Environmental Impact Assessment Report
Volume 2 of 3 – Main Report

For

BLACK LOUGH WIND FARM
INTERNAL ELECTRICAL CONNECTION

TAWNAMORE to CLOONKEELAUN
COUNTY SLIGO

Prepared for:-
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March 2019

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PREAMBLE

Sligo County Council granted planning permission for a number of wind farms and related infrastructure in Cloonkeelaun and Tawnamore as follows:

- In June 2017, planning permission was granted to John Hallinan for the revised Black Lough Wind Farm in Tawnamore – planning number PL17/93 refers. This consists of 4 No turbines (T1 to T4) and ancillary infrastructure.
- In January 2017, planning permission was granted to Tapbury Management Ltd for the Cloonkeelaun Wind Farm – planning number PL15/466 refers. This consists of 2 No turbines (referred to in this report as T5 and T6) and ancillary infrastructure.
- In August 2017, planning permission was granted to Tapbury Management Ltd for that part of the grid connection in County Sligo between Black Lough Wind Farm and Glenree Substation (County Mayo) via a control building at Cloonkeelaun Wind Farm - planning number PL16/422 refers.

In August 2017, Mayo County Council granted planning permission to the southern section of the grid connection to Tapbury Management Ltd - planning number P16/822 refers.

This permitted grid connection will serve the wind turbines permitted under planning reference numbers PL17/93 (Black Lough Wind Farm) and PL15/466 (2 No. turbines in Cloonkeelaun). The as-permitted grid connection, shown on Figure 2-1, has a total length of approximately 19.1km and consists of mostly underground cabling with approximately 2.62km of overhead line.

As the turbines and control building at Cloonkeelaun were granted planning permission, the control building at Black Lough is not required. As such, the grid connection point for the six turbines is the control building at Cloonkeelaun and the cable between Black Lough and Cloonkeelaun becomes cabling internal to the wind farm; it will not become an ESB asset as will the section between Cloonkeelaun and Glenree.

Due to difficulties with landowner leases along the permitted route between Black Lough and Cloonkeelaun, an alternative electric connection is required on this northern section; it has not been possible to enter lease arrangements with the landowners for the installation of the underground cabling, so this as-permitted route is no longer an option. The proposal is for a more direct route, using mostly overhead line mounted on single wooden poles. This alternative connection would reduce the distance between Black Lough and Cloonkeelaun from 6.92km to approximately 2.64km. Importantly, it does not cross any third-party landowners, so lease arrangements are not required. The purpose of this Environmental Impact Assessment (EIA) is to consider this alternative internal wind farm route between Black Lough and Cloonkeenlaun.

The site, which is the subject of this EIAR, is located in the townlands of Tawnamore and Cloonkeelaun County Sligo.

The Applicant

The application is being made by John Hallinan, Tawnamore County Sligo. Mr. Hallinan is one of the landowners along the connection route. He also owns the land in which Black Lough Wind Farm is located.

The Consultants

Keohane Geological & Environmental Consultancy (KGEC) (Ivy House, Clash, Carrigrohane) is a Cork-based consultancy specialising in geological and environmental sciences. Mr. Dan Keohane has over 25 years' experience in environmental assessment. In the past 15 years, KGEC has prepared planning applications, EISs and/or geotechnical assessments for over 25 wind farm developments throughout Ireland and UK. He has also been involved in the construction of over 30 wind farms in Ireland.

Jennings O'Donovan & Partners Limited (Finisklin Business Park, Sligo), undertook the preparation of the planning drawings, and Landscape & Visual Assessment chapter for the application. The company has particular expertise in the area of Renewable Energy and in the preparation of Environmental Reports, Environmental Monitoring, Environmental Impact Assessments, Appropriate Assessments, Environmental Engineering, Substation Design, Structural Engineering and Geotechnical Engineering. The firm is also involved in Water Supply, Wastewater, Drainage, Aquaculture and Roads Projects. Jennings O'Donovan is an ISO 9001, ISO 14001 and OHSAS 18001 accredited company. Jennings O'Donovan have been an established presence in the Renewable Energy Wind Farm Sector since 1998. To date, the company has a portfolio of projects extending to approximately 1,520MW of power in Ireland and Northern Ireland and is a recognised market leader in the whole area of wind energy development. This portfolio will equate, when completed, to an investment of €1.8 billion in the Wind Energy Sector.

Woodrow Sustainable Solutions Ltd (Main Street, Ballisodare, County Sligo). Will Woodrow MCIEEM, CEcoL of Woodrow Sustainable Solutions Ltd prepared the bat assessment for this proposed development. Will is a full member of the Institute of Ecology and Environmental Management and one of only a few Chartered Ecologists in Ireland and Northern Ireland. He has extensive wind farm experience gained in involvement with over 40 wind farm projects to date including bird, bat, habitat and protected species surveys, including surveys under licence. Will has undertaken bat surveys for EIAs for 18 wind farm proposals in the last 6 years and is also involved in post construction compliance monitoring on other sites. Will has been involved with pioneering appropriate survey approaches in the field, including monitoring 'at height' throughout the active bat season and has developed a good understanding of the way that bats use upland wind farm sites in varying conditions. Will has supplemented his bat survey experience over the past decade with formal training, including bat survey design, assessment and mitigation methodologies, bat capture and handling and advanced bat data analysis. Will holds NPWS licences for roost disturbance and for bat handling.

Dermot Nelis Archaeology (36 Fingal Street, Dublin 8) prepared the archaeological assessment for the proposed development. Dermot has carried out numerous walkover surveys, testing and monitoring programmes. He has acted as Senior Archaeologist on several motorway road schemes for various County Councils/National Roads Authority and Directed large-scale test trenching and multi-period excavations associated with those developments. In addition, he has prepared cultural heritage desk-based reports and Environmental Impact Assessments for wind farms, road schemes, mineral extraction sites, retail parks *etc*.

Mr Tyrone Nelson B.Sc. (Hons.) Env. Sci. MCIEEM, AEECoW, Nelson Ecology Ltd (The Grange Inch Island County Donegal) prepared the birds assessment for this proposed development. Tyrone is the director of Nelson Ecology Ltd. He holds an Honours degree in Environmental Science (University of Ulster 2005). He is a full member of both the Chartered Institute of Ecology & Environmental Management and Association of Ecological and Environmental Clerk of Works. He has over 20 years' experience carrying out formal bird surveys for RSPB, Ulster Wildlife Trust, British Trust for Ornithology, Birdwatch Ireland and NIEA in an employed capacity. He has successfully completed numerous bird survey and assessment projects in a consultancy capacity since 2008 for a large range of clients.

Iain Mac Phee of AV acoustics (Ballymoneen, Enniscrone, Co Sligo) undertook the noise impact assessment for the proposed development. Iain holds the Institute of Acoustics Diploma in Acoustics and Noise Control, and is an active member of the Irish branch of the Institute. Iain has been working in the fields of nose measurement and control for about 30 years. In the last 10 years, Iain has undertaken noise impact assessments for developers for a wide range of projects, throughout Ireland, and previously spent 20 years working in the UK on machinery noise measurement and control. In addition, he has undertaken environmental noise measurements for both developers and statutory bodies, to ensure compliance, or otherwise, with conditions pertaining to noise associated with planning permissions or licensing, typically windfarms, quarries, licensed premises and factories.

EIAR Structure

While the proposed modification to the internal electrical connection doesn't require an EIA in of itself, it forms part of a wind farm development of greater than 5 megawatts which does require one. An EIA is required for developments which fall within category 3(i) of the Fifth Schedule Part II of the Planning & Development Regulations 2001 (S.I. 600 of 2001):

> *'Installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output of greater than 5 megawatts'*

and categories 13(a)(i) and (ii) of the Fifth Schedule Part II of S.I. 600 of 2001:

> *'Any change or extension of development which would:-*
> *(i) result in the development being of a class listed in Part 1 or paragraphs 1 to 12 of Part 2 of this Schedule, and*
> *(ii) result in an increase in size greater than –*
> - *25 percent, or*
> - *An amount equal to 50 percent of the appropriate threshold,*
>
> *whichever is the greater.'*

The internal wind farm cable will connect the Black Lough Wind Farm, which consists of four turbines with an installed capacity of 9.4MW, to the two turbines at Cloonkeelaun (installed capacity of 4.7MW). It therefore meets the criteria of category 3(i), requiring an EIAR.

The EIAR has been prepared using the grouped format structure as recommended in the EPA's '*Guidelines on the Information to be contained in Environmental Impact Statements*[1], '*Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements)*'[2], *'Revised Guidelines on the information to be contained in Environmental Impact Statements'*[3] and '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*'[4]. The latter are draft (dated August 2017) and will be reviewed when new regulations transposing Directive 2014/52/EU[5] are published.

Using the grouped format structure, the EIAR examines each topic as a separate section. Each specialist section refers to the relevant specialist topic using the following general structure:

- the existing environment.
- impacts of the proposed development, which takes account of the other nearby permitted and proposed wind farm developments.
- mitigation measure.

The EIAR is submitted in three volumes:

- Volume 1: Non-Technical Summary
- Volume 2: Main Report
- Volume 3: Appendices

The non-technical summary provides an overview of the work presented in the main body of the EIAR. It is a shortened and simplified version of Volume 2 but contains all the key information presented in a non-technical format.

Scoping of the EIAR was developed from the Sixth Schedule of the Planning & Development Regulations 2001, Directive 2014/52/EU and in consultation with the relevant organisations. The main body of the EIAR describes the proposed development, and examines the impact of the proposed development on the following aspects of the environment:

- Landscape and Visual Impact
- Population & Human Health
- Noise
- Traffic

- Geology & Hydrogeology
- Hydrology
- Air, Climate and Climate Change
- Archaeology & Cultural Heritage
- Biodiversity - Flora & Fauna
- Biodiversity - Avian Ecology
- Land Use
- Material Assets
- Electro-magnetic Effects
- Interaction of the Foregoing.

For each topic, a screening process was undertaken to identify those topics that are important / relevant to the proposed development – refer to Section 1.6. As discussed in Section 1.6, some aspects of the environment were screened out. For each topic discussed, the potential impacts and mitigations are discussed. Cumulative impacts associated with the nearby operational and permitted wind farms are also assessed, where appropriate. As is the permitted section of grid connection route between Cloonkeelaun and Glenree substation in County Mayo.

1. INTRODUCTION

1.1. Global, EU and National Policy

Wind farm development and its inherent benefits are supported by global, national and local policy. Local policy is discussed in Section 1.2. The historic policies and strategy documents leading to, and underpinning, the current framework for renewable energy projects include:

- Kyoto Protocol, 1997 – sets targets for the reduction in the emission of greenhouse gases.
- EU White Paper on Renewable Sources of Energy[6], November 1997- sets a strategy to supply 12% of EU energy requirements from renewable sources by 2010.
- Campaign for Take Off[7], April 1999 - sets out the action plan for the implementation of the White Paper.
- Green Paper on Sustainable Energy[8], 1999 – sets an initial target for renewable energy capacity in Ireland at 500MW by 2005. Further targets to be set up to 2010
- Strategy for Intensifying Wind Energy Deployment[9], 2000 - Arising from one of the recommendations of the Green Paper, the Renewable Energy Strategy Group was established. Their report presents recommendations for the future growth of the wind energy industry in Ireland. This is a key report for the industry.
- National Climate Change Strategy[10], 2000 – relates the growth of renewable energy capacity with achievement of Ireland's obligations under the Kyoto Protocol.
- Consequent to the EU White Paper, Directive 2001/71/EC[11] addresses the obligation of Member States to establish a programme to increase the gross consumption of electricity from renewable energy sources. This directive sets out indicative targets for each Member State and discusses support schemes. The target set for Ireland was to increase green electricity from 3.6% (1997 figure) to 13.2% by 2010.

Current Government policies and strategies which outline targets for increased renewable energy deployment are:

- Green Paper – Towards a Sustainable Energy Future for Ireland[12], October 2006. This paper sets a new target of 15% by 2010 of electricity consumption to be met by renewable energy, with a further target of 30% penetration by 2020.
- White Paper - Delivering a Sustainable Energy Future for Ireland, March 2007[13].
- National Development Plan 2007 – 2013[14], January 2007. With respect to the energy sector, this sets out programmes to improve the electricity network, provision of a second north-south inter-connector and investment in the renewable energy sector, including the large-scale deployment of wind energy.
- Carbon Budget - 2009[15]. The most recent target set by Government (carbon budget 2009) is 40% of electricity needs to come from renewable sources by 2020. This target increase is unpinned by the investment in the All-Island national electricity grid as outlined in the NDP 2007 – 2013.
- EU Directive 2009/28/EC[16] on the promotion of the use of energy from renewable sources. This Directive sets out targets for each Member State for the increase in the use of energy from renewable sources. For Ireland, the 2020 target is set at 16% (from a 2005 base of 3.1%) for the share of energy from renewable sources in gross final consumption of energy.
- Strategy for Renewable Energy 2012 – 2020[17], May 2012. This strategy document confirms the commitment of Government to support the renewable energy industry on environmental and economic grounds.
- Green Paper – Energy Policy in Ireland[18], May 2014. This is a consultation paper seeking input on six priority areas for the energy sector. There are no new targets as such.
- European Council – Climate and energy policy framework for 2030[19], October 2014. This sets out new targets for carbon emission reduction, new targets for renewable energy penetration, increased energy efficiency and installation of interconnector infrastructure.

The more recent and important policies and strategy documents, which address grid connections, are discussed in detail in the following sections.

Strategy for Intensifying Wind Energy Deployment
The Renewable Energy Strategy Group was formed in November 1999 by the Minister of State at the Department of Public Enterprise. The group was formed to devise a strategy for the increased contribution of onshore wind energy to electricity generation. The Green Paper on Sustainable Energy announced that a target of 500MW of energy be produced by renewable sources, the majority of this energy will be produced by wind energy. The main aim of the Strategy to implement a support hierarchy to allow this target to be reached. The Renewable Energy Strategy Group recommended that an open market approach be taken to the provision of renewable energy and that project cap size be removed; this will ensure that the only constraints affecting the creation of renewable energy sources are commercial considerations and technical limitations.

The Group recommends a Plan led approach to wind farm provision and identifies the three main elements which require integration under this approach as appropriate location, adequate availability of the wind resource and accommodating electricity network infrastructure. The Strategy centres on a cohesive plan led approach to market mechanisms, grid upgrading and spatial planning.

The identification of suitable wind farm locations is the role of spatial planning. These locations are identified by the availability of wind and the strength of the electricity networks. The short-term strategy recommends that Local Authorities identify areas as 'preferred', 'open for consideration', 'strategic', and 'no-go' areas for wind energy development and that these should be included in the Development Plans.

Strategy for Renewable Energy: 2012 – 2020
In May 2012, the DCENR published the Government's Strategy for Renewable Energy 2012 – 2020. The document confirms that the development of renewable is at the heart of the Government's energy policy. The strategy states that:

> *The development of renewable energy is central to overall energy policy in Ireland. Renewable energy reduces dependence on fossil fuels, improves security of supply, and reduces greenhouse gas emissions creating environmental benefits while delivering green jobs to the economy, thus contributing to national competitiveness and the jobs and growth agenda.*

Five strategic goals are set out, namely:

- **Strategic Goal 1 -** Progressively more renewable electricity from onshore and offshore wind power for the domestic and export markets
- **Strategic Goal 2 -** A sustainable bioenergy sector supporting renewable heat, transport and power generation.
- **Strategic Goal 3 -** Green growth through research and development of renewable technologies including the preparation for market of ocean technologies.
- **Strategic Goal 4 -** Increase sustainable energy use in the Transport sector through biofuels and electrification.
- **Strategic Goal 5 -** An intelligent, robust and cost-efficient energy networks system.

To realise these strategic goals, some of the key actions to be taken in relation to the wind industry include:

1. *Support delivery of the 40% target for renewable electricity through the existing GATE processes. A further targeted Gate may be developed, if necessary, following a review of the take-up of Gate 3 offers. While developing a next phase plan led approach for additional onshore capacity in future.*
2. *Work to overcome the existing obstacles and delays in the GATE processes including the environmental and permitting and any emerging regulatory barriers.*

3. *Ensure the cost effective and timely delivery of investment in the key strategic transmission projects under Grid 25 by Eirgrid and in the distribution network by ESB Networks, so that on average at least 200MW of new renewable generation is being connected per annum to ensure we can deliver our 2020 target.*
4. *Take forward the Local Authority Renewable Energy Strategies template being developed by SEAI through working with and local authorities to assist in developing Local Authority Renewable Energy Strategies for renewable energy development commensurate with spatial planning and environmental needs.*

European Council – Climate and Energy Policy Framework for 2030
On 24 October 2014, the European Council published its new climate and energy policy framework for 2030. The most significant targets agreed include:

- A reduction of at least 40% of greenhouse gas emissions by 2030.
- At least 27% Renewable Energy, binding at EU level, by 2030. The current share of renewables in the energy mix across the European Union is 14%.
- An increase of at least 27% in Energy Efficiency. This is a non-binding target and is to be reviewed in 2020.
- Installation of 15% interconnection capacity by 2030. This is a non-binding target. It would require the installation of 15MW interconnector capacity (i.e. electricity import / export capacity) for every 100MW of generation capacity installed.

1.1.1. Development Policy

There are a number of guidance documents, plans and strategy documents concerning wind farm development. These include the Sligo County Development Plan 2017-2023[20], '*Wind Farm Development - Guidelines for Planning Authorities'*[21] Department of the Environment, Heritage & Local Government, June 2006, the '*Strategy for Intensifying Wind Energy Deployment*'[22], Renewable Energy Strategy Group 2000 and the, '*National Climate Change Strategy'*[23], Department of the Environment and Local Government, 2000.

1.1.2. County Development Plan

The Sligo CDP 2017-2023 addresses the issue of wind farms in Section 11.1.2. This section of the CDP doesn't specifically address wind farm connections; it refers to the Department's 2006 Wind Farm guidelines – see Section 1.2.3.

Section 11.1.7 of the CDP addresses Electricity transmission, but this relates to the high voltage (110kV and greater) transmission system operated by Eirgrid, not medium voltage powerlines (20kV) as proposed.

Section 7.4 of the CDP addresses the protection of landscape character in the County. A landscape characterisation and appraisal study was commissioned by Sligo County Council and completed in 1996. The landscape characterisation map from that study was used in subsequent Development Plans and in the current CDP; it is reproduced as Figure 3-1 in this EIAR. The map classifies the County '*according to its visual sensitivity and ability to absorb new development without compromising the scenic character of the area'.* Four features / landscape types are defined as follows:

> ***Normal Rural Landscapes:*** *areas with natural features (e.g. topography, vegetation) which generally have the capacity to absorb a wide range of new development forms – these are largely farming areas and cover most of the County. At the same time, certain areas located within normal rural landscapes may have superior visual qualities, due to their specific topography, vegetation pattern, the presence of traditional farming or residential structures. These areas may have limited capacity for development or may be able to absorb new development only if it is designed to integrate seamlessly with the existing environment.*

Sensitive Rural Landscapes: *areas that tend to be open in character, highly visible, with intrinsic scenic qualities and a low capacity to absorb new development – e.g. Knocknarea, the Dartry Mountains, the Ox Mountains, Aughris Head, Mullaghmore Head etc.*
Visually Vulnerable Areas: *distinctive and conspicuous natural features of significant beauty or interest, which have extremely low capacity to absorb new development – examples are the Ben Bulben plateau, mountain and hill ridges, the areas adjoining Sligo's coastline, most lakeshores etc.*
Scenic Routes: *public roads passing through or close to Sensitive Rural Landscapes, or in the vicinity of Visually Vulnerable Areas, and affording unique scenic views of distinctive natural features or vast open landscapes. In addition to remote views, scenic routes have often a distinctive visual character conferred by old road boundaries, such as stone walls, established hedgerows, lines of mature trees, adjoining cottages or farmyards together with their traditional, planted enclosures etc., all of which warrant protection.*

The site is located in an area which has been designated as Sensitive Rural Landscape. It is not located in a visually vulnerable area. The visually vulnerable areas nearest the site coincide with the ridges on the Ox Mountains to the east and southeast. The site is not located near a scenic route. Distant views of the site are available from scenic routes to the east and north.

1.1.3. Other Relevant Policy and Strategy Documents

Local Authorities have been using the Department of the Environment, Heritage & Local Government Guidelines[21] to assist in the consideration of planning applications for wind farms. These guidelines were published first in 1996, were revised in 2004 (and issued as draft) and were finalised in June 2006. The Guidelines act as the guiding principles for Planning Authorities when they are deciding planning applications for wind farms. The Guidelines offer advice on many aspects of wind farms such as the siting of turbines, impacts on the local environment and natural heritage and the effect that wind farms have on the landscape. The Guidelines are not prescriptive in nature as they recognise that each location is different and should be treated as such.

Section 4.3 of the guidelines addresses the planning process relating to Access to Electricity Grid. Section 6.11.3 of the guidelines address technical aspects of Connection to Electricity Providers. The guidelines recommend:

- *Power line connections between turbines and from turbines to the control building should be underground.*
- *Power lines should be interred alongside turbine access roads in order to minimise spatial extent of soil/hydrological and vegetation damage/ disturbance.*
- *The cost of underground connection from the compound to the national grid is generally prohibitive. This connection can thus be above ground in all but the most sensitive landscapes.*
- *In certain landscapes, such as highly sensitive Mountain Moorland, consideration should be given to burying the cables until such a distance as the poles and cables would be visually acceptable, for example, where other power lines exist.*
- *In order to reduce visual impact, connections should preferably be carried on wooden poles rather than lattice towers, except where necessary for changes in direction and within the compound.*
- *Power line connections to the grid should, where possible, avoid running perpendicular to contours, especially on Mountain Moorland slopes. Where practicable, it should not cross the horizon at ridge level unless a line already exists. Where passing through a forest, power line connections should follow existing firebreaks or roads. In landscape types where human presence and rectilinear landscape patterns are typical, power line layout can be more flexible*.

To avoid and minimise potential ecological impacts, the proposed internal wind farm electrical connection modification doesn't satisfy a number of the above recommendations, but on balance is the most appropriate connection method.

In December 2013, the Department of Environment, Community and Local Government (DoECLA) published proposed revisions[24] to the 2006 Guidelines for public consultation. The consultation closed on 21 February 2014. The proposed revisions to the 2006 Guidelines relate to noise, proximity to houses and shadow flicker. On 13 June 2017, the DCCAE and DHPCLG published a 'preferred draft approach'[25] to the review of the 2006 Guidelines. The proposed approach focuses of six key aspects – sound/noise, visual amenity setback, shadow flicker, consultation obligations, community dividend and grid connections. It was expected that the process of consultation and finalising the revised Guidelines will be completed in the first quarter of 2018, but it is still awaited. It is now expected to be completed towards the end of 2019.

1.2. Need for the Proposed Development

The proposed development will facilitate the export of green electricity from the Black Lough Wind Farm to Cloonkeelaun control building and from there to the National Grid at Glenree. It would replace approximately 6.92km of permitted underground grid connection. The planning permissions granted in Black Lough and Cloonkeelaun, as outlined in the Preamble, means that the connection between Black Lough and Cloonkeelaun is now an internal wind farm electrical connection. Only the section of the route between Cloonkeelaun control building and Glenree substation will be an ESB asset.

This alternative connection is needed due to difficulties with landowner leases along the permitted route between Black Lough and Cloonkeelaun; landowners have not entered lease arrangements required for the installation of the underground cables. The proposal is for a more direct route, using mostly overhead line mounted on single wooden poles within lands owned by the applicant and the project developer. This alternative connection would reduce the distance between Black Lough and Cloonkeelaun from 6.92km to approximately 2.64km. The rational for the alternative route is:

- The land is in the control of the applicant and developer and not subject to leases or consents from third-party landowners.
- It is a shorter route than that permitted by approximately 4.3km. It will therefore be more economical to construct.
- As this section of the route will no longer be an ESB asset, it doesn't need to follow the road network in accordance with ESB policy, which requires underground cables to be installed along public roads, as far as possible.
- The section of the route through the SAC will be overhead as this will have a much lesser potential environmental impact than undergrounding through this new route.

1.3. Public Attitudes to Power Lines

While there are no known studies of the public attitudes to wind farm grid connections and powerlines in general, there have been a number of contentious grid connection projects. While most of these relate to high voltage powerlines and the perceived public health impacts, some involved medium voltage powerlines. The issues that generally arises with medium voltage powerlines are:

- Pole placement in fields, making ongoing agricultural activities more awkward. If poles are placed at ditches, many landowners have no difficulty with powerlines. The applicant / project developer own all the land over which the proposed overhead powerline will pass, so this is not an issue.
- Powerlines too close to houses. There are no houses near this route, so this is not an issue.

1.4. Alternatives to Proposed Development

Alternatives to the proposed development can be considered in terms of:

- Alternative routes.
- Alternative design.

The importance of the consideration of the alternatives is highlighted in Section 2.4.3 of the EPA's revised "*Advice Notes on Current Practice (in the Preparation of Environmental Impact Statements"*[2]. The 2014 Directive[5] require '*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*'.

1.4.1. Alternative Connections – Routes & Design

ESB Networks has included the Black Lough Wind Farm in GATE 3 for connection to the National Grid – DG312 refers. The allocated capacity for Black Lough is 12.5MW, of which 3.3MW is 'spare' capacity to be taken up by the proposed turbines at Cloonkeelaun – the 6 turbines will be constructed at a single wind farm. GATE 3 projects were selected for connection to the National Grid to meet the 2020 targets for electricity generation from renewable sources. ESB Networks intends that the Black Lough Wind Farm is to be connected to the Glenree substation using a medium voltage (20kV) connection. The grid connection has planning permission from Sligo and Mayo County Councils – planning numbers PL16/422 and P16/822 refer. As the connection point to the grid will be at the Cloonkeelaun control building, the section between it and Black Lough will be an internal wind farm connection.

Normally, internal wind farm cabling would be underground. However, due to the distance involved an overhead line is also considered. Medium voltage connections for wind farms are of three general types as follows:

1. Overhead line mounted on single wooden poles, with guywire supports typically at changes in direction or where ground conditions require additional support.
2. Underground cable buried approximately 1.2m below ground level with cables pulled through PVC ducting or buried directly.
3. A combination of overhead line and underground cable.

For the Black Lough Wind Farm, two options for connection are discussed; the permitted underground route and the proposed route:

1. Option 1 – Connection of the Black Lough turbines to the Cloonkeelaun control building via 6.92km of underground cabling, following the road network for most of its length. The issues arising with this route are:
    a. It involves a number of landowners along the route. It has not been possible to enter lease arrangements with the landowners for the installation of the underground cabling. As such, this route is no longer an option.
2. Option 2 – Connection of the Black Lough turbines to the Cloonkeelaun control building with a more direct route using mostly overhead line and short sections of underground at each end. The issues associated with the proposed route to be considered are:
    a. It crosses through the Ox Mountains Bogs SAC for approximately 2km. For this reason, an overhead powerline was selected over an underground cable; the overhead powerline would have less environmental impact on the blanket bog than the underground cable.
    b. It is shorter by approximately 4.3km than the permitted route. This has benefits in terms of project construction, but also in terms of electrical losses over the lifetime of the wind farm.
    c. It doesn't involve works on the public road.
    d. There are no third-party landowners involved; the land through which the proposed route passes is owned by the applicant and the wind farm development company.

The proposed connection route between Black Lough and Cloonkeelaun is shown on Figure 2-4. Also shown is the grid connection granted planning permission by Sligo County Council (PL16/422) and Mayo County Council (P16/822).

1.4.2. Technical Difficulties

There were no technical difficulties encountered during the environmental assessment conducted at the site.

1.5. Pre-Submission Consultation

In the course of the preparation of the EIAR, KGEC and the specialist sub-consultants contacted a number of organisations and individuals. These are referred to in each section of the EIAR as appropriate. Sligo County Council was also consulted for this development. Mr. Jim Harley held a preplanning meeting with the Planning Department of Sligo County Council on 26 October 2018.

1.6. Scoping

An initial scoping of possible impacts of the proposed development was carried out to identify those impacts thought to be potentially significant. This scoping study was carried out to examine the impacts in the various categories listed in the Sixth Schedule of the Planning & Development Regulations 2001, and as listed above in the Preamble. The level of work carried out for each topic reflects the potential impact on each area, as identified during the scoping process, with some topics screened out.

The scoping process was based on:

- Consultation with various stakeholders, including a pre-planning meeting with Sligo County Council.
- Having regard to the various published guidelines and the County Development Plan.
- A review of the project documentation relating to the permitted nearby wind farms.
- Experience of the consultants in carrying out environmental impact assessments.

1.6.1. Scope of EIAR

The emphases placed on potential impacts following the scoping process are described below:

Landscape and Visual Impact

The main objective of the landscape assessment is to evaluate the likely impact of the proposed development on the surrounding landscape. The remoteness of the site and small-scale of the structures (single wooden poles) will mean the impact will be contained. Visibility of the overhead line will be limited to a few local roads. An assessment of the visual impact was made from the viewpoints selected for the Black Lough Wind Farm assessment. The cumulative impact of the powerline with the operational and permitted wind farms and the permitted grid connection was undertaken. These are presented in Chapter 3.

Noise

For the proposed electrical connection, noise will primarily be associated with the construction stage which will be of relatively short duration – approximately 3 weeks. As the route is remote from third-party houses, construction noise is not expected to be a concern. The use of a helicopter will introduce an unfamiliar noise source for a few days. The proposed route will offset noise associated with the permitted underground route. Powerlines can create aerodynamic noises in windy weather during the operational phase, but due to its remoteness, the noise will not be a nuisance. Potential noise impacts are discussed in Chapter 5 of this report.

Population & Human Health

Potential impacts affecting human beings in the vicinity of the proposed electrical connection include:

- Possible increased traffic on local roads.
- EMF associated with powerlines

This potential impact is not expected to significantly affect human beings in the surrounding environment. Traffic and road infrastructure are addressed in Chapter 6. Risks to human health associated with powerlines, by way of literature review, is discussed in Chapter 4.

Soils & Geology

Most of the electrical connection route passes through blanket bog, forming part of the Ox Mountains Bogs SAC. Geology and construction-related peat landslide risk assessment is an important factor on blanket bog sites. Geology, including an assessment of slope stability is provided in Chapter 7.

Surface Water & Hydrology

Construction activity along the electrical connection route has the potential to alter the hydrology of the blanket bog and impact on water quality of the streams draining the area. Unmitigated, potential impacts include trampling / rutting providing surface water flow paths thus altering bog hydrology, siltation of streams and pollution from diesel during refuelling machinery. The site is located within the Ox Mountains Bogs SAC, so surface water management is an important consideration. This topic is discussed in Chapter 8.

Air, Climate and Climate Change

The proposed electrical connection route itself will not have an impact on air, climate or climate change. It will however facilitate a wind farm that will generate electricity that would otherwise be generated by fossil fuel burning power stations. The proposed development will therefore have an indirect positive impact on climate. Information on local climate is provided in Chapter 9 and in Chapter 8 as it relates to site hydrology.

Archaeology & Cultural Heritage

The development could have a potential impact on the cultural heritage of the area. In particular, disturbance of the ground during installation of the poles and underground section could uncover previously unknown archaeological features. While there are no recorded monuments within the electrical connection route corridor, there is always potential to uncover previously unrecorded features. Monitoring of excavations during construction by an archaeologist under licence is therefore proposed to identify and preserve any archaeology if discovered. The archaeological assessment for the proposed development and included as Chapter 10.

Biodiversity - Flora & Fauna and Birds

Flora & fauna is the most important factor for consideration as the electrical connection route passes through a designated site – Ox Mountains Bogs SAC. To assess potential impacts, assessments were carried out, including identification of habitats, identification of flora and fauna species and birds impact assessment. A Natura Impact Assessment of the potential impacts on the Ox Mountains Bogs SAC was also carried out. This is provided under separate cover and includes the ecology descriptions. Ecology, including bats, is discussed in Chapter 11. Birds are not a significant concern with respect to the proposed development, but are discussed in Chapter 12.

Land

Land uses on, and within the vicinity of the site is discussed in a number of chapters throughout the EIAR. A specific chapter on land use is not considered necessary as the topic is covered sufficiently in a number of chapters.

Material Assets

The proposed electrical connection route is not expected to have any significant impact on material assets and therefore not a primary consideration. This topic is discussed in Chapter 13.

Electro-Magnetic Effects
Powerlines have an associated electro-magnetic field. The health effects of this is discussed in Chapter 4. Considering the size of the proposed line (20kV – medium voltage) and remoteness of the development a separate chapter on electro-magnetic effects was not considered necessary.

Demolition Works
No demolition works are required for the construction of the electrical connection.

Use of Natural Resources
The material requirements for the construction of the project is addressed in Section 2.4. Material requirements during the operational phase are not significant.

1.7. Contributors

The EIAR was co-ordinated by Keohane Geological & Environmental Consultancy. Specialist sub-consultants employed with reference to specific portions of the study are summarised in Table 1-1.

Table 1-1: Contributors to the EIAR

Company Name	Topic Addressed
Keohane Geological & Environmental Consultancy	Overall EIAR Coordinator Geology, Hydrogeology, Hydrology
Jim Harley	Planning consultant
Woodrow Sustainable Solutions Ltd	Flora & Fauna Bats Natura Impact Assessment
JKW Environmental	Surface Water monitoring
Dermot Nelis Archaeology 36 Street, Dublin 8	Archaeological Impact Assessment
Nelson Ecology Ltd	Ornithological Assessment
AV Acoustics	Noise Impact Assessment

1.8. Format of EIAR

This document has been prepared in accordance with guidelines provided by the EPA included in:

a) Advice notes on Current Practice (in the preparation of Environmental Impact Statements)[2].
b) Guidelines on the Information to be Contained in Environmental Impact Statements[1] .
c) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports[4].

The document has been structured according to the direct format structure, as described in (b) above. The guidelines recommend that EIAR documents be kept as concise as possible. The report is submitted in three volumes:

Volume 1: Non-Technical Summary.
Volume 2: Main Report.
Volume 3: Appendices.

2. DESCRIPTION OF PROPOSED DEVELOPMENT

2.1. Site Setting

The site for the proposed development is located in the townlands of Tawnamore and Cloonkeelaun, County Sligo. The Hallinan's own approximately 429ha through which the majority of the connection route will pass; the land at the southern end of the route, in Cloonkeelaun, is owned by Rouse Project Developments Ltd, covering approximately 96ha.

The nearest villages are Bunnyconnellan in County Mayo, approximately 7km to the southwest and Dromore West, approximately 8.8km to the northeast. Enniscrone is the nearest town to the site at approximately 11km to the northwest. Ballina is the main population centre in the area at approximately 13km to the southwest. Figure 2-1 shows the site location map (Discovery Series Map No. 24). The site can be accessed from the N59 (Sligo – Ballina road) via a number of local country roads which generally run north-south between the N59 and the R294. The most direct routes to the site are the local road (L6707) which heads south to Black Lough from the N59 at Camcuill, local road L2601-13 which heads south to Cloonkeelaun from Tullylin and local road L2604 which heads southeast to Cloonkeelaun from Ballymoghany.

The site lies within a large expanse of peatland that extends from the western foothills of the Ox Mountains. These peatlands slope gently to the west and northwest from approximately 200mOD near Lough Easky to approximately 100mOD approaching the N59. The peatlands are cut by a number of rivers with narrow V-shaped valleys. The proposed electrical connection runs from farmland at Black Lough, crossing the Gowlan River and through an expanse of blanket bog.

Much of the peatlands in the wider area form the Ox Mountains Bogs SAC (site code 002006). The proposed electrical connection passes through the SAC for a distance of approximately 2km. A section of the Easky River between the N59 and R297, approximately 9km to the north and downstream of the site, is a proposed Natural Heritage Area (pNHA) (site code 001665).

There are no third-party dwellings within 500m of the proposed electrical connection route. The nearest inhabited third-party dwelling is located approximately 980m to the north of the northern-most part of the route. The settlement pattern in the vicinity of the wind farm is discussed in Chapter 4.

2.2. Planning History

The planning history associated with this proposed development is provided below.

08/195 - Wind farm consisting of 5 turbines (up to 120m tip height), access road, and associated infrastructure. Application lodged on 18 March 2008. Withdrawn on 10 February 2009.

11/379 - Wind farm consisting of 5 turbines (up to 120m tip height), access road, and associated infrastructure. Application lodged on 01 December 2011. Sligo County Council decided to grant permission on 24 January 2013. An Bord Pleanala upheld the Council's decision on 10 September 2013 – planning reference number PL 21A.241637.

15/466 - Wind farm (Cloonkeelaun Wind Farm) consisting of 2 turbines (up to 124.33m tip height), site access roads, hardstanding areas, underground cabling and all ancillary site works located. Application lodged on 22 December 2015. Sligo County Council decided to grant permission on 21 December 2016, with a final grant issued on 21 January 2017.

16/422 – Planning application for that part of the grid connection in County Sligo between Black Lough Wind Farm and Glenree, via Cloonkeelaun control building. Application lodged on 01 November 2016. Sligo County Council requested further information on 22 December 2016. A decision to grant permission was made on 24 July 2017 and a final grant issued on 11 August 2017.

16/822 - Planning application for that part of the grid connection in County Mayo between Black Lough Wind Farm and Glenree, via Cloonkeelaun control building. Application lodged on 26 October 2016. Mayo County Council requested further information on 16 December 2016. A decision to grant permission was made on 24 July 2017 and a final grant issued on 28 August 2017

17/93 - Wind farm (Black Lough Wind Farm) consisting of 4 turbines (up to 124.33m tip height), cranage and assembly hardstanding areas, control room and parking area, cabling, widening of existing access road, stilling ponds, peat reinstatement area, replacement of Gowlan River bridge, use of existing borrow pit and all ancillary site infrastructure. Application lodged on 14 March 2017. Sligo County Council decided to grant permission on 03 May 2017, with a final grant issued on 03 June 2017.

2.3. Description of the Proposed Development

The proposed development, shown on Figure 2-2, will consist of a 20kV connection between the permitted Black Lough Wind Farm (PL17/93) and the control building at the permitted Cloonkeelaun Wind Farm (PL15/466). This proposed electrical connection will replace a 6.92km section of the permitted grid connection between Black Lough Wind Farm and the Glenree substation in County Mayo – planning numbers PL16/422 (Sligo) and P16/822 (Mayo) refer. The permitted route between Black Lough and Cloonkeelaun is entirely underground and mostly follows existing public and bog roads; a short (330m) section goes across bogland at the approach to the control building at Cloonkeelaun. The proposed electrical connection between the two wind farms and the permitted grid route are shown on Figure 2-3.

The proposed route will consist of:

1. Approximately 2.3km of overhead line and 340m of underground cabling. The underground sections consist of:
    a. 240m of underground cabling will extend from turbine T2 at Black Lough to the first wooden pole. This underground section is needed to provide sufficient setback of the overhead line from the turbine in accordance with ESB specifications.
    b. 100m of underground cabling from the southern-most pole to the control building at Cloonkeelaun
2. The underground section at Black Lough will follow the alignment of an existing farm track that passes turbine T2 and extends in a southerly direction. The underground section at Cloonkeelaun will cross blank bog. The underground sections will use either direct burial of cables or using ducting. The trench will be approximately 1.2m deep and 0.4m wide, with earthing conductors and 150mm diameter and 50mm diameter ducting for electrical cables, communications and low voltage cables.
3. Approximately 18 No single wooden poles with stays at the 2 No. end poles, 4 No angle poles and where required for line stability.
4. Of the total route length, approximately 2km of the overhead line will pass through the Ox Mountains Bogs SAC. This compares to approximately 1.4km of cabling that would follow roads through the SAC in the permitted route.

This section of the electrical connection is likely to be constructed at the latter end of the construction of the wind farms (Black Lough and Cloonkeelaun turbines). The short underground section at the northern end of the proposed connection route will use ducting (150mm diameter PVC ducts); the ducts are installed first and the cables are pulled through at a later stage. The typical trench section is shown on Plate 2-1. A facility to electrically isolate the Black Lough turbines will be installed near T2.

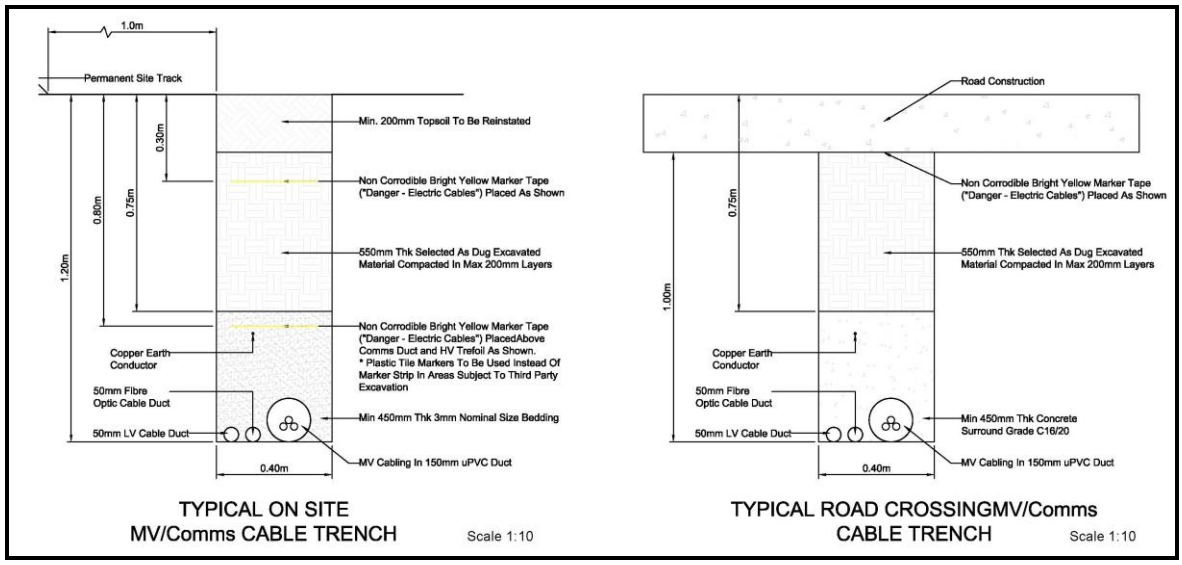

Plate 2-1: Typical Cable Trench Details

The trench will be located on the 'soft' verge of an existing farm track at Black Lough. It will be backfilled with bedding material (sand or peat) and selected excavated material. Material excavated during trenching will be reused for trench backfill and landscaping along the road verge as appropriate. Low permeability clay or peat will be used at intervals (every 30m or so) to plug the trench and prevent the creation of preferred flow paths. Permanent durable marker posts will be installed at intervals of 100m (maximum distance) and at changes in direction. The southern end of the electrical connection will be underground through blanket bog for approximately 100m. Bedding sand will not be used in this section through peat.

