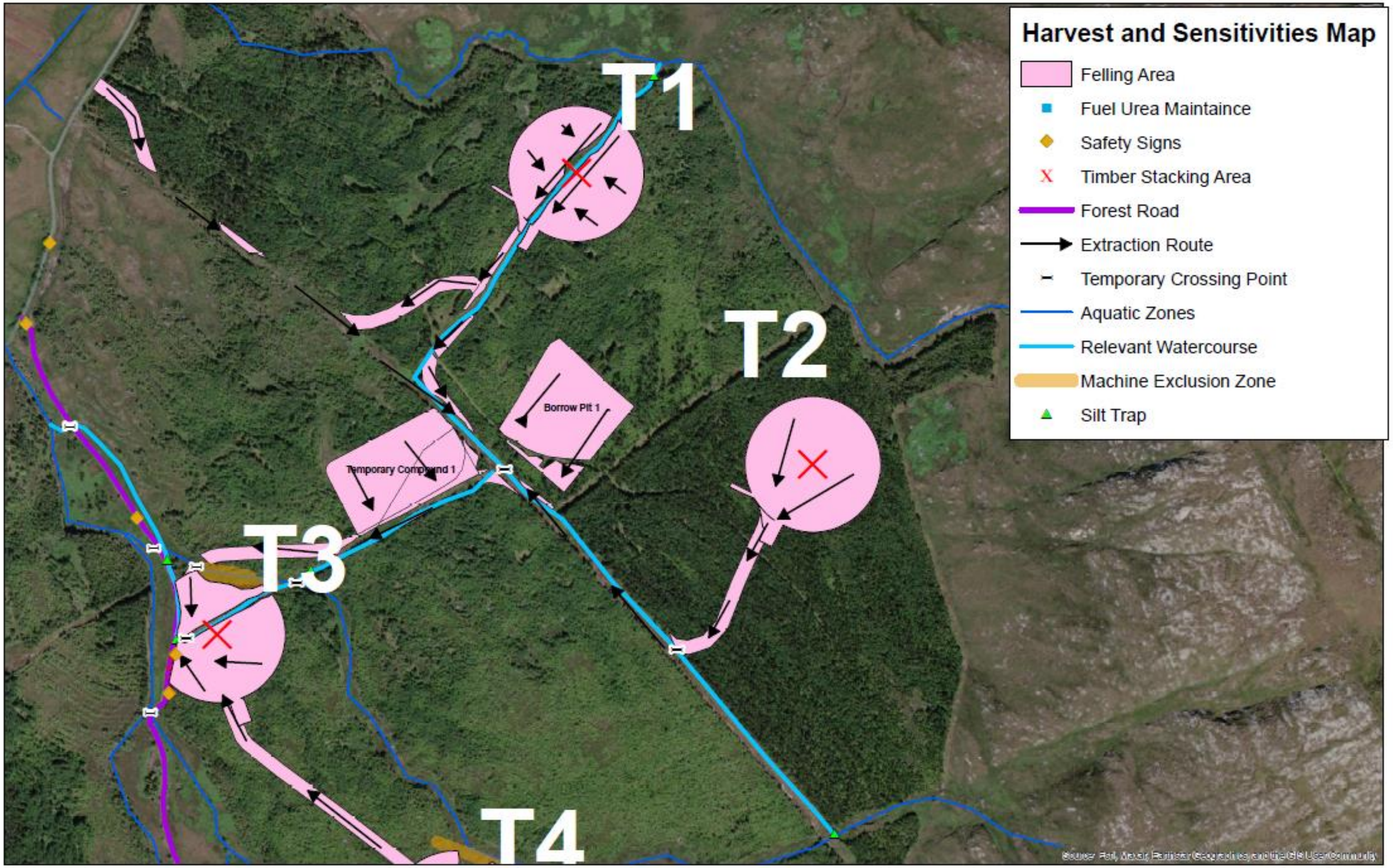
ESB will be contacted prior to felling along powerlines. Goal posts are to be erected with a minimum height of 4.2 metres with a safe corridor established under the powerlines. Warning signage to be erected.

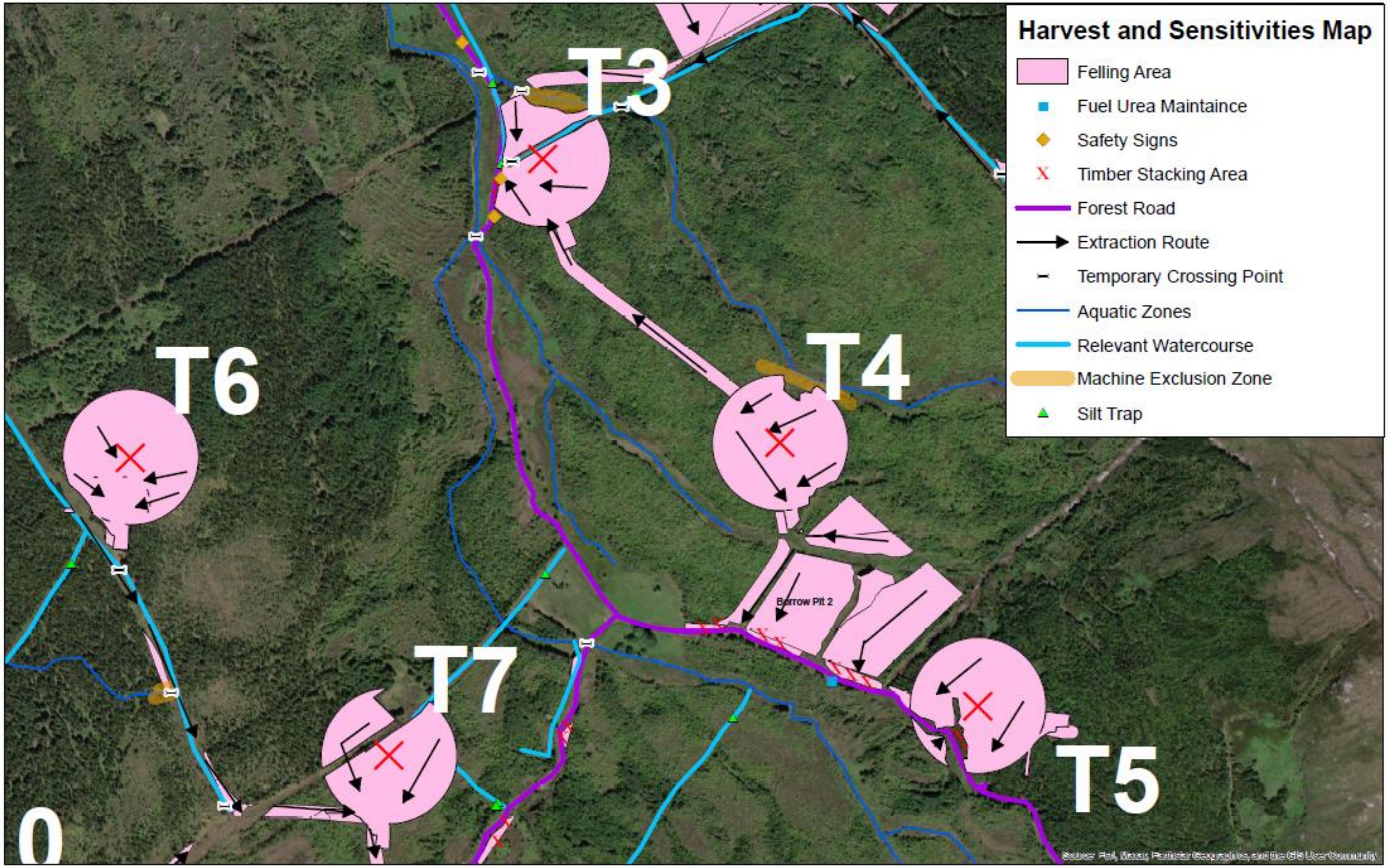
Urea will be applied immediately to tree stump after the tree has been cut. Urea will not be used within 10 metre of relevant watercourse or aquatic zone or where the peat dept is greater than 25cm.

Onsite supervision and checks are necessary to ensure that felling and extraction operations are carried out appropriately and that water protection measures are adequate and remain effective throughout, and also to trigger contingency measures, if necessary (e.g. cease operations if rainfall creates a risk of sediment mobilisation and runoff).

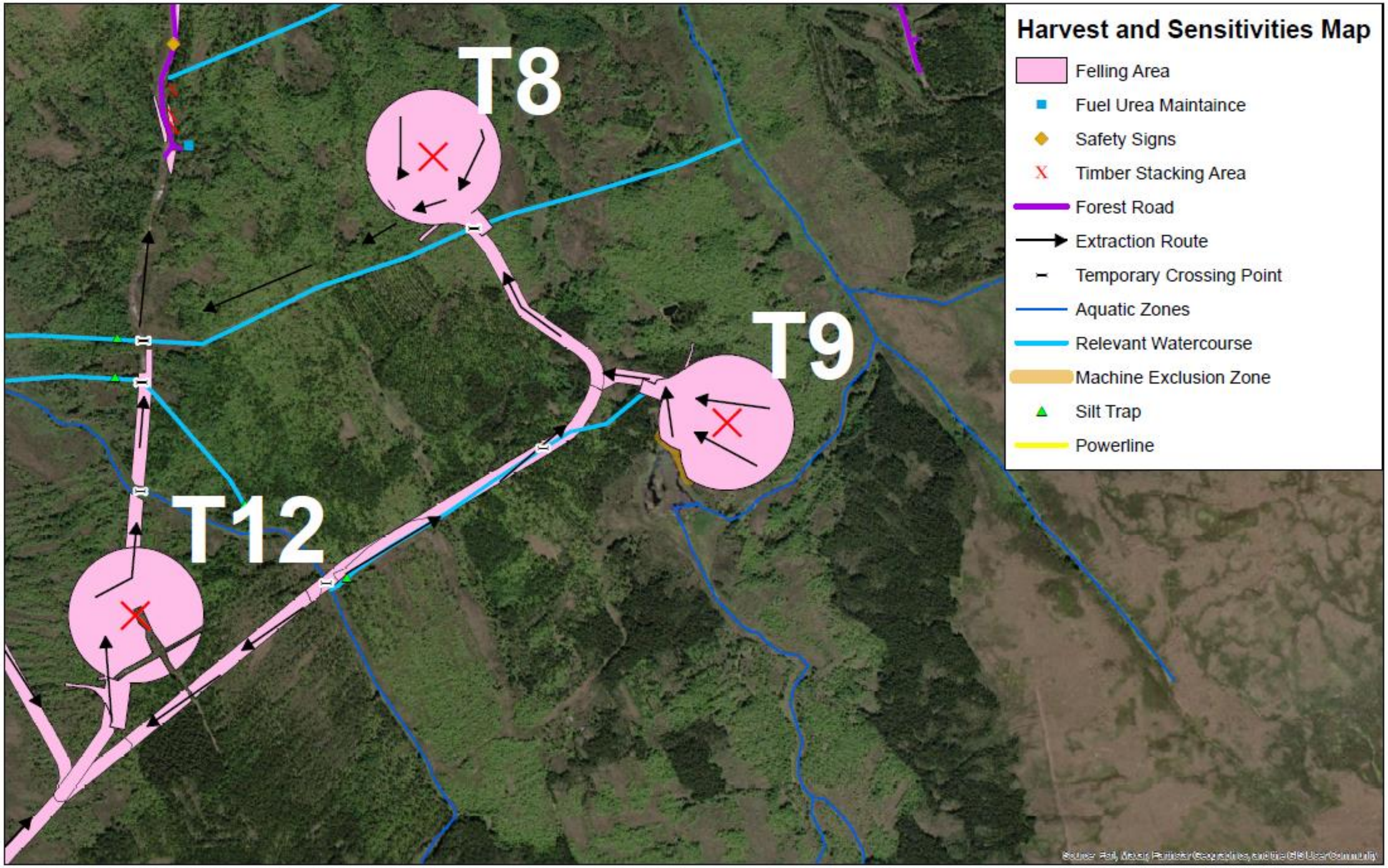
All sub-contractors should be briefed prior to operations starting and a copy of the Harvest Plan and Harvest plan maps made available to them.

Figure 4 - Harvest Plan Maps for Turbines 1-19, Substation, Roads, Met Mast, Borrow Pits, Temp Construction Compounds, Bio Felling area

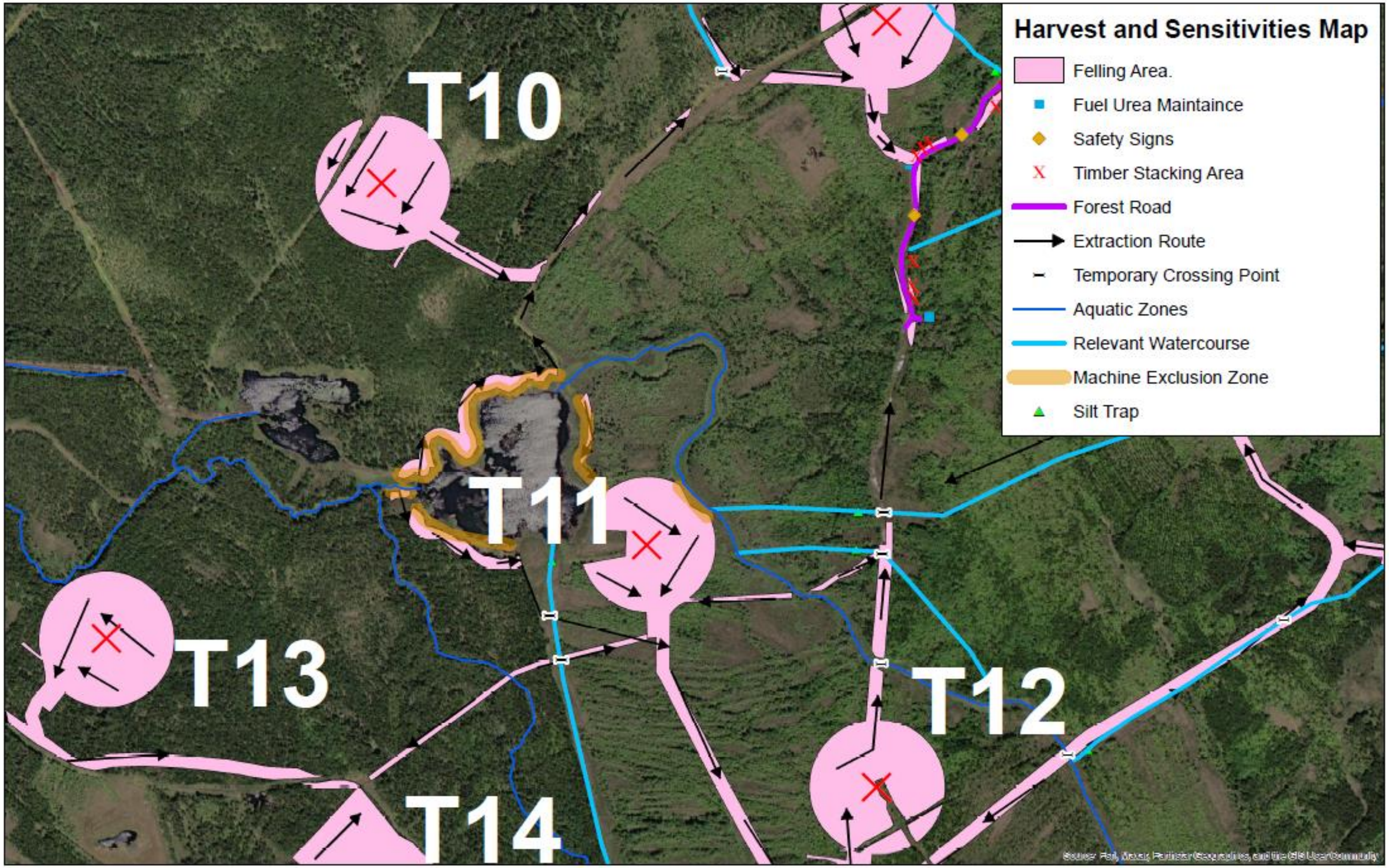




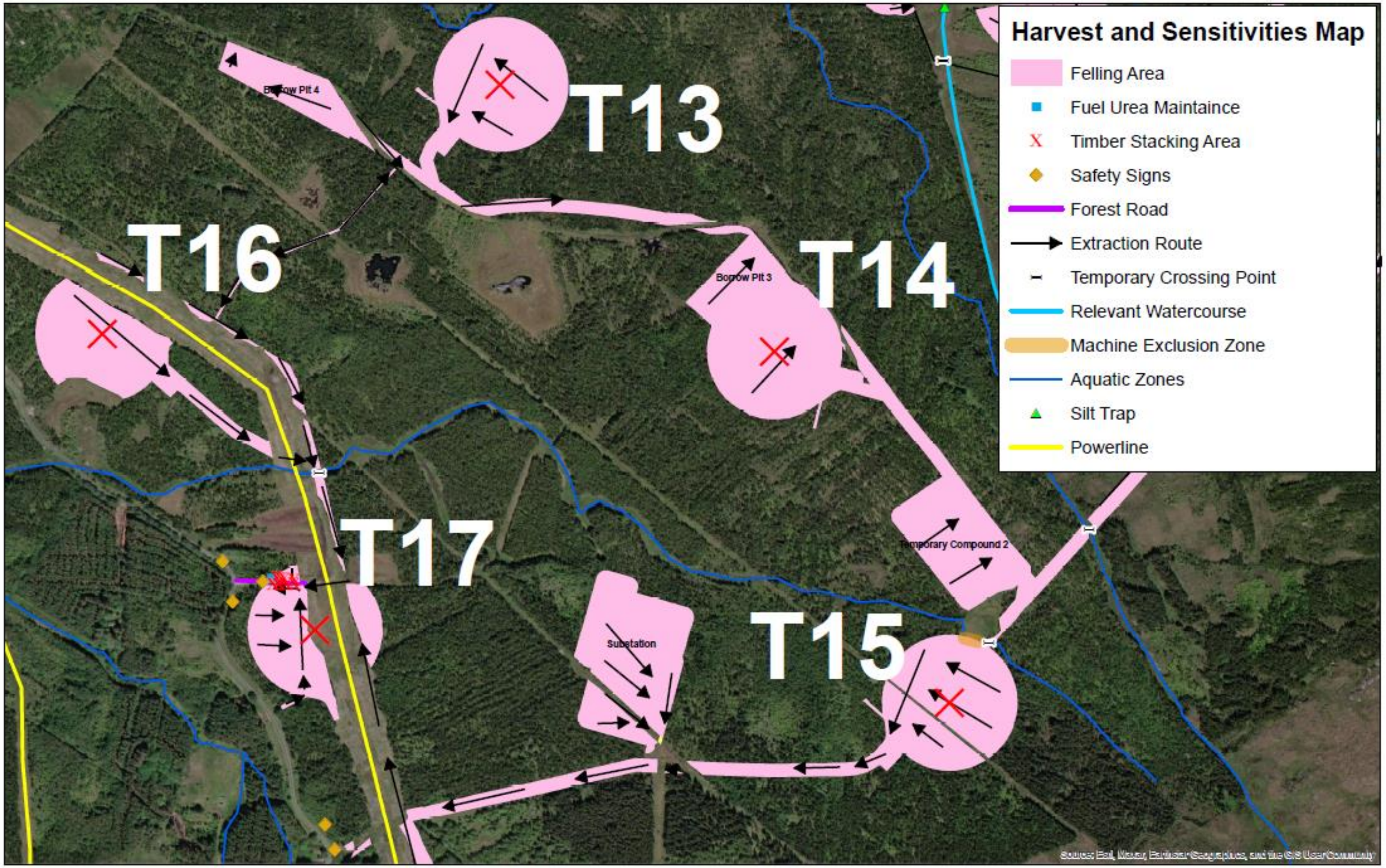
Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
T3
T4
T5
T6
T7
Borrow Pit 2
0

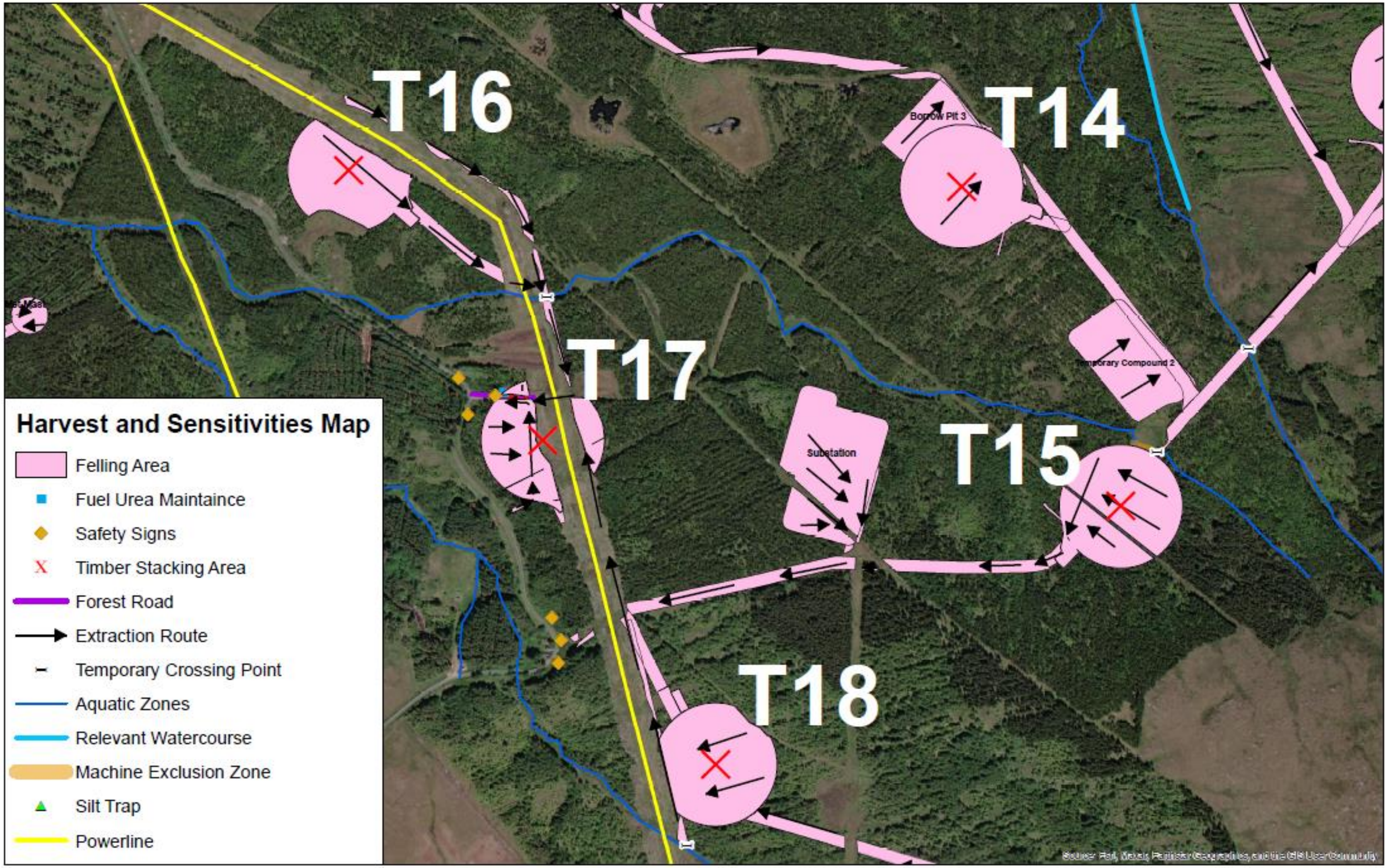


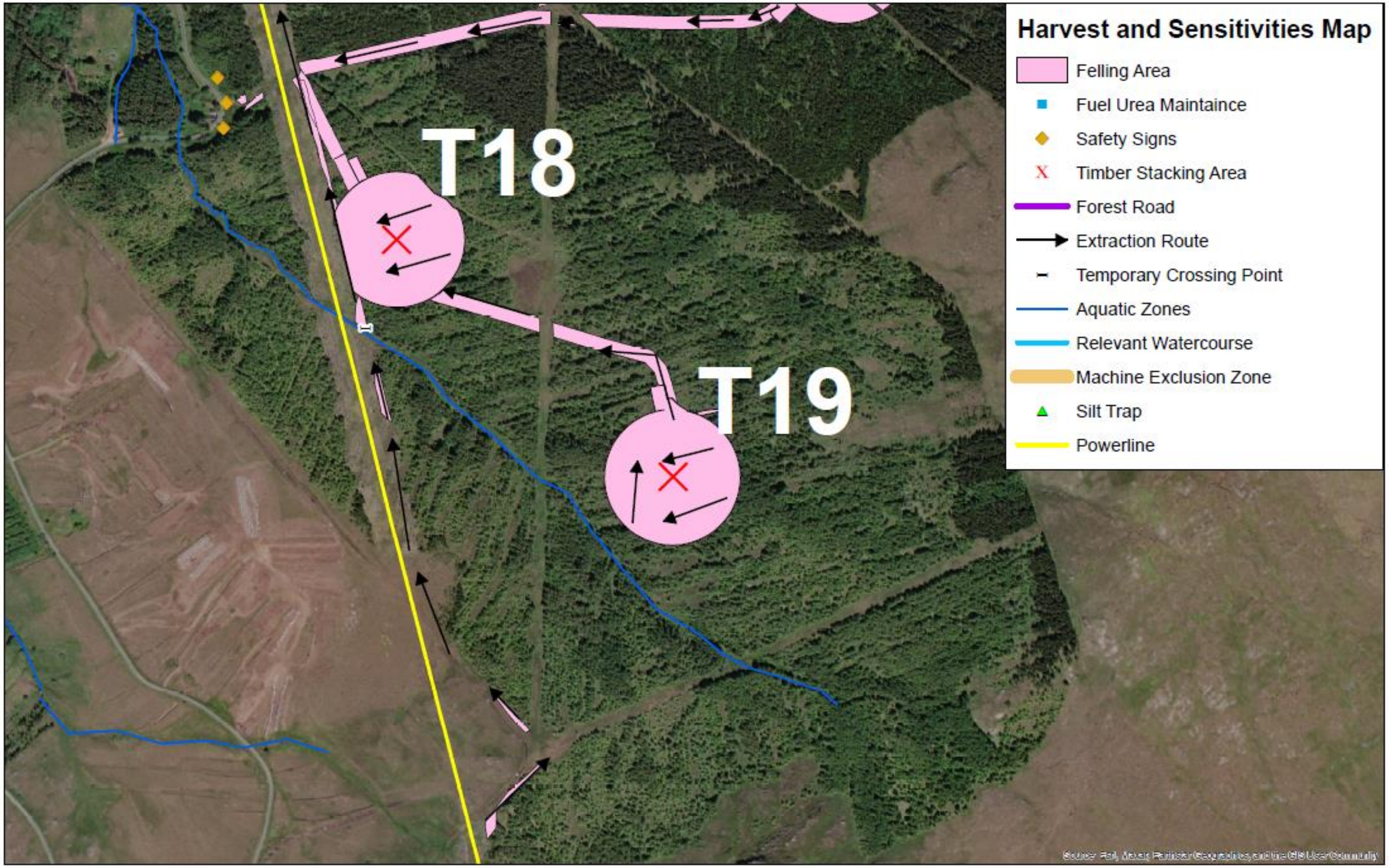
T8
T9
T12
Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline



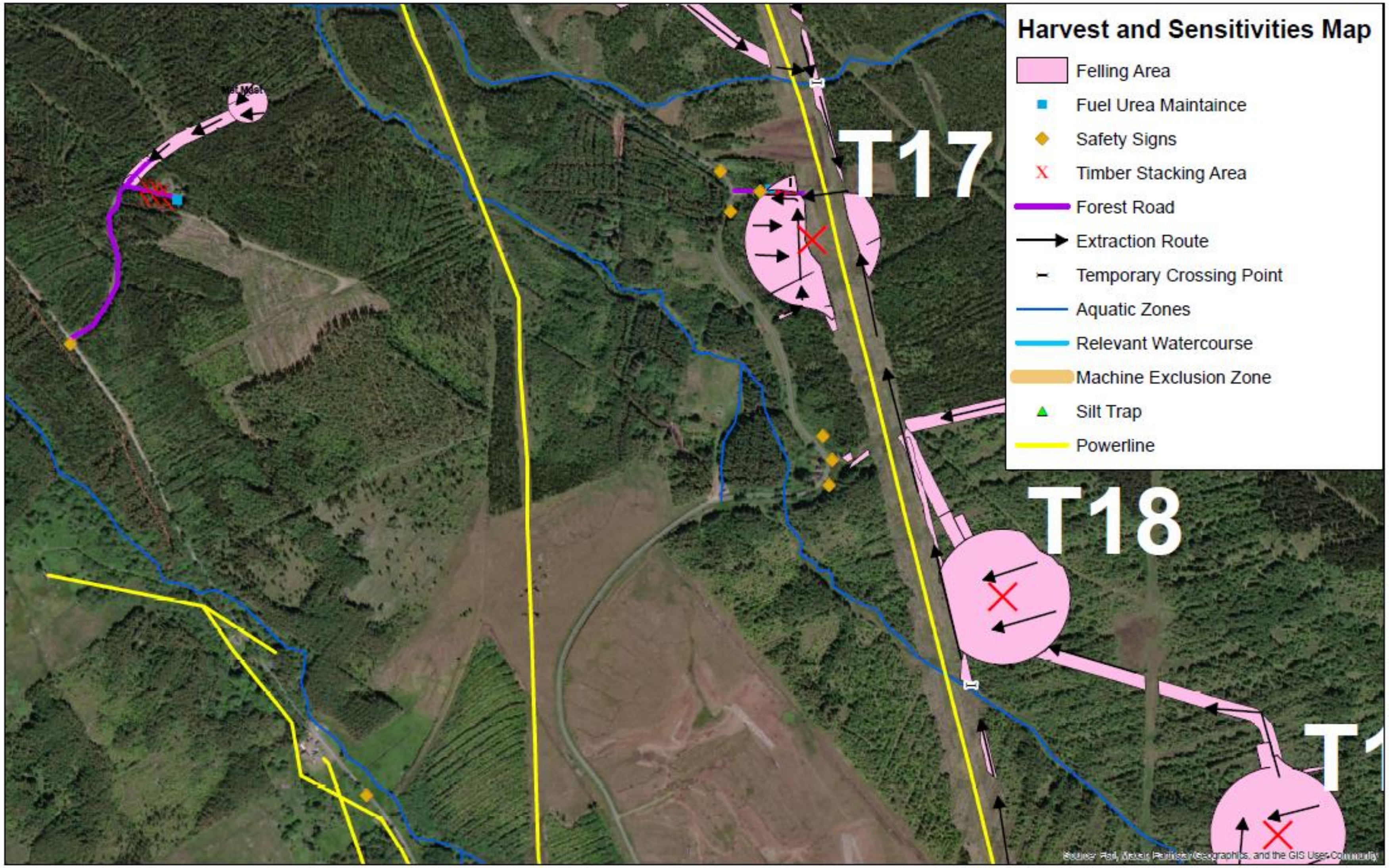
Harvest and Sensitivities Map
Felling Area.
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
T10
T11
T12
T13
T14


Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Timber Stacking Area
Safety Signs
Forest Road
Extraction Route
Temporary Crossing Point
Relevant Watercourse
Machine Exclusion Zone
Aquatic Zones
Silt Trap
Powerline
T13
T14
T15
T16
T17
Borrow Pit 4
Borrow Pit 3
Temporary Compound 2
Substation


T16
T14
T17
T15
T18
Borrow Pit 3
Temporary Compound 2
Substation
Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline
T18
T19



Harvest and Sensitivities Map
Felling Area
Fuel Urea Maintaince
Safety Signs
Timber Stacking Area
Forest Road
Extraction Route
Temporary Crossing Point
Aquatic Zones
Relevant Watercourse
Machine Exclusion Zone
Silt Trap
Powerline
T17
T18

1.6.1.1.1 *Harvesting Site Specifications*

All staff must wear high visibility jacket and hard hat at all times. Chainsaw contractors must wear all required PPE equipment during operations set out in the Health & Safety Authority's (HSA) *Code of Practice for Managing Safety & Health in Forestry Operations*. All personnel on site must have appropriate Health and Safety training.

Agreed Truck Types: Artic ☑ Rigid ☐ Rigid and Trailer ☐

EMERGENCY CONTACT NUMBERS

Agencies	**Telephone**	**Location**
Coillte Forest Representative	TBC	Donegal
Garda Síochána	999; (074) 9551080	Glenties, Co Donegal
NPWS District Conservation Ranger, Donegal North	(01) 539 3433	NPWS Northern Region
Forest Service Inspector Martin Regan	087-2536562	Glenties, Co Donegal
Fire Station	999 or 112 (074) 955 1275	Glenties, Co Donegal

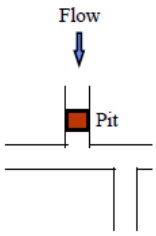
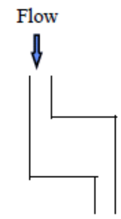
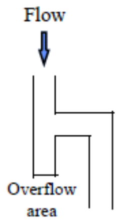
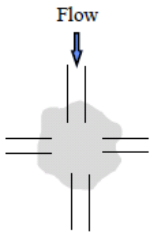
It is essential that all forest workers and machine operators involved in any forest operation are made aware of and understand the Forest Service Environment Guidelines, all relevant environmental issues relating to the site and the working practices which minimise environmental disturbance. All operators will have contact telephone numbers onsite for all relevant agencies (Owners, Local Authorities, Regional Fisheries Board, NPWS, Garda Síochána, etc.) in case of accidental damage to aquatic zones, archaeological sites, important wildlife habitats and other environmental features. Furthermore all Coillte forest workers and machine operators will have completed the Coillte Environmental Risk Assessment Training as well as all appropriate training and certification as required for harvesting operations.

Further information in relation to site safety and operations can be found in the Construction & Environmental Management Plan which forms Appendix 2 to Chapter 2 (Description of the Proposed Development) of this EIAR.

1.6.1.1.2 *Silt and Sediment Control Measures*

Best forest practice aims at minimising sediment mobilisation by reducing soil disturbance through planning, timing of operations and using appropriate machinery. Mobilised sediment transportation is minimised by the use of naturally occurring vegetated overland flow areas and the use of sediment traps. The following mitigation measures with regard to forest clearfelling will be followed:

- Prior to commencement of operations sediment or silt traps will be installed at intervals, as close as possible to the source of the sediment. Where required, correctly planned, installed and maintained sediment traps/drains for each individual felling site will help to ensure that water quality is protected. Typical sediment trap designs are illustrated below (source *Forestry Schemes Manual, 2011)*:

No. 1 (Pit)	No. 2 (Staggered Type)	No. 3 (Run Off Type)	No 4 (Swamp Type)
			
The end of the mound drain is slightly deepened for c. 0.3 metres before it enters the collector drain.	Forces water to slow down within the trap - more efficient than if the water ran straight through the trap. Minimum 1 metre long.	Caters for runoff events that exceed the design capacity. Useful on slopes. Overflows floods onto vegetation. Do not plant within 4 metres of the lower side in order to conserve dense vegetation.	Many drains may enter a natural depression to create a mini "swamp". Dimensions of the "swamp" depend on the needs of the site. May be c. 20 sq. metres. Do not plant within 4 metres of the "swamp".

Sediment traps will require monitoring and maintenance throughout the operations. Sediment traps are to be constructed and maintained in line with the requirements of the *Forestry Schemes Manual (2011), the Forest Road Manual and Forest Drainage Engineering – A Design Manual.* Sediment or silt trap mitigation measures are also included in Chapter 9 Hydrology & Hydrogeology.

- Silt traps and silt fences, such as geotextile membrane and straw bales, should be placed in the forest drainage network to minimise silt loss. Silt traps should be staggered along the length of the drain, and not only at the lower reaches towards its outflow. These should be inspected and cleaned regularly. A series of stepped silt traps/fences to trap any silt/debris will be installed. Their purpose will be to slow water flow and allow settlement of solids to occur. These will be regularly inspected and cleared out to ensure they are functioning properly. Traps should not be constructed immediately adjacent to natural water courses.
- Silt trap design can vary, from depressions added to the drain bed, to log sections laid lengthways into the drain or the use of geotextile barriers.
- Apply silt fences where necessary, to block pathway for silt in areas where overland flow is possible.
- Brash from the clearfell should be utilised as roading material to reduce impact on ground thereby minimising ground disturbance.
- Existing forest drainage shall be reinstated where damaged to allow use to be made of vegetated ground areas to reduce the flow of silt overland.
- A 15m buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist in silt interception.
- Within the buffer zone, forest harvesting, machine refuelling, forwarder movement and other forest operations are prohibited in order to protect water quality. Furthermore, drainage channels leading from the site must taper out before entering the buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone.

During a study of a harvesting site by Rodgers et al 2002 in Co Mayo, sediment concentrations, yields and release patterns upstream and downstream were compared before and after harvesting. These showed that harvesting did not significantly increase the sediment concentrations in the receiving water, confirming that if the Forests and Water Quality Guidelines are followed and care is taken on site, the aquatic zone need not be adversely affected by sediment releases from sites without a buffer strip.

1.6.1.1.3 Temporary Water Crossings

Temporary water crossings include forest drains, roadside drains, relevant watercourses[2] and aquatic watercourses. The following measures should be adhered to as per the *Interim Standards for Felling and Reforestation:*

Forest Drains:

- Minimise the crossing of drains during felling and extraction and restrict machine activity to brashed extraction racks and forwarding routes as shown in Figure 4 Harvest Plan Maps
- Where a drain crossing is needed, based on the size of the forest drain one of the following methods will be selected that prevents the breakdown and erosion of drain sides, namely:
    - For larger drains , deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route.
    - Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, select logs that approximate the depth of the channel to be crossed.

Aquatic Zones and Larger Relevant Watercourses:

- Minimise the crossing of aquatic zones and larger relevant watercourses during felling and extraction by choosing alternative routes which avoid the watercourses/aquatic zones where possible.
- Direct crossing over the stream bed is not permitted.
- If you must cross an aquatic zone or larger relevant watercourse install a temporary crossing point. When installing and removing the temporary crossing, ensure that no work is carried out within the aquatic zone, and that the stream bed and bankside remain undisturbed.
- Avoid crossing points in hollows where surface water gravitates towards, or in areas of the site more prone to sediment release, as indicated by terrain classification.
- Ensure the feature is crossed at a right angle to the flow of water.
- Where needed, any necessary crossing shall be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks.
- Typical solutions include the laying down of a bridge comprising logs overlaid with geotextile and brash to intercept soil falling off wheels.
- Alternatively, utilise temporary prefabricated concrete drop-in bridging

[2] **Relevant watercourse:** Any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone. Relevant watercourses are existing drains and channels that may contain flowing water during and immediately after rainfall.
Note, not every watercourse is a 'relevant watercourse'. For example, a well-vegetated agricultural drain or ditch draining a small area of moderately sloping ground may not be a relevant watercourse, as there will be little or no potential for it to carry significant amounts of sediment/nutrients

1.6.1.1.4 Brash Management

The objective of brash management is to contribute to the retention of the nutrients on site, thus preventing nutrients entering watercourses and to provide for access of machinery, specifically harvesters and forwarders, minimising damage to the soil.

The decay of brash takes place for some time after harvesting is completed and this process releases nutrients to the environment. These nutrients can be taken up by the soil or plants either within the forest or in a buffer zone/strip. Nutrients, which are not immobilised, can be washed away by overland flow, usually during the first significant rainfall event after their release.

Retention of the nutrients on site is achieved by the control of water, ensuring that the sediment and nutrients it contains are retained on site and as far away from the watercourse as possible. The following points will be implemented for this site:

- Where the brash is not required to form brash mats, it should be allowed to decay evenly distributed over the harvesting site. This allows for a more even distribution of the nutrient release on the site. If windrowing[3] is required, it should not be carried out until the needles have been shed
- Where the brash is required to form brash mats, it is laid out at harvesting stage as a mat to prevent soil disturbance by machine movement. Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations
- Extraction routes, and hence brash mats, should be aligned to the contour where possible. This assists in reducing the rate of water flow towards the receiving waters and consequently assists in onsite sediment entrapment
- Brash mats must be minimum 20m away from the watercourses, and
- The removal of brash mats in normal clearfell and replanting is not recommended as it is likely to be a source of sedimentation and ineffective in reducing nutrient loss.

1.6.1.1.5 Ancillary structures

The following ancillary structures will be required on site:

- Sediment traps in drains where considerable sediment flow is expected
- Brash mats to reinforce short sections of soft ground subject to high traffic usage
- Log steps on steep routes to prevent the flow of sediment-laden surface water along machine paths, especially where wheel ruts form.

Furthermore, prevent the accumulation of brash, logs and debris in drains and aquatic zones. The installation of heavy-duty plastic culverts with a protective brash cover is preferable for drain crossings. If logs are used for this purpose, they should be examined regularly and removed, if necessary, to avoid blockages and localised flooding. Remove temporary bridges and crossings as harvesting progresses.

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[3] Windrowing is the stacking of leftover vegetation, brash and other organic. matter into long narrow rows. The purpose of windrowing is to clear enough space for the replanting of new trees.

1.6.1.1.6 Site restoration

1.6.1.1.7 After felling has been completed, the felled areas will be checked to replace any damaged culverts, clear and repair drains, clean sediment traps, correctly dispose of hazardous materials such as machine oils or lubricants and remove log bridges and other temporary structures as necessary. Wildlife habitats and biodiversity

Assess harvest operations with due regard to the breeding and nesting seasons of important species, and associated features such as badger setts and red squirrel dreys, as discussed in Chapter 6 (Biodiversity) and Chapter 7 (Ornithology) of the EIAR.

1.6.1.1.8 Method of harvesting and the harvesting equipment

Load sizes recommended by machinery manufacturers will not be exceeded. Overloading will damage extraction machinery and will increase the risk and severity of soil compaction and rutting. Good management practices such as the use of brash mats and harvesting only in dry weather should be used to minimise soil surface disturbance and stream bank erosion. As some of the soils at the site are poorly drained soils, 8 wheeled harvesters should be used which will distribute the weight and reduce the loading and compaction and damage to the soil.

1.6.1.1.9 Storage and Handling of Chemicals, Fuels and Oils

Prepare and securely store all chemicals, fuel and machine oils under shelter on a dry, elevated site at least 50m from the nearest aquatic zone. Cleaning of equipment should not take place within 50m of an aquatic zone. All wash waters must be disposed of carefully. Spent oil must be collected and retained for correct off-site disposal. Biodegradable oil should be used as a substitute for mineral oil, where possible. Refer to the CEMP (Appendix 2) and Chapter 9 Hydrology and Hydrogeology for more information.

1.6.1.1.10 Landscape

Coupe sizes should reflect the scale of the landscape. Landscape issues favour asymmetric and irregularly shaped coupes which follow landform, with edges diagonal to the contour, rising in hollows and descending on spurs. Skylines need to be treated on a large scale, with the forest either left standing or cleared fully to reveal the shape of the underlying landform. Narrow belts of perimeter trees on the skyline tend to accentuate the negative visual impact of harvesting operations and generally, should not be retained. The coupe sizes for this proposed development are generally small in nature averaging 2-3 hectares.

1.6.1.1.11 Monitoring Requirements

Regular inspections during the course of harvesting operations will be undertaken to allow for immediate corrective action to be taken in the event of deviations from the plan or unforeseen problems. An assessment should involve an evaluation of the location and condition of roads, landings and machine routes, particularly in relation to drainage, compaction and rutting. Sites should be visited in the aftermath of an extended period of heavy rainfall to ensure that, if merited, operations are suspended. An assessment should be undertaken to determine whether protected areas are undamaged, and that fuel, lubricants and other hazardous compounds are stored correctly and removed from the site on the completion of operations.

1.6.2 Operational Phase

1.6.2.1 Onsite Replanting

Under the Forestry Act 2014, permanent forest removal is permitted under certain scenarios. Supporting renewable energy in the form of windfarm installation is an acceptable scenario as outlined in Table 7, Forest Service Felling and Reforestation Policy May 2017.

Table 7 – Requirements for each category of felling associated with wind farm development, regarding reforestation, alternative afforestation, and the refunding of grant and premiums.

Category of tree felling		**Reforestation of felled area required?**	**Alternative afforestation required?** (See Note 1)	**Refunding of grant & premiums required?** (See Note 2)
Infrastructure felling		No	Yes	Yes
Construction felling		Yes	No	No
Turbulence felling	≤20 ha	Yes	No	No
	>20 ha	Yes	Yes, 10% turbulence fell area – see Section 5.3.2.4	No

Note 1 If 'YES', the alternative site must be of an area equivalent in size. Section 5.7 sets out the procedures required. If the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme, the alternative site may be eligible under the Afforestation Grant & Premium Scheme.

Note 2 If 'YES', the refunding of any afforestation grants and premiums already paid out by the Forest Service is required if the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme. Also, if 'YES' or 'NO', if premiums are still being paid, premium payments on the area will cease.

As outlined in Section 1.4.1.1, it is estimated a total area of between 57.117ha and 78.263 ha will be required to be replanted under the Infrastructural felling, depending on the size of the bat felling buffer. Construction felling areas (12.63 ha) as outlined in section 1.4.1.1 will be temporarily felled and replanted at the same location once construction works are completed. There areas will be replanted with the same tree species that were felled, namely Sitka spruce and Lodgepole pine.

As part of the application for a Felling License for permanent forest removal, details of the replacement lands must be included. A Technical Approval for an afforestation license for any replacement lands must be granted by the licensing authority, the Department of Agriculture, Food and the Marine (DAFM), which will have assessed the silvicultural and environmental suitability for planting.

1.7 RESIDUAL EFFECTS

The premature and semi-mature felling of the different forest areas for the construction of the infrastructure (temporary and permanent) will result in a slight effect to the forest structure within the proposed development site as opposed to the do nothing scenario.

The residual impacts of the proposed felling and onsite replanting activities are assessed through the EIAR chapters for the relevant topic.

1.8 CONCLUSION

There is an extensive network of existing access roads across the site to facilitate the ongoing forestry operations and will subsequently facilitate the windfarm development. The area of forest to be permanently removed for infrastructural felling is estimated at between 57.117 ha and 78.263 ha (determined by bat felling buffer areas) distributed throughout much of the study area. This loss of forest area and carbon stored is temporary as an equivalent area of between 57.117 ha and 78.263 ha of bare land will be planted as replacement land elsewhere, and it is also noted that afforestation licences for the replacement land will be on mineral soils which have higher timber yields and therefore higher carbon storage capacity.

A further 12.63 ha will be felled to facilitate the wind farm construction phase and replanted once construction operations have ceased. It is expected that clearfelling works would be carried out over a 3 month period and during dry weather conditions.

It is concluded that, with the implementation of the Harvest Management Plan and associated mitigation measures, forestry operations associated with the proposed Cloghercor Wind Farm development will not give rise to significant impacts on the surrounding environment.

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Cummins. T., Farrell, E. P. (Eds), 1999. *Environmental Impacts of Harvesting and Reforestation Practices in Blanket Peatland Forests*. COFORD, Dublin.

M. Rodgers, M. O'Connor, M. G. Healy, C. O'Driscoll, Z. Asam, M. Nieminen, R. Poole, M. Muller, L. Xiao, Phosphorus release from forest harvesting on an upland blanket peat catchment, Forest Ecology and Management, Volume 260, Issue 12, 15 December 2010, Pages 2241-2248

Suspended solid yield from forest harvesting in an upland blanket peat. Michael Rodgers, Mark O’Connor, Marcus Muller, Liwen Xiao. COFORD 2012. Environment No.12

Appendix 2-6 - Recreation Development Plan

Cloghercor Wind Farm Recreational Trails Plan

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December 2022

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report builds on the Frame of Reference (FOR) initially developed regarding the recreation development approach for the proposed windfarm at Cloghercor.

The proposed Cloghercor wind farm site is bounded by the West of Ardara/Maas Road Special Area of Conservation (SAC) 000197 along its north-eastern boundary and some adjoining proposed Natural Heritage Areas. There are also some nearby heritage and archaeological sites, and a small number of old abandoned buildings that are visually appealing, within the site and along its boundary. While there are some nearby heritage and archaeological sites, there are no apparent protected structures, burial grounds, archaeological excavations, national monuments, or heritage features within the proposed windfarm site. However, trail development must take into account the presence of eagles on the upper slopes.

While the sloped land, ranging in elevation of 20 meters to 140 meters, may limit some trail use by children, the less mobile and make the site unsuitable for family recreational cycling, due to the consequences of the trail gradients. However, the elevated areas of the site will provide viewing points of the estuary and the surrounding landscapes. Recreation development on the site is likely to add value to the emerging tourism base within the area. In particular, the provision of a series of two walking trails and a viewing point at an elevated area of the site is likely to provide a focal point.

Consultation and feedback regarding the location was limited apparently due to limited local awareness and use of the existing site, with most walking and cycling activity in the area taking place at other locations. While Cloghercor is not used currently for significant recreational walking and recreational cycling, the development of recreation facilities here are likely to be relevant to both residents and incoming tourism.

Recreational trial development in Cloghercor is best suited to recreational walking using the existing forest road network, see figure 8 on page 11. The proposed windfarm roads and some short sections of additional walking trails to connect these roads into a two-trail network to be constructed to a classification 2 or 3 standard:

- Trail 1: a looped 8 km walking trail (80 meters gradient) from P1 of a, b, f, g, h, a. This trail includes the public road section from h to a.

- Trail 2: a looped walking trail from P1 of a, b, c, d, e, d, f, g, h, a circa 10 km, and 200 meters elevation. This route includes an out and back section (d, e, d) to the viewing point at A.

Note that both of these trails will use the installation of a short section of additional walking trail and the use of the public road on the north-western boundary of the site.

A small-scale car park on the north-western boundary of the site (P1 on page 13), is proposed. This car park will greatly facilitate access to the trails from the surrounding villages.

An additional walking trail location along the north-western coastal area of the site the has also been identified and might be realised through a subsequent development phase.

The future management of the site is to be undertaken through a blend of Coillte and windfarm staff as part of the general forest and windfarm maintenance process. Any recreation events at the site will be developed and delivered under a licence agreement with Coillte, they will be self-contained and will not require the input of Coillte and landowners or wind-farm staff.

INTRODUCTION

Irish Leisure Consultants (ILC) have been tasked by Future Energy Ireland to investigate the suitability the proposed wind farm on lands at Cloghercor, County Donegal, for the development of outdoor recreation infrastructure, recreational initiatives, and tourism opportunities. The following document indicates the proposed outdoor recreation developments for this site.

In particular this plan identifies:

- **Context**: location, enviornmental, heritage and historical assets as well as social, tourism and economic.
- The **scope and scale** of the potential development: target markets, recreation significance (local, regional, national, comparison of the site within the area, desired economic and social impact
- **Trail Model**, **and trail types**: Category 2, Category 3 trails. The site footprint, landownership, the operating structure, the recreation/trail provider, method of development, trail management and maintenance (facility inspections maintenance, vegetation clearing).

CONTEXT

The site is on a northwest facing slope backed to the southeast by Croaghleheen, Gafarretmoyle, Gaffaretcor and Derkbeg Hill mountains. These slopes are steepest close to the mountains however there is a significant slope across most of the remainder of the site except for the Aneane Beg area, a quasi-plateau in the centre of the site.

Most of the site is forested with the exception of the slopes leading down from Gafarretmoyle and Gaffaretcor to the public road (Doocharry to Derryloaghan). Three public roads, that service a small number of outlying houses and farms in the area, transect the site, none of these roads have any significant levels of traffic. The southern boundary of the site is paralleled by the relatively busy Fintown to Glenties main road (R253).

The main body of the site has three existing internal forest roads two of which begin at the northern boundary and travel southeast while the third extends in a southerly direction as a spur from one of the other forest roads. The south-western edge of the site includes a small network of forest roads that parallel the Gwebarra River two thirds of the way to the Gwebarra bridge.

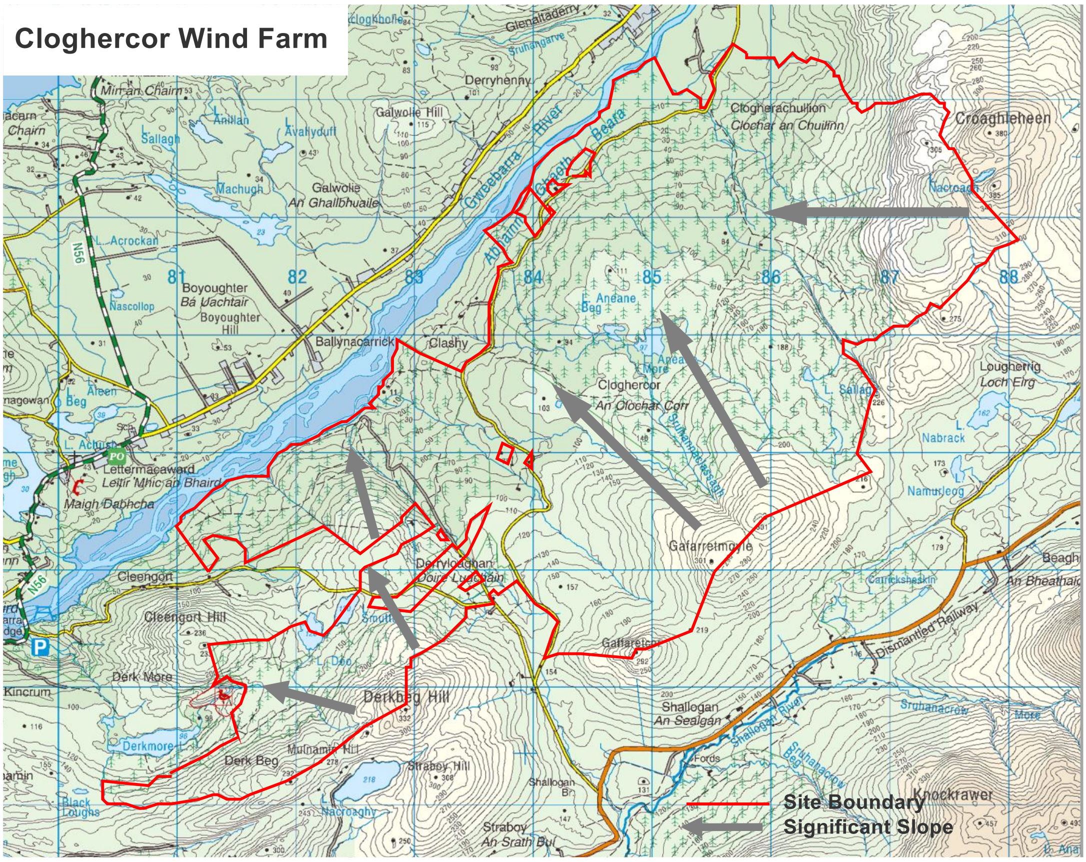


Figure 1: Site Boundary and Topography

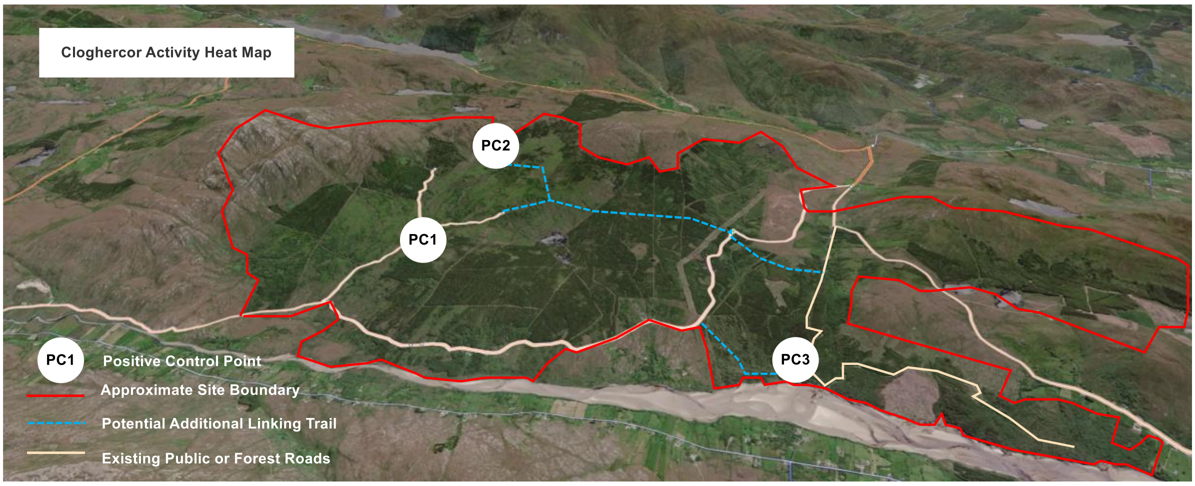


Figure 2: Activity Heatmap and Control Points

There are at least three positive control points (PC) within the site:

- PC1: Old farmstead, open ground and plateau type area, adjacent to the current met mast.
- PC2: Potential viewing area.
- PC3: Existing road/trail route to and adjacent to the estuary.

