3. CONSIDERATION OF REASONABLE ALTERNATIVES

3.1 Introduction

Article 5(1)(d) of Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification) as amended by Directive 2014/52/EU (the EIA Directive) requires that the EIAR prepared by the developer contains *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment."*

Article 5(1)(f) of the EIA Directive requires that the EIAR contains *"any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."*

Annex IV of the EIA Directive states that the information provided in an Environmental Impact Assessment Report (EIAR) should include a *"description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This section of the EIAR contains a description of the reasonable alternatives that were studied by the developer, which are relevant to the proposed project and its specific characteristics, in terms of site location and other renewable energy technologies as well as site layout incorporating size and scale of the project, connection to the national grid and transport route options to the site. This section also outlines the design considerations in relation to the wind farm, including the associated substation, construction compound and borrow pits. It provides an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

The consideration of alternatives is an effective means of avoiding environmental impacts. As set out in the '*Draft Guidelines on The Information to be Contained in Environmental Impact Assessment Reports' (Environmental Protection Agency, 2017),* the presentation and consideration of reasonable alternatives investigated is an important part of the overall EIA process.

Hierarchy

EIA is concerned with projects. The Environmental Protection Agency's draft guidelines (EPA, 2017) state that in some instances neither the applicant nor the competent authority can be realistically expected to examine options that have already been previously determined by a higher authority, such as a national plan or regional programme for infrastructure which are examined by means of a Strategic Environmental Assessment, the higher tier form of environmental assessment.

Non-environmental Factors

EIA is confined to the potential significant environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility or planning considerations.

Site-specific Issues

The EPA guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

3.1.2 Methodology

The EU Guidance Document (EU, 2017) on the preparation of EIAR outlines the requirements of the EIA Directive and states that, in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

There is limited European and National guidance on what constitutes a 'reasonable alternative' however the EU Guidance Document (EU, 2017) states that reasonable alternatives "*must be relevant to the proposed project and its specific characteristics, and resources should only be spent assessing these alternatives*".

The guidance also acknowledges that "*the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative*".

The current Draft EPA Guidelines (EPA, 2017) state that "*It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account is deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required.*"

Consequently, taking consideration of the legislation and guidance requirements into account, this chapter addresses alternatives under the following headings:

- 'Do Nothing' Alternative;
- Alternative Locations;
- Alternative Technologies;
- Alternative Turbine Layouts and Development Design; and,
- Alternative Mitigation Measures.

Each of these is addressed in the following sections.

When considering a wind farm development, given the intrinsic link between layout and design, the two will be considered together in this chapter.

While environmental considerations have been at the core of the decision-making process for all of the project processes and infrastructure components, it should be noted that the majority of alternative options considered under the headings listed above are unlikely to have had significantly, greater environmental effects than the chosen option.

3.2 'Do-Nothing' Alternative

Article IV, Part 3 of the EIA Directive states that the EIAR should include "*an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline* *scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge."* This is referred to as the "do nothing" alternative. EU guidance (EU, 2017) states that this should involve the assessment of "an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario."

An alternative land-use option to the development of a renewable energy project at the proposed development site would be to leave the site as it is, with no changes made to existing land-use practices. Commercial forestry operations would continue at the site.

In implementing the 'Do-Nothing' alternative, however, the opportunity to capture a significant part of the country's renewable energy resource would be lost, as would the opportunity to contribute to meeting Government and EU targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. The opportunity to generate local employment, local authority development contributions, rates and investment in the local area would also be lost. Also, the proposed amenity walkways and associated carpark would not be constructed and therefore this recreational opportunity would be lost. On the basis of the positive environmental effects arising from the project, when compared to the do-nothing scenario, therefore the do–nothing scenario was not the chosen option.

The existing surrounding commercial forestry operations can and will continue in conjunction with this proposed use of the site.

A comparison of the potential environmental effects of the 'Do-Nothing' Alternative (wind farm is not developed) when compared against the chosen option of developing a renewable energy project at this site are presented in Table 3-1 below.

Table 3-1 Comparison of environmental effects when compared against the chosen option (developing the proposed wind farm at this site)

Environmental Consideration	Do Nothing Alternative (existing land uses continue)
Population & Human Health (incl. Shadow Flicker)	No increase in local employment and no long-term financial contributions towards the local community. No potential for shadow flicker to affect sensitive receptors.
Biodiversity & Ornithology	No habitat loss
Land, Soils & Geology	No excavation of large volumes of peat and spoil
Geotechnical/Peat Stability	Neutral
Water (Hydrology & Hydrogeology)	Neutral
Air & Climate	Will not provide the opportunity for an overall increase in air quality or reduction of greenhouse gasses. Will not assist in achieving the renewable energy targets set out in the Climate Action Plan.
Noise & Vibration	No potential for noise impacts on nearby sensitive receptors.
Landscape & Visual	Landscape and visual impacts avoided.

Environmental Consideration	Do Nothing Alternative (existing land uses continue)
Cultural Heritage & Archaeology	No potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Large volume of construction traffic avoided

3.3 Alternative Locations

3.3.1 Strategic Site Screening

In 2014, Coillte's Renewable Energy Development Team (now FuturEnergy Ireland, refer to Section 1.3 of Chapter 1) undertook a detailed screening process, through Geographical Information Spatial software (GIS), using a number of criteria and stages to assess the potential of a large number of possible sites, on lands within its stewardship (c. 441,000 hectares), suitable to accommodate a wind energy development. The GIS database drew upon a wide array of key spatial datasets such as forestry data, ordnance survey land data, house location data, transport, existing wind energy and grid infrastructure data and environmental data such as ecological designations, landscape designations and wind energy strategy designations available at the time.

The following is a summary of the methodology used in the screening process. The screening process included the following phases:

- Phase 1 – Initial Screening
- Phase 2 - Grid Constraints
- Phase 3 - Screening

3.3.1.1 Phase 1 – Initial Screening

This initial stage in the selection process discounted lands that were not available for development under a number of criteria, as follows:

- Committed Lands for other developments
- Millennium Sites (This is a Coillte environmental designation – these sites were planted and managed for provision of a tree for every household in the country as part of the Millieneum tree planting project)
- Life Site (This is a Coillte environmental designation – these former forested sites were cleared and are managed for biodiversity)
- Wild Nephin Properties (This is a Coillte designation. Since 2014 these properties have been incorporated into National parks)
- Farm Partnerships and Leased Lands
- National Parks
- Natura 2000 and Nationally Designated Sites (SAC, SPA, NHA, pNHA)

Coillte also reviewed the relevant local authority's County Development Plan (CDP) and/or Renewable Energy Strategy (RES) provisions and did not proceed with further analysis where the policy context was not supportive of wind farm development. In this regard, areas were not brought forward for further analysis if they were not identified as being at least "open for consideration" for wind farm development.

Lands where the average wind speed at 80 metres above ground level is less than 7 m/s and, therefore, potentially not suitable for a commercially viable wind energy development were also discounted at this stage. In addition, sites with a contiguous area of less than 300 hectares were discounted.

3.3.1.2 Phase 2 – Grid Constraints

As part of the site selection process, it was necessary to consider the potential for grid connection, including in terms of distance to potential connection nodes and the grid capacity at the nodes, in the local area, to accommodate the connection.

3.3.1.3 Phase 3 – Screening

As part of the next stage of screening, the following were considered when screening out lands from further analysis:

- Sensitive Amenity or Scenic Areas designation in CDPs (at the time of the screening process)
- Tourist areas/sites/trails
- Lands utilised for other wind farm developments
- Telecommunications masts and links
- Sensitive habitat/species of bird
- Land Ownership title Issues,
- Relatively high residential density in vicinity
- Unfavourable slopes and ground conditions

This stage of screening was generally applied using Coillte's in-house expertise and local knowledge, and was subsequently validated by MKO, in 2014, in terms of the engineering considerations and the likelihood of obtaining a successful grant of planning permission based on industry trends.

3.3.2 Results of the Screening Process

The application of the above criteria, to identify a site relevant to the project and its specific characteristics, resulted in the selection of a site known as Glenard, located north of Eskaheen Mountain, Inishowen in Co. Donegal as a candidate site to be brought forward for more detailed analysis. Figure 3-1 shows the initial boundary of the Glenard site.

Sites that also emerged from the site selection process, outlined in Section 3.3.1 above, for which Coillte have submitted or are in the process of preparing separate planning applications are:

- Carrownagowan, Co. Clare
- Croagh, Co. Leitrim/Sligo
- Bottlehill, Co. Cork
- Castlebanny, Co. Kilkenny

Coillte has brought forward some of these landholdings and intends to bring forward the remainder for wind energy development as all were considered by Coillte to be viable sites for a wind energy project. Each are projects in their own right which will be subject to EIA. As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option with regards to their environmental impacts will be provided in the EIAR accompanying the applications for same.

At the time of writing this EIAR, applications for permissions to construct wind energy developments at the Croagh, Carrownagowan, Castlebanny and Bottlehill sites have been submitted and are under consideration by the relevant planning authorities.

The alternative would be to bring forward a site that did not pass one or all of the above phases of the screening process. In that instance, there would be the potential for the construction and operation of a wind energy development to have an adverse effect on ecologically designated or sensitive areas and visually sensitive (scenic) or amenity areas. There would also be the potential for greater shadow flicker, noise and traffic impacts if the candidate site was located in an area with a higher number of residential dwellings. Numerous third-party land agreements would also be required to ensure a site of adequate size, (ie. a 300ha contiguous site area). In addition, a site with an average wind speed less than 7m/s (at 80m above ground level) and/or not located within practical proximity of existing grid infrastructure may not be economically viable.

3.3.3 Suitability of the Candidate Site

Glenard, as a candidate site, was further examined under the following headings in order to confirm its suitability for wind energy development.