The remainder of the electrical connection will be an overhead line mounted on single wooden poles. Poles are placed in holes approximately 3m deep, with suitable excavated material replaced and compacted around the poles. As there is deep peat at some of the pole locations, wooden sleepers are used for support. At changes in direction or for stability, poles are supported with steel wire stays. The overhead line will be similar in appearance to the ESB distribution network supplying electricity to homes in the area. Plate 2-2 shows the type of pole construction to be used.

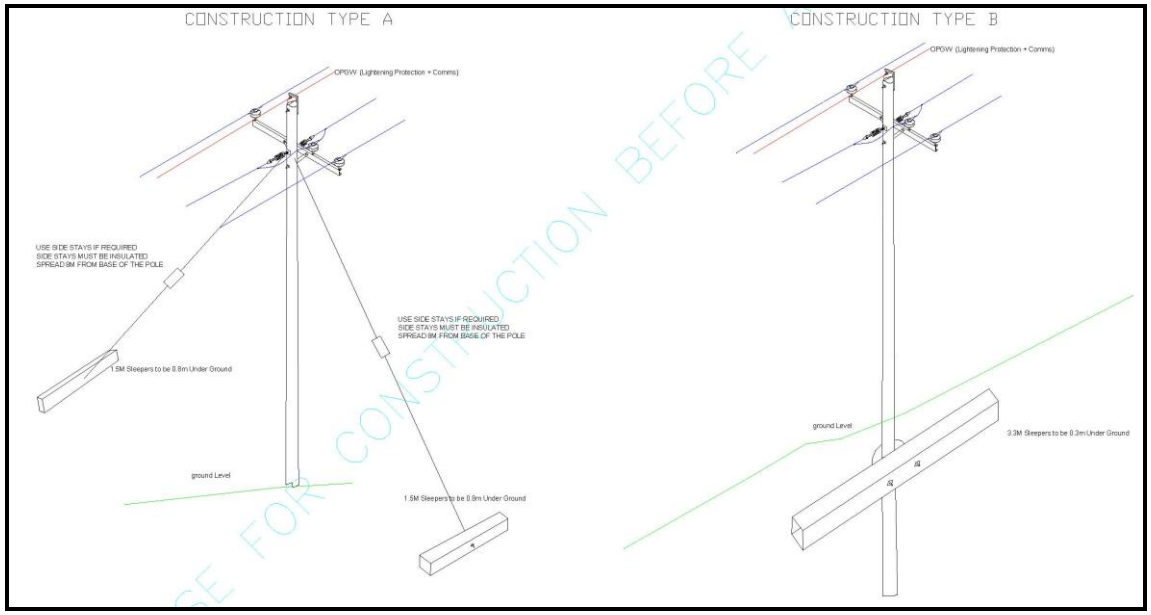

Plate 2-2: Typical Overhead Line Pole Construction

The cabling can be advanced at approximately 100m per day, but this could vary from 50m to 200m per day depending on ground conditions. For the total underground length of approximately 340m, this would take between 3 and 6 working days for the trenching and duct installation. A further day or two would be required to pull the cables through the ducting.

It is estimated that the poles can be erected in 2 to 3 days, with a further day or two to string the powerlines. The method statement for the powerline installation is provided in Appendix 2-1.

The Cloonkeelaun control building will be located adjacent to the existing floating road in a relatively flat area with shallow peat (<1m typically). It will be constructed at the same time as the wind farms / grid connection. The control building and parking area will have a total footprint area of 40m x 20m (800m^2). Plate 2-3 shows typical 20kV control buildings for wind farms.

Plate 2-3: Typical 20kV Wind Farm Control Buildings

2.4. Project Construction

The nature of wind farm developments is that a grid connection is generally constructed prior to or concurrent with the delivery of turbines to site. This approach minimises the risk that the turbines will be installed without facility to export energy. The construction sequencing of the proposed electrical connection will therefore need to dovetail with the construction of the permitted Black Lough and Cloonkeelaun wind farms and the construction of the grid connection from Cloonkeelaun to Glenree substation.

Construction works for the proposed electrical connection will follow this general sequence:

- Set-out of the site, marking the pole locations.
- Delivery of the poles to the site. Poles will be delivered to Black Lough T2 cranage area.
- Turbine T2 hardstand will be used as the main staging area for transport of poles to their installation location; the hardstand at Black Lough (and Cloonkeelaun) will be constructed prior to construction of this section of the electrical connection. Deliveries of poles and materials onto the SAC will be by helicopter to minimise trampling and rutting of the bog surface.
- Mobilisation of construction crew with low-bearing pressure plant to commence installation of poles.
- Trenching and ducting at northern and southern sections of route.
- Installation of cables and stringing of overhead line.

It is anticipated that this section of the electrical connection can be installed in approximately 1 week.

2.4.1. Material Requirements

The proposed electrical connection will require the following materials for its construction:

- Approximately 18 No wooden poles.
- Approximately 30 wooden sleepers.
- Approximately 12 No steel wire stays.
- Approximately 340m of 150mm diameter PVC ducting; 680m of 50mm ducting; 340m of earthing conductor; warning tiles / tape; approximately 6 No warning posts.
- Approximately 8km of cable.
- Sand for cable trenches (northern portion only).

The plant associated with the construction phase of the grid route will consist typically of the following:

- 1 or 2 No wide-track (low bearing pressure) excavators.
- 1 No. Argocat (or similar), low ground pressure vehicle with rubber tracks
- Cable pulling rigs.

Fuel consumption during the construction phase of this section of the grid route is estimated at 500 litres.

2.4.2. Temporary Site Structures and Facilities

During the construction phase, the site compounds for Black Lough Wind Farm and Cloonkeelaun Wind Farm will be used for the construction personnel installing the electrical connection. Facilities will include the following:

- Site office (Portacabin type construction).
- Canteen.
- Employee parking.
- Contractor lock-up facility.

These temporary facilities will be located at the construction site compound at Black Lough Wind Farm and on the hardstand of T17 at Cloonkeelaun.

Services at the site during construction will include:

- Toilet facilities will be a Portaloo. No septic tank will be provided.
- Electrical power will be provided by petrol/diesel powered generators.
- Bottled water will be used for potable supply.
- Water tanker will supply water used for other purposes.

The compounds will provide secure storage for ducting, cable drums etc.

2.4.3. Construction Traffic

The volume of construction traffic associated with the proposed development is discussed in Chapter 6.

2.4.4. Wastes Generated during Construction

The wastes/spoils likely to be generated during the construction phase will include the following:

- Excavated material: it is anticipated that excavated material will be used as backfill in cable trenches and around poles. Removal of excavated material offsite is not envisaged.
- Cut-offs from cable: any cut-offs will be taken off site for re-use (where appropriate), recycled (in the case of copper and other metal cut-offs), or taken to a licensed landfill facility.

- Domestic type waste generated by contractors will be collected on site, stored in an enclosed skip at the construction compounds and disposed of at a licensed landfill facility.

2.5. Operational Lifespan & Decommissioning

The expected physical lifespan of the turbines is at least 25 years from the date of commissioning. After this time, the owner will decide whether to replace (subject to planning permission) or decommission the turbines. However, it may be more financially viable to replace the turbines sooner, based on economic and technical grounds. This section of the electrical connection will remain in situ for as long as the turbines are in operation.

The Planning Guidelines for wind farm developments (DEHLG, June 2006)[21]**Error! Bookmark not defined.** set out the guidance for restoration in Section 5.14 as follows:

> '*The decommissioning of a wind energy development once electricity ceases to be generated must be assessed. Plans for decommissioning should be outlined at the planning stage. Issues to be addressed include restorative measures, the removal of above ground structures and equipment, landscaping and/or reseeding roads. It may be appropriate to allow tracks to remain, e.g., as part of a walking route after decommissioning*'.

Scottish Natural Heritage (SNH) also provides guidance on restoration and decommissioning of onshore wind farms (SNH, 2013)[26]. The SNH Guidelines represent recent research into site restoration and decommissioning of wind farm infrastructure. One important point to note is that reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. As noted in the SNH Guidelines, it is therefore:

> '*best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm*'.

In developing the reinstatement programme, a number of factors need to be considered when selecting the best option for each component of the wind farm. These are:

1. Re-powering of the wind farm. This will be an important factor in determining how the reinstatement of the wind farm will progress. If there is a decision to re-power (i.e. replace the turbines with new, more efficient turbines), then it is probably that the electrical connection will remain, perhaps being upgraded if a greater transmission capacity is required.
2. Carbon impact. For this section of the electrical connection, the poles and cabling will be removed if the wind farm ceases operation. Carbon impact of removing this infrastructure will be minimal.
3. Hydrological impact. Removal of the grid connection is unlikely to change the hydrological conditions at the site.
4. Landowners' preferences in consideration of their ongoing land uses: It is not envisaged that leaving this section of the grid route in place after the wind farm ceases would have any benefit for the landowner.
5. Utility operator: It is possible that the system operator (currently ESB Networks) would have a use for this section of line, but that could not be determined so far in advance.

An outline of the proposed decommissioning preferences is outlined as follows:

- **Underground Cabling**: It is proposed to remove the cables from site for recycling. This can be achieved by digging trial pits at intervals along the cable route, cutting the cable and pulling them out.
- **Overhead Line**: Powerlines would be removed for recycling. Poles would be removed for re-use or recycling.

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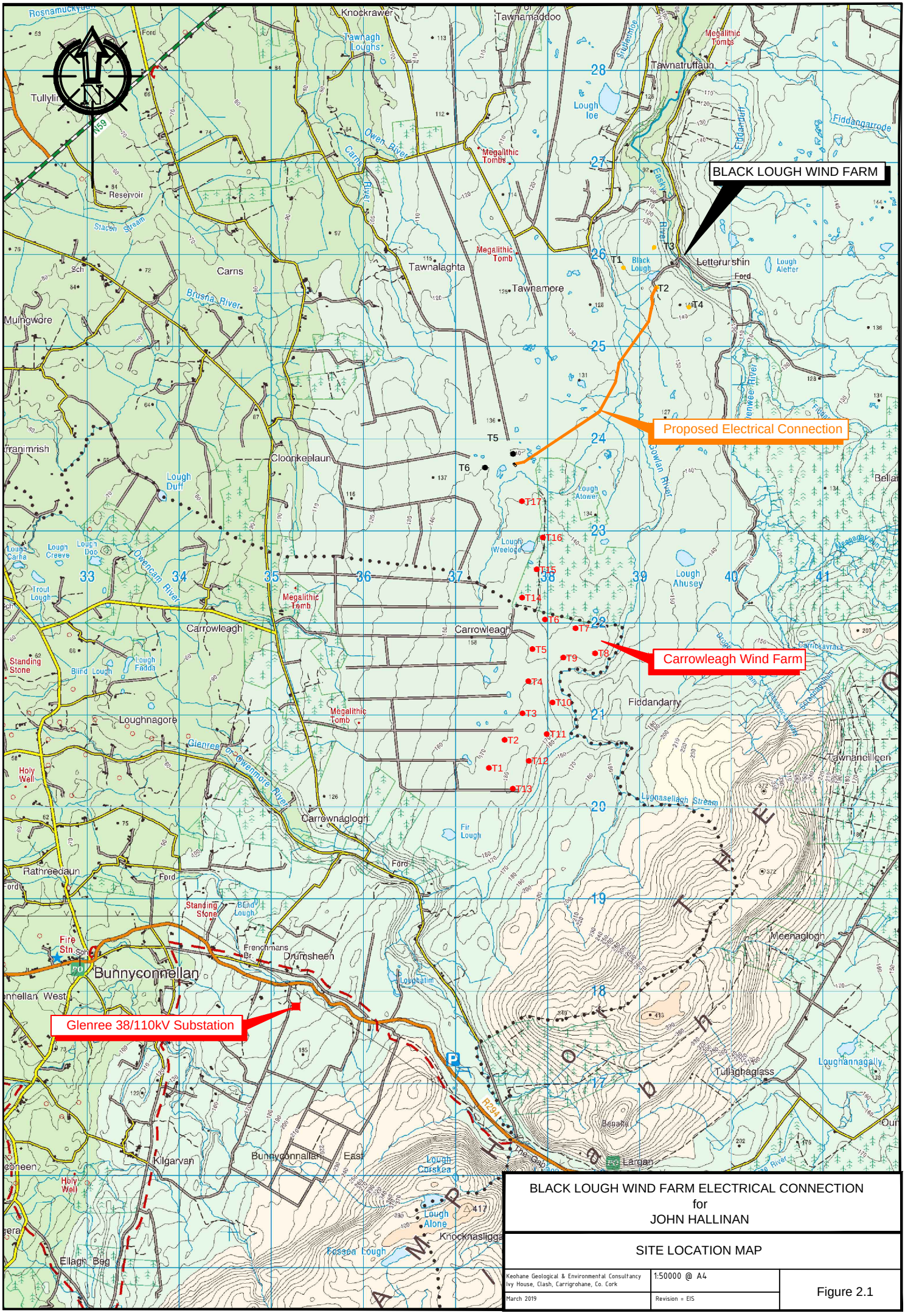

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

SITE LOCATION MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:50000 @ A4	Figure 2.1
March 2019	Revision = EIS	

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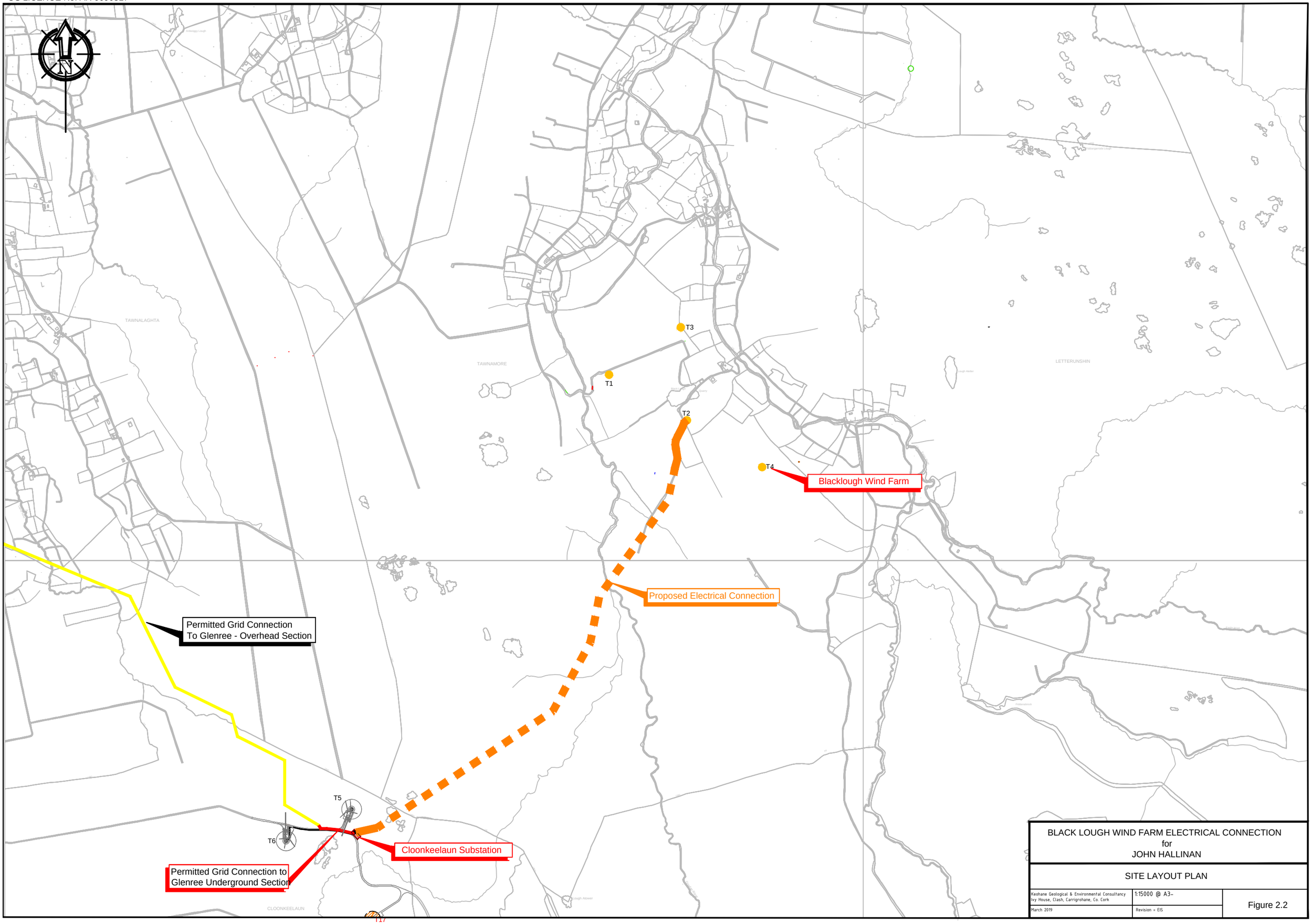

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

SITE LAYOUT PLAN

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:15000 @ A3-	Figure 2.2
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OS LICENCE No. AR 0090317

BLACK LOUGH WIND FARM

Proposed Electrical Connection

Cloonkeelaun Substation

Carrowleagh Wind Farm

Carrowleagh Substation

Glenree 38/110kV Substation

LEGEND

- PERMITTED CLOONKEENLAUN TURBINES (15/466)
- OPERATIONAL CARROWLEAGH WIND FARM
- PERMITTED BLACK LOUGH WIND FARM (17/93)
- EXISTING CARROWLEAGH 38kV GRID CONNECTION
- PERMITTED 20kV UNDERGROUND CABLE ROUTE
- PERMITTED 20kV OVERHEAD LINE ROUTE

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

PROPOSED CONNECTION ROUTE

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:35000 @ A3	Figure 2.3
March 2019	Revision = EIS	

3. VISUAL IMPACT ASSESSMENT

3.1. Introduction

This landscape assessment was prepared by Jennings O'Donovan and Partners Consulting Engineers in February 2019, having regard to the preservation of Focal Points and Views, as set out in the Sligo County Development Plan 2017-2023.

Sligo County Council granted planning permission for 6 No turbines (and associated infrastructure) – 4 No at Black Lough and 2 No at Cloonkeelaun – planning numbers PL17/93 and PL15/466 refer. The turbines have tip heights of 124.33m. The Council also granted planning permission for the northern part of the grid connection for the turbines – planning number PL16/422 refers. Mayo County Council granted permission for the southern section of the grid connection – planning number P16/822 refers. This grid connection is largely underground with a section of approximately 2.5km of overhead line, extending from Black Lough to Cloonkeelaun and then to Glenree County Mayo. It is now proposed (refer to Section 1.2 – Need for Development, and Section 1.4 – Alternatives) to replace the underground section (6.92km long) between Black Lough and Cloonkeelaun with an alternative connection. This will be approximately 2.64km long, with 2.3km of overhead line, 2km of which crosses the Ox Mountains Bogs SAC.

This assessment examines the effect of the electrical connection between the consented Black Lough Wind Farm and the control building on the consented Cloonkeelaun Wind Farm. The assessment looks at the cumulative impact of the proposed electrical connection with the consented turbines at Black Lough and Cloonkeelaun and other operational wind farms in the area.

3.1.1. Methodology

This assessment is carried out by examining the potential effects of the proposed electrical connection from the Viewpoints used in the Landscape and Visual Assessment of the 4 turbine Black Lough Wind Farm.

3.1.2. Scope of Study

This Landscape and Visual Assessment explores the potential effects of siting the proposed electrical connection between the consented Black Lough Wind Farm and the consented Cloonkeelaun Wind Farm control building in the townland of Tawnamore in regard to the character and features of the landscape and concomitant views/viewers. The assessment takes into consideration the consented 4 turbines at Black Lough Wind Farm and the 2 consented turbines at Cloonkeelaun Wind Farm as well as other existing neighbouring wind farms in both County Sligo and County Mayo. These include; Kings Mountain Wind Farm, Dunneill Wind Farm, Carrowleagh I+II Wind Farms and Lackan Wind Farm. Also, the assessment takes into account the consented wind farms in the area including; Bunnyconnellan Wind Farm and Kilbride Wind Farm (located in Carrowleagh townland).

In this report, the baseline (i.e. existing) quality of the receiving landscape is described in terms of its designated character, visual and scenic quality. The baseline also assumes the presence of the permitted 6 No turbines. Landscape character and sensitivity are appraised in terms of the proposed electrical connection. Comment is made on the visual presence of the proposed development and the anticipated aesthetic impact on its landscape context.

3.1.3. Definition of Study Area

The study area is the same as that used in the 2017 EIS[47] for the consented Black Lough Wind Farm. This allows the proposed electrical connection to be assessed cumulatively with the wind farm. The study area for the 2017 EIS was 20km due to the blade tip height being more than 100m as specified in the Wind Energy Development Guidelines.

3.2. Landscape Character & Assessment

3.2.1. Landscape Description

The site is located in the townlands of Tawnamore and Cloonkeelaun. The town of Dromore West is approximately 8.8km northeast of the site. Lough Easky is approximately 6km to the southeast.

The total site area is approximately 15.4ha. The landholding area is approximately 548ha. The site ranges in elevation from approximately 110m to 149mOD (Malin Head) sloping upwards from east to west. The site can be located on Discovery Series Map No. 24 between between Irish Grid Reference G377238 and G392256. This route crosses the Gowlan River and Ox Mountains Bogs SAC.

3.2.2. Sligo CDP 2011-2017-Landscape Character Assessment

The County has been classified into four landscape designations. These are based upon the visual sensitivity and ability to absorb new development without compromising the scenic character of the area. Please refer to Figure 3-1 – Sligo County Council Development Control Policy Map.

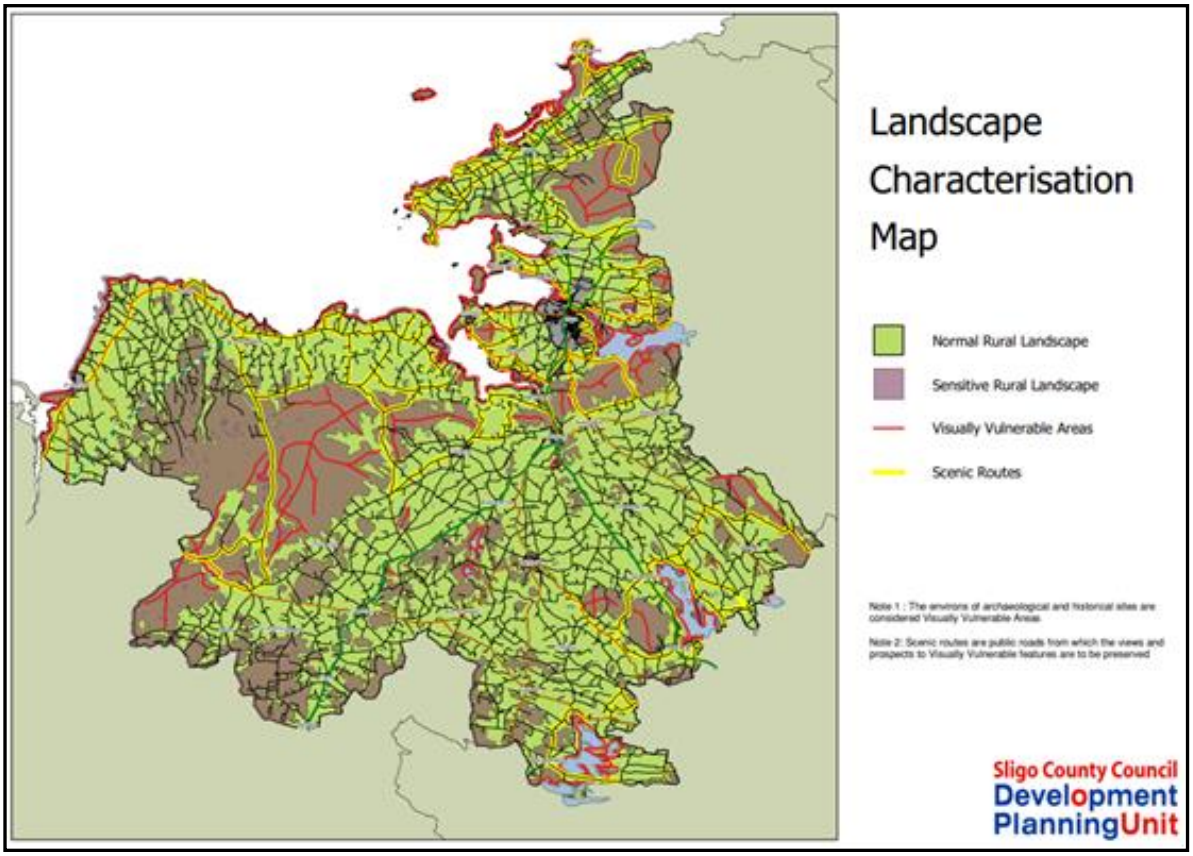

Figure 3-1: Landscape Character Areas & Archaeological Landscapes

The four main types of designation are:

- Normal Rural Landscape
- Sensitive Rural Landscape
- Visually Vulnerable Areas
- Scenic Routes

Normal Rural Landscapes: These are areas with natural features (e.g. topography, vegetation) which generally have the capacity to absorb a wide range of new development forms – these are largely farming areas and cover most of Sligo. At the same time, certain areas located within normal rural landscapes may have superior visual qualities, due to their specific topography, vegetation pattern, the presence of traditional farming or residential structures. These areas may have limited capacity for development or may be able to absorb new development only if it is designed to integrate seamlessly with the existing environment.

Sensitive Rural Landscapes: These are areas that tend to be open in character, with intrinsic scenic quality and a low capacity to absorb new development – e.g. Knocknarea, the Dartry Mountains, the Ox Mountains, Aughris Head, Mullaghmore Head etc.

Visually Vulnerable Areas: These are areas of distinctive and conspicuous natural features of significant beauty or interest, which have extremely low capacity to absorb new development – examples are the Ben Bulben plateau, mountain and hill ridges, the areas adjoining Sligo's coastline, most lakeshores etc.

Scenic Routes: These are public roads passing through or close to Sensitive Rural Landscapes, or in the vicinity of Visually Vulnerable Areas, and affording unique scenic views of distinctive natural features or vast open landscapes. In addition to remote views, scenic routes have often a distinctive visual character conferred by old road boundaries, such as stone walls, established hedgerows, lines of mature trees, adjoining cottages or farmyards together with their traditional, planted enclosures etc., all of which warrant protection.

The site is located in an area which has been designated as Sensitive Rural Landscape. These are "*areas with intrinsic scenic quality. Most of the sites are seen against sky or water*".

According to Sligo County Council's landscape assessment and protection objectives new developments which are to be situated in Sensitive Rural Areas must ensure that they:

- Do not impinge in any significant way on the character, integrity and distinctiveness of the area.
- Do not detract from the scenic value of the area.
- Meet high standards of siting and design.
- Satisfy all other criteria with regard to, inter alia, servicing, public safety and prevention of pollution.

There are 5 Sligo County Council designated views and prospects directed towards the general site location. These are listed in Table 3-1.

Table 3-1: List of Views and Prospects

Ref. No.	Description of Location	Views include	Dist. to Site (km)
7.	N59 Dromore West to Beltra	Atlantic Ocean and Ox Mountains	7
19.	R294 - The Gap to Mullany's Cross	Lough Talt and Ox Mountains	10
45.	Dromore West to Easky	Sligo Bay, the coast, and Ox Mountains	10
49.	Dromore West to Mullany's Cross (The Sligo Way)	Lough Easky, Ox Mountains and Atlantic Ocean	5
50	Masshill to Largan	Lough Talt and Ox Mountains	10

The closest of these is the local road network which runs from Dromore West to Mullany's Cross, it runs in a north-south orientation to the east of the site. The existing wind farms at King's Mountain, Dunneill and Carrowleagh I+II+III are presently clearly visible along this scenic amenity. Long range views of Lackan Wind Farm are visible to the northwest from sections of this route to the north of Easky Lough.

The 6 No permitted turbines will be wholly or partly visible from only two of these scenic amenities which are the N59 designated prospect and the Dromore West to Mullany's Cross prospect. Viewpoints 1, 2, 8 and 9 show the extent of visibility along the N59 designated prospect. Viewpoints 7 and 11 show the extent of visibility along the Dromore West to Mullany's Cross prospect. Please refer to Section 3.4.2.

3.2.3. Sligo CDP 2017 – 2023 – Transmission & Distribution Lines

The Sligo County Development Plan does not have any specific policies or objectives relating to overhead or underground transmission lines for renewable energy developments. However, SP-EN-1 states the following:

'Support the sustainable development, upgrading and maintenance of energy generation, transmission, storage and distribution infrastructure, to ensure the security of energy supply and provide for future needs, as well as protection of the landscape, natural, archaeological and built heritage, and residential amenity and subject to compliance with the Habitats Directive'.

3.3. Selection of Viewshed Locations

The locations of the selected viewpoints are set out in Table 3-2. The selected viewpoint locations are the same as those used in the assessment for the consented Black Lough Wind Farm.

Those eleven key views were selected through the following methods:

- Consultation with Sligo County Council's Planning Section,
- Analysis of the Sligo County Development Plan 2011-2017 and 2017-2023,
- Visual Modelling Analysis,
- Ground Surveys.

The locations of the selected viewpoints are discussed below and displayed in Figure 3-2 and described in Table 3-2. They include:

- Key Settlement of Dromore West,
- Views from the N59 and R294,
- Views from across Lough Easky,
- Sligo County Council designated viewpoints, tourist routes or viewpoints/parking areas specified in the Discovery Series Map.
- Views adjacent to site were also selected.

The consented Black Lough Wind Farm site is visible from the immediate north, southeast and west. Visibility further to the east and southeast of the assessment area is restricted due to the Ox Mountain range and the Atlantic Ocean covers approximately 20% of the assessment area to the north.

Views were selected from all directions however to give a full picture of the site on the landscape. This assessment aimed to produce a mix of short and long-range views.

Table 3-2: Viewpoint Details

View Points	Grid Co-ordinates	Description	Approx. Distance to Site
1	139224 E 332441 N	N59 - Camcuill	6.7 km
2	142082 E 333767 N	N59 – Dromore West	8.6 km
3	141405 E 334462 N	Porlaghbradagh	9.0 km
4	141440 E 335375 N	R297 - Ballymeeny	9.9 km
5	131611 E 323922 N	Farranimrish	7.5 km
6	136338 E 317546 N	Bunnyconnellan	8.4 km
7	144914 E 322364 N	Easkey Lough	6.1 km
8	133968 E 328240 N	N59 Ford Crossroads	6.5 km
9	138309 E 331722 N	N59 Owenbeg	6.0 km
10	137891 E 326488 N	Tawnamore	1.1 km
11	144768 E 325235 N	County Road to Easky Lough	5.2 km

3.4. Potential Impacts

3.4.1. Photomontages / Wireframes

Wireframes and Photomontages were prepared for the eleven selected viewpoints. The furthest viewpoint is located 9.9km from the consented Black Lough Wind Farm site. Each viewpoint has been examined to determine the potential effects the proposed electrical connection may have in conjunction with the consented 6 No turbines, which the electrical connection will serve.

The assessment has taken into consideration the existing neighbouring wind farms including; Kings Mountain Wind Farm, Dunneill Wind Farm, Carrowleagh I+II+III Wind Farms and Lackan Wind Farm. Also, the assessment takes into account the consented wind farms in the area including; Bunnyconnellan Wind Farm and Kilbride Wind Farm (located in Carrowleagh townland).

3.4.2. Viewpoint Details & Landscape Sensitivity

Black Lough Wind Farm was assessed from eleven different viewpoint locations. The assessment of each viewpoint took into consideration the viewsheds sensitivity rating and the potential dominance of the turbines on the landscape. The cumulative visual impact of wind farms in the vicinity of the proposed Black Lough Wind Farm was incorporated into the visual assessment. The proposed electrical connection from T2 to the control building at the consented Cloonkeelaun Wind Farm has been assessed taking the visual assessment of the consented 6 No. turbines as its baseline condition.

View Point 1 – N59 Camcuill
This viewpoint is located 6.7km west of Dromore West on the National Secondary Road N59 to Ballina. This view is not designated as a scenic prospect by Sligo County Council Development Plan 2017 – 2023 (though it was in the 2011-2017 Plan). The area does not hold any Environmental Designations (National and International). The proposed turbines are screened behind the conifer plantation with limited turbine visibility. There is minimal impact resulting from the consented turbines on views from this location and the landscape has been classified with a low sensitivity rating. The proposed overhead line from T2 to the control building at Cloonkeelaun will not be visible from this location. Overall the visual impact is of very low significance.

View Point 2 – Dromore West
This view is located along a Sligo County Council scenic prospect. It is located adjacent to the town of Dromore West. The area does not hold any Environmental Designations (National and International). It is at the edge of the scenic route which runs between Dromore West and Beltra. Again, there is limited visibility of the consented turbines from this location. There is minimal visual impact resulting from the consented turbines, the viewshed has been classified as medium sensitivity. The proposed overhead line from T2 to the control building at Cloonkeelaun will not be visible from this location due to distance and intervening vegetation. Overall the visual impact is of low significance.

View Point 3 - Portlaghbradagh
This view is located just off the regional scenic route from Dromore West to Easky. Due to the fact that there are no key features, the viewshed has been given a low sensitivity rating. The consented turbines are completely screened behind the conifer plantations, so no visual impact arises at this viewshed. The proposed overhead line will not be visible from this location.

View Point 4 – R297 Ballymeeny
This view is located at on the R297 which runs from Dromore West to Easky. The area is classified as a scenic amenity in the Sligo County Council Development Plan. It does not hold any Environmental Designations (National and International). The area has been rated as a medium landscape sensitivity area. No turbines are visible along this route therefore there is no visual impact. Nor will the proposed overhead line be visible from this location.

View Point 5 – Farranimrish
This viewpoint is located at Farranimrish, just outside Corballa. The area does not hold any Sligo County Council Landscape Designations or Environmental Designations (National and International). The viewpoint has been classified as medium sensitivity. Blades of the consented turbines are visible from this viewshed. Due to the extensive distance from the proposed site and the resulting unimposing impact, the dominance rating is moderate. Kings Mountain Wind Farm is also visible from this viewshed, located behind Black Lough Wind Farm. The proposed overhead line is unlikely to be visible from this location given the height of the line, distance, intervening topography and vegetation. Overall the visual impact is of medium significance.

View Point 6 - Bunnyconnellan
This viewpoint is located just outside the village of Bunnyconnellan. The area does not hold any Environmental Designations (National and International). In the foreground of the photomontage, the existing Carrowleagh I+II+III Wind Farms are the most visually dominant wind energy development. Also, the consented Kilbride (Carrowleagh) wind farm is visually dominant. The 6 No consented turbines are visible to the rear of the operational Carrowleagh I+II+III Wind Farms, and the consented Kilbride Wind Farm.

The 6 No consented turbines have a moderate dominance on the surroundings. The viewshed has been classified as highly sensitive due its panoramic views and proximity to the Western Way. Due to the masking topography of the Ox Mountains, this is the closest location to the Sligo Way and Masshill to Lurgan scenic prospects at which the 6 No turbines are visible. Overall the visual impact is of high significance. However, the proposed overhead line will not be visible from this location due to the distance and the area of forestry in the foreground. As such, it will not add to the visual impact.

View Point 7 – Easky Lough
This view overlooks Easky Lough in the direction of the consented turbines. The viewshed is considered to be of very high sensitivity as it is designated as a Special Area of Conservation. The area has also been classified as a scenic amenity by Sligo County Council. Only, the blade tip for one of the consented turbines is visible from this viewshed resulting in a minor visual impact. Overall the visual impact is of medium significance The proposed overhead line will not be visible from this location, screened by hills, so the overhead line doesn't increase the visual impact.

View Point 8 – N59 Ford Crossroads
This view is located between Culleens and Corballa on the National N59 to Ballina. This view is part of the N59 designated scenic prospect. Some of the consented turbines are partially exposed from this location. The dominance is considered to be moderate. This area has no specific visual sensitivity, and the viewshed has been classified as being of low sensitivity. The area does not hold any Environmental Designations (National and International). Long range views are limited at this location of the existing Carrowleagh Wind Farms I+II+III due to screening by existing forestry. The consented Kilbride Wind Farm to the right of photomontage is also screened by existing forestry. The viewshed is predominantly subject to adjoining treelines across the photomontage. This provides screening, therefore, lowering the visual impact. Overall the visual impact is considered of low significance. The proposed overhead line will not be visible from this location due to the existing forestry.

View Point 9 - Owenbeg
This view is located on the N59 between Dromore West and Culleens. This view is part of the N59 designated scenic prospect. The landscape is considered to be of medium sensitivity, with moderate visual dominance. Most of the consented turbines are visible. The blade tips for some of the existing Carrowleagh I+II+III Wind Farms and consented Kilbride Wind Farm, are slightly visible in the background of the photomontage. The proposed overhead line is unlikely to be visible from this location given the height of the poles (c.11m) and the intervening topography. Overall, the visual impact on the landscape is considered to be of medium significance.

View Point 10 – Tawnamore
This view is located in the townland of Tawnamore, on the local road which runs to the site. The area does not hold any Sligo County Council Landscape Designations or Environmental Designations (National and International). Although the turbines appear uncharacteristic when set within the receiving landscape there are no appreciable features from which their presence detracts. Thus, the landscape is considered to be low sensitivity and the visual dominance is considered to be high. The proposed overhead line will be visible from this location. Overall the visual impact is of medium significance.

View Point 11 – County Road to Easky Lough
This view is located in the townland of Trasgarve, on the local road which runs from the N59 to Easky Lough. This route forms part of the Dromore West to Mullany's Cross scenic amenity as designated by Sligo County Council. It is designated due to its views of Easky Lough, the Ox Mountains and the Atlantic Ocean. The landscape is considered to be of high sensitivity. All consented turbines are visible at this location and the dominance has been rated as high, in particular the 4 No at Black Lough. Distant views of the other wind farms in the area are available from this location. The proposed overhead line is likely to be visible from this location, although it will be a distant view in the landscape. Overall the visual impact is of very high significance.

3.5. Proposed Vs. Consented Grid Connection

The consented grid connection from Black Lough Wind Farm to the control building at Cloonkeelaun Wind Farm is 6.92km in length and located entirely underground. The proposed electrical connection is 2.64km in length and consists mostly of overhead line. Therefore, the proposed connection will have a greater visual impact on the landscape during its operation than would the consented grid connection option, despite being longer.

The 2.62km of overhead line between Cloonkeelaun and Glenree will be well screened from public roads by topography and set-back distances, and will be similar to the existing ESB distribution network to homes in the area. The grid connection will therefore have little visual impact.

3.6. Assessment of Impact

The wind farm is deemed to be of a high and very high significance from 2 of the viewpoints, of medium significance from 4 out of the 11 viewpoints, of low significance from 2 out of the 11 viewpoints, and of very low significance for one of the viewpoints. There are 2 viewpoints where no visual impact occurs. These results show that the surrounding landscape has a high visual absorption capacity. The site is moderately visible from the surrounding areas, but not considered to be an obtrusive negative impact. The addition of the proposed overhead line will not significantly add to the impact on the landscape given its relatively small scale in comparison with the wind turbines and the distance from the viewpoints. The remote location, undulating topography and forestry will screen views of the overhead line from most public roads.

3.7. Conclusions

To avoid the visual impact of the electrical connection, it would need to be installed underground. This is the recommended option in the Wind Farm Guidelines – Section 6.11.3, '*Power line connections between turbines and from turbines to the control building should be underground'.* This is the method used for most of the turbines and indeed most of the grid connection to Glenree. However, on balance with other aspects of the environment (namely ecology), an overhead line across the SAC is the better option. Also, as discussed in Sections 1.2 (Need for the Development) and 1.4 (Alternative), the permitted underground grid connection between Black Lough and Cloonkeelaun is no longer available. The use of single wooden poles rather than steel lattice masts will reduce visual impact of the line.

3.8. References

This Landscape and Visual Impact Assessment also makes reference to, or has reviewed, the following guidelines and key documents:

1. Wind Energy and the Environment (Sustainable Energy Authority of Ireland), http://www.seai.ie/Publications/Renewables_Publications_/Wind_Power/Wind_Energy_and_the_Environment.pdf
2. Sligo County Development Plan 2011 – 2017.
3. Sligo County Development Plan 2017 – 2023.
4. Landscape Character Assessment Guidance for England and Scotland (Scottish Natural Heritage & The Countryside Agency, 2002).
5. Environmental Impact Assessment DCAN 10 (revised; Department of the Environment Planning Service, 1999).
6. Best Practice Guidelines for Wind Energy Development (British Wind Energy Association, 1994).
7. Planning Guidelines for Wind Farm Development (Department of Environment, Heritage and Local Government, 2006).
8. Attitudes Towards The Development of Wind Farms in Ireland (Sustainable Energy Ireland, 2003).
9. Atlas of the Irish Rural Landscape (Aalen, F.H.A., Whelan, K. & Stout, M., 1997) ISBN 1 85918 0957.

4. POPULATION & HUMAN HEALTH

Human beings in the vicinity of the site, potential impact of the development thereon and proposed mitigation measures are presented in this chapter. The aspects covered include public health, socio-economics, house prices and tourism. The other areas examined with respect to the potential effects of the proposed development on humans are noise (Chapter 5), traffic (Chapter 6) and visual impacts (Chapter 3). The topics addressed in this chapter do not have any cumulative impact with the wind farms. The cumulative impacts of the wind farms on the other aspects (noise, traffic and visuals) are discussed in the relevant chapters.