HERITAGE AND ENVIRONMENT

The site is bounded by the West of Ardara/Maas Road Special Area of Conservation (SAC) 000197 along its north-eastern boundary. This SAC relates to the tidal zone outside of the site. However, a 15-kilometre buffer zone extends from this SAC onto the site.

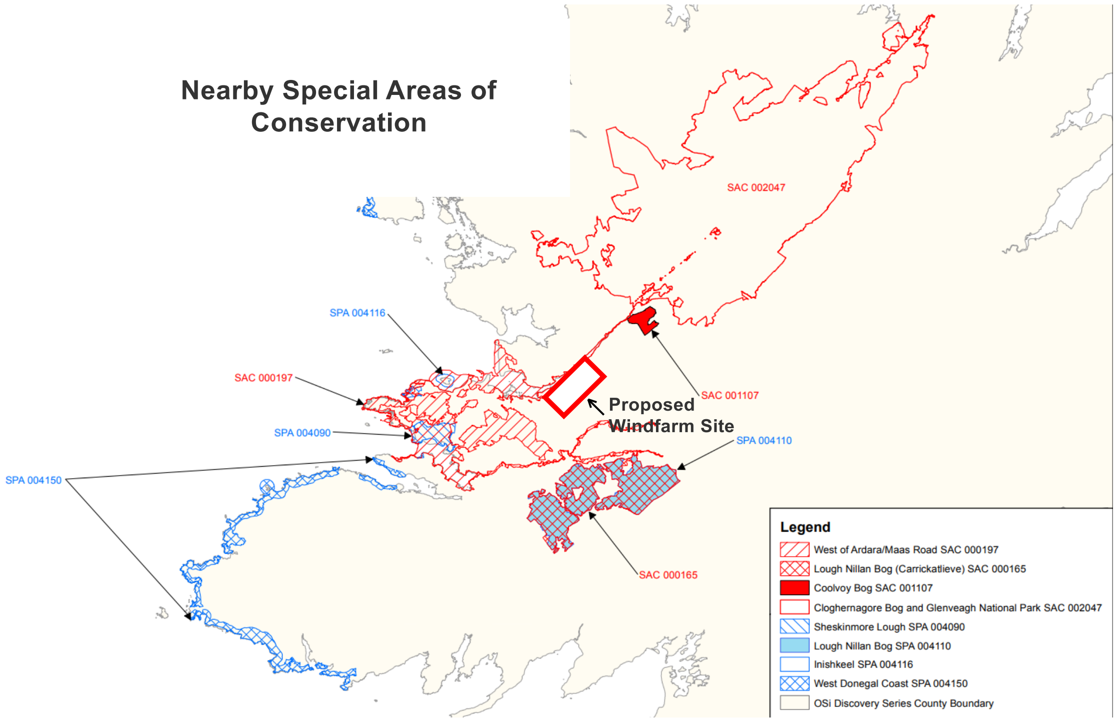


Figure 3: Site Heritage and Environment

Other nearby environmental designations include:

- Proposed Natural Heritage Area: Derkmore Wood Nature Reserve, 00131 on the western boundary of the site.
- Natural Heritage Area, Meenmore West Bog 002453 to the northeast of the site.
- Proposed Natural Heritage Area: Coolvoy Bog, 001107.

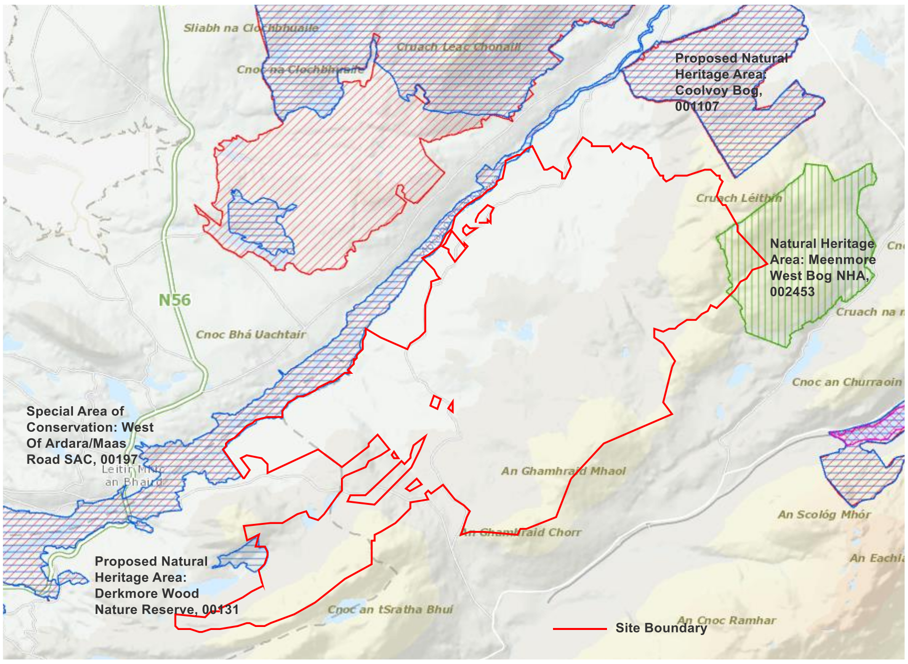


Figure 4: Site Environmental Designations.

While there are some nearby heritage and archaeological sites, there are no apparent protected structures, burial grounds, archaeological excavations, national monuments, or heritage features within the proposed windfarm site.

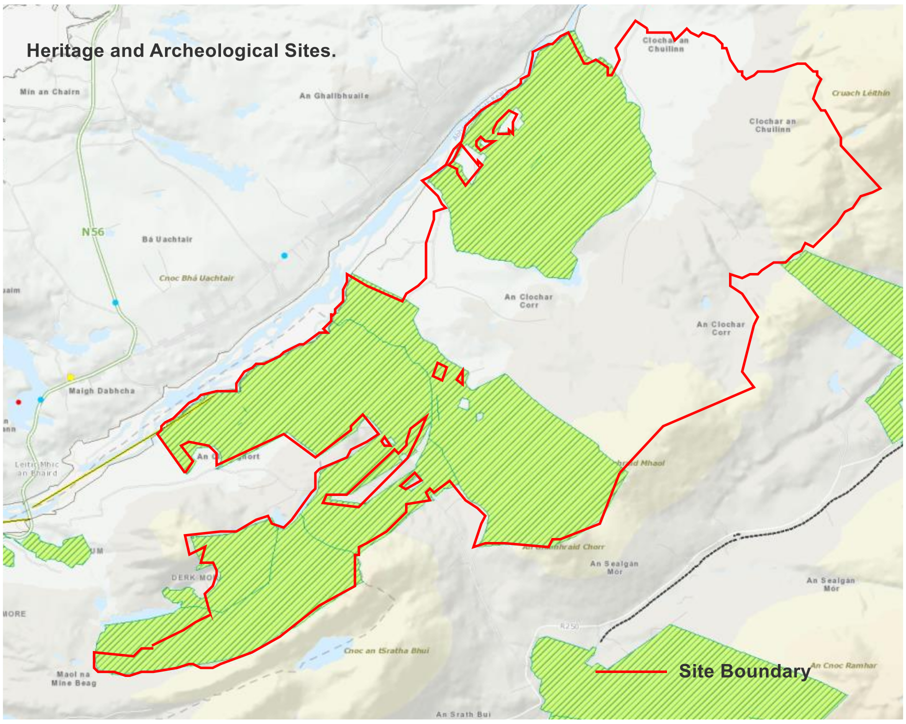


Figure 5: Heritage Sites

ECONOMY

The local economy is a mix of farming, fishing, tourism with little manufacturing industry. The main local centres of population and tourism are in Gweedore, Dungloe Fintown, Glenties, Glencolmcille and Ardra. Letterkenny and Donegal are the principal towns in the wider area.

Most of the tourism is cross border with local second homes and holiday home ownership and renting by Northern Ireland residents. Donegal Airport is an important connection with daily flights from Dublin. Glenveagh National Park is the largest tourism attraction in the area while the western coast is a popular seaside and driving route.

The proposed recreation amenities at the windfarm site at Cloghercor will provide an additional tourism venue as part of the cluster of Fintown, Dungloe, and Glenties. It is noteworthy that the bridge at Lettermacaward is identified as a scenic viewing point with views extending along the estuary.

Figure 6: Local Tourism Movement

SYNOPSIS

While the sloped land of the site may limit some trail use amongst children and the less mobile due to the effort of the height gain. Conversely such elevated trails can provide viewing points of the estuary and the surrounding landscapes, including the Fintown area.

There are no apparent significant heritage limitations on the site, however there are a small number of old abandoned buildings that are visually appealing, within the site and along its boundary.

There is a growing tourism base within the area that recreation development on the site is likely to support or add value to. In particular, the provision of a viewing point at the elevated areas of the site is likely to provide a focal point for local tourism orientation.

SCOPE AND SCALE

The recreation value of the site is relevant to residents, in Doochry, Ardra, Dungloe, Glenties and Fintown, and incoming tourism. There is however, a relatively low population density in the area.

The following outdoor recreation activity heatmaps, where the brightness and thickness of the lines represent areas of high activity, indicate that while walking and cycling is popular in the Lettermacaward area and on nearby roads there is relatively little cycling or walking within the footprint of the proposed windfarm site. The consultation process strongly indicates that there is limited awareness of and use of the site currently for outdoor recreation activities such as walking and recreational cycling. However, local cycling clubs and participants note the value of the location as a venue for cycle tourism and training primarily on the adjacent and traversing public roads and not within the footprint of the proposed windfarm.

An analysis of the recreational walking activities from the following heatmaps and the consultation process suggests that:

- The Cloghercor is not typically used for recreational walking and recreational cycling.
- The adjacent and traversing public roads are used for competitive and some recreational cycling. See recreational cycling heatmap below.
- The gradient across the site ranges from sea level to approximately 300 meters with the existing road network within the site ranging from an elevation of 20 meters to 140 meters. Such a gradient is generally unsuitable for family type cycling activities.
- There is a strong local angling community, some of whom use the site for this activity.
- There are no apparent equestrian activities on the site.
- The public road to the North of the site is both picturesque and has low volumes of traffic and is suitable as a recreational walking route.
- Beaches and rural roads provide the main outdoor recreation resources in the surrounding area. Specifically, Dooey Beach and Tramore Beach as well as some trails at Fintown and the on-road trail that extends from Doochary to the site. There are some off-road and mountain walking trails in Glencolmcille as well.

Currently recreational cycling is primarily on-road and less popular compared to recreational walking. Cyclists frequently use the two public roads that traverse the site and these form part of a series of cycling loops in the wider area. There has been a recent development of a Greenway that transits through Letermacaward en-route to Dungloe. This Greenway is likely to support cycling tourism in the area and it is located circa 2.2 km from the edge of Cloghercor forest.

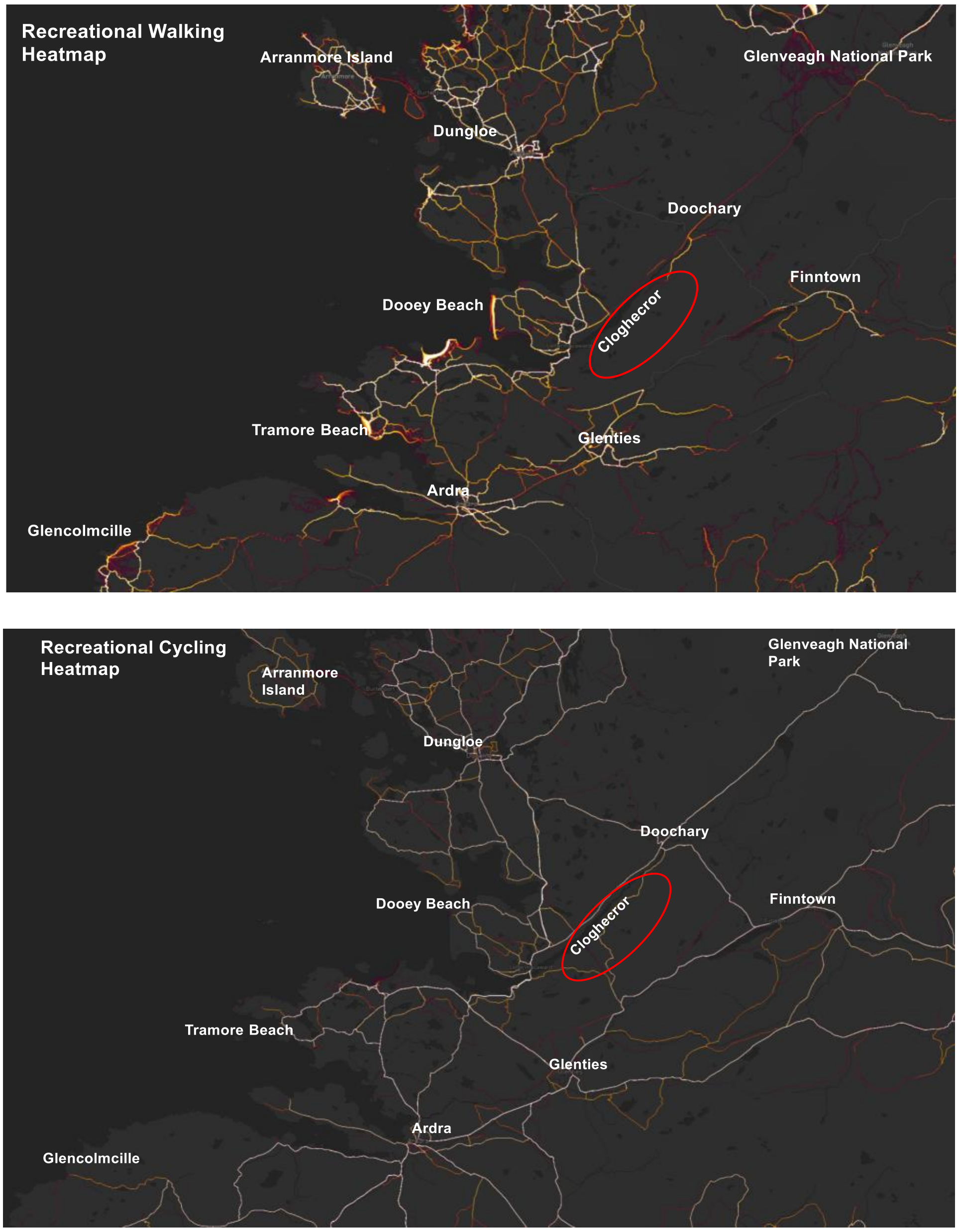


Figure 7: Recreational Walking and Cycling Heatmaps

The population density in the immediate area of the site is very low and includes a high number of seasonal holiday homes. Most walking and cycling activity in the area appears to emanate from and take place in the nearby villages.

There is no expressed demand for outdoor gym type facilities in the forest.

SCOPE

Given the low population density in the immediate area, recreational users will drive to the forest, rather than walk or cycle, to use its recreation facilities. The potential for elevated viewing points of the surrounding area and especially of the estuary, suggests that the site has a tourism potential both for trail use and for presenting the area's vistas.

PROPOSED ROAD AND TRAIL DEVELOPMENT

The following maps indicate the existing and the proposed new forest road development envisioned as part of the windfarm development.

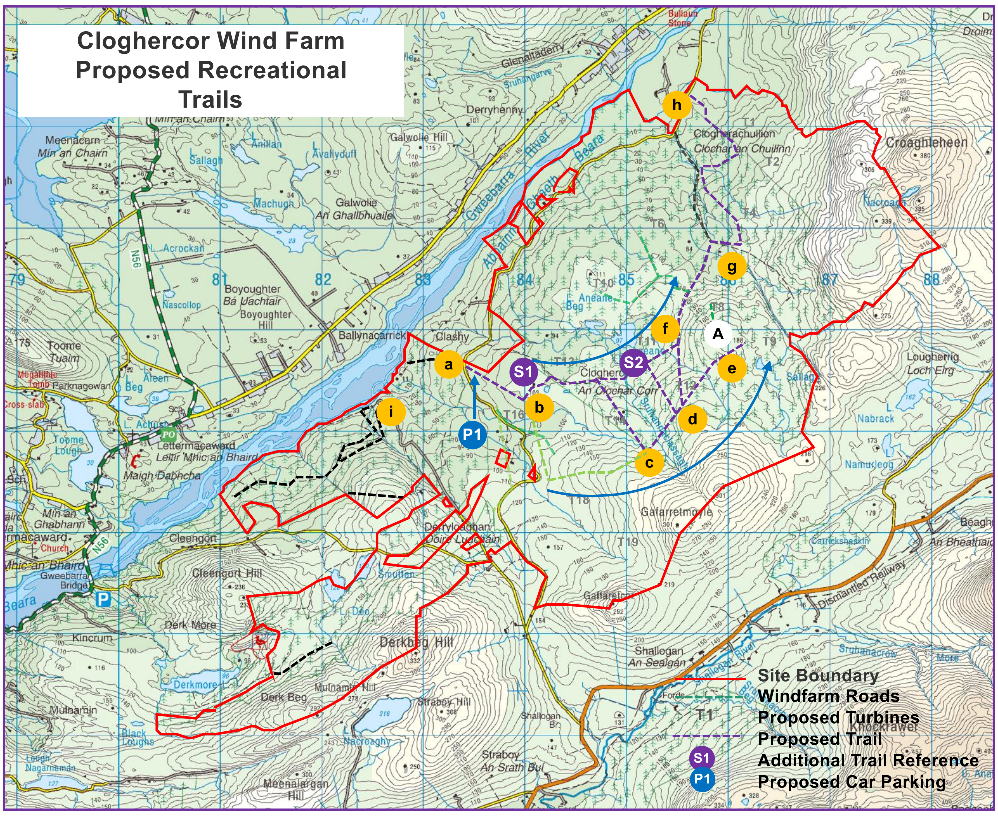


Figure 8: Recreational Trails.

OBSERVATIONS

- The proposed windfarm road network will substantially increase the recreational trail distances and choices that are available.
- P1 is the proposed location of the recreational trailhead for the site.
- To provide walking trail connections and loops the proposed linking new trail sections S1 T13 to T16, and S2 Circa T13 are in addition to the proposed windfarm road network.
- The very quiet public road (a – h), can be used as a return route for Trail 1.
- Location A has potential as a panorama viewing area for the site.
- The elevated topography of the site means that trails at this location will be challenging for the young and infirm given the gradients. However, a 'Challenging Access Route[1]' is possible

[1] Two levels of accessibility for trails are Multi Access (a fully accessible route with little gradient), a Challenging Access Route (significant gradients in some sections). Ref Great Outdoors A guide for accessibility, Sport Ireland.

from P1 (a to b and f). With an initial gradient of 7%, over an approximate 400-meter distance, this trail can be suitable for powered wheelchairs but will require assistance for manual wheelchairs.

- The route to g and h is not recommended as a Challenging Access Route given the 9% plus gradient in some sections of this trail.
- The elevated nature of the site and the resultant gradients makes it unsuited for family type cycling, although, a small number of adults may use the new forest road network as an off-road recreational cycling venue. However, given the very short distance of the routes, for cycling, and the steepness of terrain it should not be promoted as a cycling venue.

RECOMMENDATIONS

- The recreation area should be promoted for recreation walking and in particular as a site to view the Gweebarra vista.
- The addition of a simple trailhead at P1 (a) opens the recreation site to the western area this is preferable to a car park at h, as this latter site would increase traffic volumes along the narrow Gweebarra River road.
- Develop an additional recreational trail section at S1 connecting Turbine 16 and 13, and S2, circa 1 km long with two short footbridge spans.
- Develop Trail 1: a looped 8 km walking trail (80 meters height gain) from P1 extending along a, b, f, g, h, a with the potential to be extended by participants (see Trail 2 below). This Trail 1 includes a public road section from h to a. This latter public road has very low levels of traffic and is very scenic.
- Trail 1 to also be positioned as a Challenging Access Route for individuals with a disability and appropriate symbols for this classification should be used in promotional materials and local trail signage.
- Develop Trail 2: a looped walking trail from P1 of a, b, c, d, e, d, f, g, h, circa 10 km, and 200 meters height gain. This route includes an out and back section (d, e, d) to the viewing point at A.
- Develop a viewing area at A with supporting panorama locating photograph, information panel and seating etc.
- Direction road signage to P1 and an information panel at this location.
- Appropriate directional signage and way marking along trails 1 and 2.
- Circa 5 bench seats to the side of the trail in the areas of b, c and f and between g and h.
- Appropriate names should be identified for the two trails in consultation with the community and ideally with reference to the heritage of the area.
- Consider later, in response to demand, if Trail 3 should be signposted. This is an existing circa 4 km ‘lollypop loop’ type trail (40 meter height gain) at i.

TRAIL MODEL, AND TRAIL TYPES:

The sustainable operation, management and maintenance of the recreation facilities at this site, is dependent on these recreation components being low maintenance. Hence, robust trail surfaces, small sections of post and rail fencing in areas such as the viewing platform A and other infrastructure are required. The installation of litter bins and toilet facilities is to be avoided due to their ongoing management costs.

The future management of the site is likely to be undertaken through a blend of Coillte and the wind farm staff as part of the general forest and wind farm maintenance process.

Any recreation events at the site, organised by community or commercial bodies, will be developed and delivered under a licence agreement with the landowners (Coillte, or the private landowners). Recreation events will be self-contained and will not require the input of wind farm staff or landowners.

Trail Classification and Grading

The proposed windfarm trails will adhere to classification 2 standards except for some limited sections having steeper gradients, wider routes and limited seating. Sections of walking trail construction in addition to any windfarm trail development, will be Category 2 or Category 3. For example location S1.

The following indicates the National Trails Office requirements regarding these walking trail classifications and grading.

Trail Classification

A Trail Classification system provides a means of classifying a trail based on its physical attributes and needs to be taken into consideration when planning trails. The class is determined by:

- the type of trail surface,
- the width of the trail and
- the gradient (steepness) on the trail.

Trail classes range from Class 1 to Class 5. Trail planners should aim to provide a trail class (or classes) which correspond with the intended user's needs and expectations.

Table 2.1: Walking trail classes suited to different land types

Land Type	Description	Class 1	Class 2	Class 3	Class 4	Class 5
Urban/ Urban Fringe	Cities, towns and villages and in urban and suburban parks					
Core Recreation Areas	Established recreational areas e.g. central areas of forest parks or national parks, near beach car-parks, etc.					
Rural landscapes/ forest areas	Countryside areas away from communities, villages; farmland and forest areas away from core recreation areas					
Upland or Remote area	Open mountain area, remote landscapes, areas far away from any habitation					

Table 4.1

CLASS 1 - WALKING TRAIL	
GENERAL DESCRIPTION	• Specifically multi-access trails[2] which can accommodate users with reduced mobility. • Will be serviced by a vehicle parking area. • Can readily facilitate frequent two-way traffic. • Will have minimal cross slopes and gradient • Will have a firm surface. • No steps, waterbars, stiles, barriers or trip hazards of any kind. • Should have resting places with seating approximately every 100m. **Further detailed requirements for multi-access trails are provided Appendix 2.**
SITE SUITABILITY	Urban/ Urban Fringe or Core Recreation Areas (see table 2.1) but some trails providing access to reduced mobility users may also be appropriate in other areas.
TRAIL SURFACE	Sealed non-slip surfaces, non-slip timber boardwalk, tarmac or compacted surface with no loose stone or gravel greater than 5mm.
TRAIL WIDTH	Range: 1800mm to 3000mm
TRAIL GRADIENT	Range: Flat to 5% (Up to 8% allowed for ramps where required) Desirable: Flat

Table 4.2

CLASS 2 - WALKING TRAIL	
GENERAL DESCRIPTION	• Essentially trails for casual use, by people of all ages. • Serviced by a vehicle parking area if appropriate. • Reasonably flat and wide enough to accommodate two-way traffic. • Will have a relatively smooth surface with minimal loose material. • No waterbars or climb over stiles should be used. Steps should be minimal and if used should be limited. • May use bridges and boardwalks. • Should have resting places with seating approximately every 500m. • May have lighting where provided in an urban area
SITE SUITABILITY	Urban/ Urban Fringe or Core Recreation Areas or Rural landscapes/ forests (see table 2.1)
TRAIL SURFACE	Consistent sealed surfaces, non-slip timber boardwalk or compacted aggregate - 20mm to dust stone.
TRAIL WIDTH	Range: 1200mm to 3000mm
TRAIL GRADIENT	Range Flat to 8% Desirable: 5% average

Table 4.3

CLASS 3 - WALKING TRAIL	
GENERAL DESCRIPTION	• Typically relatively narrow undulating trails • Will have moderate gradients. • Surface may be variable including loose material and can be uneven in places. • May include steps, protruding roots and rocks, water bars, stiles and gates. • May include bridges, bog bridges and boardwalks.
SITE SUITABILITY	Core Recreation Areas or Rural landscapes/ forests (see table 2.1)
TRAIL SURFACE	Variable surfaces including some loose material not greater than 50mm in size
TRAIL WIDTH	Range: 600mm to 1200mm
TRAIL GRADIENT	Range: Flat to 12% Desirable: 5% average

Table 4.4

CLASS 4 - WALKING TRAIL	
GENERAL DESCRIPTION	• Typically challenging, single file walking trails over mixed terrain. • Will have steep gradients. • Surface will be very variable and may include loose material, steps, protruding roots and rocks, water bars, stiles and gates.
SITE SUITABILITY	Rural landscapes/ forests or Upland and Remote (see table 2.1)
TRAIL SURFACE	Very variable and uneven surfaces including loose material up to 100mm in size; protruding roots and rocks.
TRAIL WIDTH	Range: 500mm to 1000mm
TRAIL GRADIENT	Range: Flat to 30% Desirable: 10% average

Table 4.5

CLASS 5 - WALKING TRAIL	
GENERAL DESCRIPTION	• Challenging trails, surfaced or unsurfaced over variable ground, may be in exposed areas. • Can include rough steps, stiles, water-bars, side drains simple bridges or river crossings.
SITE SUITABILITY	Upland or Remote areas (see table 2.1)
TRAIL SURFACE	Extremely variable and uneven surfaces with large rocks, roots and other obstacles offering a challenging hike.
TRAIL WIDTH	Range: 500mm to 1000mm
TRAIL GRADIENT	No gradient constraints Desirable: Maximum 40% requiring steps

Appendix 2-7 – Traffic Management Plan

CLOGHERCOR WIND FARM

TRAFFIC MANAGEMENT PLAN

February 2023

Table of Contents

Table of Figures

1.0 INTRODUCTION

This Traffic Management Plan (TMP) has been prepared for the proposed Cloghercor Wind Farm project (proposed project). The TMP is a "living document". Therefore, any changes which may occur in the planning process and in the detailed construction programme can be incorporated, as can inputs by the contractor(s), the detailed design team and the Applicant. The commitments included within the Environmental Impact Assessment Report (EIAR) for the proposed project are the minimum commitments that the Contractors shall follow and will be implemented in full together with any measures conditioned by the planning permission.

1.1 OBJECTIVES

This document is a Traffic Management Plan (TMP) which has been prepared prior to the appointment of a contractor, material suppliers and final Construction Phase programme. It will be updated following grant of planning permission and prior to commencement of any construction works as outlined in section 1.5 of the CEMP.

The primary objectives of this TMP are to:

- Outline minimum road safety measures to be undertaken at site access / egress locations during the Construction Phase, including approaches to such access / egress locations; and
- Demonstrate to the applicant, contractor and suppliers the need to adhere to the relevant guidance documentation for such works.

The TMP addresses the following issues which are explained in detail in this report:

- Consent, Licenses, Notifications and Permissions;
- General Provisions;
- Site Access and Egress;
- Routing of Construction Traffic;
- Site Specific Temporary Traffic Measures;
- Enforcement of Traffic Management Plan; and,
- Emergency Procedures During the Construction.

1.2 IMPLEMENTATION AND MONITORING

The principal contractor shall agree and implement measures to monitor the effectiveness of the TMP, in conjunction with the Donegal County Council and the Applicant. On finalisation of the TMP, the contractor shall adopt the plan and associated monitoring measures.

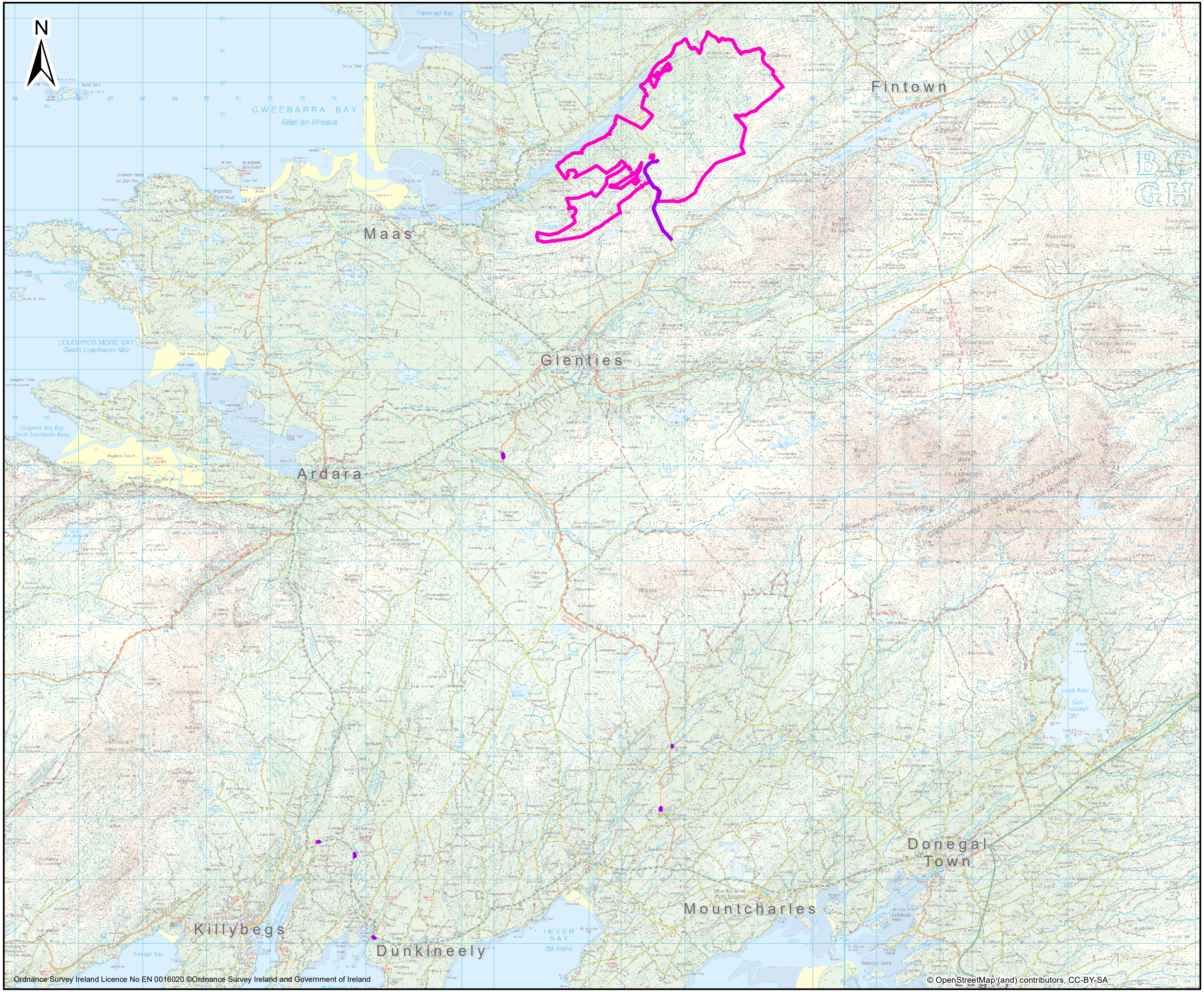
In order to ensure that environmental awareness and compliance is communicated effectively at the start and throughout the construction works, this TMP in conjunction with the CEMP and its contents will be communicated to all site personnel, including management staff, operatives and sub-contractors. The key elements of this TMP will form part of the site induction which will be mandatory for all employees, contractors and visitors attending the site. Refer to Environmental Training and Awareness in Section 1.6 of the CEMP.

2.0 THE PROJECT

2.0 PROJECT LOCATION

The proposed wind farm site is located primarily within forestry landscape located 2.1km south of Doochary in northwest County Donegal. The Gweebarra Estuary runs to the east of the site. The R252 runs northwest from Doochary to Fintown.

The majority of the existing land-use is commercial forestry owned by Coillte and the remaining area is third party property. Mapping showing the full extent of the proposed project, is included as Figure 2-1.



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works

* all land identified is within Boundary of the Proposed Project

0 1 2 3 4
Kilometres

NOTES
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	03/03/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 2-1:
Proposed Project Extent

Scale @ A4: 1:150,000

Prepared by: S.Pezzetta
Checked: J.Staunton
Date: March 2023

Project Director: O.Fitzpatrick

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10798 - 001 - S.BO - S.Area - TOB - A
Ver002

Draft: A

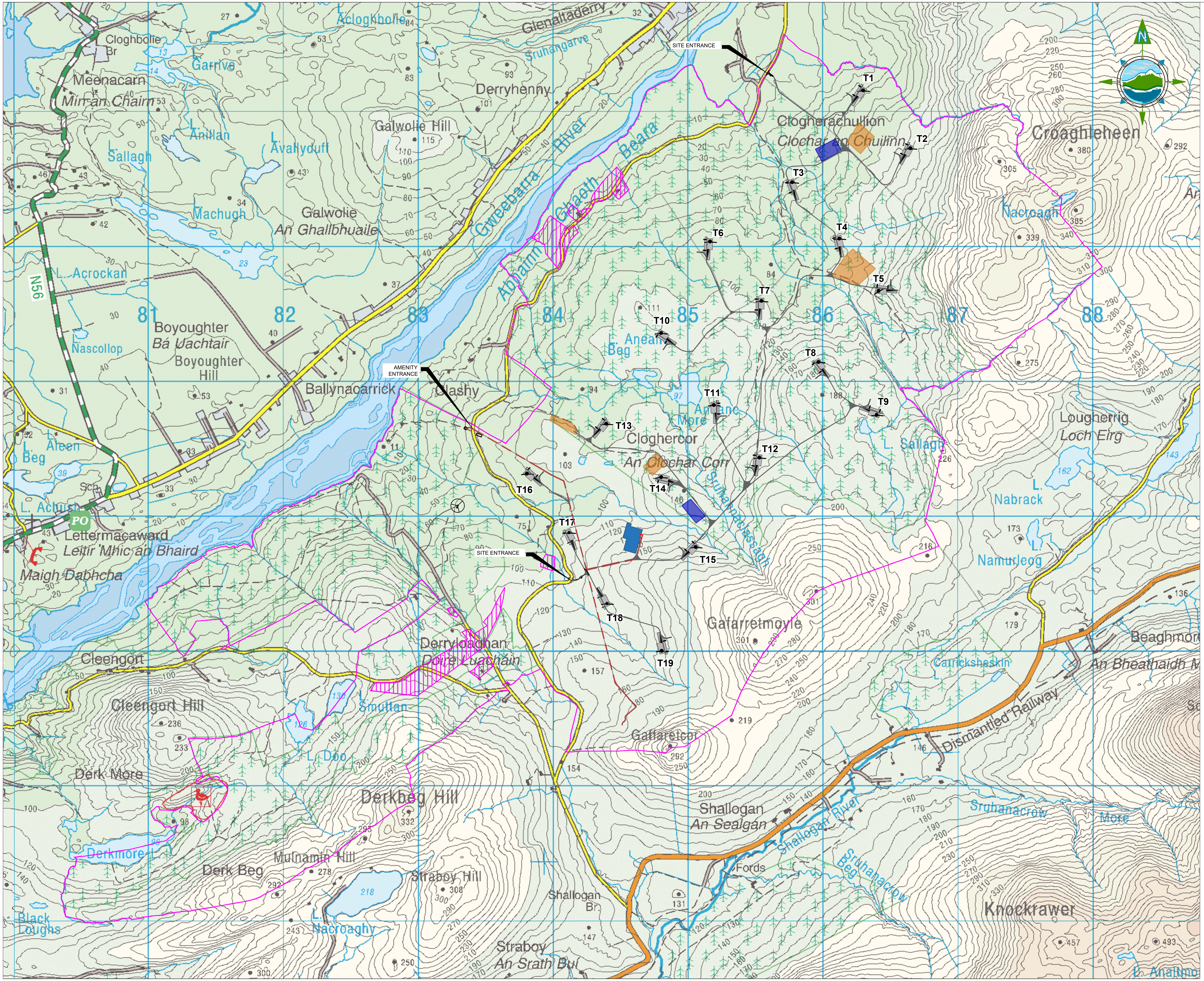
2.1 PROJECT DESCRIPTION

The proposed project includes a proposal to construct a wind farm and a 110 kV substation with loop-in connection to the national grid in the townland of Doochary in northwest County Donegal via underground cabling. The site of the proposed project comprises a single elongated land parcel. A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought. The EIAR submitted with the planning application describes the development in more detail. A Site Layout Map is provided in Figure 2-2 and shows the proposed project boundary and the locations of the proposed turbines.

The proposed project (as described in full in Chapter 2 (Description of the Proposed Project) of the main EIAR) will comprise the following:

- Erection of 19 no. wind turbines with an overall blade tip height range from 185 m to 200 m, a rotor diameter range from 149 m to 164 m, a hub height range from 112 m to 125 m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5 m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100 m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;

- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36 km of internal access roads) to the existing 110 kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of 13 no. existing wooden polesets and 1 no. steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed project and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.



LEGEND:

- PROPOSED WIND FARM SITE BOUNDARY
- AREA EXCLUDED FROM BOUNDARY
- ACCESS ROADS WITH PASSING BAYS
- GRID CONNECTION ROUTE
- TURBINE HARDSTAND
- TURBINE LOCATIONS
- TEMP. CONSTRUCTION COMPOUND
- SUBSTATION LOCATION
- BORROW PIT LOCATIONS
- MET MAST LOCATION

OSI 1:50,000 Sheet No's: 1638, 1640, 1838, 1840

Rev	Date	Description	By	Chkd.
A	07.03.22	INFORMATION ISSUE	EB	OF

Client: CLOGHERCOR WIND FARM LTD.

Project: CLOGHERCOR WIND FARM

Title: SITE LAYOUT

Scale @ A3: 1:25,000

Prepared by: E. Beggs | Checked: O. Fitzpatrick | Date: January 23

Project Director: S. Tinnelly

Drawing Status: Information

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Drawing No.: Figure 2.2

Revision: A

Grid Connection

The proposed wind farm will connect to the existing national grid via the onsite substation and associated underground grid connection. The onsite substation and associated grid connection has been assessed in this EIAR, along with the required works to allow connection to the grid at the existing overhead line in Cloghercor.

Advanced Abnormal Indivisible Load (AIL) Haul Route Works

It is intended that the AILs will be delivered to the site from Killybegs Port in southwest County Donegal via the N56 national road network and the R263. Several junction locations along the national road and both bends and junctions on the regional road network require temporary works to accommodate these AIL deliveries to the site. These works include temporary improvements at locations on the N56 and R262 road network at junctions and bends for hardstanding areas, making signposts and kerbs demountable / hinged, utility diversions, minor drainage works (i.e. temporary relocated interceptor ditches) hedgerow / vegetation cutting for oversail, local road widening (of the L6363 and L6483) between the R250 and the site entrance and constructing a blade changeover area.

2.1.1 *PROPOSED SITE ACCESS & EGRESS*

The proposed site will have a 3 no. direct accesses off the public road network from the L6483 local road (see Figure 16.1, Chapter 16 of the EIAR).

Access point 1 is located in a rural setting with limited dwellings and agricultural / field accesses. It will be used as a main entrance point during the early stages of construction until such time as the internal access roads are constructed as far as access point two. At that stage access point two will be the main site exit and access point one will be the main site entrance, with a one-way system in place through the site.

Access point 2 and 3 will be used by the low level of traffic associated with the maintenance and operation of the proposed project. During the operational phase, there will be a separate public entrance (access point three) in the townland of Cloghercor to easily access the proposed car park and amenity facilities (located at the intersection of the proposed grid connection cable and the L6483).

A Road Safety Audit (RSA) was undertaken at the 3 no. accesses on the L6483 (further information in Chapter 16 of the EIAR).

The 3 no. junctions have been designed and upgraded in accordance with the Transport Infrastructure Ireland (TII) document *Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated and compact grade separated junctions)* DN-GEO-03060 June 2017. The visibility at the access junctions complies with the requirements of a 2.4m ‘x-distance’ setback with ‘y-distance’ of 160m. Swept path analysis for the largest vehicles accessing the site at both locations have been undertaken and the accesses modified to accommodate the wheel tracks of these vehicles (i.e. AIL (turbine blade) and maximum legal articulated vehicle (16.5m in length)).

2.1.2 *EXISTING ROAD NETWORK*

Chapter 16 (Traffic and Transportation of the proposed project EIAR) describes the existing surrounding road network impacted by the proposed wind farm project. The main haul routes to the site are via the national and regional road network, which has sufficient width to accommodate two-way passing typical construction vehicles (i.e. HVs). Construction traffic movements are limited on the local road network, with use of the local roads only in the absence of an alternative on the national and regional road network. Three construction haul routes have been identified and the haul route will be determined on procurement of materials by the appointed Contractor.

The haul route for the AILs is from the via Killybegs Port to the site via the N56, R263 and R262. The route continues northwards to a proposed temporary blade changeover location (where the turbine blades are mounted on a vertical blade transporter for the rest of the route). It then runs north to re-join the N56, where it turns eastwards to Glenties. In the town of Glenties the route joins the R250 and continues traveling in a north-easterly direction until turning to the northwest onto the L6363 local road. It then turns onto the L6483 where it continues to the site entrance for the proposed project.

The following existing roads will be potentially impacted by the proposed wind farm project as outlined in Section **Error! Reference source not found.**:

- National Road Network
  - N56
- Regional Road Network
  - R263
  - R262
  - R250
- Local Road Network
  - L6363
  - L6483

3.0 CONSTRUCTION PHASE

3.1 CONSTRUCTION PHASE WORKS

The wind farm construction has a construction period of approximately 24 months with construction envisaged to commence in January 2026. The proposed project has 5 Construction Phases:

• Phase 1 Civil	14 months
• Phase 2 Electrical grid connection	6 months
• Phase 3 Site electrical	12 months
• Phase 4 Turbine deliveries and erection	4 months
• Phase 5 Commissioning	2 months

The durational and phasing of the works are outlined in detail in the Chapter 2 (Description of the Proposed Project) and Chapter 16 (Traffic and Transportation) of the EIAR and included in Section 3.1 of the CEMP. As evident in the above list, the phases will be overlapping and occurring concurrently at different works areas within the main site.

3.2 CONSTRUCTION HOURS

The hours of construction activity will be limited to avoid unsociable hours, where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs on weekdays and between 07:00hrs and 14:00hrs on Saturdays.

However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours or to accommodate delivery of large turbine components along public routes), it may be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with Donegal County Council.

3.3 CONSTRUCTION PHASE TRAFFIC

3.3.1 *Staff Levels*

For the wind farm construction, a peak workforce of between 96-139 persons are anticipated on the main site. There will be peaks and troughs in the numbers, with a larger workforce during the general site works.

In addition to the onsite construction workforce, additional construction staff will be required for the cable laying works and the advanced AIL haul route works. At each location off site, a maximum of 10 construction staff are anticipated including traffic management operatives.

3.3.2 *Staff Traffic Generations*

The 139 workers will generally travel to the site via light vehicle (LV) (i.e. car or small van) assuming 2 persons per vehicle, or 70 trips to and 70 trips from the site.

3.3.3 *Construction Vehicles*

The construction phase for the proposed project will result in additional traffic on the roads in the vicinity of the development. The proposed HVs will typically be rigid vehicles (i.e. concrete trucks, dump trucks, delivery vehicles) or maximum legal articulated vehicles within normal vehicle loading.

This additional construction traffic will include the following:

- Construction worker vehicles, e.g. cars or vans (light vehicles).
- HVs carrying conventional earthworks equipment such as an excavator, a roller, stone crusher, forklifts, etc.
- Forestry felling machinery and timber transportation trucks.
- Mobile Cranes.
- Delivery vehicles carrying:
    - conventional construction materials for the site, e.g. aggregate, concrete, rebar, etc.
    - conventional construction materials for the substation, e.g. electrical components, bricks, concrete, rebar, fencing, etc.
    - drainage infrastructure i.e. culverts, clear span bridge, tanks, etc.
    - met mast, electric cabling, inverter stations and electrical equipment for the on-site substation.

3.3.3.1 Abnormal Indivisible Load

The transformer and the wind turbine components will be abnormal indivisible loads (AILs). An assessment of the AIL loads have been made based on the proposed project details, as described in further detail in Chapter 16 (Traffic and Transportation) of the EIAR, pending confirmation of the specification during procurement at Construction Stage. The maximum blade length to be used will be 82m. The contractor will be responsible for obtaining all associated licenses from Donegal County Council or Gardaí during construction for the abnormal load.

3.3.4 Construction Vehicles Traffic Generation

It is estimated that the peak construction phase will generate approximately 160 no. additional HV and 140 LV movements two way during peak construction activity at the main site. Outside of the 3 months peak delivery days, the construction traffic generated by the proposed project is on average 70 HVs two-way per day.

3.3.5 Construction Haul Route

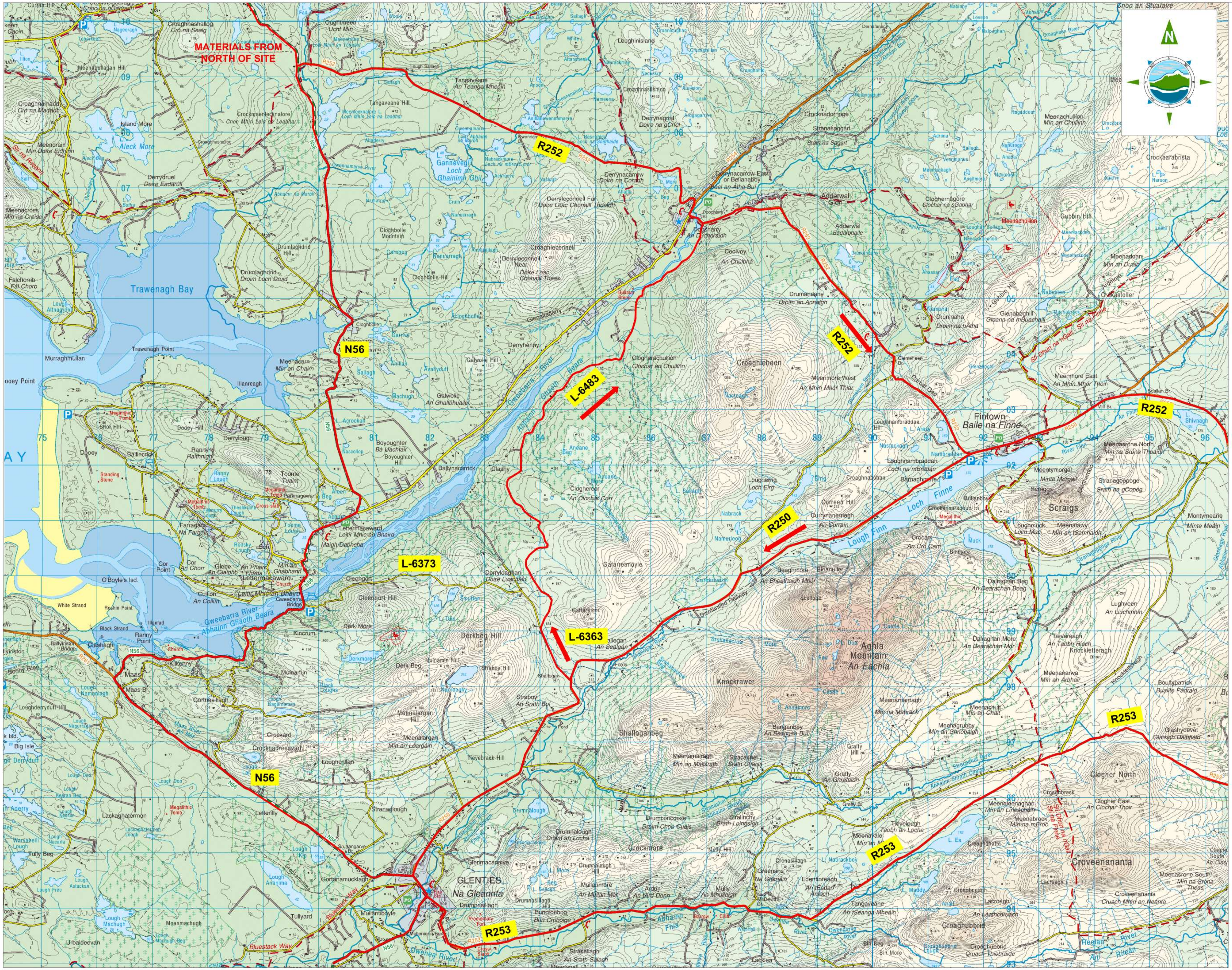
3.3.5.1 Construction Traffic Deliveries

The proposed haul routes to the proposed project for the construction traffic are shown in Figure 3-1. The majority of material deliveries and trips to the site will be via the N56 and R262, as this route is the best access to the site from the wider area.

The haul routes identified utilise principally the national and regional road network with carriageway cross sections facilitating passing of two-way HV movements. Short sections of local roads form part of the haul routes in the absence of these national and regional roads. The haul routes have been optimised to maximise the use of the national and regional road network over the use of local roads.

The haul routes selected also take into consideration the sensitive receptors presented by towns and villages, with routes avoiding towns and villages when the opportunity presents itself.

The haul routes have been reviewed and are considered suitable to accommodate the two-way passing delivery vehicles anticipated at the site in terms of alignment, condition, and width. It is not anticipated that any works will be required on the road network for the purpose of normal construction deliveries beyond the provision of the new site accesses on the L6483.



GENERAL LEGEND

MATERIAL HAUL ROUTE

NOTES:

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER/EMPLOYERS REPRESENTATIVE, AS APPROPRIATE, TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. THE CONTRACTOR SHALL UNDERTAKE A THOROUGH CHECK FOR THE ACTUAL LOCATION OF ALL SERVICES/UTILITIES, ABOVE AND BELOW GROUND, BEFORE ANY WORK COMMENCES
5. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

OSI 1:50,000 Sheet No's: 1638, 1640, 1838 & 1840.

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400m 0 400m 800m 1200m

Rev	Date	Description	By	Chkd.
A	28.09.22	IFI	DK	JS

Client:

Cloghercor Wind Farm Ltd.

Project:

CLOGHERCOR WINDFARM

Title:

MATERIAL HAUL ROUTEs

ROUTES

Scale @ A3:	1:40,000	
Prepared by: T ingham	Checked: J. Staunton	Date: Dec 2022
Project Director:	D. Grehan	
Drawing Status:	Information Only	

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Drawing No.: Fig 3-1

Revision: A

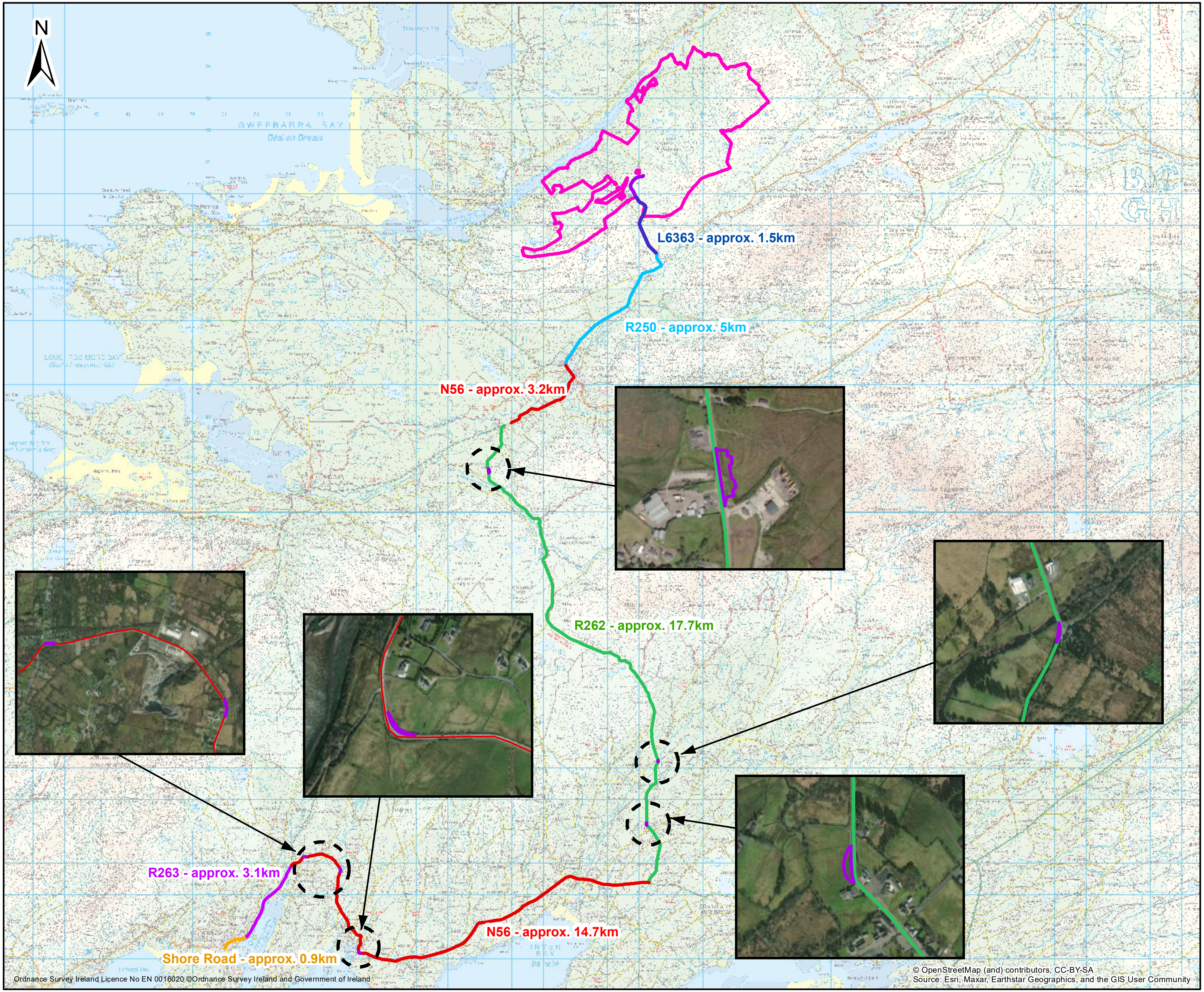
3.3.5.2 Abnormal Indivisible Load Deliveries

Killybegs Port is the proposed port for import of the AILs. The route selected for the AILs utilised the national road network as much as feasible from the port to the site as outlined in Figure 3-2. The AIL route on the national road network is on a Type 1 single carriageway with wide carriageway widths and hard-shoulder.

The R262, regional road accommodates the longest swept path of the AILs, the turbine blade. Donegal County Council have been advised of the proposed AIL haul route during the scoping process. The swept path analysis used an 82m blade length which is the maximum blade length to be used in the windfarm.

A desktop study of the haul route was undertaken to consider the proposed haul routes suitability to accommodate the size of delivery vehicles in terms of alignment, capacity, condition and width on the national and regional road network. This is discussed further in the EIAR Chapter 16.

The study identified advanced works which will be required at approximately 6 no. location on the haul route (excluding the proposed site accesses on the L6483). These works will include making traffic signs and lighting columns demountable / hinged, temporary hardstanding, vegetation and hedgerow cutting, utility diversions etc.



Legend ✱

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works

Turbine Delivery Routes

- L6363
- N56
- R250
- R262
- R263
- Shore Road

✱all land identified is within Boundary of the Proposed Project

0 1 2 3 4
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 3-2:
Turbine Delivery Route

Scale @ A4: 1:150,000

Prepared by: S.Pezzetta | Checked: J.Staunton | Date: January 2023

Project Director: O.Fitzpatrick

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Draft: A

3.3.6 *Internal Access Track Construction Haul Route*

Internal to the main site and the forestry area access from the L6483, a new internal access track layout will be constructed. These access tracks will consist of upgraded existing forestry access tracks and construction of new access tracks. There will be approximately 16 km of new internal permanent access track constructed and approximately 3 km of internal access track upgrade works carried out. The proposed internal access track layout is indicated in Figure 2-2.