- Planning Policy
- Proximity of Existing Grid Infrastructure
- Designated Sites
- Average Wind Speeds
- Population Density

3.3.3.1 Planning Policy

The Donegal County Development Plan 2018-2024 (CDP) is the principal policy instrument used to manage change in land use within the County. The Plan sets out the Planning Authority's strategic land use objectives and policies for the overall development of the County over the 6 year life of the Plan (to 2024) and beyond to a 20 year timeframe (to 2038). This spatially based strategic framework seeks to manage and coordinate change in land use in the County setting out a clear view ahead in development terms together with clear priorities to drive growth. On the subject of the development of energy within the County it is an aim of the CDP to:

> *"facilitate the development of a diverse energy portfolio by the sustainable harnessing of the potential of renewable energy including ocean energy, bioenergy, solar, wind and geothermal, along with the sustainable use of oil and gas, and other emerging energy sources in accordance with National Energy policy and guidance. It is also an aim to facilitate the appropriate development of associated infrastructure to enable the harnessing of these energy resources and to promote and facilitate the development of Donegal as a Centre of Excellence for Renewable Energy."*

The CDP outlines that in terms of wind speed and its consistency the County is 'ideally located on the North-West Atlantic coast'. Under the County Development Plan's Economic Development Strategy it is the express target to maximise appropriate development to support and create a sustainable local renewable energy market place as follows:

- **ED-O-9:** To maximise the appropriate development of the county's renewable energy resources and to support and facilitate the creation of a sustainable local renewable energy market place in Donegal from where energy operators can transport, store, trade and export their "local renewable energy product" to domestic and non-domestic markets subject to environmental designations and amenity considerations.

The Wind Energy Map (Map 8.2.1) of the County Development Plan was included in the plan which identified three policy/zone areas for the development of wind farms within the county. In November 2018, a judicial review of the plan resulted in the High Court omitting Map 8.2.1 from the County Development Plan. The following note was listed within the County Development Plan which references the above:

> *"By Order made on the 5th day of November, 2018, in proceedings bearing Record Number 2018/533JR between Planree Limited, Applicant and Donegal County Council, Respondent, certain provisions of the County Donegal Development Plan 2018-2024, being Section 6.5(c) and (f) of the Wind Energy standards at Part B: Appendix 3, Development Guidelines and Technical Standards and Map 8.2.1 as contained in the County Donegal Development Plan 2018-2024 as published were ordered to be deleted and/or removed from the County Donegal Development Plan 2018-2024. The Development Plan should be read in light of the Order in question pending any possible future variation of same."*

Donegal County Council at the time of lodgement have yet to publish a revised Wind Energy Map following on from this removal.

Although it is fully acknowledged that map 8.2.1 has been set aside and is no longer part of the CDP the current site is located wholly within an area which was designated as '*Open to Consideration*'.

There are a range of provisions within the CDP that support the provision of renewable energy, including the objectives listed in Section 2.2.7 of Chapter 2 of this EIAR.

3.3.3.2 Existing Grid Infrastructure

The Glenard site is located within close proximity of 2 no. existing electricity substations and therefore a wind energy development at this location has multiple options for connection to the national electricity grid. The 110kV Trillick substation is located 5.5km southwest of the candidate site boundary at its closest point. The 110kV Sorne substation is located 2.3km northwest of the Glenard candidate site boundary.

3.3.3.3 Designated Sites

The nearest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA), to the candidate site is Lough Foyle SPA, located approximately 3.65 kilometres southeast of the proposed development site at its closest point. The nearest SACs are the Magheradrumman Bog SAC and the Lough Swilly SAC, located approximately 7.7 kilometres northeast and west of the site respectively.

Camowen River Bog Natural Heritage Area (NHA) is located approximately 170 metres from the northern boundary of the Glenard site.

3.3.3.4 Average Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Authority of Ireland (SEAI) shows average wind speeds for the country. With the upland nature of the landscape, the Wind Atlas shows that wind speeds on the proposed development site range from 7.8m/s to 9.2m/s at a 100m elevation. Such wind speeds indicate that this site is viable for commercial wind energy development. On-site monitoring of the wind resource, which is ongoing, will further verify that with a sufficient turbine height and blade diameter, the wind resource of the site is commercially viable.

3.3.3.5 Population Density

As described above, the Applicant sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity, the study area has emerged as suitable to accommodate the proposal. The population density of the Three Trees District Electoral Division within which the candidate site is located is 23.8 persons per square kilometre. This is less than the average rural area population density of 27 persons per square kilometre and significantly lower than the average national population density of 68.1 persons per square kilometre.

3.3.3.6 Summary

The Glenard site is located within an existing commercial forestry property which allows the site to take advantage of existing access roads. This, when combined with the relatively close proximity of two existing 110kV substations and associated electricity transmission infrastructure, further highlights the suitability of the site as it can make further sustainable use of these established items of infrastructure.

The Glenard site does not overlap with any environmental designations and is also located in an area with a very low population density, relative to the national average, with viable annual wind speeds.

The purpose of the site screening exercise in 2014 outlined in Section 3.3.1, above, was to identify areas within Coillte's nationwide portfolio, that would be capable of accommodating a wind farm development while minimising the potential for adverse impact on the environment. In order to satisfy this requirement, significant landholdings that would yield a sufficient viable area for the siting of each element of the proposed development was required (ie. sites with a contiguous area of more than 300 hectares as described in Stage 1 of the screening process).

While the outcome of the site screening process has identified the site of the current proposal as a suitable location for a wind farm development of the nature proposed, it does not preclude other sites within Coillte's portfolio being brought forward for consideration in the future. Coillte continuously examines the lands under its stewardship for further candidate sites for wind energy development.

3.4 Alternative Renewable Energy Technologies

Although the 2014 screening exercise was based on identifying lands for wind development; a reasonable alternative source of renewable electricity generation, namely solar, was considered based on the scale and current land-use of the Glenard site that emerged.

Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). To achieve the same maximum electricity output, as is expected from the proposed wind energy development (c.93MW), from solar energy would require a significantly larger development footprint. In this instance, the proposed wind energy development requires approximately 80.5 hectares of commercial forestry to be permanently felled. A solar PV array of the scale necessary to provide the same electricity output would require the permanent felling of approximately 148 hectares of commercial forestry. In addition, a solar development, of this scale, would have a higher potential environmental effect on Hydrology and Hydrogeology, Traffic and Transport (construction phase) and Biodiversity and Birds (habitat loss, glint and glare) at the site.

For the reasons set out above, the proposal for a wind energy development at this site is considered to be the most efficient method of electricity production with the lesser potential for significant, adverse environmental effects.

A comparison of the potential environmental effects of the development of a solar PV array when compared against the chosen option of developing the proposed wind farm at this site are presented in Table 3-2 below.

Table 3-2 Comparison of environmental effects when compared against the chosen option (wind turbines)

Environmental Consideration	Solar PV Array (with a 93MW output)
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors. Potential for glint and glare impacts on local road users and residential receptors.

Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss. Potential for glint and glare impacts on birds.
Land, Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated.
Geotechnical/Peat Stability	Shallower excavations involved in solar PV array developments would decrease the potential for peat instability.
Hydrology & Hydrogeology	A solar PV array development would require a significantly larger area of forestry to be felled therefore increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.
Noise & Vibration	Less potential for noise impacts on nearby sensitive receptors.
Landscape & Visual	Potentially less visible from surrounding area due to screening from forestry and topography.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to the number of solar panels required to achieve the same output.

3.4.1 Alternative Turbine Numbers and Turbine Models

The proposed wind turbines will each have a potential power output in the 4 to 6.2 megawatt (MW) range. It is proposed to install 15 turbines at the site which could achieve a minimum output of 60MW and a maximum output of 93MWoutput. Such a wind farm could also be achieved on the proposed site by using smaller turbine technology (for example 2.5 MW machines). However, this would necessitate the installation of between 24 and 38 turbines to achieve a similar output range. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the site.

A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the site, with a larger amount of supporting infrastructure being required (i.e. roads etc.) and increasing the potential for negative environmental impacts to occur on biodiversity, hydrology and traffic and transportation.

The use of alternative smaller turbines at this site would not be appropriate as they would fail to make the most efficient use of the wind resource passing over the site. Furthermore, the increased use of materials, excavation and movement of peat and increase in visual impact associated with a larger number of smaller turbines would result in a higher level of negative environmental effects than the chosen option.

The proposed wind turbines to be installed on the site will have a ground-to-blade tip height, hub height and blade length within the following, limited, ranges:

- Turbine Tip Height – Maximum height 173 metres, Minimum height 162 metres
- Hub Height – Maximum height 107 metres, Minimum height 96 metres
- Blade Length: - Maximum length 70 metres, Minimum length 66 metres.

For the purposes of this EIAR a range of turbines within the proposed dimensions has been assessed (e.g. tallest turbine within defined range has been assessed for visual impact, widest rotor diameter within the defined range has been assessed for shadow flicker etc.). The EIAR therefore provides a robust assessment of the turbines that could be considered within the overall development description.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in Table 3-3 below.

Table 3-3 Comparison of environmental effects when compared against the chosen option (larger wind turbines)

Environmental Consideration	Larger number of smaller turbine models
Population & Human Health (incl. Shadow Flicker)	Greater potential for shadow flicker impacts on nearby sensitive receptors due to the increased number of turbines.
Biodiversity & Ornithology	Larger development footprint would result in greater habitat loss. Greater potential collision risk for birds due to the presence of more turbines
Land, Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated and managed.
Geotechnical/Peat Stability	Neutral
Water (Hydrology and Hydrogeology)	Larger development footprint, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Increased potential for vehicle emissions and dust emissions due to an increased volume of construction material and turbine component deliveries to the site.
Noise & Vibration	Potential for increased noise levels at nearby sensitive receptors due to reduced separation distance between residential dwellings and turbine locations.
Landscape & Visual	A larger number of turbines would have a greater landscape and visual impact.
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.5 Alternative Turbine Layout and Development Design

The design of the proposed development has been an informed and collaborative process from the outset, involving the designers, developers, engineers, environmental, hydrological and geotechnical, archaeological specialists and traffic consultants. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, near neighbours / the local community and local authorities as detailed in Sections 2.4 and 2.5 of Chapter 2.

The aim of the process being to reduce the potential for environmental effects while designing a project capable of being constructed and viable.

Throughout the preparation of the EIAR, the layout of the proposed development has been revised and refined to take account of the findings of all site investigations, baseline assessments and external feedback received from the local community, which have brought the design from its first initial layout to the current proposed layout.

3.5.1 Detailed Constraints Mapping

The design and layout of the proposed wind energy development follows the recommendations and guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006) and the 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012.

The 'Wind Energy Development Guidelines for Planning Authorities' (DoEHLG, 2006) were subject to a targeted review 2013. Currently, the proposed changes to the development management standards associated with onshore wind energy developments are outlined in the Draft Revised Wind Energy Development Guidelines, December 2019 (Draft WEGs 2019).