4.1. Human Beings in the Existing Environment

The proposed electrical connection is in a rural setting, with the nearest third-party dwellings greater than 980m to the north. The settlement pattern in the area is one of scattered farmhouses and one-off housing along the local roads to the west and north of the site. There are no occupied houses to the south or east of the proposed connection route for distances greater than 4km. The public roads in the vicinity of the site are local roads with a low housing density. The electrical connection is located mostly within peatland, with rough grazing lands at its northern end. Commercial turf cutting, low intensity farming and commercial forestry are the principle land uses in the area.

The nearest villages are Bunnyconnellan in County Mayo, approximately 7km to the southwest and Dromore West, approximately 8.8km to the northeast. Enniscrone is the nearest town to the site at approximately 11km to the northwest. Ballina is the main population centre in the area at approximately 13km to the southwest. Figure 2-1 shows the site location map.

The nearest inhabited dwellings to the electrical connection are listed in Table 4-1 with distances to the nearest part of the proposed electrical connection provided. Figure 4-1 shows the locations of the referenced dwellings. Of the 7 houses listed in Table 4-1, no third-party houses are located within 500m of electrical connection. The nearest house to the proposed grid route is H1 at 345m; this is owned by the applicant's parents. The nearest third-party house, H4, is located 980m from the northern part of the grid route. The site is remote from any village, schools or churches.

Table 4-1: List of Nearest Houses to the Proposed Turbines

House No.	Co-ordinates	House Separation Distances (m) Proposed Electrical Connection
H1 (applicant's parents' house)	539315 / 825895	345
H2 (applicant's house)	539388 / 826331	735
H3	539338 / 826621	1,000
H4	539181 / 826614	980
H5 (not occupied)	538404 / 826292	990
H6 (new build – not completed / construction stopped)	538453 / 826363	995
H7	538494 / 826405	1,010

4.2. Public Health

Electricity powerlines have an associated electro-magnetic field (EMF), the strength of which is dependent on the voltage, current flows and distance from the powerline. EMF are also naturally occurring (e.g. earth's magnetic field) and also associated with many everyday household appliances (e.g. microwaves, TVs and hair driers). Electrical power at 50Hz operates at extremely low frequency (ELF). The ESB has published an information booklet on this topic – EMF and You[27].

Since the 1970's, studies have been carried out on the health effects of EMF associated with high voltage powerlines – 110kV up to 400kV; there are no known studies for 20kV powerlines. Following reviews of the available research, international health agencies have not found a causative link between childhood illnesses and high voltage powerlines[28], [29]. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has recommended an ELF-EMF exposure limit of 5kV/M and 100µT, respectively, for the general public. These were adopted by the Council of the European Union in 1999. In 2010, ICNIRP revised its EMF exposure limit to 200µT, but this has not been adopted by the European Union.

Plates 4-1 and 4-2 show the strengths of EMF and ELF of different sources against the guideline exposure limit.

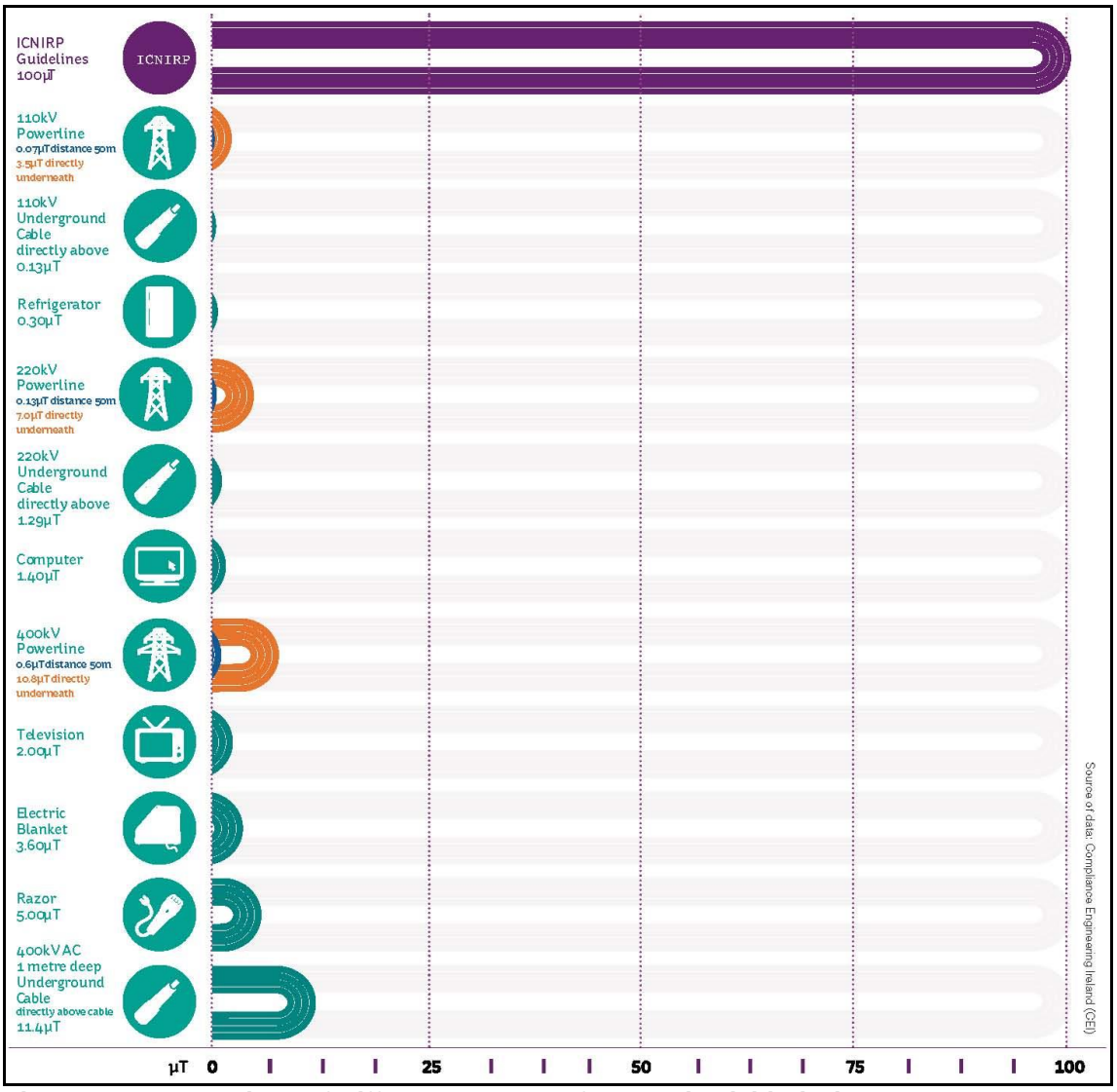

Plate 4-1: Comparison of Different Sources of Magnetic Fields (µT)

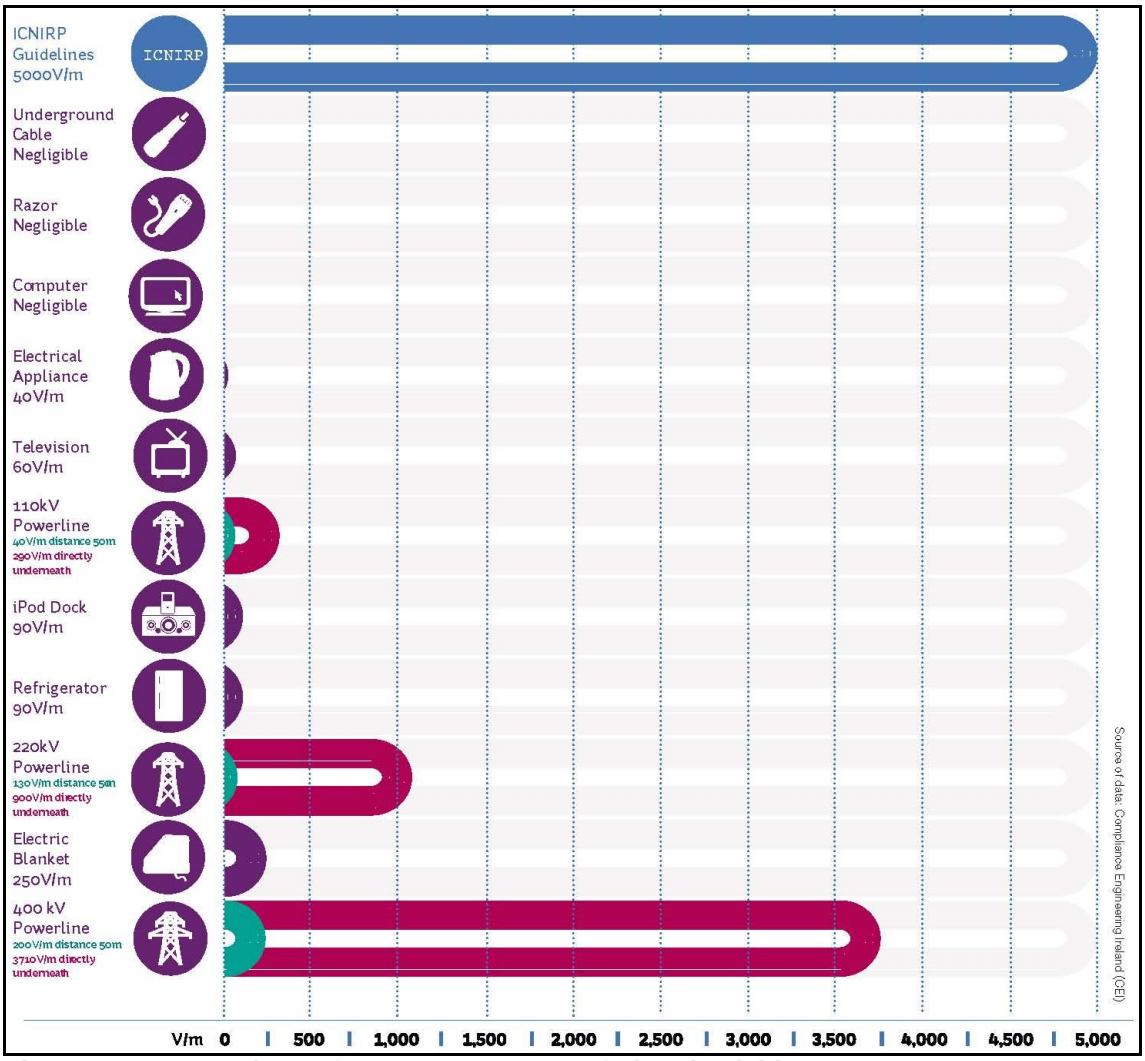

Plate 4-2: Comparison of Common Sources of Electric Fields

The magnetic field strength under 11kV powerlines is typically 0.4µT with a maximum of 3.7µT. The electrical field strength under 11kV powerlines is typically 50V/m with a maximum of 108V/m[30]. These would be comparable to the proposed 20kV line.

The overall conclusion of the research is that medium voltage powerlines do not present a human health risk. As noted in the Plates 4-1 and 4-2, the levels of ELF and EMF are measured directly under the powerlines. The proposed 20kV is distant from houses in a remote, relatively inaccessible location. There is no cumulative impact with the wind farms.

4.3. House Prices

No impact is predicted on house prices associated with the proposed electrical connection. International studies on the impact of wind farms on houses prices[31], [32], [33], [34], [35] concluded that there is no evidence of long-term negative impact on house prices due to proximity of wind farms. As such, no cumulative impact is envisaged with the construction of the overhead powerline in combination with the wind farms (operational and permitted).

4.4. Potential Impact on Human Beings

4.4.1. Health and Safety

The proposed electrical connection will be designed, constructed, operated and decommissioned in accordance with the Safety, Health & Welfare at Work (Construction) Regulations 2013, and as amended and with the Irish best practice guidelines (as available). Aspects of the development will present health and safety issues. These are discussed as follows:

Construction Health and Safety

- Traffic safety during the transport of materials to the site.
- Lifting of poles and material to the route using helicopter.
- Working with electricity during commissioning.
- Working at heights.
- General construction site safely (e.g., slip/trip, deep peat, moving vehicles etc.).

A safety statement covering all aspects of the construction process will deal more fully with these and other related issues. Safety procedures will be developed specific to the site. These procedures will apply to the entire site area. Specialist contractor will be engaged for the installation of the electrical connection.

FAS Safepasses will be required for all construction staff. All machinery operators, slingers/signallers and telescopic handler operators will be required to have a Construction Skills Certificate Scheme (CSCS) Card. The site manager will be responsible for the implementation of procedures outlined in the safety statement. Similar procedures will be implemented during construction of the wind farms.

There may also be a concern for visitors to the site both during the construction phase and the operation phase. It is not feasible to erect a security fence around the entire construction site due to the site size. Access to the site during the construction phase will be restricted in a manner similar to any construction site. Appropriate warning signs will be posted, directing all visitors to the site manager. It should be noted that the electrical connection will be located on private lands, to which members of the public have no right of access.

Operational Health and Safety

During the operation, access to the electrical connection will be restricted in the same way as it was to the private farmland prior to construction.

4.4.2. Socio-Economics

The design, construction and operation of the electrical connection will provide employment to the local community. The design and planning stage will provide employment for a number of technical consultants. This will be relatively short-term (i.e. six to nine months for the entire wind farm project including electrical connection) during the planning, detailed design and construction periods. The construction phase will provide employment for local trades people, labourers, and specialised contractors. This will have a direct short-term positive impact on the local economy.

Contribution to Local Community

The operational phase of the electrical connection will not present direct full-time employment opportunities. The employment opportunities will be associated with the wind farm operation. Repairs to the powerline may be required from time to time.

4.4.3. Recreation, Amenity & Tourism

The electrical connection will have no impact on recreation, amenity or tourism.

4.5. Mitigation Measures for Human Beings

4.5.1. Health and Safety

Construction Health and Safety

A site-specific health & safety statement for the construction phase of the project will be prepared in accordance with the Safety, Health & Welfare at Work (Construction) Regulations 2013. This will address all issues of the construction project including:

- general site safety
- footwear required
- heavy equipment operation
- air-deliveries of poles etc
- Working near open water
- protective clothing
- remote working & deep peat
- lockout/tag-out procedures for electrical work
- working at heights

FAS Safepasses will be required for all construction, delivery, and security staff. All machinery operators, slingers/signallers and telescopic handler operators will be required to have a Construction Skills Certificate Scheme (CSCS) Card. The site manager will be responsible for the implementation of procedures outlined in the safety statement.

Public safety will be addressed by restricting site access. Appropriate warning signs will be posted, directing all visitors to the site manager. Similar procedures will be implemented during construction of the wind farm.

Operational Health and Safety

A safety, health and welfare statement for the operation of the wind farm will be prepared in accordance with the Safety Health and Welfare at Work Act 2005, Safety Health and Welfare at Work (General Application) Regulations 2007, Safety Health and Welfare at Work (Construction) Regulations 2013 and any other relevant statutory requirements. This will address maintenance and repair work associated with this section of the electrical connection. The safety statement will be brought to the attention of all workers on the site to help achieve a safe place to work.

No new fencing will be put in place on the site, other than standard livestock fencing.

Adequate clearance of structures from overhead lines will be provided. In this case, the overhead head will commence >145m from the turbines at Black Lough and Cloonkeelaun.

No avoidance/remedial/reductive measures are required for levels of electro-magnetic radiation, since these are not in any way likely to lead to health effects.

4.5.2. Socio-Economics

The development will provide employment opportunities to the local community during the construction phase. The ongoing sustainable income for the developer / landowners involved is associated with the wind farms, rather than the electrical connection.

As these effects are positive or neutral, no mitigation measures are necessary.

4.5.3. Recreation and Amenity

It is not considered likely that mitigation measures are necessary in this respect.

4.6. Conclusions on Human Beings

Mitigation measures will be put in place to minimise health & safety impacts during the construction phase of the electrical connection. These are not considered to be significant. In terms of socio-economics, the development is expected to have a positive impact with local employment during construction. The electrical connection will facilitate the alternative income streams for landowners from the wind farm it will serve. The electrical connection will have no impact on tourism in the area.

OS LICENCE No. AR 0090317

BLACK LOUGH WIND FARM

OX MOUNTAIN BOG SAC/ pNHA

Proposed Electrical Connection

Permitted Grid Connection To Glenree - Overhead Section

Permitted Grid Connection To Glenree Unfround Section

Cloonkeelaun Substation

1Km Offset

Megalithic Tomb

Tawnalaghta

Tawnamore

Letterunshin

Ford

Black Lough

Lough Aletter

Lough Atower

Lough Weelogue

Gowlan River

Owenwee River

Fiddanabrock

H1 H2 H3 H4 H5 H6 H7

T1 T2 T3 T4 T5 T6 T17 T16

LEGEND

- PERMITTED BLACK LOUGH WIND FARM
- PROPOSED ELECTRICAL CONNECTION, DASHED WHERE OVERHEAD LINE
- SPECIAL AREA OF CONSERVATION
- H1H2 = HOUSE LOCATION

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

HOUSE LOCATION MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:15000 @ A3-	Figure 4.1
March 2019	Revision = EIS	

5. NOISE

The noise chapter of this EIAR has been prepared by Mr. Iain Mac Phee of AV acoustics. Mr Mac Phee prepared the noise chapter for the Black Lough Wind Farm – planning number P17/93 refers.

Mr Mac Phee has completed the Institute of Acoustics Diploma in 'Acoustics and Noise Control', is an active member of the Institute of Acoustics Irish branch and has been involved in the field of noise measurement and control for over 30 years. Since 2005, Mr Mac Phee has worked in the acoustics industry in Ireland, undertaking a range of projects for developers, statutory bodies or complainants. Projects completed include wind turbine developments and compliance measurements, noise impact assessments for commercial premises, and noise measurements pertaining to quarry developments in the planning and operational phases. Prior to 2005 Mr Mac Phee worked in the UK acoustic sector with a special emphasis on machinery noise measurement and control.

The main aspects considered in this assessment are:

- Existing noise environment at Noise Sensitive Locations (NSL) in the vicinity of the proposed development.
- Impact during construction of the electrical connection.
- Cumulative noise impacts during construction.

No significant operational noise emissions from the proposed electrical connection are envisaged.

5.1. Site layout and Measurement Locations

The general area of the proposed development site is shown in Figure 4-1 (House Location Map). Background noise measurements were made for the wind farm noise assessment.

Figure 4-1 shows seven houses within approximately 1km of a proposed electrical connection. The houses are identified as H1 to H7. Note that the owners of H1 and H2 have a financial interest in the wind farm and proposed electrical connection. H3 and H4 are both occupied, and during noise measurements vehicular movements were observed at both these locations.

H1 has some large trees in the immediate vicinity, and the Easky River flows fairly close by, and was audible during site visits. In the immediate vicinity of H2 there is open ground, with the nearest trees about 100m to the west. The fields around H2 were being grazed by sheep and cattle during site visits. In the vicinity of H3, the Easky River flows quickly over small waterfalls and rock pools, and there are some high trees in the immediate vicinity. Nominally south of H4, there is an open field, bounded by hedges and some high trees. During site visits this field was not being grazed, though evidence of recent tractor movements were obvious in the soft ground. Houses H1 to H4 are in the 'noise shadow' of the turf banks, and there was no contribution to the existing noise environment due to activities on the turf banks. There was very little vehicular movement on the local road that ends at H1, and any observed vehicular traffic was directly associated with houses H1 to H4 with no observed traffic passing to, or from, the turf banks.

Houses H5, H6 and H7 lie very close to each other, nominally north of the development site. During site visits, it was apparent that H5 was unoccupied, and appeared to have been unoccupied for a considerable time. H6 is unfinished and though roofed has no windows. H7 appeared to be occupied and vehicle movements in the vicinity of H7 were noted.

Plate 5-1: View of Houses H5 to H7

There are a variety of tall trees, and some lower bushes and hedges, in very close proximity to H5, H6 and H7.

A local road, the L6707, runs between H5 and H6. During site visits, this local road had regular vehicular traffic movements in the vicinity of H5 / H6. The majority of these movements were associated with works on the turf banks in the area, and most vehicles were slow moving tractors. Some noise was also discernible in the area around H5 / H6 and H7 from vehicle movements in the distance as they accessed or manoeuvred on the turf banks.

In order to avoid the influence of the passing traffic on the noise measurements, and to minimise the influence of the noise from running water in the Easky River on measurements, the locations chosen for the long-term noise measurements were H2 and H4. Measurements in these locations were expected to result in the lowest noise levels in the development area.

This selection of measurement locations is in accordance with recommendations in the Institute of Acoustics publication '*A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise'* where in Section 2.3.1 it states:

> ***SB6:*** *Background noise surveys may be carried out at any time of the year provided that seasonal effects leading to raised noise levels can be excluded by selection of measurement position or by exclusion of non-typical data during analysis*

And further in Section 2.5.2 of the same publication:

> *Equipment should be placed at outdoor positions where noise levels are representative of typical 'low' levels likely to be experienced in the vicinity of a dwelling (or group of dwellings if the measurements are intended to be applied to more than one dwelling). The overriding consideration is that it can reasonably be claimed, from inspection and observation, that there are no other suitable noise-sensitive locations, in the vicinity of any selected location and close to a dwelling, where background noise levels would be expected to be consistently lower than the levels at the selected position. This is a matter of judgment: the objective is to measure 'typical' or 'indicative' not 'absolute lowest' levels of background noise (which could only be determined by extended measurements at a large number of locations over a long period which is neither necessary nor practicable).*

And again, in Section 2.5.7 recommendations for the positioning of the microphone have been followed:

> *In all cases, microphones should be supported at a height of 1.2 – 1.5 metres above the ground and no closer than 3.5 metres to any significant reflecting surface (such as a building or fence), except the ground. The position should be within 20 metres of the dwelling unless there are particular reasons for measuring at a more distant position (such as the presence of vegetation or denial of access); if so, the reasons should be explained.*

The noise measurement locations are shown in Plates 5-2 and 5-3.

Plate 5-2: Noise measurement location 1 with H2

Plate 5-3: Noise measurement location 2 with H4

The combined anemometer and rain gauge was located near turbine T3 and is shown in Plate 5-4. This photograph also shows the activity on the turf banks, (right of photo) and house H1 obscured by the high trees in the centre of the photo.

Data from the rain gauge was used to remove any sound level measurements that included periods of rainfall.

Plate 5-4: Anemometer and Rain Gauge

The anemometer was at a fixed 1.5 m height. The wind shear effect for a 10m height was calculated using $v / v_o = (h / h_o)^{\alpha}$ where v = the velocity at height h (m/s), v_o = the velocity at height h_o (m/s) and α = the wind shear exponent. A wind shear exponent of 0.25 for hilly terrain was used.

A site layout is shown in Figure 4-1, with the proposed electrical connection, Black Lough turbines (T1, T2, T3 and T4), Cloonkeelaun turbines (T5 and T6), Carrowleagh turbines (T16 and T17), along with houses (H1 to H7) also indicated.

5.1.1. Noise Level Measurements

Noise level measurements were carried out in accordance with ISO 1996 Part 1 (Description and Measurement of Environmental Noise - Part 1. Basic Quantities and Procedures). The equipment used for the noise measurements is summarised in Table 5-1.

Table 5-1: Noise Measurement Equipment Used

Equipment inc Serial Number	Location Used	Calibration Details
Bruel & Kjaer Type 2250 Sound level meter serial number 250363	H2	Factory calibrated 22nd June 2016
Bruel & Kjaer Type 2250 Sound level meter serial number 2506361	H4	Factory calibrated 18th Jan 2016

Prior to, and following measurements, the sound level meters were 'field calibrated' using a B&K 4231, s/n: 2010166 and no drift was observed. The Bruel & Kjaer 4231 was itself factory calibrated on 25 February 2016. Calibration certificates are included in Appendix 5-1.

Noise levels presented are the L_{90} levels, that is, the background level, which is in accordance with the recommendations of ETSU (R) 97.

Figure 5-1 shows the L_{90} background level measured at H4, vs the calculated wind speed at a nominal 10m height. Figure 5-1 also shows the 'average' background level calculated using a third order polynomial function trendline, and the 'average' background + 5 dB. Figure 5-2 shows the L_{90} background level measured at H2, vs the calculated wind speed at a nominal 10m height. Figure 5-2 also shows the 'average' background level calculated using a third order polynomial function trendline, and the 'average' background + 5 dB.

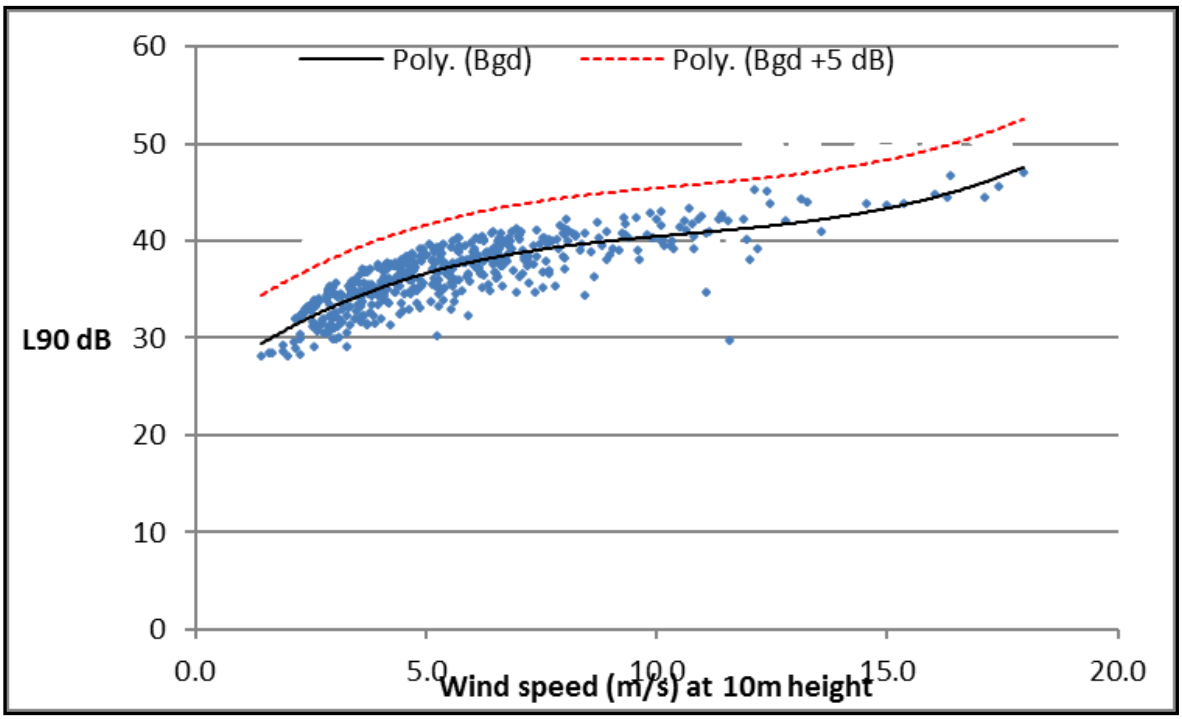

Figure 5-1: Background Noise Levels and 'Average' Levels at H4

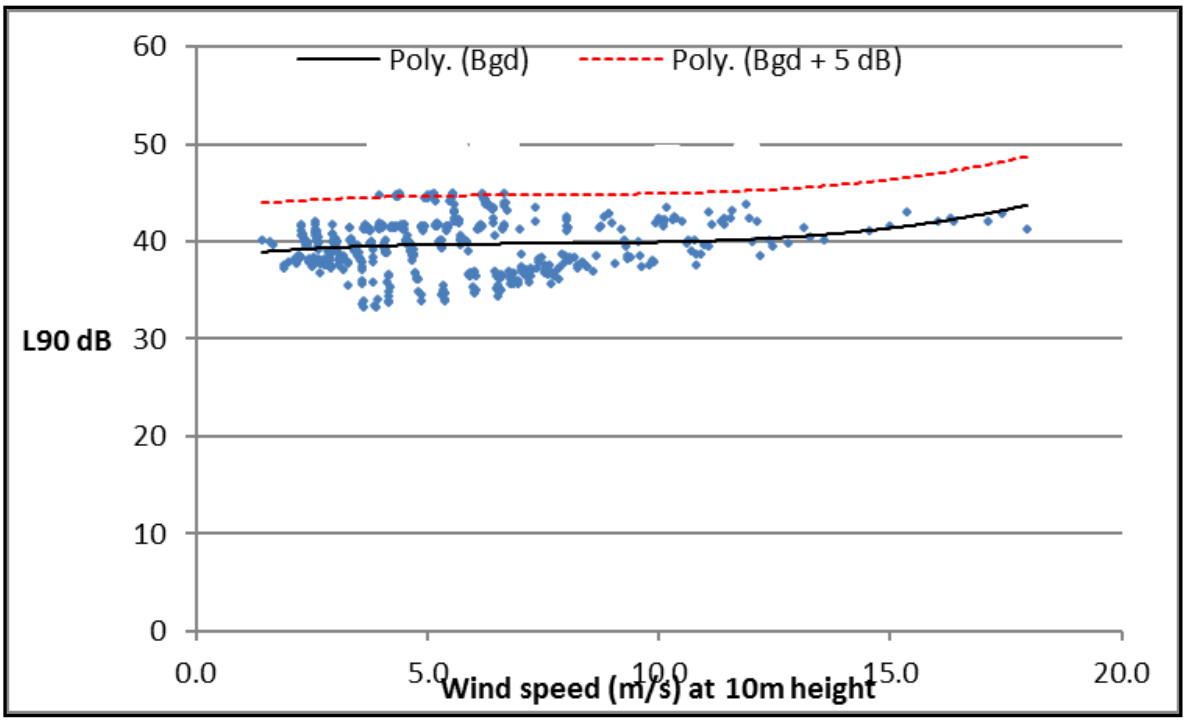

Figure 5-2: Background Noise Levels and 'Average' Levels at H2

Figure 5-1 shows a correlation between wind speed and measured L_{90} noise level at H4, that is, the noise level increased with an increase in wind speed. Figure 5-2 shows that in contrast, variations in the noise level at H2 did not directly correlate with wind speed.

At low wind speeds, up to about 5 m/s, the noise levels measured at H4 were significantly lower than at H2. From 5 m/s to about 12 m/s the noise levels were generally similar at both locations, and at the higher wind speeds from 12 m/s to 18 m/s noise levels at H4 were generally higher than at H2.

During site visits, it was apparent that wind in the tall trees along the Easky River, in the vicinity of H2 was the major noise source in that location, in addition there were sheep and lambs in an adjacent field, and at times they contributed to the noise environment. At H4, there were no tall trees, only some low bushes, hedges and lower growing individual trees. The fields around H4 were not being grazed. At H4 the main noise source was wind movement in the vegetation and bushes. There was no mechanical noise contribution to levels during any site visits to H2 and H4. Noise from tractors and other vehicles, accessing or working on, the turf banks was discernible in the vicinity of H5, H6 and H7.

H1, H5, H6 and H7 have some tall trees in very close proximity (see Plate 5-1) and it is expected that the L_{90} noise levels in each of these locations would be significantly higher than at H2 or H4.

5.2. Electrical Connection Construction Noise

There will be noise generated during the construction stage of the electrical connection associated with traffic delivering materials, airlifting of materials to the route and construction machinery working on the route installing poles and string powerlines. In addition, the construction of the wind farms and the grid route will result in machinery movement and construction noise over an extended area.

This site noise will be due to a variety of excavation machinery, generators, helicopter and general construction work.

There are no mandatory noise limits for construction noise in Ireland. However, part 1 of BS 5228 'Code of practice for noise and vibration control on construction and open sites' does give guidance on minimising noise emission from construction sites. Noise emission due to the construction phase will be fairly short in duration, though at particular times may be intense. Typical noise levels from a variety of machinery, likely to be used in construction, are tabulated below.

Table 5-2: Construction Machinery Noise Levels

	Octave band sound pressure levels at 10 m, Hz								Sound Pressure Level
Machinery	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**@10m dB(A)**
22-T tracked excavator	75	76	72	68	65	63	57	49	71
Telescopic handler	85	79	69	67	64	62	56	47	71
Diesel generator 6.5 kW	80	74	57	54	53	48	45	37	61

Using the data in Table 5-2, it is possible to estimate the total noise contribution from this machinery, at H4, the NSL with no financial interest, closest to the electrical connection.

The logarithmic addition of the sound pressure levels gives 74 dB(A) at 10m. NSL H4 is 980m from the closest part of the electrical connection. Using the inverse square law, the attenuation due to increased distance from 10m to 980m can be calculated as 20 log (R1/R2) where R1 is the separation distance (980m) and R2 is the stated distance for the existing sound pressure level (10m) thus the attenuation is 20 log (980/10) or 40dB. The resultant sound pressure level at H4 would then be 74 – 40 = 34dB(A), if all machinery listed was operating simultaneously.

In addition to familiar construction machinery and in order to minimise environmental and ecological impacts, it is proposed that some materials movements will be achieved using a helicopter. Helicopter activity will have sound pressure levels of between 90dB(A) and 98dB(A) at 10m, depending on the model used and its activity (whether taking off loaded or hovering). Using the inverse square law, the resultant sound pressure level at H4 would be up to approximately 58dB(A) as the helicopter left and retuned to T2 hardstanding. Any helicopter activity will be of very short duration, expected to last 1 to 2 days in total, in one period. Helicopter movements will result in an increase in noise levels, though the impact will be localised.

5.3. Cumulative Effects

Cumulative noise impacts are likely to occur during the construction phase of the proposed electrical connection. It is probable that other construction activities will be ongoing at Black Lough, Cloonkeelaun and the grid connection. However, the remoteness of the proposed electrical connection will not result in any significant cumulative noise impact at the NSLs. The exception to this will occur during the airlift of materials by helicopter. As noted, this will occur over a short period of a few days. Works will be scheduled so that the most intensive wind farm works (i.e. concrete pours for turbine foundations) do not coincide with airlift activity.

No operational phase cumulative noise impact is envisaged.

5.4. Mitigation

To mitigate against the impacts of noise on the local community, the following mitigation measures are proposed for the construction phase and included in the agreed EECMP for Black Lough Wind Farm:

- Working hours at the site during the construction phase will generally be limited from 07:00 to 19:00 Monday to Saturday inclusive. Work on Sundays or Bank Holidays will only be conducted in exceptional circumstances or emergency or where heavy (i.e. noisy) machinery is not required. Exceptional circumstances would include airlifting of materials in calm weather periods outside normal working hours.
- All construction will be carried out in accordance with BS 5228: 2014 (Noise and Vibration Control on Construction and Open Sites - Part 1[36]. Accordingly, all construction traffic to be used on site will have effective well-maintained silencers.
- Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery. Machines that may be in intermittent use will be shut down between work periods or will be throttled down to a minimum.
- The contractor will be instructed to use the least noisy equipment. With efficient use of well-maintained mobile equipment considerably lower noise levels than those predicted can be attained.
- The Client's Representative will closely supervise all construction activity. Construction activity due to its nature is a temporary activity and thus any impacts will be short term. The majority of construction works will be carried out during the day-time period.
- Plant known to emit noise strongly in one direction will, where possible, be orientated so that the noise is directed away from the nearest noise sensitive locations.
- Speed limits of 15km/hr will be enforced on internal site roads. This will reduce noise emissions from the HGV traffic.

5.5. Conclusions

Noise impacts associated with the proposed electrical connection will primarily occur during the construction phase. The remoteness of the location will mitigate impacts of normal construction plant on NSLs. The use of a helicopter to lift materials will result in higher noise levels for a short period of time at NSLs. Construction activity at the wind farms and grid connection may coincide and will result in cumulative noise impacts, however, these will be imperceptible at the NSLs. In addition, during the most intensive works on the wind farm (i.e. concrete pours), airlift operations on the electrical connection will be avoided.

During the operation phase, there will be noise associated with the overhead line in windy weather. However, this noise will be localised to the vicinity of the overhead line, which at its closest point, will be >1km from the nearest NSL. At the distances involved, it is expected to result in an imperceptible increase of the overall environmental noise – i.e. noise associated with wind rusting trees etc, and have no cumulative noise impact with the wind farms on NSLs.

6. TRAFFIC & TRANSPORT

This chapter assesses the delivery of materials to the site during the construction phase and traffic associated with the operational phase. It considers the transport route for delivery of materials and the condition of the existing roads to deal with this traffic. As the proposed connection may be constructed at the same time as the Black Lough and Cloonkeelaun wind farms (which have full planning permission) the cumulative impacts associated with transport and traffic is discussed.

6.1. Existing Road Network

The nearest national route, the N59, runs in a northeast to southwest direction approximately 5km to the northwest of the site. The nearest regional route, the R294, runs in an east-west direction approximately 7km to the south, linking Ballina and Tobercurry. County roads, used by local traffic, are used to access the site from both the east and west. These local road networks link the N59 to the R294. The access to the northern part of the connection route is from the L6707, which follows the western valley of the Easky River south from the N59 at Camcuill. The southern end of the proposed route is accessed by local road L2601-13 which heads south to Cloonkeelaun from Tullylin and local road L2604 which heads southeast to Cloonkeelaun from Ballymoghany. The roads have a low usage and are largely used for local traffic only. Private roads extend from the public roads which are used for access turf banks, operational wind farms and forestry. The road layouts are shown in Figures 6-1.

6.2. Potential Traffic Impacts

The potential impacts on traffic and roads associated with the proposed development during the construction phase includes:

1. Increase in local traffic during construction.
2. Interaction of connection construction works with on-site wind farm construction activity.

Delivery of poles and material to the site for the proposed connection will not require over-sized loads; rigid-body trucks are likely to be used.

6.2.1. Traffic Volumes

There will be an increase in local traffic during the construction phase of the project. Staff, including plant operators, electricians, engineers and trades people, will be commuting to and from the site each morning and evening. It is estimated that as many as 10 workers may be on site during times of maximum activity. Conservatively assuming each travel separately, 10 vehicles will use the local access roads. This will be a significant percentage increase in local traffic numbers however, it is not expected to create any problems in terms of traffic congestion. Intermittent deliveries of building material will also take place.

The greatest impact during the construction stage will be associated with concrete deliveries for the wind farms. The construction traffic associated with this section of the proposed connection will not generate that level of traffic. The volume of construction traffic likely to be associated with the proposed development is given in Table 6-1.

Table 6-1: Construction Traffic Estimates

Construction Item	Maximum Number/Volume Required	Associated Traffic	Comment
Electrical components + building materials	Varies	10	Cable drums, insulators, earthing conductors, cross arms, stays, sleepers, bog mats, environmental control materials (silt fences, sand bags, etc.) etc.
Poles	18	4	Assumes 5 poles delivered per load.
Bedding Sand	43m^3	6	Assumes 0.18 m^3/m run used of on-site cabling runs of ~240m
Employees	10	10/day	Will vary depending on activities.
Fuel	1,000L /machine/week	2	Assumes deliveries once per week
Plant	4	4	See Section 2.4.1

Notes:

1. The associated traffic refers to the number of loads delivered to site; traffic movements would be twice that number.

Once commissioned, service, maintenance and repair of this section of the electrical connection will generate very little traffic. The impact of this on local traffic will be imperceptible. With the infrequent, low volumes of traffic during the operational life of the connection, no cumulative impact in combination with the wind farms it will serve is envisaged.

6.3. Cumulative Impacts

The construction of this section of the grid connection may coincide with the construction of the Black Lough and Cloonkeelaun turbines and the grid connection between Cloonkeelaun to the Glenree substation in County Mayo, all of which have full planning permission. However, once the materials are delivered to the hardstands of the turbines prior to air-lifting to their position, there will be little cumulative impact on traffic.

The section of the route on the eastern side of the Gowlan River will be accessed from the Black Lough Wind Farm. This section will consist of 240m of underground cabling and 2 No. poles. Materials will be delivered to the hardstand of turbine T2 prior to commence of construction of the connection. The poles for the remainder of the connection will also be staged at T2 for air-lifting to their position. However, workers will access the route from the south via Cloonkeelaun to avoid machinery crossing of the Gowlan River.

The proposed new route will avoid potential conflicts between traffic accessing the Black Lough Wind Farm and works on the permitted underground route to Cloonkeelaun; the permitted grid connection route (refer to Figure 2-3 and 6-1) coincides, in part, with the delivery route to the wind farm site. The proposed route will also have less construction traffic than the permitted route as reinstatement of roads with engineered fill is avoided. Furthermore, works along the public road and any associated traffic disruption is also avoided.

The changes in traffic volumes associated with the revised connection route are set out below. The deliveries to Black Lough for the permitted route are given first, followed by the volumes associated with the proposed route:

- Electric Cable Ducting: 16.585km of ducting in 6m lengths = 2,765 lengths. Approximately 13 deliveries, assuming 225 lengths per delivery, 5 of which would go to the Black Lough compound. *1 delivery would go to Black Lough for the new route*.
- Fibre Optic Cable Ducting: 16.585km of 50mm ducting supplied typically in 1km roll lengths; requiring approximately 17 rolls. This would require approximately 9 deliveries, 4 of which would go to the Black Lough compound. *1 delivery would go to Black Lough for the new route.*

- Electric Cables: There are 3 cables installed in a trefoil arrangement, requiring approximately 60km of cable. These will be delivered in cable drums as specified lengths to suit the locations of the jointing bays. For the purposes of estimating traffic volumes, it is assumed that the average lengths of cable per drum is 1km, giving 60 drums. These would be brought to site in approximately 15 deliveries, 5 of which would go to the Black Lough compound. *2 deliveries would go to Black Lough for the new route.*
- Fibre Optic Cables: These are delivered to site in drums of 2km length typical. The 10 drums would be delivered to site in two loads, one of which would go to the Black Lough compound. *No change in traffic volumes*.
- Earthing Cable: These are delivered to site in drums of 2km length typical. The 4 drums would be delivered to site in one load and distributed along the entire cable route as needed. *1 delivery would go to Black Lough for the new route.*
- Lean-mix Concrete: Assuming lean-mix is used for the 10km of the cable route from Black Lough to Glenree, approximately 1,800m^3 of lean-mix concrete would be required (used at a rate of 0.18m^3 per metre run). This would require approximately 225 loads, one third of which would be used for the northern section of the route. *None required for the new route.*
- Engineered Fill: Assuming engineered fill is required anywhere lean-mix concrete is used, 3,000m^3 of engineered fill would be required (used at a rate of 0.3m^3 per metre run). This would require approximately 375 loads, one third of which would be used for the northern section of the route. *None required for the new route.*
- Bedding Sand: Assuming bedding sand is used for the cable route where lean-mix concrete is not used, 1,185m^3 of sand would be required (used at a rate of 0.18m^3 per metre run). This would require approximately 148 loads, one third of which would be used for the northern section of the route. *5 loads would go to Black Lough for the new route.*
- Wooden Poles: Approximately 30 wooden poles will be required for the overhead section of the grid connection. These will be delivered to directly to the overhead section in 5 or 6 loads, so is unlikely to have a cumulative traffic impact with the Black Lough Wind Farm. *5 deliveries would go to Black Lough for the new route (assuming that T2 hardstand is the staging point prior to air-lifting).*
- Miscellaneous Deliveries: Warning tape, warning posts, steel covers and other miscellaneous items and consumables will be required. These would be brought to site in 4 to 6 deliveries. *1 or 2 deliveries would go to Black Lough for the new route.*

6.4. Summary of Traffic Mitigation

To avoid and reduce the impacts of traffic associated with the new connection, the following mitigation measures will be undertaken:

- Works associated with the new route will comply with the Traffic Management Plans agreed with Sligo County Council for Black Lough Wind Farm, Cloonkeelaun Wind Farm and the permitted grid connection, as applicable.
- Deliveries to site of building materials will have regard to other activities on site. For example, deliveries will avoid conflict with deliveries of over-sized loads to the wind farms, concrete pours or periods of intense deliveries of stone.
- Speed limits for HGVs on local roads to / from the site.
- Parking facilities will be provided at the construction compounds at Black Lough, Cloonkeelaun and Glenree for construction traffic.
- The roads will be repaired and resurfaced to make good any damage, including roadside drainage. The roads will be left in a similar or better condition than that recorded during the road condition survey.