Internal access tracks will have a running width of approximately 5m (5.5m including shoulders), with wider sections up to 10m approx. at corners and on the approaches to turbine locations. In addition, the direct accesses on the L6483, will be widened on the approach to a minimum road width of 7.0m over a length of 50m to accommodate two large vehicles (i.e. HVs) to pass at the approach to each public road interface and to allow for queuing of vehicles within the site and off the public road.

The layout of the access track within the main site area has two access track loops, turning areas, compounds and hardstanding areas. The layout will allow for a one-way system to be utilised as a means of traffic management for the deliveries on the site once constructed. Passing bays will also facilitate passing of HV's within the site.

The compounds onsite will be utilised for material laydown areas and for staff office and welfare facilities and car parking. The southern compound will be located relatively close to the site entrance from the L6483 local road and the northern compound will be located between Turbine 1 and Turbine 3. The use of two separated construction compounds will improve efficiency and capacity across the extensive wind farm site area.

The proposed internal access track layout will incorporate regular passing bays to allow traffic to pass easily while travelling around the site. The passing bays are indicated in Figure 2-2, and will have dimensions of 5m wide by 50m long, suitable to accommodate 5 no. 10m long rigid trucks within each passing bay including the passing bay tapers.

During the construction stage a temporary self-contained wheel wash will be installed at the site entrance to minimise the transfer of dirt and dust from the site onto the public road and to minimise the potential for transfer of alien invasive species onto the site.

The internal access track network will also be utilised for ongoing commercial forestry operations and will facilitate the public recreational use of the lands.

3.4 CONSTRUCTION PHASE SUMMARY

The construction traffic impact of the additional HVs and light vehicles on the existing road network has the potential to impact on the existing pavement condition, the carrying capacity of the road, the existing junctions flows on the haul route and at the site access and crossing point of the local road for the duration of the construction programme. The 5 construction phases, as outlined in section 3.1, and the cable laying and advanced AIL works will have varying impacts on the road network and environs.

The Wind Farm construction has an envisaged construction programme of 24 months, with lower traffic volume impacts on the road network outside of the 19 no. days for the concrete pours for the turbine foundations. The main construction traffic associated with the development, and the typical construction vehicles may result in a negligible / slight increase in delay due to the increase of traffic at junctions removed from the site and the increase in vehicle slowing on the R250 to turn to the site. This impact will be greater during the peak construction activities (i.e. turbine foundation pours) but these will be isolated occurrences.

Motorists may encounter minor delays along the L6483 at the new accesses where traffic management operatives' control will be required to facilitate safe access / egress at the site during the peak construction activities.

Minor delays for short duration may be encountered on the following road networks due to temporary traffic management employed by the appointed contractor to safely facilitate works on / adjacent to the live carriageway for the advanced works for the AIL including the N56, R262, and R250. The works themselves will be of short duration within the verges, splitter island and the roundabout centre islands. These advanced AIL works will occur in advance of the delivery of the AILs to site.

The grid connection cabling works will impact on the local road network (i.e. L6483) at a single point only and for short duration. The cabling works will require a temporary road closure of the L6483 for a day for the trenched crossing. This will result in disruption for local road users; however, diversions will be provided, local access maintained and carried out at off-peak times / night-time works as agreed with the Local Authority

Passing bays will be utilised within the internal access track layout to accommodate two-way traffic. The widened approaches to the accesses will provide safe locations for vehicles to queue and pass clear of the public road network.

4.0 CONSTRUCTION PHASE TRAFFIC MANAGEMENT PLAN

The contractor implement in full the commitments imposed within this TMP. The following are the commitments made at the planning stage of the project which shall be further developed by the contractor and included in the TMP agreed with the Roads Authority, prior to works commencing on site:

- General Provisions;
- Site Access & Egress;
- Routing of Construction Phase Traffic;
- Site Specific Temporary Traffic Measures;
  - Traffic Management Logistics;
  - Traffic Management Speed Limits;
  - Traffic Management Signage;
  - Road Closures;
  - Timings of Material Deliveries to Site;
  - Abnormal Load;
  - Road Cleaning;
- Enforcement of Traffic Management Plan and
- Emergency Procedures During the Construction.

4.1 CONSENTS, LICENCES, NOTIFICATIONS AND PERMISSIONS

The key consents, licences, notifications and permissions required for the project with regards to traffic and roads are summarised as:

- Planning permission and associated planning compliance.
- Abnormal loads – it is envisaged that permits will be required for the abnormal loads that will be required for the delivery of the transformer and turbine components to the site.
- Road opening licences for underground cable works, junction upgrade works, foundations in the public roadway etc.
- Approval of temporary traffic management plans.
- Road closures and diversions.
- Permission for works outside of standard construction operation hours agreed with Donegal County Council.

The above list is non-exhaustive but identifies the key consents, licenses, notifications and permissions required for the project. This list will be further populated as required through planning compliance and stakeholder engagement to ensure that any further consents are identified as early as possible and do not impact on the construction programme.

4.2 GENERAL PROVISIONS

The construction traffic impacts of the proposed project have been identified as being temporary in nature. It is important that any impact caused by the proposed project is minimised as far as possible and, considering this the following mitigation measures shall be included in future developments of this TMP:

- Traffic movements will be limited to 07:00 - 19:00 Monday to Friday and 07:00 – 14:00 Saturday, unless otherwise agreed in writing with Donegal County Council.
- HV movements will be restricted during peak road network hours (including morning school hours) from 08.00 – 09.00 and 17.00 - 18.00 Monday to Friday, unless otherwise agreed in writing with Donegal County Council.

- HV movements for the proposed project shall be directed away from sensitive areas (i.e. schools, urban centres).
- No parking shall be permitted along the access route for unloading or activities that result in blockages of access routes. Such vehicles will be immediately requested to move to avoid impeding the works and traffic on the road network.
- Measures to remove queuing of construction traffic on the adjoining road network including turning space and queuing of convoy HVs will be provided within the site (i.e. one-way internal access track loop system and passing bays).
- Wheel wash equipment will be used on site to prevent mud and stones being transferred from site to the public road network.
- Activities generating dust will be minimised where practical during windy conditions. Loads will be covered on arrival and departure from site, where required. Other measures are outlined in the CEMP.
- Clear construction warning signs will be placed on the public road network to provide advance warning to road users to the presence of the construction site and slower moving vehicles making turning manoeuvres.
- 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 and site visitors will all receive a suitable Health and Safety site induction.
- Security gates will be sufficiently set back from the public road, so that vehicles entering the site will stop well clear of the public road.
- The approaches to the site accesses have a width of 7.0m over a length of 50m to accommodate queuing and passing of vehicles clear of the public road.
- Passing bays located within the main Wind Farm site with have dimensions of 5.0m x 50m long.
- Compound locations have been identified for storage, site offices and welfare facilities.

The final TMP will also include provision by the appointed Contractor, for details of intended construction practice for the development, including:

- Traffic Management Co-ordinator – a competent traffic management co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management;
- Delivery Programme – a programme of deliveries will be submitted to Donegal County Council (DCC) in advance of the delivery of the turbine components to site;
- Information to locals – local residents in the area will be informed of any upcoming traffic related matters, e.g. temporary lane/road closures (if required) or any night deliveries of turbine components, via letter drops and posters in public places. Information will include the contact details of the Applicant's representative, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided;
- Pre and Post Construction Condition Survey;
  - A pre-condition survey of roads on approach to the site will be carried out prior to construction commencement to record the condition of the road;
  - A post construction survey will be carried out after works are completed;
  - Impacts on the road condition as a result of the proposed project will be rectified and the road condition returned at least to its original condition.
  - The timing of these surveys will be agreed with DCC;
- Liaison with Local Authorities – liaison with DCC, including their roads and transport section, through which the delivery route traverses and An Garda Siochána, during the delivery phase of the AILs, wherein an escort for all convoys may be required;
- Temporary Alterations – implementation of temporary alterations to road network at critical junctions;

- Travel plan for construction workers – a travel plan for construction staff and sub-contractor construction staff;
- Temporary traffic signs – As part of the traffic management measures, temporary traffic signs will be put in place;
- Travel Management Operatives will be present at all site access points during peak delivery times; and,
- Delivery Times of Large Turbine Components – The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage.

The Traffic Management Plan (TMP) will be updated by the principal contractor (on appointment) and agreed with the Planning Authority prior to commencement of development in the event of a grant of permission.

4.3 SITE ACCESS AND EGRESS

- At the proposed access points to the proposed project, visibility splays shall be provided and maintained in accordance with the TII guidelines of a 2.4m setback over a length of 160m in both directions. To ensure a safe working access for all construction vehicles on the Wind Farm, these works will be required to be undertaken in advance of all other activities on the site utilising this access. Minor improvements to the sight lines in the form of trimming and removal of existing vegetation within the site shall be required on completion of the site accesses construction works.

The principal contractor shall be required to utilise a safe system of traffic management, including the use of Traffic Management Operatives (TMOs) for the control of traffic during access / egress operations at the site access locations during the peak construction activities (e.g. during the 19 days of delivery for the concrete pours).

4.4 ROUTING OF CONSTRUCTION PHASE TRAFFIC

- The proposed haul roads were identified based on review of existing quarry sources, principal road networks (i.e. national and regional) and consultation with the local authorities. Felled trees will be taken off site for processing. Tree felling is part of the normal site operations as forestry is thinned and felled in cycles. The haul routes utilise the national and regional road network as much as feasible, with only localised use of the local road network. All construction traffic to the Wind Farm site will arrive via the R250, with the most prevalent use of the national road network to be the N59. As detailed in Section **Error! Reference source not found.**, the majority of materials delivered to site will be delivered using maximum legal articulated lorries or smaller vehicles.

Project construction HV traffic will be directed away from communities and sensitive receptors (i.e. schools, dense residential areas, urban centres) where possible to minimise the effect on these communities.

Other Construction Materials such as stone fill required for internal access tracks, concrete, fencing materials and landscaping elements will be sourced by the principal contractor. Such material deliveries are envisaged to utilise one of the haul routes identified in **Error! Reference source not found.**. The principal contractor shall be required, in the further development of the TMP, to identify the sources and proposed haul routes for all material supplies.

4.5 SITE SPECIFIC TEMPORARY TRAFFIC MEASURES

The specific details of each temporary traffic measure shall be developed by the contractor(s) for each site access in consultation with the Roads Authority, An Garda Síochána and other Emergency services, before being submitted to the Roads Authority for formal approval prior to any works taking place.

The maximum length of the active traffic management area (i.e. including taper lengths) shall be no more than 500m in length for any proposed shuttle system i.e. the length of road affected by the works. In order to minimise traffic delays, it may be necessary to limit the works site to shorter lengths if queuing delays are encountered.

Any requirement for a traffic lane closure will be controlled by an active traffic management system (i.e. temporary traffic signals or Stop & Go / Téigh discs). An Garda Síochána shall be consulted prior to the implementation of the active traffic management system. The operation of a manual 'Stop & Go / Téigh' system will be undertaken by trained personnel, wearing suitable high visibility garments. The operators of this type of system will be in verbal contact (i.e. walkie talkie) and preferably inter-visible. At these locations queue lengths will be estimated initially with onsite measurements to determine the necessary warning distance for approaching drivers. The signage shall be adjusted as necessary when the actual impact on traffic flows is established.

The optimum traffic lane width shall be 3.3m, with a minimum width of 3.0m. Reduction of the temporary traffic lane width below these parameters may result in the requirement for marshalling of larger vehicles (i.e. HV and buses) or alternatively implementing a diversion route for traffic, which shall be approved by the Road Authority following consultation with the Road Authority, An Garda Síochána and other emergency services.

Where roadworks impede dwelling access onto the road network, the residents shall be instructed on how to egress the property at times when a shuttle system is in operation. The contractor shall provide a TMO at accesses where the motorist is having difficulty following the instructions.

Where reasonably practicable, consideration will be given to the possibility of removing the traffic management measures in order to deal with:

- Particularly high traffic volumes due to sporting or other events;
- Adverse weather conditions;
- Emergency access; or
- Times when work is not in progress.

If the night-time or weekend Temporary Traffic Management (TTM) measures varies from the daytime plan, a separate TTM will be prepared to be approved by the Roads Authority.

On completion of the works, the traffic management measures will be removed when the road is safe and free from obstructions, all reinstatement of road surfacing is completed and all permanent signs, road markings and other items are in place.

4.5.1 *TRAFFIC MANAGEMENT SYSTEMS / LOGISTICS*

The principal contractor as a minimum shall employ the following traffic management systems and logistics to facilitate the safe transport of materials to and from the proposed project.

4.5.1.1 Traffic Management Operatives (TMOS)

No pinch points are present on the public road during the delivery of materials from the sources on the haul routes to the site accesses on the L6483. Due to improvement works at the site access it is not envisaged that TMOs would be required at the L6483 access during average construction traffic volumes. The road has adequate width for vehicles to turn into the site and advanced warning signage is proposed. During peak construction activities, the appointed contractor may require TTM (i.e. stop / go system) at the site access to facilitate movement of construction vehicles off site if in convoy.

During large volume of movements both to and from the site of HVs, TMOs implementing a Stop / Go System will be in place on the L6483.

TMOs will be required within the site to manage the movement of HVs within the internal layout, in particular during peak construction activities.

TMOs and TTM for the AIL delivery will be developed by the appointed contractor in consultation with the specialised haulage provider, An Garda Síochána and the Local Authority.

4.5.1.2 Convoy System

A convoy system shall be employed by the principal contractor, applied to HVs departing the site, involving:

- Traffic management operatives at the proposed project access / egress points. The TMOs shall restrict HVs exiting the site, to facilitate the development of a convoy system (maximum 4 no. HVs);
- Suitable spaces shall be made available within the site for queuing of HVs (i.e. passing bays and at widened crossing points / site accesses);
- Traffic management operatives shall be stationed at the L6483 accesses with suitable intercommunication system (i.e. radio) to control the release of the convoy system;
- The convoy shall have separation between convoys to facilitate use of the public road network in the absence of construction HV movements.

4.5.2 Traffic Management Speed Limits

Where a temporary speed limit is deemed appropriate by the contractor(s) to facilitate the Construction Phase activities along the public roads serving the proposed project, it shall be a requirement for the appointed Contractor to liaise with the relevant Roads Authority for the purpose of obtaining a temporary speed limit.

Adherence to posted / legal speed limits will be emphasised to all staff / suppliers and contractors during induction training. In speed zones greater than 60km/h, drivers of construction vehicles / HVs will be instructed that vehicular movements in sensitive locations, such as schools and local community areas, shall be restricted to 60 km/h. Such advisory speed limits will only apply to Construction Phase haulage traffic and shall not apply to general traffic. It is not proposed to signpost such speed limits in the interest of clarity for local road users.

4.5.3 Traffic Management Signage

Signage for temporary traffic measures shall be provided in accordance with the Department of Transports Traffic Signs Manual, August 2019 - Chapter 8 – Temporary Traffic Measures and Signs for Roadworks (or any subsequent update of the standards that will be in place at the time of construction).

Advanced warning signs will be used to alert drivers to the unexpected road layout. Clear construction warning signs shall be placed at adjacent roads and the entrances, to advise the general public of the presence of construction sites and activities. All permanent road signs contrary to the proposed roadworks will be covered for the duration of the works and uncovered on removal of the temporary traffic management measures.

4.5.4 *Timing of Material Deliveries*

In order to reduce impacts on local communities and residents adjacent to the proposed sites, it is proposed that:

- Construction activities will be undertaken based on a six-day working week, with deliveries between 07:00-19:00 on weekdays and 07:00-14:00 on Saturdays.
- HV deliveries shall avoid passing schools at opening and closing times where it is reasonably practical. Deliveries are restricted between the hours of 08:00 and 09:00hrs, the school morning peak and peak traffic on the road network.
- Construction activities and deliveries outside these hours shall be agreed with the Local Authority in advance.
- The contractor shall liaise with the management of other construction projects and the local authority to co-ordinate deliveries.
- The contractor shall schedule deliveries in such a way that construction activities and delivery activities do not occur during peak traffic flows or run concurrently, such as;
  - avoiding pouring of concrete on the same day as other large material deliveries to site in order to avoid conflicts between vehicles.
  - staggering the pouring of concrete on different days.
- HV deliveries to the development site will be suspended on the days of any major events (i.e. sporting, agricultural etc), that have the potential to cause larger than normal traffic volumes on the existing road network, in the vicinity of the works.
- The contractor will be required to interact with members of the local community to ensure that deliveries will not conflict with sensitive events such as funerals; and
- It is likely that some deliveries will be required to be undertaken outside these hours. For example, during large concrete pours or other essential continuous operation whereby the continuous delivery of material will be required. Such deliveries will be agreed in advance with Donegal County Council.

The scheduling of material deliveries is required in order to facilitate the implementation of traffic management activities at the site and the works zones within the site. It will also impact on the offsite works locations for the AIL advanced works. A convoy system shall be employed for HVs departing the proposed project to reduce the frequency of isolated HV movements on the public road network as much as practicable.

4.5.5 *Abnormal Indivisible Load*

A total of 171 no. AILs are anticipated to be transported to the site along the AIL haul route. It is envisaged that these loads will be moved outside of normal hours as night-time works in convoys. A maximum of 5 turbines (i.e. all tower, nacelle and blades) will be delivered to site per month. The convoys are anticipated to be have 3 or 5 no. AILs per convoy with deliveries over a maximum of 9 days or a minimum of 6 days.

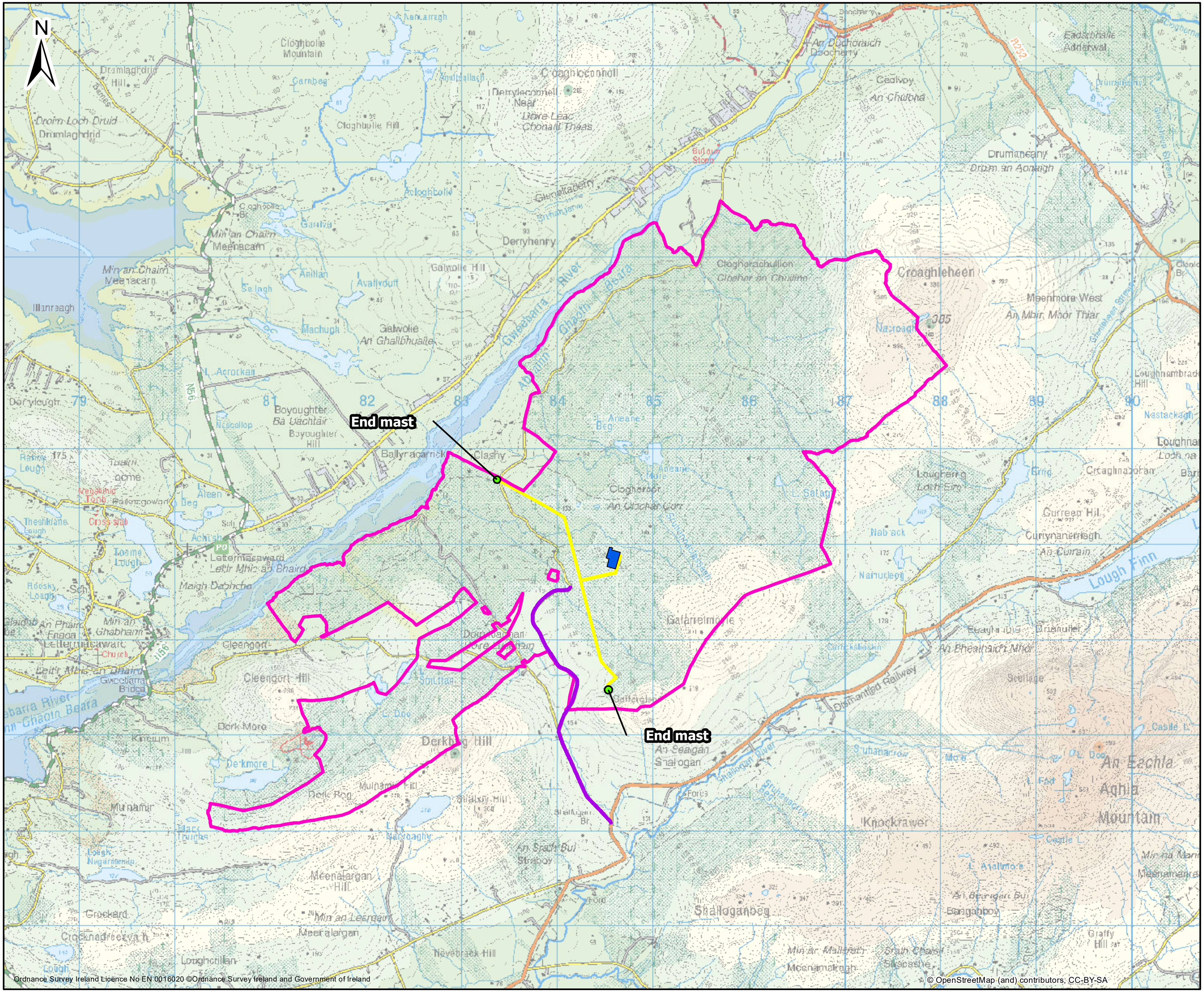
The principal contractor shall ensure that the haulage of these AILs is done in conjunction with an Gardaí Síochána and the Roads Authority The principal appointed contractor and their haulage provider will be responsible for obtaining all necessary permissions and licences from the local authority and Gardaí.

4.5.6 *Road Closure*

In order to facilitate the grid connection of the proposed wind farm to the national grid, a connection between the proposed site and 110kV overhead line is required, see Figure 4-1. This requires a transverse trenched road crossing of the local road, the L6483.

A temporary road closure or off-peak works shall be required to facilitate the laying of the cable crossing. The road closure or off-peak works will be limited to 1 day or night. The principal contractor shall carry out such temporary road closures outside of peak traffic flow times, and only for the duration of the working day. At the time of this construction work and in advance of the required Road Closure, the appointed Contractor shall consult with the Roads Authority, An Garda Síochána and other Emergency services to agree a suitable diversion route prior to implementing a Road Closure.

The trench shall be suitably backfilled at the end of the working day, with the provision of suitable temporary surfacing material, as may be requested by the local authority. Such closures shall only be undertaken following consultation with the local authority and following any requests for notifications by the local authority. A road opening licence shall also be applied for, by the principal contractor to the local authority. The contractor will also be required to provide the requisite bond to ensure reinstatement is completed to the satisfaction of the road's authority. Full pavement reinstatement is required in accordance with the "Purple Book" or former Department of Transport, Tourism and Sport '*Guidelines for Managing Openings in Public Roads'*, Second Edition Rev 1 April 2017.



Legend *

Proposed Wind Farm Site Boundary

Turbine Delivery Route works

Proposed Grid Connection Route

Substation Location

* all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2

Kilometres

NOTES

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A	24/01/2023	Final issue	S.P	J.S
Issue	Date	Description	By	Chkd.

Client:

Cloghercor Wind Farm ltd.

Project:

Cloghercor Wind Farm

Title:

Figure 4-1:Proposed Grid Connection Route

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta

Checked: J.Staunton

Date: January 2023

Project Director: O.Fitzpatrick

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Draft: A

For the AIL advanced works, road and lane closures will be avoided due to the high volume of baseflow traffic and the strategic importance of these routes at the works locations. At these locations, a short-term temporary traffic management system of an “All Stop” may be more appropriate. Off-peak working hours would also reduce the impact on the high traffic volumes. The details of these traffic management plans will be formalised by the appointed Contractor and agreed with the Roads Authority (including TII representatives on the national roads).

4.5.7 *Road Cleaning*

Regular visual surveys of the road network in the vicinity of the sites will be carried out. Where identified / required, the contractor shall carry out road sweeping operations, employing a suction sweeper to remove any project related dirt and material deposited on the road network by construction / delivery vehicles. It shall be a requirement of the works contract that the contractor(s) will be required to provide wheel cleaning facilities, and any other necessary measures to remove mud and organic material from vehicles. In addition, the cleaning of delivery lorries such as concrete delivery lorries shall be carried out at the material storage yard as outlined in the CEMP.

4.6 ENFORCEMENT OF TRAFFIC MANAGEMENT PLAN

The appointed contractor will further develop this TMP in consultation with the Road’s Authority Donegal County Council. The contractor will, during the development and adoption of the TMP, agree and implement an appropriate way of monitoring the effectiveness of the plan by continually inspecting the site for traffic tailbacks and monitoring and recording any potential complaints.

All project staff and material suppliers will be required to adhere to the Traffic Management Plan. Inspections / spot checks will also be carried out by the contractor(s) to ensure that all project staff and material supplies follow the agreed measures adopted in the Traffic Management Plan.

4.7 EMERGENCY PROCEDURES DURING THE CONSTRUCTION

In the case of an emergency, the following procedure shall be followed:

- Emergency Services will be contacted immediately by dialling 112;
- Exact details of the emergency/ incident will be given by the caller to the emergency line operator to allow them to assess the situation and respond in an adequate manner;
- Instructions of the Local Authorities and An Garda Síochána will be followed;
- The emergency will then be reported to the Site Team Supervisors and the Safety Officer;
- Where required, appointed site first aiders will attend the emergency immediately; and
- The Safety Officer will ensure that the emergency services are enroute.

It is important that during the Construction Phase, emergency services can gain ready access to any property along the Haul Road or in the vicinity of any of the proposed infrastructure sites, or indeed can gain priority usage of any Haul Road. Emergency procedures will be agreed, and contact numbers provided to the local Emergency Services. On being notified of a priority condition, all construction vehicles will be directed to give right of way to the emergency vehicles until the need for priority access has passed.

With respect to an emergency condition arising on any of the sites, priority access to and from these sites will be given to ambulance or fire tenders.

5.0 OPERATIONAL AND DECOMMISSIONING PHASES

5.1 OPERATIONAL PHASE

On completion of the construction works, and when the wind farm is operational, the majority of the traffic generated for the operation of the site will be for routine maintenance by a small van or four by four. The access to the site will not be via the L6483 construction accesses.

The site will be regularly accessed for forestry proposes similar to the existing background traffic generated. The site will also have recreational use for walkers and cyclists on completion of the construction. This will generate a small amount of additional traffic to the L6483.

Overall, due to the relatively low operational and recreational traffic, it is envisaged that the operational impacts of the proposed project will be slight when compared to the existing background traffic.

As the site accesses for construction have been designed as new or upgraded in accordance with the TII DN-GEO-03060, adequate visibility splays are available from the accesses in both directions. Minor maintenance of hedgerows and vegetation to maintain the required visibility shall be required.

5.2 DECOMMISSIONING PHASE

The wind turbines proposed as part of the proposed project are expected to have a lifespan of up to 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site may be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning of the proposed wind farm, the wind turbines will be disassembled in reverse order to how they were erected. All above ground turbine components will be separated and removed off-site for recycling. Turbine foundations will remain in place underground and will be covered with earth and allowed to revegetate or reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in potentially significant environment nuisances such as noise, dust and/or vibration. The site roadways will be in use for additional purposes to the operation of the wind farm (e.g. for forestry and recreational use) by the time the decommissioning of the project is to be considered, and therefore the site roads will remain in situ for future use.

The traffic management of the decommissioning phase will be advised by the road conditions at the time of decommissioning. It is not possible to predict the changes to the public road infrastructure and policies in the next 30-40 years. A Traffic Management Plan will be developed for the decommission phase.

6.0 CONCLUSION

The TMP is a living document and shall be developed through the Detailed Design and Construction phases with ongoing consultation with the Local Authority, An Garda Síochána, Emergency Services and other stakeholders.

This TMP ensures that the necessary steps are taken to support an efficient, safe transportation operation, with the least possible impact upon vulnerable road users and traffic along the haul roads or in close proximity to the proposed project.

Appendix 2-8 – Flood Risk Assessment

TOBIN
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BUILT ON KNOWLEDGE

Cloghercor Wind Farm, Co. Donegal

Flood Risk Assessment

TOBIN
CONSULTING ENGINEERS

Wind Farm at Clogherachullion & Cloghercor, Co. Donegal

Flood Risk Assessment

Document Control Sheet	
Document Reference	10798 Cloghercor Wind Farm FRA
Report Status	Final
Report Date	October 2022
Current Revision	A01
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Client Address:	TBC
Project Number	10798

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Revision	Description	Author:	Date	Reviewed By:	Date	Authorised by:	Date
D0	Draft	KD	18/10/2022	ML	27/10/2022	JS	30/01/2023
TOBIN Consulting Engineers							

Table of Contents

Table of Figures

Table of Tables

1.0 INTRODUCTION

TOBIN Consulting Engineers were appointed by Orsted/FEI to undertake a Flood Risk Assessment (FRA) for their lands (see Figure 1-1) and proposed wind farm site (see Figure 1-2) at Clogherachullion and Cloghercor, Co. Donegal.

Figure 1-1 shows the location of the subject site. The approximately 20km^2 subject site is comprised of forestry, bogland and lakes. A number of watercourses flow through the subject site. All the watercourse flow in a north-westerly direction towards the Gweebarra River that flows in a south-westerly direction before discharging to the Atlantic Ocean approximately 7km from the western site boundary. The subject site ground levels ranging from approximately 1mOD at the north-western corner of the subject site up to 275mOD at the southern boundary of the subject site. The site falls in a westerly direction, with the western boundary of the subject site low lying, and the eastern side of the subject site considerably higher.

The purpose of this report ('Stage 2' Flood Risk Assessment report as defined by The Planning System and Flood Risk Management Guidelines) is to identify, quantify, and communicate the risks of flooding, if any. The report assesses at the entire land holdings including the proposed wind farm and the areas for future development, as one subject site.

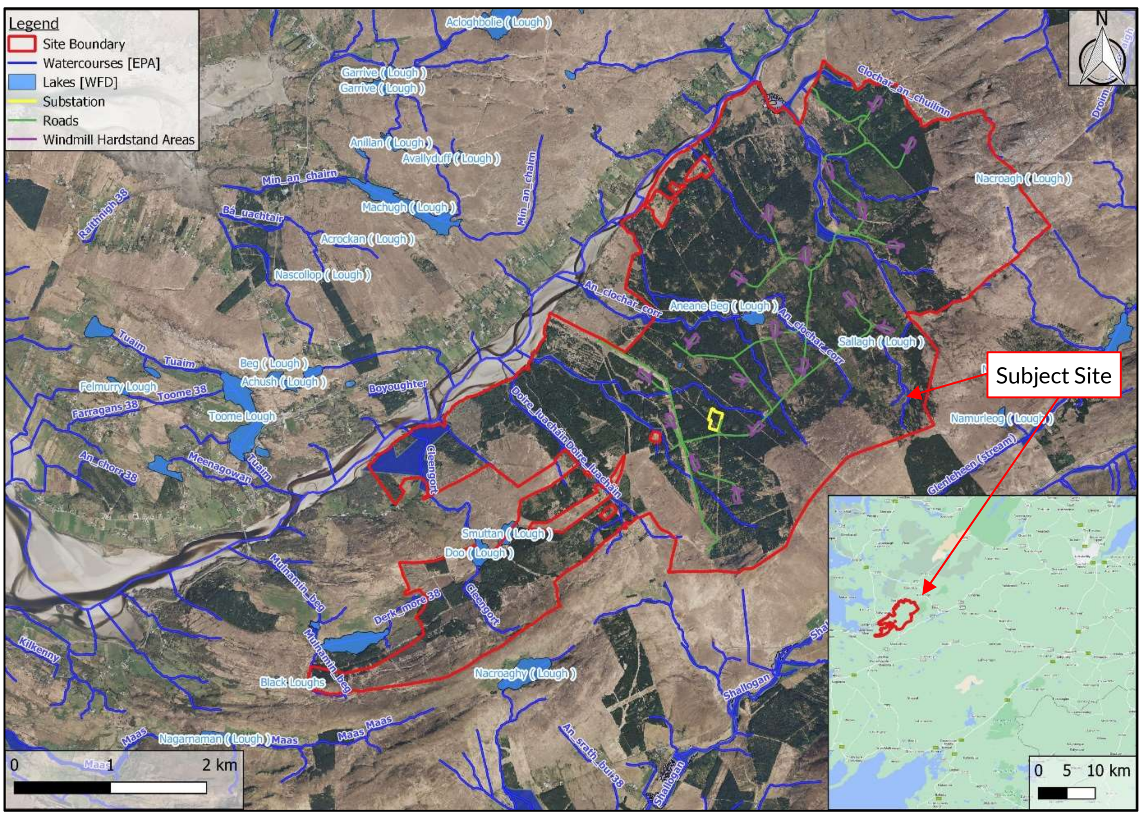

Figure 1-1 Site Location

A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height of between 185-2m, a rotor diameter of between 149-164m, a hub height of between 112-125m, and all associated foundations and hard-standing areas in respect of each turbine;

- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery and construction access at 5 locations on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;
- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.01km cable length within trenches on approximately 3.36km of internal access roads) to the existing 110kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of fourteen existing wooden polesets between the two new end masts;
- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed development and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking and cycling trails along the site access roads and paths, and associated recreation and amenity signage; and

- Approximately 252.5ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

The site layout for the proposed wind farm site is outlined in Figure 1-2.

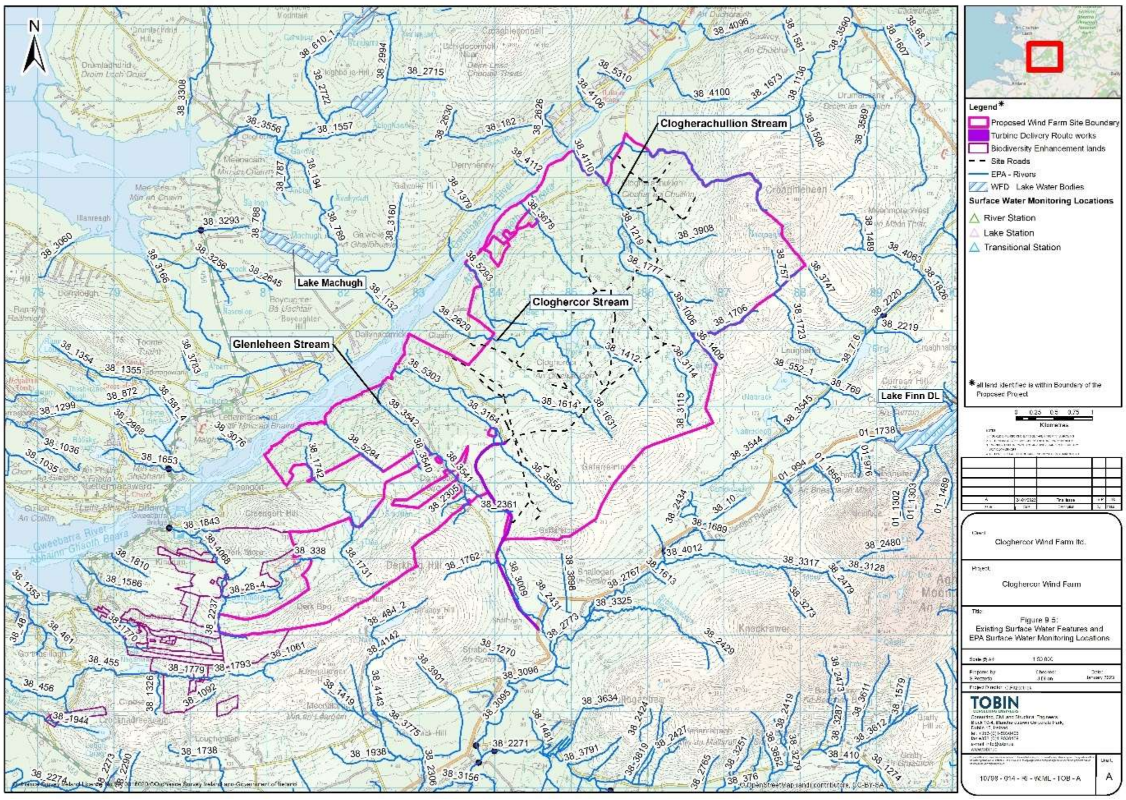

Figure 1-2 Proposed Development

2.0 FLOOD RISK MANAGEMENT GUIDANCE

This Strategic Flood Risk Assessment was carried out in accordance with the following flood risk management guidance documents:

- The Planning System and Flood Risk Management Guidelines for Planning Authorities
- Flood Risk Management Climate Change Sectoral Adaptation Plan
- Donegal County Council Development Plan

2.1 The Planning System and Flood Risk Management Guidelines

The Planning System and Flood Risk Management Guidelines for Planning Authorities (PSFRM Guidelines) were published in 2009 by the Office of Public Works (OPW) and Department of the Environment, Heritage and Local Government (DoEHLG). Their aim is to ensure that flood risk is considered in development proposals and the assessment of planning applications.

2.1.1 Flood Zones and Vulnerability Classes

The PSFRM Guidelines discuss flood risk in terms of flood zones A, B, and C, which correspond to areas of high, medium, or low probability of flooding, respectively. The extents of each flood zone are based on the Annual Exceedance Probability (AEP) of various flood events.

The PSFRM Guidelines also categorise different types of development into three vulnerability classes based on their sensitivity to flooding.

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

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

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

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

The PSFRM guidelines classify essential infrastructure, such as electricity substations, as 'highly vulnerable' in terms of their sensitivity to flooding, while the proposed turbines and ancillary works are considered 'water compatible'.

The proposed substation is therefore considered appropriate in Flood Zone C, where the probability of flooding is less than 1-in-1,000-years (<0.1% AEP).

2.1.2 The Justification Test

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

Box 5.1 Justification Test for development management (to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
   (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
   (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
   (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
   (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 2-1 Criteria of the Justification Test

2.2 The Flood Risk Management Climate Change Adaptation Plan

The Flood Risk Management Climate Change Sectoral Adaptation Plan was published in 2019 under the National Adaptation Framework and Climate Action Plan. This plan outlines the OPW's approach to climate change adaptation in terms of flood risk management.

This approach is based on a current understanding of the potential impacts of climate change on flooding and flood risk. Research has shown that climate change is likely to worsen flooding through more extreme rainfall patterns, more severe river flows, and rising mean sea levels.

To account for these changes, the Adaptation Plan presents two future flood risk scenarios to consider when assessing flood risk:

- Mid-Range Future Scenario (MRFS)
- High-End Future Scenario (HEFS)

Table 2-2 indicates the allowances that should be added to estimates of extreme rainfall depths, peak flood flows, and mean sea levels for the future scenarios.

Table 2-2 Climate Change Adaptation Allowances for Future Flood Risk Scenarios

Parameter	Mid-Range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Extreme Rainfall Depths	+ 20%	+ 30%
Peak River Flood Flows	+ 20%	+ 30%
Mean Sea Level Rise	+ 0.5 m	+ 1 m

The proposed development has considered a Mid-Range Future Scenario (MRFS) as this represents a likely future scenario.

2.3 County Donegal Development Plan 2018-2024

The current County Donegal Development Plan provides a strategic framework for land use planning for 2018 to 2024. Section 5.4 outlines Donegal County Council's strategy for the management of flooding, with the aim "to manage development proposals within flood risk areas in a sequential manner based on avoidance, substitution, justification and mitigation and to otherwise ensure that flood risks can be managed to an acceptable level without increasing flood risk elsewhere".

The development plan sets out seven key policies, integrating land use planning and flood risk management:

F-P-1 It is a policy of the Council to ensure that all development proposals comply with The Planning System and Flood Risk Management - Guidelines for Planning Authorities', November 2009, DoEHLG. In doing so the planning authority shall:

- Assess developments in accordance with the Sequential approach and precautionary principle set out the in the Planning System and Flood Risk Management – Guidelines for Planning Authorities'; and
- Utilise the Draft Flood Risk Management Plans (and any associated flood risk mapping) prepared as part of the CFRAMS programme, or any other flood risk datasets or mapping it considers appropriate, in assessing flood risk.

F-P-2 It is a policy of the Council to require applicants/developers to submit, where appropriate, an independent 'Flood Risk Assessment' in accordance with the Flood Risk Management Guidelines, DEHLG, 2009 or any subsequent related publication and/or 'Surface Water Drainage Calculations', from suitably qualified persons.

F-P-3 It is a policy of the Council to require applicants/developers to submit, where appropriate, evidence of compliance with the Justification test set out in S5.15 of The Planning System and Flood Risk Management - Guidelines for Planning Authorities' (DoEHLG 2009) or any subsequent related publication.

F-P-4 It is a policy of the Council not to permit development where flood or surface water management issues have not been, or cannot be, addressed successfully and/or where the presence of unacceptable residual flood risks remain for the development, its occupants and/or property or public infrastructure elsewhere including, inter alia, up or downstream.

F-P-5 It is a policy of the Council to promote the use of Sustainable Urban Drainage Systems (SUDs), flood attenuation areas, the controlled release of surface waters and use of open spaces and semi permeable hard surfaces for appropriate development proposals.

F-P-6 It is a policy of the Council to consider the development of long and short-term flood remediation works, including embankments, sea defences, drainage channels, and attenuation ponds to alleviate flood risk and damage to livelihoods, property and business subject to environmental considerations including potential impact on designated shellfish water and, fresh water pearl mussel catchment areas, compliance with Article 6 of the Habitats Directive, best practice in Coastal Zone Management and the Marine Resource and Coastal Management policies of this Plan.

F-P-7 It is a policy of the Council not to permit developments which would hinder the maintenance of river or drainage channels.

3.0 INITIAL FLOOD RISK ASESSMENT

3.1 Past Flood Events

The OPW's National Flood Information Portal[1] provides past flood event mapping with records of flooding reports, meeting minutes, photos, and/or hydrometric data.

There are no past flood events located within the subject stie. The closest recorded past flood event is located approximately 2.5km north of the subject site. This event is noted as a recurring flood event. The flood source is noted as being from coastal/ estuarine waters. Minutes from a Donegal County Council meeting held on the 12th January 2006 notes that high tides once or twice a year flood low lying lands. The adjacent road is also liable to flood occasionally.

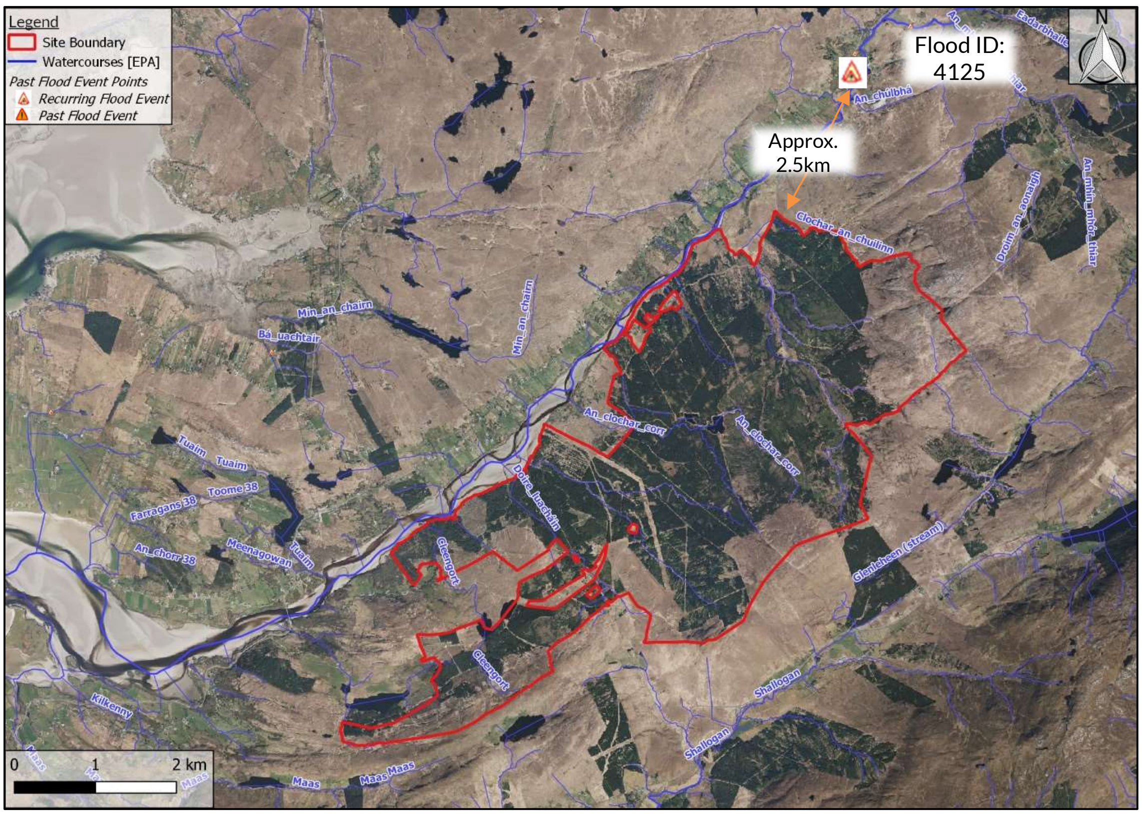

Figure 3-1 OPW Flood Map of Past Flood Events

[1] floodinfo.ie

3.2 OPW Preliminary Flood Risk Assessment (PFRA) Study

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

The OPW’s National Preliminary Flood Risk Assessment (PFRA) Overview Report from March 2012 noted that *“the flood extents shown on these maps are based on broad-scale simple analysis and may not be accurate for a specific location”*[2].

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

The PFRA mapping indicates that potions of the subject site are liable to fluvial flooding during the 1 in 100-year flood event. These flood extents are isolated to the watercourses within the subject site.

There are pockets of small pluvial flood extents located within the subject site. These extents are located in localised depressions within the subject site.

There is some coastal flooding noted along the western boundary of the subject site. There are also two Lakes/ Turloughs idnetified within the subject on the PFRA mapping.

Figure 3-3 below outlines the fluvial flood extents identified by the PFRA mapping.

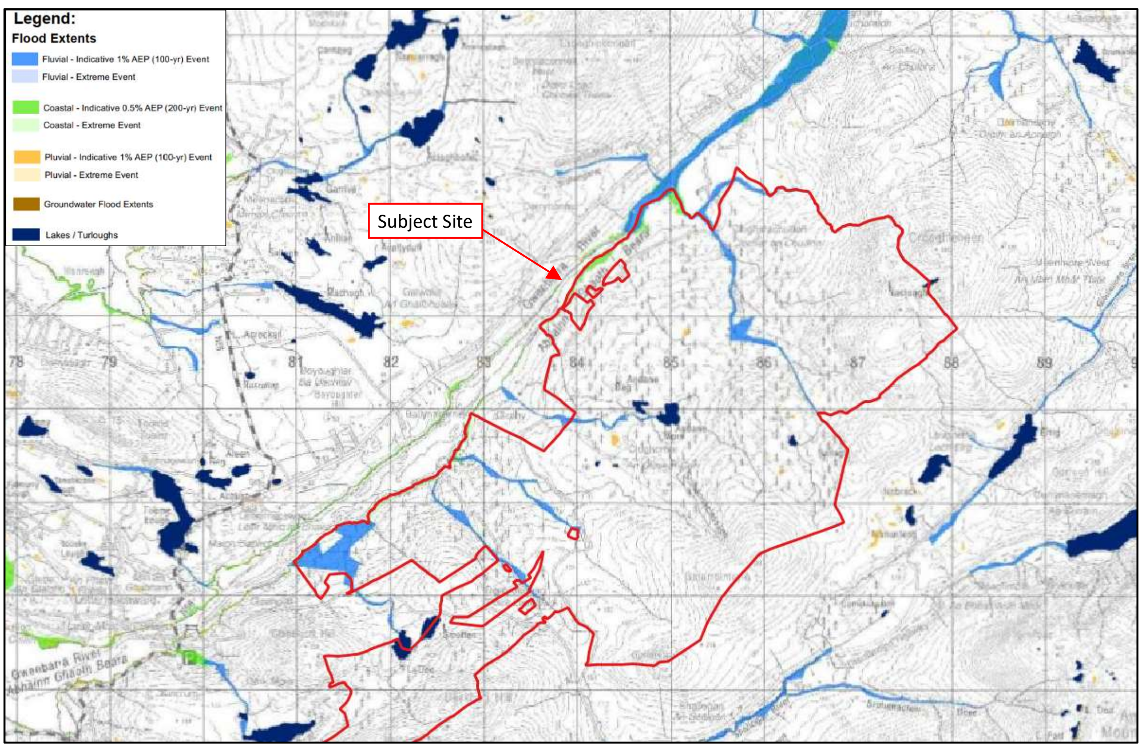

Figure 3-2 Indicative Flood Mapping (extract from PFRA Map 397)

[2] The National Preliminary Flood Risk Assessment (PFRA) Overview Report, OPW (March 2012)

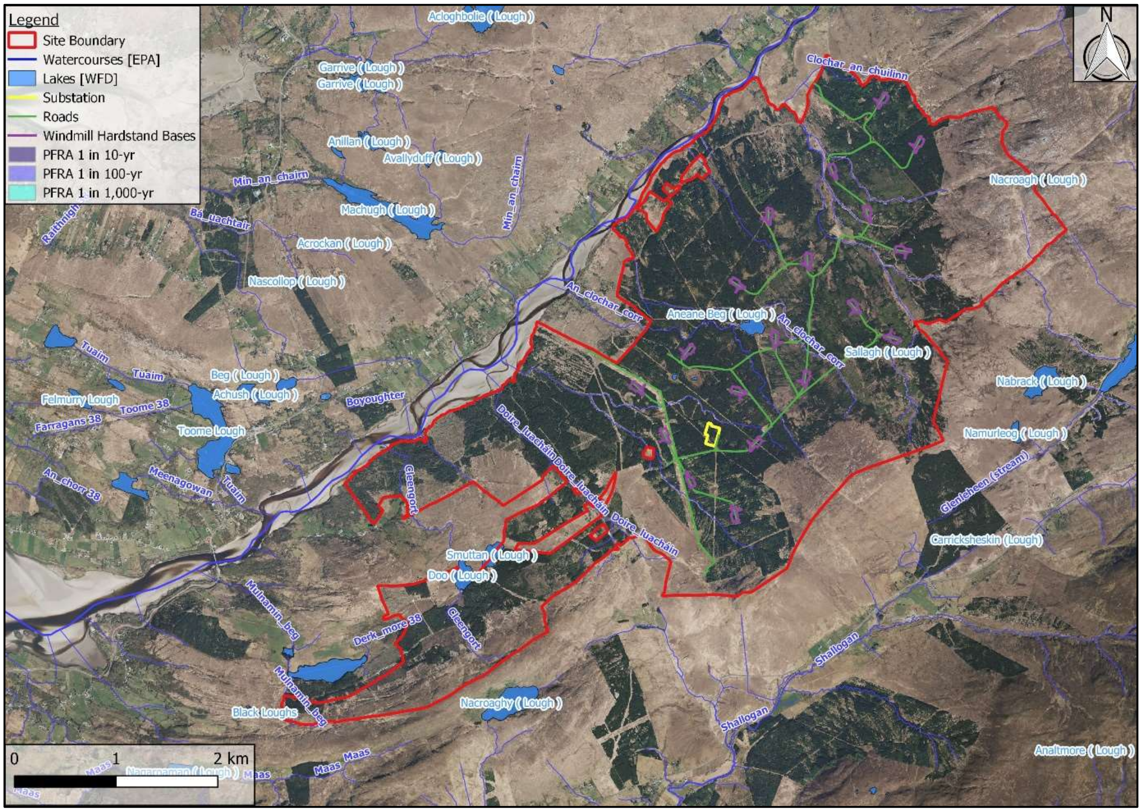

Figure 3-3 Indicative Fluvial Flood Mapping from OPW PFRA Study

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

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

3.2.1 National Indicative Fluvial Mapping[3] (NIFM)

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

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

Figure 3-4 provides an overview of the 1% and 0.1% AEP indicative fluvial flood mapping of the subject site.

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

NIFM mapping was produced for one of the watercourses within the subject site. This mapping indicates that a small portion of the subject site is susceptible to flooding during the 1 in 100-year and 1 in 1,000-year flood events. There is no critical infrastructure located in the vicinity of the modelled flood extents.

The NIFM update also included an assessment of the likely impact of climate change on flood risk in the area. The flood extents for a Mid-Range Future Scenario are shown in Figure 3-5.

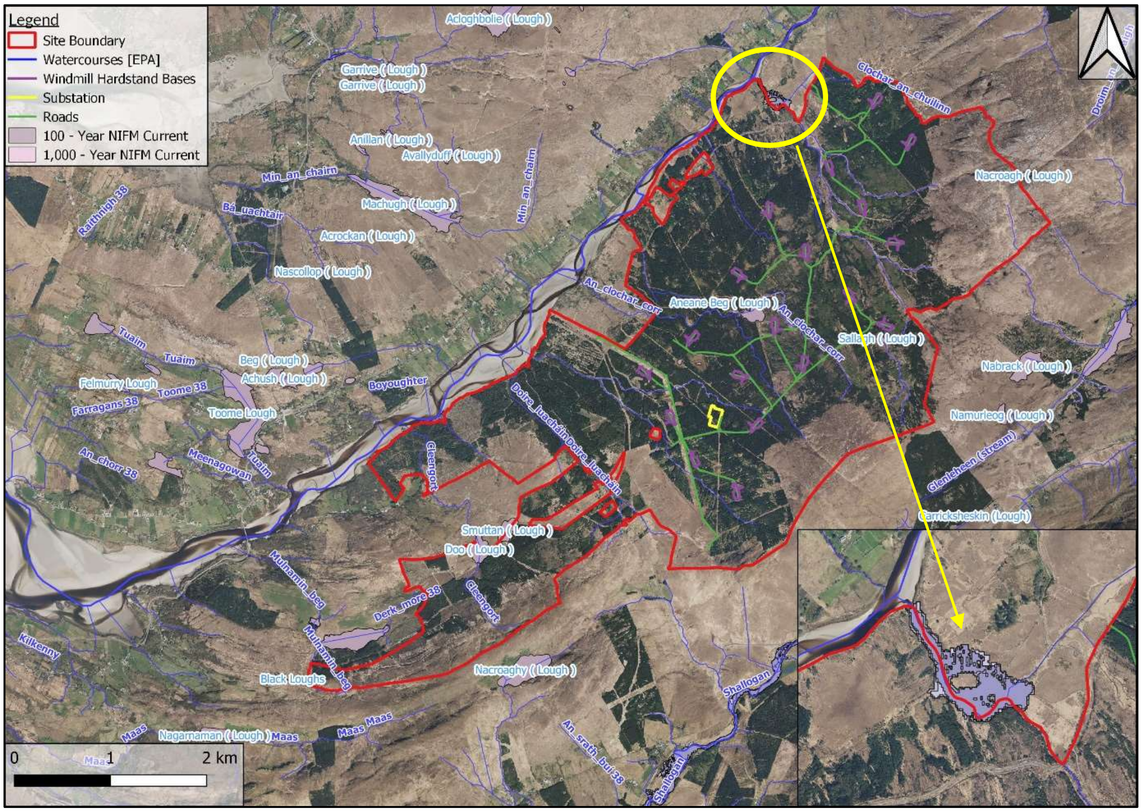

Figure 3-4 NIFM Current Flood Extents

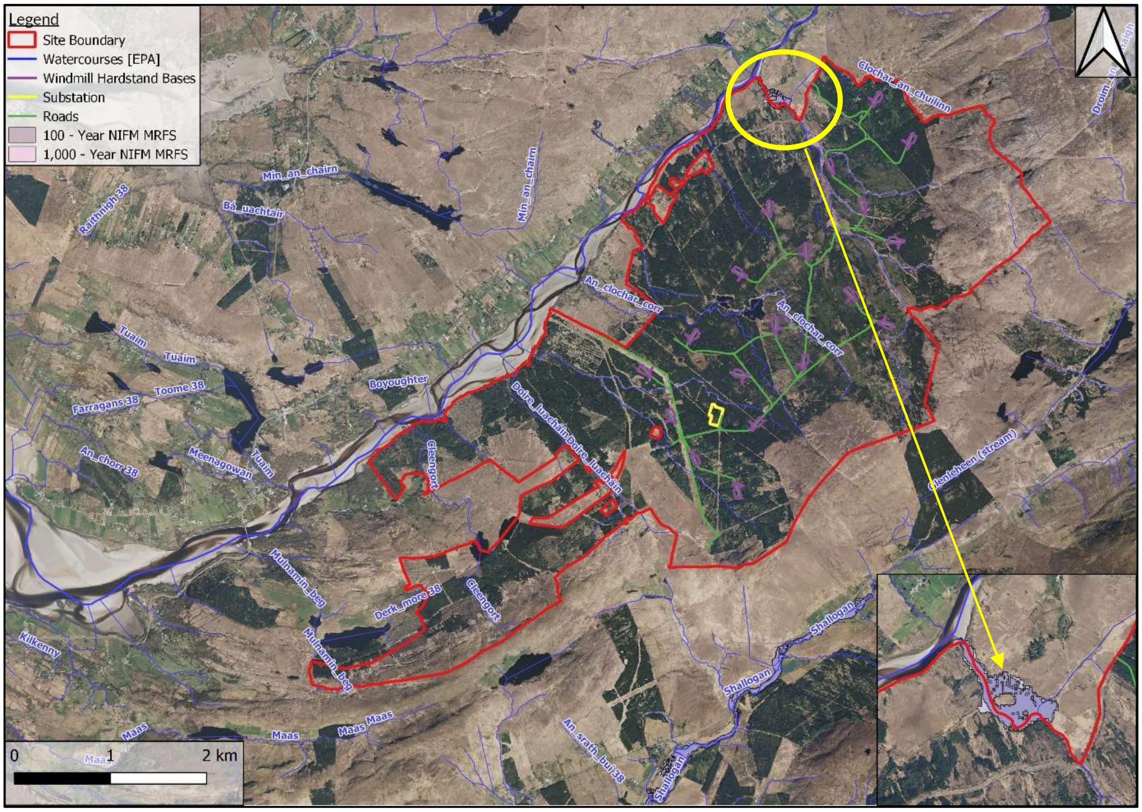

Figure 3-5 NIFM MRFS Flood Extents

3.3 Catchment Flood Risk Assessment and Management Study

In 2015, the OPW produced flood maps[1] as part of the Catchment Flood Risk Assessment and Management (CFRAM) Study. The flood extents in these maps are based on detailed modelling of Areas for Further Assessment identified by the National Preliminary Flood Risk Assessment.