The constraints mapping process involves the placing of buffers (separation distance) around different types of constraints so as to identify clearly the areas within which no development works will take place if possible. The size of the buffer zone for each constraint has been assigned using standards presented in the wind energy guidance documents listed above. The constraints maps for the site encompasses the following constraints and associated buffers:

- Residential dwellings plus a minimum 700 metre buffer (exceeding the requirement of 4 x tip height separation distance as required by the Draft WEGs 2019) (Refer to Chapter 5 of EIAR);
- Designated sites plus 100 metre buffer (Refer to Chapter 6 of EIAR);
- Hen Harrier Roost Exclusion Zone (Refer to Chapter 7 of EIAR);
- Rivers and streams plus 50 metre buffer (Refer to Chapter 9 of EIAR);
- Recorded Archaeological Sites and Monuments plus 50 metre buffer.
- Telecommunications buffer plus operator-specified buffer (refer to Section 14.2 of EIAR;
- Existing wind turbines setback. Facilitators at the site build on the existing advantages and include the following:
- Available lands for development;
- Separation distance from neighbouring landowners;
- Good wind resource;
- Existing access points and general accessibility of all areas of the site due to existing road infrastructure; and
- Limited extent of constraints.

For clarity, the constraints map is presented in two parts. Environmental constraints are presented in Figure 3-1a and the physical (telecommunications and other infrastructure) and residential constraints are presented in Figure 3-1b. The inclusion of the detailed, combined constraints on a map of the EIAR Site Boundary allows for a viable area to be identified as shown in Figure 3-1c.

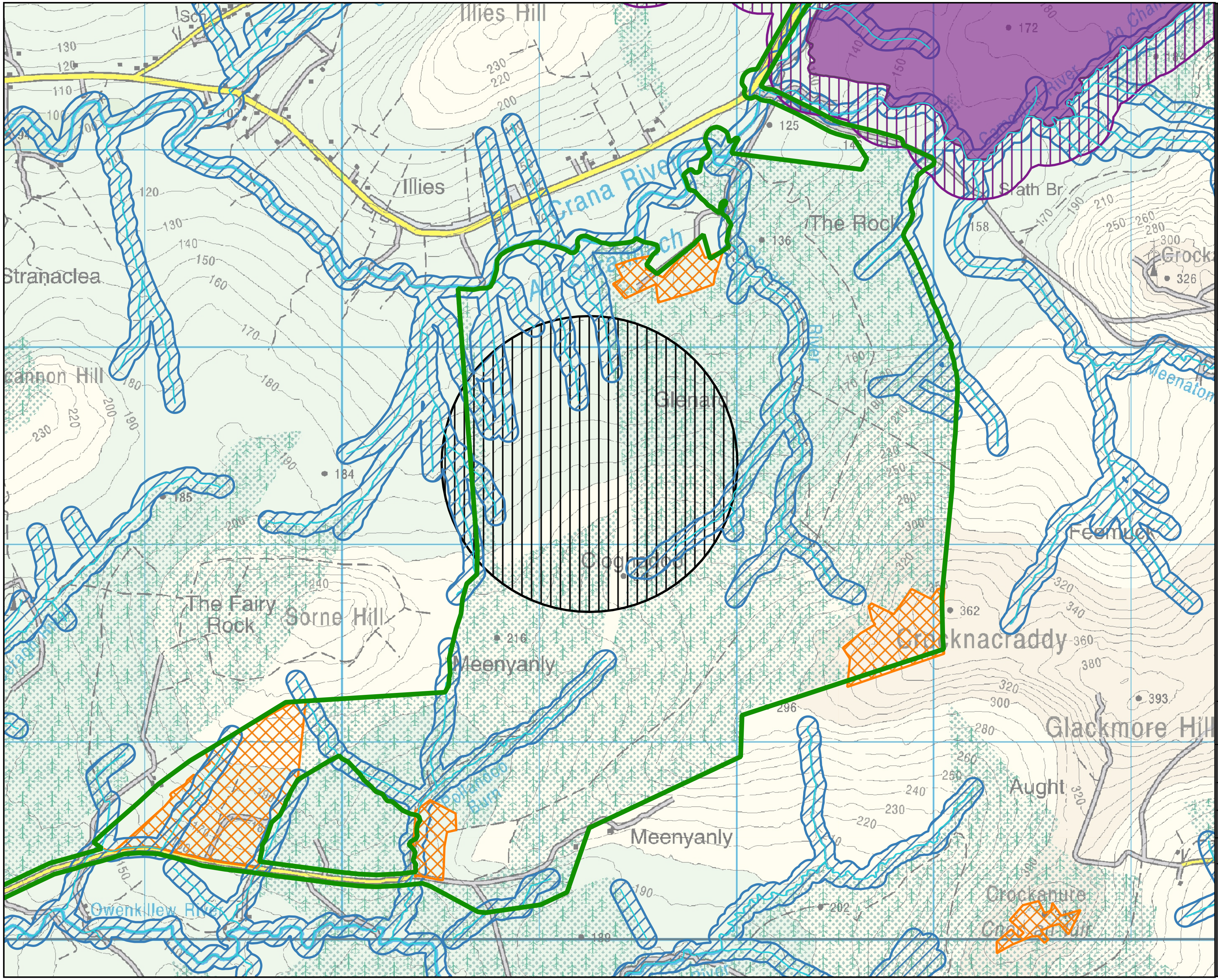
A turbine layout was then developed to take account of all the constraints mentioned above including their associated buffer zones and the separation distance required between them.

Following the mapping of all known constraints described above, detailed site investigations were carried out by the project team. The ecological assessment of the site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in Chapters 6 and 7 of this EIAR, informed the decision on the siting of turbines and the carrying out of any development works, such as the construction of roads. The hydrological and geotechnical investigations of the site examined the proposed locations for turbines, roads and other components of the proposed development, such as the substation and the construction compound. Where specific areas were deemed as being unsuitable (e.g. due to sensitive habitat, unmapped watercourse, poor ground conditions) for the siting of turbines or roads, etc., alternative infrastructure locations within the Glenard site were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm was also informed by wind data and the results of noise assessments as they became available.

3.5.2 Turbine Layout

The final proposed turbine layout takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on a combination of the results of all site investigations and surveys that have been carried out during the EIAR process, the community engagement process that began in July 2019 (e.g. landscape and visual sensitivities of nearby residents was taken into consideration) and the scoping with statutory and non-statutory consultees. As information regarding the site of the proposed development was compiled and assessed, the proposed layout has been revised and amended to take account of the physical constraints of the site and the requirement for buffer zones and availability of land as well as cumulative impacts.

The selection of turbine number and layout has also had regard to wind-take, noise and shadow flicker impacts and the separation distance between turbines. The EIAR and wind farm design process was an iterative process, where findings at each stage of the assessment were used to further refine the turbine layout, always with the intention of minimising the potential for environmental impacts.



Map Legend

- EIAR Site Boundary
- Watercourses
- 50m Watercourse Buffer
- Natural Heritage Area (NHA)
- 200m Natural Heritage Area Buffer
- Hen Harrier 750m Exclusion Zone
- Sensitive Habitats

Drawing Title	Environmental Constraints Map
Project Title	190114 - Glenard Windfarm
Drawn By: Shaun Doolin	Checked By: Eoin McCarthy
Project No.: 190114	Drawing No.: Figure 3-1a
Scale: 1:25000	Date: 18.01.2022

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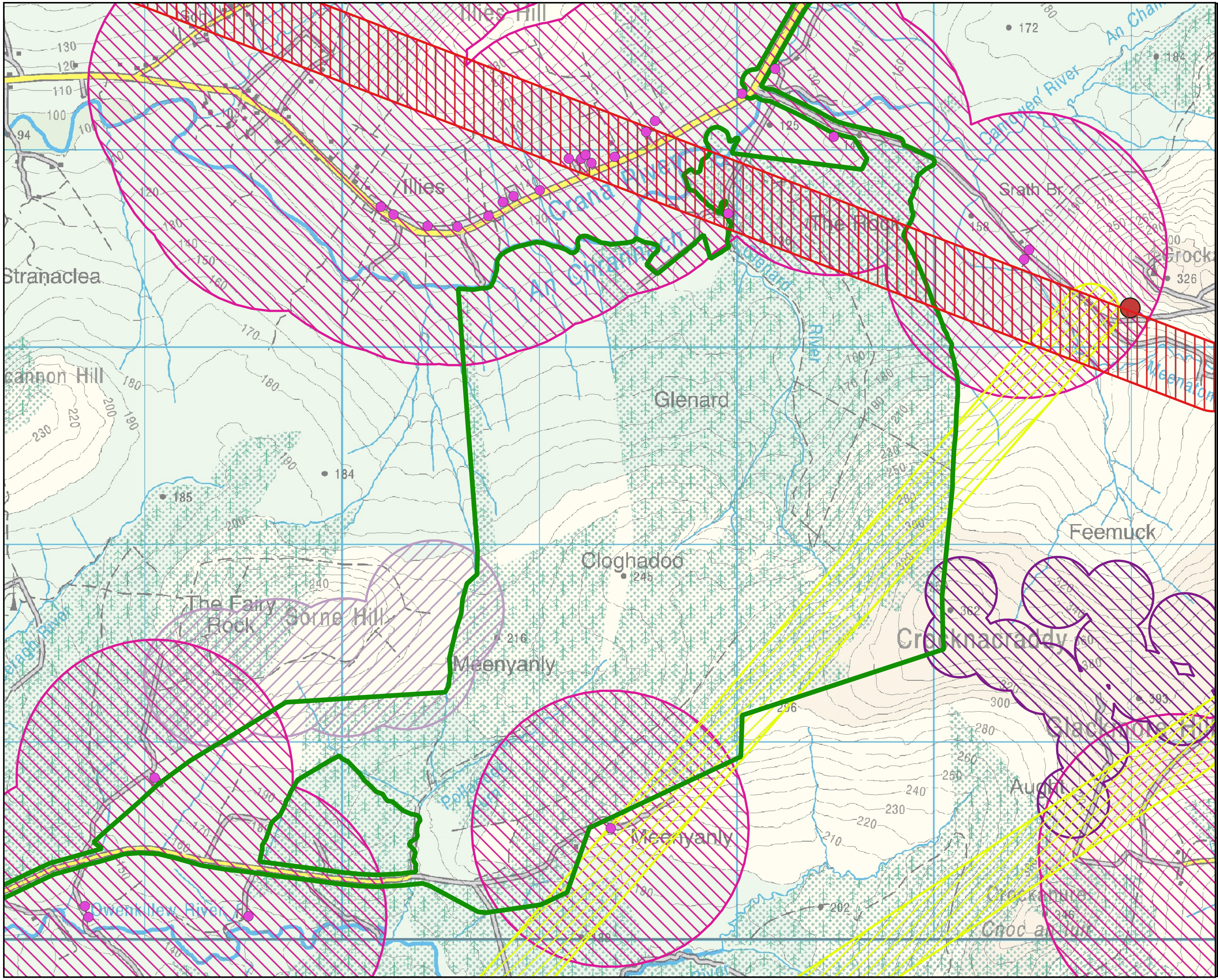