Regular vehicle traffic to and from the site will have imperceptible impact. On a long-term basis, once the site is in operation, it is anticipated that the operational wind farms / electrical connection will not generate any adverse impacts on traffic in the vicinity of the site.

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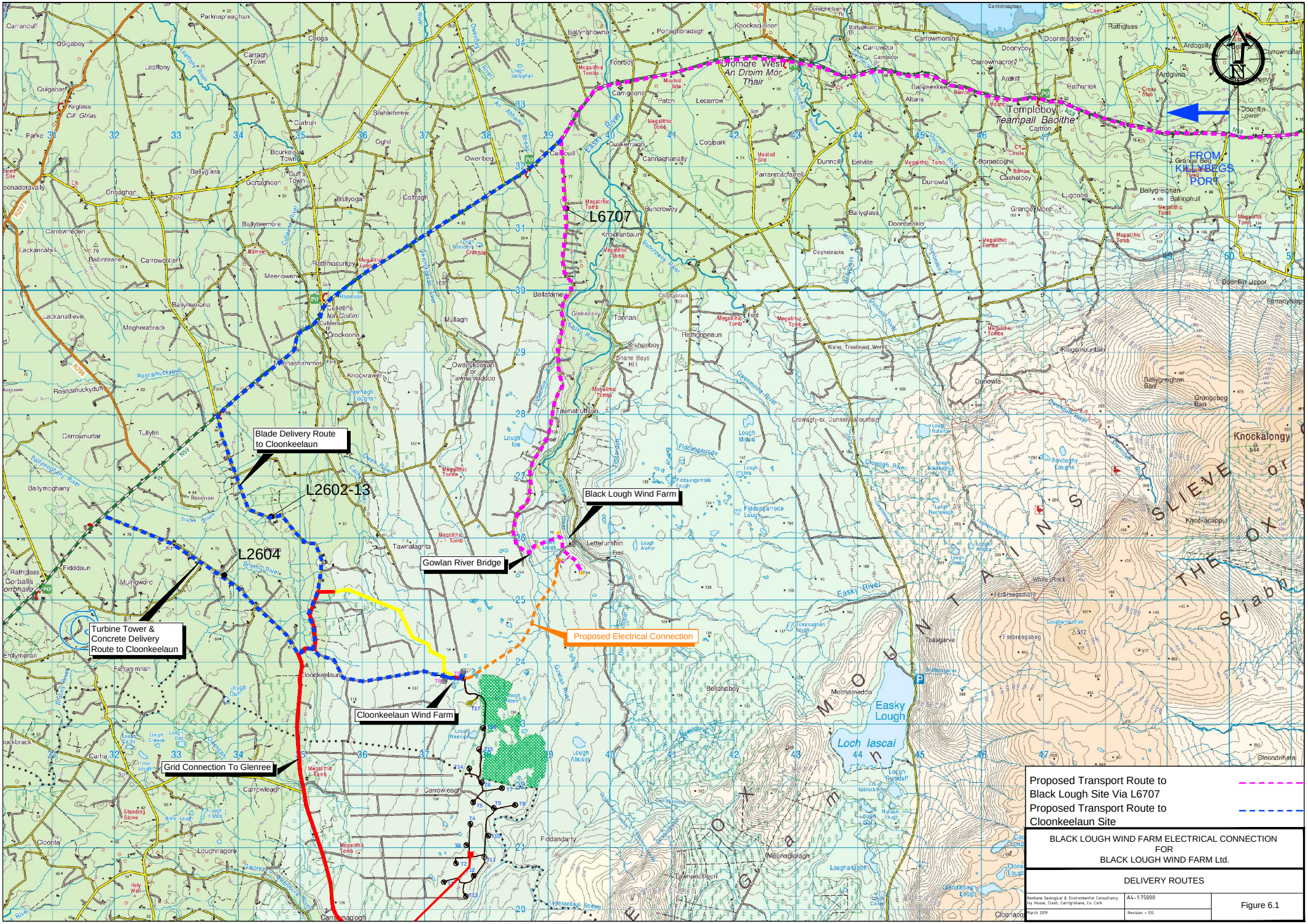


7. SOILS, GEOLOGY & HYDROGEOLOGY

This chapter addresses geology and hydrogeology in the existing environment, the potential impacts of the proposed electrical connection on geology and hydrogeology, and the proposed mitigation measures to avoid or reduce potential impacts. This includes a peat landslide risk assessment. It assesses the cumulative impact on geology and hydrogeology of the permitted turbines at Black Lough and Cloonkeelaun and grid connection to Glenree. It compares the proposed route to the permitted route. The other nearest operational and permitted wind farms are too distant to contribute to a cumulative impact on soils, geology or hydrogeology.

7.1. Methodology

In relation to soils / geology, the Wind Energy Guidelines recommend the following scope of assessment:

- A geological assessment of the locality.
- A geotechnical assessment of the overburden and bedrock.
- A landslide and slope stability risk assessment.
- An assessment of bog burst or landslide hazard.
- Location of geological heritage areas.
- Location of any significant mineral or aggregate potential.
- Assessment of impacts on groundwater.
- Details of borrow pits and blasting proposals.

To address the requirements of the Guidelines, the assessment of the site consisted of:

1. Desk study, including a review of reports prepared for the nearby permitted wind farms.
2. Site walkover, including peat depth probing and collection of geological and geotechnical data.
3. Collection of data from Government Departments including the Geological Survey of Ireland (GSI) and the National Parks & Wildlife Service.
4. Data interpretation.

Some of the information used in the assessment was collected during the assessment of the permitted wind farms but is relevant as there is some overlap in the assessment areas. The literature reviewed as part of the desk study included:

1. Geology of Sligo-Leitrim, Geological Survey of Ireland (GSI), 1996[37].
2. Soils Association of Ireland and their Land Use Potential, M. J. Gardiner and T. Radford, National Soil Survey of Ireland, 1980[38].
3. Directory of Active Quarries and Pits in Ireland, GSI 2014[39].
4. Landslides in Ireland, GSI 2006[40].
5. The Bogs of Ireland, Feehan and O'Donovan[41].
6. County Development Plan for Sligo.
7. Memoir of Localities of Minerals of Economic Importance and Metalliferous Mines in Ireland, The Mining Heritage Society of Ireland, 1998[42].
8. Black Lough Wind Farm EIS, Jennings O'Donovan & Partners, November 2011[43].
9. Report on Soils, Geology and Water, Minerex Environmental[44].
10. Peat Slide Risk Assessment, Whiteford Geoservices Ltd, April 2011[45].
11. Response to Further Information Request, Hydro Environmental Service, 01 April 2012[46].
12. Environmental Impact Statement for Black Lough Wind Farm at Tawnamore County Sligo, dated February 2017 and prepared by Keohane Geological & Environmental Consultancy[47].

13. Environmental Impact Statement for Cloonkeelaun Wind Farm Extension at Cloonkeelaun County Sligo, dated December 2015 and prepared by Keohane Geological & Environmental Consultancy[48].
14. Environmental Report for Cloonkeelaun Wind Turbine at Cloonkeelaun County Sligo, dated October 2015 and prepared by Keohane Geological & Environmental Consultancy[49].

Site walkovers and collection of data were carried out in Cloonkeelaun and Black Lough over the past 10 years. Data that was collected at or near the proposed connection route was compiled to identify data gaps. A site walkover was then conducted in July 2018 to obtain peat depth, strength and ground conditions along the route corridor. Coverage was sufficient to allow a robust assessment of ground conditions across the site. Data collected included:

1. Measurement of peat depth using a metal probe and un-drained shear strength.
2. Visual description of the soil, peat, topography, drainage and ground conditions.
3. Measurement of slopes along the route corridor.

The aspects considered in the assessment were slope stability, bedrock and overburden geology, hydrogeology. These are discussed in the sub-sections below.

7.2. Existing Environment

The site lies within a large expanse of peatland that extends from the western foothills of the Ox Mountains. These peatlands slope gently to the west and northwest from approximately 200mOD near Lough Easky to approximately 100mOD approaching the N59. The peatlands are cut by a number of rivers with narrow V-shaped valleys. The proposed electrical connection is located in the central area of the peatland expanse at an elevation of between approximately 120mOD and approximately 130mOD. The site location and layout maps are provided as Figures 2-1 and 2-2.

Much of the peatlands in the wider area form the Ox Mountains Bogs SAC (site code 002006). Approximately 2km of the proposed electrical connection (part of the overhead section) passes through the Ox Mountains Bogs SAC. A section of the Easky River between the N59 and R297, approximately 9km to the north and downstream of the site, is a pNHA (site code 001665). The proposed route passes over the Gowlan River, a tributary to the Easky River. A number of small tributary streams/drains to the Gowlan River drain the bog along the proposed route.

The northern end of the route is currently used for rough grazing of sheep and peat cutting; peat cutting is conducted on a commercial scale at Black Lough and in adjacent land with large sections cutaway to the underlying tills. There is commercial forestry near the southern end of the route in Cloonkeelaun. The central section of the route passes through the Ox Mountains Bogs SAC and is largely unused, apart from low intensity sheep grazing. The route can be accessed by local roads and tracks to its northern end in Black Lough, and by local and forestry roads at its southern end in Cloonkeelaun.

7.3. Geological Heritage Sites

The GSI - Irish Geological Heritage Section (IGH) and NPWS (National Parks and Wildlife Service) is undertaking a programme to identify and select important geological and geomorphological sites throughout the country for designation as NHAs (Natural Heritage Areas) – the Irish Geological Heritage Programme. This is being addressed under 16 different geological themes. For each theme a larger number of sites from which to make the NHA selection are being examined, in order to identify the most significant scientifically. The criteria of designating the minimum number of sites to exemplify the theme means that many sites of national importance are not selected as the very best examples. However, a second tier of County Geological Sites (CGS) (as per the National Heritage Plan) means that many of these can be included in County Development Plans and receive a measure of recognition and protection through inclusion in the planning system. The GSI are still in the process of finalizing these proposed sites.

It is a policy (P-NH-1) of the Sligo CDP to '*Protect, sustainably manage and enhance the natural heritage, biodiversity, geological heritage, landscape and environment of County Sligo in recognition of its importance for nature conservation and biodiversity, and as a non-renewable resource, in association with all stakeholders'*. It is an objective (O-SGI-1) of the CDP to '*Protect from inappropriate development, and maintain the character, integrity and conservation value of those features or areas of geological interest that are listed in this Plan or that may be proposed by the DAHG and/or the GSI in the lifetime of this Plan'*. Appendix C of the CDP lists the 24 geological heritage sites identified in the County.

The site is not listed in the Sligo CDP as being a site of Geological Interest. The nearest designated sites to the proposed development are:

1. The Gap Meltwater Channel. This is located northwest of Lough Talt in County Sligo, approximately 8km south of the proposed development site at coordinates 139000 / 315900. This is a major meltwater channel cut through the Ox Mountains during the last glaciation. It is a proposed County Geological Site (CGS). GHS-1 on Figure 7-1.
2. Easky River Solifluction Lobe. This is located just north of Lough Easky in County Sligo, approximately 5km southeast of the proposed development site at coordinates 144000 / 325000. It is a solifluction lobe of unconsolidated material at the foot of the hill slope, formed during the latter stages of the last glaciation as seasonally thawed material slowly moved down slope. It is a proposed CGS status. GHS-2 on Figure 7-1.
3. Zion Hill. This is located 3km northeast of Lough Talt in County Sligo at Ounagh, approximately 8km southeast of the proposed development site at coordinates 142300 / 316800. The site is noted for its bedrock (Argyll Group Dalradian rocks) which have rich metamorphic mineral assemblage such as kyanite, staurolite and almandine garnet. It also has other metamorphic features and roche moutonees found in the Ummoon Formation of the Easdale Group, consisting of pelitic schists and basic volcanic rocks. It is proposed for NHA status (National importance) under GSI's IGH 5 Precambrian & IGH 6 Mineralogy Themes. GHS-3 on Figure 7-1.
4. Meenamore Fan Moraine. This is located 4km northeast of Lough Talt in County Sligo at Meenamore, approximately 9km southeast of the proposed development site at coordinates 142450 / 317440. This is a spectacular fan moraine formed at the margins of an ice sheet but has been partly quarried for forest roads. It is proposed for CGS status. GHS-4 on Figure 7-1.
5. Enniscrone foreshore rock exposures. This is located at Enniscrone and extending north from the town for approximately 2.4km. It is located approximately 12km northeast of the proposed development site at coordinates 128659 / 331366. The foreshore exposure shows a good series of Tertiary dykes and some contact / thermal metamorphism of the host limestones. The site is of National importance and is to be proposed for NHA designation under IGH 11 – Igneous Intrusion theme. It is beyond the coverage of Figure 7-1.

None of the sites are located within or in the vicinity of the proposed connection route, the closest being the Easky River Solifluction Lobe at 5km distance. At this distance from the proposed route and being upstream of the site, no direct, indirect or cumulative impact is envisaged on this geological heritage site. The proposed wind farms at Black Lough and Cloonkeelaun are also distant from these geological heritage sites, so no impact is predicted from their construction.

7.3.1. Regional Bedrock Geology

According to the GSI – Geology of Sligo-Leitrim, the area is underlain by the Ballina Limestone Formation. The regional bedrock geology is shown on Figure 7-1.

The bedrock geology of the area is dominated by the Ox Mountain inlier and surrounding younger limestone rocks. The Ox Mountains consists of metamorphic rocks which have been repeatedly folded and metamorphosed. Three major rock units make up the inlier, which are separated by major faults and slides; these are the Slishwood Division, the Dalradian Supergroup and the Callow Succession. These rocks present a range of metamorphic rocks depending on their original rock type and include such rock types as schists, gneisses, phyllites, psammites, quartzite, marbles and metavolcanics. The Dalradian Supergroup is represented in the rocks to the southeast of the site.

At the start of the Carboniferous period the sea transgressed, covering much of Ireland. This resulted in a series of sedimentary deposits dominated by limestone and shales with lesser sandstone formations.

7.3.2. Local Bedrock Geology

The rocks found within and immediately adjacent to the grid route are described in greater detail, starting with the older rocks. The formations present are the Attymass Group and the Ballina Limestone Formations (Upper and Lower). The symbol for each formation is given in brackets for cross-reference purposes with the bedrock geology map. These are described from the literature as follows:

Upper Attymass Formation (UA) – The Upper Attymass Formation consists of metamorphosed distal turbidites. They consist of a banded pelitic, semi-pelitic and feldspathic semi-pelitic schists, with minor aluminous iron-rich pelites containing various minerals including garnet, and subordinate psammitic and feldspathic psammitic schists.

Attymass Group (undifferentiated) (UX) – The Attymass Group is divided into five formations (Corradrishy Formation (CD), Carrick O'Hara Formation (CO), Attymass Volcanic Formation (AV), Lower Attymass Formation (LA) and the Upper Attymass Formation (UA)). However, in some areas this division is not possible and for convenience is shown as the Attymass Group. The rock types present are schists, marbles and metavolcanics. It lies approximately 2km to the southeast of the route, the route running approximately parallel to the geological boundary.

Ballina Limestone Formation Lower (BL) – The Ballina Limestone Formation is one of the Upper Limestone formations. It consists of grey fine-grained limestones with subordinate interbedded calcareous shales. These are best exposed along the coast at Killala Bay. Here the formation is seen to rest directly on sandstones which are the local equivalent of the Mullaghmore Sandstone. The coral fauna of the Lower Ballina Limestone Formation is characterised by caniniids and phaceloid lithostrotionids. The Lower Ballina Limestone Formation lies approximately 200m to the southwest of the southern end of the proposed route.

Ballina Limestone Formation Upper (BU) – The Upper Ballina Limestone Formation is as described above. It is differentiated from the Lower Ballina Limestone Formation by the presence of the coral fauna cerioid lithostrotionids. The entire proposed route is underlain by this bedrock formation

The bedrock geology underlying the grid connection between Cloonkeelaun and Glenree from north to south is the Upper Ballina Limestone Formation, the Lower Ballina Limestone Formation and the Upper Attymass Formation. These formations are found at depth along the route of the grid connection and unlikely to be encountered. The Black Lough Wind Farm is underlain by the Upper Ballina Limestone Formation, while the Cloonkeelaun Wind Farm is underlain by the Upper and Lower Ballina Limestone Formation. Figure 7-1 shows the bedrock geology with the connection route indicated. Also, to note from Figure 7-1 is the distance between the route and the geological heritage sites.

7.3.3. Superficial Geology

The superficial geology is also described from the GSI's Geology of Sligo-Leitrim and from the GSI website. The superficial deposits are largely derived from glaciation and the development of blanket bogs post-glaciation. During the last glaciation, approximately 10,000 years ago, the ice movement across the site was from the southeast. The retreat of the ice sheet deposited tills and sand/gravel. In the GSI website, extensive sand/gravel deposits are shown to the southwest of the site, near Bunnyconnellan. Metamorphic tills and alluvial deposits are exposed along the valleys of the Gowlan and Easky rivers, where peat has not developed or is thin.

From the site walkover, it is evident that tills and gravels were deposited across the site but are now largely concealed by the blanket bog. Till are exposed at two small borrow pits near the farmyard at Black Lough, in road cuts and in a number of cutaway areas where peat has been completely removed. This till was found to be very dense clayey sandy gravel with cobbles and stiff to very stiff gravely clay. Occasional boulders, cobbles and erratics consisting of white granite gneiss are seen at the ground surface where tills are exposed in the cutaway areas of the bogland. From the bedrock geology maps, it is apparent that the nearest source for these erratics is the Ox Mountains, supporting the ice flow direction from the southeast.

The area is covered by blanket bog, which has developed in the last 6,000 years. The peat along the connection route has been probed to depths of up to 4.2m. Figure 7-2 is sourced from the GSI website and shows the overburden geology of the area. It shows the connection route completely covered with blanket bog. It shows exposures of tills (derived chiefly from metamorphic rocks) and alluvium along the valleys of the Gowlan and Easky river valleys.

Site investigation drilling carried out for the Black Lough and Cloonkeelaun wind farms, at either end of the route, indicated overburden depth greater than 40m. Boreholes were extended to 30m and 40m at turbine locations without encountering bedrock.

Figure 7-2 shows the overburden geology of the area. As shown on Figure 7-2, most of Black Lough Wind Farm is underlain by peat with tills and alluvium in the Easky River valley. The Cloonkeelaun Wind Farm is underlain entirely by peat. Most of the permitted grid route between Cloonkeelaun and Glenree passes through peat. Alluvium, tills (derived chiefly from metamorphic rocks), tills derived from limestone and glaciofluvial sands & gravels are encountered at river crossings. As long sections of the permitted route are through cutover / cutaway peat, tills will also be encountered in areas shown as being covered by peat.

7.3.4. Economic Geology

The GSI Online Minerals Database accessed via the Public Data Viewer shows no quarries, pits or mines within, or in the immediate vicinity of the site. There are a large number in the wider area to the west, southwest and north. These consist primarily of gravel pits, clay pits and flagstone quarries which are now closed. The nearest active rock quarries are located to the west of Ballina and near Sligo Town - http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 . From the windscreen survey of the wider area, there are a number of small gravel pits to the west of the site, e.g. a small gravel pit is located at co-ordinates 134900 / 326099. There are also two gravel borrow pits at Black Lough.

The GSI online Aggregate Potential Mapping Database shows that the proposed electrical connection route is not located within an area mapped as having granular aggregate potential (i.e. potential for gravel reserves). The river valleys of the Gowlan and Easky rivers near the site are mapped as having Moderate potential for granular aggregate. The site and wider area is mapped as having Moderate potential for crushed rock aggregate. Considering the depth to bedrock of >30m in Black Lough and Cloonkeelaun, the accuracy of this mapping is questionable.

There are a number of prospecting licences held for this area of County Sligo. The licences covering the proposed route are retired and there are no exploration reports available from the DCENR website - http://spatial.dcenr.gov.ie/ExplorationAndMining/SpatialViewer/index.html . There are no drilling records available for licences near the proposed route.

It is a policy (P-MEQ-1) of the County Development Plan to '*Protect all known unworked deposits from development that might limit their scope for extraction (e.g. one-off housing)*'. It is not envisaged that the proposed connection or associated wind farms will prejudice the future development of pits, quarries or mines.

7.3.5. Hydrogeology

The proposed route corridor is located within the Easky East groundwater body. The Easky East groundwater body has been ranked as having Good groundwater quality and Not at Risk. There are no groundwater pressures identified for the Easky East groundwater body - https://www.catchments.ie/maps/ and https://gis.epa.ie/EPAMaps/ .

Groundwater is an important resource for drinking water supply, accounting for 25% of water supplies in Ireland. In County Sligo, groundwater accounts for approximately 25% of drinking water supplies, and in County Mayo it accounts for approximately 11%. There are however no groundwater wells in the vicinity of the site according to the GSI database.

On the GSI website, the Upper Ballina Limestone Formation is classified as a regionally important karst aquifer with good development potential (Rkd). The Lower Ballina Limestone Formation is classified as locally important, generally moderately productive in local zones (Ll). A spring, associated with the karst limestone, is located just south of Cullens, approximately 5km northwest of the grid route. There are no other karst features in the GSI database within 10km of the site.

Till and gravel deposits are present at the site. From the GSI website, there are extensive sand/gravel deposits to the southwest of the site (near Bunnyconnellan), which are classified as locally important sand/gravel aquifers. These are not shown to extend beneath the site. It is likely that water-bearing gravel occur beneath the grid route, which would supply sufficient water for domestic demand.

The metamorphic rocks of the Ox Mountains are classified by the GSI as poor aquifers, generally unproductive except in local zones (Pl). Wells in these rock formations yield enough water generally for only domestic supply (0.2 to 0.5litres/sec or 17 to 45m^3/day). Occasionally, in major fracture zones higher yields are achieved, but these yields often decrease in dry weather making supplies unreliable.

Aquifer vulnerability is classified by the GSI as Low – i.e. greater than 10m of overburden overlying the bedrock aquifer.

Because of the low permeability of the peat, it is interpreted that most of rainfall incident on the site will result in surface water runoff. The peat will absorb water when dry, but once saturated, any precipitation will result in runoff or water-lodging. The gravely tills were observed to be dry in road cuts and in the borrow pit adjacent to Black Lough, to depths of approximately 8m. Groundwater levels in wells installed at turbine locations indicates variable depth, suggesting discontinuous pockets of groundwater (at depths > 7m below ground surface) in the gravel lenses.

As discussed in Chapter 8, drinking water for the area is sourced from Lough Easky and distributed locally by a group scheme. The GSI database doesn't indicate the presence of any wells within 5km of the site. However, private wells were noted at a number of houses in the area. These wells are distant from the proposed grid route and would not be impacted by its construction or operation.

In previous surveys (Moorken and Killeen, 2011), groundwater-fed flushes supporting the whorl snail *Vertigo Geyeri* were identified at two locations along the banks of the Gowlan River to the west of the proposed connection route. Other flush locations were identified in the wider area during that 2011 survey. More recent surveys (see Chapter 11) identified two new locations to the east of the proposed route. Their location with respect to the proposed electrical connection are shown on Figure 11-4. These calcareous flushes are fed from groundwater discharging from the tills found at the site. The underground section of the proposed connection route passes through the estimated groundwater zone of contribution to one of the locations identified in 2011 (Site 9). As noted above, groundwater is found at depth within the development site (i.e. at T2, groundwater was measured at 11.46m below ground level on 21 February 2018). Therefore, groundwater is not expected to be encountered to the shallow depths of excavation for the short (240m) underground section of the proposed electrical connection, so the trench will not interfere with groundwater flows. The connection is overhead for the two locations identified in 2018 surveys, so no interference with groundwater flows will occur.

7.3.6. Field Survey Results

Site walkovers and collection of data were carried out in July 2018 to supplement data collected during previous fieldwork for the wind farms. Data was collected along the connection route to fill any data gaps. The data collected (160 probe locations cover the proposed route) is summarised in Table 7-1; survey data in provided in Appendix 7-1. Survey positions are shown on Figures 7-3.

Table 7-1: Summary of Ground Conditions Along Grid Route

Probe No.'s	Peat Depth Range (m)	Percentage of Total Number in this Depth Range (%)
24	0.0 – 0.5	15.0%
30	0.5 – 1.0	18.7%
57	1.0 - 2.0	35.6%
29	2.0 – 3.0	18.1%
20	>3m	12.5%

The results of the survey reveal varying ground conditions across the site. These can be divided into three broad zones according to dominant vegetation, peat depth and slopes, as follows:

- Zone 1 – Areas of cutaway bog with glacial tills often exposed. Lands in Zone 1 are used for improved grassland and grazing. Slopes are up to ~5^{o}. Peat depth is typically absent, and at most 1m.
- Zone 2 – Areas of near flat blanket bog, largely unspoilt with interconnecting bog pools in places. Peat depth is generally between 2m and 4.2m with slopes of 1^{o} to 2^{o}.
- Zone 3 – Areas of undulating unspoilt blanket bog with peat depth generally <1.5m. Slopes vary but are up to 12^{o} in river valleys.

The un-drained shear strength was measured at a number of locations and summarised in Table 7-2. This data is sourced from previous investigations and supplemented with additional data collected by KGEC in August 2016 and July 2018. The locations where peat shear strength was measured are shown on Figure 7-2.

Table 7-2: Summary of Un-Drained Shear Strength Measurements - Peat

Probe ID	Peat Depth (m)	Un-Drained Shear Strength / Residual Shear Strength (kPa)						
		0.5m	1.0m	1.5m	2.0m	2.5m	3.0m	3.5m
P36	0.6	48/28	---	---	---	---	---	---
P37	1.8	38/18	33/21	43/31	---	---	---	---
P39	2.5	16/14	21/14	25/19	46/26	47/39	---	---
P42	3.7	6/5	9/6	11/9	20/14	32/22	32/22	48/32
P47	3.0	7/4	9/6	12/8	12/9	22/14	20/17	---
P49	2.3	6/5	8/6	13/8	18/10	---	---	---
P53	3.5	4/3	8/2	8/3	12/8	17/13	23/18	49/26
P56	0.7	60/45	---	---	---	---	---	---
P58	0.8	43/18	---	---	---	---	---	---
P69	2.5	24/16	19/11	21/10	36/18	---	---	---
P80	1.5	18/12	17/9	28/25	---	---	---	---
P88	1.4	20/11	16/9	---	---	---	---	---
P99	3.1	10/7	9/6	13/9	21/12	32/18	30/17	42/22
P106	2.7	33/18	19/09	18/10	18/12	39/24	---	---

The un-drained shear strength of the peat ranged between 4kPa and 60kPa. Higher values presented in Table 7-2 are interpreted to be measurements in the clay below the peat. The highest values occurring in the upper 0.5m and were influenced by the peat fibres. The majority of the measurements were 10kPa to 20kPa representing undrained peat. The peat has a Von Post classification of H4 to H8, with the majority of the peat being classified as H5.

7.4. Characteristics of the Proposed Development

The main characteristics of the proposed electrical connection that could impact on soils, geology and hydrogeology are:

1. Excavations for the pole and sleeper.
2. Cabling between turbine T2 and the first, most northerly, pole. This will require excavation of a trench over a length of approximately 240m.
3. Cabling between the southern-most pole and the control building at Cloonkeelaun. This will require excavation of a trench over a length of approximately 100m.

The construction of the remainder of the permitted grid connection to Glenree substation will require excavation of a trench over a length of approximately 10km and the installation of approximately 2.62km of overhead line. This will also include the use of concrete and aggregate in its construction as it follows the public road. It was the subject of two separate planning applications, both of which were granted permission.

7.5. Potential Impacts

The potential impacts of the proposed electrical connection development on soils, geology, hydrogeology and slope stability are discussed below. The impacts are largely associated with the construction stage of the project. Risk of slope instability and impacts on geology and hydrogeology during operation is imperceptible. There is no impact envisaged on the geological heritage sites in the wider area.

7.5.1. Peat Stability

Slope stability during wind farm construction was highlighted following a bog burst at the Derrybrien wind farm in County Galway in 2003, and in the Stack's Mountains near Tralee County Kerry and Drumkeeran County Leitrim, both in 2008. More recently, landslides have occurred in Ireland following exceptionally heavy rainfall events, such as the storm events in Inishowen on 22 August 2017.

Failure Mechanisms
Peat and/or subsoil on sloping ground can become unstable when the gravity forces acting on the soil mass exceed the shear strength of the material. This failure can occur as landslides or flows. Slides are distinguished from flows in that slides are the movement of large continuous masses of soil/peat along a slip surface. Flows are the movement of material softened and lubricated by water, such as bog bursts. Slip planes are less evident in the latter.

The factors that could influence the failure of slopes during the construction of wind farms include:

1. Nature of peat; very wet, degraded blanket bog or excessively worked / harvested with machinery such as 'sausage cutter'. The peat at the site has been extensively worked at the northern end on the east side of the Gowlan River. Peat within the SAC is largely untouched.
2. Interference with site drainage, resulting in changes in the hydrological regime of the peat. There are no wet flushes or streams at the site that need to be accommodated. There was no evidence of pipe flows in the peat along the route of the electrical connection. The underground section at the northern end of the connection will follow an existing farm track, so is not expected to change local hydrology. The underground portion at the southern end of the route will go across blanket bog, so could influence drainage – providing a preferential flow path. Poles will be placed to provide a buffer to watercourses and span across them. Excavations for pole and sleeper installation will be relative shallow and of limited extent.
3. Rutting and trampling of peat with machinery during pole installation and stringing of powerlines. Low bearing pressure machinery will be used. Air-lifting of poles and material to their position will be done to minimise trafficking.
4. Loading of weak peat along the connection route from machinery activity.

5. Triggering events such as traffic movements.

There is no requirement for stockpiling of peat, dewatering etc. that might influence peat landslide risk.

There have been 2 documented bog bursts in County Sligo and a further 3 in County Mayo, according to the Bogs of Ireland[41], which documents 38 occurrences throughout the Country. The slides in County Sligo occurred in Geevagh in 1831 and at Straduff, where four flows are recorded between 1832 and 1984. The 1984 flow had a volume of 81,000m^3. Both Geevagh and Straduff are located in east County Sligo, and distant from the proposed development. The slides in Mayo occurred at Carrowmore Lake near Bangor in 1931, Glencastle Hill near Belmullet in 1867 and in the Owenmore Valley, Erris in 1819. A more recent bog slide occurred in Dooncarton, County Mayo.

More recently, the GSI has published a report on landslides in Ireland. This report documents a further 3 in County Sligo and a further 8 bog slides in County Mayo. Most of the slides in County Mayo are in the west of the county. The nearest one to the site occurred in Owenaher Valley 9km southeast of the site in County Sligo. It is also probable that bog bursts have occurred in other areas of Counties Mayo and Sligo but are undocumented due to their remoteness.

Bog bursts / landslides are naturally occurring events and can occur without any anthropogenic influence. In blanket bogs, they tend to be more frequent in areas with high rainfall, occurring at times of the year when rainfall is highest (autumn and winter months). Recent analysis of the occurrence of landslides in Ireland between 2003 and 2010 indicates at least two causal factors – intense rainfall and human activity (such as turf cutting and road construction)[50]. For example, intense rainfall in early August 2016 caused a landslide on the steep mountain slopes to the east of Lough Talt County Sligo without human interference (see Plate 7-1), while the peat landslide at Ballincollig Hill near Tralee in 2008 is associated with intense rainfall during wind farm road construction (floating road) on blanket bog extensively worked by sausage cutter (see Plate 7-1).

Plate 7-1: Landslide at Lough Talt, Sligo & Ballincollig Hill, Tralee
(note sausage cutting at Ballincollig Hill site)

The causes of naturally-occurring bog bursts have been attributed to prolonged periods of drought followed by heavy rainfall events; the drought causing drying and cracking of the peat, followed by the influx of large volumes of water. The water weakens, increases pore water pressures and lubricates the peat causing it to liquefy. Another cause is attributed to the blockage or restriction of underground streams (pipe-flows), resulting in the build-up of water within the peat. The bog bursts have been recorded on shallow slopes as low as 2^o.

Natural triggering events could include earthquakes. The Irish National Seismic Network operates a number of seismic monitoring stations in an expanding network around Ireland. The British Geological Survey also monitors and reports on seismic activity. Earthquakes have been recorded in recent years in Ireland; the most recent occurred on 29 April 2014 with a magnitude of 0.8. There are two to three recorded in Ireland each year, but with low magnitudes, typically less than 2.5. The largest recorded event occurred off the coast of Wales on 19 July 1984, measuring 5.4 on the Richter Scale, and felt on the east coast of Ireland and the Midlands.

Peat Slide Risk Assessment

The recently published GSI report of landslides in Ireland[40] represents a case study for the landslide susceptibility in County Mayo (one was not conducted for County Sligo). This is a desk-based assessment using data on the land cover, soil type and slope. The study used the following parameters to identify areas susceptible to landslide:

- Peat cover
- Slopes greater than 15^{o} (1V:3.73H)

Using these criteria, the connection route corridor would be a low-very low risk of peat instability. There are deep peat deposits at the site, but slopes are generally <1^{o}, the peat cover is thinnest on the steeper slopes of the river valleys, which range up to approximately 12^{o}. The Wind Farm Planning Guidelines (Appendix 4 – Best Practice for Wind Energy Development in Peatlands) requires that a geotechnical and landslide risk assessment '*is be carried out where depth of peat is in excess of 50cm*'. A peat landslide risk assessment is therefore required for the proposed development.

The Scottish Executive Guideline[51] on peat landslide hazard and risk assessment is used to provide a qualitative risk assessment using judgement and semi-quantitative rating scales. The risk assessment process is presented here for thin to moderately deep peat cover on glacial tills. The guide uses the concept of risk analysis for a particular hazard as follows:

Hazard Ranking = Hazard x Exposure

Where; Hazard = likelihood of the landslide event occurring.
Exposure = the impact and consequences that the event may have.

Table 7-3: Qualitative Assessment of Landslide Hazard

Scale	Likelihood	Probability of Occurrence
5	Almost Certain	> 1 in 3
4	Probable	1 in 10 to 1 in 3
3	Likely	1 in 10^2 to 1 in 10
2	Unlikely	1 in 10^7 to 1 in 10^2
1	Negligible	< 1 in 10^7

For the purposes of assigning a likelihood of a construction-related peat landslide, the site has been divided into three broad zones as described above in Section 7.3.5. A factor of safety is calculated for each zone using site specific measurements, including slope, peat depth, bulk unit weight for peat and un-drained shear strength of the peat.

Factor of Safety = Shear Resistance / Shear Force

- Zone 1 – Areas of cutaway bog with glacial tills exposed. Lands in Zone 1 are used for improved grassland and grazing. Slopes are up to ~5^{o}. Peat depth is typically <1m. Taking a worse-case scenario of 1.0m peat on a 5^{o} slope with a bulk unit weight of 10.3kN/m^3 and a shear strength of 25kPa (lowest recorded in Zone 1), the factor of safety in Zone 1 = 27.96.
- Zone 2 – Areas of near flat blanket bog, largely unspoilt with interconnecting bog pools in places. Peat depth is generally between 2m and 4.2m with slopes of 1^{o} to 2^{o}. Taking a worse-case scenario of 4.2m peat on a 2^{o} slope with a bulk unit weight of 10.3kN/m^3 and a shear strength of 4kPa (lowest recorded in Zone 2), the factor of safety in Zone 2 = 2.65.
- Zone 3 – Areas of undulating unspoilt blanket bog with peat depth generally <1.5. Slopes vary but are up to 12^{o} in river valleys. Taking a worse-case scenario of 1.5m peat on a 12^{o} slope with a bulk unit weight of 10.3kN/m^3 and a shear strength of 20kPa (lowest recorded in Zone 3), the factor of safety in Zone 3 = 6.37.

Table 7-4 outlines the contributing factors and hazard scoring system based on the Scottish Forestry Commission guidelines and Table 7-5 summarises how these scores translate to the likelihood of a hazard occurring.

Table 7-4: Landslide Hazard Probability Assessment Matrix

Contributing Factor	Method of Assessment	Value/Indicator	Probability of contributing to peat movement	Hazard Score
Moisture Content of Peat	Visual (Von Post Scale)	B1 (dry)	Negligible	1
		B2 (damp)	Unlikely	2
		B3 (moist)	Probable	3
		B4 (wet)	Likely	4
		B5 (very wet)	Very likely	5
Degree of Humification	Visual (Von Post Scale)	H1-H2 (fibrous, clear water)	Negligible	1
		H3-H4 (fibrous, brown water)	Unlikely	2
		H5-H6 (pseudo-fibrous)	Probable	3
		H7-H8 (amorphous, some fibres)	Likely	4
		H9-H10 (amorphous paste)	Very likely	5
Peat Depth	Peat probes and Trial Pits	0 - 0.5m	Negligible	1
		0.6 - 1.0m	Unlikely	2
		1.1 - 1.5m	Probable	3
		1.6 - 2.0m	Likely	4
		> 2.0m	Very likely	5
Peat Strength (corrected)	Hand Vane Tests	>20 kPa	Negligible	1
		16 - 20 kPa	Unlikely	2
		11 - 15 kPa	Probable	3
		6 - 10 kPa	Likely	4
		0 - 5 kPa	Very likely	5
Slope Angle	Measured from contours	0 to 3	Negligible	1
		4 to 9	Unlikely	2
		10 to 15	Probable	3
		16 to 20	Likely	4
		20 +	Very likely	5
Cracking or evidence of slips	Visual	None evident	Negligible	1
		Few	Unlikely	2
		Frequent	Probable	3
		Many	Likely	4
		Continuous/significant	Very likely	5
Local Hydrology (gulleys, channels hags, pools, flushes, water courses)	Visual	None evident	Negligible	1
		Few	Unlikely	2
		Frequent	Probable	3
		Many	Likely	4
		Continuous/significant	Very likely	5
Weather	Weather Records	Previous very dry period in excess of 5yrs	Negligible	1
		Previous very dry period within 4 - 5yrs	Unlikely	2
		Previous very dry period within 3 - 4yrs	Probable	3
		Previous very dry period within 2 - 3yrs	Likely	4
		Previous very dry period within 1 - 2yrs	Very likely	5

Table 7-5 summarises how the scores detailed in Table 7-4 translate to the likelihood of a hazard occurring.

Table 7-5: Likelihood of Hazard Occurring

Combined Hazard Score	Probability	Scale
33 to 40	Very High	5
28 to 32	High	4
23 to 27	Medium	3
18 to 22	Low	2
8 to 17	Very Low	1

Table 7-6 summarises the scores assigned for each of the three zones.

Table 7-6: Landslide Hazard Probability Ranking

Factor	Zone 1	Zone 2	Zone 3
Moisture Content of Peat	1	5	2
Degree of Humification	1	4	3
Peat Depth	1	5	3
Peat Strength	1	5	1
Slope Angle	2	1	3
Cracking or evidence of slips	1	1	1
Local Hydrology (gulleys, channels hags, pools, flushes, water courses, blocked drains)	1	4	1
Weather	1	1	1
Total Score	9	26	15

The likelihood of a construction-related landslide in:

- Zones 1 and 3 is considered 'Very Low'.
- Zone 2 is considered 'Medium'.

Table 7-7: Qualitative Assessment of Landslide Exposure

Scale	Exposure	Impact as % of Total Project Cost
5	Extremely High Impact	>100% of Project
4	Very High Impact	10% to 100% of Project
3	High Impact	4% to 10% of Project
2	Low Impact	1% to 4% of Project
1	Very Low Impact	<1% of Project

The exposure of the site to landslide in terms of project cost is estimated as low impact. The project cost is estimated at €1.7M per megawatt (MW). With 6 turbines of 2.35MW, the total project cost is estimated at ~€24M. The cost of impact for a landslide clean-up is estimated between €50,000 and €100,000 (<1% of project cost).

The hazard ranking for the three zones ranges up to 3 (3 x 1) which is considered insignificant – see Table 7-8. The action suggested for this ranking is the '*Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate*'. The site layout and construction methods has been refined to avoid the areas within the site which drive the probability score for Zone 2. In this regard, it should be noted that the construction of the electrical connection will not require any large-scale earthworks or excavations. The poles have been sited to avoid the wettest areas of the route. These are discussed below as part of the mitigation measures for the site.