The subject site and adjacent watercourses are not modelled as part of the CFRAM study.

3.4 Irish Coastal Protection Strategy Study (ICPSS)

The Irish Coastal Protection Strategy Study (ICPSS) is a national study that was commissioned in 2003 with the objective of providing information to support decision making about how best to manage risks associated with coastal flooding and coastal erosion. The Study was completed in 2013 and provides strategic current scenario and future scenario (up to 2100) coastal flood hazard maps and strategic coastal erosion maps for the national coastline.

The ICPSS flood extents show a portion of the subject site is liable to flooding during the 1 in 200 and 1 in 1,000-year flood events. Figure 3-6 below shows the current day flood extents and Figure 3-7 below shows the MRFS flood extents at the subject site. These modelled flood extents are not near any of the critical infrastructure of the proposed development.

The closest modelled ICPSS node is located in Gweebarra Bay (Node No.: NW23). This is approximately 7km west of the subject site. The water level at this node for the 1 in 200-year and 1 in 1,000-year flood events are 3.25mOD and 3.48mOD respectively. Ground levels within the subject site range from approximately 1mOD at the north-western corner of the subject site up to 275mOD at the southern boundary of the subject site. The FFLs of the critical infrastructure range from 54mOD to 179mOD.

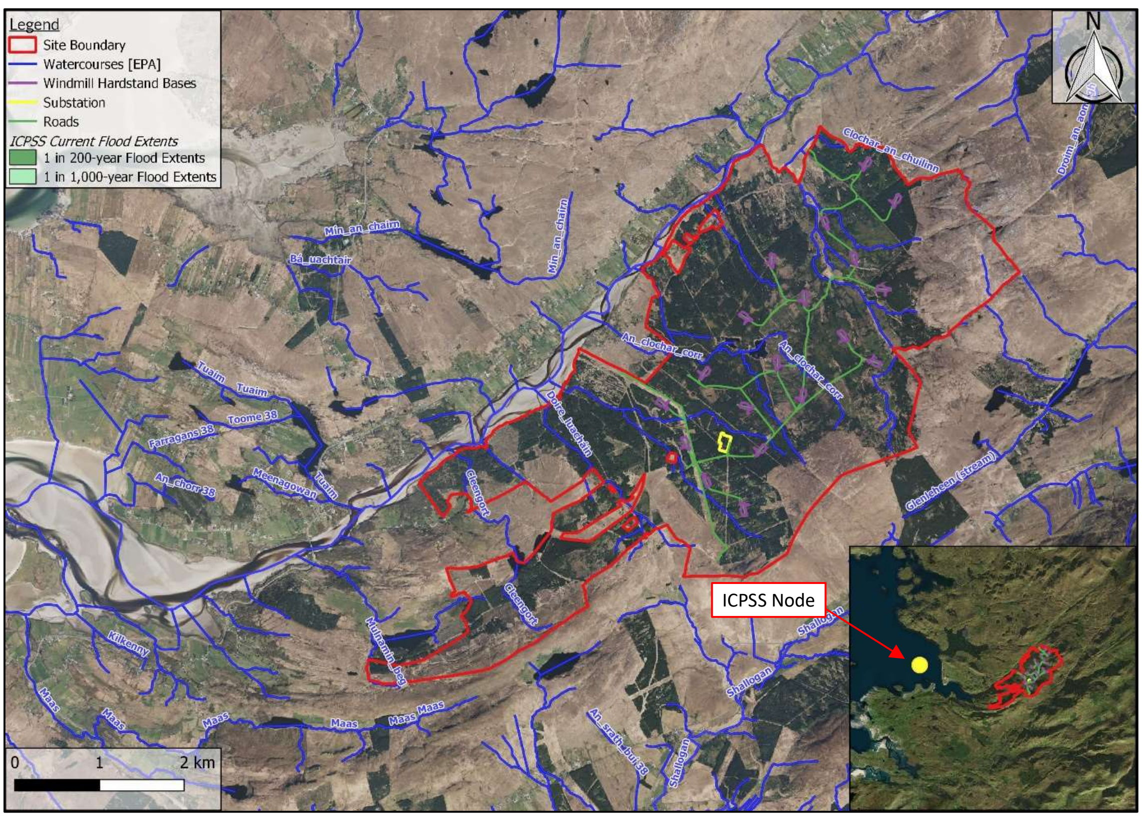

Figure 3-6 ICPSS Current Flood Extents

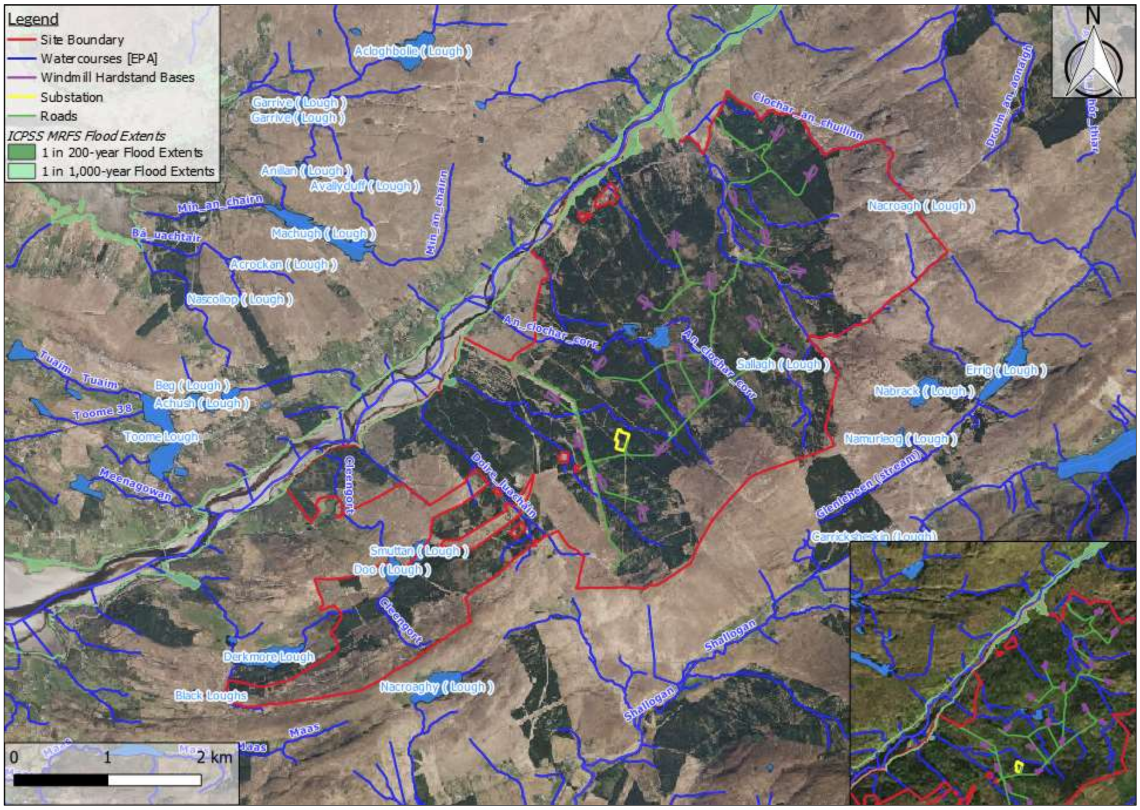

Figure 3-7 ICPSS MRFS Flood Extents

3.5 Geological Survey Ireland Mapping

The Geological Survey Ireland (GSI) provides mapping[4] with data related to Ireland's subsurface. Based on the map shown in Figure 3-8, there are no karst features (caves, springs, turloughs, etc.) in the surrounding area.

GSI mapping[5] in the vicinity of the subject site shows there is historical seasonal groundwater flooding at the subject site. The GSI mapping shows these areas as flooding seasonally from 2015 up 2021, which is the most recent mapping available.

This groundwater flooding is limited to areas around two lakes within the subject site. These lakes are located in localised depressions within the subject site and away from all critical infrastructure.

Figure 3-8 GSI Mapping of Karst Features

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

[5] https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc

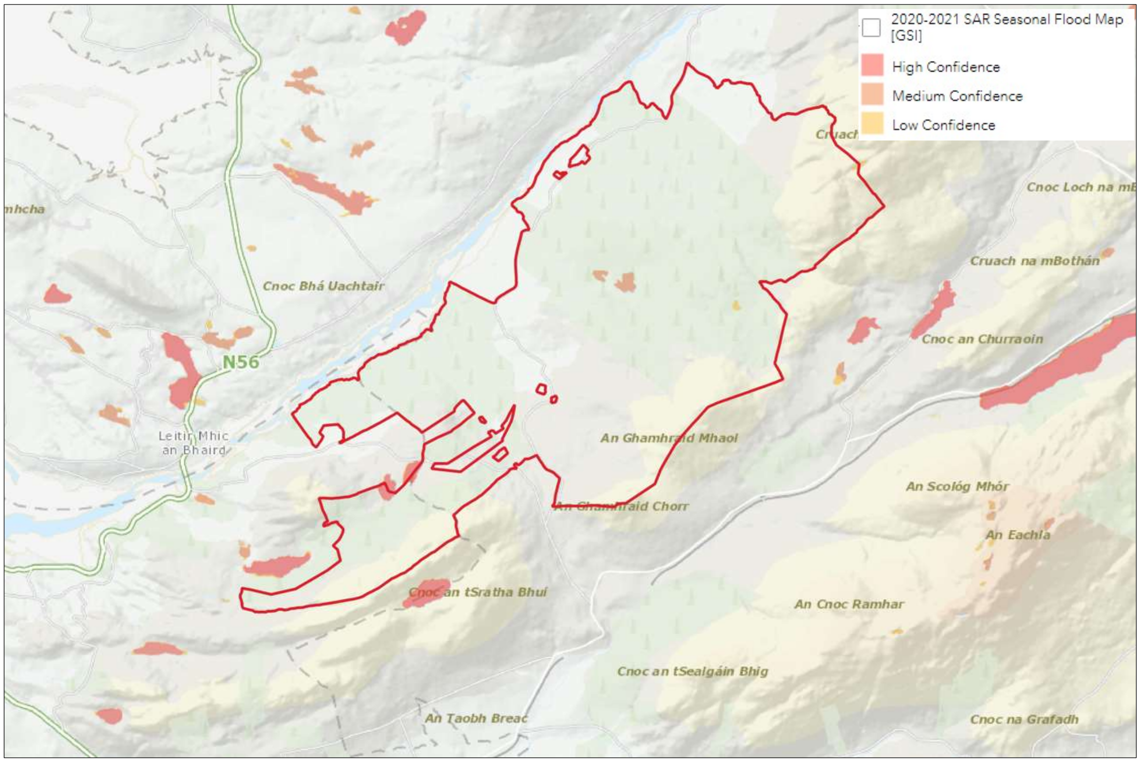

Figure 3-9 GSI Mapping of Groundwater and Surface Water Flooding

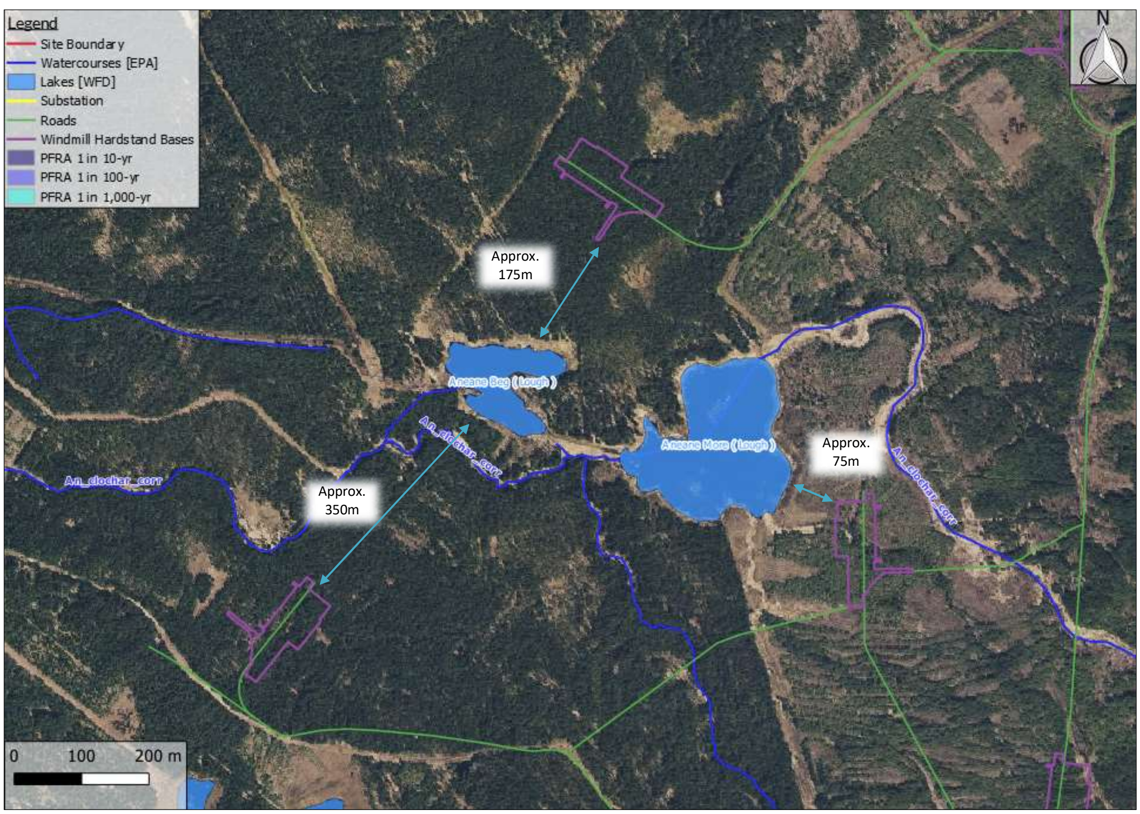

Figure 3-10 Groundwater flooding locations

4.0 DETAILED FLOOD RISK ASESSMENT

Referring to Section 2.1, the PSFRM guidelines classify essential infrastructure, such as electricity substations, as 'highly vulnerable' in terms of their sensitivity to flooding, while the proposed turbines and ancillary works are considered 'water compatible'.

Therefore, vulnerable elements of the development should be constructed in 'Flood Zone C', i.e. that there is less than a 0.1% probability of the site flooding. Accordingly, the proposed development has been assessed against a 1,000-year flood event (i.e. 0.1% Annual Exceedance Probability).

4.1 Fluvial Flooding

The proposed development is located adjacent to the Clochar an Chuilinn watercourse, along with several small watercourses which flow into the Gweebarra/ Owenwee (Doochary) watercourse. There are also two lakes within the site boundary, Aneane More and Aneane Beg.

Given the mountainous terrain of the proposed development site, the headwaters of a number of watercourses are located within the boundary of the proposed site. Due to the size of these streams (catchment area <2.5km^2), they were not surveyed/modelled as part of the OPW's CFRAM programme.

However, the lower reaches of the watercourses within the subject site are covered by the PFRA mapping. The mapping shows that there some areas of the subject site are susceptible to inundation from the 1 in 100 and 1 in 1,000-year fluvial flood events.

The Clochar An Chuilinn watercourse shows fluvial flooding during the 1 in 100 and 1 in 1,000-year flood events. The stream is U shaped in this area. The stream varies in width along its reach from 1.3m to 2.3m. The depth of the channel varies from 1m to 2m. The closest infrastructure to the stream is a wind turbine which is located approximately 150m south of the stream. The ground level at the stream is approximately 25mOD. The ground level at the proposed wind turbine is 47mOD.

The second watercourse that is unmapped by the PFRA is an unnamed watercourse located in the northern portion of the subject site. The stream is approximately 1m wide and 0.5m deep. The stream is U shaped. The closest piece of infrastructure to the flood extents is a wind turbine that is located 50m east of the modelled fluvial flood extents. Based on the existing site topography there is approximately a 2m level difference between the flood extents and the proposed turbine location. The ground level at the flood extents is approximately 47mOD while the existing ground level at the turbine location is 49mOD.

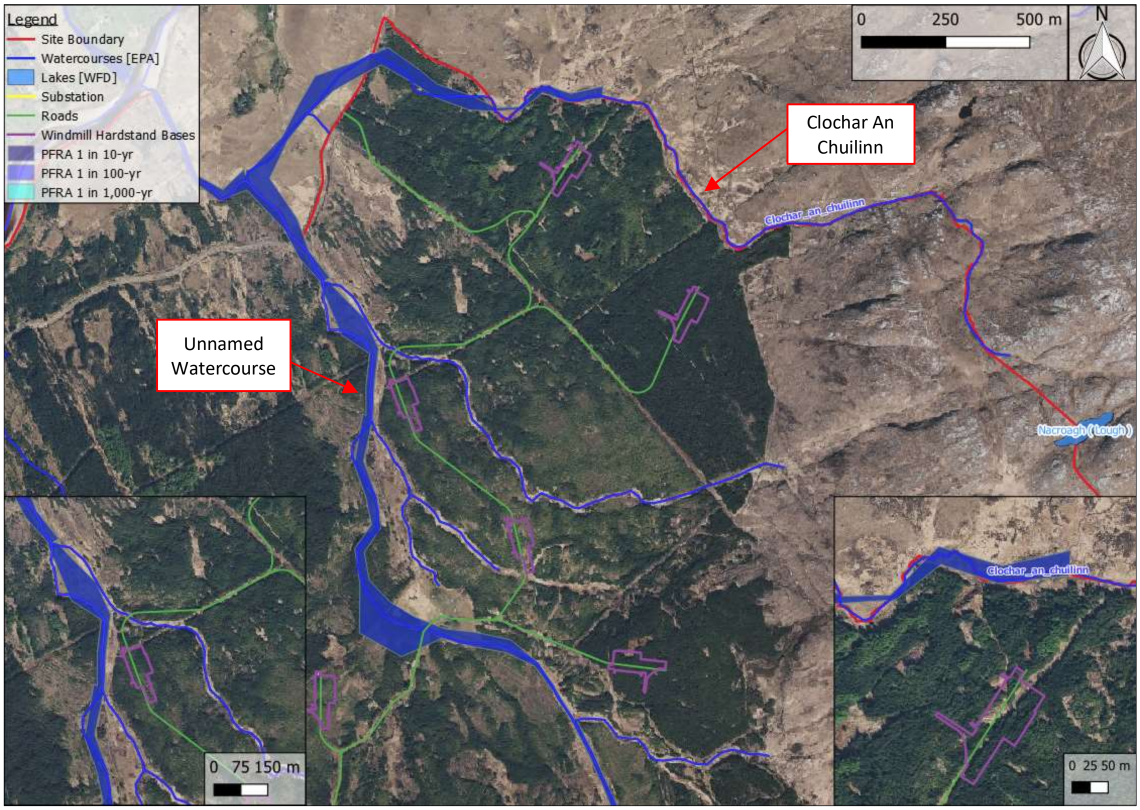

Figure 4-1 Northern portion of the subject site PFRA extents

Portions of the southern part of the subject site are also modelled by the PFRA. An Clochar Corr is the name of the watercourse located in the south of the subject site. The watercourses width ranges from 1.6m to 2m. The depth of the watercourse ranges from 0.8m to 1.3m. The watercourse is prodominantly V shaped. The watercourse drains the two lakes within the subject site, Aneane More and Aneane Beg. The closest critical infrastructure to the modelled flood extents is a windturbine located approximately 50m south of the watercourse. The ground level at the flood extents is approximately 90mOD while the existing ground level at the turbine location is 92mOD.

There is an unnamed watercourse 1km south of An Clochar Corr that is also modelled by the PFRA. The closest critical infrastructure to the modelled flood extents is a windturbine located approximately 50m west of the watercourse. The ground level at the flood extents is approximately 95mOD while the existing ground level at the turbine location is 99mOD.

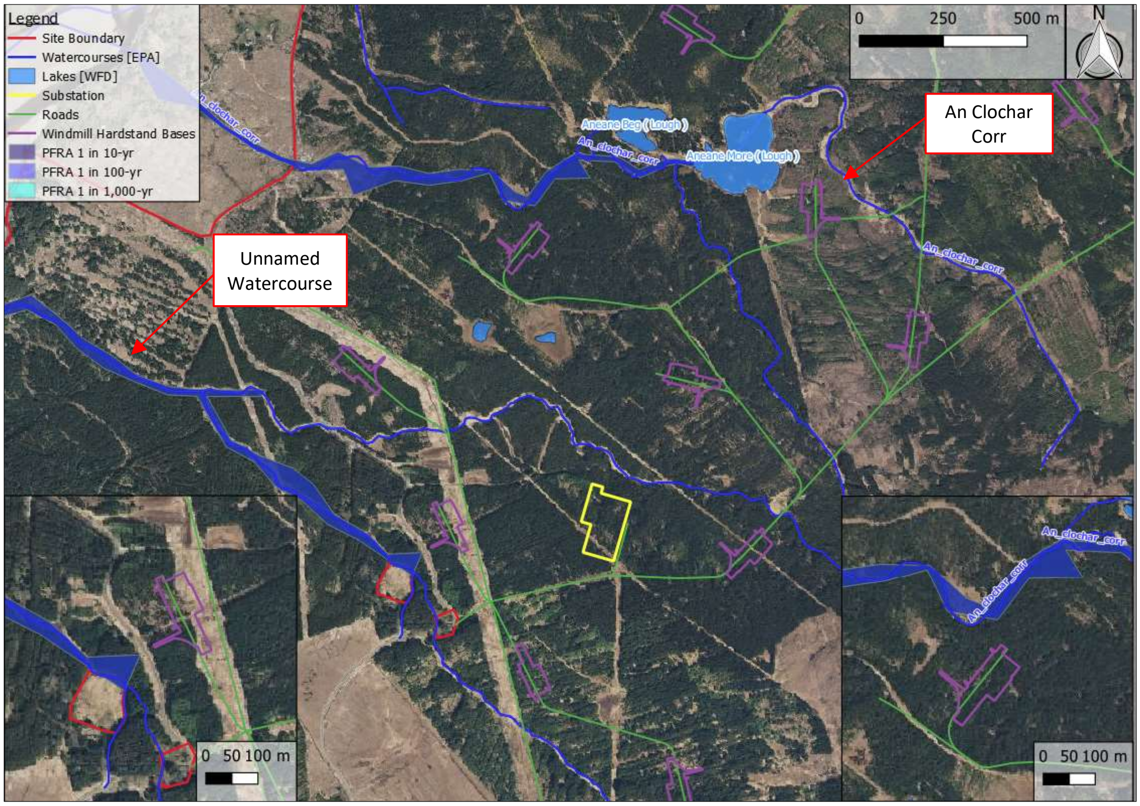

Figure 4-2 Southern portion of the subject site PFRA extents

In addition to the PFRA mapping a portion of the subject site is also NIFM mapped. The NIFM mapping shows some existing fluvial flood extents, presented in Figure 3-4, for the Clochar An Chuilinn watercourse. It indicates portions of the subject site may be at risk of flooding during the 1 in 100-year and 1 in 1,000-year fluvial flood events. These flood extents are located approximately 0.7km from the nearest piece of critical infrastructure, a turbine. The ground level at the modelled flood extents is approximately 7mOD, while the existing ground levels at the proposed turbine location are 49mOD.

The mountainous terrain and natural topography of the subject site creates a stream network that provides a natural overland flow path to convey water away from the essential infrastructure and discourage flood storage at the subject site. The natural topography of the subject site is such that flood waters would flow away from all critical infrastructure.

There are a number of windturbines located in the vicinty of local watercourses however, there is a signicicant difference in the elevtions of the infrastructure and the watercourses. The proposed substation is not located near any watercourse with modelled flood extents.

Based on the available information, it is estimated that the risk of fluvial flooding to the development is minimal.

4.2 Pluvial Flooding

There are pockets of small pluvial flood extents located within the subject site. These extents are located in localised depressions within the subject site (see Figure 3-2).

The largest area of pluvial flooding is located at the base of a hill within the subject site. The estimated ground levels at the location of the predicted pluvial flooding are 91mOD. There is a wind turbine located in the vicinity of this predicted pluvial flood event. The groundlevel at the proposed location of the wind turbine is 93mOD. There is a second area of predicted pluvial flooding located in a local depression. The ground levels in the area where the pluvial flooding occurs is 91mOD. The closest critical infrastructure is located approximately 200m north. Existing ground levels in this area are 95mOD. There are two pluvial flood events located in the vicinity of the eastern boundary of the subject site. These two events are located at approximately 158mOD and 167mOD repestively. The nearest critical infrastructure in the vicinity of these predicted pluvial flood etents is 170mOD.

Surface water arising at the site will be managed by a dedicated stormwater drainage system designed in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The proposed wind farm site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Therefore, it is estimated that risk of pluvial flooding associated with the proposed development is minimal.

4.3 Groundwater Flooding

The PFRA study (Figure 3-2) does not show any groundwater flooding in the vicinity of the subject site. Geological Survey Ireland (GSI) groundwater flooding extents in the area (Figure 3-9), shows there is historical seasonal groundwater flooding at the subject site. There has been seasonal groundwater flooding at these location from 2015 to 2021, which is the latest mapping available.

This groundwater flooding is limited to areas around two lakes within the subject site. These lakes are located in localised depression within the subject site. The ground levels at the lake are 96mOD. The existing ground levels at the nearest critical infrastructure is 102mOD. The lakes are a minimum of approximately 75m from all critical infrastructure.

Therefore, it is estimated that the proposed development is not at risk of groundwater flooding.

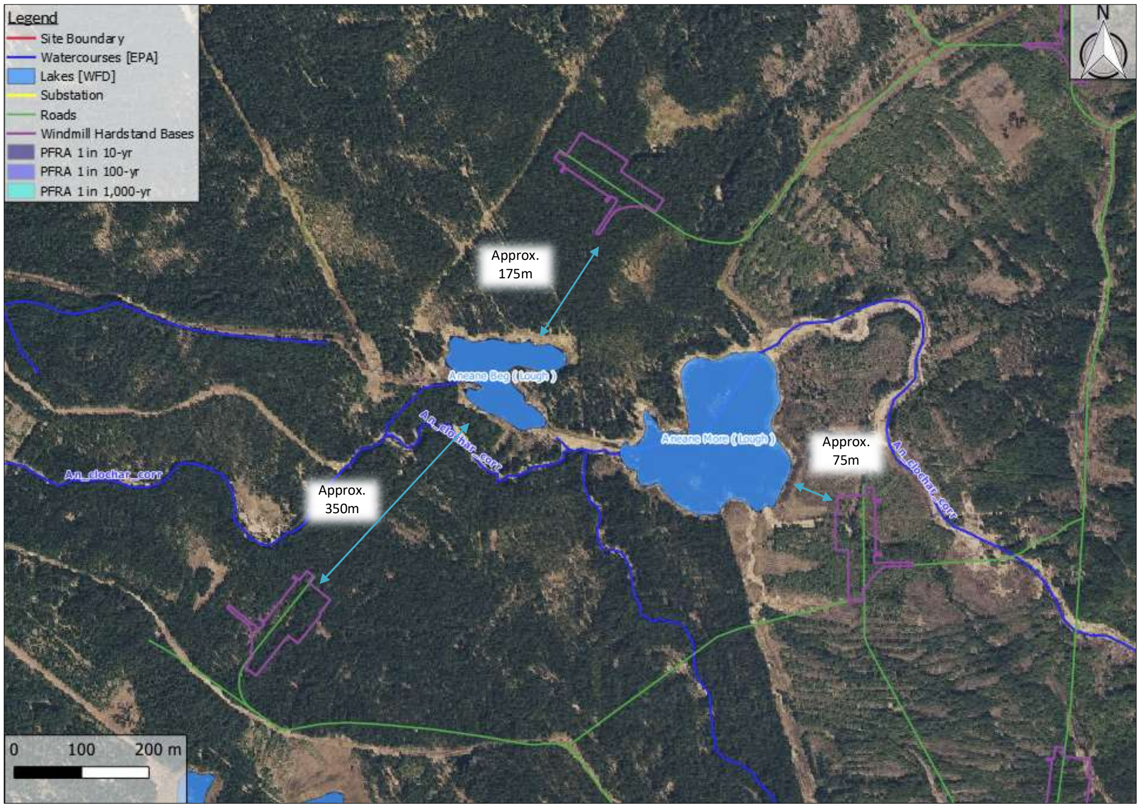

Figure 4-3 Groundwater flooding locations

4.4 Coastal Flooding

The subject site is located approximately 7km inland from the sea. The ICPSS mapping identifies portions of the subject as being liable to flooding during the 1 in 200-year and 1 in 1,000-year flood events. The closest modelled ICPSS node is located in Gweebarra Bay (Node No.: NW23). This is approximately 7km west of the subject site. The water level at this node for the 1 in 200-year and 1 in 1,000-year flood events are 3.25mOD and 3.48mOD respectively. The flood extents are isolated to the along the western boundary of the subject site.

Ground levels along the western boundary range from 1mOD to 10mOD. The closest piece of infrastructure to the coastal flood extents is located approximately 1km away. This is a wind turbine. The existing ground level at turbine location is 55mOD. This significant level difference and distance from the flood extents remove the potential flood risk.

It is therefore estimated that the risk of coastal flooding associated with the development is minimal.

5.0 CONCLUSIONS

TOBIN Consulting Engineers were appointed by Orsted/FEI to undertake a Flood Risk Assessment (FRA) for their proposed wind farm development at Clogherachullion and Cloghercor, Co. Donegal.

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

The PSFRM guidelines classify essential infrastructure, such as electricity substations, as 'highly vulnerable' in terms of their sensitivity to flooding, while the proposed turbines and ancillary works are considered 'water compatible'.

The proposed substations are therefore considered appropriate in Flood Zone C, where the probability of flooding is less than 1-in-1,000-years (<0.1% AEP).

Pluvial Flooding:

Based on the indicative pluvial flood mapping presented in the OPW Preliminary Flood Risk Assessment, there are areas of pluvial flooding within the subject site, corresponding to localized depressions (see Figure 3-2). These areas are not located at the proposed infrastructure.

Surface water arising at the site will be managed by a dedicated stormwater drainage system designed in accordance with Sustainable Drainage Systems (SuDS) principles, limiting discharge from the site to greenfield runoff rates.

The proposed development and topography of the developed site will provide safe exceedance flow paths and prevent surface water ponding to minimise residual risks associated with an extreme flood event or a scenario where the stormwater drainage system becomes blocked.

Groundwater Flooding:

GSI mapping suggests parts of the subject site are liable to flooding. These areas are only around the lakes that located within the subject site. The ground levels at the lake are 96mOD. The existing ground levels at the nearest critical infrastructure is 102mOD. The lakes are approximately 85m from the critical infrastructure.

Coastal/Tidal Flooding:

ICPSS mapping identifies portions of the subject as being liable to flooding during the 1 in 200-year and 1 in 1,000-year flood events. The flood extents are isolated to the low-lying area along the western boundary of the subject site. Ground levels along the western boundary range from 1mOD to 10mOD. The existing ground level at the location of the nearest critical infrastructure is 55mOD.

Fluvial Flooding:

There are a number of local watercourses within the bounds of the proposed wind farm site however, there is a significant difference in the elevations of the infrastructure and the watercourses. The proposed substation is not located near any watercourse. Essential infrastructure, such as electricity substations, are classified as 'highly vulnerable' in terms of their sensitivity to flooding, while the proposed turbines and ancillary works are considered 'water compatible'. The existing ground levels at the proposed substation are more than 3m above bank levels of the adjacent watercourse, with headwater arising within the subject site.

There are small portions of low-lying areas along the western boundary of the subject site that are at risk of coastal flooding. However, the ground levels at nearest critical infrastructure are approximately 54m higher than the approximate levels of the flood extents.

PFRA mapping shows there are areas of the subject site susceptible to fluvial flooding. However, there is no critical infrastructure in these areas and there is a minimum of a 2m difference in ground levels between the flood extents or banks and nearest infrastructure.

Therefore, it is estimated that the risk of flooding to the proposed development will be minimal, and that the development will not increase the risk of flooding elsewhere.

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Appendix 2-9 – Peat Stability Risk Assessment

Cloghercor Wind Farm

Planning Stage Peat Stability Risk Assessment

PRODUCED BY
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Note on status flags and revision codes:

Status	Description	Revision Code
Work in Progress (Non-Contractual)		
S0	Work In Progress	P01.01, etc
Shared (Non-Contractual)		
S1	Suitable for Coordination. The file is available to be 'shared' and used by other disciplines as a background for their information.	P01, P02, etc
S2	Suitable for Information	P01, P02, etc
S3	Suitable for Internal Review and Comment	P01, P02, etc
S4	Suitable for Construction Approval	P01, P02, etc
S6	Suitable for PIM Authorisation (Stages 2a, 2b and 3)	P01, P02, etc
S7	Suitable for PIM Authorisation (Stages 4 and 5)	P01, P02, etc
WIP to Published Unauthorized and (Non-contractual) use at risk.		
D1	Suitable for Costing	P01, P02, etc
D2	Suitable for Tender	P01, P02, etc
D3	Suitable for Contractor Design	P01, P02, etc
D4	Suitable for Manufacture / Procurement	P01, P02, etc
Published (Contractual)		
A1, A2, A3, etc	Approved and accepted as stage complete (C= Contractual/Complete)	C01, C02, etc
B1, B2, B3, etc.	Partially signed-off: with minor comments from the Client. All minor comments should be indicated by the insertion of a cloud and a statement of 'in abeyance' until the comment is resolved, then re-submitted for full authorization.	P01.01, etc
Published for AIM Acceptance		
CR	As Construction Record documentation, PDF, Models etc	C01, C02, etc

Table of contents

1. Executive Summary

Ciaran Reilly & Associates has been instructed by TOBIN Consulting Engineers (TOBIN) on behalf of Ørsted to carry out a planning stage peat stability risk assessment (PSRA) as part of the environmental impact assessment for the proposed Cloghercor Wind Farm site in the townlands of Clogherachullion, Cloghercor, and Derryloaghan (met mast only) in County Donegal. The proposed site is located in a peatland and forested landscape. It is proposed to erect 19 no. wind turbines with overall blade tip heights of 185 to 200m, new entrances, access roads, cable routes, compound areas, and borrow pits, etc.

The PSRA was carried out in accordance with Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments – Second edition (Scottish Government, 2017). The report sets out the methodology used to assess the peat stability risk, the activities undertaken, and the results of the peat stability assessment. The report should be read along with the Soils and Geology chapter of the overall Environmental Impact Assessment Report (EIAR).

The topography of the site is undulating, steeply in places, with elevation levels ranging from between 30mOD and 190mOD. Several streams cut through the site, draining typically to the north west. The site is underlain by bedrock of the Main Donegal Granite formation and superficial deposits, where present, are predominantly blanket peat with glacial till beneath the peat in places. The distribution of outcropping or subcropping rock across the site suggests that bedrock is, in general, shallow.

A comprehensive desk study was undertaken, site-specific LiDAR digital terrain model data were acquired and reviewed, and a comprehensive suite of ground investigations were undertaken to assist the assessment. Following application of mitigation measures, including consideration to the siting of infrastructure to minimise the risk, the findings of the planning stage PSRA indicate a "low" hazard ranking for instability related to the requirement for excavations on the site. Routine and common place mitigation measures can be put in place during the detailed design and construction of the scheme to reduce the likelihood of a failure. Possible mitigation measures include stepping or battering back of excavations to a safe angle (as determined through a detailed slope stability assessment by a competent temporary works designer) or construction of a temporary sheet pile wall or rock fill berm to support the peat during construction. Following mitigation, the hazard ranking of the development is considered to be "low" for all areas. Further the site terrain is rolling and undulating and topographically confined, limiting the potential and scale of peat slide and debris runout distances. It is concluded that the site is suitable for the proposed development.

Deterministic stability assessments indicate that the materials are considered to be stable in the short (undrained) and long (drained) term, including under the influence of extreme weather events, hence justifying the "low" hazard rankings assigned. Best practice guidance regarding the management of peat stability must be inherent in the construction phase of the project.

2. Introduction

In accordance with planning guidelines compiled by the Department of the Environment, Heritage and Local Government (DoEHLG) (2016), where peat is present on a proposed wind farm development, a peat stability assessment is required as part of the environmental impact assessment. Ciaran Reilly & Associates has been instructed by TOBIN Consulting Engineers (TOBIN) on behalf of Ørsted and FEI to carry out a planning stage peat stability risk assessment (PSRA) as part of the environmental impact assessment for the proposed Cloghercor Wind Farm site in the townlands of Clogherachullion, Cloghercor, and Derryloaghan (met mast only) in County Donegal.

This report sets out the methodology used to assess the peat stability risk, the activities undertaken and the results of the peat stability assessment. This report should be read along with Chapter 8 of the Cloghercor Wind Farm Environmental Impact Assessment Report (EIAR) and its appendices.

2.1. Description of the Development

The proposed wind farm site is located within a peatland and forested landscape, between Doochary, Lettermacaward and Glenties, in Co. Donegal. A summary of the overall proposed project is as follows:

- Erection of 19 no. wind turbines with an overall blade tip height range from 185m to 200m, a rotor diameter range from 149m to 164m, a hub height range from 112m to 125m, and all associated foundations and hard-standing areas in respect of each turbine;
- Construction of new site entrance with access onto the L6483 local road for the construction phase (operational phase maintenance traffic only), and utilisation of a permitted forest entrance (Pl. Ref. 1951040) to the L6483 as a second construction phase site access point. A third site entrance on the L6483 will form the operational phase public entrance to the wind farm;
- Improvements and temporary modifications to 5 no. locations adjacent to the public road to facilitate delivery of abnormal loads and turbine delivery on the R262 and N56 in the townlands of Tullycumber, Drumard, Darney, Cashelreagh Glebe and Aghayeevoge;
- Construction of an area of temporary hard standing to function as a blade transfer area to facilitate turbine delivery on the R262 in the townland of Drumnacross;
- Widening of sections of the L6363 and L6483 within the road corridor (up to 4.5m running width) to facilitate delivery of abnormal loads/turbines in the townlands of Cloghercor, Shallogan More, Derryloaghan and Straboy;
- Construction of 2 no. temporary construction compounds with associated temporary site offices, parking areas and security fencing;
- Installation of 1 no. permanent meteorological mast with a height of 100m;
- 4 no. borrow pits;
- Construction of new internal site access roads and upgrade of existing site roads, to include passing bays and all associated drainage;
- Construction of drainage and sediment control systems;

- Construction of 1 no. permanent 110kV electrical substation including:
    - 1 no. EirGrid control building containing worker welfare facilities and equipment store;
    - 1 no. Independent Power Producer (IPP) control building containing HV switch room, site offices, kitchen facilities, storeroom and toilet amenities.
    - All electrical plant and infrastructure and grid ancillary services equipment;
    - Parking;
    - Lighting;
    - Security Fencing;
    - Wastewater holding tank;
    - Rainwater harvesting equipment;
    - All associated infrastructure and services including site works and signage;
- All associated underground electrical and communications cabling connecting the wind turbines to the proposed wind farm substation;
- All works associated with the connection of the proposed wind farm to the national electricity grid, which will be via a loop-in 110 kV underground cable connection (approximately 4.1km cable length within trenches on approximately 3.36km of internal access roads) to the existing 110kV overhead line in the townland of Cloghercor, Co. Donegal, with two new 16m and 21m high steel lattice end masts at each interface;
- Removal of 26 no. existing wooden polesets and 1no. Steel lattice angle mast between the two new interface end masts;
- 2 no. watercourse (stream) crossings on the grid connection route;
- All related site works and ancillary development including berms, landscaping, and soil excavation;
- Forestry felling to facilitate construction and operation of the proposed development and any onsite forestry replanting;
- Development of a permanent public car park with seating/picnic tables at the end of the construction phase of the development at the location where the proposed grid connection intersects the L6483;
- Permanent recreational facilities including marked walking trails along the site access roads and paths, and associated recreation and amenity signage; and
- Approximately 252 ha of biodiversity enhancement lands located over 3km from the proposed wind turbines.

2.2. Statement of authority

Ciaran Reilly & Associates is a specialist geotechnical engineering practice delivering a range of consultancy services to the private and public sectors across Ireland and the UK. Ciaran Reilly & Associates was established in 2016 and is based in Co. Kildare.

This report was prepared by Dr Ciaran Reilly. Dr Reilly (BE, PhD, PGDip, CEng, MIEI, Registered Ground Engineering Specialist (UK RoGEP)) is a geotechnical engineer with over 15 years' experience in civil and geotechnical engineering consultancy, contracting, and research. He worked for several years in industry before completing his PhD in Trinity College Dublin in 2014. Since then, he has undertaken a diverse range of environmental impact assessment and engineering design projects as senior engineer and more recently as director of Ciaran Reilly & Associates.

2.3. Peat Failures

Peat landslides represent one end of a spectrum of natural processes of peat degradation. They have potential to cause fatalities, injury and damage to infrastructure and farmland. They also have the potential to cause significant damage to peatland habitats.

Excavations works on electricity infrastructure construction sites can induce slope failures due to the low basal strength in peat, even in relatively flat sites. These peat failures induced by excavations can extend significantly beyond the excavations, likely due to seepage forces caused by intentional or accidental drainage of the peat.

The potential for peat failure at this site is examined with respect to wind farm construction and associated activity.

2.4. Methodology

The evaluation of the peat stability at the site was carried out in accordance with the document "Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments – Second edition" (Scottish Government, 2017). The geotechnical and peat stability assessment at the site included the following activities:

- Desk Study,
- Site reconnaissance including peat depth measurement,
- Review of ground investigation carried out at the site by Ground investigations Ireland (GII),
- Review of digital surface model data,
- Peat stability assessment using a qualitative approach, and
- Peat stability assessment using a deterministic approach.

The risk assessment approach is discussed in detail in Section 5.

3. Ground Investigation

3.1. Desk study

A desk study was undertaken to collate and review background information in advance of the site survey. The desk study involved the following:

- Examination of the Geological Survey of Ireland (GSI) datasets pertaining to geology, landslide susceptibility, and the GSI borehole database,
- Examination of Environmental Protection Agency (EPA) data, and
- Preparation of site maps and suitable field sheets for the site survey.

The desk study information obtained is referenced below. Following the desk study and the site survey, geological maps were generated in GIS and are included in the Soils and Geology chapter of the main EIAR and reproduced in Appendix 1 to this report. The ground investigation information is included in the Soils and Geology chapter of the main EIAR.

Publicly available sources of mapping, aerial photography and satellite imagery were consulted to establish the expected ground conditions, topography, and condition of the site in the past. The following sources were referred to:

- Ordnance Survey historical mapping,
- Geological Survey of Ireland mapping,
- EPA mapping,
- Publicly available satellite photography (Google Maps & Bing Maps), and
- Site specific LiDAR digital terrain model data.

3.2. Field work

Site surveys relating to the soil and geological environment and ground investigations were undertaken between June and October 2022. These surveys included:

- Site walkovers by Ciaran Reilly & Associates staff in July 2021 and October 2022 to review the ground conditions and assess the topography, geomorphology, and requirements for site investigations,
- 39 nr peat probes and hand vane tests by Ciaran Reilly & Associates and TOBIN staff throughout the site,
- 110 nr peat probes by TLI along the route of the proposed underground cable,
- 141 nr peat probes, 23 nr Russian sampler borings, 21 nr trial pits, and 2 nr rotary core boreholes by Ground Investigations Ireland throughout the site.

The logs and records of the investigations can be found in Appendix 8-1 to the Soils and Geology chapter of the main EIAR. The locations of investigations and a resulting peat depth contour map are reproduced as Figure 8-4 and Figure 4 in Appendix 1 of this report. The observations made during the walkover survey are used to prepare the Peat Stability Risk Register included as Appendix 3 of this report.

4. Detailed Site Assessment

4.1. Site Topography and Geomorphology

The site topography and geomorphology are discussed in detail in the Soils & Geology Chapter of the EIAR and reference is made to the chapter herein. The topography of the site is undulating, steeply in places, with elevation levels ranging from between 30mOD and 190mOD. Several streams cut through the site, draining typically to the north west. For the purposes of the stability assessment, an overall view was taken on the topography of the site and individual drainage features were not assessed. LiDAR digital terrain model data were obtained and interrogated to provide a generalised ground profile for peat stability assessment. The site terrain is rolling and undulating and topographically confined, limiting the potential and scale of peat slide and debris runout distances.

4.2. Local Bedrock Geology

Geological Survey of Ireland bedrock mapping shows that the site is underlain by the Main Donegal Granite, described as coarse biotite granite and granodiorite. Bedrock geology mapping is provided as Figure 8-5 of Appendix 1.

4.3. Local soils and subsoils

Geological Survey Ireland mapping shows the site as underlain mainly by blanket peat, with significant areas of outcropping rock, as shown in Figure 1 and in Figure 8-2 and 8-3 in Appendix 1. The distribution of outcropping or subcropping rock across the site suggests that bedrock is shallow.

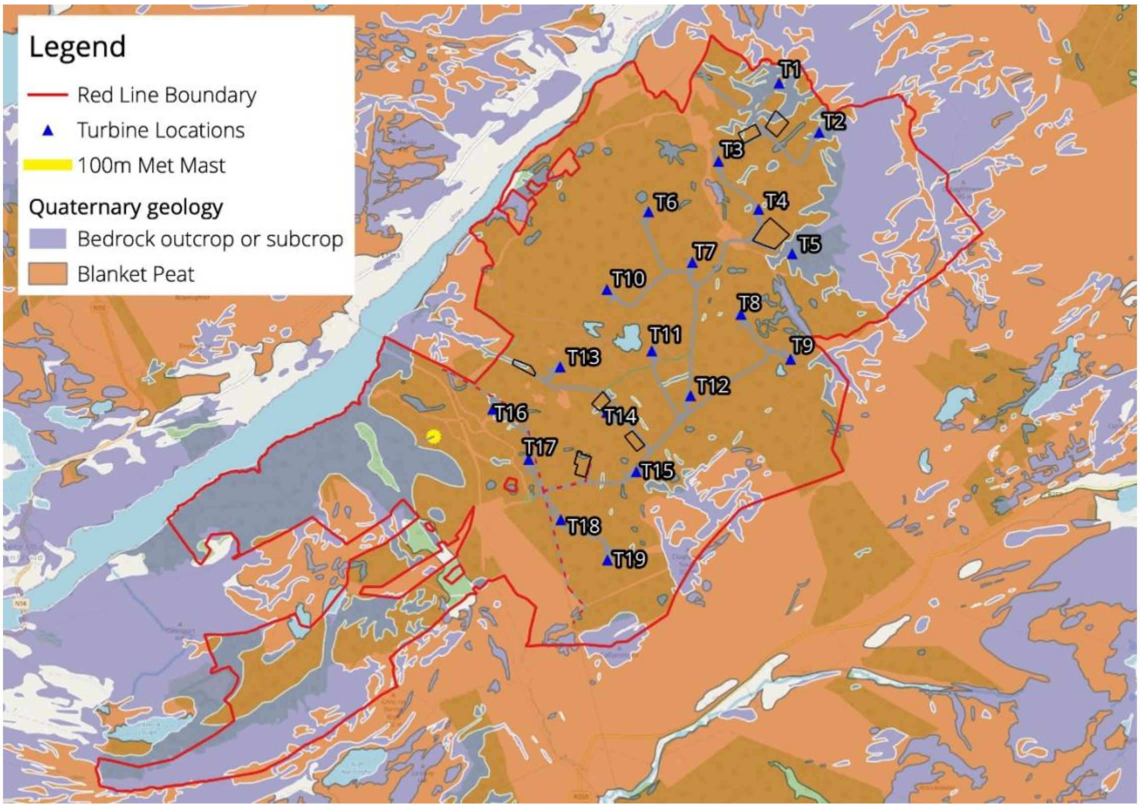

Figure 1 - Quaternary geology

Outcropping rock was observed regularly during the walkover survey, with an example shown in Figure 2.


Figure 2 - Outcropping rock near T4

4.4. Water courses

Ordnance Survey 6-inch first edition mapping (Geohive, 2022) shows the area as historically rough pasture with scattered dwelling houses. Information on the site is sparse, with only occasional spot levels, suggesting it has not been surveyed in detail. Drainage appears laid out as it does today, with the site draining to the north west. The two lakes at the centre of the site, Lough Aneane and Lough Errig West, are shown. Underground drainage of streams is noted in places. Ordnance Survey 6-inch last edition mapping (Geohive, 2022) shows more detail, including the majority of the site now characterised as having outcropping rock at the surface. Lough Aneane and Lough Errig West are now named Lough Aneane Beg and Lough Aneane More. Additional development is seen, with more roadways and enclosed parcels of land around the edges of the site. Ordnance Survey 25-inch mapping was not available for the majority of the site.

The site is in the Mulnamin Beg subbasin of the Gweebarra River catchment. Turbine 6 is the closest turbine to the Gweebarra River at a distance of 990m. Several streams cross the site, mainly flowing in a north westerly direction. Many are incised streams which have cut through peat and glacial till to sit on bedrock. The river network in the vicinity of the site is shown in Figure 3. Proximity to a water course is used to assess the risk of peat stability at individual infrastructure elements in Section 5 of this report.

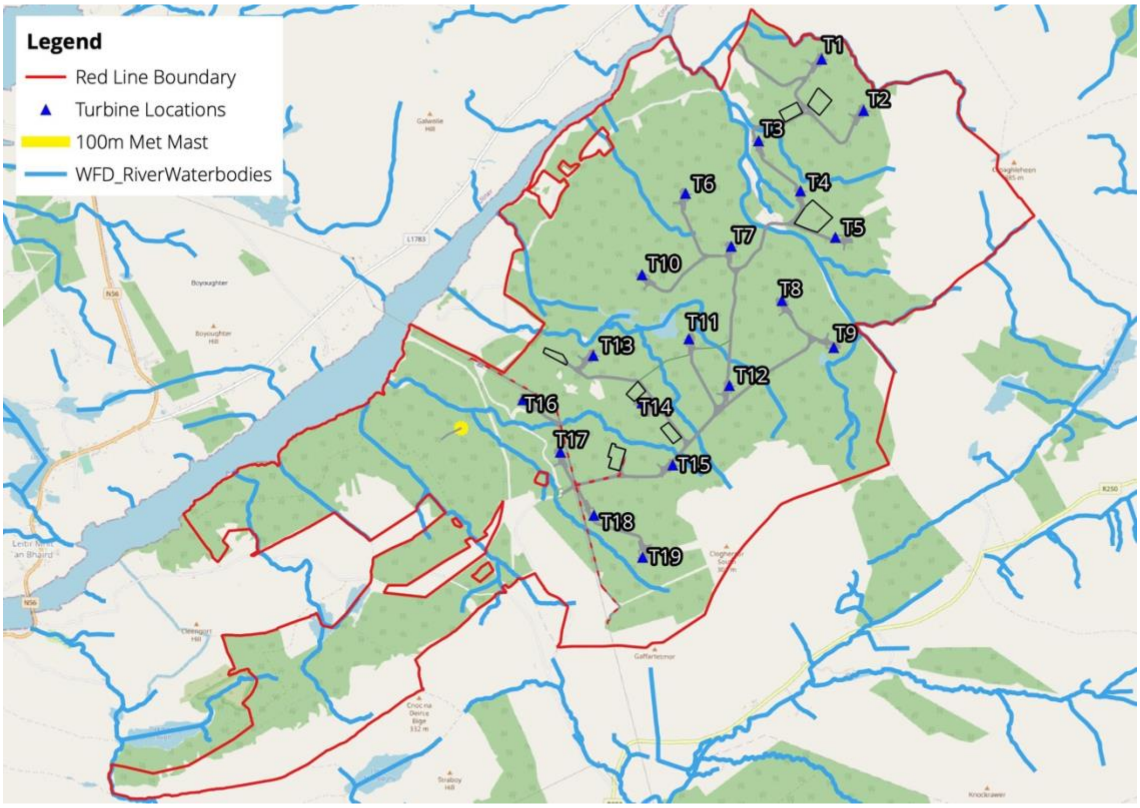

Figure 3 - River network (EPA)

4.5. Previous failures

A review of the landslide information on the GSI Irish Landslides Database indicated that the nearest recorded landslides occurred approximately 8.0km south east of the site (GSI_LS06-0296, a peat slide of "no apparent impact" at an elevation of over 200m). A number of similar slides of "no apparent impact" are recorded in this vicinity, over 8.0km from the site (GSI_LS14-0014 at 300mOD, and GSI_LS14-0019 and GSI_LS14-0022 at 320mOD being examples). A map of these events is provided in Figure 4.

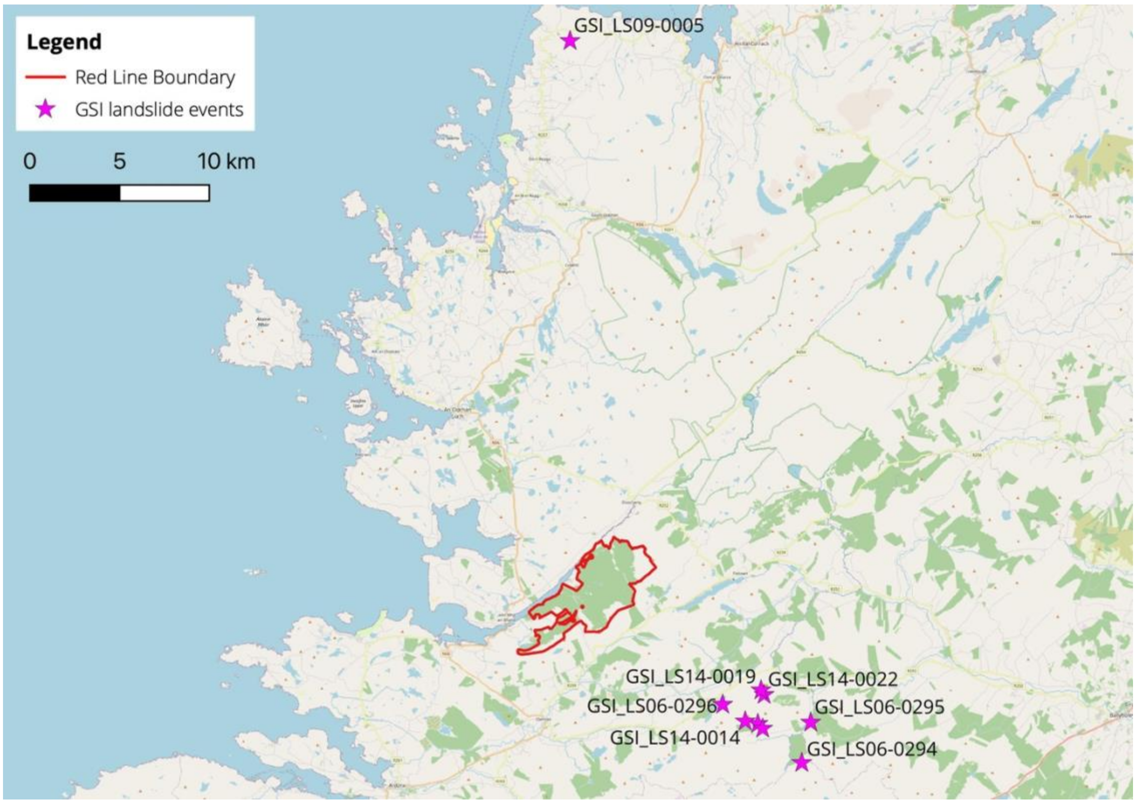

Figure 4 – Mapped landslide events (Source: GSI National Landslide Susceptibility Mapping, 2021)

4.6. Landslide susceptibility

Figure 56 shows the mapped landslide susceptibility for the site based on GSI mapping. The site is broken into 27 assessment areas. Of these, 2 are in areas of "high" landslide susceptibility, 15 are in areas of "moderately high" susceptibility, 6 in "moderately low", and 4 in "low" susceptibility. A summary is shown in Table 1.