Map Legend

- EIAR Site Boundary
- Dwellings
- 700m Dwelling Buffer
- 50m Monument Buffer
- 168m Airspeed Telecom Link Buffer
- 143m ESB Telecom Link Buffer (Link to be decommissioned prior to operation of proposed development)
- 350m Sorne Hill Buffer
- 180m Aught Turbine Buffer

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Drawing Title	Physical and Residential Constraints Map
Project Title	190114 - Glenard Windfarm
Drawn By: Shaun Doolin	Checked By: Eoin McCarthy
Project No.: 190114	Drawing No.: Figure 3-1b
Scale: 1:25000	Date: 18.01.2022

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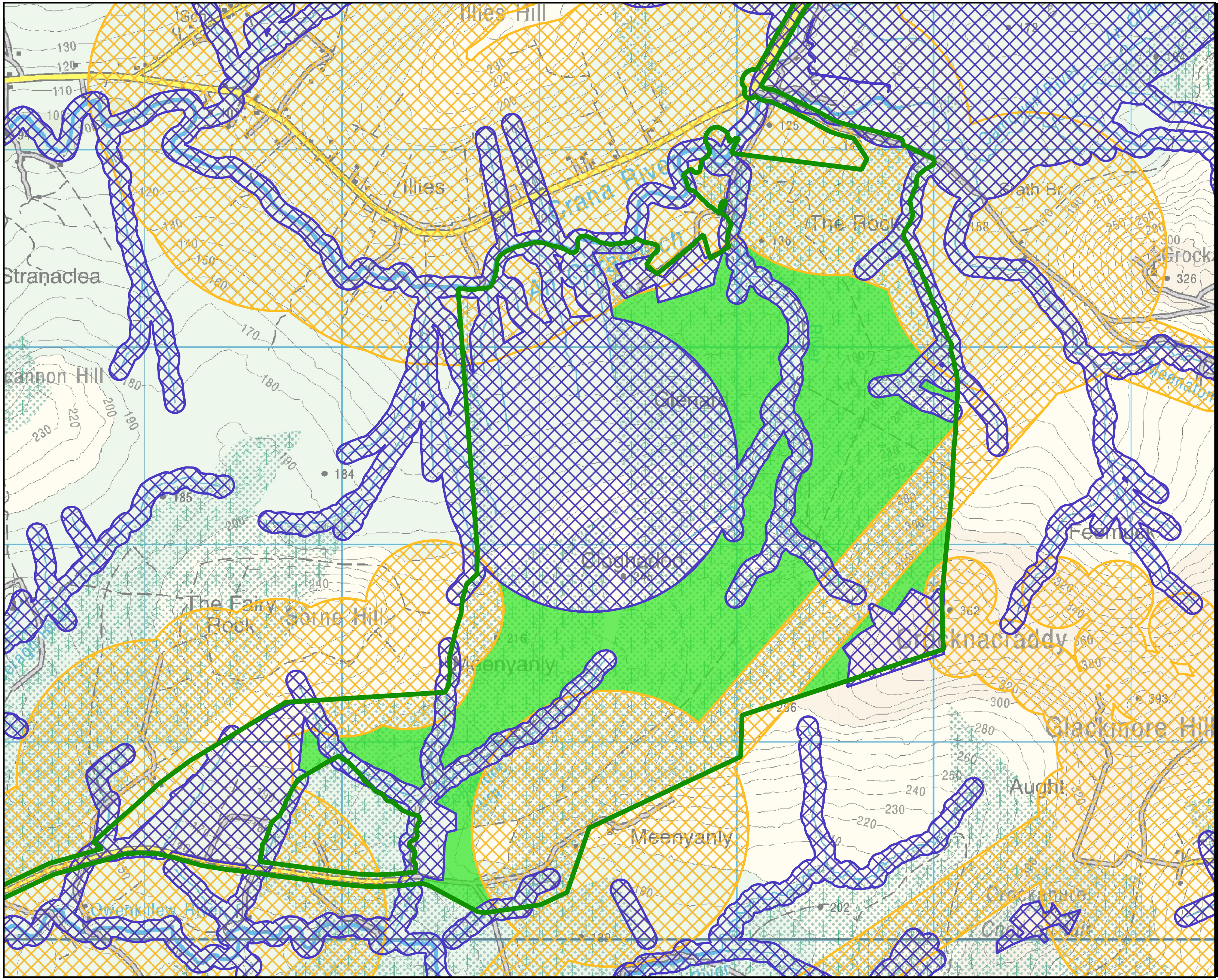

Map Legend

- EIAR Site Boundary
- Environmental Constraints
- Physical and Residential Constraints
- Remaining Viable Area

N

Drawing Title	
Constraints Map	
Project Title	
190114 - Glenard Windfarm	
Drawn By: Shaun Doolin	Checked By: Eoin McCarthy
Project No.: 190114	Drawing No.: Figure 3-1c
Scale: 1:25000	Date: 18.01.2022

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Initial Turbine Layout

There were a number of reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints study identified a significant viable area within the overall study area, which included an additional Coillte property to the south of the Glenard candidate site. The total site was considered potentially suitable for approximately 15 no. turbines (a main cluster of 13 no. turbines and a second 2-turbine cluster). This initial turbine layout, shown in Figure 3-2, occupied the viable area within the wider study area, however the proposed turbine layout was refined following feedback from the project team. The chosen turbine layout is considered optimal as this initial turbine layout had the potential for greater environmental effects in relation to shadow flicker, noise and visual amenity as the 2-turbine, southern cluster brought the development, as a whole, much closer to the reidential dwellings located on the southeastern slopes of Glackmore Hill. The initial turbine layout would have also required the construction of a new road across open peatland to connect the two clusters, thereby, also having the potential for greater effects in relation to habitat loss.

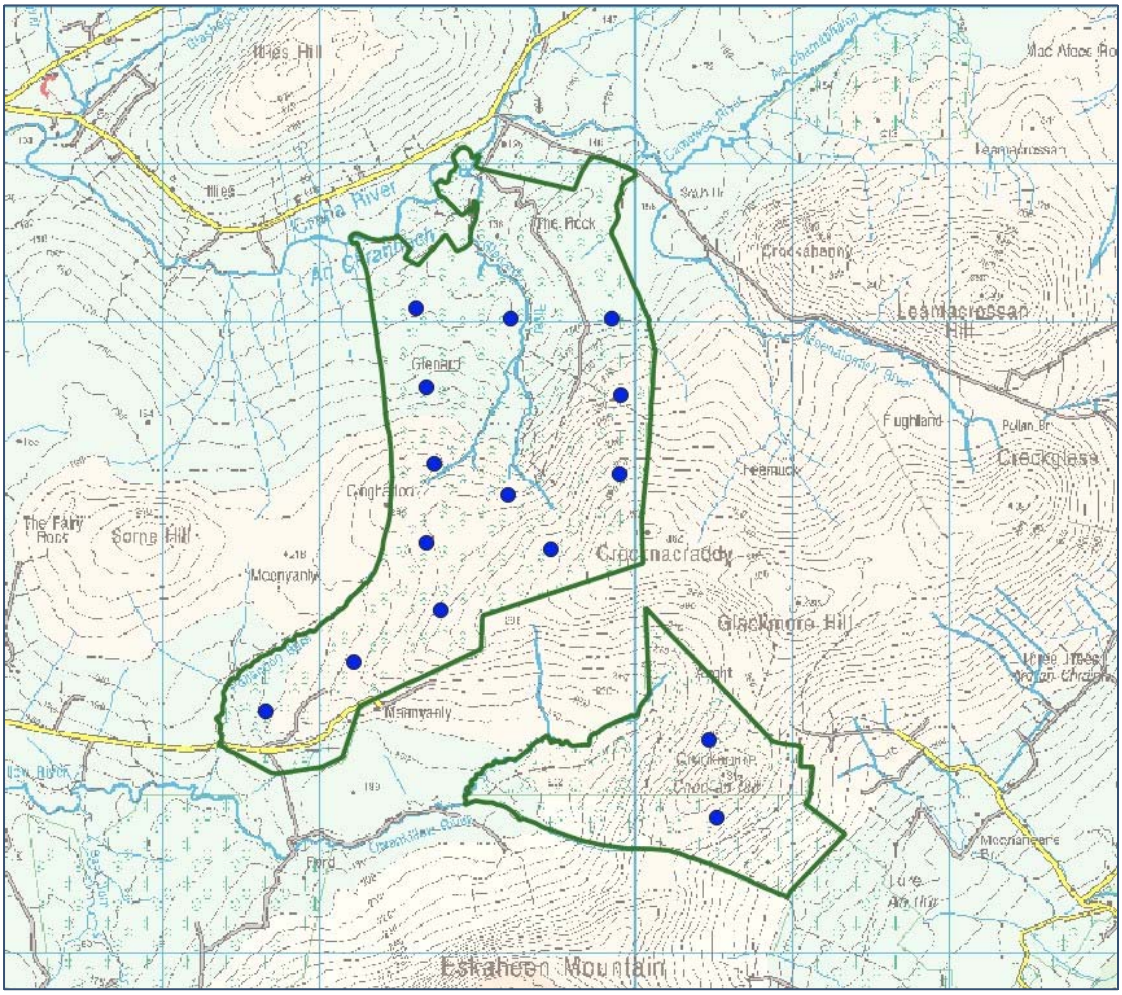


Figure 3-2 Initial Turbine Layout (15 no. turbines)

Second Version of the Turbine Layout

The first iteration of the turbine layout, shown in Figure 3-3, involved removing the southern 2-turbine cluster and also two turbines within the main 13-turbine cluster. This achieved a greater separation distance from the nearest residential dwelling. However, this 11- turbine iteration of the proposed turbine layout, while reducing the potential for adverse habitat loss, shadow flicker, noise and visual impacts would not have made the most efficient use of the latent wind resource of the area. The opportunity to further reduce the country's dependence on fossil fuels would have been missed.