Table 7-8: Hazard Ranking and Suggested Actions

Hazard Ranking for Each Hazard Zone		Action Suggested for Each Hazard Zone
17 - 25	Serious	Avoid project development at these locations
11 - 16	Substantial	Project should not proceed unless hazard can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce hazard ranking to significant or less
5 - 10	Significant	Project may proceed pending further investigation to refine assessment and mitigate
1 -4	Insignificant	Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate

7.5.2. Rock Stability

In addition to peat/soil failures, rock slopes can also be unstable or made unstable due to construction works. The erosion and failure of rock slopes is a natural process. Failure of rock slopes generally occur following a triggering event, along planes of discontinuity or weakness. Stability issues are a particular concern in limestone regions where subsidence may occur due to the presence of karst features. Although there are limestone formations underlying the site, there are no known karst features in the vicinity of the site.

Rock slides generally occur along bedding planes, joints, cleavage or faults which are inclined toward the slope (i.e. their lower surface is exposed). There are many types of failure mechanisms, such as planar slide, wedge failure, rotations, rock topple, rock falls etc. Triggering events include a rise in groundwater level (water can weaken soils, provide buoyancy and can also lubricate joints in bedrock), toe removal (i.e. undercutting of slope), head loading (e.g. turbine too close to edge of rock slope, or stockpiling of material too close to the rock edge), and vibration (e.g. earthquake, blasting or rock breaking). There are no areas of rock outcrop at that site, so there is no risk of rock slope failure.

7.5.3. Underground Section

The northern section of the underground cable route is approximately 240m long and follows an existing farm track. Peat depth along the route is shallow, with tills exposed along much of this section. The southern section of underground cable route is approximately 100m long and passes through blanket bog. An estimate of the peat volumes associated with the cable trenching is provided in Table 7-9.

Table 7-9: Summary of Peat Spoil – Road Construction

Road Section	Road Section Length (m)	Peat / Topsoil $Depth_{avg}$ (m)	Peat / Topsoil Vol (m^3)[Note 1]
T2 to first pole	240	0.3	30
Last pole to control building	100	1.5	52
TOTAL	**300**	**----**	**82**

Notes:
1. Volumes of peat excavated for underground cabling assumes a trench size of 1.3m deep and 0.4m.

This volume of peat compares to 3,600m^3 for the permitted route between Black Lough and Cloonkeenlaun.

The underground cable route could potential provide a preferential pathway for water movement (and potentially contamination) during its operational phase, if not mitigated.

7.5.4. Overhead Section

The overhead section will involve the installation of approximately 18 wooden poles, subject to detailed design. This will require small excavations approximately 2m x 2m and 3m deep. The excavated peat and soil will be segregated and reused as backfill around the poles. No significant impact is envisaged with the installation of the overhead line.

7.5.5. Other Potential Impacts on Geology & Hydrogeology

Other potential impacts on soils, geology and hydrogeology include:

- Erosion of excavated peat and soil exposed to wind and rain.
- Compaction and rutting of peat and soil from construction traffic.

- Use of hydrocarbons on the site for fuelling machinery. Spillage or leakage could impact on soil and groundwater quality. The infrastructure is located away from the drinking water supply wells, so there is no risk to the water quality of the local drinking water supply wells.
- Bedding sand will be required for the installation of the underground cable section. There will be approximately 340m of cable trench. It is estimated that approximately 44m^3 of bedding sand will be imported to site (0.18m^3 per metre run of trench) for the northern section. Bedding sand will not be used for the southern section through peat.
- Changes to the hydrogeology of the groundwater flow at the site, with potential impacts to flushes and the fauna they support. Several flushes are identified in the vicinity of the site, as shown on Figure 11-4. Of these, one site (located on the eastern bank of the Gowlan River) and zone of groundwater contribution is located within the cabling corridor. The cabling section crosses the zone of groundwater contribution, however, groundwater is found at depths below the depth of the cable trench, so no impact is predicted.

7.6. Cumulative Impacts

The cumulative impact on soils & geology of the proposed connection route with the permitted and proposed wind farms in the area and permitted grid connection (between Cloonkeelaun and Glenree) is considered negligible. The construction of the proposed connection will require a small volume of bedding sand and excavated peat / soil will be reused for trench backfill and backfill around poles and sleepers. The cumulative impacts that would have been experienced for the permitted underground route between Black Lough and Cloonkeelaun are reduced /avoided with the new proposed route. These would have taken the form of additional trench excavation; demand on quarries for bedding sand and lean-mix concrete used in the trench backfill; use of additional plant and machinery and its associated potential impacts such as peat / soil compaction, risk of contamination from fuel storage; erosion of excavated soils; and preferential pathways associated with trenches.

As noted, the grid connection route does not pass near any geological heritage sites, so is not predicted to have any impacts on any geological heritage sites in the area, either in isolation or cumulatively with the nearby wind farm developments.

7.7. Do-Nothing Scenario

In the do-nothing scenario, it is envisaged that the current land use will continue at the site – i.e. low intensity sheep grazing. It is uncertain whether the wind farms would be constructed without this proposed connection.

7.8. Mitigation Measures

The electrical connection has been designed primarily to minimise impact on ecology of the SAC. Other design considerations are to reduce the risk of slope instability and other potential impacts on geology as far as possible. The residual risks associated with the construction of this alternative electrical connection can be managed, and the following recommendations are given to achieve this.

1. The electrical connection will be constructed in accordance with the method statement provided in Appendix 2-1. This will be in addition to the construction methods detailed in the approved CEMPs for Black Lough Wind Farm and Cloonkeelaun Wind Farm.
2. Material excavated from the trenches will be reused as far as possible as trench backfill and landscaping, as appropriate. Backfilling of trenches will be carried out on an ongoing basis so that only a short section of trench is opened at any given time. The backfilling and restoration of the trench will minimise stockpiling of soils and erosion of soils from wind and rain.
3. Material excavated for the installation of the wooden poles will be reused as backfill around the poles, where suitable.

4. Fuel storage and handling will be carried out as detailed in the approved CEMP and in Chapter 8 to avoid soil (and water) contamination.
5. The pole locations will be set out by a land surveyor and access to each location will be selected to minimise tracking across blanket bog. To avoid rutting and soil erosion in wet weather, bog mats will be used where required to reduce rutting or soil erosion in accessing pole locations.
6. To avoid the cable trenches becoming preferential pathways, clay/peat plugs (or other low permeability material) will be installed at intervals along the trench to stop / inhibit water movement.
7. An ECoWs will be engaged to monitor construction works.

With the implementation of these avoidance and mitigation measures, the proposed development will not have a significant impact on geology or hydrogeology. It is unlikely that groundwater quality will be impacted. As the works are distant from supply wells, interference to groundwater flows to the wells in the vicinity of the site is not predicted.

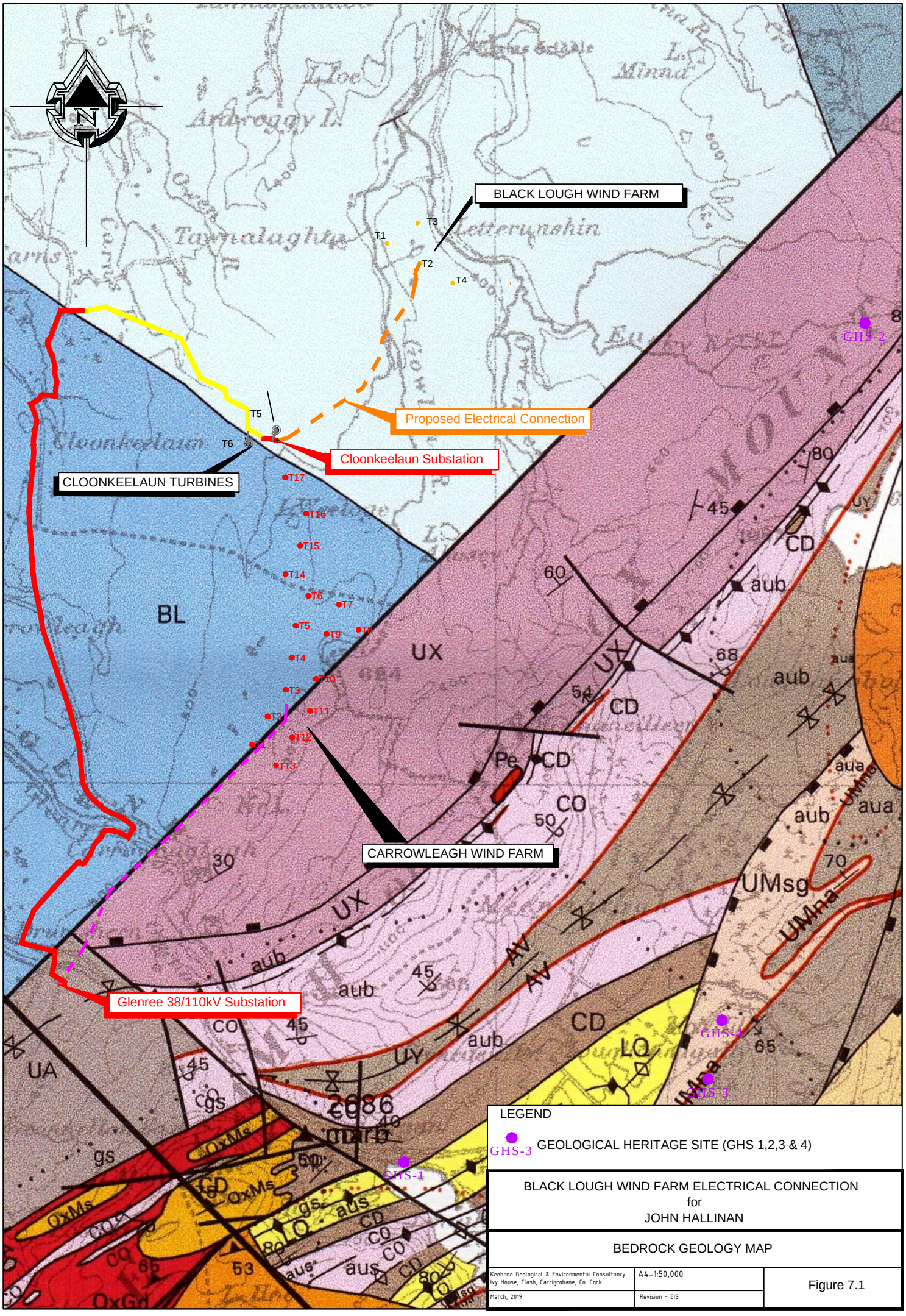
7.9. Worse-Case Scenario

The worse-case scenario would be a construction-related peat landslide that would impact on water quality in the Gowlan River. However, considering the small scale of the earthworks involved, the likelihood of this occurring is considered very low.

7.10. Monitoring

Monitoring of the works will be carried out by the project engineer, ECoW and geotechnical engineer, as appropriate. This will involve visual inspection of the works for peat stability, ground conditions and water quality. Remedial measures, if required, will be implemented as appropriate.

OS LICENCE No. AR 0090317



LEGEND

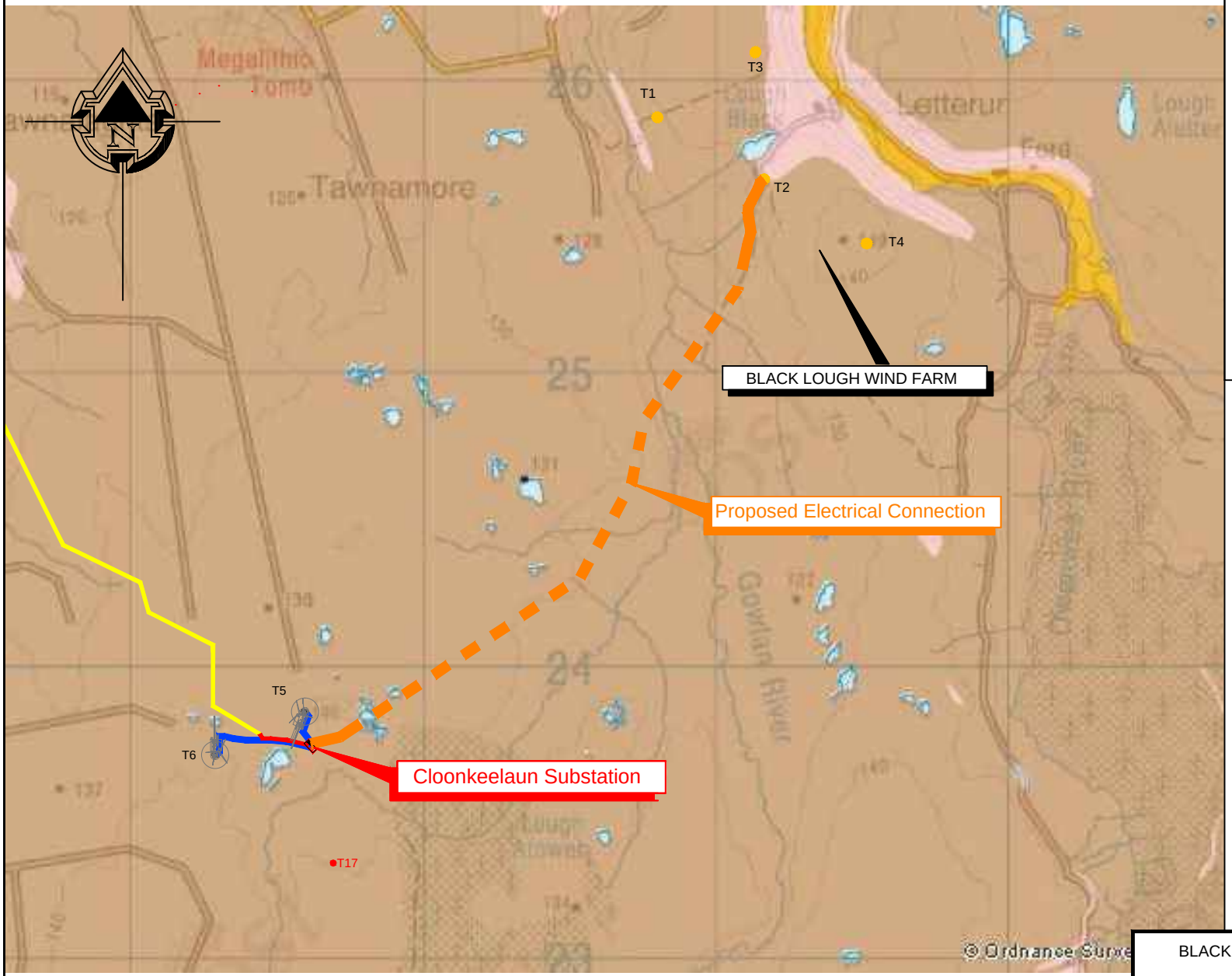
GHS-3 GEOLOGICAL HERITAGE SITE (GHS 1,2,3 & 4)

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

BEDROCK GEOLOGY MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	A4-1:50,000	Figure 7.1
March, 2019	Revision = EIS	

OS LICENCE No. AR 0090317



Legend

Teagasc Subsoils

- Alluvium
- Blanket peat
- Bedrock outcrop or subcrop
- Till derived from metamorphic rocks
- Water

OSI Basemap

0 0.175 0.35 0.7 mi

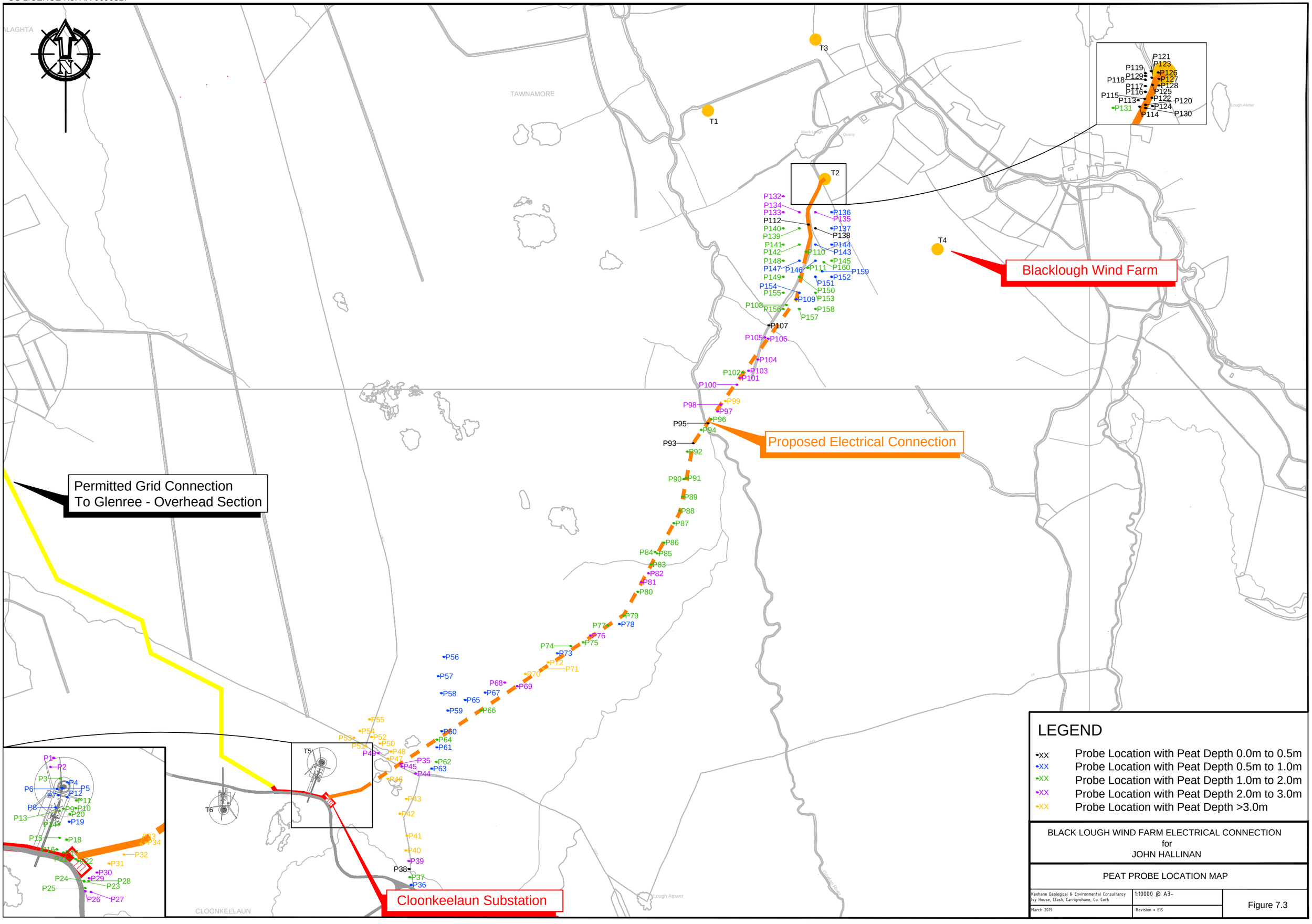
0 0.275 0.55 1.1 km

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

OVERBURDEN GEOLOGY MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	A4-1:50,000	Figure 7.2
March 2019	Revision = EIS	

OS LICENCE No. AR 0090317



BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

PEAT PROBE LOCATION MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:10000 @ A3-	Figure 7.3
March 2019	Revision = EIS	

OS LICENCE No. AR 0090317

N

TAWNAMORE

CLOONKEELAUN

Lough Atower

T1 T2 T3 T4 T5 T6

Blacklough Wind Farm

Proposed Electrical Connection

Cloonkeelaun Substation

Permitted Grid Connection
To Glenree - Overhead Section

LEGEND

- XX Probe Location with Peat Depth 0.0m to 0.5m
- XX Probe Location with Peat Depth 0.5m to 1.0m
- XX Probe Location with Peat Depth 1.0m to 2.0m
- XX Probe Location with Peat Depth 2.0m to 3.0m
- XX Probe Location with Peat Depth >3.0m

Zone 1 - Areas of cutaway bog with glacial tills exposed.

Zone 2 - Areas of near flat blanket bog, largely unspoilt with interconnecting bog pools in places with peat 2m to 4m typically.

Zone 3 - Areas of undulating unspoilt blanket bog with peat depth generally <1.5m.

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

PEAT LANDSLIDE RISK ZONING MAP

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:10000 @ A3-	Figure 7.4
March 2019	Revision = EIS	

8. HYDROLOGY & SURFACE WATER

This chapter addresses hydrology and surface water in the existing environment, the potential impacts of the proposed development on hydrology and the proposed mitigation measures to avoid or reduce potential impacts. It assesses the cumulative impact on hydrology of the permitted grid connection from Cloonkeelaun to Glenree and the operational and permitted wind farms in the River Easky catchment.

8.1. Existing Environment

The proposed electrical connection route is located within hydrometric area No. 35 – Sligo Bay and Drowse), and within the Western River Basin District. Hydrometric area No. 35 covers the surface catchment drained by the River Drowes and all streams entering tidal water in Sligo Bay and between Lenadoon Point and Aughrus Point, County Donegal.

The proposed electrical connection is located in the catchment of the Gowlan River and its tributaries. The Gowlan River joins with the Easky River approximately 1.8km to the north the route. The Gowlan River rises in Carrownaclogh in County Mayo in the foothills of the Ox Mountains. It flows generally in a northerly direction in a small valley, through peatland. It flows past the Carrowleagh Wind Farm and through forestry at Cloonkeelaun. It flows through the Ox Mountains Bogs SAC before entering Tawnamore, where commercial turf cutting takes place. It joins with the Easky River approximately 1.8km north of where the proposed electrical connection crosses the Gowlan River. The catchment area for the Gowlan River is 18km^2 to it confluence with the Easky River. The catchment areas are shown on Figure 8-1.

The Easky River rises in the Ox Mountains to the east of the site and flows into Lough Easky. The discharge from Lough Easky flows north and then west through peatland. It is joined in Letterunshin by a number of other rivers draining the peatland, including the Letterunshin, Meenamaddo and Owenwee rivers. The Easky then turns north near the Black Lough site. From Tawnamore, it generally flows in a northerly direction and discharges to Sligo Bay near Easky. The Easky River and tributaries are important fishery rivers. The lower sections of the Easky River are designated as a pNHA. The catchment area for the Easky River is 99.2km^2, which includes the Gowlan River catchment.

The permitted grid connection between Cloonkeelaun and Glenree runs through two hydrometric areas. The start of this route is located within hydrometric area No. 35 – Sligo Bay and Drowse; i.e. the first 300m extending west from the Cloonkeelaun control building. As with the proposed electrical connection, this section of the permitted grid route is located within the catchment of the Gowlan River. The remainder of the grid route is located in hydrometric area No. 34 – Moy and Killala Bay. The main rivers draining this area are the Carns, Owen River, Brusna River, Owencam River, Loughnagore River, Glenree River and Srafaungal River. With the exception of the Cairns and Owen River, these flow generally in a westerly direction and discharge to the tidal waters of the Moy River at Ballina. The Owen and Cairns rivers are tributaries of the Liffony River, which flows in a north-westerly direction, discharging to Ballina Bay to the northeast of Enniscrone.

8.1.1. Runoff Estimates

The nearest synoptic weather station to Tawnamore / Cloonkeelaun is Knock Airport County Mayo, approximately 30km southeast of the site at an elevation of 200mOD. The mean monthly rainfall for Knock Airport synoptic station is summarised in Table 8-1, along with the potential evapotranspiration. The long average rainfall for the nearby river gauging station 35072, at Lough Easky, is given as 1,573 mm/annum. The long-term average effective rainfall for Claremorris is estimated at 1,173 mm/annum for 1971 to 2000. An extreme rainfall event of 107mm/day was recorded during the 30-year period 1971 to 2000. Using the long-term rainfall for Lough Easky, the long-term effective rainfall for the site would be ~900mm/annum.

Table 8-1: Summary of Rainfall Data Knock Airport + Claremorris

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	138.4	78.1	33.4	62.4	70.1	230.1	120.5	125.8	86.1	126.4	143.0	153.2	**1367.5**
2013	153.8	73.9	47.3	105.9	134.4	68.5	81.8	73.5	71.6	122.3	63.0	211.1	**1207.1**
2014	208.1	236.2	117.0	43.4	132.8	67.0	71.0	142.2	18.7	162.1	149.7	169.9	**1518.1**
2015	224.9	95.8	135.5	87.3	151.5	51.8	160.8	178.5	89.9	78.5	250.2	347.8	**1,852.5**
2016	183.4	157.3	93.6	84.1	69.9	112.2	95.0	117.7	103.2	59.0	71.7	83.0	**1,230.1**
2017	55.4	87.6	134.9	23.6	65.4	113.0	134.3	144.3	170.3	122.0	135.4	156.2	**1,342.7**
2018	201	101.3	63.6	112.9	67.3	54.1	82.6	140.2	104.2	103.3	136.9	139.3	**1,306.7**
1971-2000	127.9	102.1	101.6	63.7	68.1	64.5	70.1	95.7	94.3	128.2	127.7	129.6	**1,173.6**
Greatest Daily Total													
1971-2000	31.5	107	26.8	34.0	51.3	38.0	42.2	49.7	41.0	46.7	54.9	41.2	**107.0**
Mean Potential Evapotranspiration													
2014	12.9	21.4	40.2	76.8	86.0	107.2	93.6	78.1	60.5	32.0	11.4	13.4	**633.5**

Notes:

1. The mean rainfall data for 1971 – 2000 is for Claremorris. Knock Airport data is not available and Claremorris closed in 2007, so 1981 – 2010 long-term average is not available.

The landholdings cover an area of approximately 525ha (429ha +96ha), most of which is within the catchment of the Gowlan River. Within this land bank, the site (i.e. the area within the red-line planning boundary) covers an area of approximately 15.4ha. The total catchment of Gowlan River to its confluence with the Easky River is ~1,800ha. Using the effective rainfall (900mm), the incident rainfall in the Gowlan River catchment average:

- 44,384m^3/day or 514litres/sec.
- This will increase to 1,926,000m^3/day (or 22,292litres/sec) in extreme rainfall events where there will be flashy flows in the streams.
- According to the EPA hydrometric section, the 95-percentile flow in the Gowlan River is 36l/sec.

The landholding will contribute approximately 29% to these rainfall volumes.

8.1.2. Surface Water Quality

The EPA water quality for the catchment is summarised in Table 8-2. The EPA biological water quality data indicates good water quality.

Table 8-2: EPA Water Quality Data

River	Location	2004 - Present
Gowlan	U/S Easky River confluence	Q4-5 / Q5
Easky	U/S Gowlan River confluence	Q4
Easky	Bridge at Camcuill (N59)	Q4-5
Easky	Easky Bridge	Q4-5

Notes:

1. U/S – indicates upstream.

As part of the assessment of water quality for the permitted Black Lough Wind Farm, Minerex Environmental (2008), Tynan Environmental (2009) and Hydro-Environmental Services (HES) (2011) assessed surface water at the site. More recently, surface water quality monitoring has been carried out by JKW Environmental as part of the construction monitoring programme for Black Lough Wind Farm. Data is available for 2018. The most recent data is from JKW Environmental is provided in Tables 8-3 (field measurements) and Table 8-4 (laboratory analyses). Sampling locations are shown on Figure 8-2.

Table 8-3: Summary of Surface Water Field Measurements

Parameter	Units	Monitoring Points			
		MP1 (Q4)	MP2 (SW4)	MP3 (SW3)	MW4 (Q5)
River		Easky	Easky	Gowlan	Gowlan
Date: 06 February 2018					
Temperature	°C	3.7	3.8	4.4	3.7
pH	pH Units	8.27	7.41	7.18	7.20
Dissolved Oxygen	%	118.8	105.3	95.4	95.2
Electrical Conductivity	µS/cm	121	117	126	124
Total Dissolved Solids	mg/l	78	76	81	80
Turbidity	NTU	7.6	3.1	1.7	0.5
Date: 04 April 2018					
Temperature	°C	5.8	6.5	5.6	5.2
pH	pH Units	7.22	7.1	7.21	7.6
Dissolved Oxygen	%	93.7	92.8	124.4	126.6
Electrical Conductivity	µS/cm	164	154	252	263
Total Dissolved Solids	mg/l	106	100	163	170
Turbidity	NTU	3.1	6.7	5	2.3
Date: 12 June 2018					
Temperature	°C	14.7	15.1	16.2	15.2
pH	pH Units	7.68	7.19	7.18	7.35
Dissolved Oxygen	%	150.6	134.5	104.3	124.5
Electrical Conductivity	µS/cm	338	363	385	409
Total Dissolved Solids	mg/l	219	235	250	265
Turbidity	NTU	0.2	1.8	0.2	0.5
Date: 19 June 2018					
Temperature	°C	12	12.3	18.2	16.5
pH	pH Units	8.26	8.37	8.35	8.52
Dissolved Oxygen	%	101.1	104	110.5	104.8
Electrical Conductivity	µS/cm	425	431	622	625
Total Dissolved Solids	mg/l	276	280	404	406
Turbidity	NTU	0	0	0	5.3
Date: 22 June 2018					
Temperature	°C	16.4	18	15	15.1
pH	pH Units	8.43	8.57	7.58	7.63
Dissolved Oxygen	%	101.1	100.3	82.8	85
Electrical Conductivity	µS/cm	216	190	285	289
Total Dissolved Solids	mg/l	140	123	185	187
Turbidity	NTU	5.2	3.8	408	728
Date: 29 June 2018					
Temperature	°C	16.7	16.9	18.1	19.8
pH	pH Units	8.17	8.41	8.19	8.3
Dissolved Oxygen	%	96.2	98.3	99.5	99.5
Electrical Conductivity	µS/cm	298	287	351	340
Total Dissolved Solids	mg/l	193	186	228	221
Turbidity	NTU	12.8	12.6	0.8	0.3
Date: 06 July 2018					
Temperature	°C	17.5	18.9	19.4	19.4
pH	pH Units	8.57	8.55	8.49	8.58
Dissolved Oxygen	%	98.4	101.8	105.8	102.3
Electrical Conductivity	µS/cm	351	354	408	426
Total Dissolved Solids	mg/l	228	230	265	276
Turbidity	NTU	4.9	6.6	6.5	10.1
Refined Oils	µg/l	0	0	0	0
Date: 14 July 2018					
Temperature	°C	16	16.4	18	18
pH	pH Units	8.54	8.33	8.52	8.59

Parameter	Units	Monitoring Points			
		MP1 (Q4)	MP2 (SW4)	MP3 (SW3)	MW4 (Q5)
Dissolved Oxygen	%	98.7	98.9	102.9	100.6
Electrical Conductivity	µS/cm	353	370	401	414
Total Dissolved Solids	mg/l	229	240	260	269
Turbidity	NTU	6.5	5.2	9.4	8.8
Refined Oils	µg/l	0	0	0	0
Date: 23 July 2018					
Temperature	°C	19.2	19.2	19.2	18.8
pH	pH Units	8.35	8.18	8.39	8.62
Dissolved Oxygen	%	103.7	113.5	100.9	102.8
Electrical Conductivity	µS/cm	404	404	371	378
Total Dissolved Solids	mg/l	262	262	241	245
Turbidity	NTU	6.7	9.5	3.5	4.5
Refined Oils	µg/l	10.4	0	0	0
Date: 31 July 2018					
Temperature	°C	14.5	14.3	14.5	14.8
pH	pH Units	7.06	7.23	7.29	7.27
Dissolved Oxygen	%	96.5	93.3	94.7	95.5
Electrical Conductivity	µS/cm	161	139	98	106
Total Dissolved Solids	mg/l	104	90	63	68
Turbidity	NTU	27.4	208	92.4	77.4
Refined Oils	µg/l	0	36.8	13	29.9
Date: 08 August 2018					
Temperature	°C	15.2	15.9	15.8	15.9
pH	pH Units	7.68	7.61	7.79	8.08
Dissolved Oxygen	%	98.8	99	102.4	103.6
Electrical Conductivity	µS/cm	159	168	268	280
Total Dissolved Solids	mg/l	103	109	174	182
Turbidity	NTU	0.9	0	3.7	3
Refined Oils	µg/l	0	0	12.1	48.2
Date: 13 August 2018					
Temperature	°C	16	16.5	17	17.2
pH	pH Units	8	7.75	8.39	8.46
Dissolved Oxygen	%	98.5	100.5	107.8	106.3
Electrical Conductivity	µS/cm	225	218	310	326
Total Dissolved Solids	mg/l	146	141	201	211
Turbidity	NTU	6.4	0.5	8.3	9.6
Refined Oils	µg/l	0	0	12.3	0
Date: 23 August 2018					
Temperature	°C	14.8	15.4	14.4	14.5
pH	pH Units	8.09	7.33	7.4	7.0
Dissolved Oxygen	%	97.2	95.4	94	96.4
Electrical Conductivity	µS/cm	70	63	65	68
Total Dissolved Solids	mg/l	45	40	42	44
Turbidity	NTU	0	0	0	2
Refined Oils	µg/l	12.7	0	27.5	30.5
Date: 29 August 2018					
Temperature	°C	11.3	11.5	11.5	11.9
pH	pH Units	7.41	7.18	7.61	7.71
Dissolved Oxygen	%	97.3	97.4	95.7	96.4
Electrical Conductivity	µS/cm	81	84	91	97
Total Dissolved Solids	mg/l	52	54	59	63
Turbidity	NTU	1.7	0.8	0	0
Refined Oils	µg/l	63.5	0	24	41.7
Date: 10 September 2018					
Temperature	°C	11.7	11.8	11.8	11.8

Parameter	Units	Monitoring Points			
		MP1 (Q4)	MP2 (SW4)	MP3 (SW3)	MW4 (Q5)
pH	pH Units	8.02	7.94	8.18	7.95
Dissolved Oxygen	%	97.7	98	96.9	96.5
Electrical Conductivity	µS/cm	134	123	145	157
Total Dissolved Solids	mg/l	87	79	94	102
Turbidity	NTU	2.8	0.8	6.0	4.1
Refined Oils	µg/l	0	0	0	66.4
Date: 16 September 2018					
Temperature	°C	10.3	10.4	10.4	10.7
pH	pH Units	7.04	6.47	6.03	6.17
Dissolved Oxygen	%	109.2	115.2	140.8	138.8
Electrical Conductivity	µS/cm	99.1	78	100.3	99.5
Total Dissolved Solids	mg/l	35	42	31	76
Turbidity	NTU	0.3	3.5	8.4	2.7
Refined Oils	µg/l	0	39.8	0	0
Date: 20 September 2018					
Temperature	°C	10.2	10.3	10.2	11.6
pH	pH Units	7.93	6.9	7.5	8.09
Dissolved Oxygen	%	99.3	98.8	99.3	100
Electrical Conductivity	µS/cm	73	72	82	90
Total Dissolved Solids	mg/l	47	46	53	58
Turbidity	NTU	3.1	4.1	3.2	4.5
Refined Oils	µg/l	19.9	58.2	78.7	25.8
Date: 26 September 2018					
Temperature	°C	12.4	12.3	12.4	13.4
pH	pH Units	8.0	7.7	7.91	8.02
Dissolved Oxygen	%	98.6	97.4	95.2	96.4
Electrical Conductivity	µS/cm	133	125	196	205
Total Dissolved Solids	mg/l	86	81	127	133
Turbidity	NTU	5.9	6.3	8.0	7.0
Refined Oils	µg/l	0	0	0	0

Table 8-4: Surface Water Quality Data Laboratory Analyses

Parameters	Units	Monitoring Points				Freshwater Fish Directive Requirements	
		MP1	MP2	MP3	MP4	Salmonid	Cyprinid
River		Easky	Easky	Gowlan	Gowlan	**---**	**---**
Date: 06 February 2018							
Alkalinity (as $CaCO_3$)	mg/l	21	19	21	20	---	---
Ammonium (as NH_4)	mg/l	<0.129	<0.129	0.34	<0.129	1	1
BOD_5	mg/l, O_2	1.4	1.2	1.5	0.4	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	0.4
pH	pH Units	7.08	7.19	7.16	7.24	6 - 9	6 – 9
Total phosphorus (as PO_4^{2-})	mg/l	<0.075	<0.075	<0.075	<0.075	---	---
TSS	mg/l	<5	<5	<5	<5	25	25
Turbidity	NTU	1.1	1.2	1.2	1.3	---	---
Nitrate (as NO_3)	mg/l	<0.5	<0.5	<0.5	<0.5	---	---
Nitrite (as NO_2)	mg/l	<0.05	<0.05	<0.05	<0.05	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.13	<0.13	<0.13	<0.13	---	---
TPH (>C6 – C40)	mg/l	<0.01	<0.01	<0.01	<0.01	---	---
Date: 04 April 2018							
Alkalinity (as $CaCO_3$)	mg/l	53	48	92.4	98	---	---
Ammonium (as NH_4)	mg/l	<0.129	<0.129	0.21	<0.129	1	1
BOD_5	mg/l, O_2	0.7	0.8	1	1.4	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	<0.01	<0.01	0.03	0.04	0.2	0.4
pH	pH Units	7.46	7.48	7.6	7.64	6 - 9	6 – 9
Total phosphorus (as PO_4^{2-})	mg/l	<0.075	<0.075	<0.075	<0.075	---	---
TSS	mg/l	<5	<5	<5	<5	25	25
Turbidity	NTU	2.5	2.6	3.1	3.1	---	---
Nitrate (as NO_3)	mg/l	<0.5	<0.5	<0.5	<0.5	---	---
Nitrite (as NO_2)	mg/l	<0.05	<0.05	<0.05	<0.05	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.13	<0.13	<0.13	<0.13	---	---
TPH (>C6 – C40)	mg/l	<0.01	<0.01	<0.01	<0.01	---	---
Date: 27 June 2018							
Alkalinity (as $CaCO_3$)	mg/l	110	108	129	139	---	---
Ammonium (as NH_4)	mg/l	0.16	0.14	0.14	0.16	1	1
BOD_5	mg/l, O_2	1.1	0.8	1.1	1.2	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	0.014	<0.01	0.010	0.010	0.2	0.4
pH	pH Units	7.84	7.72	7.78	7.88	6 - 9	6 – 9
Total phosphorus (as PO_4^{2-})	mg/l	<0.23	<0.23	<0.23	<0.23	---	---
TSS	mg/l	<5	<10	<5	10	25	25
Turbidity	NTU	4.3	4.0	3.7	3.7	---	---
Nitrate (as NO_3)	mg/l	<2.3	<2.3	<2.3	<2.3	---	---
Nitrite (as NO_2)	mg/l	<0.17	<0.17	<0.17	<0.17	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.55	<0.55	<0.55	<0.55	---	---
TPH (>C6 – C40)	mg/l	110	108	129	139	---	---
Date: 31 July 2018							
Alkalinity (as $CaCO_3$)	mg/l	20	18	34	45	---	---
Ammonium (as NH_4)	mg/l	<0.129	<0.129	<0.129	0.17	1	1
BOD_5	mg/l, O_2	3.0	3.4	2.8	3.7	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	0.4
pH	pH Units	6.8	6.73	7.00	6.82	6 - 9	6 – 9

Parameters	Units	Monitoring Points				Freshwater Fish Directive Requirements	
		MP1	MP2	MP3	MP4	Salmonid	Cyprinid
Total phosphorus (as PO_4^{2-})	mg/l	<0.075	0.11	0.08	<0.075	---	---
TSS	mg/l	66	75	67	31	25	25
Turbidity	NTU	20	16	15	5.9	---	---
Nitrate (as NO_3)	mg/l	<0.5	<0.5	<0.5	0.53	---	---
Nitrite (as NO_2)	mg/l	<0.05	<0.05	<0.05	<0.05	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.13	<0.13	<0.13	<0.13	---	---
Date: 29 August 2018							
Alkalinity (as $CaCO_3$)	mg/l	21	19	25	29	---	---
Ammonium (as NH_4)	mg/l	<0.129	<0.129	<0.129	<0.129	1	1
BOD_5	mg/l, O_2	1.2	1.3	1.2	2.0	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	0.4
pH	pH Units	7.11	7.06	6.95	7.08	6 - 9	6 – 9
Total phosphorus (as PO_4^{2-})	mg/l	<0.23	<0.23	<0.23	<0.23	---	---
TSS	mg/l	<10	<10	<10	<10	25	25
Turbidity	NTU	1.53	1.7	2.0	1.9	---	---
Nitrate (as NO_3)	mg/l	<0.5	<0.5	<0.5	<0.5	---	---
Nitrite (as NO_2)	mg/l	<0.05	<0.05	<0.05	<0.05	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.13	<0.13	<0.13	<0.13	---	---
Date: 24 September 2018							
Alkalinity (as $CaCO_3$)	mg/l	40	38	64	82	---	---
Ammonium (as NH_4)	mg/l	0.14	0.17	0.21	0.32	1	1
BOD_5	mg/l, O_2	0.2	0.1	1.5	0.2	<3	<6
Soluble Reactive Phosphorus (as P)	mg/l	<0.01	<0.01	<0.01	<0.01	0.2	0.4
pH	pH Units	7.96	7.46	7.6	7.67	6 - 9	6 – 9
Total phosphorus (as PO_4^{2-})	mg/l	<0.23	<0.23	<0.23	<0.23	---	---
TSS	mg/l	<10	<10	<10	<10	25	25
Turbidity	NTU	3.2	3.8	4.6	4.4	---	---
Nitrate (as NO_3)	mg/l	<0.5	<0.5	<0.5	<0.5	---	---
Nitrite (as NO_2)	mg/l	<0.05	<0.05	<0.05	<0.05	0.01	0.04
Total oxidised nitrogen (as N)	mg/l	<0.13	<0.13	<0.13	<0.13	---	---

TSS (Total suspended solids) is a good indicator for identifying the release of silt to the stream during construction activities. The results for this parameter do not show an increase at the downstream sampling locations (MP1 and MP4), confirming that the construction surface water management controls were effective. Turbidity and TSS are generally low at all sample locations or are comparable in upstream and downstream locations reflecting natural increases in the catchment due to heavy rainfall events. There are increases in concentrations of some parameters at the downstream locations, but there is no trend indicating an impact from the construction works.

8.1.3. Surface Water Usage

Drinking water serving the Ballina region is sourced from Lough Conn (source: National Water Survey, Atkins March 2000). Lough Conn is 20km west of the site and in a different river basin. The water supply extends to areas just west of the site. The area in the immediate environs of the site is serviced by a group water scheme that sources its water from Lough Easky. The water abstraction at Lough Easky is operated by Sligo County Council. It serves the mains supply to parts of County Sligo and it also supplies a number of group schemes in west County Sligo and east County Mayo. Lough Easky (180mOD) is in a different catchment to the proposed grid route, so will be unaffected by the proposed development.