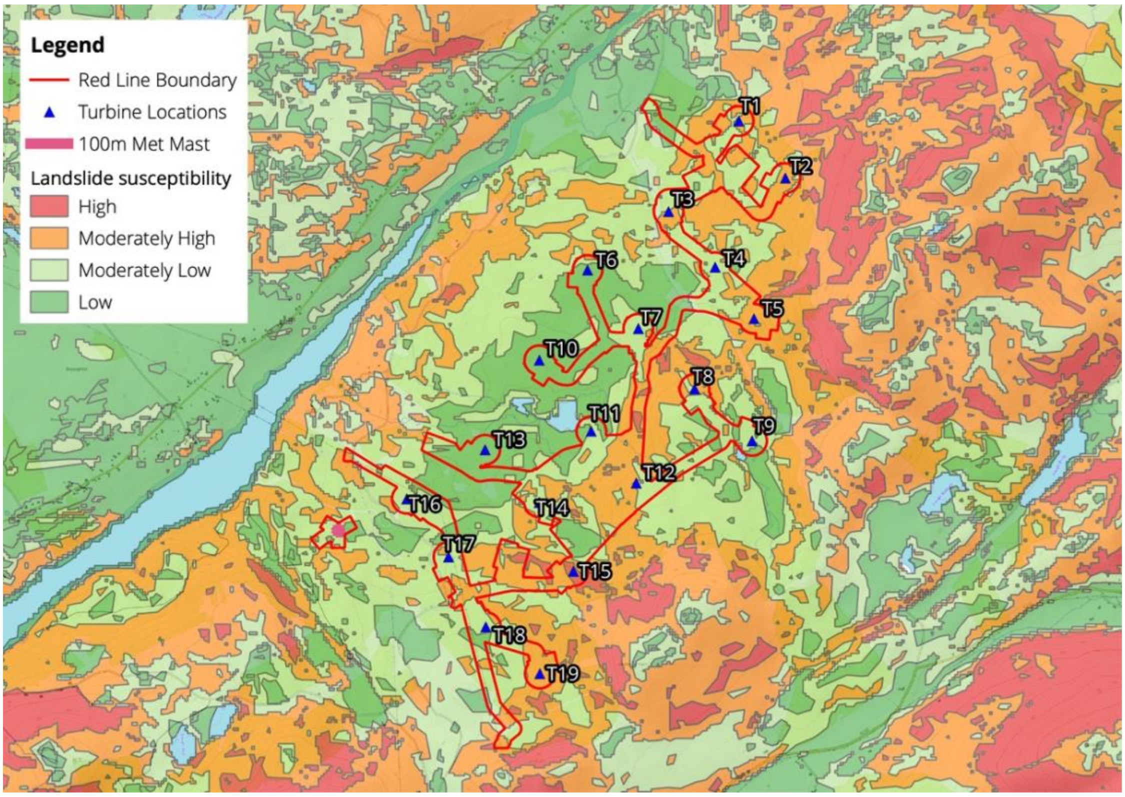

Figure 5 - Landslide susceptibility (Source: GSI National Landslide Susceptibility Mapping, 2021)

Table 1 – Landslide susceptibility (from GSI data)

Nr	Assessment area	Susceptibility
1	Access road to T1	Moderately high
2	T1	Moderately high
3	T2 & access road	Moderately high
4	Compound & borrow pit near T1	Moderately high
5	T3 & access road	Moderately high
6	T4 & access road	Moderately low
7	T5	Moderately high
8	T6 & access road	Low
9	T7	Moderately low
10	T8	Moderately high
11	T9 & access road	Moderately low
12	T10 & access road	Low
13	T11 & access road	Moderately low
14	Access road T12 to T7	Moderately high
15	T12	Moderately high
16	T13 & borrow pit	Low

17	T14 & borrow pit	Moderately high
18	T15	High
19	Substation compound	High
20	Public car park & grid connection	Moderately low
21	T16	Moderately low
22	T17	Moderately high
23	T18	Moderately high
24	T19	Moderately high
25	Grid connection route (near T19)	Moderately high
26	Access from main road	Moderately high
27	Met mast	Low

It should be noted that the GSI risk assessment is an initial indicative view which is useful to highlight areas for further assessment and is taken account of to assess the risk of peat stability at individual infrastructure elements in Section 5 of this report. Further, the GSI risk assessment only accounts for the current site topographic and hydrological conditions. The development of wind farm infrastructure can alter these parameters in the temporary and/or permanent case.

No evidence of historic peat failure was identified during the site walkover. During the geotechnical investigation by trial pits, the majority of the trial pits walls were stable, with a minority exhibiting spalling of the side walls. This spalling is not unexpected for steep-sided trial pits dug in peat deposits.

4.7. Ground Investigation

A number of phases of ground investigation (GI) of the development area were carried out as outlined in the previous section. These investigations confirmed the general geology indicated in the geological mapping. The GI indicated that the site is generally covered in shallow peat which overlies sand or gravel or presumed bedrock. Locations of the ground investigations and a peat depth contour plot generated from the data are shown in Appendix 1. The GI data is used in Section 5 and Section 6 of this report to carry out a location-specific geotechnical risk assessment. The relevant ground investigation reports and data are presented in Appendix 8-1 to the Soils and Geology chapter of the EIAR.

5. Peat Stability Assessment

5.1. Material properties

For the purposes of the peat stability assessment, material properties are assessed for Peat at the site. The results of the GII (2022) investigation are used along with comparable experience to derive the required properties.

The correlation of Amaryan et al (1973) as cited by Carlsten (2000) is used, along with comparable experience, to derive a conservative characteristic undrained shear strength value for the Peat. 55 moisture content tests were carried out on samples of Peat. The moisture content of the Peat ranges from 332% to 1441%. Taking the mean moisture content of 845% and assuming an R value of 4, a undrained shear strength of 18.0kPa is assessed. A conservative view is taken on this, and based on comparable experience, a characteristic undrained shear strength of 10kPa is assessed for the Peat at the site. Where relevant, local strengths are assessed based on local field vane measurements, with a vane correction of 0.5 used (Edil, 2001 and Mesri & Ajlouni, 2007).

Based on a range of published guidance including Long (2005) and O'Kelly and Zhang (2013), the Peat was assumed to have effective stress parameter values $\varphi' = 28°$ and $c' = 4kPa$.

A bulk weight of $10kN/m^3$ is assumed for the Peat based on comparable experience and published data (e.g. Osorio-Salas (2012), O'Kelly (2017), and Trafford and Long, 2019).

The derived and assumed characteristic parameter values for the Peat are summarised in Table 2.

Table 2 – Characteristic parameter values

Material / Parameter	Peat
Bulk Weight (γ_k) [kN/m^3]	10
Undrained shear strength ($c_{u,k}$) [kPa]	10
Effective cohesion (c'_k)	4
Effective angle of shearing resistance (Φ'_k) [degrees]	28

5.2. Qualitative risk assessment procedure

The guidelines set out four categories of risk and recommends various mitigation / avoidance actions for each category. The categories of risk are:

1. Insignificant;
2. Significant;
3. Substantial; and
4. Serious.

The concept of risk analysis for a particular hazard presented in the guidelines referred to the publication entitled "Scottish Road Network Landslides Study" by Winter et al. (2005) and is presented as follows:

Hazard Ranking = Hazard x Exposure

Where:

- Hazard = The likelihood of the landslide event occurring
- Exposure = The effect and consequences that the event may have

Table 3 presents the scale of the likelihood and Table 4 presents the classification of exposure ratings based on a percentage of total project cost/time. These classifications are taken from the report entitled Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments – Second edition (Scottish Government, 2017).

Table 3 – Qualitative assessment of peat landslide Hazard over the lifetime of the development (Scottish Government, 2017)

Scale	Likelihood	Probability of occurrence
5	Almost certain	> 1 in 3
4	Probable	1 in 10 – 1 in 3
3	Likely	1 in 10^2 – 1 in 10
2	Unlikely	1 in 10^7 – 1 in 10^2
1	Negligible	< 1 in 10^7

Table 4 – Qualitative assessment of peat landslide Exposure over the lifetime of the development (Scottish Government, 2017)

Scale	Exposure	Impact as % damage to (or loss of) receptor
5	Extremely high effect	> 100% of asset
4	Very high effect	10% - 100%
3	High effect	4% - 10%
2	Low effect	1% - 4%
1	Very low effect	< 1% of asset

Using Table 3 and Table 4 it is possible to assign a hazard ranking for each zone by multiplying the hazard by the exposure. This will result in a hazard ranking between 1 to 25 (Table 5). Following the result, mitigation measures can be targeted and a revised assessment, post-control measures, is carried out. Through the various design iterations initial control measures implemented a mitigation by design approach where turbines were moved to lower risk areas. Further control measures are listed in Section 8 and the Peat Stability Risk Register in Appendix 3. This report is therefore an assessment of the final turbine locations.

Table 5 – Hazard ranking and suggested actions (Scottish Government, 2017)

Hazard Ranking	Designation	Action suggested
17-25	High	Avoid project development.
10-16	Medium	Project should not proceed unless the hazard can be avoided or mitigated without significant environmental effect, in order to reduce hazard ranking to low or negligible.
5-9	Low	Project may proceed pending further investigation to refine assessment and mitigate hazard through relocation or re-design.
1-4	Negligible	Project should proceed with monitoring and mitigation of peat landslide hazards as appropriate.

The proposed wind farm and associated infrastructure is located in an elevated and undulating landscape with steep terrain. GSI landslide susceptibility mapping (Geological Survey of Ireland, 2021) indicates that 17 of 27 assessment areas are in areas of “moderately high” or “high” landslide susceptibility, as shown in Figure 5 and Table 1.

It should be noted that the GSI assessment only accounts for the current site topographic and hydrological conditions and is not intended to be used in isolation to determine actual onsite risk. The development of a wind farm can alter these parameters in the temporary and/or permanent case. Excavations for turbine foundations are often several metres deep and represent a significant alteration to the local topography in the short term. This can have a significant effect on the stability of the material local to the turbine.

During the geotechnical investigation by trial pits, some of the walls of the trial pits spalled to a certain extent. The material encountered was generally described as “very soft” to “soft” and low values of undrained shear strength were measured in hand vane tests. Given this, the likelihood of an excavation collapsing during construction is generally in the range “likely” to “probable” in the absence of mitigation. A non-exhaustive listing of possible proposed mitigation measures is provided in Section 8 of this report.

The significance of a collapse in terms of cost and programme is likely to be in the range “very low effect” to “extremely high effect” as the affected area due to a collapse could range from a very localised area up to a major peat slide event feeding into a watercourse.

Mitigation measures can be put in place during the construction of the scheme to reduce the likelihood of an excavation collapsing. Possible mitigation measures include stepping or battering back of excavations to a safe angle (as determined through a slope stability assessment by a competent temporary works designer) or construction of a temporary sheet pile wall or rock fill berm to support the peat during construction.

The assessment process described above was applied to discrete areas of the site, with common topography and ground conditions, and is summarised in Table 6. This assessment is based on information from geological maps from GSI, the available aerial and satellite mapping, walkovers, and the site-specific ground investigation undertaken. The Peat Stability Risk Register that this summary table is derived from is presented in Appendix 3, where detailed risk registers for each assessment area are provided.

Table 6 – Peat Stability Risk Register Summary

Assessment area	Pre-control measure risk rating	Post-control measure risk rating
Access road to T1	Low	Low
T1	Low	Low
T2 & access road	Low	Low
Compound & borrow pit near T1	Low	Low
T3 & access road	Medium	Low
T4 & access road	Medium	Low
T5	Medium	Low
T6 & access road	Medium	Low
T7	Medium	Low
T8	Medium	Low
T9 & access road	Medium	Low
T10 & access road	Medium	Low
T11 & access road	Medium	Low
Access road T12 to T7	Medium	Low
T12	Medium	Low
T13 & borrow pit	Medium	Low
T14 & borrow pit	Medium	Low
T15	Medium	Low
Substation compound	Medium	Low
Public car park & grid connection	Low	Low
T16	Low	Low
T17	Medium	Low
T18	Low	Low
T19	Low	Low
Grid connection route (near T19)	Medium	Low
Access from main road	Low	Low
Met mast	Low	Negligible

Notes: Assessment based on mitigation measures suggested in Section 8 and the Peat Stability Risk Register in Appendix 3.

While in the absence of mitigation, several areas are rated as *"medium"* risk, it is noted that in all cases a *"low"* risk rating is achieved by the implementation of suitable and common-place mitigation measures. Following mitigation, the risk ranking of the development is considered to be *"low"*. It is concluded that the site is suitable for the proposed electricity generation development.

6. Deterministic peat stability assessment

In addition to the qualitative assessment carried out in Section 5, a deterministic peat stability assessment was carried out based on the results of the ground investigation carried out on the site.

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure, and loading conditions. An adverse combination of factors could potentially result in a peat slide. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure.

6.1. Methodology

To assess the factor of safety for a peat slide, an undrained and drained analysis has been undertaken to determine the stability of the peat slopes on site. The undrained case examines the stability in the short term, while the drained case examines the long term, including the effects of extreme weather events.

The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

The formula used to determine the factor of safety for the undrained condition is as follows (Bromhead, 1986):

$$ODF = \frac{c_{u,d}}{\gamma z \sin\beta \cos\beta}$$

Where:

- ODF = Overdesign Factor (analogous to Factor of Safety, however ODF > 1.0 indicates satisfactory stability.
- $c_{u,d}$ = Design value of undrained shear strength
- γ = Bulk unit weight of material
- z = Depth to failure plane assumed as depth of peat or soft soil
- β = Slope angle

The formula used to determine the factor of safety for the drained condition is as follows (Bromhead, 1986):

$$ODF = \frac{c'_d + (\gamma z - \gamma_w h_w) \cos^2\beta \tan\phi'_d}{\gamma z \sin\beta \cos\beta}$$

Where:

- ODF = Overdesign Factor (analogous to Factor of Safety, however ODF > 1.0 indicates satisfactory stability.
- c'_d = Effective cohesion, assumed as

γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
β = Slope angle
φ' = Effective stress friction angle

6.2. Effects of weather events

The drained loading condition applies in the long term. This condition examines the effect of the change in groundwater level because of rainfall on the stability of the peat slopes. For the drained analysis the level of the water table above the failure surface is required to calculate the factor of safety for the peat slope. In order to represent varying water levels within the peat slopes, a sensitivity analysis is carried out which assesses varying water level in the peat slopes i.e. water levels ranging between 0 and 100% of the peat depth is conducted, where 0% equates to the peat being completely dry and 100% equates to the peat being fully saturated. By carrying out such a sensitivity analysis with varying water level in the peat slopes, the effects of intense rainfall and extreme dry events were analysed.

6.3. Results and discussion

The results of the analysis are shown in Appendix 2. The assessment takes account of:

1. Slope angle, as derived from LiDAR digital terrain model data,
2. Material strength, as derived from site-specific ground investigation and comparable experience,
3. Likely loadings during the construction period, and
4. Extreme weather events.

The calculations are formulated in accordance with Eurocode 7, where partial factors are applied to soil strength parameters and loadings to achieve a satisfactory level of reliability in the design.

All overdesign factors (ODF) were greater than 1.0, indicating that the stability is satisfactory in both short term (undrained) and long term (drained) condition. Hence, a general “low” risk rating for peat instability is appropriate for the proposed development.

For the case of T15 and the Substation compound, highlighted as “high” landslide susceptibility risk in Section 4, local deterministic risk assessments have downgraded the risk to what would be considered “low”. This is due to the relatively shallow depths of peat encountered during ground investigations.

7. Summary and Conclusions

Ciaran Reilly & Associates has been instructed by TOBIN Consulting Engineers (TOBIN) on behalf of Ørsted and FEI to carry out a planning stage peat stability risk assessment (PSRA) as part of the environmental impact assessment for the proposed Cloghercor Wind Farm site in the townlands of Clogherachullion, Cloghercor, and Derryloaghan (met mast only) in County Donegal.

The PSRA was carried out in accordance with Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments – Second edition (Scottish Government, 2017). The report sets out the methodology used to assess the peat stability risk, the activities undertaken, and the results of the peat stability assessment. The report should be read along with the Soils and Geology chapter of the overall Environmental Impact Assessment Report (EIAR) and its appendices.

Following application of mitigation measures, including consideration to the siting of infrastructure to minimise the risk, the findings of the planning stage PSRA indicate a "low" hazard ranking for instability related to the requirement for excavations on the site, subject to appropriate mitigation measures. Routine and common place mitigation measures will be put in place during the detailed design and construction of the scheme to reduce the likelihood of a failure. Required mitigation measures include stepping or battering back of excavations to a safe angle (as determined through a detailed slope stability assessment by a competent temporary works designer) or construction of a temporary sheet pile wall or rock fill berm to support the peat during construction. Following mitigation, the hazard ranking of the development is considered to be "low" for all areas. Further the site terrain is rolling and undulating and topographically confined, limiting the potential and scale of peat slide and debris runout distances. It is concluded that the site is suitable for the proposed development.

Deterministic stability assessments indicate that the materials are considered to be stable in the short (undrained) and long (drained) term, including under the influence of extreme weather events, hence justifying the "low" hazard rankings assigned.

Best practice guidance regarding the management of peat stability must be inherent in the construction phase of the project and further recommendations are provided in the following section.

8. Recommendations

8.1. Detailed Design

The following outlines an overview of the tasks for the detailed design phase:

- Develop a design stage PRSA to include detailed descriptions of mitigations at specific locations.
- Mitigations to be confirmed at detailed design may include but are not limited to:
    - Confirmation of design of drainage system.
    - Hydrological assessment of stream flows to inform culvert sizing.
    - Detailing of monitoring regime for peat movement.
    - Identification of areas requiring site-specific temporary works design.
    - If required, specify additional site investigations inclusive of in situ testing and laboratory testing in specific risk areas on the site.
- Update the Peat Stability Risk Register.

8.2. Construction Phase:

The following outlines an overview of the tasks for the construction phase:

- Client's Geotechnical Engineer to provide a Geotechnical Induction to all contractor supervisory staff.
- Client to appoint a Site Geotechnical Supervisor to carry out supervision of site works as required. The Site Geotechnical Supervisor will be required to inspect that works are carried in accordance with the requirements of the PSRA, identifying new risks and ensuring all method statements for works are in place and certified.
- Retain a Site Geotechnical Folder which contains all the information relevant to the geotechnical aspects of the site including but not limited to Geotechnical Risk Register, Peat Stability Risk Register, site investigation information, method statements etc.
- Contractor to develop a Method Statement for the works to be carried out in each of the PSRA areas cognisant of the required mitigating measures.
- Mitigations to be implemented at construction stage may include but are not limited to:
    - Measures to maintain hydrology of area as far as possible.
    - Limiting stockpiling of materials in any specific areas.
    - Excavated material to be removed to designated deposition areas.
    - Stepping or battering back of excavations to a safe angle (as determined through a detailed slope stability assessment by a competent temporary works designer) or construction of a temporary sheet pile wall or rock fill berm to support the peat during construction.
    - Implement of monitoring regime for peat movement.
    - Frequent monitoring and inspection during construction and operation of floating roads.
    - Provision and management of a robust drainage system.

    - Site-specific temporary works design by competent temporary works designer.
    - If required, carry out additional site investigations inclusive of in situ testing and laboratory testing in specific risk areas on the site.
- Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement.
- Contractor to provide tool box talks and on-site supervision prior to and during the works.
- Daily sign off by supervising staff on completed works.
- Implementation of emergency plan and unforeseen event plan by the contractor.

8.3. Operation and Maintenance Phase:

The following outlines an overview of the tasks for the operation and maintenance phase:

- Communication of residual peat risk to appropriate site operatives.
- Ongoing monitoring of residual risks and maintenance if required. Such items would consist of regular inspection of drains and culverts to prevent blockages and inspections of specific areas such as settlement ponds and floated access roads after a significant rainfall event.

9. References

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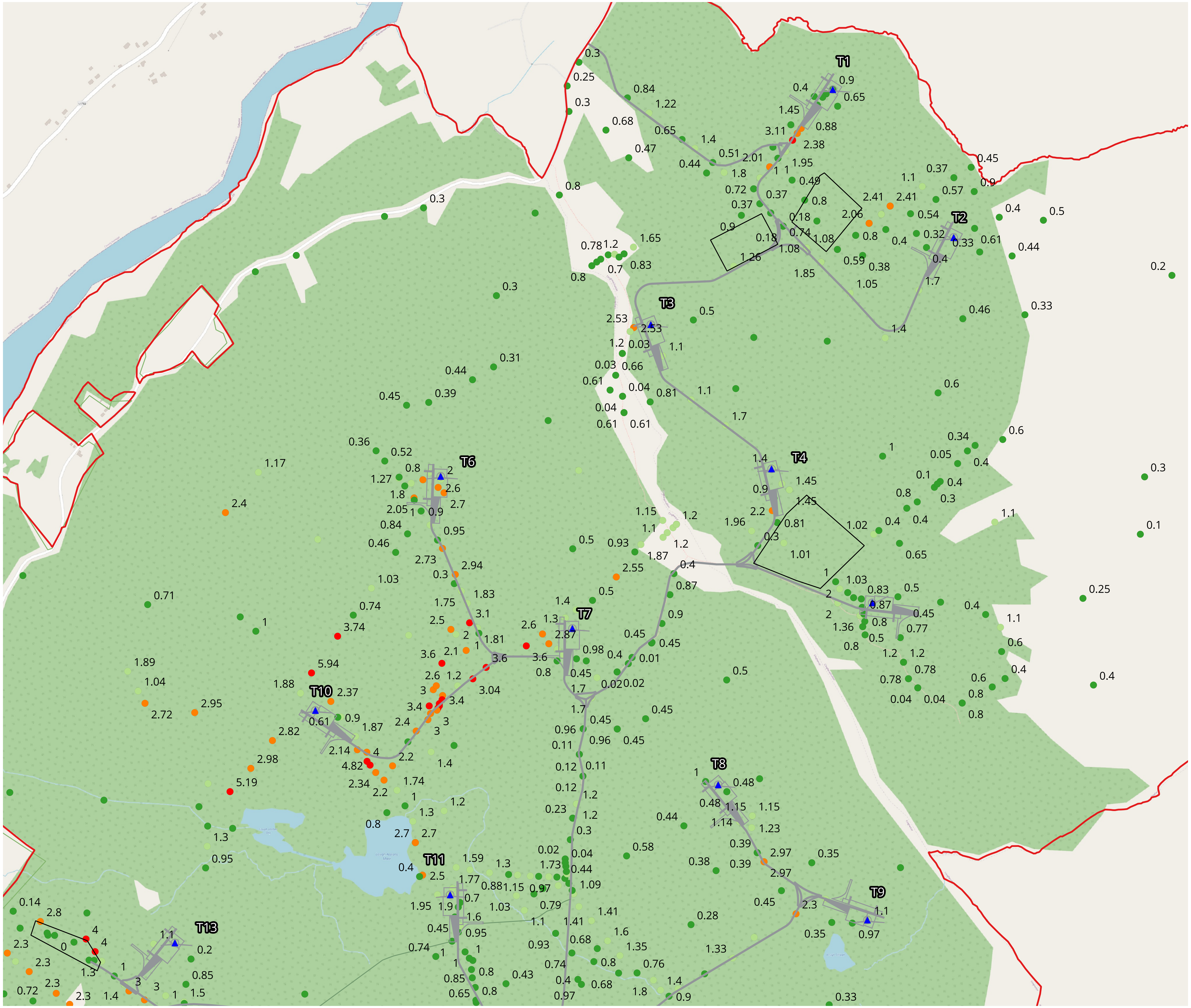
APPENDIX 1: GEOLOGICAL MAPS, GROUND INVESTIGATION LOCATIONS, AND PEAT DEPTH CONTOURS



N

Ground investigation

Peat depth (m)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 10

Ground investigation layout - Sheet 1

Cloghercor Wind Farm
Preliminary Peat Stability Risk Assessment

Doc Nr: P20_042_DR001_01
Rev: P02
Scale: 1:10,000 @ A3
Date: 10.02.2023
Drawn: CR
Background: OpenTopoMap

0 250 500 m

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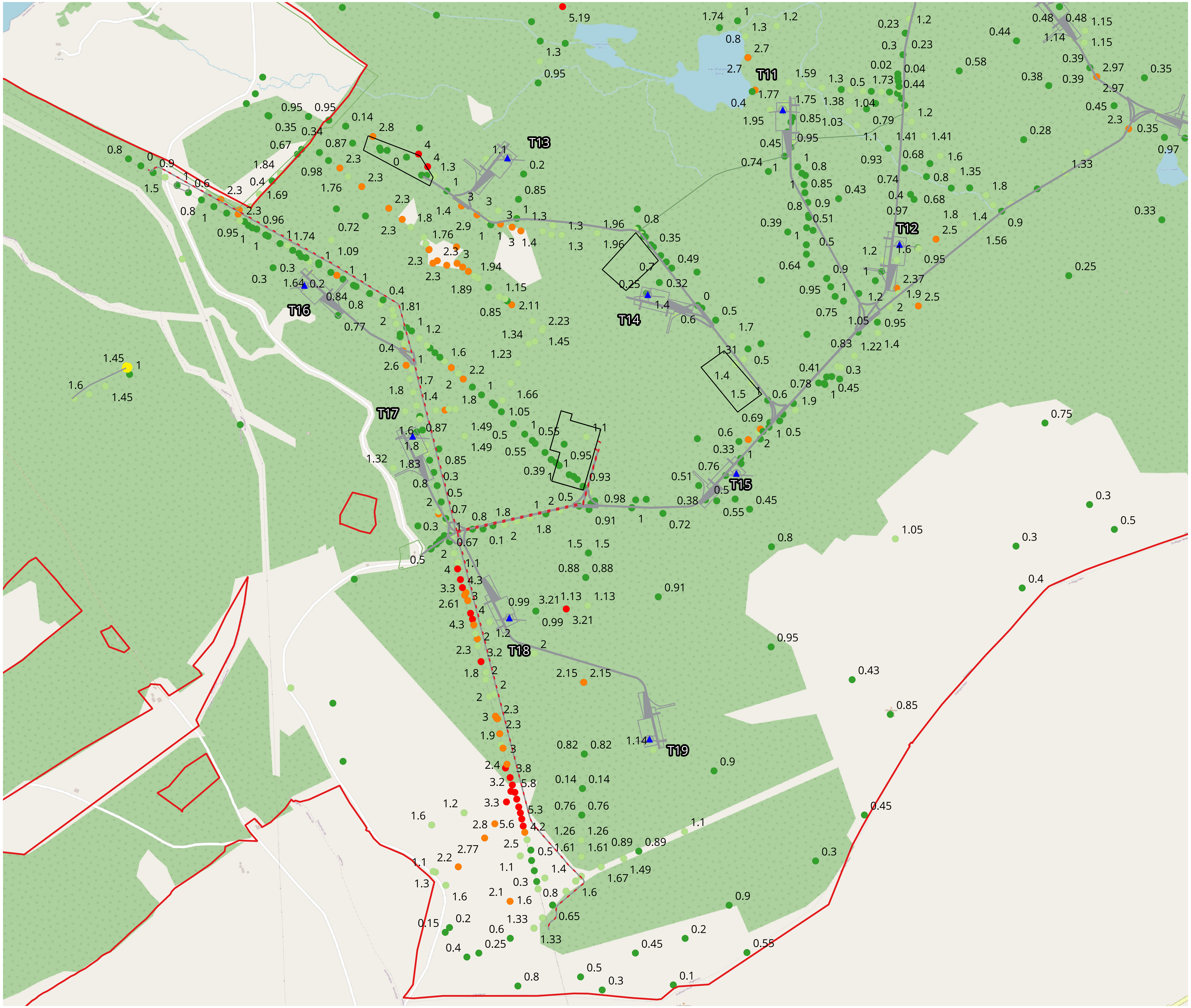

N

Ground investigation

Peat depth (m)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 10

Ground investigation layout - Sheet 2

Cloghercor Wind Farm
Preliminary Peat Stability Risk Assessment

Doc Nr: P20_042_DR001_02
Rev: P02
Scale: 1:10,000 @ A3
Date: 10.02.2022
Drawn: CR
Background: OpenTopoMap

0 250 500 m

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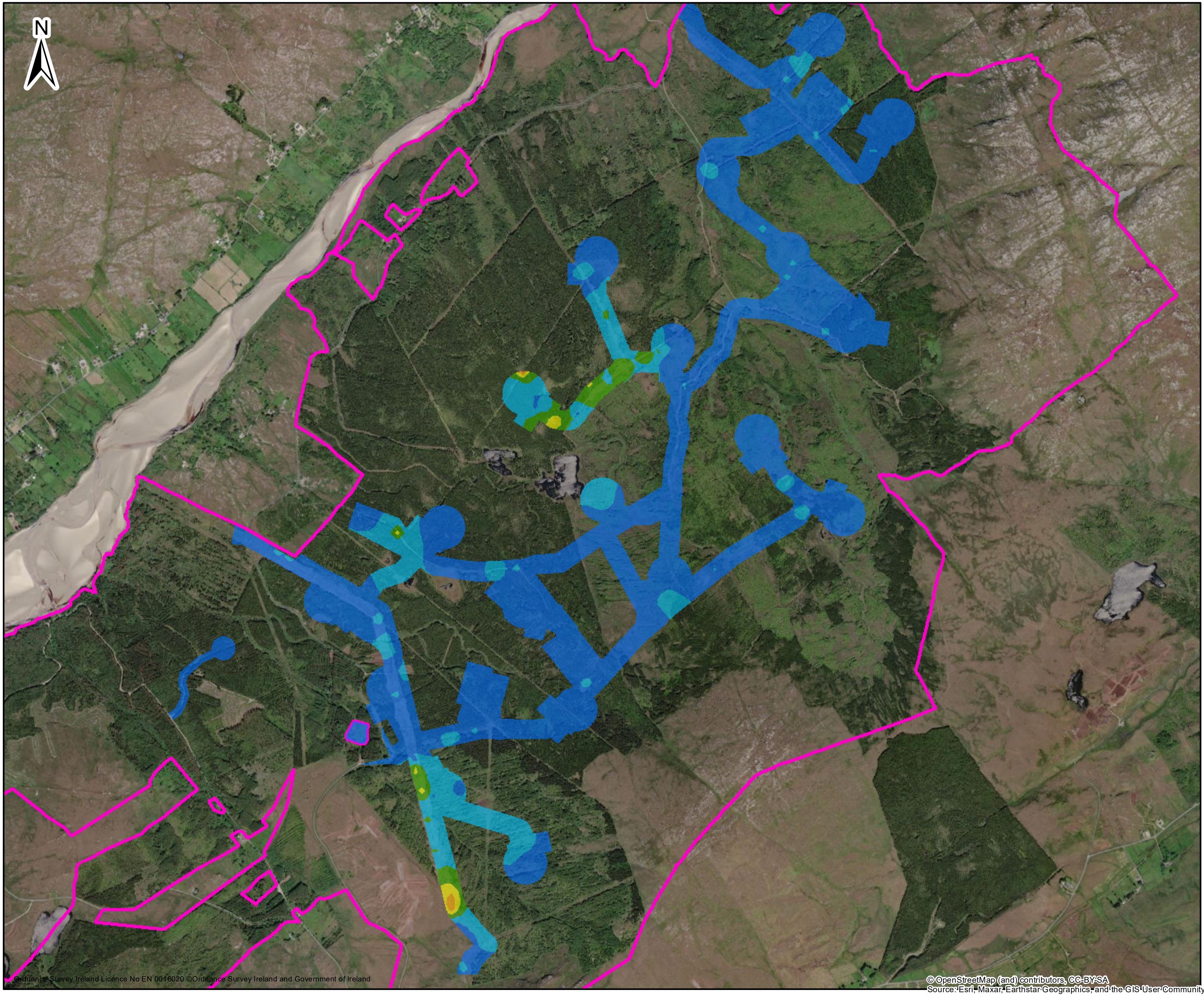

Legend

Proposed Wind Farm Site Boundary

Interpolated Peath Depths (m)

- 0.0 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0
- 4.0 - 5.00
- 5.0 - 5.5

0 0.25 0.5 0.75 1

Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

D01	30/01/2023	Draft issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:

Cloghercor Wind Farm ltd.

Project:

Cloghercor Wind Farm

Title:

Figure 4:
Interpolated Peath Depths

Scale @ A4: 1:24,000

Prepared by: S.Pezzetta

Checked: J.Dillon

Date: January 2023

Project Director: D.Grehan

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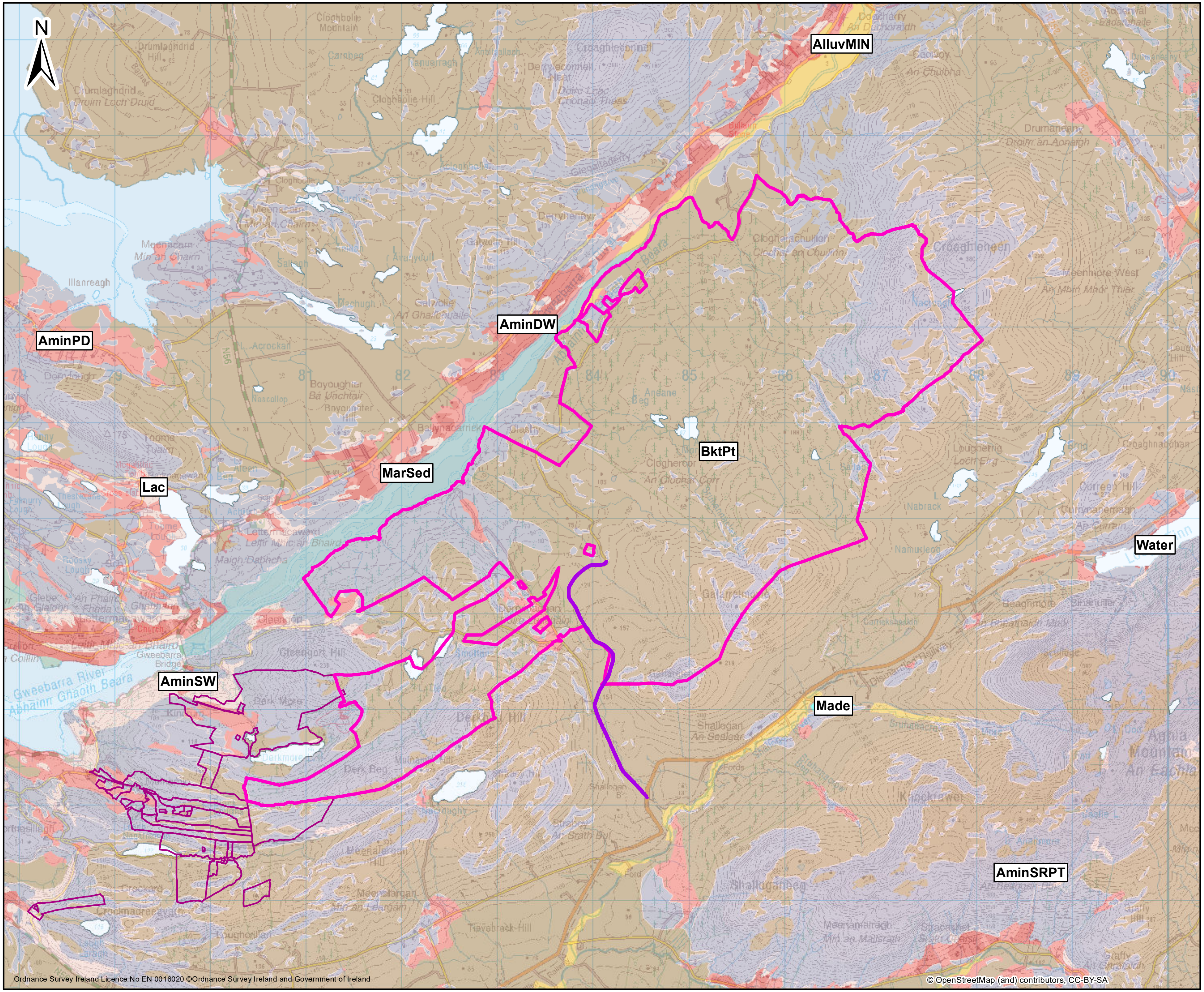
Draft: D01



Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Soils

- AlluvMIN - Mineral alluvium
- AminDW - Acid Brown Earths / Brown Podzolics
- AminPD - Surface water Gleys / Ground water Gleys Acidic
- AminSRPT - Podzols Peaty
- AminSW - Lithosols / Regosols
- BktPt - Blanket peat
- Lac
- Made
- MarSed
- Water

* all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2
Kilometres

NOTES

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A	24/01/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 8-2:
Soils Map

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: January 2023

Project Director: O.Fitzpatrick

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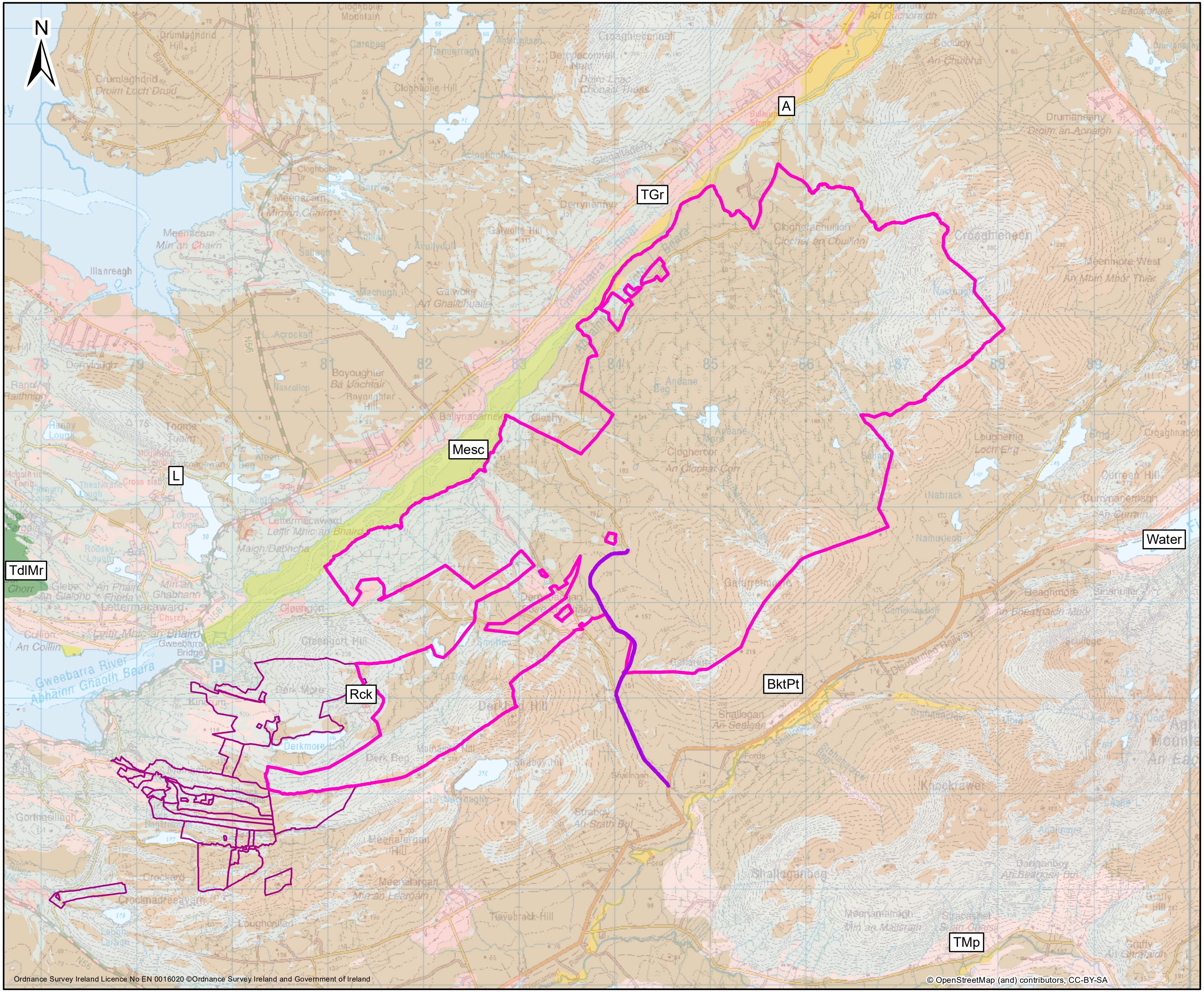

Legend*

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Subsoils

- A, Alluvium
- BktPt, Blanket Peat
- L, Lacustrine sediments
- Mesc, Esturine silts and clays
- Rck, Bedrock outcrop or subcrop
- TGr, Till derived from granites
- TMp, Till derived from Metamorphic rocks
- TdlMr, Tidal Marsh
- Water

* all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2

Kilometres

NOTES

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3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 8-3:
Subsoils Map

Scale @ A4: 1:50,000

Prepared by: S.Pezzetta | Checked: J.Dillon | Date: January 2023

Project Director: O.Fitzpatrick

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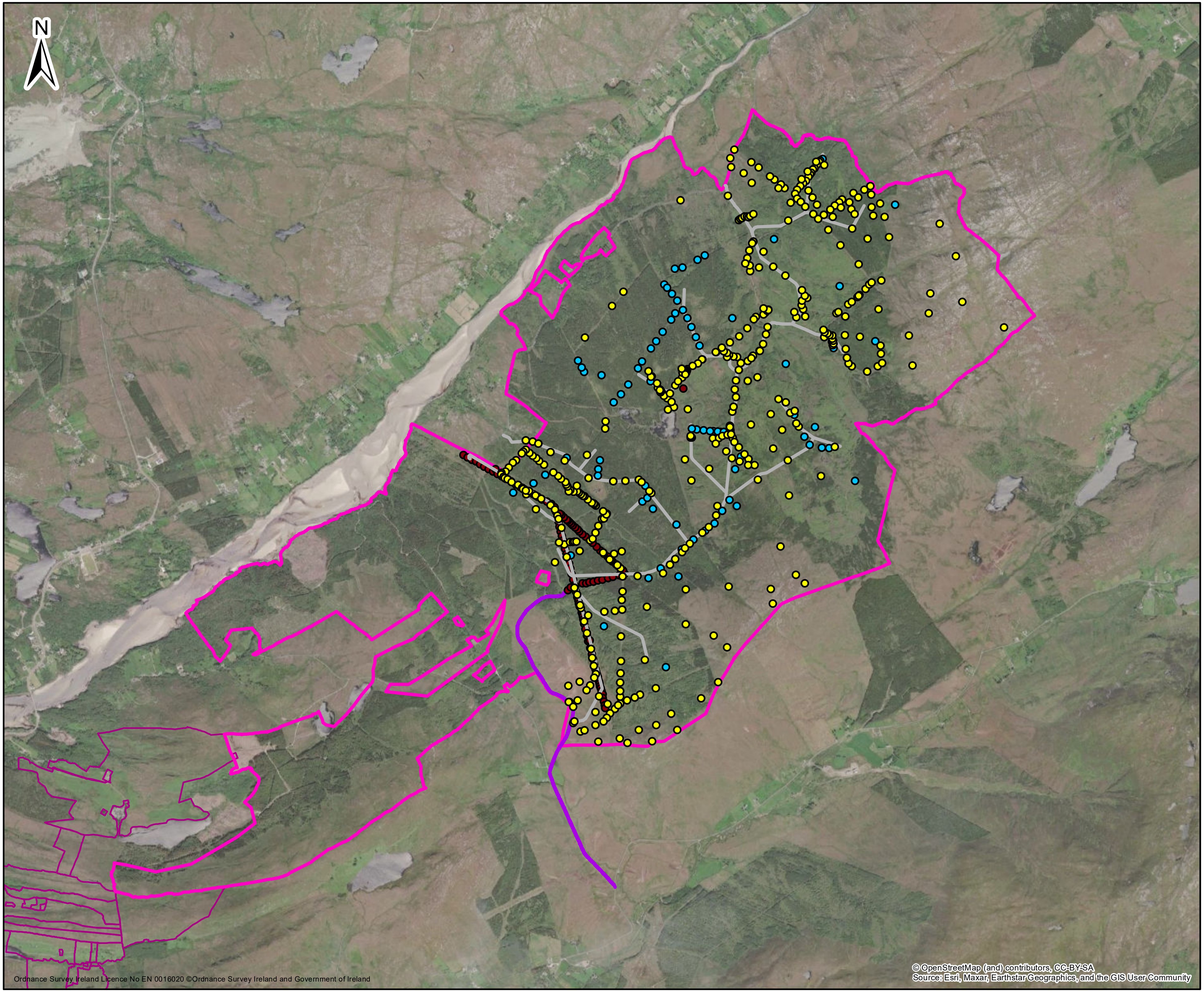

Legend*

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands
- June 22 data
- Sept 22 data
- TLI Probes
- Internal Roads

*all land identified is within Boundary of the Proposed Project

0 0.25 0.5 0.75 1
Kilometres

NOTES

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3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 8-4
GII -
Site Investigation locations

Scale @ A4: 1:40,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: January 2023

Project Director: O.Fitzpatrick

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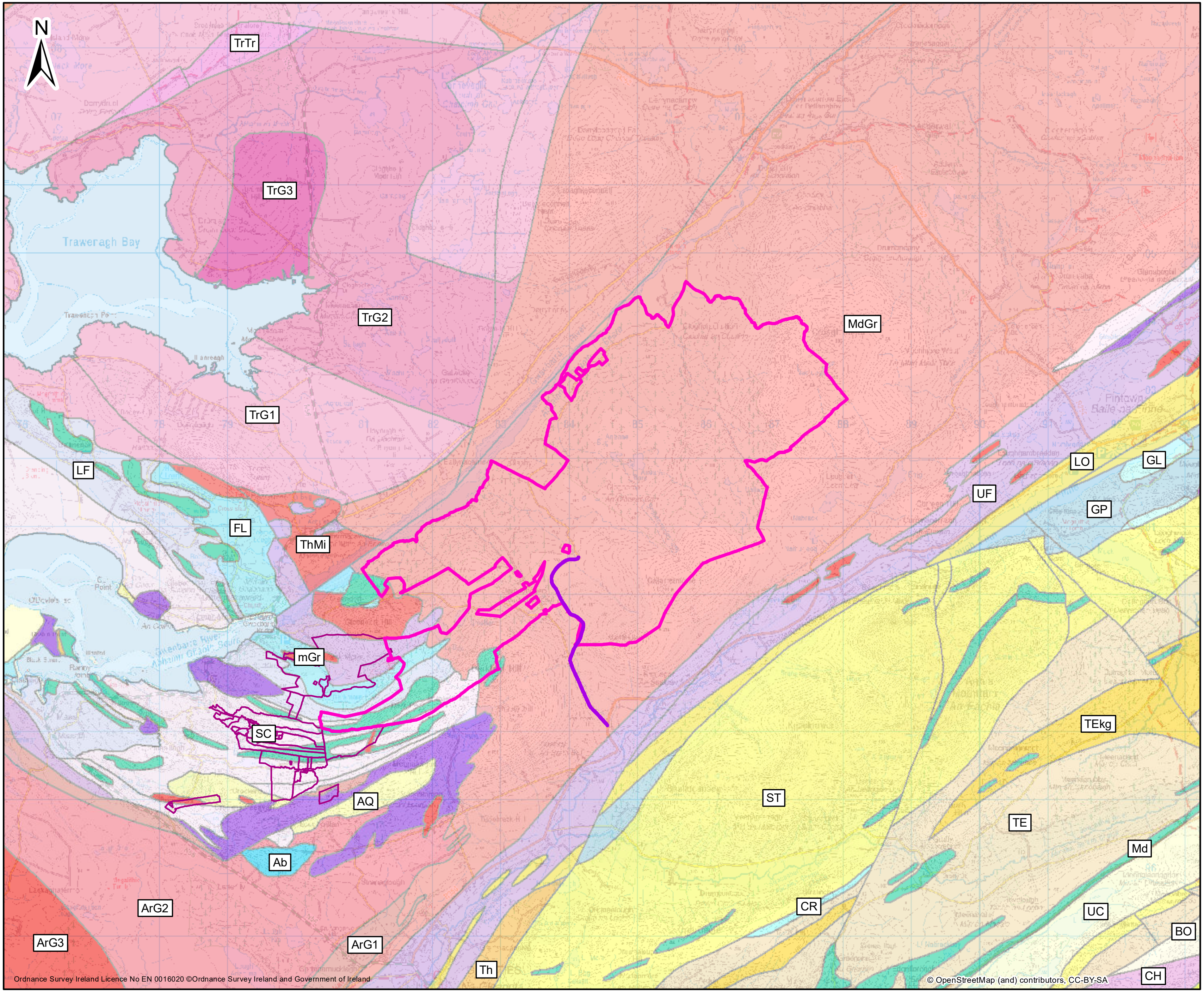

Legend *

- Proposed Wind Farm Site Boundary
- Turbine Delivery Route works
- Biodiversity Enhancement lands

Bedrock Geology

- Ards Quartzite Formation
- Boultypatrick (Grit) Formation
- Cranford Limestone Formation
- Croaghubbrid Pelite Formation
- Croveenananta Formation
- Falcarragh Limestone Formation
- Glencolumbkille Limestone Formation
- Glencolumbkille Pelite Formation
- Ardara Granite, G1 variety
- Ardara Granite, G2 variety
- Ardara Granite, G3 variety
- Thorr Granite
- Thorr Granite migmatitic facies
- Main Donegal Granite
- Microgranite and related rocks
- Trawenagh Bay Biotite Granite
- Trawenagh Bay Biotite-muscov. Grani
- Trawenagh Bay Biotite-muscov. Grani
- Trawenagh Bay Aplogranite
- Trawenagh Bay Transitional G1/G2 Gr
- Lower Falcarragh Pelite Formation
- Loughros Formation
- Appinite suite
- Appinite suite intrusive breccia
- Metadolerite
- Port Askaig Formation
- Sessiagh-Clonmass Formation
- Slieve Tooey Quartzite Formation
- Termon Formation
- Knockletteragh Member
- Upper Crana Quartzite Formation
- Upper Falcarragh Pelite Formation

* all land identified is within Boundary of the Proposed Project

0 0.5 1 1.5 2
Kilometres

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

A	24/01/2023	Final issue	S.P	J.D
Issue	Date	Description	By	Chkd.

Client:
Cloghercor Wind Farm ltd.

Project:
Cloghercor Wind Farm

Title:
Figure 8-5
Bedrock Geology Map

Scale @ A4: 1:70,000

Prepared by: S.Pezzetta
Checked: J.Dillon
Date: January 2023

Project Director: O.Fitzpatrick

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APPENDIX 2: PEAT STABILITY CALCULATIONS

Peat stability calculations for Cloghercor Wind Farm
Deterministic stability calculcation outputs
Undrained Case 1 and Case 2

Nr	Assessment area	Description	Relevant GI	Description	$c_{u,fv,avg}$ *kPa*	Vane correction	$c_{u,k}$ *kPa*	$c_{u,d}$ *kPa*	Peat depth *m*	Slope *deg*	Surcharge *m*	Design surcharge *m*	Unit weight *kN/m³*	Case 1 *ODF*	Case 2 *ODF*
1	Access road to T1	Fire road & forestry	PP127 to PP131, TOBIN probes	Probes found 0.3 to 1.8m peat		0.5	10.0	7.1	1.8	8.1	1	1.3	10	2.8	1.6
2	T1	Fire road & forestry	PP116 to PP128, GC001, TOBIN probes	Probes found 0.4 to 3.1m peat		0.5	10.0	7.1	3.1	8.0	1	1.3	10	1.7	1.2
3	T2 & access road	Fire road & forestry	TOBIN peat probes	Probes found 0.3 to 1.9m peat		0.5	10.0	7.1	1.9	12.1	1	1.3	10	1.8	1.1
4	Compound & borrow pit near T1	Fire road & forestry	PP110 to PP115, PP130 to PP133, TOBIN probes	Probes found 0.2 to 2.1m peat		0.5	10.0	7.1	2.1	9.8	1	1.3	10	2.0	1.3
5	T3 & access road	Forestry	PP069, PP070, GC003	Peat depth 0.5 to 2.5m		0.5	10.0	7.1	2.5	2.5	1	1.3	10	6.6	4.3
6	T4 & access road	Fire road & forestry	PP024, PP025, PP062, PP063, TOBIN probes	Probes found 0.0 to 2.2m peat		0.5	10.0	7.1	1.8	4.2	1	1.3	10	5.5	3.2
7	T5	Fire road & forestry	TP15, TP24, BH03, PP064, TOBIN probes	Peat depth 0.5 to 1.1m		0.5	10.0	7.1	1.1	10.1	1	1.3	10	3.7	1.7
8	T6 & access road	Fire road & forestry	PP075 to PP081, TOBIN probes	Probes found 0.8 to 3.6m peat		0.5	10.0	7.1	3.6	1.6	1	1.3	10	6.9	5.1
9	T7	Fire road & forestry	TP08, CRA & TOBIN probes	Probes found 0.5 to 3.6m peat		0.5	10.0	7.1	3.6	3.9	1	1.3	10	2.9	2.1
10	T8	Fire road & forestry	PP029 to PP037, TOBIN probes	Probes found 0.4 to 3.0m peat		0.5	10.0	7.1	2.5	7.0	1	1.3	10	2.4	1.6
11	T9 & access road	Fire road & forestry	PP026 to PP028, TOBIN probes	Probes found 0.0 to 2.3m peat		0.5	10.0	7.1	2.3	3.9	1	1.3	10	4.6	2.9
12	T10 & access road	Fire road & forestry	PP059 to PP061, TOBIN probes	Probes found 0.6 to 3.6m peat		0.5	10.0	7.1	3.6	2.3	1	1.3	10	5.0	3.7
13	T11 & access road	Forestry	PP009, PP010,PP020, PP094, TOBIN probes	Probes found 0.5 to 2.0m peat		0.5	10.0	7.1	2	7.9	1	1.3	10	2.6	1.6
14	Access road T12 to T7	Fire road & forestry	PP012-PP023, TP20	Probes found 0.0 to 1.1m peat	10	0.5	4.9	3.5	1.1	7.5	1	1.3	10	2.5	1.1
15	T12	Fire road & forestry	PP010, PP011, GC014, TOBIN probes	Probes found 0.9 to 2.4m peat		0.5	10.0	7.1	2.4	7.1	1	1.3	10	2.4	1.6
16	T13 & borrow pit	Fire road & forestry	TP07, TP13, BH02, GC015, GC151, GC152, TOBIN probes	Peat depth 1.0 to 4.0m	12	0.5	5.9	4.2	4	3.6	1	1.3	10	1.7	1.3
17	T14 & borrow pit	Forestry	PP005, PP051-PP056, TP16, GC016, TOBIN & CRA probes	Peat depth 0.0 to 1.4m	15	0.5	7.5	5.4	1.4	7.6	1	1.3	10	2.9	1.5
18	T15	Fire road & forestry	PP001, PP002, GC017, TOBIN probes	Probes found 0.33 to 1.0m peat		0.5	10.0	7.1	1	11.5	1	1.3	10	3.7	1.6
19	Substation compound	Fire road & forestry	PP040 to PP042, TLI & TOBIN probes	Probes found 0.5 to 1.1m peat		0.5	10.0	7.1	1.1	9.4	1	1.3	10	4.0	1.8
20	Public car park & grid connection	Clear ground, blanket peat	PP049, TLI probes	Probes found 0.0 to 2.3m peat		0.5	10.0	7.1	2.3	4.0	1	1.3	10	4.4	2.8
21	T16	Forestry	PP048, PP049, TLI & TOBIN probes	Probes found 0.9 to 2.6m peat		0.5	10.0	7.1	2.6	4.8	1	1.3	10	3.3	2.2
22	T17	Fire road & forestry	PP046, PP045, GC019, TLI & CRA probes	Probes found 0.3 to 2.8m peat	15	0.5	7.4	5.3	2.8	6.3	1	1.3	10	1.7	1.2
23	T18	Forestry	PP136, GC020, TOBIN probes	Probes found 1.0 to 2.0m peat		0.5	10.0	7.1	2	4.5	1	1.3	10	4.6	2.8
24	T19	Fire road & forestry	GC020, GC021, PP135, TOBIN probes	Probes found 0.9 to 2.2m peat		0.5	10.0	7.1	2	7.1	1	1.3	10	2.9	1.8
25	Grid connection route (near T19)	Underground cable route alongside existing OHL	Peat probes (TLI, TOBIN & CRA)	Probes found 1.3 to 6.1m peat		0.5	10.0	7.1	6.1	1.5	1	1.3	10	4.5	3.7
26	Access from main road	New access road	Peat probes (TOBIN & CRA)	Probe found 0.0 to 1.5m peat	16	0.5	8.0	5.7	1	8.4	1	1.3	10	4.0	1.7
27	Met mast	Met mast & access road	Peat probes (TOBIN & CRA)	Probes found 1.0 to 1.6m peat	8	0.5	4.0	2.9	1.6	5.0	1	1.3	10	2.1	1.1

	Case 1	Case 2
Minimum	1.7	1.1
Average	3.3	2.0
Maximum	4.6	3.7

Notes:

Undrained shear strength of peat is limited to 10kPa (characteristic value) or local values if less than 10kPa.