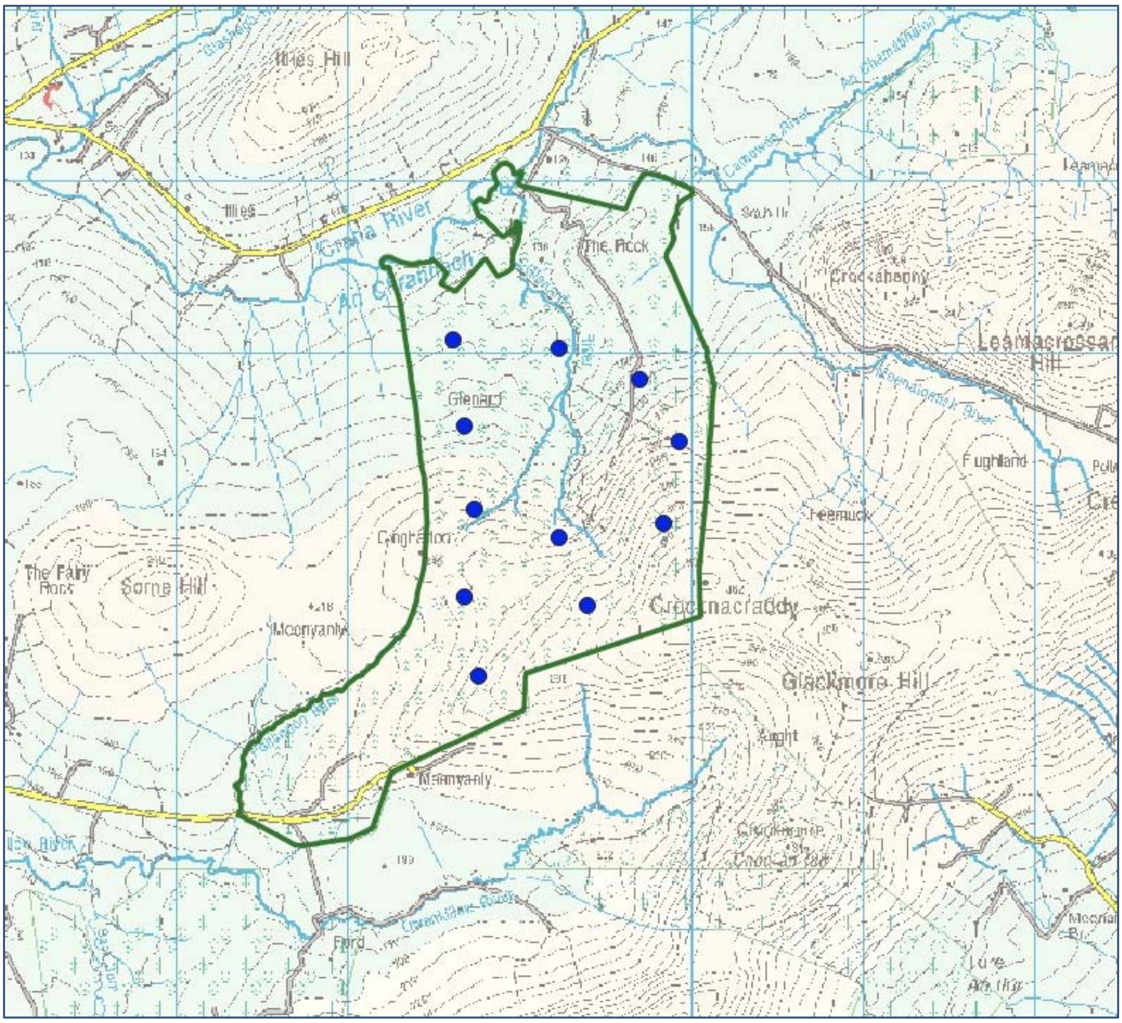


Figure 3-3 First Iteration of the Turbine Layout (11 no. turbines)

Third Version of the Turbine Layout

The second iteration of the proposed turbine layout, illustrated in Figure 3-4 below, saw the addition of 5 no. turbines at subsequently identified, suitable locations to the west of the other 11 no. turbine locations. The inclusion of these additional turbine locations was due, in part, to private lands, adjoining Coillte's Glenard property, becoming available to the applicant following discussions with local landowners. The significant separation distance between the proposed turbine locations and the nearest occupied residential dwellings was maintained even with the addition of these turbines, thereby the potential for adverse noise and shadow flicker effects did not increase. This turbine layout was also more visually coherent than the initial two- cluster, 15-turbine initial layout shown in Figure 3-2 above. This layout also maximised the efficient use of the wind resource and potential power output of the site.

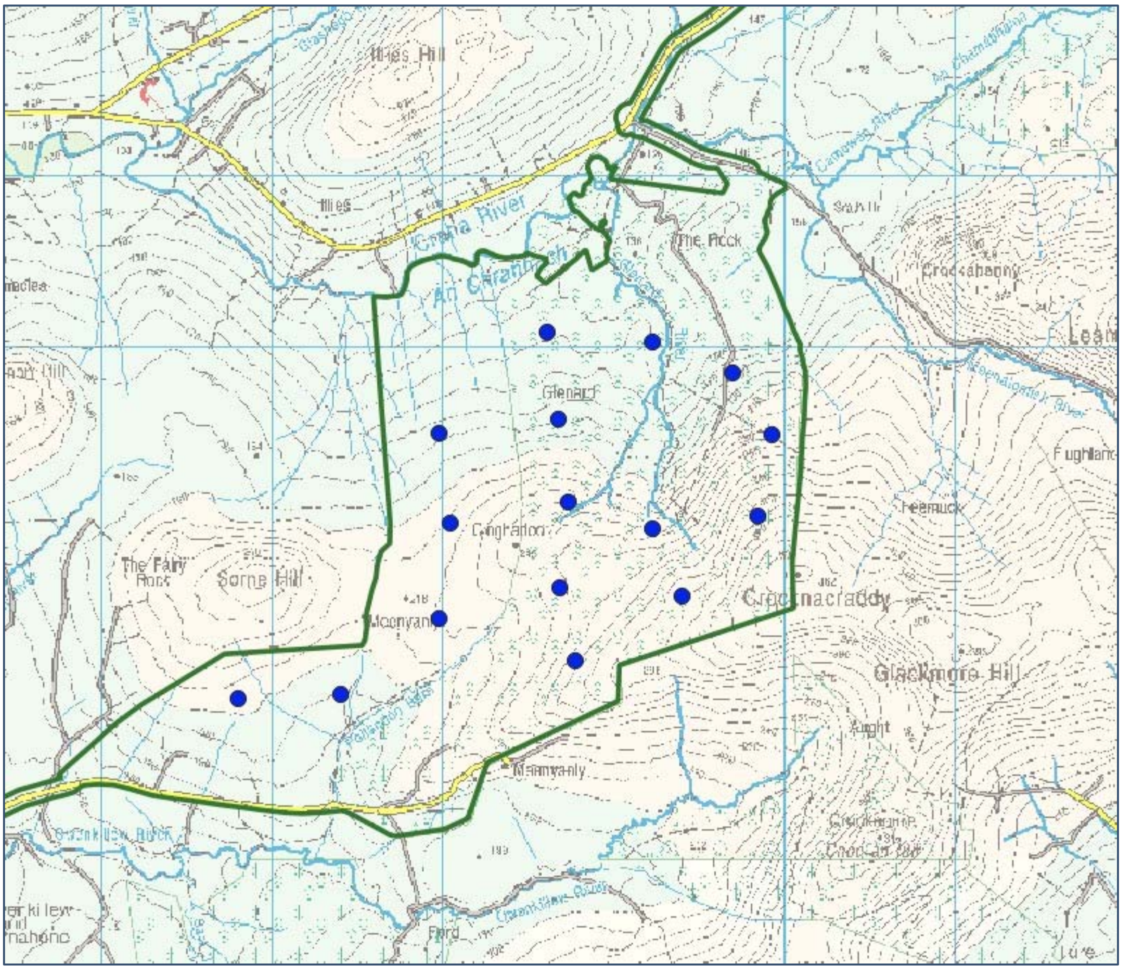


Figure 3-4 Second Iteration of the Turbine Layout (16 no. turbines)

It was also at this point that the site boundary for the purposes of the EIAR was defined. The initial site boundary was amended to focus on the final iteration of the turbine layout, the chosen grid connection route (refer to Section 3.5.4.3 below) and the turbine delivery route for the proposed development (refer to Section 3.6.2 below).

Fourth and Final Version of the Turbine Layout

In November 2020, additional ornithological survey data collected from the private lands adjoining Coillte's Glenard property was made available to the applicant. This data showed that a hen harrier roost site was identified by the surveyors within the northwestern area of the site. In order to mitigate against any potential,significant displacement effects on the hen harrier individuals using this roost site, a 750m exclusion zone was applied (as shown in Figure 3-1) around the roost site, within which proposed infrastructure was excluded (refer to Chapter 7 of this EIAR for further details). This brought about the third and final iteration of the the proposed turbine layout, illustrated in Figure 3-5, which included the elimination of one turbine from the overall turbine layout and the re-siting of 14 of the 15 no. remaining turbine locations within the viable area. This third and final iteration of the turbine layout also involved some very minor micro-siting of turbine locations based on the rigorous assessment of local ground conditions until the final turbine locations were finalised for the planning application.