In addition, a groundwater supply is used by a local group scheme in Kilbride. The well is in a different catchment to the proposed electrical connection, so will be unaffected by the proposed development.

There are no known surface water abstraction points downstream of the site.

8.1.4. Flood Risk Assessment

Flood Risk Assessment (FRA) are required to be carried out for proposed developments in accordance with the Office of Public Works (OPW) Flood Risk Management Guidelines[52]. The lands along the proposed electrical connection do not have a history of flooding. Most of proposed route is overhead and the underground sections will be restored with like-for-like surfaces, so runoff characteristics will be effectively unchanged. The nature of the development will therefore not change the runoff characteristics of the site, so it will not change flood risk potential upstream, at or downstream of the site.

The stage one flood risk identification has not identified any flood risk created by the proposed electrical connection. Considering this and in accordance with the guidelines, there is no requirement to go any further in the staged process of the flood risk assessment

8.2. Potential Impacts

The potential impacts on hydrology and surface water during construction relate primarily to the quality of surface water runoff leaving the works corridor. As the ground surface along the cable trench will be restored to its original condition (like-for-like surface finish), and most of the connection is overhead, increased runoff quantities are not anticipated. Any deterioration of water quality downstream of the works could impact on water quality and sensitive aquatic habitats / fauna. The risks to surface water quality associated with the construction phase include release of silt and leaks / spillage of hydrocarbons. Potential impacts associated with the proposed connection are primarily associated with the construction stage of the project. As there will be no hardstand construction associated with this development, (or other changes to ground surfaces), potential hydrological impacts such as increased runoff from a rainstorm event, are avoided.

The risks associated with the construction phase will be of relatively short duration. The installation of the underground and overhead sections would take approximately 2 weeks. The specific potential impacts associated with these elements of the project construction are:

1. The excavation of trenches will expose soils to erosion from incident rainfall. The siltation of runoff water from the works corridor has the potential to impact on water quality in the receiving water courses, potentially affecting sensitive aquatic habitats and fauna. Unmitigated this could be a temporary, moderate negative impact. Note that trenching works only occur outside the SAC.
2. Transport of plant, equipment, materials and personnel in and out of the works corridor could result in rutting of the access route. The rutting could provide a preferential pathway for surface water runoff. Flows are also likely to be silt-laden. Unmitigated, this could be a short-term moderate negative impact.
3. Hydrocarbons will be used and/or stored on the route, primarily diesel to fuelling plant and machinery. There is potential for spills and leaks to occur which could impact on surface water quality. The potential impact would depend on the volume and location of a fuel spill / leak. Fuel storage tanks on construction sites are typically no larger than 1,300 litres. Unmitigated, this could be a short-term moderate negative impact on surface water quality.
4. The proposed electrical connection crosses the Gowlan River, a small tributary of the Gowlan River and small man-made drains. While these water courses will be crossed by overhead line, machinery will need to cross over / back to access the works. Unmitigated, crossings of watercourses would have temporary, slight-moderate negative impact.

5. Dewatering of cable trenches may be required if groundwater is encounter or if the trench fills with rainfall runoff following a heavy rainfall event. This water will likely contain silt / clay and if not managed properly, could impact on water quality in the receiving water courses. Unmitigated this would be a temporary, imperceptible-slight negative impact.

Potential impacts from these sources will be present primarily during the construction phase, which will be of relatively short duration. Access to the electrical connection during the operation phase would only be required for repairs or maintenance. These visits to site would be infrequent.

8.3. Cumulative Impacts

The cumulative impacts associated with surface water include:

1. Runoff water quality associated with the 3 No. turbines at Cloonkeelaun (one operational and 2 permitted), all of which are within the catchment of the Gowlan River.
2. Runoff water quality associated with the 4 No. turbines at Black Lough, 2 of which are within the catchment of the Gowlan River.
3. Runoff water quality associated with the five permitted turbines in the Kilbride Wind Farm that are in the catchment of the Gowlan River.
4. Surface water quality issues associated with the permitted grid connection between Cloonkeelaun and Glenree substation in County Mayo. Approximately 200m of the underground section of this grid connection is located in the catchment of the Gowlan River. The remainder is located within other catchments, so will not have a cumulative impact on hydrology with the construction / operation of proposed development.

Having reviewed the EISs for these wind farms, it is apparent that mitigation has been incorporated into the design of each to minimise increases in runoff and to protect the water quality of the receiving watercourses. For example, existing roads are / will be used to access the turbine locations. Mitigation measures were / will be put in place to prevent silt-laden runoff reaching water courses during construction. Monitoring of stream water quality during the construction of the wind farms will be undertaken to ensure the effectiveness of these mitigation measures. Surface water quality data for the Black Lough Wind Farm construction monitoring (provided in Tables 8-3 and 8-4) demonstrates the effectiveness of the surface water management controls.

8.4. Site Specific Drainage Design/Sediment and Erosion Plan

The proposed drainage plan for the proposed electrical connection has been informed by the potential impacts to surface water quality. The drainage design is the primary mitigation measure to manage runoff from the route and includes erosion control and siltation protection measures. The aspects of the drainage plan considered are:

1. Runoff and drainage from the underground sections of the route.
2. Runoff from pole excavations in the proximity of the Gowlan River and its tributaries.

8.4.1. General Control Measures

The general principles to apply for drainage of the site and the control of erosion are:

1. Silt fences will be erected on the downslope side of any earthworks areas in the vicinity of watercourses to intercept any overland flows that could potentially be carrying silt / fines. These are constructed with geotextile embedded in the peat and supported with wooden pegs. See example in Plate 8-1. Sand bags and straw bales will also be used in combination with silt fences where appropriate.

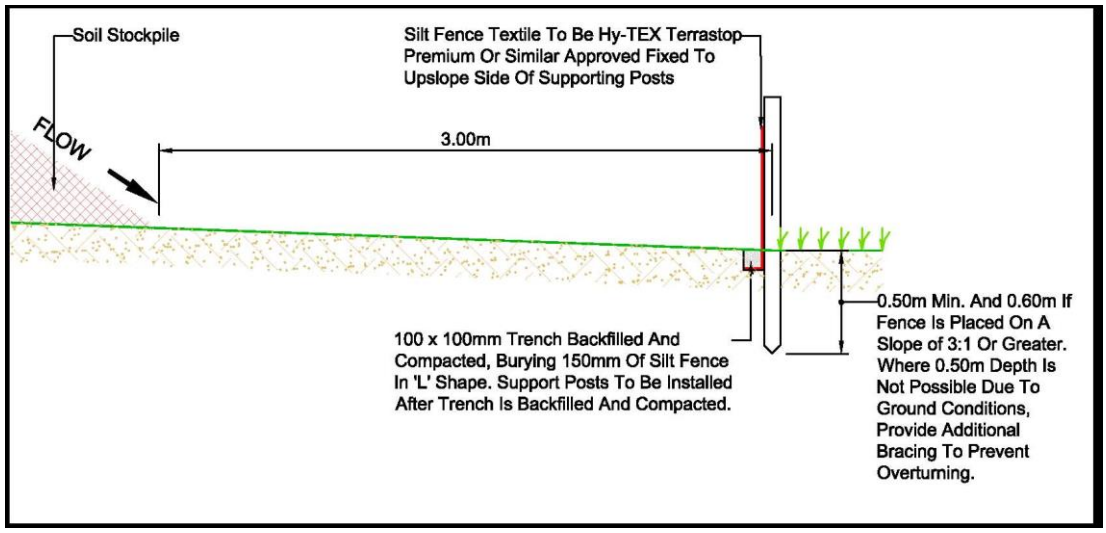


Plate 8-1: Example of Typical Silt Fence Arrangement

2. Settlement ponds will be installed at the Black Lough and Cloonkeelaun wind farms as part of their surface water management. These ponds will be used, if required, to pump out the trenches of the underground sections. The ponds will have a diffuse outfall which will encourage the diffuse spread of flows overland and back into natural drains down slope of the settlement ponds. Additional settlement ponds are not required specifically for the proposed development.

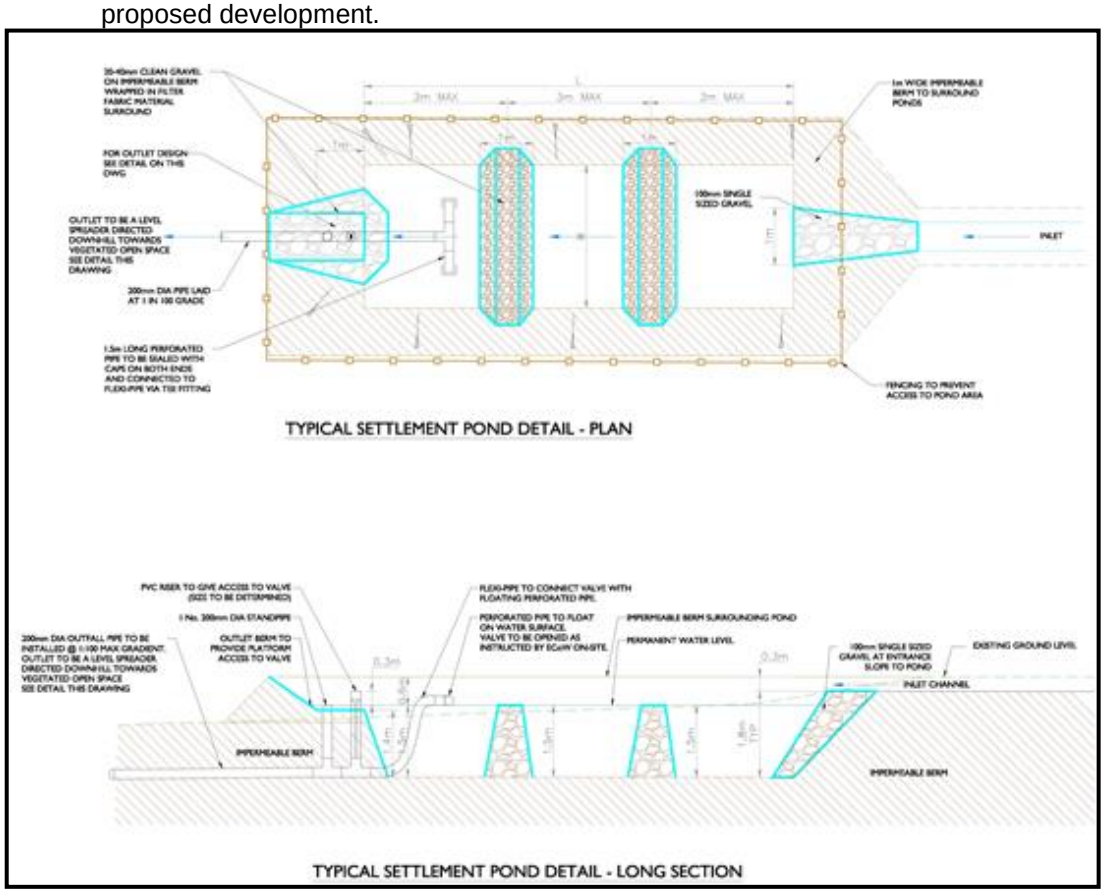


Plate 8-2: Typical Settlement Pond Arrangement for Wind Farm Sites

8.5. Mitigation Measures

The drainage from the works corridor flows to the Gowlan River and its tributaries. The Gowlan River is a tributary of the Easky River. The Gowlan River flows through the Ox Mountains Bogs SAC and the Easky River is a pNHA to the north of the N59. Freshwater pearl mussel and other important fauna are present in the Gowlan and Easky rivers. The surface water management from the route therefore requires particular measures to protect water quality.

To avoid or reduce the potential impacts, the following mitigation will be implemented at the site during the construction of the electrical connection:

1. During the construction phase, best practices will be employed to minimise the release of sediment laden storm water runoff.
2. The section of underground cable in Black Lough will follow an existing farm track. For both sections of underground, the ducting will be installed, and the trench restored on an ongoing basis. This will reduce areas of soil exposed to erosion. The underground sections can be completed in 2 or 3 days.
3. Works will be suspended in prolonged periods of wet weather.
4. If required, dewatering of the trenches will be to the temporary settlement ponds installed as part of the wind farm surface water management infrastructure. Flow from the settlement ponds will be diffuse overland flow. The water would travel over peatland and any silt would be settled before reaching watercourses.
5. Silt fences, sand bags and / or straw bales will be erected between the pole locations and any watercourse. Poles will have a minimum set back of 50m from the Gowlan River.
6. Machinery will not be permitted to cross the Gowlan River. Works on the eastern side of the Gowlan River will be accessed from Black Lough, while works on western side of the Gowlan River will be accessed from Cloonkeelaun. A temporary footbridge (scaffolding-type) will be placed over the Gowlan River for workers to cross on foot.
7. At the crossing locations of the tributary streams, the channels are narrow (300 to 500mm) and recessed below the bog surface, so can be crossed without entering the channel; the excavator can support itself while passing over the channel.
8. Poles, sleeper, guy wires and other materials will be delivered to location by helicopter. This will significantly reduce the trips to / from the route corridor using machinery, and so will reduce or avoid rutting.
9. Only low-bearing pressure (wide track) machinery will be used to erect poles on the blanket bog. This machinery will track in from the Cloonkeelaun side and work from pole to pole location and then track back out again assisting in stringing the cables. An Argo Cat vehicle will be used to bring personnel and daily consumables to / from the works location. This will reduce / avoid rutting.
10. The stringing of the cable will be done by hand.
11. Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled. These will be kept at the site compounds. Refuelling will be carried out from 20L Jerrycans and brought to the excavator each morning using the Argo Cat vehicle. Specific mitigation measures relating to management of hydrocarbons are:
    a. Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005).
    b. There will be no refuelling of machinery within 50m of any natural watercourse.
    c. Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.
    d. Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or re-cycling.
    e. Appropriate spill control equipment, such as oil soakage pads, will be kept in the excavator and Argo Cat vehicle to deal with any accidental spillage.

12. The ECoW engaged for the wind farms construction will also oversee the construction of the proposed connection. The ECoW will carry out monitoring of construction activities to ensure surface water quality is not impacted and where necessary instruct the contractor to implement remedial works. The surface water quality monitoring programme being implemented for the construction phase of the wind farms covers the watercourses draining the connection route.

Once the mitigation and avoidance measures outlined above are implemented, it is envisaged that there will be no residual impact on hydrology or surface water quality during the construction or operational phases of the grid connection

8.6. Monitoring

Monitoring of surface water quality will be carried out during the construction stage of the connection and the wind farms. Water quality monitoring will continue for the Gowlan and Easky rivers upstream and downstream of the site and in Stream A. Table 8-5 summarises the current monitoring regime to be continued for the remainder of the construction phase. Samples locations are shown on Figure 8-2.

Table 8-5: Summary of Surface Water Quality Monitoring Plan

Monitoring Location	Monitoring Frequency	Monitoring Programme	Parameters
MP1, MP2, MP3, MP4, MP5 and MP6	Monthly	Starting 1 month prior to construction and continuing for the duration of construction.	DO, Conductivity, TON, pH, Ortho-Phosphorous, Turbidity, BOD, Nitrate, Nitrite, TSS, TPH, Ammonia, Alkalinity and Total Phosphorus
MP1, MP2, MP3, MP4, MP5 and MP6	Weekly or Daily Depending on Site Activity	During and following periods of rainfall, concrete pouring, daily inspection will be carried out.	Field measurement of pH, temperature, conductivity, DO & turbidity
MP1, MP2, MP3, MP4, MP5, MP6 and settlement pond outfalls	Daily	During / following periods of heavy rainfall, daily inspection will be carried out.	Visual inspection.

Monthly samples will be submitted to an accredited laboratory for analysis. Test results will be maintained on site and available for inspection by Council and Inland Fisheries Ireland staff.

OS LICENCE No. AR 0090317

BLACK LOUGH WIND FARM

EASKY RIVER CATCHMENT

Proposed Electrical Connection

GOWLAN RIVER SUBCATCHMENT

Carrowleagh Substation

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14 T15 T16 T17

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

SURFACE WATER CATCHMENTS

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:50000 @ A3	Figure 8.1
March 19	Revision = EIS	

OS LICENCE No. AR 0090317

BLACK LOUGH WIND FARM

Proposed Electrical Connection

Permitted Grid Connection
To Glenree - Overhead Section

Cloonkeelaun Substation

OX MOUNTAIN BOG
SAC/ pNHA

MP1
MP2
MP3
MP4
MP5
MP6
Q4
Q5
T1
T2
T3
T4
T5
T6
T17

Megalithic Tomb
Tawnalaghta
Tawnamore
Black Lough
Letterunshin
Ford
Lough Aletter
Lough Atower
Lough Weelogo
Gowlan River
Owenwee River
Fiddanabrock
Bellana

LEGEND

CONSTRUCTION PHASE SURFACE WATER MONITORING POINT (MP1 TO MP6)

EPA SURFACE WATER MONITORING POINT WITH Q-VALUE

BLACK LOUGH WIND FARM ELECTRICAL CONNECTION
for
JOHN HALLINAN

SURFACE WATER MONITORING LOCATIONS

Keohane Geological & Environmental Consultancy Ivy House, Clash, Carrigrohane, Co. Cork	1:15000 @ A3-	Figure 8.2
March 2019	Revision = EIS	

9. AIR, CLIMATE AND CLIMATE CHANGE

The climate and air in the existing environment, potential impact of the development thereon and proposed mitigation measures are presented below. An assessment of the proposed development on contributions to climate change is provided. While the proposed development (electrical connection) will itself not have an impact to air, climate or climate change per say, it will facilitate the export of renewable energy that will.

9.1. Air and Climate in the Existing Environment

The nearest synoptic station to the site is located in Knock Airport County Mayo, approximately 30km southeast of the site at an elevation of 200mOD. There are no 30-year averages available for this station. The next nearest station, for which 30-year average data is available, is Belmullet County Mayo. Table 9-1 gives a summary of average mean temperatures, humidity, rainfall etc. based on a 30-year period between 1981 and 2010 for Belmullet.

Table 9-1: Climatic Data from Belmullet Synoptic Station

Monthly And Annual Mean And Extreme Values 1981-2010													
TEMPERATURE *(degrees Celsius)*	***Jan***	***Feb***	***Mar***	***Apr***	***May***	***Jun***	***Jul***	***Aug***	***Sep***	***Oct***	***Nov***	***Dec***	***Year***
mean daily max.	8.9	9.1	10.4	12.2	14.6	16.2	17.6	17.8	16.5	13.7	11.0	9.2	13.1
mean daily min.	3.7	3.6	4.7	5.8	7.9	10.4	12.2	12.2	10.7	8.4	6.0	4.2	7.5
mean	6.3	6.4	7.6	9.0	11.2	13.3	14.9	15.0	13.6	11.1	8.5	6.7	10.3
absolute max.	13.9	15.1	19.5	24.4	26.6	27.0	29.9	27.7	25.4	20.1	16.3	14.9	29.9
absolute min.	-8.1	-5.4	-5.7	-2.1	0.2	1.4	5.1	3.1	0.8	-1.7	-4.5	-7.6	-8.1
mean no. of days with air frost	4.0	3.8	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.1	1.1	3.5	14.1
mean no. of days with ground frost	10.6	10.0	6.5	5.4	1.7	0.1	0.0	0.0	0.4	2.0	5.6	10.0	52.3
RELATIVE HUMIDITY *(%)*													
mean at 0900UTC	86.0	85.8	84.1	81.1	78.7	81.4	84.9	85.1	84.5	85.7	86.1	86.8	84.2
mean at 1500UTC	81.7	79.1	77.5	73.7	73.3	77.2	79.7	79.2	77.9	80.0	82.3	84.3	78.8
SUNSHINE *(hours)*													
mean daily duration	1.4	2.3	3.1	5.2	6.1	5.2	4.4	4.4	4.0	2.8	1.6	1.2	3.5
greatest daily duration	8.3	9.6	11.6	14.1	15.5	15.9	15.1	13.9	12.1	10.4	8.2	7.2	15.9
mean no. of days with no sun	10.3	6.0	5.9	2.7	2.0	2.8	3.5	3.2	3.7	5.5	8.3	10.8	64.8
RAINFALL *(mm)*													
mean monthly total	134.0	97.1	99.2	72.0	70.4	72.1	79.0	101.9	101.8	145.9	134.0	137.4	1244.8
greatest daily total	44.7	31.3	25.6	25.9	42.2	38.9	33.2	49.5	62.6	79.6	43.0	41.7	79.6
mean no. of days with >= 0.2mm	23	20	22	18	17	17	20	20	20	23	23	23	246
mean no. of days with >= 1.0mm	19	16	17	13	13	12	14	15	15	19	20	19	192
mean no. of days with >= 5.0mm	10	7	7	4	4	4	5	6	6	10	10	9	82
WIND *(knots)*													
mean monthly speed	15.4	14.6	14.0	12.2	11.6	11.4	11.1	11.2	12.0	13.3	13.3	13.8	12.8
max. gust	94	93	88	75	66	63	67	56	73	73	80	93	94
max. mean 10-minute speed	55	60	58	43	42	45	45	40	50	52	47	59	60
mean no. of days with gales	7.0	4.8	3.1	1.4	0.9	0.2	0.2	0.4	1.5	2.6	3.1	4.4	29.6
WEATHER *(mean no. of days with..)*													
snow or sleet	4.5	4.2	3.1	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.9	3.0	17.3
snow lying at 0900UTC	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8	1.6
hail	9.2	7.8	7.4	4.4	1.7	0.1	0.0	0.1	0.5	3.3	5.6	7.5	47.7
thunder	1.1	0.7	0.6	0.4	0.5	0.5	0.6	0.6	0.3	0.6	0.5	0.9	7.2
fog	1.0	0.4	0.9	1.4	1.4	1.7	2.9	1.9	1.2	0.7	0.9	0.7	15.1

According to the SEAI wind atlas of Ireland, the mean annual wind speed for the site is approximately 8.2m/sec measured at a height of 75m above ground level. The ongoing wind speed measurements at nearby sites confirms these wind speeds.

9.2. Potential Impacts on Air and Climate

The proposed development will have an indirect long-term positive effect on climate. The proposed development will facilitate the displacement of traditional electricity generation, which is coal, peat, or oil. It would be hard to find anything more "ecologically sound" than a wind farm in operation: there are no polluting emissions, no dust particles, no waste, no effluent, no slag, no ash or no effect on the quality of the local air or water. It is the ultimate clean energy.

Each year, for every megawatt of energy that displaces fossil fuel power production, environmental, economic and social benefits include:

- Clean electricity to meet the electricity needs of 650 homes
- Removes the need to import 6,450 barrels of oil
- The avoidance of 2,700 tonnes of CO_2
- The avoidance of 49 tonnes of SO_2
- The avoidance of 5.5 tonnes of NO_x
- The avoidance of 175 tonnes of slag and ash for landfill

According to the CRU[53], the average annual domestic electricity usage is 4,200kWhr per household. Based on the average windspeed of 8m/sec and 6 No E92 turbines, the proposed wind farm would provide enough electricity for approximately 12,000 houses (which is greater than the 650 homes/MW rule-of-thumb given above). The proposed development will serve a wind farm with an export capacity of 12.5MW and will result in a net savings in emissions of:

- Clean electricity to meet the electricity needs of 12,000 homes.
- Removes the need to import 77,400 barrels of oil.
- The avoidance of 32,400 tonnes of CO_2.
- The avoidance of 588 tonnes of SO_2.
- The avoidance of 66 tonnes of NOx.
- The avoidance of 2,100 tonnes of slag and ash for landfill.

The development of the electrical connection (and associated wind farm) is not expected to have any negative impact on the climate of the area. The wind farm will generate electricity that would otherwise be generated by fossil fuel burning power stations and the proposed connection will facilitate its export to the National Grid. As outlined above, there are no atmospheric emissions (greenhouse gases and other pollutants) from wind energy generation. The excavation of peat for the construction of the connection will release carbon if that peat decomposed. The volumes involved are very small; $<100m^3$.

The change in Ireland's climate has been identified as one of the most serious environmental problems that Ireland faces at present[54, 55]. The release of greenhouse gases such as CO_2 from the burning of fossil fuels is a known contributor to global warming. Wind energy avoids the emissions of nitrogen oxides, sulphur dioxide and carbon dioxide. The enactment of the Climate Action and Low Carbon Development Act 2015 was a landmark national milestone in the evolution of climate change policy in Ireland and marks the seriousness with which this issue is taken at Government level.

9.2.1. Impacts of Climate Change on the Project

According to the EPA[56], climate change in Ireland is expected to result in rising temperatures, higher rainfall and more extreme weather events. Stronger winds will increase the output from the wind farm up to wind speeds of 25m/sec. For safety reasons, between wind speeds of 25 and 35m/sec the turbines go into storm-control mode with reduce output. Above wind speeds of 35m/sec the turbines will turn off completely. How the extreme weather events impact the wind farm will therefore depend on the wind speeds reached.

9.2.2. Cumulative Impacts

The projects that might have a cumulative impact with the proposed electrical connection include the permitted and operational wind farms in the local area. The wind farm that the proposed connection will facilitate will have an export capacity of 12MW. The operational Carrowleagh Wind Farm has an installed capacity of 39.1MW and the permitted Kilbride Wind Farm will have an installed capacity of 48.3MW. These wind farms will contribute to the displacement of fossil fuel-powered power plants and the associated greenhouse gas emissions.

The excavation of peat over sections of the grid connection route and the substation and during wind farm construction will release carbon if that peat decomposed. While the peat will be used as backfill in the cable trenches on an on-going basis, the worse-case scenario in that the peat decomposes and contributes to the release of carbon. The Scottish Executive[57] has developed a carbon calculator to take account of factors such as peat removal, tree felling, capacity factor of the site etc. The results of this indicate that the wind farms, grid connection and proposed electrical connection, when combined, will be carbon neutral after approximately 1.1 years.

9.3. Mitigation/Enhancement Measures for Air and Climate

The mitigation to reduce the release of carbon relates to the handling and management of excavated peat, which is set out in Chapters 7 and 11.

10. ARCHAEOLOGY, ARCHITECTURE & CULTURAL HERITAGE

This Heritage Impact Assessment was prepared by Dermot Nelis Archaeology. It addresses archaeological, architectural and cultural heritage aspects of the proposed development and surrounding area and aims to assess and provide for the identification of the nature and location of material on the site, and mitigate the impact of the proposed development on such archaeological, architectural and cultural heritage material as may survive.

10.1. Outline of Scope of Works

This chapter has been prepared to assess and define the impact, if any, on the archaeological, architectural and cultural heritage resource of the construction of a 20kV connection at Cloonkeelaun and Tawnamore townlands, County Sligo. The proposed development will consist of approximately 2.3km of overhead line and 300m of underground cabling and will extend from turbine T2 of the permitted Black Lough Wind Farm to the control building at the permitted Cloonkeelaun Wind Farm (Figure 10-1). Approximately 14 no. single wooden poles and 4 no. angle poles will be required for construction of the overhead line, while construction of the underground cable will involve excavation of a trench measuring approximately 1.2m deep x 0.40m wide.

The key objectives of this chapter are to assess, as far as is reasonably possible from existing records, any impacts the proposed connection may have on the archaeological, architectural and cultural heritage resource. The following key issues are addressed:

- Direct and indirect impacts of its construction and operation on recorded and unrecorded archaeological, architectural and cultural heritage features.
- Cumulative impacts with the Black Lough Wind Farm and Cloonkeelaun Wind Farm, on recorded and unrecorded archaeological, architectural and cultural heritage features.

Residual impacts of its construction and operation on recorded and unrecorded archaeological, architectural and cultural heritage features

10.1.1. Project Team

Dermot Nelis graduated from Queen's University Belfast, and after gaining extensive fieldwork experience undertook postgraduate studies at the University of Oxford in archaeological consultancy and project management.

Dermot has carried out numerous walkover surveys, testing and monitoring programmes. He acted as Senior Archaeologist on several motorway schemes for various County Councils, and Directed large-scale monitoring, test trenching and multi-period excavations associated with those developments. He has completed over 150 Licensed fieldwork programmes and over 250 archaeological, architectural and cultural heritage desk-based reports and Environmental Impact Assessments.

10.2. Assessment Methodology

The study involved detailed interrogation of the archaeological and historical background of the proposed connection route and the wider area. This included information from the Record of Monuments and Places (RMP) of County Sligo, Topographical Files of the National Museum of Ireland (NMI), Sligo County Development Plan (2017 – 2023), cartographic, documentary and aerial photographic records.

An archaeological study area 1km either side of the proposed connection route has been assessed. In addition, a study area 1km either side of the proposed connection route has been assessed to record the presence of Protected Structures, sites recorded on the National Inventory of Architectural Heritage (NIAH) and any additional statutorily protected archaeological, architectural or cultural heritage features recorded in the Sligo County Development Plan.

An impact assessment and mitigation strategy has been prepared. The impact assessment is undertaken to outline potential adverse impacts that the proposed development may have on the archaeological, architectural or cultural heritage resource, while the mitigation strategy is designed to avoid, reduce or offset such adverse impacts.

Research has been undertaken in two phases. The first phase consisted of a paper and digital survey of archaeological, historical and cartographic sources. The second phase involved a field inspection of the proposed development area.

10.2.1. Data Sources

The following sources were examined and a list of sites and areas of archaeological, architectural and cultural heritage potential was compiled:

- Record of Monuments and Places of County Sligo.
- Topographical Files of the National Museum of Ireland.
- Cartographic and documentary sources relating to the study area.
- Aerial photographs of Ordnance Survey Ireland and Bing aerial photography.
- Sligo County Development Plan.
- National Inventory of Archaeological Heritage.

Record of Monuments and Places is a list of archaeological sites known to the National Monuments Service. Back-up files of the Sites and Monuments Record (SMR) provide details of documentary sources and field inspections where these have taken place. There are no sites recorded on the Record of Monuments and Places within the proposed development area or the 1km study area.

Topographical Files of the National Museum of Ireland is the archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts, but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information in the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land-use development within a proposed area of land take, as well as providing important topographical information on sites and areas of archaeological potential. Cartographic analysis of relevant maps has been made to identify any topographical anomalies that may no longer remain within the landscape. **Documentary sources** were consulted to gain background information on the historical and archaeological landscape of the proposed development area.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its potential to contain previously unidentified archaeological and architectural remains.

Sligo County Development Plan 2017 - 2023 contains Objectives and Policies on the preservation and management of archaeological, architectural and cultural heritage sites and features. It was consulted to obtain information on sites within the proposed development area and the 1km study area.

National Inventory of Architectural Heritage is a section within the Department of Culture, Heritage and the Gaeltacht. The work of NIAH involves identifying and recording on a non-statutory basis the architectural heritage of Ireland from 1700 to the present day. The NIAH website also contains a non-statutory register of historic gardens and designed landscapes within County Sligo, and this was also assessed to look for the presence of any such features within the proposed development area or the 1km study area.

10.2.2. Field Survey Methodology

Field inspection is necessary to determine the extent, character and condition of archaeological, architectural and cultural heritage features, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information. A Field inspection was carried out on 25 June 2018, and all areas of proposed land take were visually assessed.

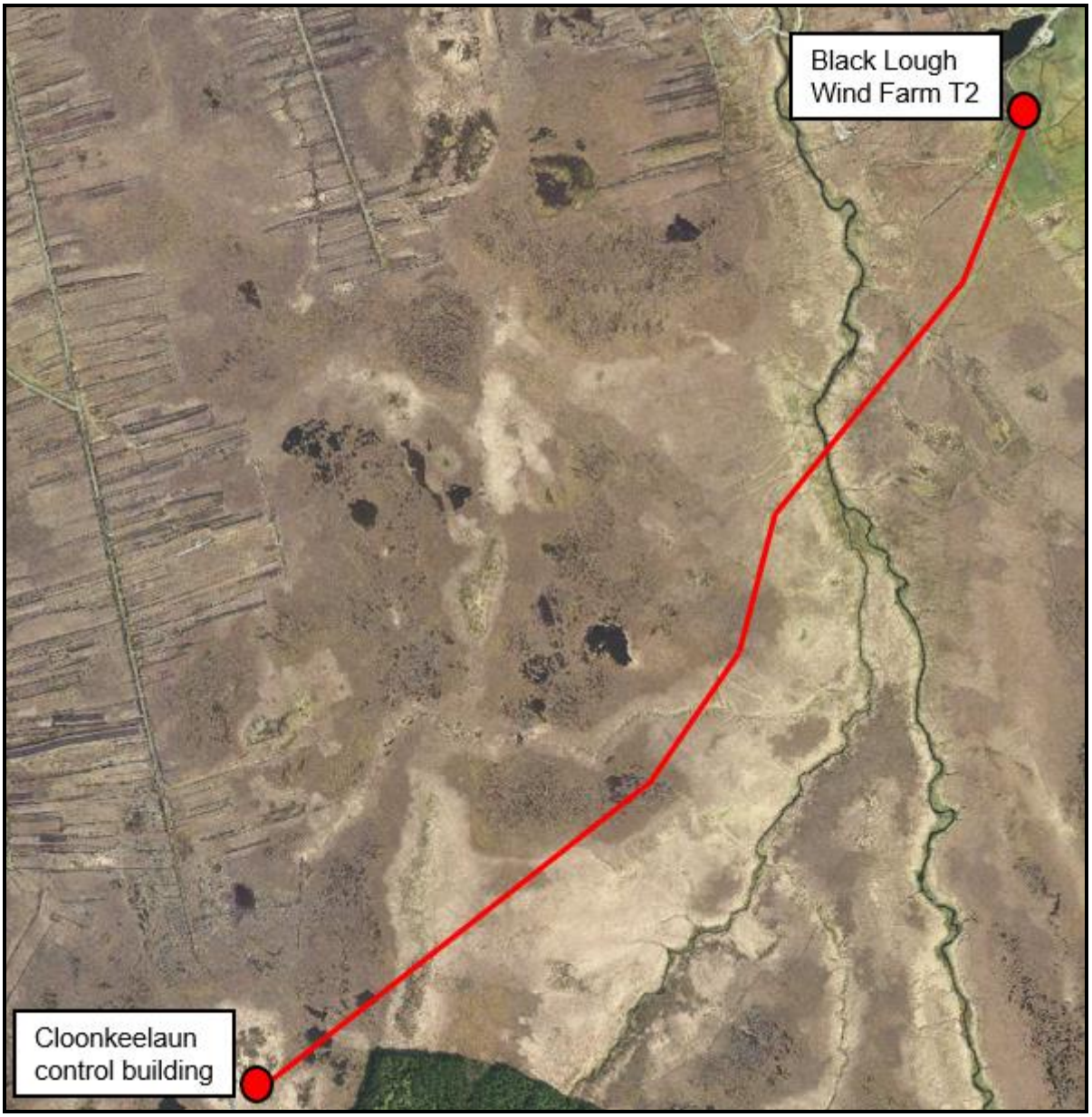


Figure 10-1: Aerial Photograph Showing Proposed Electrical Connection

10.3. Baseline Environmental Conditions

10.3.1. Archaeological and Historical Background

The development will be located in Cloonkeelaun and Tawnamore townlands. Cloonkeelaun derives from the Irish *Cluan chaolain*, translating as Keelan's meadow. Tawnamore derives from the Irish *An Tamhnaigh Mhór*. *Mór* translates as big or great and *tamhnach* translates as arable place or field.

During the Mesolithic period (*c*. 7000-4000 BC) people existed as hunters/gatherers, living on the coastline, along rivers and lakesides. They used flint and other stones to manufacture sharp tools, and locating scatters of discarded stone tools and debris from their manufacture can sometimes identify settlements.

The earliest evidence for settlement in Sligo dates from the Neolithic period (*c*. 4000-2400 BC). During this period the population became more settled with a subsistence economy based on crop growing and stock-raising.

A court tomb (RMP SL017-045) is recorded approximately 2km north west of the proposed grid connection in Caltragh townland. There is no further information recorded on this site on the National Monuments Service database (www.archaeology.ie).

There are slightly more than 400 court tombs in Ireland, the vast majority of which are in the northern half of the country with approximately 34% of the total being found in the Mayo/Sligo area (Waddell 2005, 78). In their standard form, court tombs are usually placed at the broader end of a long cairn, and consist of an open area, or court, of broadly semi-circular to circular outline leading to a long, rectangular gallery divided into two or more chambers (Archaeological Survey of Ireland 2005, 3). Radiocarbon dates from a small number of court tombs suggest that they are a feature of the fourth millennium BC (Waddell 2005, 86).

RMP SL023-001 is the site of a wedge tomb located approximately 1.5km north west of the proposed grid connection in Tawnamore townland. This monument was originally surveyed in 1974, but at some subsequent point it was damaged and the façade and some other stones were removed. A dump of boulders approximately 20m north of the tomb probably relates to this activity. Only the tops of the outer-walling and the backstone are visible above the peat surface.

Wedge tombs were the latest megalithic tomb type to be built in Ireland and date from around 2500 BC. Their period of construction and main use belongs to the Neolithic and Early Bronze Age, and there are 550 recorded examples in Ireland (Archaeological Survey of Ireland 2005, 3). They occur in heel-shaped, short, oval and sometimes round cairns and consist of a narrow gallery that usually increases in width and height towards its western end. The gallery may be divided into a short front chamber, or portico, and a long main chamber, and there is usually a line of stones constituting an outer wall around the sides and narrow end of the gallery.

The Bronze Age (*c*. 2400-600 BC) is characterised by the introduction of metalworking technology to Ireland and coincides with many changes in the archaeological record, both in terms of material culture as well as the nature of the sites and monuments themselves. Though this activity has markedly different characteristics to that of the preceding Neolithic period, including new structural forms and new artefacts, it also reflects a degree of continuity. During this period knowledge of metalworking was acquired resulting in changes in material culture such as the introduction of metal tools and artefacts as well as the introduction of a highly decorated pottery called Beaker pottery. In addition to changes in material culture, there were changes in burial rite from communal megalithic tombs to single burial in cists.

Bronze Age monuments from County Sligo include standing stones, stone alignments/rows, stone circles, cist burials, barrows and *fulachta fiadh*, which are one of the most numerous monument types in Ireland with over 4,500 examples recorded (Waddell 2005, 174).

A cist (RMP SL017-050) is recorded in Tawnatruffaun townland, approximately 1.9km north east of the proposed grid connection. It is noted (www.archaeology.ie) as being within a forestry plantation, situated on the broad, flat, bog-covered crest of the east side of the Easky River valley. The monument was exposed and largely cleared of peat *c*. 1970. It takes the form of a sub-circular cist (1.25m north/south x 0.9m east/west), defined by 10 principal upright stones (0.4m - 0.75m high) set into the pre-bog soil, with a further stone set externally in the south-east corner. All have their long axes aligned with the perimeter. Two stones inside the cist at the north east do not sit well with the overall pattern of the wall but nonetheless appear to be structural. The arrangement of the structural stones has a well-defined east/west axis, most strikingly illustrated by the arrangement of three larger and higher stones at both the north west and south east corners.

A field boundary (RMP SL023-009) is recorded in Tawnamore townland, and its location is centred on a point approximately 1.15km north west of the proposed grid connection. It is recorded (www.archaeology.ie) as being located in a field of rough pasture, bordered by bog to the west, south west and north west. The site was previously listed as "*field wall– pre-bog*", and inspection in 2014 noted that the field appears to have been reclaimed from bog. The ground surface, covered in rough grass, rushes and tufts of heather, is very uneven. Exposed stones are low and largely obscured by moss, sod or heather, and in general appear to be randomly scattered. It is unclear whether heather-covered hummocks conceal more stones. One possible linear feature was noted. It consists of a gapped line of stones and heathery hummocks covering a distance of approximately 6m on a west north west–east south east axis. The SMR file notes that it is not possible to be certain that it represents the remains of a pre-bog field wall.

A field system (RMP SL017-081) is recorded in Tawnatruffaun townland and is centred (www.archaeology.ie) on a point approximately 2km north of the proposed grid connection. The SMR file notes that there is no visible trace of a field system in this area and it is likely that it was destroyed during reclamation works.

A field system (RMP SL017-082) is centred (www.archaeology.ie) on a point approximately 1.5km north west of the proposed grid connection in Tawnamore townland. It is located in an area of cutaway blanket bog with scattered, active areas of small-scale machine turf harvesting, on a broad, flat-topped north/south ridge. The east side of the ridge falls in to the Easky River valley. Inspection in 2014 noted the remnants of three possible field walls. A cropmark of low heather highlights a linear concentration of stones which can be traced in a shallow arc for 19m - 20m. The stones protrude only slightly above the bog surface but appear densely packed. Located 35m to the south east is a short length of possible wall which is visible as a concentration of stones extending for 4m - 5m on a north west/south east axis. Located 10m to the east south east is another short length of possible wall, consisting of a concentration of stones barely protruding from the bog surface. It can be traced for 3m on a north east/south west axis. The relationship between the three discrete lengths of wall is unknown, and it is not possible to reconstruct the original pattern of the field system.

Field systems are regarded as a group or complex of fields which are related and may date to any period from the Neolithic onwards. The enclosed land could have been used for stock-raising, plant husbandry and crop protection. The fields vary in size and it is possible that many of them are more extensive than currently thought. A wide range of monuments, such as barrows, ringforts, souterrains, hut sites, ecclesiastical remains *etc*., can be found inside field systems.

During the Iron Age (*c*. 600 BC-400 AD) new influences came into Ireland which gradually introduced the knowledge and use of iron, although for several centuries bronze continued to be widely used. The Iron Age in Ireland however is problematic for archaeologists as few artefacts dating exclusively to this period have been found, and without extensive excavation it cannot be determined whether several monument types, such as ring barrows or standing stones, date to the Bronze Age or Iron Age.

The Early Medieval period (*c*. 400-1169 AD) is depicted in the surviving sources as entirely rural characterised by the basic territorial unit known as *túath.* Walsh (2000, 30) estimates that there were at least 100, and perhaps as many as 150, kings in Ireland at any given time during this period, each ruling over his own *túath*.

During this turbulent period roughly circular defensive enclosures known as ringforts were constructed to protect farmsteads. They were enclosed by an earthen bank and exterior ditch, and ranged from approximately 25m to 50m in diameter. The smaller sized and single banked type (univallate) was more than likely home to the lower ranks of society, while larger examples with more than one bank (bivallate/trivallate) housed the more powerful kings and lords. They are regarded as defended family homesteads and the extant dating evidence suggests they were primarily built between the 7th and 9th centuries AD (Stout 1997, 22-31).