Condition 1 relates to no surcharge loading.

Condition 2 takes account of a surcharge equivalent to fill depth of 1m of peat or typical construction traffic i.e. 10kPa.

Slope inclination (β) based on site readings and analysis of LiDAR data.

A minimum slope of 0.5 degrees has been considered.

Peat depths based on trial pits, boreholes, and peat probes at the site.

07/12/2022

Peat stability calculations for Cloghercor Wind Farm
Deterministic stability calculcation outputs
Drained Case 1 and Case 2

Nr	Assessment area	Description	Relevant GI	Description	φ'_k	φ'_d	c'k	c'd	Peat depth	Water level in peat	Slope (deg)	Surcharge	Design surcharge	Unit weight	Case 1	Case 2
					deg	*deg*	*kPa*	*kPa*	*m*	*m*	*deg*	*m*	*m*	*kN/m³*	*ODF*	*ODF*
1	Access road to T1	Fire road & forestry	PP127 to PP131, TOBIN probes	Probes found 0.3 to 1.8m peat	28	23.0	4.0	2.9	1.8	1.8	8.1	1	1.3	17	1.92	2.37
2	T1	Fire road & forestry	PP116 to PP128, GC001, TOBIN probes	Probes found 0.4 to 3.1m peat	28	23.0	4.0	2.9	3.1	3.1	8.0	1	1.3	16	1.59	2.02
3	T2 & access road	Fire road & forestry	TOBIN peat probes	Probes found 0.3 to 1.9m peat	28	23.0	4.0	2.9	1.9	1.9	12.1	1	1.3	15	1.18	1.50
4	Compound & borrow pit near T1	Fire road & forestry	PP110 to PP115, PP130 to PP133, TOBIN probes	Probes found 0.2 to 2.1m peat	28	23.0	4.0	2.9	2.1	2.1	9.8	1	1.3	14	1.32	1.76
5	T3 & access road	Forestry	PP069, PP070, GC003	Peat depth 0.5 to 2.5m	28	23.0	4.0	2.9	2.5	2.5	2.5	1	1.3	13	4.41	6.23
6	T4 & access road	Fire road & forestry	PP024, PP025, PP062, PP063, TOBIN probes	Probes found 0.0 to 2.2m peat	28	23.0	4.0	2.9	1.8	1.8	4.2	1	1.3	11	2.62	3.97
7	T5	Fire road & forestry	TP15, TP24, BH03, PP064, TOBIN probes	Peat depth 0.5 to 1.1m	28	23.0	4.0	2.9	1.1	1.1	10.1	1	1.3	12	1.68	2.06
8	T6 & access road	Fire road & forestry	PP075 to PP081, TOBIN probes	Probes found 0.8 to 3.6m peat	28	23.0	4.0	2.9	3.6	3.6	1.6	1	1.3	10	3.06	6.18
9	T7	Fire road & forestry	TP08, CRA & TOBIN probes	Probes found 0.5 to 3.6m peat	28	23.0	4.0	2.9	3.6	3.6	3.9	1	1.3	10	1.28	2.58
10	T8	Fire road & forestry	PP029 to PP037, TOBIN probes	Probes found 0.4 to 3.0m peat	28	23.0	4.0	2.9	2.5	2.5	7.0	1	1.3	10	1.01	1.85
11	T9 & access road	Fire road & forestry	PP026 to PP028, TOBIN probes	Probes found 0.0 to 2.3m peat	28	23.0	4.0	2.9	2.3	2.3	3.9	1	1.3	10	1.94	3.48
12	T10 & access road	Fire road & forestry	PP059 to PP061, TOBIN probes	Probes found 0.6 to 3.6m peat	28	23.0	4.0	2.9	3.6	3.6	2.3	1	1.3	10	2.21	4.47
13	T11 & access road	Forestry	PP009, PP010,PP020, PP094, TOBIN probes	Probes found 0.5 to 2.0m peat	28	23.0	4.0	2.9	2	2	7.9	1	1.3	10	1.10	1.87
14	Access road T12 to T7	Fire road & forestry	PP012-PP023, TP20	Probes found 0.0 to 1.1m peat	28	23.0	4.0	2.9	1.1	1.1	7.5	1	1.3	10	2.08	2.71
15	T12	Fire road & forestry	PP010, PP011, GC014, TOBIN probes	Probes found 0.9 to 2.4m peat	28	23.0	4.0	2.9	2.4	2.4	7.1	1	1.3	10	1.04	1.87
16	T13 & borrow pit	Fire road & forestry	TP07, TP13, BH02, GC015, GC151, GC152, TOBIN probes	Peat depth 1.0 to 4.0m	28	23.0	4.0	2.9	4	4	3.6	1	1.3	10	1.28	2.64
17	T14 & borrow pit	Forestry	PP005, PP051-PP056, TP16, GC016, TOBIN & CRA probes	Peat depth 0.0 to 1.4m	28	23.0	4.0	2.9	1.4	1.4	7.6	1	1.3	10	1.61	2.36
18	T15	Fire road & forestry	PP001, PP002, GC017, TOBIN probes	Probes found 0.33 to 1.0m peat	28	23.0	4.0	2.9	1	1	11.5	1	1.3	10	1.51	1.84
19	Substation compound	Fire road & forestry	PP040 to PP042, TLI & TOBIN probes	Probes found 0.5 to 1.1m peat	28	23.0	4.0	2.9	1.1	1.1	9.4	1	1.3	10	1.66	2.16
20	Public car park & grid connection	Clear ground, blanket peat & rock outcrop	PP049, TLI probes	Probes found 0.0 to 2.3m peat	28	23.0	4.0	2.9	2.3	2.3	4.0	1	1.3	10	1.89	3.40
21	T16	Forestry	PP048, PP049, TLI & TOBIN probes	Probes found 0.9 to 2.6m peat	28	23.0	4.0	2.9	2.6	2.6	4.8	1	1.3	10	1.40	2.61
22	T17	Fire road & forestry	PP046, PP045, GC019, TLI & CRA probes	Probes found 0.3 to 2.8m peat	28	23.0	4.0	2.9	2.8	2.8	6.3	1	1.3	10	1.00	1.90
23	T18	Forestry	PP136, GC020, TOBIN probes	Probes found 1.0 to 2.0m peat	28	23.0	4.0	2.9	2	2	4.5	1	1.3	10	1.94	3.31
24	T19	Fire road & forestry	GC020, GC021, PP135, TOBIN probes	Probes found 0.9 to 2.2m peat	28	23.0	4.0	2.9	2	2	7.1	1	1.3	10	1.24	2.10
25	Grid connection route (near T19)	Underground cable route alongside existing OHL	Peat probes (TLI, TOBIN & CRA)	Probes found 1.3 to 6.1m peat	28	23.0	4.0	2.9	6.1	6.1	1.5	1	1.3	10	2.10	4.58
26	Access from main road	New access road	Peat probes (TOBIN & CRA)	Probe found 0.0 to 1.5m peat	28	23.0	4.0	2.9	1	1	8.4	1	1.3	10	2.03	2.51
27	Met mast	Met mast & access road	Peat probes (TOBIN & CRA)	Probes found 1.0 to 1.6m peat	28	23.0	4.0	2.9	1.6	1.6	5	1	1.3	10	2.15	3.37

	Case 1	Case 2
Minimum	1.0	1.5
Average	1.8	2.9
Maximum	4.4	6.2

Notes:

Characteristic drained shear strength of peat used.

Condition 1 relates to no surcharge loading.

Condition 2 takes account of a surcharge equivalent to fill depth of 1m of peat or typical construction traffic i.e. 10kPa.

Slope inclination (β) based on site readings and analysis of LiDAR data.

A minimum slope of 0.5 degrees has been considered.

Peat depths based on trial pits, boreholes, and peat probes at the site.

07/12/2022

APPENDIX 3: PEAT STABILITY RISK REGISTER

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 1
Location: Access road to T1

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.3 to 1.8m peat	4	4	**16**	3	4	**12**
Peat strength (kPa)	10	2	4	**8**	2	4	**8**
Topography							
Elevation (mOD)	10 to 50	1	3	**3**	1	3	**3**
Slope angle (deg.)	6 to 8	2	3	**6**	2	2	**4**
Evidence of previous slips	No	2	3	**6**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	2	**4**
Hydrology							
Distance from watercourse	> 150m	2	4	**8**	1	4	**4**
Evidence of surface water flow	Yes	3	3	**9**	2	3	**6**
Evidence of subsurface flow	No	1	3	**3**	1	3	**3**
Quantative assessment							
FOS - drained	1.9	2	4	**8**	2	4	**8**
FOS - undrained	1.6						
Total (pre / post control measures)			**76**			**56**	
Max possible			**250**			**250**	
Overall hazard assessment (pre / post control measures)			**8**			**6**	
Overall hazard ranking			**Low**			**Low**	

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from access road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Inspection regime for access roads during works.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 2
Location: T1

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.4 to 3.1m peat	5	4	**20**	4	3	**12**
Peat strength (kPa)	10	3	4	**12**	2	3	**6**
Topography							
Elevation (mOD)	50 to 60	1	2	**2**	1	3	**3**
Slope angle (deg.)	7 to 8	3	2	**6**	2	3	**6**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	2	**6**	2	2	**4**
Hydrology							
Distance from watercourse	100 to 150m	2	3	**6**	2	3	**6**
Evidence of surface water flow	No	2	3	**6**	2	3	**6**
Evidence of subsurface flow	No	1	3	**3**	1	3	**3**
Quantative assessment							
FOS - drained	1.6	2	2	**4**	1	2	**2**
FOS - undrained	1.2						
Total (pre / post control measures)		**69**			**52**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**7**			**5**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 3
Location: T2 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.3 to 1.9m peat	4	3	**12**	4	3	**12**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	100 to 120	2	2	**4**	2	3	**6**
Slope angle (deg.)	7 to 12	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	2	**6**	2	2	**4**
Hydrology							
Distance from watercourse	>150m	2	3	**6**	2	3	**6**
Evidence of surface water flow	No	2	3	**6**	2	3	**6**
Evidence of subsurface flow	No	1	3	**3**	1	3	**3**
Quantative assessment							
FOS - drained	1.2	2	2	**4**	2	2	**4**
FOS - undrained	1.1						
Total (pre / post control measures)		**60**			60		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**6**			6		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Inspection regime for access roads during works.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 4
Location: Compound & borrow pit near T1

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.2 to 2.1m peat	2	3	**6**	2	2	**4**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	50 to 80	2	3	**6**	1	3	**3**
Slope angle (deg.)	6 to 10	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	3	**6**
Hydrology							
Distance from watercourse	50 to 100m	3	3	**9**	2	3	**6**
Evidence of surface water flow	No	2	3	**6**	2	3	**6**
Evidence of subsurface flow	No	1	3	**3**	1	3	**3**
Quantative assessment							
FOS - drained	1.3	3	2	**6**	2	2	**4**
FOS - undrained	1.3						
Total (pre / post control measures)		**64**			**51**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**6**			**5**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Due to size of excavatioin & likelihood it will be open for a long time, specific temporary works design required including temporary slope stability measures, e.g. rock berm, shallow slope angles, daily inspections, etc.
3	Maintain hydrology of area as far as possible.
4	Installation of interceptor drains upslope of works to divert any surface water away from compound & borrow pit area.
5	Use of experienced geotechnical staff for detailed design & temporary works design.
6	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 5
Location: T3 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Peat depth 0.5 to 2.5m	3	3	**9**	2	2	**4**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	40 to 70	2	3	**6**	1	3	**3**
Slope angle (deg.)	7 to 8	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	3	**6**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	3	**6**
Hydrology							
Distance from watercourse	Access road crosses watercourse	4	4	**16**	4	4	**16**
Evidence of surface water flow	Yes	4	4	**16**	3	4	**12**
Evidence of subsurface flow	No	3	4	**12**	2	4	**8**
Quantative assessment							
FOS - drained	4.4	2	3	**6**	1	2	**2**
FOS - undrained	4.3						
Total (pre / post control measures)		**95**			**70**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**7**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 6
Location: T4 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.0 to 2.2m peat	3	3	**9**	2	3	**6**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	70 to 100	3	4	**12**	2	4	**8**
Slope angle (deg.)	3 to 5	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	3	**6**	2	3	**6**
Hydrology							
Distance from watercourse	50 to 100m	4	4	**16**	4	3	**12**
Evidence of surface water flow	Yes	4	4	**16**	3	4	**12**
Evidence of subsurface flow	Yes	4	4	**16**	3	4	**12**
Quantative assessment							
FOS - drained	2.6	2	2	**4**	2	2	**4**
FOS - undrained	3.2						
Total (pre / post control measures)		**98**			79		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			8		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine & road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 7
Location: T5

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Peat depth 0.5 to 1.1m	2	2	**4**	2	2	**4**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	100 to 170m	4	4	**16**	4	3	**12**
Slope angle (deg.)	8 to 11	4	4	**16**	4	3	**12**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	3	**6**
Hydrology							
Distance from watercourse	50 to 100m	4	4	**16**	4	3	**12**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	3	4	**12**	2	3	**6**
Quantative assessment							
FOS - drained	1.7	3	2	**6**	2	2	**4**
FOS - undrained	1.7						
Total (pre / post control measures)		**105**			**75**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**11**			**8**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 8
Location: T6 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.8 to 3.6m peat	4	4	**16**	4	4	**16**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	95 to 110	3	3	**9**	3	2	**6**
Slope angle (deg.)	2	2	3	**6**	2	3	**6**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	Access road crosses watercourse	4	4	**16**	3	3	**9**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	3	4	**12**	2	3	**6**
Quantative assessment							
FOS - drained	3.1	3	2	**6**	2	2	**4**
FOS - undrained	5.1						
Total (pre / post control measures)		**95**			**70**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**7**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 9
Location: T7

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.5 to 3.6m peat	4	4	**16**	4	4	**16**
Peat strength (kPa)	10	2	3	**6**	2	3	**6**
Topography							
Elevation (mOD)	90 to 110	3	3	**9**	3	2	**6**
Slope angle (deg.)	3 to 4	2	3	**6**	2	3	**6**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	Access road crosses watercourse	4	4	**16**	3	3	**9**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	3	4	**12**	2	3	**6**
Quantative assessment							
FOS - drained	1.3	4	2	**8**	3	2	**6**
FOS - undrained	2.1						
Total (pre / post control measures)		**97**			**72**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**7**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.
7	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 10
Location: T8

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.4 to 3.0m peat	4	4	**16**	4	4	**16**
Peat strength (kPa)	10	4	3	**12**	4	3	**12**
Topography							
Elevation (mOD)	150 to 185	4	4	**16**	3	3	**9**
Slope angle (deg.)	4 to 7	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	2	**6**	3	2	**6**
Hydrology							
Distance from watercourse	>200m	2	2	**4**	2	2	**4**
Evidence of surface water flow	No	2	2	**4**	2	2	**4**
Evidence of subsurface flow	No	2	4	**8**	2	3	**6**
Quantative assessment							
FOS - drained	1.0	4	4	**16**	3	3	**9**
FOS - undrained	1.6						
Total (pre / post control measures)		**95**			79		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			8		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 11
Location: T9 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.0 to 2.3m peat	3	3	**9**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	150 to 185	4	4	**16**	3	3	**9**
Slope angle (deg.)	3 to 4	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	<50m, access road crosses	4	4	**16**	4	3	**12**
Evidence of surface water flow	Yes	4	4	**16**	4	3	**12**
Evidence of subsurface flow	No	2	4	**8**	2	3	**6**
Quantative assessment							
FOS - drained	1.9	3	3	**9**	3	3	**9**
FOS - undrained	2.9						
Total (pre / post control measures)		**100**			**83**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**8**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine & road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 12
Location: T10 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.6 to 3.6m peat	5	4	**20**	4	4	**16**
Peat strength (kPa)	10	5	4	**20**	4	4	**16**
Topography							
Elevation (mOD)	100 to 115	3	3	**9**	3	2	**6**
Slope angle (deg.)	1 to 3	2	2	**4**	2	2	**4**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	100 to 150m	3	4	**12**	3	4	**12**
Evidence of surface water flow	No	2	4	**8**	2	3	**6**
Evidence of subsurface flow	No	2	4	**8**	2	3	**6**
Quantative assessment							
FOS - drained	2.2	3	2	**6**	2	2	**4**
FOS - undrained	3.7						
Total (pre / post control measures)		**95**			**78**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**8**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine & road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 13
Location: T11 & access road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.5 to 2.0m peat	4	4	**16**	4	3	**12**
Peat strength (kPa)	10	4	4	**16**	4	3	**12**
Topography							
Elevation (mOD)	100 to 165	4	4	**16**	3	3	**9**
Slope angle (deg.)	4 to 8	3	4	**12**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	50 to 100m	3	4	**12**	3	4	**12**
Evidence of surface water flow	Yes	4	4	**16**	3	4	**12**
Evidence of subsurface flow	No	2	4	**8**	2	3	**6**
Quantative assessment							
FOS - drained	1.1	4	3	**12**	3	2	**6**
FOS - undrained	1.6						
Total (pre / post control measures)		**116**			86		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**12**			9		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine & road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 14
Location: Access road T12 to T7

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.0 to 1.1m peat	3	4	**12**	3	3	**9**
Peat strength (kPa)	5	5	4	**20**	4	3	**12**
Topography							
Elevation (mOD)	115 to 170	4	4	**16**	3	3	**9**
Slope angle (deg.)	7 to 8	3	4	**12**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	2	**4**
Hydrology							
Distance from watercourse	Access road crosses watercourse	5	4	**20**	4	4	**16**
Evidence of surface water flow	Yes	4	4	**16**	3	4	**12**
Evidence of subsurface flow	No	2	4	**8**	2	3	**6**
Quantative assessment							
FOS - drained	2.1	4	4	**16**	3	3	**9**
FOS - undrained	1.1						
Total (pre / post control measures)		**133**			**90**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**13**			**9**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from road construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 15
Location: T12

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.9 to 2.4m peat	4	4	**16**	3	3	**9**
Peat strength (kPa)	10	4	4	**16**	4	3	**12**
Topography							
Elevation (mOD)	150 to 180	4	4	**16**	3	3	**9**
Slope angle (deg.)	6 to 7	3	4	**12**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	2	2	**4**
Hydrology							
Distance from watercourse	>150m	3	3	**9**	3	2	**6**
Evidence of surface water flow	No	2	2	**4**	2	2	**4**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.0	4	4	**16**	3	3	**9**
FOS - undrained	1.6						
Total (pre / post control measures)		**106**			**70**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**11**			**7**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 16
Location: T13 & borrow pit

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Peat depth 1.0 to 4.0m	5	4	**20**	4	4	**16**
Peat strength (kPa)	6	5	4	**20**	4	4	**16**
Topography							
Elevation (mOD)	90 to 110	3	3	**9**	3	3	**9**
Slope angle (deg.)	3 to 4	3	3	**9**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Low	2	3	**6**	2	3	**6**
Hydrology							
Distance from watercourse	50 to 100m	3	3	**9**	3	2	**6**
Evidence of surface water flow	Yes	4	3	**12**	4	2	**8**
Evidence of subsurface flow	Yes	4	3	**12**	4	2	**8**
Quantative assessment							
FOS - drained	1.3	4	4	**16**	3	3	**9**
FOS - undrained	1.3						
Total (pre / post control measures)		**117**			**91**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**12**			**9**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Quaking peat observed at site - access road moved to north as mitigation measure.
3	Maintain hydrology of area as far as possible.
4	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
5	Use of experienced geotechnical staff for detailed design & temporary works design.
6	Engage experienced contractors and trained operatives to carry out the work.
7	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.
8	Due to size of excavatioin & likelihood it will be open for a long time, specific temporary works design required including temporary slope stability measures, e.g. rock berm, shallow slope angles, daily inspections, etc.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 17
Location: T14 & borrow pit

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Peat depth 0.0 to 1.4m	3	3	**9**	3	3	**9**
Peat strength (kPa)	8	4	4	**16**	4	4	**16**
Topography							
Elevation (mOD)	110 to 150	3	3	**9**	2	3	**6**
Slope angle (deg.)	6 to 8	4	4	**16**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	3	**9**
Hydrology							
Distance from watercourse	50 to 100m	4	3	**12**	3	3	**9**
Evidence of surface water flow	Yes	4	3	**12**	4	2	**8**
Evidence of subsurface flow	Yes	4	3	**12**	4	2	**8**
Quantative assessment							
FOS - drained	1.6	3	3	**9**	3	3	**9**
FOS - undrained	1.5						
Total (pre / post control measures)		**108**			**87**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**11**			**9**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Due to size of excavatioin & likelihood it will be open for a long time, specific temporary works design required including temporary slope stability measures, e.g. rock berm, shallow slope

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 18
Location: T15

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.33 to 1.0m peat	3	3	**9**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	150 to 180	4	4	**16**	3	4	**12**
Slope angle (deg.)	10 to 12	5	4	**20**	4	4	**16**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	High	5	4	**20**	3	4	**12**
Hydrology							
Distance from watercourse	50 to 100m	4	3	**12**	3	3	**9**
Evidence of surface water flow	Yes	4	3	**12**	4	2	**8**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.5	3	3	**9**	3	3	**9**
FOS - undrained	1.6						
Total (pre / post control measures)		**115**			92		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**12**			9		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 19
Location: Substation compound

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.5 to 1.1m peat	3	3	**9**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	110 to 155	4	4	**16**	3	4	**12**
Slope angle (deg.)	8 to 10	4	4	**16**	3	4	**12**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	High	5	4	**20**	3	4	**12**
Hydrology							
Distance from watercourse	50 to 100m	3	3	**9**	3	3	**9**
Evidence of surface water flow	Yes	4	3	**12**	4	2	**8**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.7	3	3	**9**	3	3	**9**
FOS - undrained	1.8						
Total (pre / post control measures)		**108**			88		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**11**			9		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 20
Location: Public car park & grid connection

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.0 to 2.3m peat	4	3	**12**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	60 to 100	3	3	**9**	3	2	**6**
Slope angle (deg.)	3 to 4	3	4	**12**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	3	**6**	2	3	**6**
Hydrology							
Distance from watercourse	> 200m	2	4	**8**	2	3	**6**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.9	3	3	**9**	3	3	**9**
FOS - undrained	2.8						
Total (pre / post control measures)		**89**			**71**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**9**			**7**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 21
Location: T16

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.9 to 2.6m peat	3	3	**9**	3	2	**6**
Peat strength (kPa)	10	3	3	**9**	3	2	**6**
Topography							
Elevation (mOD)	90 to 100	3	3	**9**	3	2	**6**
Slope angle (deg.)	3 to 5	2	2	**4**	2	2	**4**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	Access road crosses watercourse	3	4	**12**	2	3	**6**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.4	2	2	**4**	2	2	**4**
FOS - undrained	2.2						
Total (pre / post control measures)		**75**			**53**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**8**			**5**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 22
Location: T17

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.3 to 2.8m peat	4	3	**12**	3	2	**6**
Peat strength (kPa)	7	4	4	**16**	3	3	**9**
Topography							
Elevation (mOD)	95 to 120	3	3	**9**	3	2	**6**
Slope angle (deg.)	4 to 7	3	3	**9**	3	2	**6**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	2	**6**
Hydrology							
Distance from watercourse	100 to 150m	3	4	**12**	2	3	**6**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.0	4	3	**12**	3	3	**9**
FOS - undrained	1.2						
Total (pre / post control measures)		**103**			**65**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**10**			**7**		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 23
Location: T18

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 1.0 to 2.0m peat	3	4	**12**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	120 to 140	3	3	**9**	3	2	**6**
Slope angle (deg.)	3 to 5	3	3	**9**	3	2	**6**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	2	**6**
Hydrology							
Distance from watercourse	50 to 100m	3	3	**9**	2	3	**6**
Evidence of surface water flow	No	2	2	**4**	2	2	**4**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.9	3	3	**9**	3	3	**9**
FOS - undrained	2.8						
Total (pre / post control measures)		**78**			63		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**8**			6		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 24
Location: T19

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 0.9 to 2.2m peat	3	4	**12**	3	3	**9**
Peat strength (kPa)	10	3	3	**9**	3	3	**9**
Topography							
Elevation (mOD)	125 to 165	4	4	**16**	3	3	**9**
Slope angle (deg.)	5 to 7	4	4	**16**	3	3	**9**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	2	**6**
Hydrology							
Distance from watercourse	100 to 150m	2	3	**6**	2	3	**6**
Evidence of surface water flow	No	2	2	**4**	2	2	**4**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	1.2	3	3	**9**	3	3	**9**
FOS - undrained	1.8						
Total (pre / post control measures)		**89**			69		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**9**			**7**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from turbine construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 25
Location: Grid connection route (near T19)

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 1.3 to 6.1m peat	5	5	**25**	5	4	**20**
Peat strength (kPa)	10	5	4	**20**	5	3	**15**
Topography							
Elevation (mOD)	120 to 180	4	4	**16**	3	3	**9**
Slope angle (deg.)	1 to 2	3	3	**9**	2	2	**4**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	2	**6**
Hydrology							
Distance from watercourse	Crosses watercourse	4	4	**16**	3	3	**9**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	2.1	3	3	**9**	3	3	**9**
FOS - undrained	3.7						
Total (pre / post control measures)		**128**			89		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**13**			9		
Overall hazard ranking		**Medium**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible, including adequate sizing of watercourse diversion routes & culverts.
3	Installation of interceptor drains upslope of works to divert any surface water away from OHL construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.
6	Site-specific temporary works design required at construction stage due to deeper peat, which may include soil or rock berms, sheet piles, or shallow slope angles with daily inspections.
7	Hydrological assessment of stream flows at detailed design stage to inform culvert sizing.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 26
Location: Access from main road

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probe found 0.0 to 1.5m peat	2	3	**6**	2	3	**6**
Peat strength (kPa)	8	3	3	**9**	2	3	**6**
Topography							
Elevation (mOD)	100 to 120	4	4	**16**	3	3	**9**
Slope angle (deg.)	5 to 9	3	3	**9**	2	2	**4**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Moderately high	3	3	**9**	3	2	**6**
Hydrology							
Distance from watercourse	50 to 100m	3	2	**6**	2	2	**4**
Evidence of surface water flow	Yes	4	4	**16**	3	3	**9**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	2.0	2	2	**4**	2	2	**4**
FOS - undrained	1.7						
Total (pre / post control measures)		**83**			**56**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**8**			**6**		
Overall hazard ranking		**Low**			**Low**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from OHL construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

CLOGHERCOR WIND FARM - PEAT STABILITY RISK REGISTER

Assessment area nr: 27
Location: Met mast

Factor	Value	Pre-control measures			Post-control measures		
		Probability	Impact	Risk	Probability	Impact	Risk
Ground conditions							
Peat depth & condition	Probes found 1.0 to 1.6m peat	3	3	**9**	2	3	**6**
Peat strength (kPa)	4	4	4	**16**	2	3	**6**
Topography							
Elevation (mOD)	55 to 65	3	3	**9**	2	2	**4**
Slope angle (deg.)	3 to 5	3	3	**9**	2	2	**4**
Evidence of previous slips	No	2	2	**4**	2	2	**4**
Landslide susceptibility	Low	2	2	**4**	2	2	**4**
Hydrology							
Distance from watercourse	100 to 150m	2	2	**4**	1	1	**1**
Evidence of surface water flow	Yes	3	3	**9**	2	2	**4**
Evidence of subsurface flow	No	2	2	**4**	2	2	**4**
Quantative assessment							
FOS - drained	2.1	2	2	**4**	2	2	**4**
FOS - undrained	1.1						
Total (pre / post control measures)		**72**			**41**		
Max possible		**250**			**250**		
Overall hazard assessment (pre / post control measures)		**7**			**4**		
Overall hazard ranking		**Low**			**Negligible**		

Control Measures	
1	Develop design stage Peat Stability Risk Assessment.
2	Maintain hydrology of area as far as possible.
3	Installation of interceptor drains upslope of works to divert any surface water away from OHL construction area.
4	Use of experienced geotechnical staff for detailed design & temporary works design.
5	Engage experienced contractors and trained operatives to carry out the work.

NIS Appendix 6 – Golden Eagle Habitat Management Plan

Table of Contents

Table of Figures

INTER

A7.9.1 INTRODUCTION

This appendix presents the Golden Eagle habitat management plan that will be implemented as part of the Cloghercor Wind Farm project. The plan was developed to mitigate the potential effective loss of foraging habitat due to displacement impacts from the development if the wind farm.

As part of the preparation of this habitat management plan, consultation requests were made to the National Parks and Wildlife Service, the Irish Raptor Study Group, and the Golden Eagle Trust. These organisations did not provide any specific responses relating to the habitat management plan.

This appendix was prepared by Tom Gittings. It includes a review of habitat management for the Irish Hare, which was prepared by Samantha Ball (Annex A7.9.2)

A7.9.2 OBJECTIVES

The main objective of the Golden Eagle habitat management plan is to increase populations of Red Grouse and Irish Hare, which are important prey resources for the Golden Eagles. Where the habitat management plan lands are in the vicinity of a Golden Eagle nest site, an additional objective will be to prevent disturbance to the nesting eagles.

A7.9.3 SELECTION OF HABITAT MANAGEMENT PLAN LANDS

The selection of the habitat management plan lands was based on the following considerations:

- They had to be within the indicative home range of the Cloghercor Golden Eagle pair (see Figure 7.9 in the Ornithology chapter).
- They had to be outside the 600 m turbine buffer so that they will not be affected by any displacement impacts.
- They had to be predominantly open habitat as Golden Eagles do not feed in closed canopy forestry.
- Areas of degraded habitat will have higher potential to demonstrate that management will significantly improve eagle prey resources. Degraded habitat includes eroded, or overgrazed, moorlands with low heather cover.
- Lands with high topographic suitability for eagles are likely to have higher eagle use and will provide more convincing evidence of the likely effectiveness of the mitigation.
- A few large blocks of habitat management plan lands were preferable to fragmented smaller blocks.

A7.9.4 HABITAT MANAGEMENT PLAN LANDS

The habitat management plan lands are shown in Figure A7.9.1. The habitats and topographic suitability for Golden Eagles of these lands are analysed in Section 7.5.3 of the Ornithology chapter.

A habitat condition survey was carried out in August and September 2022. The lands covered by the habitat condition survey are shown in Figure A7.9.2. Some additional lands were added to the habitat management plan after completion of the survey. From review of aerial imagery, and knowledge of the area from other survey work, these lands are mainly open bog/heath habitat and are, therefore, suitable for inclusion in the habitat management plan, Habitat condition surveys of these remaining lands will be carried out in 2023.

The habitat condition survey was designed to collect the information that will be used to inform the development of management plans for each land parcel included in the habitat management plan. The method statement for the habitat condition survey is included in Annex A7.9.1.

A7.9.5 HABITAT MANAGEMENT PLAN MANAGEMENT MEASURES

The management measures included in the agreements that have been signed for all the land parcels included in the Golden Eagle habitat management plan are listed in Table A7.9.1 and Table A7.9.2.

Detailed management plans will be prepared for each land parcel included in the habitat management plan. These management plans will use the results of the habitat condition surveys to select the appropriate measures from the lists in Table A7.9.1 and Table A7.9.2.

Table A7.9.1. Management of unenclosed lands for Red Grouse.

Item	Measure
i.	Encourage the growth of Ling Heather (Calluna vulgaris), of diverse age structure and encourage the growth of wet flushes with tall grasses, rushes and sedges.
ii.	Creation and maintenance of mosaics of suitable age structures of heather will be managed through rotational cutting, with each patch cut every 8-30 years.
iii.	Controlled strip burning will not be used as a management tool.
iv.	For restoration of degraded habitat management measures will include collection of heather seed and/or litter, preparation of ground seeding, for example by shallow rotavation or adding forestry brashings. Add seed mixture, with companion grasses if required.
v.	Control bracken by cutting/rolling/bruising.
vi.	Where necessary management measures will include predator control, supplementary feeding and control of disturbance.
vii.	Exclusion and reduction of grazing for a 2-5 year period will be employed for restoration of degraded habitat to allow heather to establish.
viii.	Burning for agricultural reasons will not take place.
ix.	For the creation and maintenance of suitable habitat, grazing of appropriate stocking densities will be employed, for example, winter densities of 1.0-1.5 ewes per hectare or 0.1 to 0.15 livestock units (LSUs) per hectare. Control of grazing to maintain wet flushes with tall grasses, rushes and sedges. Management of winter feeding to prevent localised overgrazing.
x.	Where necessary management measures will include predator control, and control of disturbance.
xi.	Predator control is a widely used measure for Red Grouse management, including local Red Grouse projects in Ireland. The focus is typically on foxes and crows. Any predator control carried out as part of a Biodiversity Habitat Plan strategy will comply with all legal requirements.
xii.	Nesting Golden Eagles are very sensitive to disturbance. Therefore, lands should include provisions for restrictions on agricultural activities in the vicinity of occupied, or potentially occupied, eagle nests. The grantor will receive additional payments for the protection of these sites, as set out in clause 8 of this agreement.

Item	Measure
xiii.	Not to carry out or permit any of the following to be carried out: (i) Burning areas of vegetation. (ii) Removal of hedgerows. (iii) Planting of Conifers. (iv) Land Drainage (v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles. (vi) Shooting between 1 March and 31 August each year, excluding predator control. (vii) Turf Cutting
xiv.	Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land for Biodiversity Habitat Management.

Table A7.9.2. Management of enclosed lands for Irish Hare.

Item	Measure
i.	Delay silage and hay cutting until after July 1st. Cut from the inside out, to minimise risk of leveret mortality. Leave a headland or uncut field margin.
ii.	Avoid undertaking rush control during peak breeding or at least between March and July. Cut fields in rotation so there are always some rushy fields. Allow some un-cut rushes in all fields.
iii.	Avoid other field operations such as weed control or fertiliser application during peak breeding times.
iv.	Retain farm woodland, rough margins around new plantings, rushy field corners, scrub patches and bog as all provide food, cover and shelter.
v.	Maintain areas of species-rich grassland as they provide a diverse food source.
vi.	Develop an awareness of hares on the farm, especially noting where they are located in spring. This will indicate where their favourite feeding and shelter areas are. These areas should be protected from disturbance where possible.
vii.	Where nesting golden eagle sites are identified, restriction of agricultural activity will take place in these areas.
viii.	Not to carry out or permit any of the following to be carried out on the Demised Property: (i) Burning areas of vegetation. (ii) Removal of hedgerows. (iii) Planting of Conifers. (iv) Land Drainage. (v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles. (vi) Shooting between 1 March and 31 August each year, excluding predator control.
ix.	Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land as Biodiversity Habitat Management Lands.
x.	Where necessary management measures will include predator control, supplementary feeding and control of disturbance.
xi.	Supplementary feeding may be used to increase the food resources for eagles in winter. This can help with over winter survival and improving the eagle's condition for the breeding season. If the management prescriptions for unenclosed lands results in reductions in sheep densities, supplementary feeding may compensate for reduced availability of sheep carcasses. However, legal restrictions regarding the placement of deer or sheep carcasses on open land will be adhered to.

Item	Measure
xii.	Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land as Biodiversity Habitat Management Lands.

A7.9.6 RATIONALE FOR THE MANAGEMENT MEASURES

This section provides details of the reasons for the management measures included in the habitat management plan. Further details about management measures for Irish Hares are included in Annex A7.9.2.

Management of unenclosed lands for Red Grouse

Most unenclosed land in this area is bog or heath habitat. The primary objective for these lands will be to improve the habitat for Red Grouse.

Red Grouse have a strong association with Ling Heather (*Calluna vulgaris*), and the adults feed almost exclusively on this plant. They require areas with high cover of heather: in studies in western Ireland, areas with less than 16-20% cover were rarely used (Lance, 1976, quoted by Finnerty *et al.*, 2007; Murray and O'Halloran, 2003). They also require a diverse age structure, using younger stands for feeding and older stands for shelter and nesting. Wet flushes with tall grasses, rushes and sedges provide important food resources for the chicks, which supplement their diet with invertebrates in the first two-three weeks after hatching (Watson and Moss, 2008).

Traditional grouse moor management in Britain uses controlled strip burning to produce a mix of four age-classes of Heather: pioneer, building, mature and degenerate (Hudson and Newborn, 1995). An alternative to burning is cutting. Grazing by sheep is usually carried out in conjunction with burning or cutting.

The use of controlled strip burning for management of grouse moors in Britain has become controversial in recent years. Burning peatlands can affect the carbon dynamics of the habitat and, potentially, cause net emissions of carbon. However, the research evidence is mixed and controlled burning may not have much effect on carbon budgets (Harper *et al.*, 2018). Burning peatlands may also cause changes in water quality and aquatic fauna in the catchments draining from the peatlands, as well as increased risk of extreme floods (Brown *et al.*, 2015).

The Red Grouse Species Action Plan (NRGSC, 2013), recommends controlled burning as one of the main tools for managing habitats for Red Grouse. The plan was produced by a steering group that included the National Parks and Wildlife Service. However, it predates a lot of the recent research that has highlighted the potential negative impacts of burning peatlands. I am not aware of any more recent documentation available that provides information on the current NPWS position on using controlled burning to manage habitats for Red Grouse.

Given the potential risks of controlled burning, it has not been included as a potential management option for the Golden Eagle habitat management plan lands. Furthermore, burning for agricultural reasons (to promote grass growth for grazing) will have to be excluded from any of the mitigation lands, as it will prevent development of heather cover.

The management measures that will be implemented on the unenclosed Golden Eagle mitigation lands will depend on the amount and condition of the heather. On overgrazed and/or eroded peatlands, it will be necessary to reduce stocking levels, and carry out other management interventions, to increase heather cover. On peatlands with good existing heather cover, the management requirements will be to implement suitable cutting and/or grazing regimes to provide a suitable mix of heather age-classes.

Cutting has traditionally been regarded as less effective than burning, but has been recommended for wetter areas, areas where the peat depth is greater than 0.5 m, and areas adjacent to forestry (NRGSC, 2013). A lot of the habitat management plan lands falls in to one or more of the above categories. Cutting is used as a management strategy by several gun clubs in Ireland (NRGSC, 2013). A variety of equipment can be used for cutting, including: specifically designed heather flails; self-powered flails which can be towed behind an ATV; and strimmers (NRGSC, 2013).

Optimal stocking density for heather moorland is 1.0-1.5 ewes/ha during winter (Hudson and Newborn, 1995). However, this may need to be reduced for various reasons. On wet peatlands, lower stocking rates will be required (e.g., 1 ewe every 2-4 ha). Winter feeding of sheep can cause localised overgrazing and requires careful management. On severely overgrazed peatlands, winter grazing may need to be removed for 2-5 years to allow heather recovery.

In areas of severely degraded habitat, heather litter and/or seedlings may be introduced to establish heather cover.

The potential management measures for managing the unenclosed mitigation lands for Red Grouse are summarised in Table 2. The measures with the objective of restoration of degraded habitat will only be required where the appropriate degraded habitat conditions occur.

Table A7.9.3. Management measures for Red Grouse in unenclosed lands.

Type	Objective	Management prescriptions
Burning	Creation / maintenance of suitable habitat	Controlled strip burning will not be used as a management tool. Burning for agricultural reasons will not take place.
Cutting	Creation / maintenance of mosaics of suitable age structures	Rotational cutting, with each patch cut every 8-30 years.
Grazing	Restoration of degraded habitat	Exclusion / reduction of grazing for 2-5 years.
Grazing	Creation / maintenance of suitable habitat	Grazing at appropriate stocking densities: e.g., winter densities of 1.0-1.5 ewes/ha, or 1 ewe every 2-4 ha in wet peatlands. Control of grazing to maintain wet flushes with tall grasses, rushes, and sedges. Management of winter feeding to prevent localized overgrazing.
Seeding	Restoration of degraded habitat	Collect heather seed and/or litter. Prepare ground for seeding: e.g., by shallow rotovation, etc., or adding forestry brashings. Add seed mixture, with companion grasses if required. Excluded grazing animals for at least five years to allow heather to establish.
Bracken control	Restoration of degraded habitat	Control bracken by cutting / rolling / bruising.

Sources: based mainly on Hudson and Newborn (1995) and NRGSC (2013).

Management of enclosed lands for Irish Hare

The enclosed lands mainly comprise areas of grassland, which are more intensively managed than the unenclosed lands. However, the intensity of management in these grasslands varies along a gradient from unimproved semi-natural grasslands to improved agricultural grasslands. These grasslands provide habitat for the Irish Hare.

The Irish Hare exploits a variety of habitats. Productive grasslands, such as silage fields and intensively managed grazing, provide food resources, but they also require more marginal habitats for breeding and resting.

There does not appear to be much specific literature about managing land for the Irish Hare. However, the Northern Ireland Environment Agency has produced a leaflet for farmers (Reid, 2009). The summary management prescriptions from that leaflet are shown in Table 2. These prescriptions mainly involve timing farm operations avoid the hare breeding season and maintaining suitable marginal habitats.

The availability of suitable marginal habitats is likely to be important in lowland agricultural landscapes. However, in the area around the Cloghercor Wind Farm site, this is probably a less significant factor as the enclosed lands are generally small islands surrounded by large areas of bog and heath.

Table A7.9.4. Management measures for Irish Hare in enclosed lands.

Target	Management prescriptions
Silage / hay cutting	Delay cutting until after July 1st. Cut from the inside out, to minimise risk of leveret mortality. Leave a headland or uncut field margin
Rush control	Avoid undertaking rush control during peak breeding or at least between March and July. Cut fields in rotation so there are always some rushy fields, and always leave some rushes un-cut in any field.
Other field operations	Avoid other field operations during peak breeding, such as weed control or fertiliser application.
Marginal habitats	Retain farm woodland, rough margins around new plantings, rushy field corners, scrub patches and bog as all provide food, cover and shelter.
Species-rich grassland	Maintain areas of species-rich grassland as they provide a diverse food source.
Disturbance	Develop an awareness of hares on the farm, especially noting where they are in spring. This way you will learn where their favourite feeding and shelter areas are, and protect these from disturbance where possible.

Source: Reid (2009).

Other management

Other management measures that are included in the habitat management plan are predator control; supplementary feeding; and control of disturbance.

Predator control is a widely used measure for Red Grouse management, including local Red Grouse projects in Ireland (NRGSC, 2013). The focus is typically on foxes and crows. In Britain, illegal persecution of raptors (including Golden Eagles) can be associated with grouse moor management. Clearly any predator control carried out as part of this Golden Eagle habitat management plan will comply with all legal requirements.

Supplementary feeding could be used to increase the food resources for eagles in winter. This would help with over winter survival and getting the eagles into condition for the breeding season. If the management prescriptions for unenclosed lands results in reductions in sheep densities, supplementary feeding may compensate for reduced availability of sheep carcasses. However, there are legal restrictions to the placement of deer or sheep carcasses on open land.

Nesting Golden Eagles are very sensitive to disturbance. Therefore, in the habitat management plan lands, there will be restrictions on agricultural activities in the vicinity of occupied, or potentially occupied, eagle nests.

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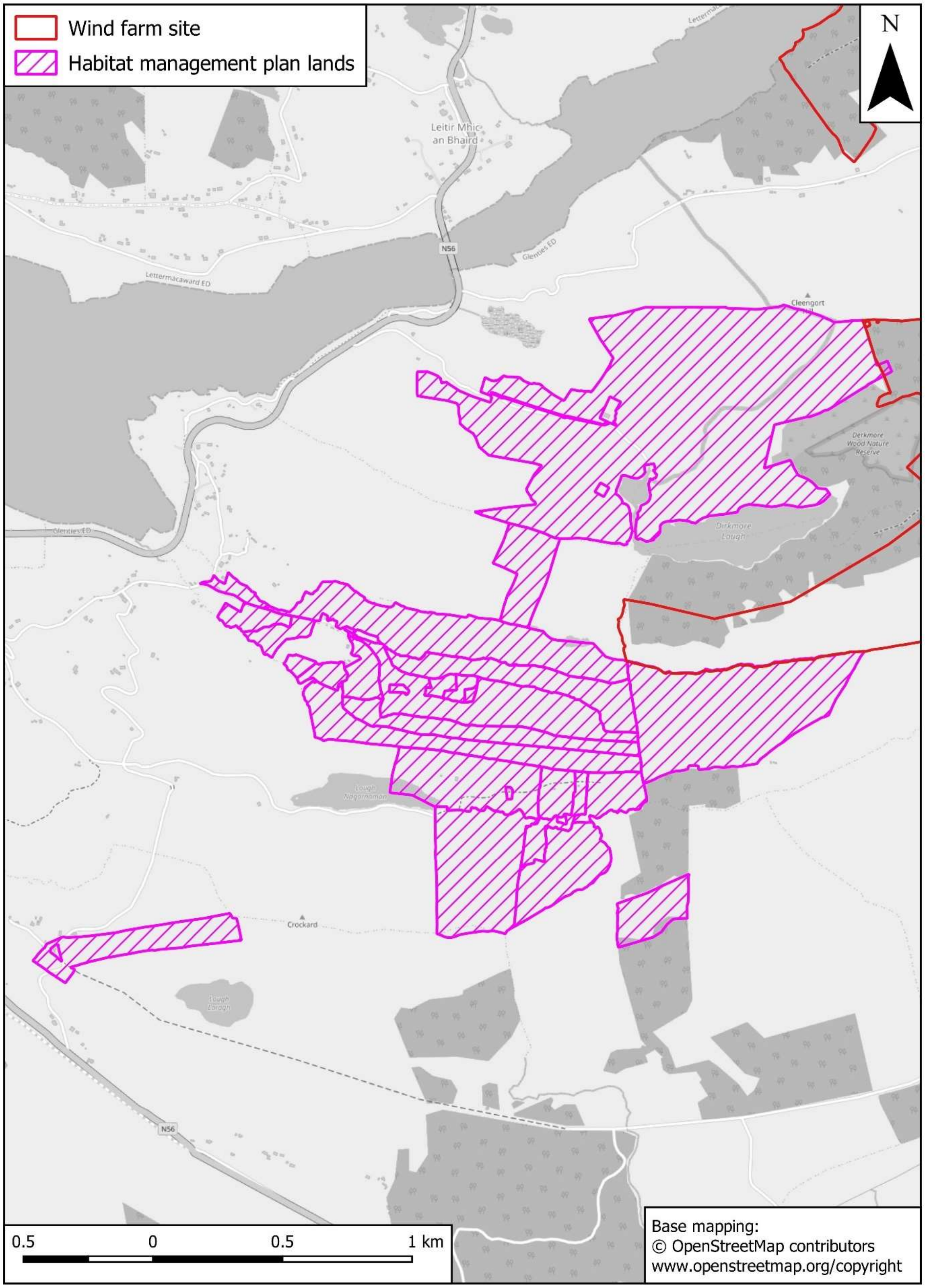

Figure A7.9.1 - Golden Eagle habitat management plan lands.

INTER

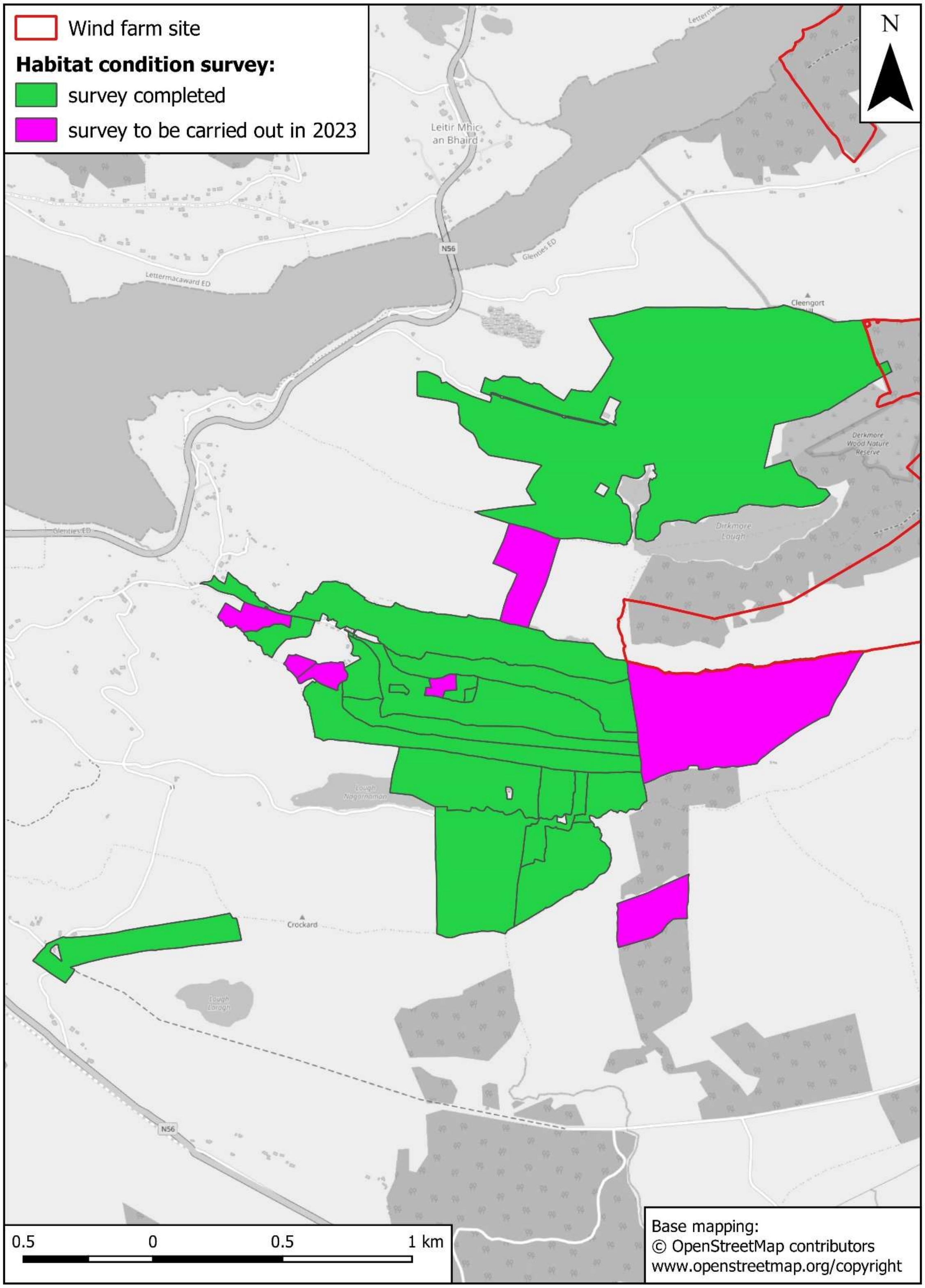

Figure A7.9.2 - Status of habitat condition surveys.

INTER

ANNEX A7.9.1 – METHOD STATEMENT FOR HABITAT CONDITION SURVEYS OF THE GOLDEN EAGLE HABITAT MANAGEMENT PLAN LANDS

Introduction

(1) This document contains a method statement for the assessment of lands that are being considered for inclusion in the Golden Eagle mitigation plan for the Cloghercor Wind Farm.

(2) The main objectives of the management of the Golden Eagle mitigation lands will be to increase populations of Red Grouse and Irish Hare, which are important prey resources for the eagles. Where the mitigation lands are in the vicinity of a Golden Eagle nest site, an additional objective will be to prevent disturbance to the nesting eagles.

(3) The assessment of the mitigation lands will focus on the unenclosed bog and heath habitats, and on assessing their condition for Red Grouse. There is little information available on the habitat requirements of Irish Hares in upland habitats, although enhancing heather cover for grouse is also likely to benefit the hares.

Assessment methods

(4) The assessment will be carried out on management units. Each management unit is a defined area of a landholding that is subject to uniform management: e.g., an area enclosed by fences. Management units will not include sections of land under different ownership.

(5) Where a management unit contains distinct habitats (e.g., an area of heather moorland and an area of *Molinia* grassland), separate assessments will be carried out of each habitat.

(6) Therefore, the survey units will comprise management units, or habitat subdivisions of the management units.

(7) The boundaries of each survey unit will be mapped on the survey map.

(8) The surveyor will carry out a zig-zag walk across the survey unit to get an overall picture of the habitat condition. The surveyor will then classify the habitat to Fossitt Level 3, estimate the approximate percentage cover of heather across the survey unit, and record other relevant parameters (see survey forms).

(9) The surveyor will then pick representative points within the survey unit for detailed recording. The number of points selected will be based on the level of habitat variation within the survey unit, and the size of the survey unit: e.g., if there are areas of heavily grazed heather and areas of ungrazed heather, points will be selected to represent both types of cover.

(10) The number of survey points per survey unit is not defined in this method statement, as it will depend on survey logistics. However, the required survey effort will be kept under constant review, based on feedback from the surveyor.

(11) Each survey point will be mapped on the survey map, and its GPS position will be recorded.

(12) At each survey point, the surveyor will record the percentage heather cover within a 5 m radius and classify its growth form and height based on the categories used in the National Red Grouse Survey (see survey form).

Survey forms

(13) There are four survey forms: the habitat recording form, the grazing recording form; the threats and pressures recording form; and the survey points recording form.

(14) On each recording form, the landowner and the survey unit will be recorded for each entry. The survey unit will correspond to the code used to define the survey unit on the survey map. On the survey points recording form, the survey point will correspond to the

code used to define the survey point on the survey map, and to record the GPS position of the survey point.

(15) On the habitat recording form the main habitat, and any significant secondary habitats, will be recorded using Fossitt Level 3 codes. The approximate percentage heather cover and the presence of any wet flushes will also be recorded. Additional information will be recorded in the Notes section (e.g., the condition of any wet flushes). On this form, only one entry will be made per survey unit.

(16) On the grazing recording form, the current presence of any grazing animals, or evidence of past use will be recorded. If grazing animals are currently present, their approximate numbers will be recorded. If no grazing animals are currently present, but there is evidence of past use, the type of evidence will be recorded. Additional information will be recorded in the Notes section (e.g., evidence of overgrazing). On this form, multiple entries will be made per survey unit, if there is evidence of more than one grazing animal.

(17) On the threats and pressures recording form, any threats or pressures will be recorded using the relevant NPWS code, and notes will be made about the details of each threat or pressure. On this form, multiple entries will be made per survey unit, if there is evidence of more than one threat or pressure.

(18) On the survey points recording form, the percentage heather cover and its growth form and height will be recorded for each survey point. The growth form will be recorded using four categories: Pyramidal; Drumstick; Topiary; Carpet. The heather height will be recorded using three categories: Low < 10 cm; Medium = 10-30 cm; Tall > 30 cm. Additional information will be recorded in the Notes section. On this form, only one entry will be made per survey point.