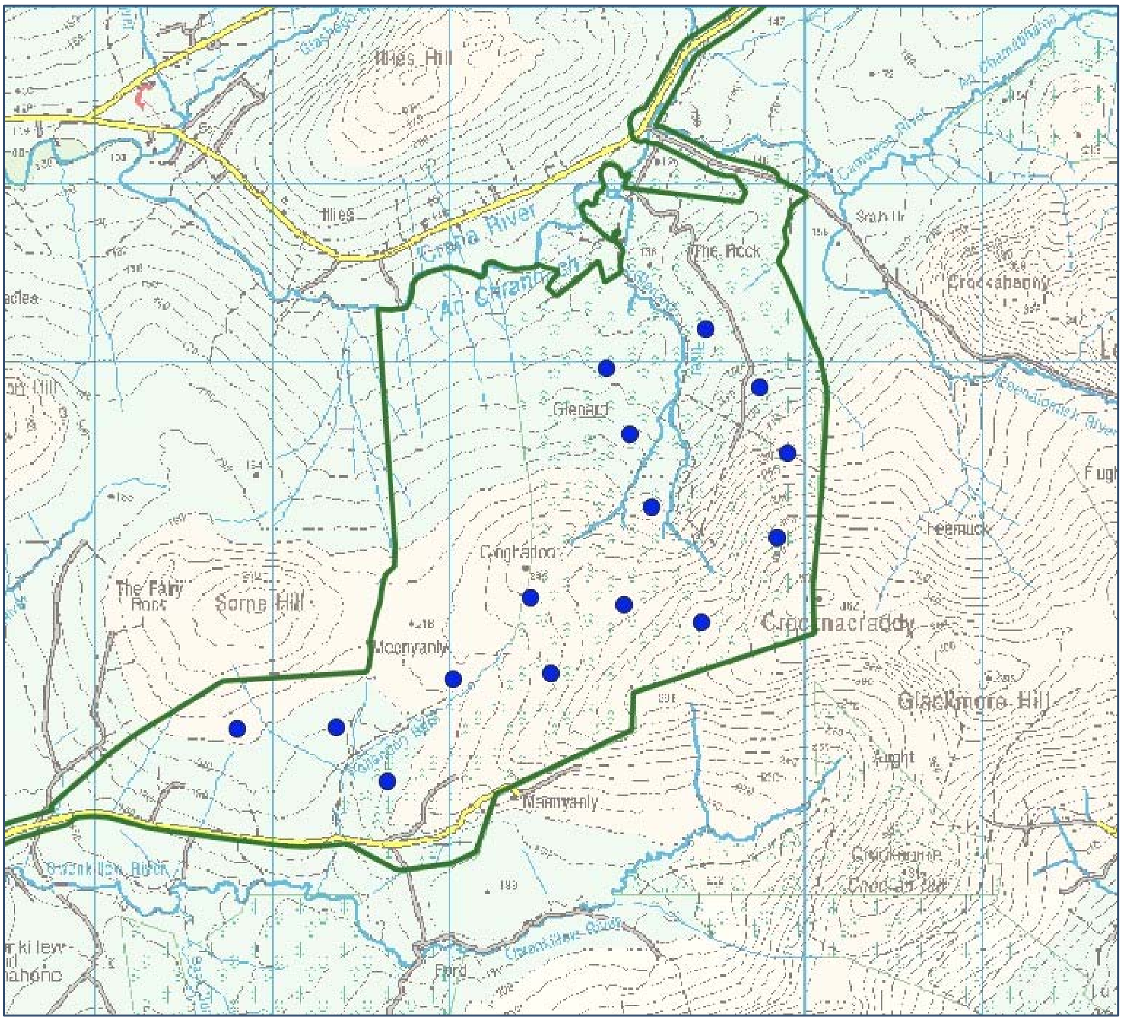


Figure 3-5 Third and Final Iteration of the Turbine Layout (15 no. turbines)

A comparison of the potential environmental effects of initial and first iterations of the turbine layout as compared against the second and final turbine layout are presented in Table 3-4 below.

Table 3-4 Comparison of environmental effects when compared against the chosen option (final turbine layout 15 no turbines.)

Environmental Consideration	Initial Layout (15 no. turbines)	Second Version (11 no. turbines)	Third Version (16 no. turbines)
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health. Potential for increased shadow flicker duration at nearby sensitive receptors.	No material environmental difference for population or human health. No significant difference in shadow flicker duration at nearby sensitive receptors.	No material environmental difference for population or human health. No significant difference in shadow flicker duration at nearby sensitive receptors.
Biodiversity & Ornithology	No significant environmental difference for either biodiversity or birds. Similarly-sized development footprint with no material difference in overall habitat loss.	No significant environmental difference for either biodiversity or birds. Smaller development footprint would have resulted in reduced habitat loss within the constrained-out area i.e. viable area. Slightly reduced collision risk or bird species due to smaller number of turbines.	Potential significant displacement effect on hen harrier individuals using roost site. Larger development footprint development footprint and therefore, increase overall habitat loss.
Land, Soils & Geology	Similarly-sized development footprint would have meant no material difference in peat and spoil volumes to be excavated or crushed stone to be extracted for construction.	Smaller development footprint would lead to a reduction in peat and spoil volumes to be excavated and would require less crushed stone to be extracted for construction.	Similarly-sized development footprint would have meant no material difference in peat and spoil volumes to be excavated or crushed stone to be extracted for construction.
Geotechnical/Peat Stability	This layout was amended following more detailed geotechnical investigations to	Overall, no significant environmental difference.	Overall, no significant environmental difference.

	reduce risk of peat instability.		
Water (Hydrology and Hydrogeology)	Neutral	Neutral	Neutral
Air & Climate	Neutral	Fewer turbines would have not maximised the use of the latent wind resource of the site and the opportunity to further reduce the country's dependence on fossil fuels.	Additional turbine would have maximised latent wind resource of the site and further reduce the country's dependence on fossil fules, however, overall, no significant difference.
Noise & Vibration	Potential for greater noise impacts due to reduced separation distance between turbines and closest sensitive receptors.	Neutral	Neutral
Landscape & Visual	Potential for greater visual impacts due to the wider visual extent of the proposed turbines.	Potential for lesser visual impacts due to the reduced visual extent of the proposed turbines.	Neutral
Cultural Heritage & Archaeology	No material environmental difference for cultural heritage	No material environmental difference for cultural heritage	No material environmental difference for cultural heritage
Material Assets	No material environmental difference for material assets.	Smaller development footprint would lead to a reduction in construction traffic volumes and traffic impacts across a greater extent of the public road network.	No material environmental difference for material assets.

3.5.3 Road Layout

Access tracks are required onsite in order to enable transport of infrastructure and construction materials within the proposed development. Such tracks must be of a gradient and width sufficient to allow safe movement of equipment and vehicles. It was decided at an early stage during the design of the proposed development that maximum possible use would be made of existing roadways and tracks, where available and where possible, to minimise the potential for impacts by using new roads as an alternative.

As the overall site layout was finalised, the most suitable routes between each component of the development were identified, taking into account the extensive network of existing roads and the physical constraints of the site. Locations were identified where upgrading of the existing road would be required and where new roads are to be constructed, in order to ensure suitable access to and linkages between the various project elements, and efficient movement around the site.

An alternative option to making maximum use of the existing road network within the site would be to construct an entirely new road network, having no regard to existing roads or tracks. This approach was not favourable, as it would create the potential for additional significant environmental effects to occur in relation to land, soils and geology (increased excavation and aggregate requirements), hydrology (increased number of new watercourse crossings) and biodiversity (increased habitat loss).

A comparison of the potential environmental effects of constructing an entirely new road network when compared against maximising the use of the existing road network is presented in Table 3-5 below.

Table 3-5 Comparison of environmental effects when compared against the chosen option (maximising the use if the existing road network)

Environmental Consideration	New Road Network
Population & Human Health (incl. Shadow Flicker)	Neutral
Biodiversity & Ornithology	Larger, new development footprint would result in greater habitat loss.
Land, Soils & Geology	Larger, new development footprint would result in greater volumes of peat and spoil to be excavated and stored. Larger volume of stone required from on-site borrow pit and off-site quarries for road construction.
Geotechnical/Peat Stability	Neutral
Water (Hydrology and Hydrogeology)	Larger, new development footprint and increased number of new watercourse crossings, therefore, increasing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Potential for greater dust emissions due to the requirement of an increased volume of stone from the on-site borrow pit and off-site quarries. Potential for greater vehicular emissions due to and increased volume of construction traffic.
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors during the construction of the new roads.
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of an entirely new network of roads.
Cultural Heritage & Archaeology	Larger, new development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger, new development footprint and requirement for more construction materials.

3.5.4 Location of Ancillary Structures

The ancillary infrastructure required for the construction and operation of the proposed development include temporary construction compounds, an electricity substation and associated grid connection and borrow pit.

3.5.4.1 Construction Compounds

The two proposed construction compounds will be used for the storage of all construction materials and turbine components. The use of multiple temporary construction compounds was deemed preferable to the alternative of a single large compound at the site for a number of reasons. Principally, it will facilitate more efficient construction practices and will result in shorter distances for traffic movements within the site during construction. As a result, vehicle emissions and the potential for dust arising will be reduced.

A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing multiple, smaller compounds is presented in Table 3-6 below.

Table 3-6 Comparison of environmental effects when compared against the chosen option (multiple construction compounds)

Environmental Consideration	Single Large Construction Compound
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site which could have adverse health effects.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical/ Peat Stability	Neutral
Water (Hydrology & Hydrogeology)	Neutral
Air & Climate	Potential for increased vehicular and dust emissions from longer distance of traffic movements within the site
Noise & Vibration	Potential for increased noise impacts on nearby sensitive receptors due to longer distance of traffic movements within the site.
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Less efficient construction practices due to longer movements of construction vehicles, plant and materials within the site.