The ringfort is considered to be the most common indicator of settlement during the Early Medieval period. The most recent detailed study (*ibid*., 53) has suggested that there is an approximate total of 45,119 potential ringforts or enclosure sites throughout Ireland.

Enclosures belong to a classification of monument whose precise nature is unclear. Often they may represent ringforts, which have either been damaged to a point where they cannot be positively recognised, or are smaller or more irregular in plan than the accepted range for a ringfort. An Early Medieval date is generally likely for this site type, though not a certainty.

The Early Medieval period is also characterised by the foundation of a large number of ecclesiastical sites throughout Ireland in the centuries following the introduction of Christianity in the 5th century AD. The early churches tended to be constructed of wood or post-and-wattle. Between the late 8th and 10th centuries mortared stone churches gradually replaced the earlier structures. Many of the sites, some of which were monastic foundations, were probably originally defined by an enclosing wall or bank similar to that found at coeval secular sites. This enclosing feature was probably built more to define the sacred character of the area of the church than as a defence against aggression. An inner and outer enclosure can be seen at some of the more important sites; the inner enclosure surrounding the sacred area of church and burial ground and the outer enclosure providing a boundary around living quarters and craft areas. Where remains of an enclosure survive it is often the only evidence that the site was an early Christian foundation.

The commencement of Viking raids at the end of the 8th century and their subsequent settlement during the following two centuries marked the first ever foreign invasion of Ireland. Viking settlement evidence is scarce, however excavations in Cork, Dublin and Waterford have revealed extensive remains of the Viking towns. Outside these towns, understanding of Viking settlement is largely drawn from documentary and place-name evidence. In addition to Cork, Dublin and Waterford, documentary sources provide evidence for the Viking foundation of the coastal towns of Limerick and Wexford (Edwards 2006, 179). Other indirect evidence which suggest Viking settlement, or at least a Norse influence in Ireland, is represented by upwards of 120 Viking-age coin hoards, possible votive offerings of Viking style objects and the assimilation of Scandinavian art styles into Irish designs. While the initial Viking raids would have been traumatic, the wealth and urban expansion brought into the country as a result of Viking trading would have eventually benefited the Gaelic Irish and cultural assimilation in some parts would have been significant.

The arrival of Anglo-Normans in Ireland towards the end of the 12th century caused great changes during the following century. Large numbers of colonists arrived from England and Wales and established towns and villages. They brought with them new methods of agriculture which facilitated an intensification of production. Surplus foods were exported to markets all along Atlantic Europe which created great wealth and economic growth. Results of this wealth can be seen in the landscape in the form of stone castles, churches and monasteries.

The political structure of the Anglo-Normans centred itself around the establishment of shires, manors, castles, villages and churches. County Mayo came under Anglo-Norman control in 1235 and Sligo Castle was built in 1245. In the initial decades after the Anglo-Norman invasion a distinctive type of earth and timber fortification was constructed- the motte and bailey. Mottes were raised mounds of earth topped with a wooden or stone tower while the bailey was an enclosure, surrounded by an earthen ditch with a timber palisade, used to house ancillary structures, horses and livestock. There are three motte and baileys recorded in County Sligo (www.archaeology.ie).

In certain areas of Ireland however Anglo-Norman settlers constructed square or rectangular enclosures, now termed moated sites. Their main defensive feature was a wide, often water-filled, fosse with an internal bank. As in the case of ringforts, these enclosures protected a house and outbuildings usually built of wood. They appear to have been constructed in the latter part of the 13th century though little precise information is available. Moated sites were also built in Britain and elsewhere in north west Europe. There are 48 moated sites recorded in County Sligo (www.archaeology.ie).

More substantial stone castles followed the motte and bailey and moated sites in the 13th and 14th centuries. Tower houses are regarded as a late type of castle and were erected from the 14th to early 17th centuries. Their primary function was defensive, with narrow windows and a tower often surrounded by a high stone wall (bawn). An Act of Parliament of 1429 gave a subsidy of £10 to "*liege*" men to build castles of a minimum size of 20ft in length, 16ft in breadth and 40ft in height (6m x 5m x 12m). By 1449 so many of these £10 castles had been built that a limit had to be placed on the grants. The later tower houses were often smaller, with less bulky walls and no vaulting. There are 11 tower houses recorded in County Sligo (www.archaeology.ie).

The 14th century throughout north west Europe is generally regarded as having been a time of crisis, and Ireland was no exception. Although the Irish economy had been growing in the late 13th century, it was not growing quickly enough to support the rapidly expanding population, especially when Edward I was using the trade of Irish goods to finance his campaigns in Scotland and Wales. When the Great European Famine of 1315-1317 arrived in Ireland, brought about by lengthy periods of severe weather and climate change, its effects were exacerbated by the Bruce Invasion of 1315-1318. Manorial records which date to the early 14th century show that there was a noticeable decline in agricultural production. This economic instability and decline was further worsened with the onset of the Bubonic Plague in 1348.

Before the Tudors came to the throne, the kings of England were also the kings of western France, and so during the 14th and 15th centuries the various lords who ruled in Ireland were largely left to themselves. The Tudors however took more of an interest in the affairs of Ireland. They wanted to put a stop to the raids of Gaelic Irish on areas under English rule. To do this they ruthlessly put down any rebellions and even quashed inter-tribal feuds. English settlers were then brought in to settle their lands. The first of these plantations occurred in the mid 16th century in what is now Laois and Offaly. After the Desmond rising in Munster in 1585 came another plantation, and parts of south western Tipperary were planted at that time.

From 1593 until 1603 there was a countrywide war between the Gaelic Irish, who were supported by the French, and the Elizabethan English. The Irish were finally defeated and with the "*Flight of the Earls*" in 1607, Ulster, which until then had been independent of English rule, was planted.

RMP SL023-003 is the site of a burial located approximately 1.5km north west of the proposed grid connection in Tawnamore townland. It is recorded (www.archaeology.ie) that the body of a middle-aged man was found at a depth of 0.8m below the surface in a bog in Tawnamore townland. The body, which was extended on its back, with the head to the south south east, lay on birch twigs. A full set of well preserved woollen clothing was recovered, including a hat, overcoat, jacket, breeches, a pair of knitted woollen socks, a pair of garters and a pair of shoes: these are on display in the National Museum of Ireland. The style of the clothing suggested a date of the mid-17th century. The location of the site of the discovery was verified in 2013.

The proposed development is located in Cloonkeelaun and Tawnamore townlands. Cloonkeelaun is in the barony of Tireragh and parish of Castleconor. Tawnamore is in the barony of Tireragh and parish of Kilmacshalgan. Lewis (1837, Vol. I. 197) describes the parish of Castleconor as containing 4,507 inhabitants. He notes that it derives its name:

> "*from an ancient castle, of which the ruins are still visible . . . The greater portion is under an improving system of tillage, and there are some large stock farms; there is a considerable extent of bog, and abundance of limestone is quarried for agricultural and other purposes*" (*ibid*.).

Lewis (1837, Vol. II. 167) describes the parish of Kilmacshalgan as containing, with the post-town of Dromore West, 3,330 inhabitants. He notes that it:

> "*comprises 25,884 statute acres, the greater portion of which is reclaimable mountain land and bog: the cultivated part is chiefly under tillage. There are quarries of limestone, freestone, and slate*" (*ibid*.).

Bogs or waterlogged areas frequently contain previously unrecorded remains and often form important archaeological landscapes. Waterlogged conditions provide an anaerobic environment which preserves organic remains and features such as wooden trackways or toghers. The practice of laying down trackways or causeways across wet areas and bogs to facilitate movement is known from as early as the 4th millennium BC. Trackways vary in form from a localised use of brushwood to large-scale linear features substantial enough to carry wheeled vehicles. In addition, monuments such as crannogs, *fulachta fiadh* and sites of votive offering are frequently found in or near wet, waterlogged regions.

Areas of present-day marginal land use and bogland may not always have been of such inferior quality or of little practical use. The discovery of cultivation ridges beneath blanket bog at Carrownaglogh townland for example, approximately 4.8km south west of the proposed development area, suggests that such areas may not always have been considered marginal (O'Connell 1991, 67). In addition, if the presence of wedge tombs is taken as an indicator of the settlement pattern of their builders (Mitchell and Ryan 2007, 195), the recording of such monuments in areas that are of low agricultural value today suggests that they may have been relatively productive in the past. A wedge tomb (RMP SL023-001) is recorded approximately 1.5km north west of the proposed development area in Tawnamore townland.

The line of the proposed grid connection will cross over the Gowlan River. Riverbank occupation sites have been favoured from prehistoric times for their proximity to rich food sources and are often represented by habitation sites and middens. Rivers were also important areas of activity serving as routeways, boundaries, defences and ritual sites. Riverbanks and riverbeds are considered areas of high archaeological potential, containing features such as *fulachta fiadh*, fords, ancient bridging sites, mills, longphorts and other habitation sites, and also produce archaeological artefacts such as logboats, organic material or votive offerings of swords, axeheads and other archaeological objects

10.3.2. Summary of Previous Fieldwork in Development Area

Reference to Summary Accounts of Archaeological Excavations in Ireland (www.excavations.ie) revealed that no fieldwork projects have been carried out in Tawnamore townland.

Monitoring by the writer of the construction of Carrowleagh wind farm (16 no. turbines), which is located south of the proposed development area and partially within Cloonkeelaun townland, failed to reveal any archaeological features or artefacts. In addition, recent monitoring of the construction of 1 no. wind turbine in Cloonkeelaun townland failed to reveal any archaeological features or artefacts.

10.3.3. Cartographical Analysis

Ordnance Survey Map First Edition 1837 (Figure 10-2)
The First Edition Ordnance Survey map records the wider landscape of the proposed development area as unenclosed rough pasture. The proposed development will cross the line of a townland and parish boundary. Research suggests that:

> "*hoards and single finds of Bronze Age weapons, shields, horns, cauldrons and gold personal objects can all be shown to occur on boundaries*" (Kelly 2006, 28).

"*Gowlan River*" is recorded either side of the proposed connection route. "*Black Lough*" is recorded at the northern end of the development area, along with two small structures and three possible wells, although these features are all outside the area of land take.

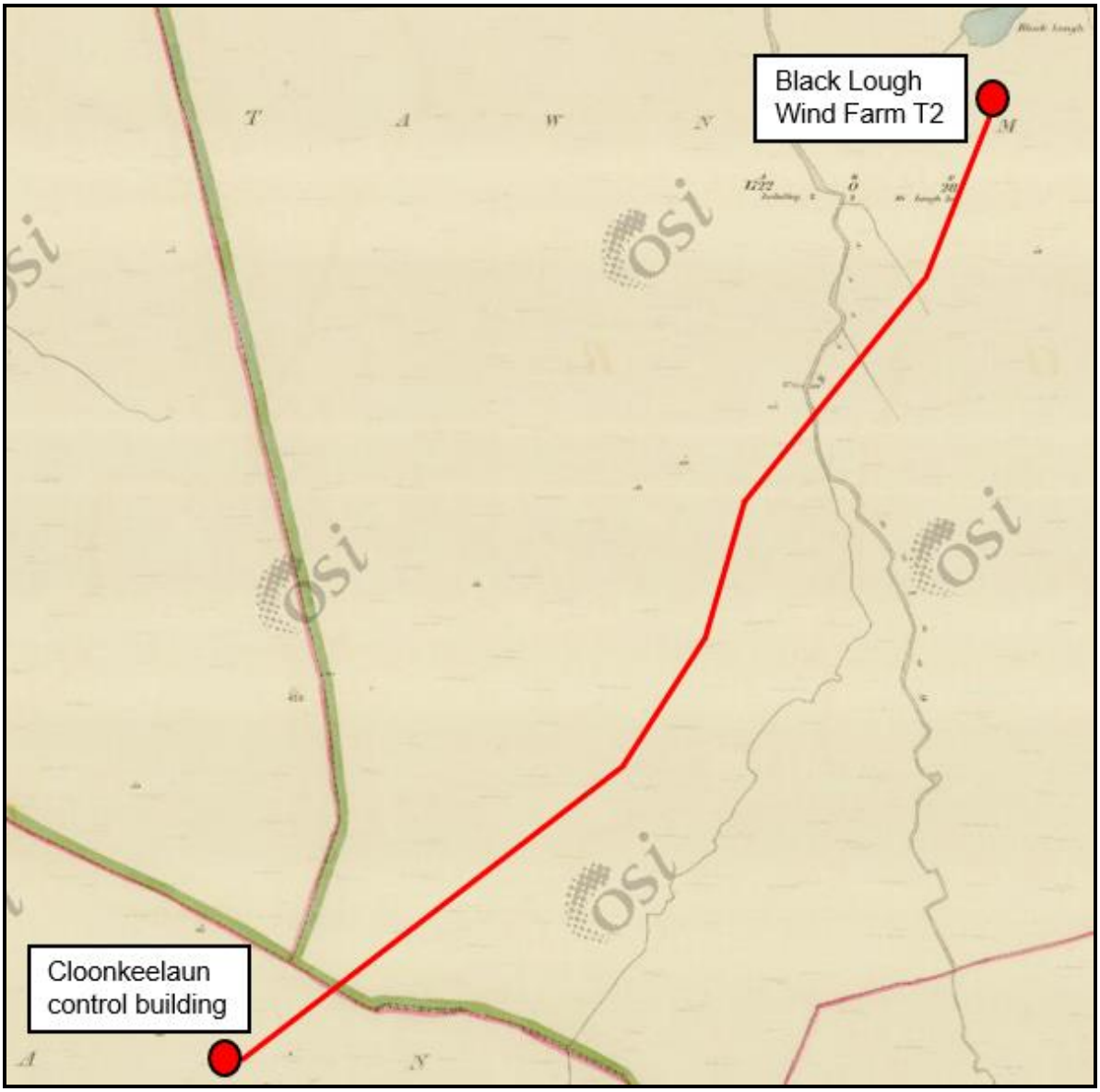


Figure 10-2: Extract from First Edition Ordnance Survey Map 1837

There are no archaeological, architectural or cultural heritage features recorded on the First Edition map within the area of proposed land take.

Ordnance Survey Map Third Edition 1913 (Figure 10-3)
The Third Edition Ordnance Survey map again records an unenclosed landscape of rough pasture in the location of the proposed development area.

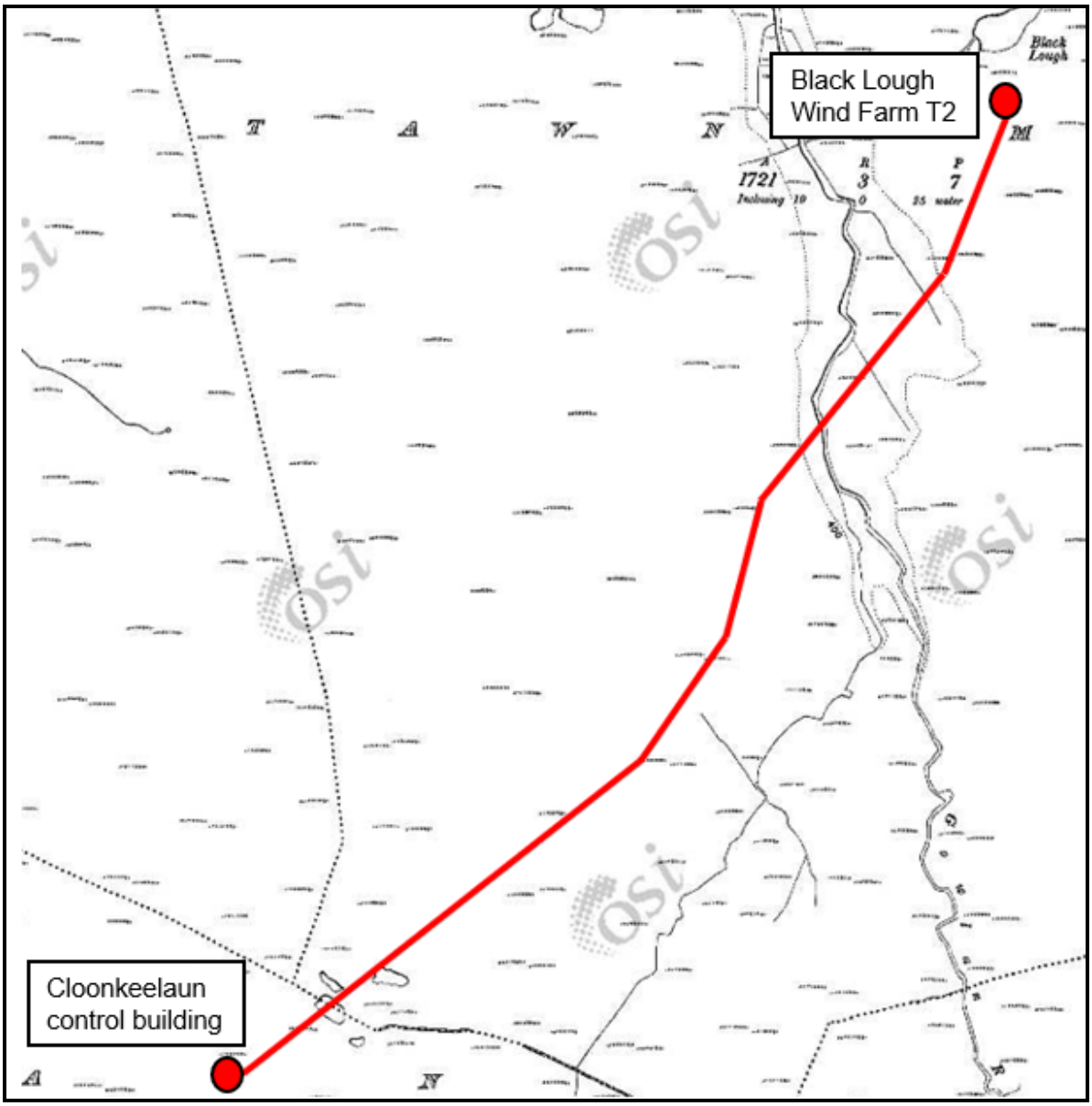


Figure 10-3: Extract from Third Edition Ordnance Survey Map 1913

There are no archaeological, architectural or cultural heritage features recorded on the Third Edition map within the area of proposed land take.

10.3.4. Aerial Photographs

Aerial photographs held by Ordnance Survey Ireland (www.map.geohive.ie) were consulted to look for the presence of any archaeological or architectural features within the proposed development area or the surrounding landscape.

The 1995, 2000 and 2005 aerial photographs record a similar landscape to that which was noted during the walkover survey (see Section 10.3.9. Field Inspection below), with the area of proposed land take recorded as unenclosed bogland. Gowlan River is visible extending north/south across the development area.

More recent aerial photography (www.bing.com/maps) also shows the proposed development area as unenclosed bogland.

There was no evidence of any archaeological, architectural or cultural heritage features within the area of proposed land take or surrounding landscape recorded on aerial photographs.

10.3.5. County Development Plan

Sligo County Development Plan 2017 - 2023
It is the Policy (P-AH-1) of Sligo County Council to:

> "*Protect and enhance archaeological sites, monuments, their setting, appreciation and amenity within the Plan area, including those that are listed in the Record of Monuments and Places (RMP) or newly discovered archaeological sites and/or sub-surface archaeological remains*" (Sligo County Council 2017, 121).

There are no Recorded Monuments within the proposed development area or the 1km study area.

Appendix D of the *Sligo County Development Plan* (*ibid*., 275 - 276) contains a list of *Monuments in State Care* from within the county. There are no Monuments in State Care within the proposed development area or the 1km study area.

It is the Policy (P-ARH-2) of Sligo County Council to:

> "*Ensure that any development, modifications, alterations, or extensions affecting a protected structure, an adjoining structure or a structure within an ACA is sited and designed appropriately and is not detrimental to the character of the structure, to its setting or the general character of the ACA*" (*ibid*., 127).

The Sligo County Development Plan (2017) contains the *Record of Protected Structures* for the county. There are no Protected Structures within the proposed development area or the 1km study area.

The Sligo County Development Plan (*ibid*., 125) contains a list of *Architectural Conservation Areas* from within the county. There are no Architectural Conservation Areas within the proposed development area or the 1km study area.

10.3.6. National Monuments in State Care

The Department of Culture, Heritage and the Gaeltacht maintains a database on a county basis of National Monuments in State Care: Ownership and Guardianship. The term National Monument is defined in Section 2 of the National Monuments Act (1930) as:

> "*a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto*" (www.archaeology.ie).

There are no National Monuments in State Care within the proposed development area or the 1km study area.

There are no sites with Preservation Orders or Temporary Preservation Orders within the proposed development area or the 1km study area.

There are no World Heritage Sites or sites included in the Tentative List as consideration for nomination to the World Heritage List within the proposed development area or the 1km study area.

10.3.7. National Inventory of Architectural Heritage

NIAH (www.buildingsofireland.ie) maintains a non-statutory register of buildings, structures *etc*. recorded on a county basis. There are no entries recorded on the NIAH building survey within the proposed development area or the 1km study area.

NIAH also maintains a non-statutory register of historic gardens and designed landscapes recorded on a county basis. There are no entries recorded on the NIAH garden survey within the proposed development area or the 1km study area.

10.3.8. Topographical Files of the National Museum of Ireland

Information on artefact finds from County Sligo is recorded by the National Museum of Ireland. Location information relating to these finds is important in establishing prehistoric and historic activity in the study area. One entry is recorded for Tawnamore townland and one for Cloonkeelaun townland.

National Museum of Ireland Registration Number: 1969:706 A - L. 1969:706 A: human remains. Body with clothing found in a bog with feet to the north north west and head to the south south east *c*. 0.80m below the surface of the peat with a full suit of clothing. The bones were almost fully disarticulated on arrival at the Museum and belonged to a male of middle age and *c*. 5 feet 7 inches tall. There were 3.34 grams of soft tissue present, mainly of muscle and tendon, and possible faeces were also noted. Fragments of hair and skin were present. On finding the remains they were described as resting on a wicker bier made from birch wood (1969:706 L).

Clothing found with the human remains included a felt hat (1969:706 B), an outside coat (1969:706 C), an inner jacket (1969:706 D), breeches (1969:706 E), stockings (1969:706 F and G), garters (1969:706 H and I) and shoes (1969:706 J and K). This site is recorded in the Record of Monuments and Places as RMP SL023-003, and is located approximately 1.5km north west of the proposed development area.

A carved wooden dagger (National Museum of Ireland Registration Number: 1974:47) was found in Cloonkeelaun townland in 1974. The pommel is roughly circular in outline and rectangular in cross-section. The handle is narrow and widens towards the blade. It has an overall length of 24.2cm and was found in a cutaway bog during turf cutting. It is also noted in the Topographical Files that several timber branches extending for approximately 6m were exposed and "*it looked as if it was some type of shelter at one time*".

10.3.9. Field Inspection

The field inspection sought to assess the site, its previous and current land use, the topography and any additional environmental information relevant to the report. The inspection took place on 25 June 2018 and weather on the day of the site visit was dry and sunny.

The site visit showed the proposed development area to consist of gently undulating, generally unworked, unenclosed bogland. Views from the north east corner were good to north and south, moderate to west and poor to east. Views from the south west corner were very good to east and west and good to north and south.

Plate 10-1: Northeast Corner of the Proposed Development Area, Looking SW

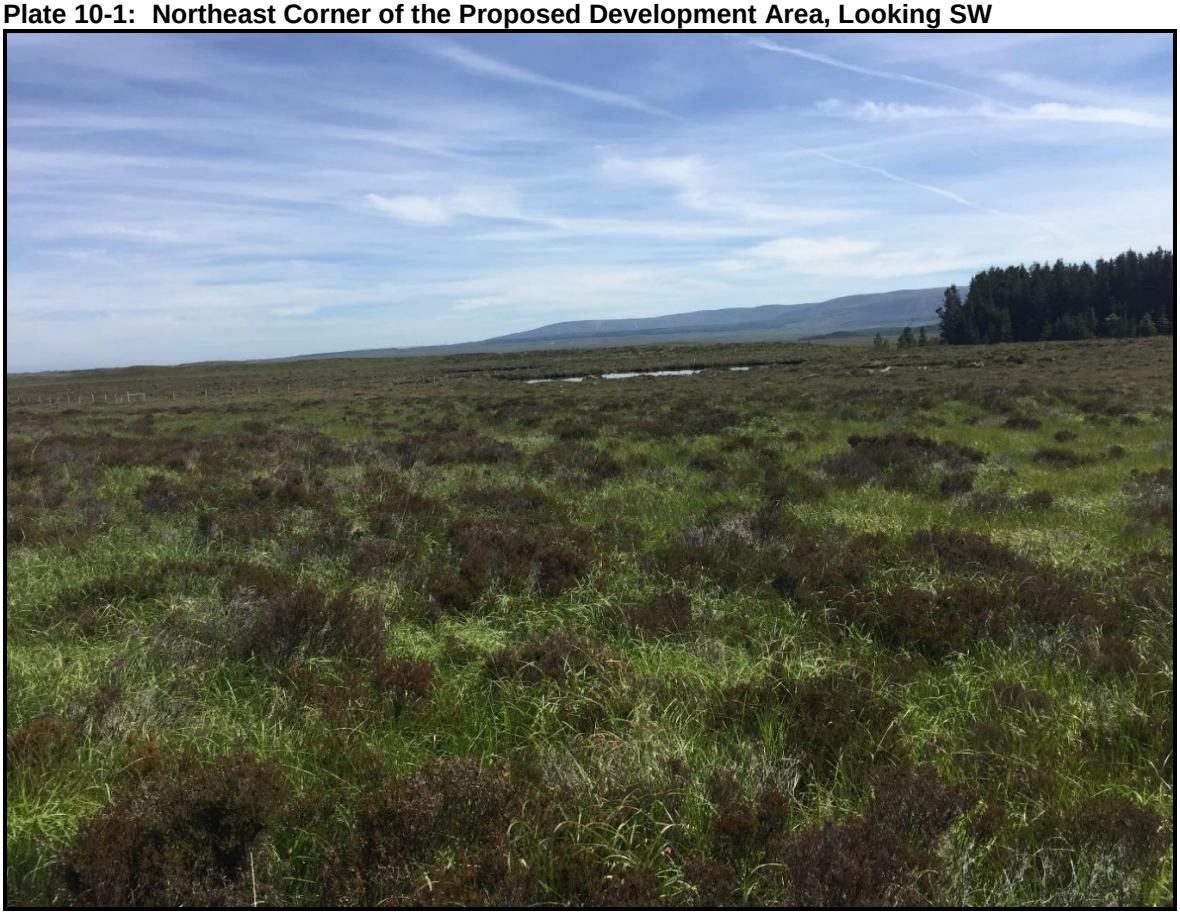


Plate 10-2: Southwest Corner of the Proposed Development Area, Looking NE

Plate 10-3: Middle of the Proposed Development Area, Looking Northeast

No archaeological, architectural or cultural heritage features were revealed within the area of proposed land take as a result of carrying out the walkover survey.

10.3.10. Conclusions

There are no Recorded Monuments, National Monuments, sites with Preservation Orders or Temporary Preservation Orders, World Heritage Sites, sites included in the Tentative List as consideration for nomination to the World Heritage List, Protected Structures, Architectural Conservation Areas, NIAH structures or NIAH historic gardens within the proposed development area or the 1km study area. There are seven Recorded Monuments within 2km of the proposed development area. Reference to Summary Accounts of Archaeological Excavations in Ireland has shown that no fieldwork has taken place within Tawnamore townland. Monitoring by the writer of the construction of Carrowleagh wind farm, which is located south of the proposed development area and partially within Cloonkeelaun townland, failed to reveal any archaeological features or artefacts. In addition, recent monitoring of the construction of 1 no. wind turbine in Cloonkeelaun townland failed to reveal any archaeological features or artefacts. Reference to cartographic sources failed to identify any archaeological, architectural or cultural heritage features within the proposed area of land take. There was no evidence of any archaeological, architectural or cultural heritage features recorded on aerial photographs within the proposed development area. There is a record of a human burial from Tawnamore townland recorded in the Topographical Files of the National Museum of Ireland, while a carved wooden dagger has been found in Cloonkeelaun townland. No previous archaeological, architectural or cultural heritage features were revealed within the proposed development area as a result of carrying out the walkover survey.

10.4. Assessment of Impacts

As a result of carrying out this Environmental Impact Assessment, the following potential archaeological, architectural and cultural heritage impacts have been identified:

10.4.1. Direct Construction Impacts

- There are no Recorded Monuments, National Monuments, sites with Preservation Orders or Temporary Preservation Orders, World Heritage Sites, sites included in the Tentative List as consideration for nomination to the World Heritage List, Protected Structures, Architectural Conservation Areas, NIAH structures or NIAH historic gardens within the proposed development area or the 1km study area. As a result, there will be no direct construction impacts on any protected archaeological, architectural or cultural heritage features.
- There are seven Recorded Monuments within 2km of the proposed development area. The proposed development will have an indeterminable direct construction impact on any previously unrecorded archaeological remains that may exist within the area of land take.
- The proposed development will have no visual or noise construction impacts on the archaeological, architectural or cultural heritage resource.

10.4.2. Indirect Construction Impacts

- There will be no indirect construction impacts on the archaeological, architectural or cultural heritage resource.

10.4.3. Residual Construction Impacts

- There will be no residual construction impacts on the archaeological, architectural or cultural heritage resource after mitigation measures have taken place.

10.4.4. Cumulative Construction Impacts – Grid Connection

- There will be no cumulative construction impacts between the proposed connection and any existing, permitted or proposed development, including the permitted Black Lough Wind Farm (turbines T1 – T4), the permitted Cloonkeelaun Wind Farm (turbines T5 and T6), the permitted grid connection between the Cloonkeelaun control building and the Glenree substation, the permitted Kilbride Wind Farm or the operational Carrowleagh Wind Farm, on any archaeological, architectural or cultural heritage remains.
- Planning permission was previously granted for an underground grid connection extending from the permitted Black Lough Wind Farm to the control building at Cloonkeelaun. It was confirmed that the underground grid connection would have no direct or indirect construction impact on any protected archaeological, architectural or cultural heritage features. As such, there will no construction impact change between the proposed connection and the permitted underground grid connection.

10.4.5. Direct Operational Impacts

There are no Recorded Monuments, National Monuments, sites with Preservation Orders or Temporary Preservation Orders, World Heritage Sites, sites included in the Tentative List as consideration for nomination to the World Heritage List, Protected Structures, Architectural Conservation Areas, NIAH structures or NIAH historic gardens within the proposed development area or the 1km study area. As a result, there will be no direct operational impacts on any protected archaeological, architectural or cultural heritage features

10.4.6. Indirect Operational Impacts

- There will be no indirect operational impacts on the archaeological, architectural or cultural heritage resource.

10.4.7. Residual Operation Impacts

- There will be no residual operational impacts on the architectural or cultural heritage resource.

10.4.8. Cumulative Operational Impacts

- There will be no cumulative operational impacts between the proposed connection and any existing, permitted or proposed development, including the permitted Black Lough Wind Farm (turbines T1 – T4), the permitted Cloonkeelaun Wind Farm (turbines T5 and T6), the permitted grid connection between the Cloonkeelaun control building and the Glenree substation, the permitted Kilbride Wind Farm or the operational Carrowleagh Wind Farm, on any archaeological, architectural or cultural heritage remains.
- Planning permission was previously granted for an underground grid connection extending from the permitted Black Lough Wind Farm to the control building at Cloonkeelaun. It was confirmed that the underground grid connection would have no direct or indirect operational impact on any protected archaeological, architectural or cultural heritage features. As such, there will no operational impact change between the proposed connection and the permitted underground grid connection.

10.5. Recommendations and Mitigation Measures

10.5.1. Mitigation

Due to the presence of seven Recorded Monuments within 2km of the proposed development area, and the known potential of bogs to contain previously unrecorded archaeological remains, it is recommended that archaeological monitoring be carried out during groundworks associated with construction of the underground cabling. In addition, it is recommended that intermittent archaeological monitoring be carried out during groundworks associated with construction of the overhead line. Monitoring will be carried out under Licence to the Department of Culture, Heritage and the Gaeltacht and the National Museum of Ireland. Provision will be made for the full excavation and recording of any archaeological features or deposits that may be exposed during monitoring.

10.5.2. Micro-Siting

A micro-siting buffer zone will be required to facilitate construction of the electrical connection. Due to the absence of any recorded archaeological, architectural or cultural heritage features within the proposed development area or the 1km study area, and the recommended monitoring of groundworks, micro-siting will have no adverse impact on any archaeological, architectural or cultural heritage remains.

Please note that all recommendations are subject to approval by National Monuments Service- Department of Culture, Heritage and the Gaeltacht.

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www.bing.com/maps	Bing aerial photography
www.buildingsofireland.ie	National Inventory of Architectural Heritage
www.excavations.ie	Database of Irish Excavation Reports
www.map.geohive.ie	Ordnance Survey Ireland aerial photographs
www.sligococo.ie	Sligo County Council

11. BIODIVERSITY – FLORA & FAUNA

11.1. Introduction

Woodrow Sustainable Solutions was commissioned to undertake an Ecological Impact Assessment (EcIA) for the EIA Development. Full details of the proposed EIA Development are provided in Chapter 2: Project Description. The EIA Development is to be located in the townlands of Tawnamore and Cloonkeelaun County Sligo. The location of the EIA Development is illustrated in Figure 11-1.

This chapter of the EIAR evaluates the effects of the proposed EIA Development on terrestrial biodiversity with the exception of avian ecology, which is addressed in Chapter 13. The assessment details the methods used to establish the terrestrial biodiversity interest within the Proposed Development Site and hinterland area, and the process used to determine the nature conservation importance of the populations present. It then sets out the potential effects on local biodiversity during construction, operation and decommissioning and assesses the significance of these effects. Means to mitigate any significant effects are then proposed. As well as considering potential impacts on flora and fauna, this chapter also considers impacts on designated areas.

The EcIA is supported by the following appendices:

- Appendix 11-1: Natura Impact Statement.
- Appendix 11-2: Figures
- Confidential Appendix 11-3: Freshwater Pearl Mussel Survey 2018.
- Confidential Appendix 11-4: Geyer's Whorl Snail Survey 2018.
- Confidential Appendix 11-5: Protected Species Records and Marsh saxifrage survey 2018.

11.1.1. Statement of Authority

This EcIA was undertaken by Will Woodrow MSc, MCIEEM, CEcol and Bridget Keehan BSc, ACIEEM. The authors have considerable experience in impact assessment of projects and specifically in Article 6 assessments under the EU Habitats Directive. As members of the Chartered Institute of Ecology and Environmental Management ("CIEEM"), the authors employ a high degree of competence and professional standard in their approach to environmental assessment.

Botanical and habitat surveys in 2018 were undertaken by Bridget Keehan BSc, a professional botanist who has over ten years' surveying experience in both Ireland and the UK. Bridget is an Associate member of the Chartered Institute of Ecology and Environmental Management. Aquatic ecology surveys were undertaken by Patrick Quinn, who has an honours B.Sc. in Environmental Science, a degree in Environmental Protection and a Higher Certificate in Science in Fisheries Management. Patrick is an Associate member of the Institute of Fisheries Management and an applicant for Associate Membership of the Chartered Institute of Ecology and Environmental Management

11.1.2. Legislation, Policy and Guidance

This EcIA has been undertaken with full account of legislation, policy and guidance relating to species and habitat protection, importance and survey protocol. The guiding legislation, policy and guidance includes the following:

Legislation

EU Habitats Directive 92/43/EEC, European Communities (Natural Habitats) Regulations 1997, European Communities (Birds and Natural Habitats) Regulations 2011

The Habitats Directive provides the basis of protection for Natura 2000 sites, namely Special Protection Areas (SPAs) and Special Areas of Conservation (SACs). Article 6 of the EU Habitats Directive requires that any proposal that may have a significant effect on a Natura 2000 site must be subject to an Appropriate Assessment. An Appropriate Assessment is required in order to ascertain the potential impact of a proposal on the reasons for which the site is designated, and thereby ascertain the potential for adverse impact on the integrity of the site. A proposal that may adversely impact the integrity of the site may not be consented except in the absence of Feasible Alternative Solutions and in the event of Overriding Public Interest. A Natura Impact Statement has been undertaken for the proposed EIA Development (Appendix 11-1). This concludes that the proposed EIA Development will not, adversely affect the integrity of any European Site (Natura 2000 site), either directly, indirectly or cumulatively.

The Habitats Directive also provides for the protection of species listed under Annex IV of the Directive wherever they occur. These species include otter and all bat species.

The Habitats Directive was transposed in to Irish law by the European Communities (Natural Habitats) Regulations 1997 and subsequently amended in the European Communities (Birds and Natural Habitats) Regulations 2011. Regulation 42 of the 2011 regulations requires that any proposal likely to have a significant effect on a European Site, alone or in combination with other operations or activities, needs to be assessed with respect to its potential impact in the site's conservation objectives (an Appropriate Assessment) and that the decision-making authority should be furnished with a Natura Impact Statement that incorporates a Screening Assessment and Appropriate Assessment as necessary.

Environmental Impact Assessment Directive (2011/92/EU)

European Union Directive 2011/92/EU (the EIA Directive) considers the assessment of the effects of certain public and private projects on the environment. It has been transposed to Irish legislation by the Planning and Development Act 2000 (as amended), and the Planning and Development Regulations (2000 – 2015) (hereafter referred to as the 2011 EIA Regulations).

The Planning and Development Act 2000 (as amended) Part X, Section 171A(1) requires that an EIA is carried out by the competent authority (i.e. the local planning authority or An Bord Pleanála):

> *'that shall identify, describe and assess in an appropriate manner, in light of each individual case and in accordance with Articles 4 to 11 of the Environmental Impact Assessment Directive, the direct and indirect effects of a proposed development on the following:*
>
> *(a) human beings, flora and fauna….,'*

Environmental Impact Assessment Directive (2014/52/EU)

The requirements of the revised EIA Directive (2014/52/EU) ("the Revised EIA Directive"), which will be incorporated into Irish law, are taken into account by the observance of draft *Revised Guidelines on the information to be contained in Environmental Impact Statements*[3].

Annex IV of the Revised EIA Directive provides requirements for information to be included in the EIAR (as referred to in Article 5(1)(f). Additional emphasis has been placed on 'biodiversity' in the 2014 EIA Directive.

EU Birds Directive 79/409/EEC

EU Birds Directive 79/409/EEC (the Birds Directive) establishes a system of general protection for all wild birds throughout the European Union. Annex I of the Birds Directive comprises 175 bird species that are rare, vulnerable to habitat changes or in danger of extinction within the European Union. Article 4 establishes clearly that wherever those species occur, they should be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in the area of distribution. Similar actions should be taken by Member States regarding migratory species, even if they are not listed in Annex I.

Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

The Wildlife Act (1976) as amended (2000)

The Wildlife Act 1976 gives protection a wide variety of birds, animals and plants in the Republic of Ireland. It is unlawful to disturb, injure or damage to their breeding or resting place wherever these occur without an appropriate licence from National Parks and Wildlife Service (NPWS). All birds, their nests and eggs are protected under law in Ireland through the Wildlife Act 1976 (as amended in 2000). Wilful destruction of an active nest from the building stage until the chicks have fledged is an offence. The act also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs). The amendment in 2000 broadens the scope of the Wildlife Acts to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

Flora (Protection) Order, 1999

The Flora (Protection) Order affords protection to 56 vascular plants, fourteen mosses, four liverworts and two stoneworts. It is illegal to cut, uproot or damage the listed species in any way, or to offer them for sale. This prohibition extends to the taking or sale of seed. In addition, it is illegal to alter, damage or interfere in any way with their habitats. This protection applies wherever the plants are found and is not confined to sites designated for nature conservation.

Policy

Regional Planning Guidelines for the West Region 2010 - 2022

Relevant policies contained within the '*Regional Planning Guidelines for the West Region 2010 – 2022*' (the Regional Guidelines[58]) are given below.

- Section 5.5.4: Energy & Utilities - Wind Energy
  '*Areas identified for wind farms must have regard to the level of the resource, the nature of the landscape, the status of surrounding lands and the Department of the Environment, Heritage and Local Government's 'Wind Energy Development Guidelines, 2006'*.
- Section 6.1: Landscape
  - EAP3: *Landscape protection policies should also take account of the need to manage the provision of forestry and renewable energy development and of the particular vulnerability of certain features, such as bogs and mires, designated sites and important archaeological landscapes. The potential for impacts on Natura 2000 sites should be assessed through Habitats Directive Assessment.*

- Section 6.3: Natural Heritage & Ecological Integrity
  - EAP12: *To implement the EU Directives with regard to the protection and enhancement of the natural environment.*
  - EAP13: *To support the protection of Nature Heritage Areas, Special Protection Areas, Special Areas of Conservation, Nature Reserves, Ramsar Sites (Wetlands), Wildfowl Sanctuaries, National Parks, Nature Reserves and the biodiversity designated under the Habitats Directive, Birds Directive, Wildlife Act, Flora Protection Order and other designated or future designated sites.*

Sligo County Development Plan 2017-2023

Relevant objectives and policies from the Sligo County Development Plan 2017-2023 (the CDP[20]) are given below.

Under the Development management Standards chapter (Chapter 13) of the CDP the following statement policies are considered relevant in the context of this chapter:

- The Planning Authority will have regard to the DoEHLG's Wind Energy Development Guidelines (June 2006) and any revised guidelines, when considering wind energy applications. The Guidelines outline the main criteria to be used in assessing development proposal. These criteria include:
    - environmental impact – effects on landscape, natural and archaeological heritage;
    - seeking visual harmony and balance – choice of turbines, towers, colour and siting;
    - keeping secondary structures to a minimum – buried on-site cabling, minimal fencing, transformers placed inside towers where possible;
    - keeping access roads to a minimum – using established roads where possible and following natural contours if roads are necessary;
    - managing the building site – removing waste, avoiding erosion, replanting the land.
- In assessing proposals for wind farms, the Council will require detailed information to Environmental Impact Assessment (EIA) standard. Assessment in accordance with government guidelines will have regard to visual impact (including the scarring effect of access roads), noise, electro-magnetic interference, ecological impact, safety (including aircraft safety and navigation) and land use implications. Proposals will generally be discouraged in or close to pNHAs, cSACs, SPAs, designated Sensitive Rural Landscapes, Visually Vulnerable Areas, Scenic Routes, protected views, Zones of Archaeological Potential.