INTER

Cloghercor Wind Farm
Habitat recording form

Surveyor	
Date:	

Landowner	Survey unit	Main habitat (Fossitt Level 3)	Other habitats (Fossitt Level 3)	Percentage heather cover	Presence of wet flushes (yes/no)

Notes:

INTER

Cloghercor Wind Farm

Grazing recording form

Surveyor	
Date:	

Landowner	Survey unit	Grazing animal	Approximate number	Evidence of past use

Notes:

Cloghercor Wind Farm

Threats and pressures recording form

Surveyor	
Date:	

Landowner	Survey unit	Threat (NPWS code)	Details

Cloghercor Wind Farm
Survey points recording form

Surveyor	
Date:	

Landowner	Survey unit	Survey point	Heather cover (%)	Growth form (P / D / T / C)	Heather height (L / M / H)

Notes:

Growth form: P = Pyramidal; D = Drumstick; T = Topiary; C = Carpet

Heather height: L = Low (< 10 cm); M = Medium (10-30 cm); T = Tall (> 30 cm)

INTER

ANNEX A7.9.2 – HABITAT MANAGEMENT RECOMMENDATIONS FOR INCREASING IRISH HARE NUMBERS AT CLOGHERCOR WIND FARM MITIGATION LANDS (PREPARED BY SAMANTHA BALL, AUGUST 2022)

Introduction

The Irish hare (*Lepus timidus hibernicus*) is an endemic sub-species of Mountain hare found throughout Ireland. Mean Irish hare density is estimated at ~3.19 hares hares/km^2 nationally, with density fluctuating across time and space, depending on available habitat type and inter-annual changes in management and climatic conditions. The Irish hare occupies a range of habitat types, including those typically associated with Mountain hares, such as upland heath and bogs. However, unlike other Mountain hares, the Irish hare is also found occupying agricultural pastoral and arable landscapes and other lowland habitats. Indeed, higher densities of Irish hare are associated with pastoral grassland habitats (9.18 hares/km^2) rather than heath/bog/moor habitats (2.89 hares/km^2; Reid *et al.*, 2007), as although Irish hare can survive on the harsh vegetation typical of upland bogs and heaths (Walker and Fairley, 1968), they have a preference for softer grass species. Therefore, the Irish hare has a similar ecological niche to the Brown hare (*Lepus europaeus*) - a species closely associated with farmland in the UK and Europe in lowland habitats- as well as other Mountain hare subspecies. This means that hares are likely to occupy both the enclosed (grasslands) and unenclosed (heath/bog) mitigation lands if managed preferably for hares.

In Donegal, the Irish hare is an important prey-species of the Golden Eagle (*Aquila chrysaetos*), making up a large proportion of the diet (NPWS, 2009; O'Toole *et al.*, 2002) and is likely crucial for Golden Eagle survival. The Cloghercor Wind Farm site is proposed for an area with high Golden Eagle activity and therefore it is proposed that mitigation lands be managed to compensate for Golden Eagle displacement. Here, we discuss possible land management practices for both enclosed and unenclosed mitigation land types to favour Irish hare, to provide sufficient prey for potentially displaced Golden Eagle.

Objectives

The main objectives of this document are to:

(20) Identify habitat management measures to improve current habitat as favourable for the Irish hare at mitigation lands for Cloghercor wind farm.
(21) Determine methods for assessing the current condition of the habitats surrounding Cloghercor wind farm for Irish hare.

Legal Status

The Irish hare is offered legal protection under: EU Habitats Directive [92/43/EEC] Annex V | Wildlife Act, 1976 | Wildlife (Amendment) Act, 2000 | Appendix III of the Berne Convention.

Management of hares in enclosed habitats

<u>Food source</u>

- Grasses make up the main dietary component of the Irish hare, with the species showing a strong preference for grass species in both lowland and upland areas. In upland areas (250 m+ above sea level), approximately 32% of the diet consists of grasses such as *Agrostis* spp. and *Festuca* spp. Monocotyledonous flowering plants (e.g., sedges) consist of ~20% of the diet and dicotyledonous flowering plants make up 24% of diet, mainly consisting of heather (*Calluna vulgaris*; 16%; Dingerkus and Montgomery, 2001).

- Irish hare feed on a broad variety of species (e.g., Tangney, Fairley and O'Donnell, 1995; Wolfe *et al.*, 1996; Strevens and Rochford, 2004) with twenty-six species reported in the dietary analysis from a single site (Dingerkus and Montgomery, 2001). As there is likely a gradient from unimproved semi-natural grasslands to improved agricultural grasslands in mitigation lands, habitat improvement measures should promote habitat appropriate species to increase biodiversity.

Habitat heterogeneity

- Habitat heterogeneity (diversity) is important to the Irish hare, as hares move between feeding and resting sites between day and night. Particularly, *Juncus* (rushes) dominated grasslands play an important role for the Irish hare, which is actively selected for diurnal rest sites with semi-natural grasslands and improved grasslands, selected for nocturnal feeding grounds (Dingerkus and Montgomery, 2001; Reid *et al.*, 2007). Hare density is positively associated with heterogeneous habitats (Reid *et al.*, 2010a).

- The presence of hedgerows in grassland environments are also important for the Irish hare to provide shelter from climatic conditions and predators and to provide diurnal resting sites (Dingerkus and Montgomery, 2002), as does the presence of *Juncus* (rushes) and similar vegetation. The presence of diverse hedgerows and *Juncus* should be incorporated into enclosed mitigation lands to provide hares with adequate shelter. Any removal of *Juncus*, or similar vegetation, should take place outside of the peak breeding season (April-June) and should be done on rotation, preferably with small areas remaining within each island.

- Hares select for within-field heterogeneity (Smith *et al.*, 2004). As grassland habitats present at mitigation lands are likely to be 'islands' surrounded by bog and heath, it will be important that grazing densities are low to facilitate a variety of vegetation lengths and to encourage biodiversity within individual islands.

- The development and maintenance of habitat heterogeneity on enclosed lands is likely to be the most important factor in increasing hare numbers at the mitigation lands for Cloghercor wind farm. Heterogenous habitat types, providing grazing (e.g., improved, semi-natural grasslands) and shelter (e.g., hedgerows, Juncus, heather) need to be well-connected and occur within individual hares home ranges ~21 ha in size on upland agriculture (Jeffery, 1996; Reid, 2006).

Improved grassland management

- Studies have demonstrated the importance of Perennial ryegrass (*Lolium perenne;* Strevens and Rochford, 2004) in the diet of the Irish hare, demonstrating the potential for hares to use all grassland types in the enclosed mitigation lands and the potential of moving between grassland 'island' types.

- Habitat heterogeneity or 'patchiness' may encourage uniform coverage of hares across all habitat types available (Reid *et al.*, 2010b). However, improved agricultural grasslands need to be managed in a way to reduce the mortality of leverets in the summer, and to promote recruitment into the population, as evidence suggests that hares will utilise agricultural grasslands for nocturnal foraging and diurnal resting in the summer months if adequate shelter is available (Reid *et al.*, 2010b). Therefore, it is likely that leverets are present in agricultural grasslands in the summer months. These improved grassland areas should therefore be managed accordingly with low grazing densities to ensure variable grass lengths and the reduction of silage production (Smith *et al.*, 2004). If grasses do need to be cut, this should be delayed until late summer and cut from the inside out (Reid, 2009).

- Agricultural intensification is believed to negatively impact on Irish hare densities (Dingerkus and Montgomery, 2002) and therefore, intensification of these improved grassland areas should be avoided.
- Irish hare numbers are higher on hare preserves managed by coursing clubs and where active fox management is undertaken (Reid *et al.*, 2010a), the majority of which are improved grassland systems. Therefore, predator control can be considered if recorded in high numbers during periods when high numbers of leverets are expected (April-June; Reid, 2009) and during the winter months when hares make up a higher proportion of the foxes diet (Wolfe and Long, 1997). Additional predatory species of the Irish hare can be seen below.

Table A7.9.1. Brief summary of management recommendations for enclosed mitigation lands.

Target	Management prescriptions
Promote biodiversity (1.1)	Maintain biodiverse semi-natural grassland areas to provide a variety of food plants for the Irish hare, consisting of a variety of grasses, flowering plants and sedges.
Improve current habitats to ensure the existence of suitable heterogeneous habitat (1.2)	Low grazing densities in grasslands to maintain a variety of grass lengths. Preservation of *Juncus* (and similar) vegetation and promotion of hedgerows where appropriate. Promote heterogeneity between grassland islands and within individual islands, ensuring there is shorter grass available for feeding and longer vegetation (>15 cm) for taking shelter within each island. Ensuring connectivity between grassland islands by the presence of vegetation which can act as shelter for hares travelling between islands.
Prevent leveret mortality and increase habitat suitability in improved grassland systems (1.3)	Cutting only after July 1st if necessary, and from the inside out. Appropriate grazing stocking levels to ensure grasslands are not overgrazed. Removal of predatory species if recorded in high numbers.

Management of hares in unenclosed habitats

General notes

- The Irish mountain hare is more closely associated with grassland habitats than with heath or bog habitat types. However, hares will utilise these areas and regularly feed on heather when it is available (Dingerkus and Montgomery, 2001). Irish hares are a highly adaptable species and as enclosed grasslands are surrounded by heath and bog habitats, hares are likely to utilise these areas also.
- There is little available data or literature on Irish hare use of these habitat types and therefore we look to management examples for the Scottish subspecies of Mountain Hare (*Lepus timidus scoticus*), which is also a major component of the diet for golden eagle

(Whitfield *et al.*, 2013) in Scotland, and to the isolated hare population inhabiting the peak district in England.

- In Scotland, Mountain hare distribution is closely associated with heather dominated habitats managed for grouse (Patton *et al.*, 2010), particularly with driven grouse moors (Hesford *et al.*, 2019).
- It is important to note that the Irish hare is genetically (Hughes *et al.*, 2009) and morphologically (Reid, 2018) distinct from the Scottish sub-species and they occupy slightly different ecological niches, due to the Irish hares preference for grassland habitats (Reid, 2018). Therefore, here we discuss management measures implemented in the UK which are likely to benefit the Irish hare in Donegal.

Predator control

- One of the main components attributed to the association of high Mountain hare numbers in Scotland on driven grouse moors is due to extensive predator control (Hesford *et al.*, 2019), for species such as foxes and stoats. Official records for both predatory taxa (Fox and Irish stoat) in proximity to Cloghercor are sparse, particularly for the Irish stoat (*Mustela erminea hibernica*; BDC, 2022).
- While hare numbers are higher on driven moors in Scotland, populations fluctuate more than on moor systems where alternative grouse management is carried out (Hesford *et al.*, 2019). This is potentially due to density dependant processes such as parasitism and food competition (Newey *et al.*, 2007; Newey and Thirgood, 2004). As parasite species which influence population fluctuations have also been recorded in the Irish hare (e.g., *Trichostrongulus retortaeformis*; Ball *et al.*, 2020), severe predator control should be carefully considered before implementation. However, this is unlikely to become an issue if Golden Eagle are feeding from these areas.
- Corvid species are additional predators of the Irish hare and will often take unattended leverets (personal observation). The Common Buzzard (*Buteo buteo*) will also take hares if available (Rooney and Montgomery, 2013)[1], as will domestic dogs.

Heather age classes

- Strip burning is carried out in the UK to create the various age classes of heather required for grouse but was not recommended in the briefing note for the mitigation lands at Cloghercor due to environmental concerns with the suggestion of implementing grazing and cutting regimes in its place. This is likely to benefit the hare population, as early stage heather (pioneer) is favoured by Mountain hares (Hewson, 1989) as a food source and as burning regimes are associated with a lower plant biodiversity and less cover for hares (Bedson *et al.*, 2022; Bonn *et al.*, 2009). However, the presence of grazing sheep is negatively associated with the presence of Mountain hares as both taxa select for the same vegetation type (Hewson, 1989), therefore, grazing sheep numbers should be kept low and grazing should occur seasonally.
- In Scotland, Mountain hare home range sizes are estimated to be between 10-100 ha (Hewson and Hinge, 1990; Rao *et al.*, 2003). In upland agricultural habitats in Ireland, Irish hare home range sizes are estimated to be small (~21 ha; Jeffery, 1996; Reid, 2006) with little known about their home range within heather dominated areas, although it is generally

[1] Buzzards are a protected species and will not be included in any predator control measures.

thought to be larger to allow for travel between suitable resting and feeding areas. Therefore, heather cutting/ management to create a cohort of age classes should be carried out over a relatively small scale.

- The creation of a variety of heather age classes is likely to also facilitate hare movement between enclosed grassland feeding sites, as dense heather allows for hares to hide, but less dense vegetation is required to facilitate movement (Bedson *et al.*, 2022; Hewson, 1989).

Table A7.9.2. Brief summary of management recommendations for unenclosed mitigation lands.

Target	Management prescriptions
Consider the requirements for predator control	Monitor the presence of predators, such as foxes and corvids. Predators can be removed if in high numbers, particularly during April-June when there are a high number of leverets.
Create suitable habitat for Irish hare through the management of a cohort of heather age classes	Not to implement strip burning, but to use cutting and grazing regimes, with low stocking density, in its place. Create areas of pioneer heather, suitable for hare grazing, scattered throughout mitigation lands over a relatively small scale.

Other Management

Timing of habitat modifications

- Irish hare have a prolonged breeding season with leverets produced year-round in ideal conditions. However, Leveret numbers are likely to be at their highest between April-June (Reid, 2009). While there is no known specific literature regarding Irish hare reproduction in upland habitats, it is unlikely that peak season of reproductive output varies greatly from lowland habitats. Therefore, any modifications or improvements to habitats should not take place during this time frame to reduce leveret mortality and disturbance.

Reduction of recreational disturbance

- Recreational users of the area (if any) should be encouraged to only use existing paths/ roads so as not to flush/ stress hares.
- Domestic dogs can take leverets and flush adult hares. Awareness programs and signage forbidding the presence of unleashed dogs should be installed if dogs are liable to be present on mitigation land sites.

Disease vigilance

- Rabbit haemorrhagic disease virus 2 (RHDV2) is a pathogenic lagovirus (virus of rabbits/hares) confirmed to have been present in wild Irish hares in the summer of 2019 (Byrne *et al.*, 2022). Although only a small number of cases have been confirmed, the virus has an estimated mortality rate of ~90% and is thought to be transmissible between hares. As this virus could rapidly decimate the population, managers should be vigilant of any hares displaying atypical neurological behaviour, such as running in circles (Kennedy *et al.*, 2021) and should report any suspected cases to the National Parks and Wildlife Service (NPWS).

Hunting restrictions

- There is an open season for the Irish hare (September- February). A prohibition of hunting (e.g., shooting) should be in place on mitigation lands to prevent anthropogenic removal of hares, as is advocated as an effective management practice on Irish Coursing Club affiliated land preserves (Reid *et al.*, 2010a).

General

- As mentioned in the briefing note, conversion of forestry plantation to bog/ heath habitat would be an effective mitigation measure, as not only is conifer plantation of low ecological value to Irish hare, but habitat restoration on bogland has been positively associated with increased hare density in the UK (Bedson *et al.*, 2022).
- Supplementary feeding has been shown to increase individual level fitness in the Mountain hare in Scotland feeding on heathers, but was shown to have no significant effect at the population level (Newey *et al.*, 2010). As the Irish hare has a preference for grass species, supplementary feeding is unlikely to be necessary at the Cloghercor mitigation lands. If supplementary feeding stations are to be utilised, these could be introduced into heather dominated areas during the winter months.

Table A7.9.3. Brief summary of general management recommendations.

Target	Management prescriptions
Reduce leveret mortality and disturbance	Habitat improvements and modifications should not be carried out between April-June.
Reduce recreational disturbance	Create awareness for recreational users of the area, encouraging owners to leash dogs and to encourage any walkers to stick to existing paths/ roads.
Reduce human removal of hares	Prohibit hare hunting/ shooting/ taking on mitigation lands, including for the open season. This is to prevent any depletion of the population and to reduce stress and disturbance.

Measures for assessing current suitability for hares

- Conduct biodiversity grassland surveys to ensure that grasslands have a diverse variety of species available as hare forage and shelter, including grass species such as *Agrostis* spp., *Festuca* spp. and *Lolium perenne*, in addition to *Juncus* spp., sedges (e.g., *Eriophorum* spp.), and flowering plants (e.g., *Calluna vulgaris*), depending on grassland type.
- Collect data on current and expected grazing sheep numbers for enclosed grasslands as hare presence is negatively associated with the presence of sheep.
- Collect data on current land management practices for improved grassland areas and future use (e.g., heavy grazing, hay/silage production) as these areas are likely to have leverets taking refuge during the summer months.

INTER

- Determine the heterogeneity of the mitigation lands by mapping available vegetation and habitat types. Habitats should be well connected, containing suitable vegetation for hare forage and resting.
- Conduct preliminary presence/ absence surveys within enclosed grassland habitats to assess which habitats/ enclosed grasslands hares are currently using, if any. This can be conducted either via spot lamp surveys (see section 5.0) or by deploying motion activated, infrared camera traps.
- Carry out preliminary surveys to estimate the current size of the population (see section 5.0 below). These surveys can be carried out routinely to track the size of the population and to ensure that any improvements made to mitigation lands remain preferable to hares.

Monitoring

- Repeatable population estimates should be routinely conducted (autumn/winter) by a specialist, over multiple years, within enclosed and unenclosed habitat types in order to determine hare habitat preference in the area and to determine if hare populations are being maintained at high enough levels for Golden Eagle conservation. As Irish hare's undergo cyclic population fluctuations (Reynolds *et al.*, 2006), routine monitoring could alert managers as to whether additional management measures need to be implemented (e.g., predator removal) within a particular year.
- Nocturnal (after sunset) line based transect surveys conducted with a 2-million candle power spot lamp in conjunction with Distance sampling (model estimated population size from a sampled sub-population) are routinely used for hare population estimates and are successful in lowland grassland areas (e.g., Caravaggi, Montgomery and Reid, 2015). However, the vegetation types present in upland areas may obstruct such surveys, underestimating the size of the population.
- Thermal imagers for data collection for Distance sampling have successfully been used to estimate Mountain hare population sizes in difficult terrain (blanket bog) in the North of England (Bedson *et al.*, 2021) and could therefore be utilised on both enclosed and unenclosed mitigation lands.

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NIS Appendix 7 – Collision Risk Modelling Report

Table of Contents

Table of Figures

A7.7.1 INTRODUCTION

Scope

This appendix presents the results of collision risk modelling for the proposed Cloghercor Wind Farm, Co. Donegal.

The collision risk modelling was carried out to assess the potential collision risk to bird populations of conservation importance from the development of the wind farm.

The collision risk modelling used data from vantage point surveys to generate collision risk predictions for the waterbird and raptor species recorded flying at potential collision height during the surveys. Where relevant, species were divided into separate populations (e.g., breeding and non-breeding populations), and separate collision risks were generated for each population.

The collision risk modelling include all eight turbine types that are being considered for this wind farm. The minimum and maximum values from this range of turbine types, for the bird transit, collision probability and collision risk predictions are shown in the main sections of this appendix. All the values are shown in Annex 7.7.2.

The significance of the collision risk was assessed for the bird populations of conservation importance where at least one collision was predicted to occur during the 35 year lifespan of the wind farm.

A worst-case scenario collision risk model is also included for the breeding Golden Plover population.

The interpretation of the results of collision risk modelling is discussed in the main chapter (Chapter 7 Ornithology).

All the modelling and assessment was carried out by Tom Gittings.

Collision risk modelling

Collision risk modelling uses statistical modelling techniques to predict the likely collision risk. It uses flight activity data from before the construction of a wind farm to calculate the likely risk of birds colliding with turbines in the operational wind farm. There are three stages to the collision risk model.

In Stage 1, the flight activity data that was recorded is scaled up to represent the overall level of flight activity in the wind farm site across the relevant period (e.g., a full year for a resident species, or a summer or winter for a migrant species). The number of predicted transits of the rotor swept volume in the wind farm is then calculated based on the proportion of the total air space that is occupied by the rotor swept volume.

Most transits of the rotor swept volume will not result in a collision, because for the duration of a transit, most of the rotor swept volume is not occupied by the turbine blades. Therefore, Stage

2 of the collision risk model involves calculating the probability that a bird will collide with a turbine blade when it transits the rotor swept volume.

Most birds try to avoid the turbine blades, either by avoiding the wind farm area altogether, or by taking evasive action if they are likely to collide with a blade while transiting the wind farm, so it is also necessary to factor in an avoidance rate. This is done in the final stage, where the predicted number of transits are converted to predicted number of collisions by multiplying by the collision probability (assuming no avoidance behaviour) and then correcting for the avoidance rate. This stage can also include corrections for other factors, such as nocturnal flight activity, and the proportion of time the turbines are operational.

A7.7.2 DATA SOURCES

The flight activity data used for the collision risk modelling comes from the vantage point surveys carried out for the Cloghercor Wind Farm project. The scope and methods of these vantage point surveys are described in Appendix 7.1, the full results are included in Appendix 7.2, and the flightline maps are shown in Appendix 7.3.

The viewshed mapping used for the collision risk modelling was derived from a Digital Surface Model supplied by Bluesky, based on imagery acquired on 20/09/2019 and 13/04/2020. The viewshed maps are included in Appendix 7.1.

Vector mapping of the proposed turbine locations, and technical specifications for the turbine models, were provided by Ørsted.

A7.7.3 METHODOLOGY

General approach

The collision risk modelling methodology was based on the SNH guidance on collision risk modelling (SNH, 2000), and current practice in collision risk modelling. It also incorporated development of more detailed structured models for Golden Eagle.

Data management

Before beginning the analyses, the flight activity data was audited for data entry errors and missing data.

Review of the vantage point survey coverage and results

Before beginning the development of the collision risk model, a review was carried out of the vantage point survey coverage and results. This helped to assess the degree of spatial and temporal variability in the recorded flight activity, which needed to be taken into account in the development of the collision risk model. Note that, spatial and temporal variability can only be assessed for the regularly occurring species. With species that were only recorded occasionally, it is not possible to distinguish between sampling effects and true spatial and temporal variability.

Collision risk modelling methodology

The collision risk modelling methodology is described in Sections A7.7.4-A7.7.6 as part of a step-by-step account of the development of the collision risk model.

A7.7.4 COLLISION RISK MODEL STAGE 1: BIRD TRANSITS

General approach

The Stage 1 calculations use the vantage point survey data to calculate the predicted number of bird transits across the rotor swept volume. There are two methods described by SNH (2000) for carrying out stage 1 calculations: the "risk window" approach for when birds make regular flights through the flight risk area (e.g., geese commuting between roost sites and feeding areas); and the "bird occupancy" approach for when birds show variable patterns of flight activity within the flight risk area. I have used the "bird occupancy" approach, as this is generally the appropriate method for species that show variable patterns of flight activity, and the vantage point survey data and flightline mapping do not indicate regular flightlines through the wind farm site.

The sequential calculations that derive the predicted number of bird transits across the swept volume are shown in Table A7.7.1.

Table A7.7.1. Calculations of predicted number of bird transects across the rotor swept volume.

Step	Parameter	Calculation	Formula	Units	Details
1	t_1	bird-secs observed at potential collision height / total duration of VP watches	D_{bird}/VP_{eff}	birds	Mean number of birds observed flying at rotor height during the vantage point watches
2	n	t1 * total duration of season	$t_1 \times D_{season} \times 3600$	bird-secs	Predicted total number of birds observed flying at rotor height if the vantage point watches had covered the entire season
3	b	n × (volume swept by rotors / flight risk volume)	$n \times (A_{rotor} \times (L_{rotor}+L_{bird}))/(A_{vis} \times H_{rotor})$	bird-secs	Predicted bird occupancy of the swept volume across the entire season
4	$N_{transits}$	b / time taken for a bird to fly through rotors of one turbine	$b/((L_{rotor}+L_{bird})/v_{bird})$	bird transits	Predicted number of transits across the swept volume across the entire season

Note: The SNH (2000) calculation procedure include additional steps, which calculate flight activity within the "risk area", and then correct for the proportion of the risk area airspace occupied by the rotor swept volume of the turbines. However, these steps cancel out, so the calculation procedure shown in this table produces identical results.

The calculations in Table A7.7.1 simplify as Equation 1, as shown below.

Equation 1: $(D_{bird} \times D_{season} \times N_{turb} \times A_{rotor} \times v_{bird}) / (H_{rotor} \times VP_{eff} \times A_{vis})$

D_{bird} = bird-secs observed at potential collision height, D_{season} = total daylight hours across the season, N_{turb} = number of turbines, A_{rotor} = area of rotor discs, v_{bird} = bird flight speed, H_{rotor} = rotor diameter, VP_{eff} = total duration of vantage point watches, and A_{vis}= total area of viewshed.

Note that the rotor depth (L_{rotor}) and bird length (L_{bird}), which are included in the sequential calculations in Table A7.7.1, cancel out. While bird length is required for the collision probability calculations in Stage 2, the rotor depth parameter (L_{rotor}) is not usually required for collision risk modelling.

Methods

Species included

All the waterbird and raptor species recorded flying at potential collision height during the surveys, apart from Snipe, were included in the collision risk modelling. Snipe was not included because vantage point surveys are not an effective method of sampling their flight activity, so the results from collision risk modelling would not be very meaningful.

Model types

The predicted transits were calculated for all species using two modelling approaches (the combined VP and VP averaging methods). The predicted transits for Golden Eagle and the breeding Common Gull population were calculated using spatially structured versions of the combined VP method.

Detection rates

Declines in detection rates with distance from vantage points is a common issue in vantage point surveys, and the SNH guidance (SNH, 2017) recommends considering corrections for detectability effects. Therefore, analyses were carried out to assess the relationships between distance from the vantage point locations and the flightline detections.

The analyses assume that flight activity is randomly distributed in relation to distance from the vantage point locations. At individual vantage points, habitat associations and / or topography may affect the relationship between distance from the vantage point location and flight activity. Averaging across a number of vantage points is likely to minimise these biases, because the habitat / topographic effects will differ between vantage points. However, very strong habitat / topographic effects affecting a lot of the flight activity at a vantage point, could still bias these analyses.

At two of the vantage points (VPs 6 and 8), large amounts of waterbird flight activity occurred along the Gweebarra Estuary close to the vantage point locations. Inclusion of these flightlines in the analyses would have resulted in overestimation of the decline in detection rates with distance. Therefore, the following species were excluded from the analyses at these vantage points: Shelduck, Mallard, Cormorant, Grey Heron, Ringed Plover, Curlew, Black-headed Gull, Common Gull, Lesser Black-backed Gull, Herring Gull, Great Black-backed Gull and Common Tern. At VP6, after these species had been excluded, the number of remaining flightlines was too small for meaningful analysis, Therefore, VP6 was excluded from the analysis.

At VP10, a lot of gull flight activity occurred in, and beyond, the outer part of the viewshed. This was due to a commuting route to / from the mink farm located along the Stracashel River, around 4 km east of Glenties. Inclusion of these flightlines in the analyses would result in underestimation of the decline in detection rates with distance. Therefore, all the gull flightlines at VP10 were excluded from the analysis.

As detectability will be strongly affected by body size, the species recorded in the vantage point surveys were divided into three size groups, based on their cross-sectional indices (the body length multiplied by the wingspan). The small species included Mallard, Sparrowhawk, Common Sandpiper, Snipe, Common Gull, Kestrel, Merlin and Peregrine, with body lengths of 0.20-0.58 m and wingspans of 0.40-1.20 m. The medium species included Greylag Goose, Barnacle Goose, Buzzard, Osprey, Lesser Black-backed Gull, Herring Gull and Great Black-backed Gull, with body lengths of 0.54-0.90 m and wingspans of 1.20-1.64 m. The large group included Whooper Swan, Grey Heron, White-tailed Eagle and Golden Eagle, with body lengths of 0.80-1.52 m and wingspans of 1.85-2.30 m.

Each viewshed was divided into eight bands, representing increasing distance from the vantage point, from 0-250 m to 1750-200 m. The total length of flightlines for each species group in each band was then calculated. Flightlines that only occurred in the 0-25 m height band were excluded, because the viewsheds had been derived using a minimum height of 25 m.

The flightline density for each distance band in each viewshed was then calculated using Equation 2. This equation standardises the flightline density in each distance band by the total amount of flight activity recorded a that vantage point, to avoid the analyses being biased by vantage points where large amounts of flight activity were recorded.

Equation 2: $FD_{i^*} = : (FD_i / FD_{VP}) \times FD_{mean}$

FD_{i^*} = weighted flightline density in band i; FD_i = raw flightline density in band i; FD_{VP} = summed flightline densities across all bands in the viewshed containing grid square i; FD_{mean} = mean of FD_{VP} = across all the vantage points included in the analysis.

The mean flightline density across all the vantage points showed strong declines with distances for all three species groups (Figure A7.7.1). For the large species group, the flightline density was more or less constant in the first three distance bands, with a decline across the next three distance bands. In the small and medium species groups, there were large confidence intervals for the first three distance bands, but there was again a clear decline in flightline density at distances greater than 750 m, with very low detection rates in the most distant bands. The large confidence intervals in the closest distance bands (particularly the 0-250 m band) reflects the small sizes of these bands.

The detection rate / distance relationships were used to calculate adjusted viewshed areas using the formula shown in Equation 3.

Equation 3: $A_{vis^*} = sum_{i=1-10}(A_{vis(i)} \times weight_i)$

A_{vis^*}= adjusted viewshed area; i = distance band number from 0-250 m (distance band 1) to 1750-2000 m (distance band 8); $weight_i$ = mean detection rate in distance band i relative to the 250-500 m distance band.

The adjusted viewshed areas, compared to the original viewshed areas are shown in Table A7.7.2. This table also shows correction factors that represent the increase in collision risk generated by these adjusted viewshed areas. These correction factors differ between the vantage points as they depend on the distribution of the original viewshed area between the distance bands. Across all the vantage points, the mean correction factors are 3.7 for the small group, 2.8 for the medium group, and 1.7 for the large group. The viewsheds for VPs 6 and 8 had large correction factors (see footnote to A7.7.2). Excluding these viewsheds, the mean correction factors were 3.0, 2.6 and 1.6.

Table A7.7.2. Adjusted viewshed areas compared to the original viewshed areas, and the correction factors representing the increase in collision risk generated by these adjusted viewshed areas.

VP	Original viewshed area (ha)	Adjusted viewshed area (ha)			Correction factors		
		small	medium	large	small	medium	large
1	433	127	157	261	3.4	2.8	1.7
2	498	139	176	295	3.6	2.8	1.7
3	461	152	178	288	3.0	2.6	1.6
4	526	139	182	306	3.8	2.9	1.7
5	393	132	154	250	3.0	2.6	1.6
6	327	51	89	161	6.4	3.7	2.0
7	184	93	91	140	2.0	2.0	1.3
8	320	47	85	155	6.8	3.8	2.1
9	461	152	177	288	3.0	2.6	1.6
10	285	129	134	209	2.2	2.1	1.4

The low adjusted viewshed areas, and high correction factors, for VP6 and VP8, are due to the exclusion of the Gwebarra Estuary buffer from the viewsheds (see below). This meant that the closer distance bands were not included in the viewsheds.

These adjusted viewshed areas were used for the collision risk modelling. They resulted in an increase of around 1.6-3.0 in the predicted collision risks, compared to models that do not account for this factor[1]. This should be taken into account in any comparisons of predicted collision risks from this wind farm, compared to predictions from collision risk models for other wind farm projects, which do not usually account for declines in detections with distance.

Gweebarra Estuary

Two of the vantage points (VP6 and VP8) were located on the north side of the Gweebarra Estuary and their viewsheds included the Gweebarra Estuary. There were several waterbird species that were recorded in the Gweebarra Estuary, but were not recorded anywhere else within, or adjacent to, the wind farm site. There were other species for which much higher levels of activity were recorded in the Gweebarra Estuary, compared to other areas within, or adjacent to, the wind farm site.

Although the wind farm site extends to the southern shore of the estuary, there will be no wind farm infrastructure within 500 m of the estuary, while the nearest turbine location is over 1 km from the estuary. Therefore, the wind farm development is not likely to cause any disturbance or displacement impacts to bird populations in the Gweebarra Estuary.

[1] The exact value of the increase in collision risk will differ between species in each group, depending on the distribution of their flight activity between the vantage points.

Flight activity that was restricted to the estuary was excluded from the collision risk modelling. To do this, a 300 m wide buffer around the estuary shoreline was defined. This buffer distance was chosen as it included all the flightlines of birds following the estuary, but did not include any part of the 500 m buffers around the proposed turbine locations. The buffer was extended on the northern side of the Gweebarra Estuary to include the small areas of the viewsheds that were outside the buffer. Any flightlines that were wholly within this 300 m buffer were excluded from the analyses, unless otherwise stated. The flightlines that were partly within the buffer were clipped, so that only the portion outside the buffer were included in the analyses, unless otherwise stated. The sections of the VP6 and VP8 viewsheds within the buffer were also excluded from the analyses.

The viewsheds used for the collision risk modelling, after removal of the Gweebarra Estuary buffer, are shown in Figure A7.7.2.

Spatial coverage

The vantage point surveys covered the entire wind farm site. However, the proposed wind farm project will only involve development of the eastern section of the site. The eastern and western sections of the site are also topographically discrete and have some differences in their habitats. Therefore, for the analyses of the bird survey data, the wind farm site was divided into eastern and western sections. The boundary between the two sections of the site is shown in Figure 7.1 in the main chapter. This boundary follows the lowest point of the valley that divides the site.

The viewsheds of VPs 2-7 covered parts of the eastern section and did not overlap the western section. The viewsheds of VPs 9-10 covered parts of the western section and did not overlap the eastern section. The viewsheds of VP1 and VP8 covered parts of both the eastern and western sections.

Each of the basic collision risk models were run twice: an all VP analysis using the data from all the vantage points, and a main VP analysis using the data from only the viewsheds of the vantage points overlapping the eastern section of the wind farm site. For the latter models, the viewsheds of VP1 and VP8 were clipped to exclude the area outside the eastern section. The VP1 and VP8 flightlines were then clipped so that only the portions within the eastern section were included in the analyses.

The divisions of the VP1 and VP8 viewsheds are shown in Figure A7.7.2.

Re-calculation of flight durations

The Stage 1 calculations of bird transits uses the viewshed area to derive the density of flight activity recorded during the vantage point surveys. Therefore, flight activity that occurred outside the viewshed of the vantage point being surveyed need to be excluded from the analyses.

For most of the vantage point surveys, durations were only recorded for flightlines within the mapped viewsheds. However, in the first season, and for some surveys in the second and third seasons, flightline durations were recorded for 500 m buffers around the wind farm, rather than for the viewsheds. These flightline durations needed to be adjusted to reflect the portion of the flight activity that occurred within the viewshed of the vantage point being surveyed.

The procedure described above for excluding flight activity along the Gweebarra Estuary also resulted in a requirement for adjustment of durations for those flightlines that were partly within the Gweebarra Estuary buffer. Similarly, in the main VP analyses, adjustment of durations were carried out for the flightlines that were only partly within the eastern section of the VP1 and VP8 viewsheds.

The flightline durations were adjusted by clipping the mapped flightlines by the viewsheds / Gweebarra Estuary buffer / eastern section of the VP1/VP8 viewsheds. The durations and bird-secs were then recalculated by multiplying their original values by (clipped flightline length) / (original flightline length).

It should be noted that, this recalculation procedure makes two assumptions. Firstly, it assumes that the flight speed was similar between the segments used for the recalculation. Secondly, it assumes that, where a flightline includes flight activity at multiple height bands, the relative distribution between the height bands was similar between the segments used for the recalculation.

Height bands

Separate calculations of bird transits were carried out for each of the height bands that were used for the vantage point surveys (25-50 m, 50-160 m, and 160-220 m). This allowed the differences in the rotor area as a proportion of the airspace to be factored into the calculations.

To carry out these separate calculations, it was necessary to subdivide the overall rotor area (A_{rotor}) into the portions that occurred in each height band. To calculate the rotor area in each height band, the angles subtended by segments representing the 25-50 m and 50-160 m height bands were calculated using Equations 5 and 6:

Equation 4: $\theta_{25\text{-}50} = \cos^{-1}((H_{hub} - 25) / R_{rotor})$

Equation 5: $\theta_{50\text{-}160} = \cos^{-1}((H_{hub} - 50) / R_{rotor})$

H_{hub} = hub height; R_{rotor} = rotor radius.

The rotor areas were then calculated using the following equations:

Equation 6: $A_{rotor(25\text{-}50)} = 0.5 \times (\theta_{25\text{-}50} - \sin(\theta_{25\text{-}50})) \times R_{rotor}^2$

Equation 7: $A_{rotor(50\text{-}160)} = A_{rotor(25\text{-}50)} - (0.5 \times (\theta_{50\text{-}160} - \sin(\theta_{50\text{-}160})) \times R_{rotor}^2)$

Equation 8: $A_{rotor(160\text{-}220)} = A_{rotor} - (A_{rotor(25\text{-}50)} + A_{rotor(50\text{-}160)})$

Similarly, the rotor height (H_{rotor}) values for each height band were adjusted to equal the height of the rotor segment in the height band.

These ground clearances for the turbine models included in the collision risk modelling varied from 30-50.5 m, while the tip heights varied from 194-200 m. The use of the A_{rotor} values calculated above for the Stage 1 model assumed that all the flight activity within a height band occurred within the portion of the height band that was occupied by the rotor areas. This will have overestimated the flight activity density within the rotor area in the 25-50 m height band (except for the two turbine models with ground clearances of 50 and 50.5 m) and in the 160-220 m height band.

Vantage point survey effort

The overall survey effort varied between vantage points. Therefore, for models that combined data from more than one vantage point, the following equation was used to standardise the vantage point survey effort:

Equation 9: $VP_{eff^*} = {}_{\text{sum (i = 1 to n)}} (VP_{eff(i)} \times A_{vis^*(i)}) / {}_{\text{sum (i = 1 to n)}} (A_{vis^*(i)})$

VP_{eff^*} = the standardised vantage point survey effort; n = the number of vantage points grouped together for the analysis; $VP_{eff(i)}$ = the vantage point survey effort at VP_i; $A_{vis(i)}$ = the adjusted viewshed area at VP_i (see Equation 3).

Definition of seasonal periods of occurrence

In developing a collision risk model it is important to consider seasonal patterns of occurrence for two reasons. Firstly, if a species has more than one population using the wind farm site (e.g., a wintering population that is distinct from the breeding population), separate collision risks need to be calculated so that the impact on each population can be assessed. Secondly, the D_{season}/VP_{eff} ratio in Equation 1 means that if a species has uneven patterns of seasonal occurrence, the calculation of predicted transits may be biased, assuming that the monthly survey effort was not proportional to daylength (which will usually be the case).

For species with resident populations, definition of separate seasonal periods of occurrence is only required where there are clear differences in seasonal activity patterns that could bias the collision risk modelling. This would occur if there were significantly higher levels of activity in summer or winter. Where there are month to month variations without clear seasonal trends, these differences could reflect sampling effects, rather than actual seasonal variation. Where there are higher levels of activity spanning the spring and / or autumn equinoxes, the reduction / increase in the D_{season}/VP_{eff} ratio before the spring / autumn equinox will be compensated by the increase / decrease in this ratio after the spring / autumn equinox. Therefore, in these cases, there is no need for seasonal subdivision to prevent bias in the model.

The results of the analysis of the vantage point survey data (Appendix 7.1) for the regularly occurring species, and knowledge of the general occurrence patterns of the species in Ireland, for all the species, was used to define seasonal periods of occurrence for all the species included in the collision risk model.

Restricted seasonal occurrence periods were defined for the following species included in the collision risk modelling: Whooper Swan, Barnacle Goose, Osprey, Common Sandpiper. For Common Gull, Lesser Black-backed Gull, Herring Gull, and Great Black-backed Gull, breeding and non-breeding populations were defined and the collision risks were calculated separately for each population

The seasonal periods of occurrence used in the collision risk model are shown in Table A7.7.1.4 in Annex 7.7.1.

Parameter values

The wind turbine parameters, and the bird biometric and avoidance rate parameters are shown in Annex 7.7.1.

General models

The basic mathematical method for calculating predicted transits using the occupancy method (as described above) is explained by SNH (2000), and, in any case, can be easily derived from first principles. However, SNH (2000) does not provide guidance on how to incorporate data from multiple vantage points in calculations of predicted transits. The simplest method (the combined VPs method) combines the data from all the vantage points, using the sum of the flight activity across all the vantage points for the D_{bird} value, and the sum of the viewshed areas for the A_{vis} value. This method assumes that flight activity is randomly distributed throughout the combined viewsheds.

A slightly more sophisticated method is the VP averaging method. This involves calculating the flight activity density separately for each vantage point and then using the mean flight activity density across all vantage points to calculate the overall number of transits predicted across the entire wind farm site. This is a variant of a method that is widely used (in Ireland) and has also been taught at courses on collision risk modelling run by the Chartered Institute of Ecology and Environmental Management[2]. This method also assumes that there is random distribution of flight activity across the wind farm site but treats each vantage point as a separate sample.

The range of predicted transits from the combined VPs and VP averaging models, at the for the all VPs and main VPs scales, are compared in Table A7.7.3.

In each set of models, the minimum predicted transits are from the N149, and in some cases also, the V150 models. These are the two turbines with ground clearances of at least 50 m, which means that the data from the 25-50 m height bands was not included in the models. The maximum predicted transits are from the GE164. This is the turbine with the lowest ground clearance, which means that these models have the highest values of A_{rotor}.

Table A7.7.3. Range of predicted transits per year for the all VPs and main VPs variants of the combined VPs and VP averaging models.

Species	All VPs		Main VPs	
	combined VPs	VP averaging	combined VPs	VP averaging
Whooper Swan	164 - 250	112 - 171	205 - 315	161 - 250
Barnacle Goose	4 - 5	5 - 6	0	0
Mallard	40 - 64	39 - 64	7 - 12	7 - 16
Cormorant	0 - 1	0 - 2	0 - 1	0 - 7
Grey Heron	11 - 14	13 - 16	8 - 10	16 - 20
White-tailed Eagle	6 - 8	8 - 11	0	0
Sparrowhawk	20 - 29	34 - 51	4 - 7	31 - 57
Buzzard	44 - 103	64 - 139	23 - 51	76 - 149

[2] The method that is widely used calculates predicted transits per turbine separately for each vantage point and then uses the mean predicted transits/turbine across all vantage points to calculate the overall number of transits predicted across the entire wind farm site. This is equivalent to the method used in this report when all viewsheds contain turbines. However, the method used in this report can also include data from viewsheds that do not contain turbines.

Species	All VPs		Main VPs	
	combined VPs	VP averaging	combined VPs	VP averaging
Golden Eagle	99 - 180	119 - 213	76 - 139	96 - 171
Osprey	4 - 12	4 - 15	5 - 8	5 - 13
Common Sandpiper	10 - 12	9 - 11	0	0
Snipe	4 - 6	4 - 6	0	0
Common Gull (breeding)	70 - 277	75 - 273	22 - 84	25 - 94
Common Gull (non-breeding)	0	0	0	0
Lesser Black-backed Gull (breeding)	119 - 191	134 - 224	122 - 190	130 - 218
Lesser Black-backed Gull (non-breeding)	112 - 177	109 - 173	4 - 14	5 - 19
Herring Gull (breeding)	709 - 925	939 - 1221	10 - 12	56 - 67
Herring Gull (non-breeding)	23 - 4075	35 - 3269	0 - 108	0 - 553
Great Black-backed Gull (breeding)	47 - 92	79 - 146	1 - 10	2 - 13
Great Black-backed Gull (non-breeding)	13 - 29	16 - 29	17 - 38	23 - 41
Kestrel	107 - 198	104 - 270	12 - 31	11 - 32
Merlin	0 - 1	0 - 1	0 - 0	0
Peregrine	3 - 3	2 - 3	3 - 4	4

Golden Eagle Stage 1 models

The analyses presented in the main chapter showed that Golden Eagle flight activity was strongly associated with the ridgeline along the southern / eastern margins of the wind farm site. This distribution pattern was strongly associated with both altitude and the scores from the Golden Eagle Topography model. Both parameters explained a similar amount of variation in the distribution of Golden Eagle flightlines. Therefore, separate Stage 1 models were developed using altitude and using the scores from the Golden Eagle Topography model. Variants of these models were also analysed to assess whether potential avoidance effects could have influenced the predicted transits.

Golden Eagle Stage 1 altitudinal zones model

The analysis of Golden Eagle flightline density by altitudinal zone indicated that, for analyses of Golden Eagle flight activity, the area covered by the vantage point surveys can be divided into three altitudinal zones: a low altitudinal zone (0-160 m), a middle altitudinal zone (160-210 m), and a high altitudinal zone (above 210 m).

No turbines are proposed for altitudes above 210 m, so Golden Eagle flight activity in the high altitudinal zone does not need to be included in the collision risk model. Therefore, two altitudinal zones were used: the low altitudinal zone (0-160 m), and the middle altitudinal zone (160-210 m).

The Golden Eagle flightlines were divided by these two altitudinal zones. Where the flightlines intersected both altitudinal zones, the durations and bird-secs in each zone were recalculated by multiplying their original values by (flightline length in zone) / (original flightline length).

The number of turbines were 16 in the 0-160 m zone, and 3 for the 160-210 m zone.

The predicted transits ranged from 37 per year for the N149 turbine, to 63 per year for the GE164 turbine (see Annex 7.7.2).

Golden Eagle Stage 1 GET model

The analyses of Golden Eagle flightline density by scores from the Golden Eagle Topography model indicated that, for analyses of Golden Eagle flight activity, the area covered by the vantage point surveys can be divided into three zones: low-medium suitability (GET scores of 1-5), high suitability (GET scores of 6-8) and very high suitability (GET sores of 9-10). Therefore, the viewsheds were divided into three zones representing these categories, named GET zone 1 - GET zone 3.

The Golden Eagle flightlines were divided by these zones. Where the flightlines intersected more than one GET zone, the durations and bird-secs in each zone were recalculated by multiplying their original values by (flightline length in zone) / (original flightline length).

There were nine turbines in GET zone 1, seven in GET zone 2, and three in GET zone 3.

The predicted transits ranged from 43 per year for the N149 turbine, to 77 per year for the GE164 turbine (see Annex 7.7.2).

Model variants

The analyses of Golden Eagle flightline densities indicated a possible observer avoidance effect in the 0-250 m distance band around each vantage point (see main chapter). Also, low flight activity in the 2020 breeding season, despite the presence of a nest site close to some of the vantage point locations indicated that the birds may have been avoiding the viewsheds when they entered / left the nest (see main chapter). Therefore, variants of both models were developed which excluded the 0-250 m distance band around each vantage point and excluded data from 2020.

For the variant of the altitudinal zone model, the predicted transits ranged from 32 per year for the N149 turbine, to 62 per year for the GE164 turbine.

As the values from these variants did not differ significantly from the original models, the latter were used for the Stage 3 analyses.

Common Gull model

All the breeding season Common Gull flight activity in the eastern section of the wind farm site occurred in a narrow corridor between Lough Aneane More and the Gweebarra Estuary. This means that the assumptions of random distribution of flight activity between the viewsheds required by the general models was clearly violated. Therefore, a separate model was developed for the breeding season Common Gull population.

The flightline corridor between Lough Aneane More and the Gweebarra Estuary was entirely contained within the viewshed of VP3. Parts of the corridor also overlapped the viewsheds of other vantage points. However, these were generally the more distant parts of those viewsheds, and no Common Gull flightlines were recorded in flightline corridor from those vantage points. Therefore, the model was restricted to data from VP3.

The viewshed of VP3 was clipped by generating a 200 m buffer around the Common Gull flightlines. As with the general models, the Gweebarra Estuary buffer was also clipped from the viewshed. The viewshed area was then recalculated using the band weightings procedure in Equation 3.

The predicted transits were then calculated for each turbine model using Equation 1, and a value of three for the number of turbines.

The predicted transits ranged from 44 transits/years for the N149 and V150 turbines to 167 transits / year for the GE164 turbine (see Annex 7.7.2).

Selection of transit values for the Stage 3 model

For Golden Eagle and Common Gull, the transit values from their species-specific models were selected for use in the Stage 3 model.

For the other populations, it was necessary to decide whether to use the values from the combined VPs or VP averaging models, and whether to use the all VPs or main VPs scales of analyses.

For resident / regularly occurring populations, the analyses of their distribution patterns presented in the main chapter showed strong differences in occurrence patterns across the wind farm site. Therefore, for these species, the main VPs scale was used, as this scale was focussed around the proposed turbine locations. The model (combined VPs or VP averaging) that produced the highest predicted transits was used.

For the other populations, the model and scale that produced the highest predicted transits was used.

A7.7.5 COLLISION RISK MODEL STAGE 2: COLLISION PROBABILITY

Methodology

Stage 2 of the collision risk model involves calculating the probability of a collision when a bird makes a transit of the rotor swept volume.

The Scottish Natural Heritage collision risk model (SNH, 2000; Band *et al.,* 2007; Band, 2012) calculates the probability, p (r, ϕ), of collision for a bird at radius r from the hub and at a position along the radius that is at angle ϕ from the vertical. This probability is then integrated over the entire rotor disc, assuming that the bird transit may be anywhere at random within the area of the disc. Separate calculations are made for flapping and gliding birds and for upwind and downwind transits. This method assumes that: birds are of a simple cruciform shape, fly through turbines in straight lines with a perpendicular approach to the plane of the rotor, and their flight is not affected by the slipstream of the turbine blade; and that turbine blades have width and pitch angle, but no thickness.

The collision probability calculations for the original Scottish Natural Heritage collision risk model can be carried out using an Excel spreadsheet which is provided as an accompaniment to the SNH (2000) guidance. This spreadsheet was updated by Band (2012) by changing the details of the blade profile used in the model[3]. The updated model is included in R code provided by Masden (2015). For the present assessment, R code was adapted from that provided by Masden (2015) to carry out the collision probability calculations. This R code was audited against the Band (2012) spreadsheet to confirm that it produced matching collision probability calculations.

One of the turbine parameters used to calculate collision probability is the mean pitch angle of the turbine blade. This parameter specifies the angle of the blade from the horizontal, so the collision probability will increase as the mean pitch angle increases. Data on mean pitch angle can be difficult to obtain so generic values are often used in collision risk models. These are often based on the statement by Band (2012) that a mean pitch angle of "25-30 degrees is reasonable for a typical large turbine". However, Band was referring to offshore wind farms where wind speeds are higher than at onshore wind farms, resulting in higher mean pitch angles. For this assessment, I applied a more realistic scenario from an onshore wind farm (Meenwaun, Co. Offaly). The pitch angle over a continuous 12 month period at this site was for approximately 90% of the time between -3° and 9° (MKOS, 2019).

Sensitivity analyses showed that collision probability values were more or less constant over the range of pitch angles from -5° to at least 12.5° (see below) . Therefore, a mean pitch angle of 3° was used for the Stage 3 models. This value represents the median of the -3° - 9° range recorded by MKOS (2019).

The bird biometrics and turbine parameter values used in the calculations of collision probability are shown in Annex 7.7.1.

Collision probability values

The minimum and maximum collision probabilities for each species are shown in Table A7.7.4.

The minimum values were produced by the E160 or GE164 turbines, which were the models with the slowest rotation speed values used for the calculations. The GE164 had a slightly higher rotation speed than the E160, but a slightly lower maximum chord value. This turbine produced the minimum values for species with lower wingspan / body length ratios, while the E160 produced the minimum values for species with higher wingspan / body length ratios.

The maximum values were produced by the N149 or SG155 turbines. The N149 was the model with the highest rotation speed value used for the calculations, while the SG155 was the model with the highest maximum chord value. As with the minimum values, the maximum values for species with higher wingspan / body length ratios were associated with the turbine with the highest rotation speed value (N149), while the maximum values for species with lower wingspan

[3] Note that, strictly speaking, the model should be adapted for each turbine specification by changing the details of the blade profile in the model to match the blade profile of the turbine. However, in practice, this would make very little difference to the predicted collision risk, and the details of the blade profile are usually not available.

/ body length ratios were associated with the turbine with the highest maximum chord value (SG155)

Table A7.7.4. Minimum and maximum collision probabilities.

Species	Minimum collision probability		Maximum collision probability	
	Value	Turbine	Value	Turbine
Whooper Swan	0.066	E160	0.076	N149
Barnacle Goose	0.047	GE164	0.054	N149
Mallard	0.044	GE164	0.05	SG155
Cormorant	0.054	E160	0.062	N149
Grey Heron	0.063	E160	0.073	N149
White-tailed Eagle	0.06	E160	0.069	N149
Sparrowhawk	0.042	GE164	0.048	SG155
Buzzard	0.05	E160	0.056	N149
Golden Eagle	0.059	E160	0.068	N149
Osprey	0.052	E160	0.059	N149
Golden Plover	0.038	GE164	0.044	SG155
Common Sandpiper	0.036	GE164	0.041	SG155
Snipe	0.037	GE164	0.042	SG155
Common Gull	0.044	GE164	0.051	SG155
Lesser Black-backed Gull	0.05	GE164	0.056	N149
Herring Gull	0.05	E160	0.057	N149
Great Black-backed Gull	0.052	E160	0.06	N149
Kestrel	0.044	GE164	0.05	SG155
Merlin	0.041	GE164	0.047	SG155
Peregrine	0.045	GE164	0.051	SG155

Sensitivity

Rotation speed

The rotation speed has a strong influence on the collision probability values. However, the rotation speed values used in the Stage 2 model were nominal values supplied by the manufacturer. In practice, rotation speeds will vary with wind speed. Therefore, sensitivity analyses were carried out to investigate how collision probabilities varied with rotation speeds across the range of operational rotation speeds.

This analysis was carried out for the three turbines for which rotation speed ranges were available: the N149, N163 and SG155 turbines. Collision probability values were calculated for each 0.1 m/sec increment in the rotation speed value within the rotation speed ranges.

Examples of the relationships between collision probabilities and rotation speeds are shown in Figure A7.7.4 for species representing the range of body sizes and wingspans.

For small species like Golden Plover, the variation in rotation speed, within the operational speed ranges, had a negligible effect on the collision probabilities. However, for large species like Whooper Swan and Golden Eagle, there was a 2-3% variation in collision probabilities across the operational speed ranges. For these two species, this variation would result in an increase in the predicted collision risk of up to 1.5 times between the minimum and maximum rotation speeds.

Pitch angle

Modern wind turbines have variable pitch angles, so sensitivity analyses were carried out to investigate how collision probabilities varied with pitch angle.

These analyses was carried out for the same three turbines as the rotation speed sensitivity analyses: the N149, N163 and SG155 turbines. Collision probability values were calculated for each 1° increment in pitch angle between -5° and 90°.

Examples of the relationships between collision probabilities and pitch angle are shown in Figure A7.7.4 for species representing the range of body sizes and wingspans. The collision probabilities remained more or less constant up to pitch angles of around 10-15°, after which they showed steep increases.

As discussed above, monitoring data indicates that pitch angles at onshore wind farms in Ireland rarely exceed 9°. Therefore, variation in pitch angle is unlikely to affect collision risk predictions.

A7.7.6 COLLISION RISK MODEL STAGE 3: COLLISION PREDICTION

General

Stage 3 of the collision risk model uses the predicted transits from Stage 1 and the collision probabilities from Stage 2 to calculate the predicted collisions. However, three further factors need to be considered: the avoidance rate; the degree of any nocturnal flight activity; and the proportion of time the wind farm is operational;.

Correction factors

Avoidance rates

The avoidance rate reflects the fact that most potential collisions are avoided due to birds taking evasive action (SNH, 2010). This avoidance rate includes both behavioural avoidance (micro-avoidance) and behavioural displacement (macro-avoidance).

Behavioural avoidance is “action taken by a bird, when close to an operational wind farm, which prevents a collision”. Behavioural displacement refers to the process by which a “bird may (possibly over time) change its home range, territory, or flight routes between roosting areas and feeding areas, so that its range use (or flight paths) no longer bring the bird into the vicinity of an operational wind farm”.

Scottish Natural Heritage provides guidance on avoidance rates to use in collision risk assessments (SNH, 2010, 2018). For some species, including Whooper Swan, Barnacle Goose, White-tailed Eagle, Golden Eagle and Kestrel, there is some evidence available that has been used to specify species-specific avoidance rates (SNH, 2018). In addition, a recent review for Scottish Natural Heritage has recommended the use of an avoidance rate of 0.995 for large gulls (including Lesser Black-backed Gull) at onshore wind farms (Furness, 2019). For the other species included in this collision risk model, the SNH guidance specifies a default avoidance rate of 98%.

Nocturnal flight activity

Another factor that needs to be considered is the degree of nocturnal flight activity that is likely to occur. The calculations of predicted transits are based on flight activity during daylight hours only. Therefore, if a species is likely to have a significant amount of nocturnal flight activity, a correction should be made to account for this nocturnal flight activity.

Correction factors for nocturnal flight activity were included for Whooper Swan and Grey Heron.