3.5.4.2 Electricity Substation

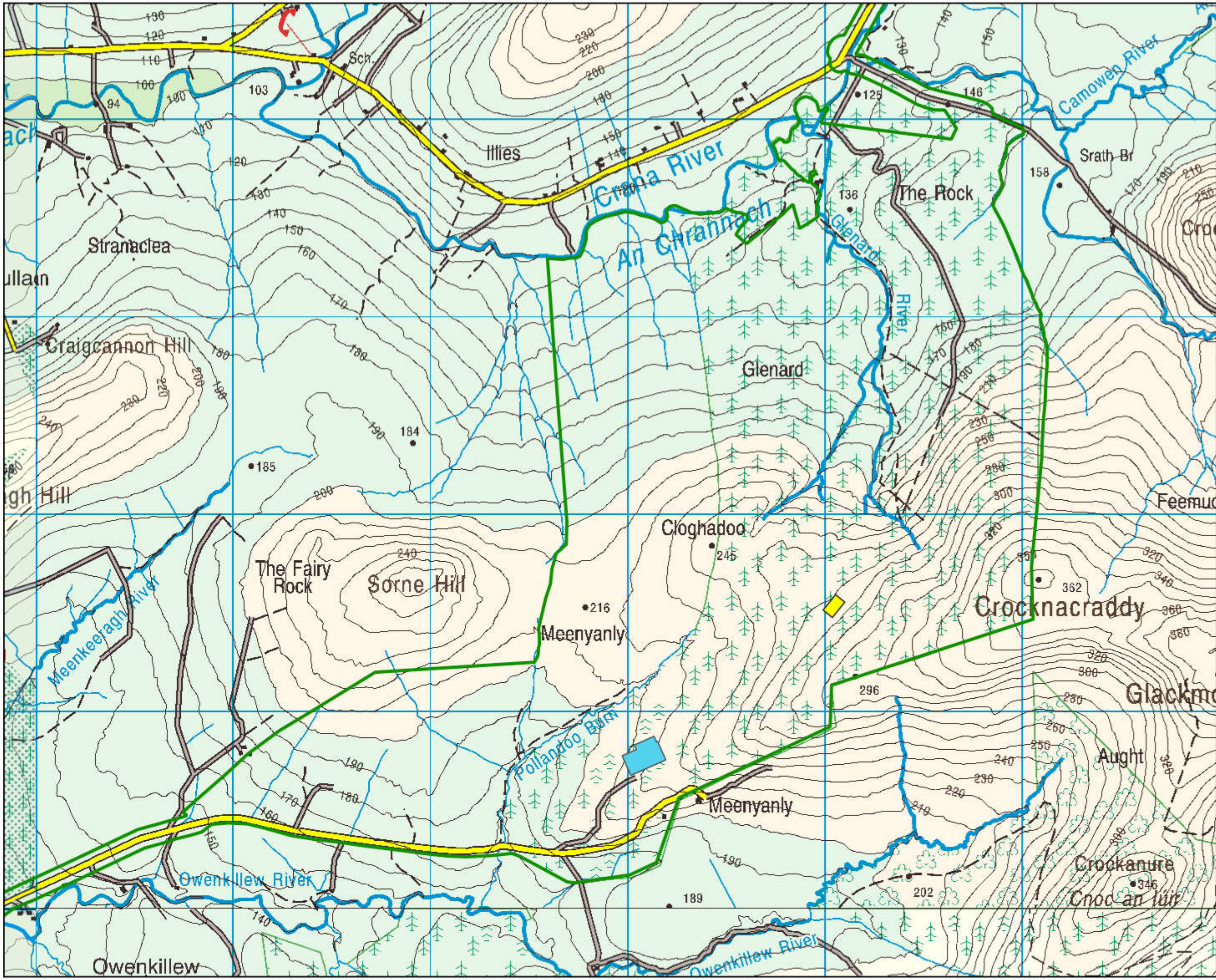
The selection of the location of the on-site substation has had regard to the constraints of the site, outlined in Section 3.6.1 above. Ease of access and ensuring a suitable setback from turbine locations was also taken into consideration. It should also be noted that while the operational lifespan of the proposed turbines is expected to be 35 years (following which they may be replaced subject to a future permission or decommissioned as proposed in this planning application) the electricity substation and associated infrastructure will become an Eirgrid asset and will be a permanent feature of the proposal as it will continue to form part of the electrical infrastructure of the area in the event of the remainder of the site being decommissioned.

One alternative substation location was considered at a very early stage of the design of the proposed development, as shown in Figure 3-6. While this alternative location was more centrally located within the site and would have slightly decreased the length of internal cabling between the turbines and the substation, it would have led to an increase in the length of grid connection cabling to the nearest existing substations. The construction of the substation compound at the alternative location, situated on a steep slope, would have required a significant volume of rock to be broken or blasted out. Therefore, the footprint of the substation compound would be larger relative to the chosen location and the potential for noise and dust emissions during the construction phase would increase. Due to its position on an elevated slope, the alternative location would also be more visually exposed to the nearest residential dwellings when compared to the chosen location which is screened by a combination of forestry and topography.

A comparison of the potential environmental effects of the alternative location when compared against chosen location is presented in Table 3-7 below.

Table 3-7 Comparison of environmental effects when compared against the chosen option

Environmental Consideration	Alternative Substation Location
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of rock to be excavated, which could have adverse health effects.
Biodiversity & Ornithology	Increased habitat loss due to the requirement for a larger development footprint.
Land, Soils & Geology	Increased volume of peat and spoil to be excavated due to larger development footprint.
Geotechnical	Neutral
Water	Increased potential for silt laden runoff to enter watercourses due to the volume of stone to be excavated.
Air & Climate	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of rock to be excavated.
Noise & Vibration	Potential for increased noise impacts during construction and operational phases on nearby sensitive receptors due to location being closer to nearby sensitive receptors.
Landscape & Visual	Location is potentially more visually exposed to the nearest residential dwellings.



Map Legend

- EIAR Site Boundary
- Chosen Substation Location
- Alternative Substation Location

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Drawing Title	Alternative Substation Location
Project Title	Glenard Wind Farm
Drawn By: DOS	Checked By: EM
Project No.: 190114	Drawing No.: Fig 3-6
Scale: 1:25000	Date: 03.12.2021

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Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.

3.5.4.3 Grid Connection

A key consideration in determining the grid connection method for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. For this reason, it was considered that underground lines would be a preferable alternative to overhead lines. The draft Wind Energy Guidelines 2019 also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. Similarly, Part B, Appendix 3, Section 6 of the Donegal CDP sets out the development guidelines and technical standards for wind energy including:

> *"6.4 - All grid cable connections within the site should be undergrounded."*

The output of the windfarm is such that it needs to connect to a 110kV substation. There are 2 no. existing 110kV electricity substations located within 10km of the proposed development site, namely:

- Trillick 110kV Electricity Substation
- Sorne Wind Farm 110kV Electricity Substation

Therefore, underground grid connection cabling routes to each of these existing substations was considered and assessed in order to determine which route would be brought forward as the grid connection route to be assessed as part of the overall Glenard Wind Farm project within the EIAR. The three routes considered are shown in Figure 3-6 and are detailed below.

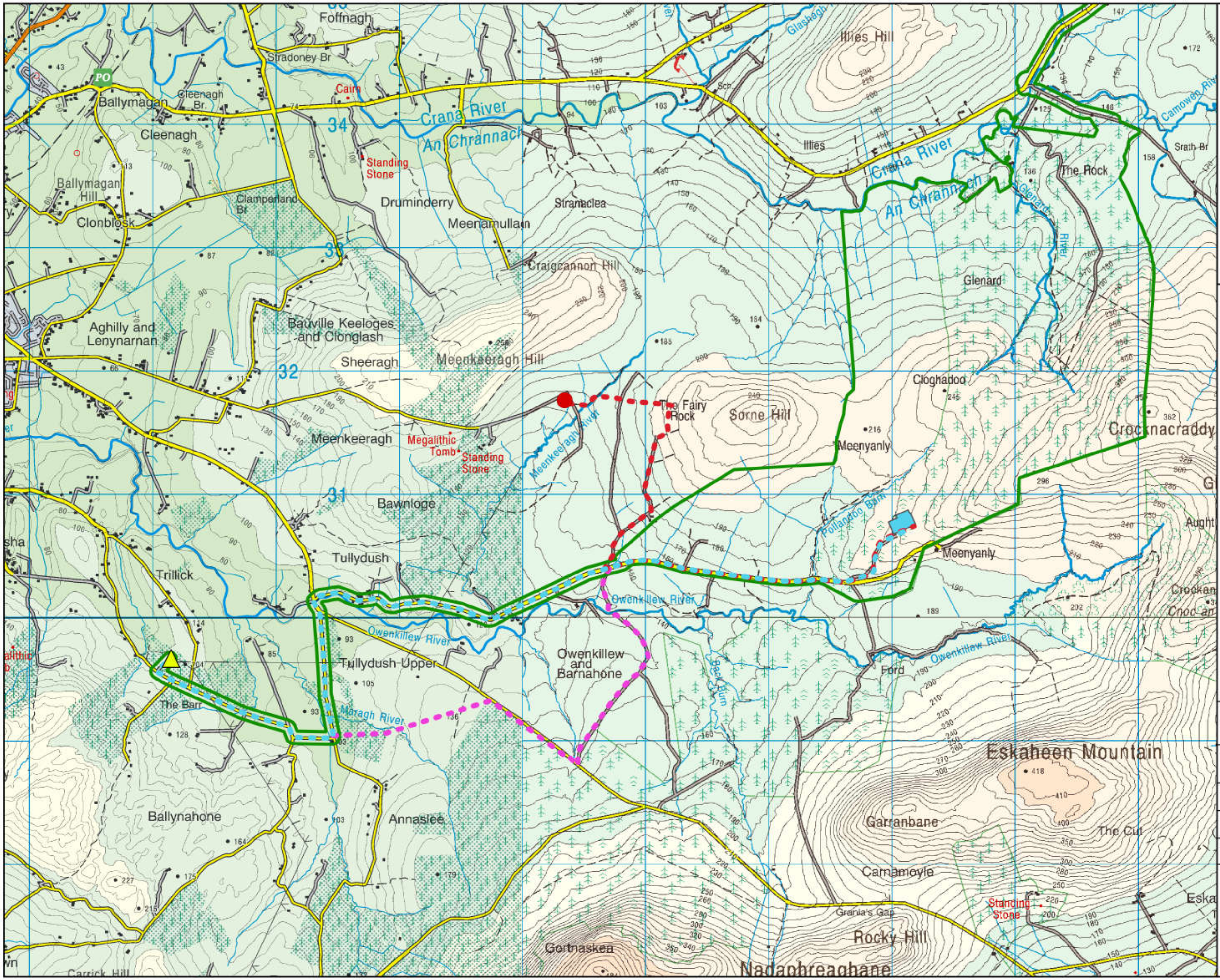
Option A is an underground grid connection cabling route, connecting the proposed onsite electricity substation to the existing Trillick substation. The Trillick substation is located approximately 6.2km southeast of the proposed onsite substation. The grid connection cabling route runs entirely along a combination of forestry and public roads. The cabling route measures approximately 8km in length.

Option B is an underground cabling route also connecting the proposed onsite substation to the existing Trillick substation. This grid connection cabling route runs approximately 880m of forestry roads, 1.9km of private tracks, 4.7km of public roads and includes 1.3km off road section over which a new access road would need to be constructed. This option would also require the construction of two new watercourse crossings. In total, the cabling route measures approximately 8.7km in length.

Option C is an underground cabling route connecting the proposed onsite substation to the existing Sorne Wind Farm substation which is located approximately 3.1km northeast of the proposed onsite substation. This cabling route runs along approximately 880m of forestry roads, 2.5km of private access roads and tracks, 2.1km of public road. In total, the cabling route measures approximately 4.7km in length.

Grid Connection Options A and C run along existing roads and/or tracks for their entire lengths. Option B includes 1.3km of a currently off-road section which would require an access road to be constructed resulting in an increased development footprint, an increase in volumes of peat and spoil to be excavated and manged and greater habitat loss.

Option B also requires the construction of two new watercourse crossings which would increase the potential for silt-laden water to enter natural watercourses.



Map Legend

- EIAR Site Boundary
- Chosen Substation Location
- Trillick Substation Location
- Sorne Substation
- Option A - Current UGC Route
- Option B - Alternative UGC Route
- Option C - Sorne UGC Route

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Drawing Title	Alternative Grid Connection Route Options
Project Title	Glenard Wind Farm
Drawn By: DOS	Checked By: EM
Project No.: 190114	Drawing No.: Fig 3-7
Scale: 1:40000	Date: 03.12.2021

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Option A passes by more residential dwellings than Options B and C and therefore has the potential to cause greater, short-term nuisance to local residents in terms of access, traffic volumes, noise and dust emissions during the construction phase.

Option A runs along a road under the control of the applicant and then local public roads for the remainder of the route. Options B and C both include sections which run along roads, tracks or off-road routes within private, third-party landholdings which are not available to the applicant and would require consent from the relevant landowners.

Based on the environmental land availability considerations outlined above, Grid Connection Option A was the most favoured option of those considered.

A comparison of the potential environmental effects of the alternative grid connection cabling routes when compared against the chosen option (Option A) is presented in Table 3-8 below.

Table 3-8 Comparison of environmental effects when compared against the chosen option (Option A)

Environmental Consideration	Option B	Option C
Population & Human Health (incl. Shadow Flicker)	The route passes fewer residential dwellings and therefore, there is reduced potential for nuisances for local residents to occur in relation to dust emissions from vehicle movements and excavations which could have adverse health effects.	This route passes the fewest residential dwellings and therefore, has the least potential for nuisances for local residents to occur in relation to dust emissions from vehicle movements and excavations which could have adverse health effects.
Biodiversity & Ornithology	Increased habitat loss due to the requirement to construct new lengths of roads where the cable route is proposed 'off-road',	Neutral
Land, Soils & Geology	Increased volume of peat, spoil and tar to be excavated due to longer route and the requirement for new roads along certain sections of the route.	Neutral
Geotechnical	Neutral	Neutral
Water	Requires the construction of two new watercourse crossings which increases the potential for silt-laden runoff and hydrocarbons to enter receiving watercourses.	Neutral
Air & Climate	Potential for increased vehicular and dust emissions traffic movements along the cable route due to the requirement for the construction of new access road.	Neutral
Noise & Vibration	Reduced potential for increased noise and vibration nuisances	Least potential for increased noise and vibration nuisances during

	during construction phase on sensitive receptors (residential dwellings) located along the public road sections of the cable route.	construction phase on sensitive receptors (residential dwellings) located along the public road sections of the cable route.
Landscape & Visual	Neutral	Neutral
Cultural Heritage & Archaeology	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology.	Neutral
Material Assets	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials.	Shortest route and shortest length on public roads and therefore has the least potential for impacts on existing services.

3.5.4.4 Borrow Pit

The majority of material required for the construction of access roads and turbine bases will be obtained from one borrow pit onsite which will be located approximately 156m to the west of Turbine No. 9. The use of an onsite borrow pit represents an efficient use of existing onsite resources. It eliminates the need to transport large volumes of construction materials along the local public road network to the site. The location for the borrow pit was identified taking into account the site characteristics, including topography, ground conditions, habitat type and surface water features. No alternative borrow pit locations were identified on site.

While a certain volume of more durable, crushed stone for the finished surface layer of site roads and hardstanding areas will be sourced from fully authorised, local quarries (identified in Chapter 4), an alternative to using an on-site borrow pit was the option of sourcing of all stone and hardcore materials from a licensed quarry or quarries in the vicinity of the site. The movement of the volume of material required for the construction of 15 no. turbine wind farm would result in a significant increase in construction traffic and heavy loads, in combination with a potential for an increase in noise and dust emissions along the haul routes, and was therefore considered a less preferable option. The cost of importing the required volume of crushed stone was also a factor in choosing to obtain stone from an on-site borrow pit.

A comparison of the potential environmental effects when comparing the sourcing of stone from local, off-site quarries against the chosen option (on-site borrow pit) is presented in Table 13-8 below.

Table 3-8 Comparison of environmental effects when compared against the chosen option

Environmental Consideration	Sourcing all stone from local, off-site quarries
Population & Human Health (incl. Shadow Flicker)	Potential for increased vehicular, noise and dust emissions from increased traffic movements, due to the volume of rock to be transported to the site along the public road network, which could be a nuisance to local residents along the haul route.
Biodiversity & Ornithology	Potential increase in habitat loss as there would be no on-site borrow pit and, therefore, additional peat repository areas would be required within the site.

Land, Soils & Geology	Slight reduction in peat and spoil to be excavated, however, additional peat repository areas would be required as an on-site borrow pit would not be available for the placement of excavated peat and spoil.
Geotechnical	Increased potential for peat instability as additional peat repository areas would be required for the placement of excavated peat and spoil.
Water	Increased potential for silt laden runoff to enter watercourses due to additional peat repository areas being required within the site.
Air & Climate	Potential for increased vehicular and dust emissions from increased traffic movements within the site, due to the volume of rock to be excavated.
Noise & Vibration	Reduced potential for noise and vibration effects on local sensitive receptors as no large-scale rock breaking or blasting required within the site. Increased potential for noise and vibration effects on sensitibve receptors along haul routes due to volume of traffic required to transport the volume of crushed stone needed for the construction of the proposed development.
Landscape & Visual	Reduced landscape and visual effects as no open rock face would be visible from certain viewpoints.
Cultural Heritage & Archaeology	Slightly smaller development footprint would reduce the potential for impacts on unrecorded, subsurface archaeology.
Material Assets	Significantly higher traffic volumes on the public road network during construction phase due to the volume of crushed stone required to be transported to the site.

3.6 Turbine Delivery

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported overland to the site of a proposed development. With regard to the selection of a transport route to the proposed development site, alternatives were considered in relation to the movement of turbine components, general construction-related traffic, and site access locations.

3.6.1 Port of Entry

The alternatives considered for the port of entry of wind turbines for the proposed development include Foyle Port in Derry and Killybegs Harbour in Donegal due to their proximity to the site. Foyle Port is the principal seaport for the northwest of the country handling approximately 2 million tonnes of cargo per annum. Killybegs Harbour also offers a roll-on roll-off procedures to facilitate import of wind turbines. Both ports have been considered for this project given that they are the closest commercial ports to the site of the proposed development, however, others in the State (including Dublin, Galway, Cork and Shannon-Foynes), offer potential for the importing of turbine components and therefore are also viable alternatives.

3.6.2 Turbine Delivery Route

For turbine components and other abnormal loads (e.g. pre-frabricated buildings for construction compound areas etc.) transport, cognisance was taken of the haul routes used for other wind farm developments in the local area in addition to the general preference to minimise the requirement for significant accommodation or widening works along the public road network and associated environmental effects.

Turbine Delivery Route Option A comprises the delivery of turbine components to the site from Foyle Port via the A2 road into Derry City, the A515 road across the Foyle, returning to the A2 road towards Muff, Co. Donegal. From here, the delivery vehicles will follow the R238 Regional Road, R240 Regional Road and the L1731 Local Road towards the site. The total length of the delivery route is approximately 38 kilometres.

Turbine Delivery Route Option B comprises the delivery of turbine components to the site from Killybegs Harbour via the R263 Regional Road and the N63 National Secondary Road to Donegal Town, the N15 National Primary Road from Donegal Town to Lifford, the N13 and N14 National Primary Roads from Lifford to Derry City. From Derry City the delivery vehicles will turn onto the A2 Road on the western side of the River Foyle. The total length of the delivery route is approximately 147.5 kilometres.

The turbine delivery route options are shown on Figure 3-8.

Both turbine delivery route options would require some accommodation works and road widening along the L1731. No works would be required, other than the temporary removal of street furniture, between either port of entry and the L1731.

Option A was selected as the preferred turbine deliver route as it is over four times shorter than Option B. Therefore, there is reduced potential effects in relation to impacts for other road users and vehicular emissions.

Table 3-10 Comparison of environmental effects when compared against the chosen option (chosen turbine delivery route)

Environmental Consideration	Option B
Population & Human Health (incl. Shadow Flicker)	Increased vehicular emissions due to increased distance of travel may lead to potential adverse effects on human health.
Biodiversity & Ornithology	Neutral
Land, Soils & Geology	Neutral
Geotechnical	Neutral
Water	Neutral
Air & Climate	Increased vehicular emissions due to distance of travel.
Noise & Vibration	Neutral
Landscape & Visual	Neutral
Cultural Heritage & Archaeology	Neutral
Material Assets	Increased potential for adverse traffic impacts on more local road users due to distance of travel.

Map Legend

- EIAR Site Boundary
- Option A - Current Turbine Delivery Route
- Option B - Alternative Turbine Delivery Route

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Drawing Title	Alternative Transport Delivery Route
Project Title	Glenard Wind Farm
Drawn By: DOS	Checked By: EM
Project No.: 190114	Drawing No.: Fig 3-8
Scale: 1:500000	Date: 03.12.2021

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It should be noted that while large turbine components and other abnormal loads deliveries will be via the Option A delivery route exclusively and accessing the site along the L1731 from the east, other general construction material deliveries may be delivered via other major routes (national primary, national secondary and regional routes) in the wider area and travel towards the site from Buncrana to the west. The assessment of traffic volumes associated with the construction and operation of the proposed development is included in Chapter 14: Material Assets, Section 14.1 of this EIAR.

The geometric assessment of large turbine components and other abnormal load deliveries during the construction of the proposed wind energy development is based on the use of extended articulated trucks which is the standard and most common delivery vehicle technology for turbine blades. This assessment is included in Section 14.1 of this EIAR. However, alternative delivery vehicle technologies such as blade adapters or lifters may be considered, should they be deemed economically viable and readily available at the time of construction of the wind farm and to fall within all assessment envelopes identified in this EIAR.

3.6.3 Alternative Mitigation Measures

Mitigation by avoidance (buffer zones/separation distances as per Section 3.5.1 above) has been a key aspect of the proposed project's evolution through the selection and design process. Avoidance of the most ecologically sensitive areas of the site limits the potential for environmental effects. As noted above, the site layout aims to avoid environmentally sensitive areas. Where loss of habitat occurs within the site, this has been mitigated by proposing enhancement lands as described in Chapter 6 of this EIAR. The alternative to this approach is to encroach on the environmentally sensitive areas of the site and accept the potential adverse environmental effects associated with this.

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks and have been designed to break the pathway between the site and any identified environmental receptors.