Whooper Swan does not normally show significant levels of nocturnal flight activity. However, analysis of the vantage point survey data indicated that most of the Whooper Swan flightlines recorded were likely to be of birds on direct migration. As Whooper Swan can migrate at night, a nocturnal correction factor was required. In the absence of any information on the diel variation in the relative frequency of Whooper Swan migration, it was assumed that there was an equal probability of Whooper Swan flightlines occurring at any time in a 24 hour period. Therefore, the nocturnal correction factor was given by the following equation:

Equation 10: $NCF = 1 + h_{night^*} / h_{day^*}$

h_{night^*} = mean night-time hours across seasonal period of occurrence; h_{day^*} = mean day-time hours across seasonal period of occurrence.

Flight activity patterns for Grey Heron from Vessem and Draulans (1987) indicate low levels of nocturnal flight activity. For this assessment, a nominal value of 25% of daytime flight activity was used to calculate the nocturnal correction factor for Grey Heron, using the following equation:

Equation 11: $NCF = 1 + 0.25 \times h_{night^*} / h_{day^*}$

NCF = correction factor for nocturnal flight activity; h_{night^*} = mean night-time hours across seasonal period of occurrence; h_{day^*} = mean day-time hours across seasonal period of occurrence.

Operational time

Wind turbines in operational wind farms will have periods when they are not turning due to maintenance or wind speeds. Therefore, the predicted collisions need to be corrected by the percentage of time the wind turbines will be operational.

Collision predictions

The results of the Stage 3 calculations are summarised in Table A7.7.5. This shows the minimum and maximum collision risks for the eight turbine types that were included in the collision risk modelling. The table also shows the turbine types that generated the minimum and maximum values, the scale and type of the Stage 1 model, and the approximate correction factor that was used to adjust the viewshed area for under-detection of distant flightlines. For Golden Eagle, the table shows the results from the two alternative Stage 1 models that were used.

Table A7.7.5. Minimum and maximum collision risk predictions.

Species / Population	Scale	Model	Collisions / year		Turbine		Correction factor
			min	max	min	max	
Whooper Swan	main	cVPs	0.16	0.23	V150	GE164	1.6
Barnacle Goose	all	VPa	0.00045	0.00049	V150	SG155	2.6
Mallard	main	VPa	0.006	0.012	V150	GE164	3.1
Cormorant	main	VPa	0	0.0061	V150	V162	2.6
Grey Heron	main	VPa	0.02	0.023	V150	V162	1.6
White-tailed Eagle	all	VPa	0.023	0.028	V150	GE164	1.6
Sparrowhawk	main	VPa	0.025	0.041	V150	GE164	3.1
Buzzard	main	VPa	0.071	0.13	V150	GE164	2.6
Golden Eagle	all	alt bands	0.034	0.056	V150	GE164	1.6
Golden Eagle	all	GET bands	0.040	0.068	V150	GE164	1.6
Osprey	main	VPa	0.0052	0.011	GE164	SG155	2.6
Common Sandpiper	all	VPa	0.0063	0.007	V150	GE164	3.1
Common Gull	CM	CM model	0.024	0.087	V150	GE164	3.1
Lesser Black-backed Gull (breeding)	main	VPa	0.031	0.046	V150	GE164	2.6
Lesser Black-backed Gull (non-breeding)	main	VPa	0.0012	0.0039	V150	V162	2.6
Herring Gull (breeding)	main	VPa	0.013	0.015	V150	GE164	2.6
Herring Gull (non-breeding)	main	cVPs	0	0.023	V150	GE164	2.6
Great Black-backed Gull (breeding)	main	VPa	0.00044	0.0030	V150	GE164	2.6
Great Black-backed Gull (non-breeding)	main	VPa	0.0057	0.0093	V150	V162	2.6
Kestrel	main	VPa	0.023	0.060	V150	GE164	3.1
Merlin	all	VPa	0	0.00076	V150	SG155	3.1
Peregrine	main	VPa	0.0031	0.0034	V150	GE164	3.1

Scale: all = data from all vantage points used; main = data only included from VPs2-7, and the sections of VPs 1 and 8 overlapping the eastern section of the wind farm site; CM = data only included from the section of VP3 overlapping the Common Gull flightline corridor. Model: cVPs = combined VPs; VPa = VP averaging; alt bands = Golden Eagle altitudinal zone model; GET bands = Golden Eagle GET bands model; CM model = Common Gull model. Correction factor = the mean correction factor across all viewshed for the relevant species group.

A7.7.7 COLLISION RISK ASSESSMENT

General

The potential increase in annual mortality, as a percentage of the background annual mortality, was assessed for all species / populations, with a predicted risk that would result in at least one collision within the 35 year lifespan of the wind farm. For each of these species / populations, the impact was assessed at the national scale. The impact was also assessed at the county scale where relevant population data was available, or could be estimated.

The sources of the population data are listed in the relevant species accounts. For some species, the Donegal population sizes were estimated using the BirdAtlas dataset from the National Biodiversity Data Centre. This included hectad presence-absence data covering the whole of the Republic of Ireland, and tetrad data of relative abundance for samples of tetrads from most of the hectads. The hectad data was used to estimate the proportion of the Republic of Ireland breeding range of each species that occurs in Donegal. The tetrad data was used to estimate the mean relative abundance of the species in Donegal as a percentage of its mean relative abundance throughout its range in the Republic of Ireland. The product of these two factors was then used to multiply the Republic of Ireland population figure to give an estimate for the Donegal population.

Whooper Swan

The predicted collision risk would result in around 6-8 collisions over the lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 1.6). This should be taken into account when comparing this collision risk with collision risks from other wind farm projects (which generally do not include correction for detectability effects).

The Whooper Swan flightlines recorded in the vantage point surveys were not associated with a discrete local population, but instead were considered to mainly involve birds on direct migration. As Whooper Swans migrating through Donegal in spring and autumn may be wintering anywhere in Ireland, the only relevant scale at which to consider the significance of the collision risk is the national population.

As Whooper Swan migrate by night as well as during the day, the predicted collision risk included a correction for nocturnal flight activity (which increased the risk by a factor of around 2.5). This should be taken into account when comparing this collision risk with collision risks from other wind farm projects involving local populations of Whooper Swan (which generally do not fly at night).

The calculations in Table A7.7.6 indicate that the predicted collision risk would cause a negligible increase in annual mortality to the national Whooper Swan population. Note that these calculations overestimate the likely increase as they do not take account of juvenile birds, which have higher annual background mortality rates.

Table A7.7.6. Potential increase in mortality to the national Whooper Swan population.

Parameter	Description	Source	National
pop	population size	1	1,911
surv	adult survival rate	2	0.801
m_1	annual background mortality	pop × (1-surv)	380
m_2	predicted annual collision mortality	collision risk model	0.16-0.23
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.04-0.06%

1: national population size Burke *et al.* (2021).

2: Brazil (2003), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

Sparrowhawk

The predicted collision risk would result in around one collision over the lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 3.1). This would have a negligible impact on both the Irish and Donegal Sparrowhawk populations (Table A7.7.7).

Table A7.7.7. Potential increase in mortality to the national and Donegal populations of Sparrowhawk.

Parameter	Description	Source	National	Donegal
pop	population size	1	11,965	959
surv	adult survival rate	2	0.675	0.675
m_1	annual background mortality	pop × (1-surv)	3,889	312
m_2	predicted annual collision mortality	collision risk model	0.025-0.041	0.025-0.041
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.001%	0.01%

1: national population size median of range from Crowe *et al.* (2014); Donegal population estimated from BirdAtlas data (see text).

2: mean of male and female survival rates from Newton (1986), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

Buzzard

The predicted collision risk would result in around 2-5 collisions over the lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 2.6). This collision risk would have a negligible impact on both the Irish and Donegal Buzzard populations (Table A7.7.8).

Table A7.7.8. Potential increase in mortality to the national and Donegal populations of Buzzard.

Parameter	Description	Source	National	Donegal
pop	population size	1	13,248	1,191
surv	adult survival rate	2	0.9	0.9
m_1	annual background mortality	pop × (1-surv)	1,325	119
m_2	predicted annual collision mortality	collision risk model	0.071-0.13	0.071-0.13
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.005-0.01%	0.06-0.1%

1: national population size from Rooney (2013), adjusted to account for the estimate by Kenward *et al.* (2000) that only around one in four individuals breed each year; Donegal population estimated from BirdAtlas data (see text).

2: Kenward *et al.* (2000), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

Common Gull

The predicted collision risk is 1-3 collisions over the lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 3.1).

This collision risk would have a negligible impact on the Irish Common Gull population (Table A7.7.9). The impact on the Donegal population is also likely to be very small (Table A7.7.9).

Table A7.7.9 Potential increase in mortality to the national and Donegal Common Gull breeding populations.

Parameter	Description	Source	National	Donegal	
				min	max
pop	population size	1	1,948	149	940
surv	adult survival rate	2	0.86	0.86	0.86
m_1	annual background mortality	pop × (1-surv)	273	21	132
m_2	predicted annual collision mortality	collision risk model	0.024-0.087	0.024-0.087	0.024-0.087
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.009-0.03%	0.1-0.4%	0.02-0.07%

1: population sizes from Cummins *et al.* (2019); the Donegal population is shown as the minimum and maximum of the ranges given by the dot map.

2: Buckcicinski and Buckcicinski (2003), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

Lesser Black-backed Gull (breeding population)

The predicted collision risk would result in around 1-2 collisions over the lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 2.6). This collision risk would have a negligible impact on the Irish Lesser Black-backed Gull population (Table A7.7.10).

Allowing for uncertainty in the predicted collision risk, the calculations in Table A7.7.10 suggest that, if the Donegal population is at the lower end of the range indicated by the available data, the potential increase in annual mortality to the Donegal breeding population could exceed the

1% threshold that Percival (2003) suggested for determining whether the impact is non-negligible. However, the calculated increase in annual mortality is likely to be a substantial overestimate, as it does not allow for the occurrence of immature and non-breeding birds, or birds from outside Donegal (which is a real possibility given the foraging range of Lesser Black-backed Gulls). Secondly, as discussed in the main chapter, the 1% threshold is very conservative, and an increase substantially greater than 1% is likely to be required to have a significant impact. Therefore, based on these factors, the potential increase in annual mortality to the Donegal breeding population is not likely to be significant.

Table A7.7.10. Potential increase in mortality to the national and Donegal Lesser Black-backed Gull breeding populations.

Parameter	Description	Source	National	Donegal	
				min	max
pop	population size	1	7,112	51	470
surv	adult survival rate	2	0.913	0.913	0.913
m_1	annual background mortality	pop × (1-surv)	619	4	41
m_2	predicted annual collision mortality	collision risk model	0.031-0.046	0.031-0.046	0.031-0.046
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.005-0.007%	0.7-1.0%	0.08 – 0.1%

1: population sizes from Cummins *et al.* (2019); the Donegal population is shown as the minimum and maximum of the ranges given by the dot map.
2: Wanless *et al.* (1996), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

Kestrel

The predicted collision would result in around 1-2 collisions over the 35 year lifespan of the wind farm. This collision risk includes a correction for detectability effects (which increases the risk by a factor of around 3.1). This would have a negligible impact on both the Irish and Donegal Kestrel populations (Table A7.7.11).

Table A7.7.11. Potential increase in mortality to the national and Donegal Kestrel breeding populations.

Parameter	Description	Source	National	Donegal
pop	population size	1	16,660	1,325
surv	adult survival rate	2	0.69	0.69
m_1	annual background mortality	pop × (1-surv)	5,165	411
m_2	predicted annual collision mortality	collision risk model	0.023-0.060	0.023-0.060
Δm	increase in annual mortality due to collisions	m_1 / m_2	0.000-0.001%	0.006-0.02%

1: national population size from NPWS (undated); Donegal population estimated from BirdAtlas data (see text).
2: Village (1990), as quoted by BirdFacts (www.bto.org/understanding-birds/birdfacts).

A7.7.8 GOLDEN PLOVER COLLISION RISK MODEL

A breeding pair of Golden Plover was recorded in the eastern corner of the wind farm site. The territory of this pair was outside the 500 m buffer around the proposed turbine locations. However, during the incubation period, breeding Golden Plover typically commute from their moorland breeding areas to feed in more productive grasslands. Therefore, there is potential for collision risks to arise if the breeding Golden Plover pair commutes across the wind farm site to feed on grasslands along the Gweebarra Estuary.

No evidence of commuting Golden Plover was recorded in the vantage point watches and the Golden Plovers appeared to stay in the moorland habitat to feed. However, the possibility of some commuting could not be ruled out.

As no Golden Plover flight activity at potential collision height was recorded, no potential collision risk was generated by the vantage point survey data. However, due to the very short time window during which commuting is likely to occur, there is a possibility of flight activity being missed by the vantage point watches. To allow for this possibility, calculations were carried out to assess the implications of a worst-case scenario.

During the incubation period the male and female take turns incubating with two changeovers per day. Therefore, the worst-case scenario, involved the incubating Golden Plovers commuting before/after every changeover. This would involve four commuting flights per day across the incubation period.

The core foraging range for breeding Golden Plover defined by SNH (2016) is 3 km. Therefore, for the worst-case scenario, a potential commuting corridor was defined from Golden Plover breeding territory to the section of the Gweebarra Estuary within 3 km of the breeding territory.

The potential commuting corridor was defined by drawing buffers of 3.2 km and 500 m around the 2022 nest site location. The 3.2 km buffer represents the likely core foraging range. The extra 200 m included in the buffer allows for movement of the nest site position from year to year. The buffer of 500 m represents the position of the Golden Plovers when they arrive / depart during incubation changeovers, as the birds do not fly directly into the nest site (Parr, 1980). Lines were then subtended from the outer edges of the 500 m buffer to the eastern and western edges of the grassland habitat along the Gweebarra Estuary included in the 3.2 km buffer. This potential commuting corridor is shown in Figure A7.7.6.

The worst-case scenario assumed that all flight activity occurred at potential collision height.

The worst-case scenario was used to calculate a theoretical collision risk using the risk window method of SNH (2000). The calculation procedure is shown in Table A7.7.7.

The worst-case scenario would result in one collision every 50-52 years (Table A7.7.7).

If the breeding Golden Plover do commute to grassland foraging areas, the actual collision risk will be much lower because they will not commute before / after every changeover, they are likely to also use other grassland areas, and not all the flight activity will be at potential collision height.

It should also be noted that these calculations use the default avoidance rate of 98%, because the guidance (SNH, 2018) does not include species-specific avoidance rates for Golden Plover.

However, a review of collision fatality monitoring studies by Gittings (2020) indicated that the non-avoidance rate for wintering Golden Plover is around an order of magnitude higher. If, as seems likely, this also applies to breeding Golden Plover populations, the collision risk from the worst-case scenario would be an order of magnitude lower: i.e., around one collision every 400 years.

Table A7.7.12 Worst-case scenario calculations of potential collision risk to breeding Golden Plover commuting over the wind farm site.

Parameter	Description	Source	National
w	Width of the commuting corridor perpendicular to the commuting route	1	2,045 m
d	Rotor diameter	2	149-164 m
n	Number of turbines	2	4
a_{RW}	Risk window	w*d	391,945-431,402 m^2
a_T	Rotor swept area	pi*(d/2)^2*n	104,620-126,744 m^2
ip	Duration of incubation period	3	29.5
f	Number of commuting flights	ip * 4	118
t_{RSW}	Number of transits through the rotor swept area each year	f * a_T/a_{RW}	27-30
p	Probability of collision per transit through rotor swept area	4	0.038 - 0.043
ar	Avoidance rate	5	0.98
op	Percentage of operational time	2	0.85
c	Collisions per year	t_{RSW}*p*(1-r) *(1-op)	0.019 - 0.020

Sources: 1 = weighted mean (by turbine number) of four cross-sections containing turbines; 2 = turbine specifications; 3 = median incubation period from the range given by BirdFacts (www.bto.org/understanding-birds/birdfacts); 4 = mean collision probability from the Stage 2 collision risk model (A7.7.5); 5 = SNH (2018).

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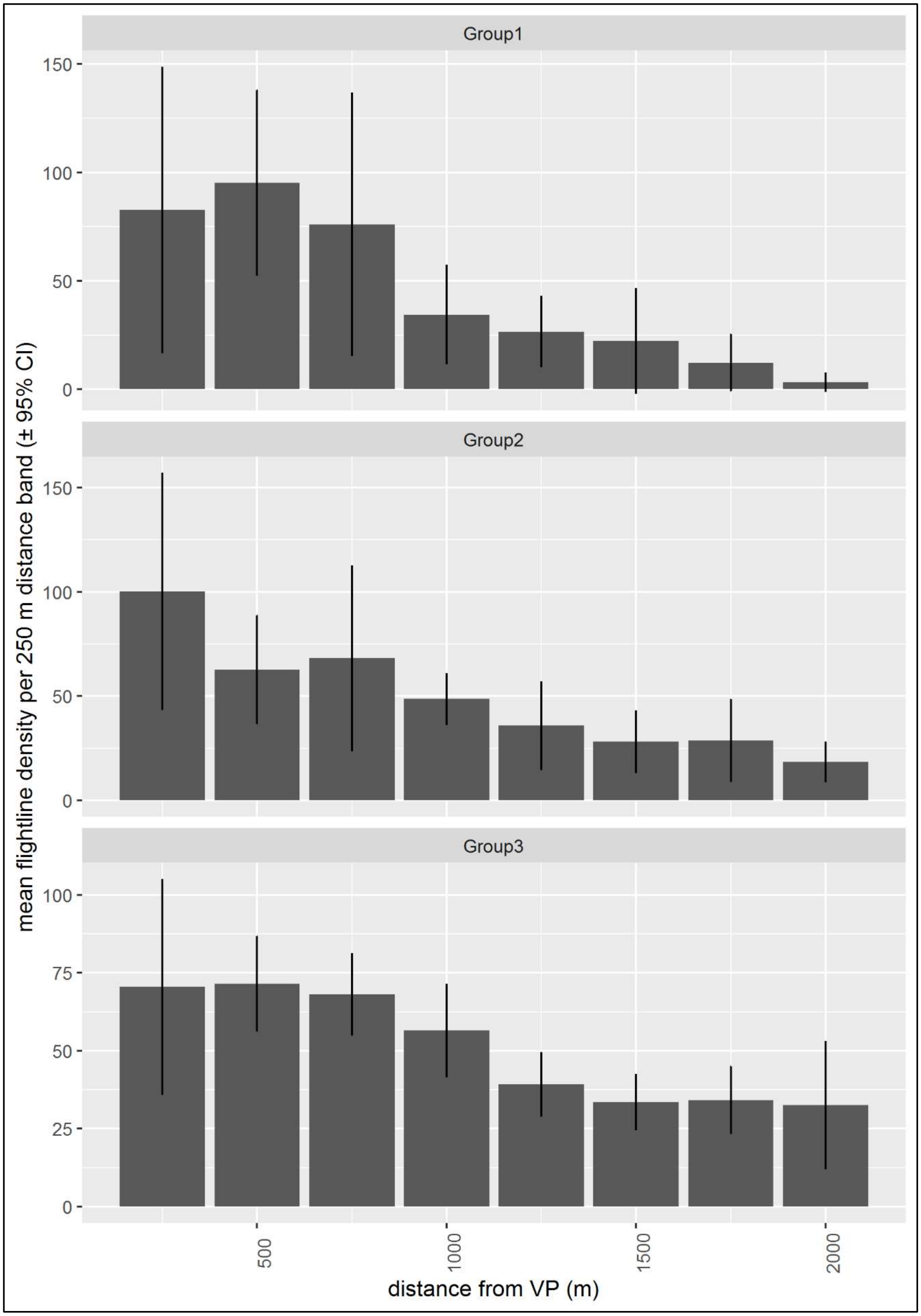

Figure A7.7.1 - Relationship between flightline density and distance from vantage point location for small (Group 1), medium (Group 2) and large (Group 3) species.

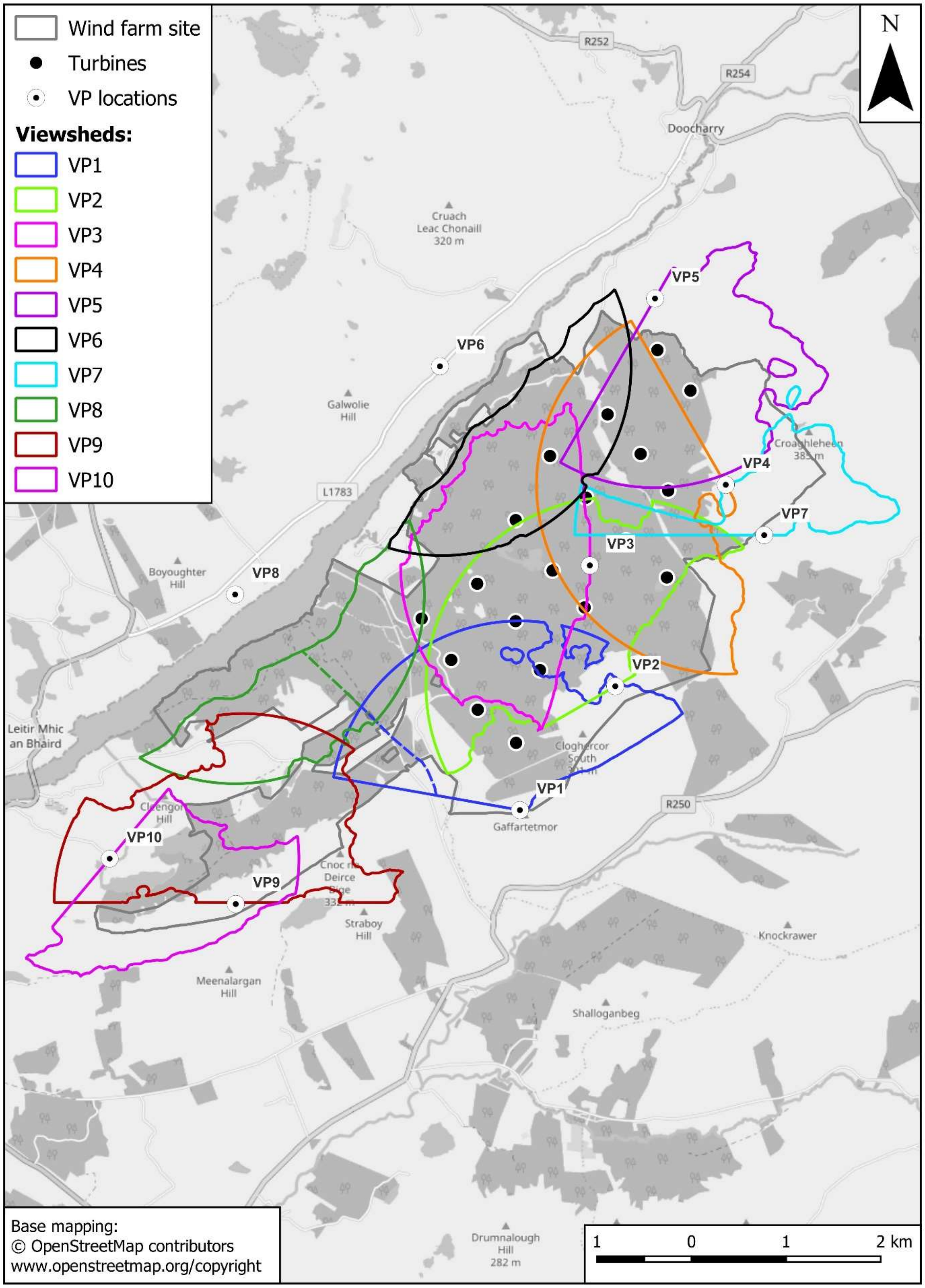

Figure A7.7.2 - Viewsheds used for the collision risk modelling, with dashed lines showing the divisions of VP1 and VP8 used for the analyses at the main VPs scale.

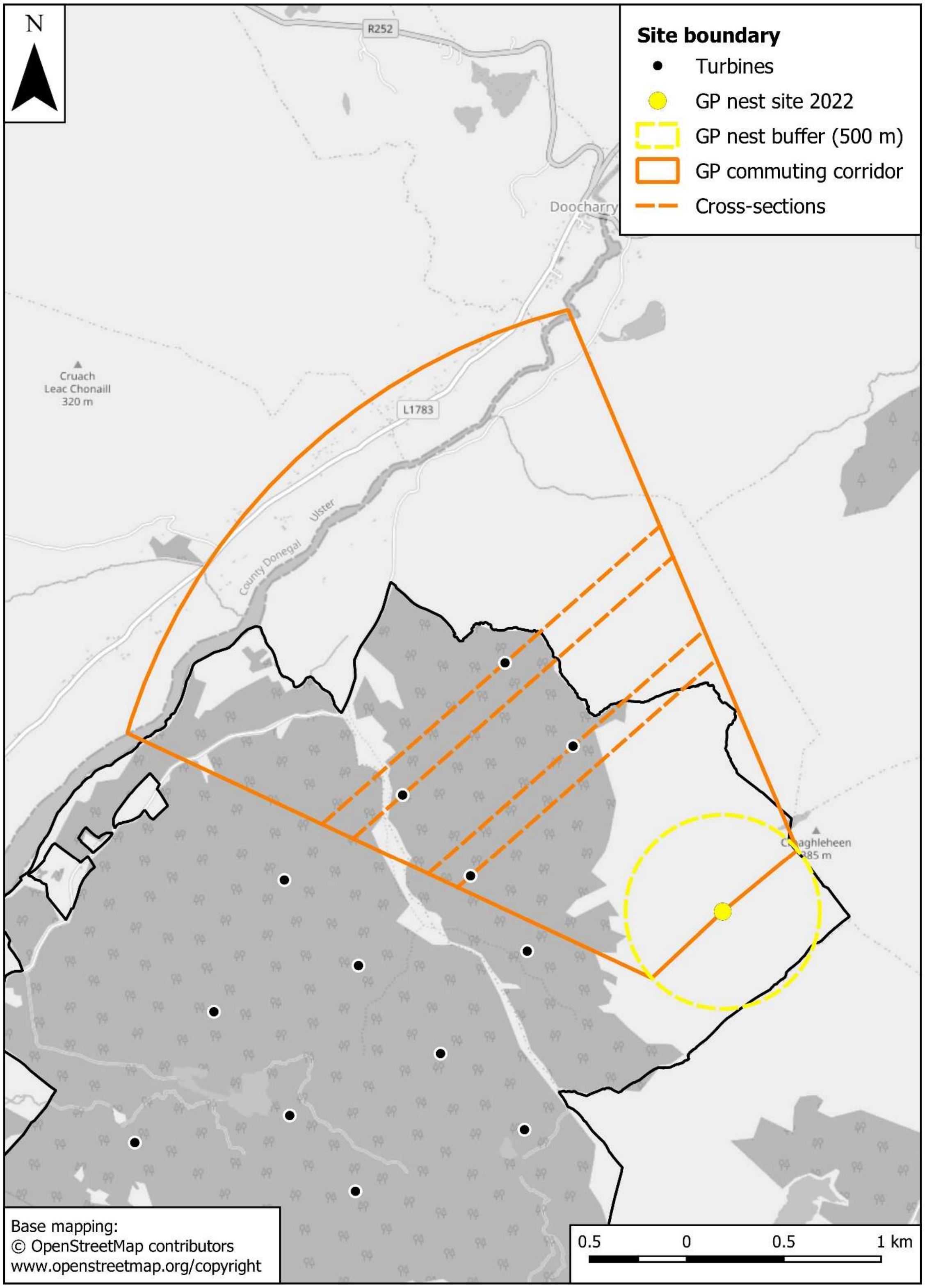

Figure A7.7.3 - Common Gull breeding season flightlines and the viewshed used for the Common Gull stage 1 model.

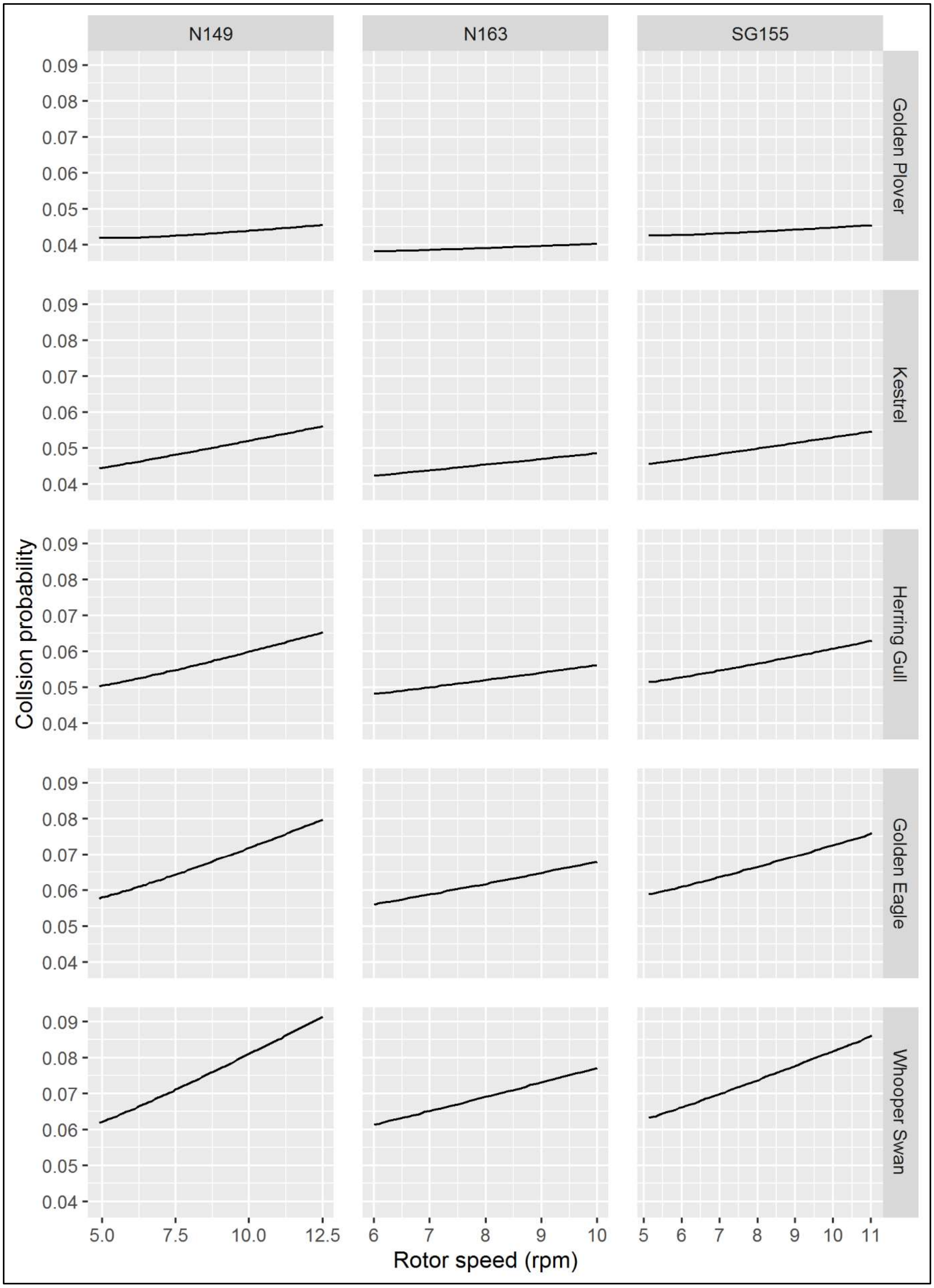

Figure A7.7.4 - Relationship between rotor speed and collision probability.

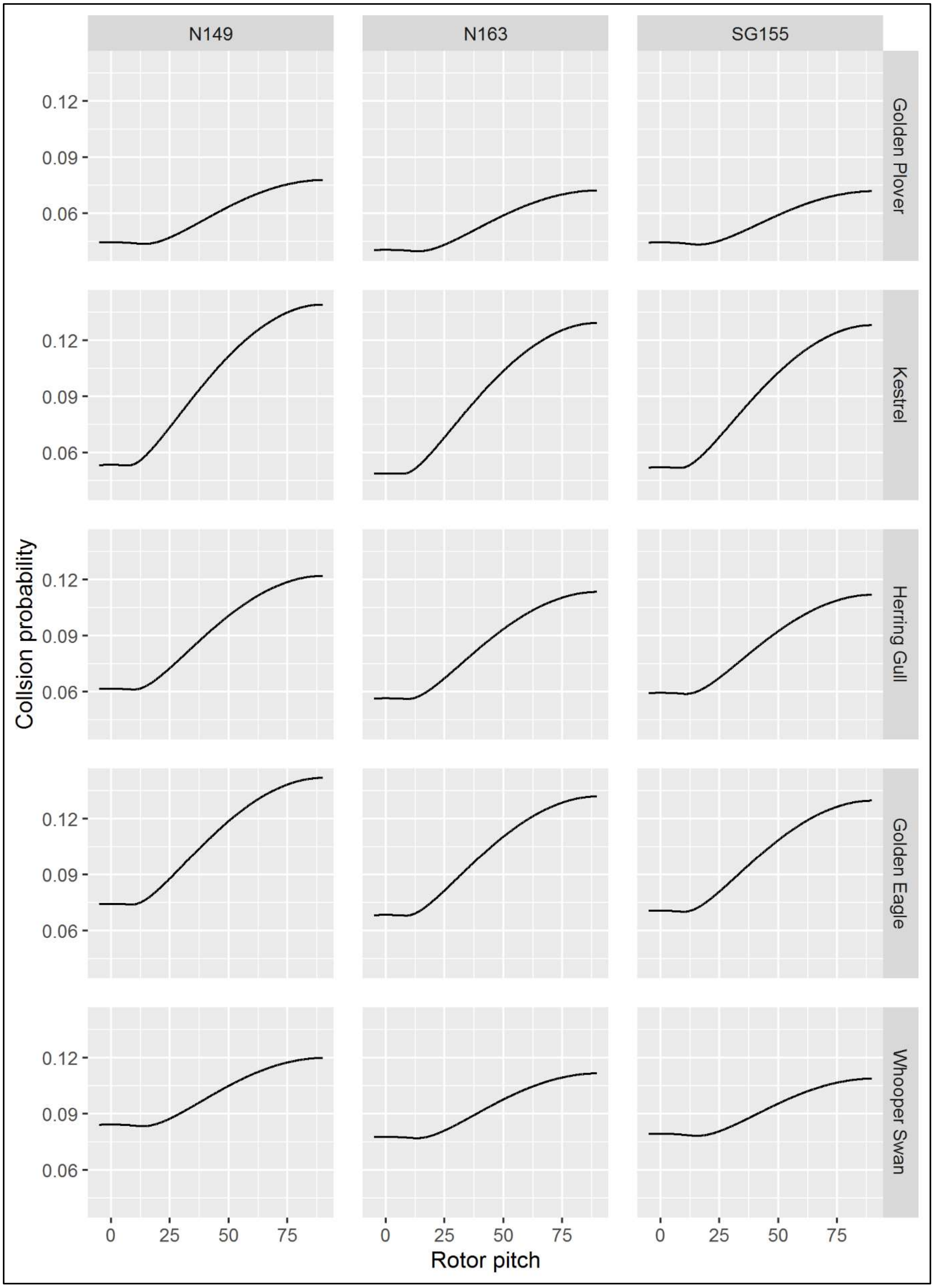

Figure A7.7.5 - Relationship between rotor pitch and collision probability.

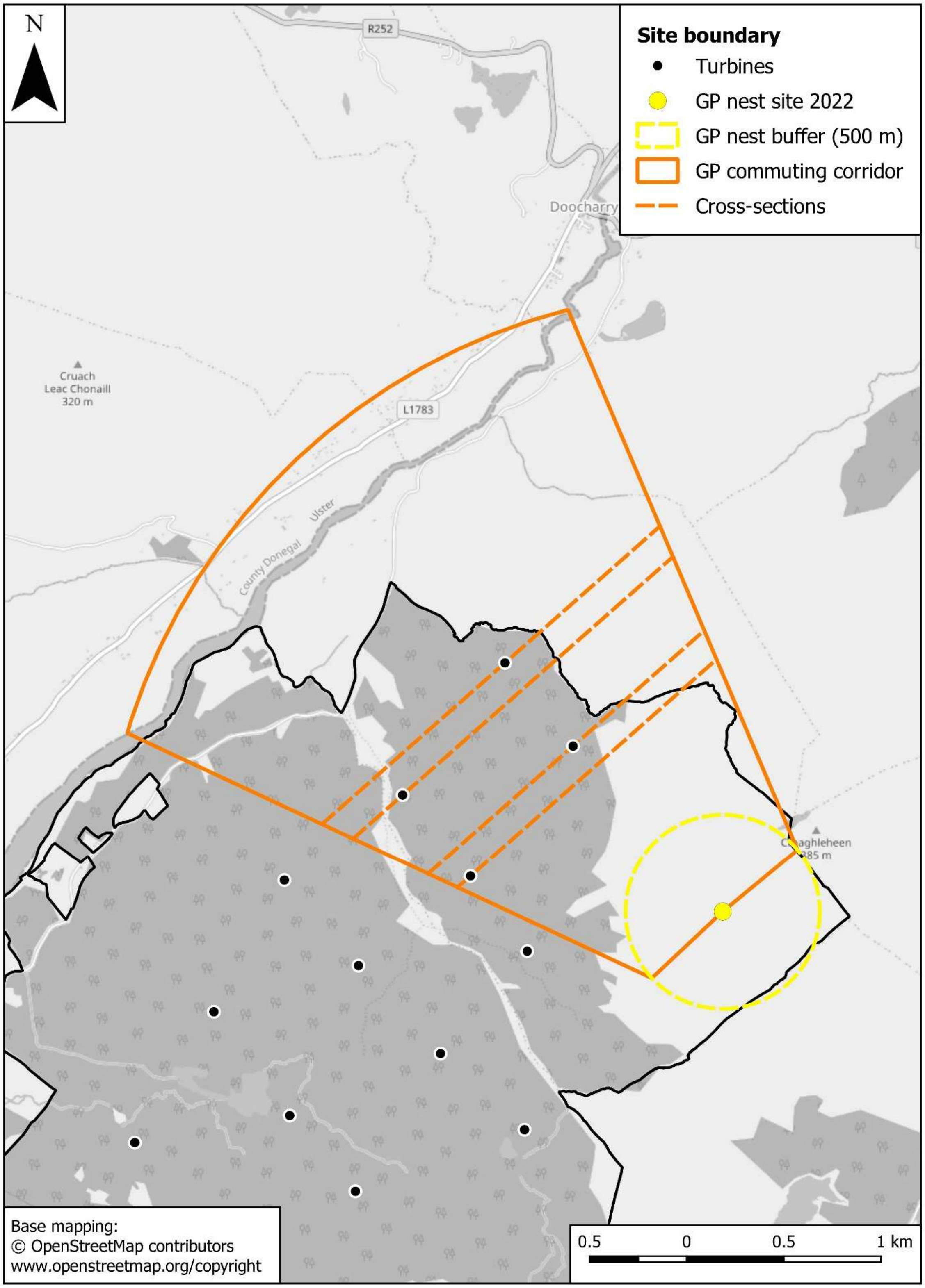

Figure A7.7.6 - Potential Golden Plover commuting corridor used for the Golden Plover worst-case scenario collision risk model..

ANNEX 7.7.1 - PARAMETER VALUES USED IN THE COLLISION RISK MODELLING

Introduction

This annex provides details of the parameter values used in the collision risk modelling. These include the wind turbine parameters (Table A7.7.1.1 and Table A7.7.1.2), the biometric and avoidance rate values for the bird species included in the models (Table A7.7.1.3) and the seasonal periods used in the Stage 1 models (Table A7.7.1.4). Rounded parameter values are shown for clarity, but the unrounded values were used in the models.

Details of the viewshed areas are shown in Table A7.7.2 above, and viewshed maps are included in Appendix 7.1. Details of the vantage point survey effort are included in Appendix 7.1. The flight activity data is included in Appendix 7.2, and the flightline maps are included in Appendix 7.3.

Data tables

Table A7.7.1.1. General wind turbine parameters used in the collision risk model.

Parameter	Value
Number of turbines	19
Number of blades in rotor	3
Mean pitch angle of blade	6°
Percentage of time the turbines will be operational	85%

Table A7.7.1.2. Turbine specific wind turbine parameters used in the collision risk model.

Parameter	GE164	N163	V162	E160	GE158	SG155	V150	N149
Hub height (m)	112	118	119	120	121	122.5	125	125
Rotor diameter (m)	164	163	162	160	158	155	150	149
Tip height (m)	194	199.5	200	200	200	200	200	199.5
Ground clearance (m)	30	36.5	38	40	42	45	50	50.5
Max chord (m)	4	4.15	4.3	4.126	4	4.5	4.2	4.2
Rotor speed range (rpm)		6.0-10.1				5.13-11.17		4.9-12.6
Rotor speed nominal (m)	9.7	10.1	9.5	9.6	9.9	9.31		10.75

No rotor speed values were provided for the V150 turbine. Instead, the mean of the rotor speed values for the other turbines was used.

Table A7.7.1.3. Bird species parameters used in the collision risk model.

Species	Speed (m/sec) v_{bird}	Body length (m) L_{bird}	Wingspan (m) W_{bird}	Avoidance rate
Whooper Swan	17.3	1.52	2.3	0.995
Barnacle Goose	17.0	0.64	1.38	0.998
Mallard	18.5	0.58	0.9	0.98
Cormorant	15.2	0.9	1.45	0.98
Grey Heron	11.2	0.94	1.85	0.98
White-tailed Eagle	11.3	0.8	2.2	0.95
Sparrowhawk	11.3	0.33	0.62	0.98
Buzzard	11.6	0.54	1.2	0.98
Golden Eagle	11.9	0.82	2.12	0.99
Osprey	11.4	0.56	1.58	0.98
Golden Plover	17.9	0.28	0.72	0.98
Common Sandpiper	15.3	0.2	0.4	0.98
Common Gull	13.4	0.41	1.2	0.992
Lesser Black-backed Gull	13.1	0.58	1.42	0.995
Herring Gull	12.8	0.6	1.44	0.995
Great Black-backed Gull	13.7	0.71	1.58	0.995
Kestrel	10.1	0.34	0.76	0.95
Merlin	10.1	0.28	0.56	0.98
Peregrine	12.1	0.42	1.02	0.98

L_{bird} and W_{bird} values taken from www.bto.org/about-birds/birdfacts. v_{bird} values taken from Alerstam et al. (2007); value for Grey Plover (*Pluvialis squatarola*) used for Golden Plover, as no value given for the latter species. Avoidance rates from SNH (2018) and Furness (2019).

Table A7.7.1.4. Seasonal periods used in the Stage 1 models for calculating predicted transits.

Species / Population	Season	Months
Whooper Swan	winter	October - March
Barnacle Goose	winter	October - March
Osprey	spring and autumn	April - May and August - October
Common Sandpiper	summer	April - September
Common Gull (breeding)	breeding season	April - July
Lesser Black-backed Gull (breeding)	breeding season	April - August
Lesser Black-backed Gull (non-breeding)	non-breeding season	September - March
Herring Gull (breeding)	breeding season	April - August
Herring Gull (non-breeding)	non-breeding season	September - March

Species / Population	Season	Months
Great Black-backed Gull (breeding)	breeding season	April - August
Great Black-backed Gull (non-breeding)	non-breeding season	September - March
Other species	all year	January - December

The seasonal duration values for the Stage 1 models (D_{season}) values were calculated for each month using the *suncalc* package (Thieurmel and Elmarhraoui, 2022) in R, using an input latitude of 54.86018, and an input longitude of -8.245005. They were then summed for each species across the months included in the seasonal period of occurrence.

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ANNEX 7.7.2 – CRM RESULTS FOR EACH TURBINE MODEL

Predicted transit data

Table A7.7.2.1. Predicted transits from the combined VPs model at the all VPs scale.

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
WS	250.3	237.4	232.8	225.3	217.4	204.1	165.7	163.9
BY	5.1	5.1	5.1	5.0	4.9	4.8	4.5	4.5
MA	63.8	60.2	59.0	57.0	54.9	51.3	40.9	40.5
CA	1.0	0.8	0.7	0.7	0.6	0.5	0.0	0.0
H.	13.8	13.7	13.6	13.3	13.0	12.5	11.1	11.0
WE	8.4	8.1	8.0	7.8	7.6	7.3	6.5	6.5
SH	29.1	27.8	27.3	26.5	25.6	24.2	20.2	19.9
BZ	103.1	93.8	90.8	86.3	81.4	73.0	44.5	44.0
EA	180.1	168.0	163.8	157.3	150.4	138.5	100.4	99.4
OP	12.1	10.9	10.5	9.9	9.2	8.1	4.0	4.0
CS	11.7	11.9	11.8	11.6	11.4	11.2	10.6	10.5
CM-breeding	277.0	242.3	232.2	217.1	200.6	171.9	70.4	69.6
LB-breeding	191.4	180.4	176.6	170.5	164.0	153.0	119.9	118.6
LB-non-breeding	177.5	167.4	163.9	158.4	152.5	142.6	113.5	112.3
HG-breeding	924.9	896.5	884.1	862.9	840.7	804.6	717.0	709.1
HG-non-breeding	4074.8	3384.1	3190.8	2907.2	2595.9	2048.8	23.5	23.2
GB-breeding	92.3	85.1	82.8	79.2	75.3	68.7	47.2	46.7
GB-non-breeding	29.4	26.7	25.9	24.6	23.2	20.9	13.1	13.0
K.	198.3	184.1	179.5	172.2	164.4	151.1	108.7	107.5
ML	1.1	0.9	0.9	0.8	0.7	0.6	0.0	0.0
PE	3.2	3.1	3.1	3.0	2.9	2.8	2.7	2.6

Table A7.7.2.2. Predicted transits from the combined VPs model at the main VPs scale.

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
WS	314.9	298.3	292.4	283.0	272.9	256.1	207.3	205.0
MA	11.6	10.9	10.6	10.2	9.8	9.0	6.8	6.7
CA	1.2	1.0	1.0	0.9	0.8	0.6	0.0	0.0
H	9.9	9.9	9.8	9.6	9.3	9.0	7.9	7.9
SH	7.0	6.5	6.3	6.1	5.8	5.3	3.9	3.8

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
BZ	50.9	46.7	45.3	43.1	40.8	36.8	23.1	22.9
EA	139.1	129.6	126.4	121.3	115.9	106.6	77.1	76.3
OP	8.0	7.8	7.6	7.4	7.1	6.6	5.1	5.1
CM-breeding	84.1	73.8	70.7	66.2	61.3	52.7	22.4	22.2
LB-breeding	190.1	180.0	176.4	170.6	164.3	153.9	122.9	121.6
LB-non-breeding	14.5	12.8	12.2	11.5	10.7	9.2	4.2	4.1
HG-breeding	11.9	11.7	11.5	11.3	11.1	10.7	10.0	9.9
HG-non-breeding	108.3	89.8	84.6	77.1	68.7	54.1	0.0	0.0
GB-breeding	9.9	8.5	8.1	7.5	6.9	5.7	1.5	1.4
GB-non-breeding	37.9	34.4	33.3	31.7	30.0	27.0	17.0	16.8
K	31.1	28.0	27.0	25.6	24.0	21.3	12.1	12.0
ML	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
PE	4.1	4.0	4.0	3.9	3.8	3.7	3.5	3.4

Table A7.7.2.3. Predicted transits from the VP averaging model at the all VPs scale.

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
BY	5.8	5.7	5.7	5.6	5.5	5.4	5.1	5.0
BZ	138.7	126.8	123.1	117.3	111.0	100.3	64.4	63.7
CA	1.9	1.5	1.5	1.3	1.2	0.9	0.0	0.0
CM-breeding	273.4	240.1	230.4	215.8	200.0	172.4	75.4	74.5
CM-non-breeding	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS	10.4	10.6	10.5	10.4	10.2	10.0	9.5	9.4
EA	213.2	199.0	194.2	186.6	178.4	164.4	119.8	118.5
GB-breeding	146.3	135.8	132.3	126.9	121.1	111.2	79.7	78.9
GB-non-breeding	28.8	26.8	26.2	25.1	24.0	22.2	16.3	16.1
H	15.7	15.6	15.4	15.1	14.8	14.2	12.7	12.6
HG-breeding	1220.6	1183.8	1167.5	1139.7	1110.6	1063.3	949.0	938.6
HG-non-breeding	3268.8	2717.5	2563.2	2336.6	2088.0	1651.2	34.9	34.5
K	270.3	243.2	235.0	222.5	208.9	185.5	105.4	104.3

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
LB-breeding	224.2	210.3	205.6	198.1	190.1	176.6	135.2	133.7
LB-non-breeding	172.9	163.0	159.6	154.2	148.4	138.8	110.4	109.2
MA	63.7	59.8	58.5	56.5	54.3	50.6	39.7	39.3
ML	1.1	0.9	0.8	0.8	0.7	0.5	0.0	0.0
OP	15.4	13.7	13.1	12.3	11.4	9.9	4.3	4.3
PE	2.6	2.5	2.5	2.5	2.4	2.3	2.2	2.2
SH	51.3	48.9	47.9	46.4	44.8	42.2	34.5	34.1
SN	5.9	5.6	5.5	5.3	5.1	4.8	4.0	3.9
WE	10.6	10.3	10.1	9.9	9.6	9.2	8.3	8.2
WS	171.2	162.6	159.5	154.4	149.0	140.0	113.7	112.5

Table A7.7.2.4. Predicted transits from the VP averaging model at the main VPs scale.

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
BY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BZ	130.7	120.7	117.4	112.4	106.9	97.6	67.4	66.7
CA	5.7	4.7	4.4	4.1	3.6	2.8	0.0	0.0
CM-breeding	70.7	62.0	59.4	55.6	51.5	44.3	18.9	18.6
CM-non-breeding	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EA	169.6	158.6	154.8	148.8	142.3	131.3	96.3	95.3
GB-breeding	11.4	9.8	9.3	8.6	7.8	6.4	1.4	1.4
GB-non-breeding	36.0	33.5	32.7	31.4	30.0	27.7	20.4	20.2
H	5.3	5.4	5.3	5.2	5.1	4.9	4.2	4.1
HG-breeding	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HG-non-breeding	4134.9	3429.7	3232.6	2943.3	2625.8	2067.7	0.0	0.0
K	32.0	28.5	27.5	25.9	24.2	21.3	11.2	11.0
LB-breeding	188.5	179.4	176.1	170.6	164.8	155.1	127.2	125.9
LB-non-breeding	15.9	14.0	13.5	12.6	11.7	10.1	4.5	4.5
MA	13.4	12.2	11.8	11.3	10.7	9.6	6.2	6.2
ML	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
OP	9.6	9.2	9.1	8.8	8.5	7.9	6.2	6.1
PE	3.7	3.6	3.6	3.5	3.5	3.3	3.1	3.1

Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
SH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WS	238.1	225.5	221.0	213.8	206.1	193.3	155.9	154.2

Table A7.7.2.5. Predicted transits from the Golden Eagle altitudinal bands Stage 1 model.

Zone	GE164	N163	V162	E160	GE158	SG155	V150	N149
0-160 m	46.8	44.0	43.0	41.4	39.7	36.9	27.9	27.6
160-210 m	16.6	15.5	15.2	14.6	14.0	12.9	9.6	9.5

Table A7.7.2.6. Predicted transits from the Golden Eagle Golden Eagle Topography Stage 1 model.

Zone	GE164	N163	V162	E160	GE158	SG155	V150	N149
GET 1-5	17.4	16.6	16.3	15.8	15.2	14.3	11.7	11.6
GET 6-8	32.2	29.9	29.1	27.9	26.6	24.4	17.3	17.1
GET 9-10	27.9	25.8	25.1	24.0	22.9	20.9	14.6	14.4

Table A7.7.2.7. Predicted transits from the Common Gull Stage 1 model.

Turbine	Transits
GE164	167.4
N163	146.8
V162	140.8
E160	131.8
GE158	122.0
SG155	104.9
V150	44.7
N149	44.2

Collision probability results

Table A7.7.2.8. Collision probability values from the Stage 2 model.

Species	GE164	N163	V162	E160	GE158	SG155	V150	N149
WS	0.068	0.069	0.070	0.066	0.069	0.074	0.073	0.076
BY	0.047	0.049	0.050	0.048	0.049	0.053	0.052	0.054
MA	0.044	0.045	0.046	0.044	0.045	0.050	0.048	0.050
CA	0.055	0.057	0.058	0.054	0.056	0.061	0.060	0.062
H.	0.065	0.067	0.068	0.063	0.066	0.072	0.070	0.073
WE	0.061	0.063	0.064	0.060	0.063	0.068	0.067	0.069
SH	0.042	0.043	0.045	0.042	0.043	0.048	0.047	0.048
BZ	0.050	0.051	0.053	0.050	0.051	0.056	0.055	0.056

Species	GE164	N163	V162	E160	GE158	SG155	V150	N149
EA	0.061	0.062	0.063	0.059	0.062	0.067	0.066	0.068
OP	0.052	0.053	0.055	0.052	0.053	0.058	0.057	0.059
GP	0.038	0.039	0.040	0.039	0.039	0.044	0.042	0.043
CS	0.036	0.037	0.038	0.037	0.037	0.041	0.040	0.041
SN	0.037	0.038	0.039	0.038	0.038	0.042	0.041	0.042
CM	0.044	0.046	0.047	0.045	0.046	0.051	0.049	0.050
LB	0.050	0.051	0.052	0.050	0.051	0.056	0.054	0.056
HG	0.051	0.052	0.053	0.050	0.052	0.057	0.056	0.057
GB	0.053	0.054	0.056	0.052	0.054	0.059	0.058	0.060
K.	0.044	0.045	0.047	0.044	0.045	0.050	0.049	0.050
ML	0.041	0.043	0.044	0.042	0.043	0.047	0.046	0.047
PE	0.045	0.047	0.048	0.045	0.046	0.051	0.050	0.051

Collision risk predictions

Table A7.7.2.9. Collision risk predictions for each turbine type for Golden Eagle and Common Gull.

Turbine	Golden Eagle		Common Gull
	alt bands	GET bands	
GE164	0.056	0.068	0.087
N163	0.053	0.064	0.077
V162	0.050	0.061	0.072
E160	0.050	0.061	0.070
GE158	0.049	0.059	0.065
SG155	0.046	0.055	0.058
V150	0.034	0.040	0.024
N149	0.036	0.042	0.026

Table A7.7.2.10. Collision risk predictions for each turbine type for the other species / populations.

Species/ Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
WS	0.18	0.18	0.18	0.16	0.16	0.16	0.13	0.13
BY	0.00046	0.00048	0.00048	0.00045	0.00045	0.00049	0.00045	0.00046
MA	0.047	0.046	0.046	0.042	0.041	0.043	0.033	0.033
CA	0.0017	0.0015	0.0014	0.0012	0.0011	0.00097	0	0
H	0.017	0.018	0.018	0.016	0.017	0.017	0.015	0.016
WE	0.028	0.027	0.028	0.025	0.026	0.027	0.023	0.024
SH	0.037	0.036	0.036	0.034	0.033	0.034	0.027	0.028
BZ	0.12	0.11	0.11	0.099	0.096	0.096	0.06	0.061

Species/ Population	GE164	N163	V162	E160	GE158	SG155	V150	N149
OP	0.014	0.012	0.012	0.011	0.01	0.0098	0.0042	0.0043
CS	0.0063	0.0067	0.0069	0.0065	0.0064	0.007	0.0065	0.0065
LB-breeding	0.047	0.046	0.046	0.042	0.041	0.042	0.031	0.032
LB-non-breeding	0.036	0.035	0.036	0.033	0.032	0.033	0.026	0.026
HG-breeding	0.26	0.26	0.26	0.24	0.25	0.26	0.22	0.23
HG-non-breeding	0.88	0.75	0.72	0.62	0.57	0.5	0.0055	0.0056
GB-breeding	0.033	0.031	0.031	0.028	0.028	0.028	0.02	0.02
GB-non-breeding	0.0065	0.0062	0.0062	0.0056	0.0055	0.0056	0.004	0.0041
K	0.51	0.47	0.47	0.42	0.4	0.4	0.22	0.22
ML	0.00076	0.00065	0.00063	0.00055	0.00049	0.00043	0	0
PE	0.002	0.002	0.002	0.0019	0.0019	0.002	0.0019	0.0019

The collision risk predictions in this table were calculated using the transit data from: the combined VPs models at the main VPs scale for Whooper Swan and non-breeding Herring Gull; the VP averaging models at the all VPs scale for Barnacle Goose, White-tailed Eagle, Common Sandpiper, and Merlin; and the VP averaging models at the main VPs scale for the other populations.