Relevant Guidelines

Wind Energy Development Guidelines for Planning Authorities

Relevant guidance from the current 2006 Wind Energy Planning Guidelines (the 2006 WEPG[21]) is given below:

- Section 3.7 Natural and Built Heritage and Wind Energy Development - *"The designation of an area for protection of natural or built heritage or as an amenity area does not automatically preclude wind energy development. However, consideration of any wind energy development in or near these areas must be subject to Ireland's obligations under the Habitats Directive (92/43/EEC), the EU (Birds) Directive (79/409/EEC) and the Environmental Impact Assessment Directive (97/11/EC). Clear guidance on policy and objectives should be available in development plans on the natural and built heritage, and the information contained therein on location and status should be accurate and up-to-date.*

Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities (2010)

The 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities' (2010) (the Appropriate Assessment Guidance[59]) provides methodological and legislative guidance on Appropriate Assessment for any proposals that may impact on Natura 2000 sites in Ireland. These guidelines are highly relevant in assessing the potential impact on neighbouring Natura 2000 sites.

CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine

The 'CIEEM Guidelines (2018)[60] (the CIEEM Guidelines), published by the Chartered Institute of Ecology and Environmental Management (CIEEM), are the acknowledged reference on ecological impact assessment and reflect the current thinking on good practice in ecological impact assessment across the UK and Ireland. They are consistent with the British Standard on Biodiversity, which provides recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring.

These CIEEM Guidelines have the endorsement of the Institute of Environmental Management and Assessment ("IEMA"), the Chartered Institute of Water and Environmental Management, Northern Ireland Department of the Environment, Scottish Natural Heritage, The Wildlife Trusts and other leading environmental organisations.

Guidelines on the information to be contained in Environmental Impact Statements
The Environmental Protection Agency's 2002 'Guidelines on the information to be contained in Environmental Impact Statements' were prepared in response to the 1992 Environmental Protection Agency Act (Section 72), which states that those preparing and evaluating Environmental Impact Statements shall have regard to such guidelines. The aim of these Guidelines is to improve the quality of Environmental Impact Statements in Ireland, and as such they address a wide range of project types and potential environmental issues.

EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements
The EPA Draft revised guidelines on the information to be contained in Environmental Impact Statements (the revised EPA Draft Guidelines) have been produced by the Environmental Protection Agency in response to the adoption of revised Environmental Impact Assessment Directive 2014/52/EU. The new guidelines also incorporate experience arising from EU and Irish court cases, appeals and various pieces of new legislation adopted since the publication of the previous (2002) guidelines.

The revised EPA Draft Guidelines provide guidance on the principles and associated practice of preparing Environmental Impact Statements, with the aim of ensuring that the information that they contain is available in a format that is clear, concise and accessible to the greatest number of people.

11.1.3. Overview of the Proposal

A full description of the EIA Development is provided in Chapter 2. The layout of the proposed development is shown on Figure 2-2 and consists of cabling and overhead line between turbine T2 and the control building at Cloonkeelaun.

11.2. Assessment Methodology & Significant Criteria

11.2.1. Baseline Surveys

Field surveys of the terrestrial ecology of the Proposed Development Site were undertaken following appropriate approaches for the relevant target species. These are outlined in Table 11-1. The importance of the habitats and species present is evaluated using the CIEEM Guidelines.

The sections below describe the methods used to survey and identify valued ecological receptors and assess potential effects which may occur as a result of the proposal.

11.2.2. Desk Study

A desktop survey was undertaken to gather information on the likely occurrence of species in the general area prior to the survey visits so that a targeted approach to surveying could be undertaken. Information was gathered online from a variety of sources including the National Biodiversity Data Centre (NBDC) and National Parks and Wildlife Service (NPWS) online database. The following databases were used:

- OSI Map Viewer
- NBDC online map viewer
- EPA online map viewer
- NPWS Map Viewer
- NPWS site synopses
- Ox Mountains Bogs SAC

The original Black Lough Wind Farm EIS documents (2011 and 2016), prepared by Jennings O'Donovan and Keohane Geological and Environmental Consultancy, respectively (the 2011 EIA and the 2016 EIA) were also referred to.

The original Cloonkeelaun Wind Farm EIS documents (2015), prepared by Keohane Geological and Environmental Consultancy (the 2015 EIA) was also referred to.

Consultation for occurrence of protected species in the area was undertaken with the NPWS - data request for protected species and Ox Mountains Bogs SAC habitat shapefiles submitted and data received September 2018.

11.2.3. Protected Areas / Designated Sites

Shapefiles of designated areas in Ireland, including NHAs, SPAs and SACs were downloaded from the NPWS website and imported into ArcGIS. Proximity of the proposal to designated areas and potential for connectivity with the proposal was assessed using ArcGIS, orthophotographs and Ordnance Survey maps as well as shapefile datasets of watercourses as potential connecting features. The potential for connectivity (such as resulting from joining watercourses or proximity) with the proposal was assessed using available datasets and professional judgement.

11.2.4. Site Investigations Undertaken

Table 11-1 details the surveys and investigation and ongoing monitoring undertaken at the Proposed Development Site. The table details the field surveys undertaken in 2018 but does not detail the previous field surveys undertaken as part of the previous EIS reports and planning applications. Much of the fieldwork undertaken in 2018 has concentrated on the electrical connection corridor between Black Lough Wind Farm and Cloonkeelaun, since this area had not previously been fully surveyed.

Field surveys for the current application have been ongoing since February 2018. The results from these surveys, in combination with the desk study and the assessment contained within the 2011, 2015 and 2016 EIAs, have informed the findings of this EcIA.

Table 11-1: Field Investigations Undertaken- 2018

Description	Coverage	Dates and Personnel
Site scoping and walkover survey	Initial walkover of Proposed Development Site. Description and identification of issues. Mammal signs survey.	13 February 2018 Will Woodrow
Breeding bird / mammal / habitat survey	Walkover mammal survey / general habitat survey	10 May 2018 31 May 2018 Will Woodrow
Aquatic habitats and species survey	Aquatic survey to identify salmonid suitability, freshwater pearl mussel suitability, other aspects of aquatic ecology and otter signs.	09 April 2018 Patrick Quinn
Freshwater pearl mussel survey	Snorkelling and wading freshwater pearl mussel survey within the Gowlan River and tributaries	10 May 2018 Gerard Hayes Patrick Quinn Will Woodrow
Specialist habitat survey	Habitat survey including mapping of Annex I habitats and assessment of potential for rare and protected plant species.	17 April 2018 19 April 2018 Bridget Keehan
Marsh saxifrage survey	Survey of known and potential marsh saxifrage areas in order to map extent and ascertain any potential within proposed cable route.	27 September 2018 Bridget Keehan
Geyer's whorl snail survey	Survey for potential Geyer's whorl snail and survey for Geyer's whorl snail within any suitable habitat areas	23 October 2018 Maria Long

11.2.5. Field Survey Methodology

Surveys were undertaken followed industry-standard methodologies, as detailed in the following sections. Field survey data was recorded on maps and each record was accompanied by a photo and six figure grid references, using 'EcoLog' software operating on a mobile phone. As a result, the data collected could then be used in Geographical Information System (GIS).

Habitat Surveys

Habitat surveys of the Proposed Development Site were undertaken on 31 May, 17 and 19 April 2018, following the standard methodology described in the Heritage Council publication *A Guide to Habitats in Ireland*[61]. Specific marsh saxifrage surveys were undertaken on 27 September 2018. Surveys supplemented the existing data gathered for the site during previous surveys and submissions. The entire Proposed Development Site was walked, ecological features of interest noted and the habitats present classified into recognised communities. In 2018, surveys were undertaken along the entire electrical connection corridor and across the entire Cloonkeelaun area.

During these visits, ecological features of interest were noted and habitats classified into recognised communities outlined by Fossitt, 2000. Potential correspondence to the Annex I Habitat Classification system of the Habitats Directive was also noted and cross referenced using appropriate NPWS interpretation guidelines, based on quadrat data obtained in the field. During the botanical and vegetation survey, consideration was also given to identifying habitats that could be used by protected species. Following these initial surveys, a dedicated marsh saxifrage survey was undertaken. This latter survey mapped the extent of known marsh saxifrage populations and surveyed all potentially suitable habitat for the species within the Ox Mountains Bogs SAC that had the potential to be affected by the proposal.

Aquatic Surveys

An aquatic habitat assessment was carried out on 09 April 2018 according to NRA (2009) guidance in order to establish the suitability of the river for particular fish and aquatic invertebrate species. An experienced aquatic ecologist made an assessment of the river habitat within the redline boundary for this scheme to establish whether or not it sustained habitat that was suitable to support the following protected species:

- Salmon *Salmo salar*
- Lamprey species
- White-clawed crayfish *Austropotamobius pallipes*
- Freshwater pearl-mussel *Margaritifera margaritifera*.

The survey conducted was to identify any potential for suitable spawning habitat and or the suitable habitat for protected species to exist within the area designated as the works zone. Suitable spawning habitat for salmon, lamprey species and for freshwater pearl mussel to exist include fast flowing, well oxygenated, shallow head streams. For crayfish to occur within an aquatic environment a number of habitat requirements are needed. Suitable crayfish habitat includes substrates with large boulders, cobbles and rubble for refuge and areas of vertical banks which are undercut to provide shelter for individuals. As part of the aquatic assessment the possibility of the existence of aquatic invasive species at this proposed site were also examined.

Following the results of the survey, a full survey of the area for freshwater pearl mussel under licence was undertaken.

Protected Species Surveys

Surveys were undertaken for protected species likely to occur in the Proposed Development Site and within the immediate vicinity. Mammal surveys were also incorporated into general surveys. Protected species surveys undertaken included:

Freshwater pearl mussel Margaritifera margaritifera

During the initial aquatic surveys (including salmonid and freshwater pearl mussel habitat suitability surveys), a single freshwater pearl mussel was recorded within the Gowlan River. Following this, a specialist freshwater pearl mussel survey was commissioned for the Gowlan River and tributaries under license. This survey was intended to complement the information gathered during a previous commissioned survey for the Black Lough Wind Farm (10/05/2018). The survey followed a best practice as recommended in the NPWS guidance (Anon, 2004)[62]. Surveying was carried out on 10 May during bright weather and normal water levels.

Geyer's whorl snail Vertigo geyeri

Surveys for Geyer's whorl snail were undertaken in 2012 as part of the original application for Black Lough Wind Farm, including areas of relevance to the electrical connection route. In 2018, a dedicated survey for Geyer's whorl snail was undertaken in the vicinity of the proposed electrical connection route. The survey followed best practice as recommended in Moorkens *et al* 2011[63].

Marsh saxifrage Saxifraga hirculus

A dedicated marsh saxifrage survey was undertaken in September 2018 in the vicinity of the proposed electrical connection route. The survey followed best practice survey approach as detailed in Muldoon *et al* (2015)[64].

Terrestrial mammals

Badger (*Meles meles*) surveys were undertaken to NPWS and Transport Infrastructure Ireland (TII) specifications. Survey methodology described in the TII (previously National Roads Authority) publication 'Guidelines for the Treatment of Badgers Prior to the Construction of National Road Schemes'[65], was followed for assessing badger activity at the Proposed Development Site. The survey recorded all signs of badger activity, and any possible setts, within and around the Proposed Development Site, with particular emphasis on the EIA Development infrastructure layout. Within the search areas, boundary and fence lines and habitats were systematically surveyed for all evidence of badgers, such as feeding areas, hair traces, latrines and paths.

An otter survey was undertaken along the Gowlan River and tributaries in 2018, to complement surveys previously undertaken along the Easky River in previous years.

Field signs and habitat suitability surveys for other species (red squirrel, pine marten, fox and Irish hare) were undertaken as walkover surveys and also incorporated into other surveys and site visits. These included the identification of suitable habitat, detection of field signs such as tracks, markings, feeding signs, droppings and scent-points, and direct observation.

Bats

The assessment of potential impacts on bats for this application has used data on bat populations in the area derived from surveys associated with the consented wind farm at Black Lough. The survey and assessment of bat activities at Black Lough Wind Farm and the impact assessment were carried out by combining the results of desktop research with the results of field surveys from 2016 and with input from a full season survey undertaken in 2011.

Bat Conservation Ireland has provided guidelines[66] on what would be expected in the approach and content of a bat survey and ecological assessment (December 2012), although these guidelines have not been given any statutory basis or sanctioned by statutory agencies. Reference was also made to a variety of best practice documents for wind farm bat surveys in Northern Ireland and Europe.

Taking account of the above, the bat survey approach for Black Lough Wind Farm was as follows:

- An initial desk study of ortho-photographs was undertaken and likely features established that bats may be associated with. A draft transect route was proposed based on the likely existence of features, full coverage of representative habitat and an appropriate level of coverage of the entire site.

- An initial daylight survey of the site was undertaken to establish potential roost sites and to look for signs of roost activity (droppings). During this initial visit, survey transects were walked in daylight and marked onto a handheld GPS, taking account of potential roost and foraging features and commuting routes. Draft transects as identified in the desk study were amended to provide the best coverage across the site as a whole, provide good representative coverage of all habitats and suitable features, and cover the areas of proposed infrastructure. Where appropriate, transects were undertaken away from the proposed infrastructure. An equally important issue considered in the setting up of transects was health and safety, considering that the site is somewhat remote and that routes would be walked in darkness.
- Monthly survey visits were undertaken by two surveyors for health and safety reasons, to provide an appropriate level of coverage throughout the site.
- Transects were walked using professional Wildlife Acoustics EM3 bat detectors. Temperature and wind speed was measured at intervals throughout the survey using a Silva hand held weather meter. Field records were made of bat species encountered, number of bat passes, activity where known (e.g. foraging, commuting, advertising), travelling direction and approximate height (where known). Analysis of sound recordings was undertaken using Kaleidoscope Pro software to confirm species and exact number of bat passes for survey sections (or genus for *Myotis* species).
- Static bat detectors (Wildlife Acoustic SM2s) were deployed for a period of a minimum of 4 nights each month, placed in a selection of locations intended to be indicative of both the turbine locations and features that may attract feeding and / or commuting bats.

In 2016, both transect and static detector surveys were undertaken in July and August. Three static detectors were deployed in July, with a primary aim of assessing bat activity in the vicinity of the amended turbine 3 location and the nearest features potentially likely to be significantly used by bats. In August, a total of six static detectors were deployed across the proposed wind farm site, including areas near proposed turbine locations and likely feeding and commuting features.

11.2.6. Impact Assessment Methodology

The impact assessment methodology applied is from the CIEEM Guidance, as well as building on other methodologies for faunal groups. The general approach is to identify and characterise potential impacts, assess the magnitude / extent and probability of occurrence of each impact, and relate these factors to the value and sensitivity of the receptor. These terms are quantified in the following subsections.

Identifying Ecological Features within the Zone of Influence

Information acquired during the desk-study and field surveys will determine those ecological features which have the potential to be affected by the proposed EIA Development and as such occur within the 'zone of influence' of the proposed EIA Development. The zone of influence depends on the type of development taking place, its likely impacts and the presence of ecological connections which provide a pathway for such impacts to an ecological feature of interest which is sensitive to such impacts. As such, the zone of influence may extend beyond the boundaries of the Proposed Development Site due to the presence of ecological connections with an ecological feature of interest. Similarly, ecological features which have no ecological connection with the proposed EIA Development, and as such no pathway for impacts, are not within the zone of influence regardless of their proximity to the proposed EIA Development. Any such ecological / hydrological connections which provide pathways for impacts are identified and described below.

Evaluating Ecological Features within the Zone of Influence

Those ecological features which occur within the zone of influence such as nature conservation sites, habitat or species are then evaluated in geographic hierarchy of importance. Depending on the receptor's status and its context in the wider area, its nature conservation value may be assigned one of the categories detailed in Table 11-2.

Those ecological features which occur within the zone of influence such as nature conservation sites, habitat or species are then evaluated in geographic hierarchy of importance. The following categories are used:

Table 11-2: Geographic Reference to Determine Value of Ecological Resources

Importance	Criteria
International Importance	- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation. - Proposed Special Protection Area (pSPA). - Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). - Features essential to maintaining the coherence of the Natura 2000 Network - Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. - Resident or regularly occurring populations (assessed to be important at the national level) of the following: o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. - Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). - World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972). - Biosphere Reserve (UNESCO Man & The Biosphere Programme) - Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). - Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). - Biogenetic Reserve under the Council of Europe. - European Diploma Site under the Council of Europe. - Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	- Site designated or proposed as a Natural Heritage Area (NHA). - Statutory Nature Reserve. - Refuge for Fauna and Flora protected under the Wildlife Acts. - National Park. - Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. - Resident or regularly occurring populations (assessed to be important at the national level) of the following: o Species protected under the Wildlife Acts; and/or o Species listed on the relevant Red Data list. o Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	- Area of Special Amenity. - Area subject to a Tree Preservation Order. - Area of High Amenity, or equivalent, designated under the County Development Plan. - Resident or regularly occurring populations (assessed to be important at the County level) of the following: o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; o Species protected under the Wildlife Acts; and/or o Species listed on the relevant Red Data list. o Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. - County important populations of species; or viable areas of semi-natural habitats; or

Importance	Criteria
	natural heritage features identified in the National or Local BAP; if this has been prepared. - Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. - Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; - Resident or regularly occurring populations (assessed to be important at the Local level) of the following: o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; o Species protected under the Wildlife Acts; and/or o Species listed on the relevant Red Data list. o Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality; - Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife; - Sites or features containing non-native species that is of some importance in maintaining habitat links.

Key Ecological Features are those features which are within the zone of influence and are evaluated as being of Local Importance (Higher Value) or greater.

Identification and Characterisation of Impacts

When describing ecological impacts reference should be made to the following characteristics:

- positive or negative
- extent
- magnitude
- duration
- timing
- frequency
- reversibility.

The magnitude of an impact refers to its size, amount, intensity and volume. Impact magnitude depends upon the nature and sensitivity of a receptor and the range of potential effects arising from the construction and operation of a proposed development. For the purposes of this assessment, the impact magnitude is influenced by the intensity, duration, frequency and reversibility of a potential impact. When quantifying impact magnitude, its potential to impact upon long-term populations and the integrity of the ecological system should be taken into account.

However, the assessment only needs to describe those characteristics relevant to understanding the ecological effect and determining the significance and as such does not need to incorporate all stated characteristics (CIEEM, 2016).

Impact Probability
The likelihood that an impact will occur is categorized to be:

- **Certain/ near certain** – probability of occurrence estimated at 95% chance or higher
- **Probable** – probability of occurrence estimated above 50% but below 95%
- **Unlikely** – probability of occurrence estimated above 5% but less than 50%
- **Extremely unlikely** – probability of occurrence estimated at less than 5%.

Significant Effects on Key Ecological Features
For the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for those ecological features which have been identified as important (Key Ecological Features). Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy). As such effects can be considered significant in a wide range of geographic scales from international to local. Consequently, 'significant' effects should be qualified with reference to the appropriate geographic scale (CIEEM, 2018).

Impact Significance (degree of impact)
The significance of impacts relates to the value and sensitivity of the receptor, combined with the overall level of the impact. The more ecologically valuable a receptor and the greater the potential impact, the higher the significance of that impact is likely to be.

The value of the receptor takes into account its importance at international, national, regional and local levels. The overall level of impact of a given action is dependent on a combination of factors including impact magnitude, timing, duration, reversibility and probability, as well as the sensitivity of the receptor. Each of these factors is taken into consideration in order to determine the overall significance of each individual impact.

Assessment of Residual Impacts and Effects
After characterising the potential impacts of the Development and assessing the potential effects of these impact on the 'Key Ecological Features' mitigation measures are proposed to avoid and / or mitigate the identified ecological effects. Once measures to avoid and mitigate ecological effects have been finalised, assessment of the residual impacts and effects should be undertaken to determine the significance of their effects on the 'Key Ecological Features'.

Assessment of Cumulative Impacts and Effects
Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location (CIEEM, 2018). Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:

- Additive/incremental – in which multiple activities/projects (each with potentially insignificant effects) add together to contribute to a significant effect due to their proximity in time and space (CIEEM, 2018).
- Associated/connected – a development activity 'enables' another development activity e.g. phased development as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes. It is important to assess impacts of the 'project' as a whole and not ignore impacts that fall under a separate consent process (CIEEM, 2018).

11.3. Baseline Description

The main part of the Proposed Development Site lies 8.8km south-southwest of Dromore West. The Proposed Development Site occupies a linear route of approximately 2.64km consisting of an underground and overhead electrical connection between T2 at Black Lough and the control building at Cloonkeelaun. The Proposed Development Site can be found at approximate ITM coordinates 538768 / 824946. The Proposed Development Site location is illustrated in Figure 11-1.

The site is located in a rural peatland landscape largely managed by sheep grazing and mainly comprising blanket bog. The main habitats surveyed were cutover bog (past turf cutting and now abandoned), upland blanket bog (including active blanket bog), wet heath, acid oligotrophic lake, and eroding / upland river.

The proposed electrical connection route is bisected by the Gowlan River, a tributary of the Easky River, which is a high-quality salmonid water with freshwater pearl mussel recorded within.
A linear distance of 2km of the proposal is located within the Ox Mountains Bogs SAC

11.3.1. Designated Areas

Internationally Designated Sites within the Potential Zone of Influence
One SAC is situated within the zone of influence of the Proposed Development Site. This is the Ox Mountains Bogs SAC which the development falls partly within. The Ox Mountains Bogs SAC is designated for the following habitats and species – Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae), Natural dystrophic lakes and ponds, Northern Atlantic wet heaths with *Erica tetralix*, European dry heaths, Blanket bogs (EU Annex I Priority Habitat if active bog), Transition mires and quaking bogs, Depressions on peat substrates of the *Rhynchosporion*, *Vertigo geyeri* (Geyer's Whorl Snail), *Saxifraga hirculus* (Marsh Saxifrage).

Nationally Important Sites within the Potential Zone of Influence
NHAs are designated under Wildlife Amendment Act (2000). Designations are given to features of scientific interest and include significant geological features and areas which support rare or significant flora or fauna populations. Two Natural Heritage Areas (NHA) are situated within the zone of influence of the Proposed Development Site:

- Ox Mountains Bogs pNHA falls largely within the Proposed Development. The pNHA boundaries follow those of the Ox Mountains Bogs SAC.
- Easky River pNHA, 8.3km to the north of the Proposed Development Site.

The locations of these designated areas in relation to the Proposed Development Site, and means of connectivity, are illustrated in Figure 11-2a and Figure 11-2b.

11.3.2. Desktop Study for Recorded Important & Protected Species

Records for important and protected species within proximity of the site were obtained from the NBDC online database. The NBDC database incorporates a number of databases for Ireland, including the mammal database, as well as atlas information for a variety of other taxa, including amphibians, invertebrates and Botanical Society of Britain & Ireland ("BSBI") data.

In addition, the Proposed Development Site falls within the 10km grid square G32 and two 2km grid squares (G32R, and G32Y). The 2km grid squares that encompass the Proposed Development Site are shown in Figure 11-5. Table 11-3 shows records of species of conservation importance and protected species gathered from the NBDC database (non-avian fauna only) for the 2km and 10km grid squares within which the Proposed Development Site lies (i.e. G32, G32R, and G32Y).

Table 11-3: Protected or Notable Species Recorded within 10km of the Site

Species	Scientific Name	Habitats Dir. (Annex II / IV)	Birds Dir. (Annex I)	Wildlife Order	Red List Status	Birds of Conservation Concern (2014 – 2019)	NI Priority Species	Likelihood on site	Likelihood within 2 km	Most recent record
MAMMALS										
Badger	*Meles meles*	-	-	Y	LC	-	N			2011
Pine marten	*Martes martes*	-	-	Y	LC	-	N			2012
West European Hedgehog	*Erinaceus europaeus*	-	-	Y	LC	-	Y			2015
Pygmy shrew	*Sorex minutus*	-	-	Y	LC	-	N			1989
European otter	*Lutra lutra*	Y	-	Y	NT	-	Y			1980
BATS (within 10km)										
Lesser Noctule	*Nyctalus leisleri*	Y	-	Y	LC	-	N			2012
Pipistrelle	*Pipistrellus pipistrellus sensu lato*	Y	-	Y	LC	-	N			2013
Soprano pipistrelle	*Pipistrellus pygmaeus*	Y	-	Y	LC	-	Y			2012
Brown-long-eared bat	*Plecotus auritus*	Y	-	Y	LC	-	Y			2009
Daubenton's bat	*Myotis daubentonii*	Y	-	Y	LC	-	N			2009
INVERTEBRATES										
Freshwater White-clawed Crayfish	*Austropotamobius pallipes*	Y	-	Y	CR	-	Y			1999
English Chrysalis Snail	*Leiostyla (Leiostyla) anglica*		-		LC	-	N			1972
Heath Snail	*Helicella itala*		-		LC	-	Y			1972
Marsh Whorl Snail	*Vertigo (Vertigo) antivertigo*	Y	-	Y	VU	-	Y			1972
Smooth Grass Snail	*Vallonia pulchella*		-		VU	-	Y			1972
Tree Snail	*Balea (Balea) perversa*		-		LC	-	N			1972
PLANTS										
Acute-leaved Bog-moss	*Sphagnum capillifolium subsp. capillifolium*		-		-	-	N			2012
Large White-moss	*Leucobryum glaucum*	Y	-	-	-	-	N			2012
Rigid Bog-moss	*Sphagnum teres*		-		-	-	N			2007
Three-ranked Hump-moss	*Meesia triquetra*		-	Y	-	-	N			2012
INVASIVE SPECIES										
American Mink	*Mustela vison*	-	-	-	-	-	-			2007
Keeled Slug	*Tandonia sowerbyi*	-	-		-	-	-			1972
Common Garden Snail	*Cornu aspersum*	-	-	-	-	-	-			1972
Indian Balsam	*Impatiens glandulifera*	-	-	-	-	-	-			2007
Sycamore	*Acer pseudoplatanus*	-	-	-	-	-	-			2007
Giant Hogweed	*Heracleum mantegazzianum*	-	-	-	-	-	-			2011
European Rabbit	*Oryctolagus cuniculus*	-	-	-	-	-	-			1990

11.4. Existing Ecological Baseline

This proposal includes an electrical connection (combination of overhead line and underground cable) between Black Lough and Cloonkeelaun consented Wind Farms, which was not described or assessed within the applications for the Black Lough or Cloonkeelaun Wind Farm proposals.

11.4.1. Habitats within the Proposed Development Site

Detailed habitats surveys of the Proposed Development Site were undertaken on 17 and 19 April and 31 May 2018, with a specialist marsh saxifrage survey undertaken on 27 September 2018. The survey area is illustrated in Figure 11-3.

Table 11-4 lists the habitat types (Fossitt, 2000) which occur within the Proposed Development Site. A description of each habitat at the Proposed Development Site is given below. Figure 11-4 illustrates the distribution of these habitats within the Proposed Development Site.

Table 11-4: Habitat Types Occurring within the Proposed Development Site

Code	Habitat Name	Area within Application Site
BL3	Buildings and Artificial Surfaces	0.39ha
FL1	Dystrophic Lakes	0.20ha
GA1	Improved agricultural grassland	2.13ha
GS3 / GS4	Dry Humid Acid Grassland / Wet Grassland	0.47ha
HH3 / HH1	Wet Heath / Dry Siliceous Heath Mosaic	0.49ha
PB2	Upland Blanket Bog	4.47ha
PB2 / HH3	Upland Blanket Bog / Wet Heath Mosaic	7.50ha
PB4	Cutover Bog	0.17ha

Area Description

At its north-eastern end, the electrical connection route initially passes through improved grassland and extremely degraded former blanket bog vegetation that is heavily grazed by sheep. The cable route at this point passes along an existing farm track. Southwards, this vegetation grades into blanket bog that is relatively dry underfoot and appears to have been somewhat modified by a combination of turf cutting, grazing and drainage. Nevertheless, it appears reasonably intact; the vegetation dominated by hare's-tail cottongrass (*Eriophorum vaginatum*), purple moor-grass (*Molinia caerulea*) and heather (*Calluna vulgaris*) with some cross-leaved heath (*Erica tetralix*) and variable quantities of *Sphagnum* spp. mosses. Southwards, the modified blanket bog vegetation appears to further improve in quality, supporting locally abundant *Cladonia* lichen and occasional woolly fringe-moss (*Racomitrium lanuginosum*), perhaps due to reduced grazing intensity further from the improved areas to the north.

The blanket bog in this area corresponds to the Fossitt habitat category **PB2 Upland blanket bog**. Quadrats 5 and 6 were located within this area and analysis of their vegetation indicated that the vegetation is derived from the NVC community **M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire,** that has undergone varying degrees of modification.

The vegetation to the south west of the Gowlan River was found to correspond to two main habitat types, according to the standard Fossitt habitat classification system described in *A Guide to Habitats in Ireland* (Fossitt, 2000): **PB2 Upland Blanket Bog** and **HH3 Wet heath.** Additionally, a number of bog pool formations were identified within blanket bog habitat to the west and south of the proposed cable route, corresponding to the Fossitt habitat category **FL1 Dystrophic lakes**.

At this location, the river occupies a shallow, broad valley. The lower slopes of the river valley tend to be dominated by a relatively dry, dense vegetation type resembling **wet heath (HH3)**, which is dominated by purple moor-grass (*Molinia caerulea*) and heather (*Calluna vulgaris*), underlain by some red bog-moss (*Sphagnum capillifolium*). Hare's-tail cottongrass (*Eriophorum vaginatum*) is also present in these areas, but tends not to dominate the vegetation. Bog myrtle (*Myrica gale*) is also abundant in some areas. The ground in these areas tend to be fairly firm and peat depths are likely to be relatively shallow.

These areas have been classified as habitat transitional between wet heath HH3 and blanket bog PB2. These two habitat types may appear similar in terms of species composition, but wet heath occurs on peat which is less than 0.5 in depth and for this reason the ground in wet heath areas tends to firmer, drier and less spongy than in blanket bog. The local abundance of purple moor-grass (*Molinia caerulea*) and bog myrtle (*Molinia caerulea*) tend to suggest wet heath; whereas those areas that have a greater abundance of hare's-tail cottongrass (*Eriophorum vaginatum*) and *Sphagnum* spp. are more reminiscent of blanket bog. Local variations in species composition are likely to reflect variations in peat depth, slope and hydrology. One area of wet heath vegetation situated on a low ridge at the southern end of the survey area is particularly dry in character and exhibits some characteristics of dry heath (Fossitt category HH1). This is the only location in which bell heather (*Erica cinerea*) was recorded during survey of this site.

Transitional wet heath/blanket bog habitat recorded at the site was compared to the mire and heath communities described in the National Vegetation Classification text *British Plant Communities. Volume 2. Mires and heath* (Rodwell *et al,* 1991), and was found to correspond variously to the following NVC communities:

- **M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire**
- **M15 *Scirpus cespitosus-Erica tetralix* wet heath**

Above the valley slopes, the ground becomes more level and the transitional wet heath/ blanket bog vegetation characteristic of the valley side becomes a more pronounced blanket bog; the bog surface becomes wetter and more spongy, and the vegetation supports increased quantities of cottongrasses (*Eriophorum* spp.) and a greater quantity and diversity of bog-mosses (*Sphagnum* spp.). Quadrats 1, 3, 7, 9 and 11 were placed within areas mapped as **PB2 blanket bog** vegetation and were found to correspond to the NVC community **M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire.** The more extensive areas of blanket bog located above about 120-130 m support well-defined, complex bog pool systems containing abundant feathery bog-moss (*Sphagnum cuspidatum*), which correspond to the Fossitt category **FL1 dystrophic lakes** (Fossitt, 2000) and the NVC community **M2 *Sphagnum cuspidatum/recurvum* bog pool.**

These blanket bog areas appear structurally and hydrologically intact and exhibit a good diversity of characteristic peat-forming species, and are considered to constitute active blanket bog. This means that this area is likely to gradually accumulate organic matter as peat, over time, given the species composition and physical conditions that are present

Correspondence of Habitats in this Area to EU Annex I Habitats

The correspondence of these communities at this site with Fossitt, Provisional Classification of Upland Vegetation Types and EU Annex I habitats are indicated in Table 11-5.

Table 11-5: Correspondence between Fossitt Habitats and NVC Communities

Fossitt Habitat Type	NVC Vegetation Community	Irish Provisional Classification (Perrin *et al*, 2014)	EU Annex I Habitat
PB2 Upland Blanket Bog	M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire	BB3 – *Eriophorum vaginatum – Sphagnum papillosum* bog BB5a - *Calluna vulgaris - Eriophorum* spp. bog - typical sub-community	7130 Blanket Bogs (EU Priority Habitat when active bog)
HH3 Wet Heath	M15 Scirpus cespitosus-Erica tetralix wet heath	WH3 - *Calluna vulgaris - Molinia caerulea - Sphagnum capillifolium* wet / damp heath	4010 Northern Atlantic wet heaths with *Erica tetralix*
FL1 Dystrophic lakes	M2 *Sphagnum cuspidatum/recurvum* bog pool	HW1 *Sphagnum denticulatum/cuspidatum* hollow	3160 Natural dystrophic lakes and ponds

With the exception of some relatively small areas of improved grassland and acid grassland, the vast majority of the site is considered to correspond to the EU Annex I habitats **4010 Northern Atlantic wet heaths with *Erica tetralix*** and **7130 Blanket Bogs.** Moreover, much of the blanket bog is considered to comprise active blanket bog, indicated by its intact hydrology and structure, and its abundance of peat-forming species such as cottongrasses (*Eriophorum* sp.) and bog-mosses (*Sphagnum* spp.). Active blanket bog is classified as an **EU Annex I Priority Habitat**. In addition, the bog pool systems at the site correspond to the EU Annex I habitat **3160 Natural dystrophic lakes and ponds.**

Full details of the survey undertaken in area 3 in 2018, including quadrat results, are provided within the NIS (Appendix 11-1).

Geographic Valuation of Habitats

Geographic valuation of the habitats found within all areas of the Application Site are shown in Table 11-6.

Table 11-6: Geographic Evaluation of Habitats Required

Code	Habitat Name	Highest Evaluation
FL1	Dystrophic Lakes	Local (Higher) value
GA1	Improved agricultural grassland	Not important
GS3 / GS4	Dry Humid Acid Grassland / Wet Grassland	Local (Higher) value
HH3 / HH1	Wet Heath / Dry Siliceous Heath Mosaic	International Importance
PB2	Upland Blanket Bog	International Importance
PB2 / HH3	Upland Blanket Bog / Wet Heath Mosaic	International Importance

11.4.2. Plant Species

Marsh saxifrage Saxifraga hirculus

Marsh saxifrage (*Saxifraga hirculus*) is a Qualifying Interest species for the Ox Mountains Bogs SAC. It is found in mineral flushes in blanket bog in Ireland[67] and is known to occur in the vicinity of the proposed development. Following an application to NPWS for data on the known locations of the species sin the area, those locations as well as other suitable habitats in the vicinity of the proposal were surveys in September 2018. Populations of the species were recorded in the previously known locations, which occur within the vicinity of the proposal.

Because of the occurrence of the species in the wider area, including as a Qualifying Interest of the Ox Mountains Bogs SAC, it is considered that the vicinity of the Proposed Development Site supports a population of marsh saxifrage of ***International*** importance.

Three-ranked hump-moss (Meesia triqueta)

Three-ranked hump-moss (Meesia triqueta), although not a Qualifying Interest species for the Ox Mountains Bogs SAC is protected under the Flora (Protection) Order 2015. It occurs in similar habitat to marsh saxifrage and was recorded in 2012 in the flushes supporting marsh saxifrage having been thought to be extinct in Ireland.

Because of the occurrence of the species in the wider area, with the area being the only known location in Ireland, it is considered that the vicinity of the Proposed Development Site supports a population of three-ranked humped-moss of ***National*** importance.

11.4.3. Watercourses and Aquatic Environment

The development site is located within the Sligo Bay & Drowes WFD catchment. The development crosses over the Gowlan River, the Gowlan river is a 3rd order tributary of the Easky River, which is within the Gowlan (Sligo)_010 river sub basin all of which is within the Easky_SC_010 sub catchment. The Easky River supports a significant population of Atlantic salmon. The catchment is also classified as *Margaritifera* sensitive area with historic data from the Easky catchment. The water quality within the area is classified as good, however Easky lough is considered at risk of dropping in status. As detailed above, the Easky River pNHA lies some 8km to the north.

A number of drains and minor streams within, or bordering, the application site feed into the Easky River or tributaries. For these reasons, watercourses in the area concluded to be features of ***County*** importance.

11.4.4. Non-avian Fauna

Information is provided below for species of conservation interest and / or protected species that were recorded within the zone of influence of the proposed EIA Development, including data from the previous Black Lough Wind Farm applications and the Cloonkeelaun Wind Farm Applications, where relevant.

Bats

No dedicated bat surveys were undertaken for the electrical grid connection, which occurs in an open bog context for much of the route. As detailed above, detailed bat surveys undertaken in 2011 and 2016 were drawn upon to advise on the species and populations likely to occur in the area. During the 2011 and 2016 surveys, a minimum of 5 species of bat were recorded, comprising soprano pipistrelle, common pipistrelle, Leisler's bat, *Myotis* species and brown long-eared bat.

Pipistrelle species were recorded in all months. Soprano pipistrelle was the more commonly recorded of the pipistrelle species in both transect and static surveys. The level of soprano pipistrelle activity at Black Lough, in particular, suggests the likelihood of a roost in the wider locality (likely to occur on the lower altitudes, away from the electrical connection route, where suitable structures, including trees and buildings occur). Common pipistrelle records were very limited in many cases, but the species was comparatively well represented in records from static detectors away from features. Our experience of bat surveys in such situations is that common pipistrelle, although often less numerous, can frequently be recorded away from obvious features, and may be more likely to occur along the electrical connection route. It is considered that the survey area has the potential to hold a population of foraging common pipistrelle and soprano pipistrelle of ***Local (Higher)*** importance.

Leisler's bats were only recorded in small numbers at Black Lough, with a total of only 44 passes during around 560 hours of recording. The species was surprisingly tied to strong feeding features. It may be that the species forages along the forestry edge to the south of the proposed electrical connection. It is considered that the site has the potential to hold a population of foraging Leisler's bat of ***Local (Higher)*** importance.

Myotis species activity was second to that of soprano pipistrelle during static detector surveys at Black Lough. Activity was notably associated with water features, with a small number recorded in the wider survey area. Despite being the second most commonly recorded species (group), static detectors only recorded a total of 122 passes during around 560 hours of recording. Myotis species may occur within the bog habitat surrounding the proposed electrical connection (notably around dystrophic lake habitat, along the Gowlan River and along the forestry edge to the south of the proposal. It is considered that that the site has the potential to hold a population of foraging *Myotis* species of ***Local (Higher)*** importance.

Only two bat passes from brown long-eared bats were recorded in 2016 during around 560 hours of recording. The species is generally considered to occur in more enclosed and / or sheltered habitats than a typical wind farm site. However, our experience is that it can be regularly recorded in more exposed habitats at some locations. Considering the lack of optimal habitat for the species and the low number of records, it is considered that the electrical connection route has the potential to hold a population of foraging brown long-eared bats species of ***Local (lower)*** importance only.

Badger

Badger signs surveys were undertaken within the Proposed Development Site and for a distance of 50m outside the Proposed Development Site boundary, according to standard guidelines[68]. No badger signs were recorded within or in proximity to the site. Therefore, badger has not been included as a Key Ecological Receptor for the purposes of this impact assessment.

Pine Marten

The wider area holds potentially suitable habitat for pine marten, notably in the forestry habitat to the south of the proposal. However, no pine marten signs were recorded within or in proximity to the site, and suitability is limited within the site itself. Therefore, pine marten has not been included as a Key Ecological Receptor for the purposes of this impact assessment.

Otter

Signs of otter (*Lutra lutra*) in the form of spraints, were recorded along the Gowlan River during surveys for the original Black Lough Wind Farm proposal as well as the current proposal. It is considered likely that otter will regularly occur along the Gowlan River, which is traversed by the proposal. Otter is considered to be a feature of ***Local (Higher)*** importance.

Irish Hare

Although Irish hare (*Lepus timidus hibernicus*) was not recorded during any of the field surveys, the nature of the habitat at the site is suitable for the species and it is considered highly likely to occur at the site.

Irish hare is protected under the Wildlife Act (1976) as amended (2000), although it is also cited in this Act as a species that may be hunted in season. The suitability of surrounding areas for this species, mean that this species has been included as a Key Ecological receptor for the purposes of this impact assessment. It is considered likely that the Proposed Development Site has the potential to support a population of Irish hare that is of ***Local (Higher)*** importance.

Common frog

Common frog (*Rana temporaria*) was recorded at the Proposed Development Site during surveys for the Clookeelaun Wind Farm in 2015. This species is protected under the Wildlife Act (1976) as amended (2000).

The number of pools, drains and other waterbodies in the area provide good habitat for the species, especially in combination with the areas of blanket bog and flushed habitat. For this reason, this species has been included as a Key Ecological receptor for the purposes of this impact assessment. It is considered likely that the Proposed Development Site has the potential to support a population of common frog that is of ***Local (Higher)*** importance.

Common Lizard

There are no historic records of common lizard (*Zootoca vivipara*) in the vicinity of the Proposed Development Site. However, the areas of bog, and especially the drier heath areas are of high suitability for this, generally under-recorded, species. This species is protected under the Wildlife Act (1976) as amended (2000).

Because of the high suitability of the site for the species, it has been included as a Key Ecological receptor for the purposes of this impact assessment. It is considered likely that the Proposed Development Site has the potential to support a population of common lizard that is of ***Local (Higher)*** importance.

Atlantic Salmon

There is suitable habitat present for salmon to spawn within the Gowlan River, which is traversed by the proposal. Juvenile and adult salmon are likely to use the area on passage. The downstream Easky River holds running and spawning Atlantic salmon. Atlantic salmon is considered to be a feature of ***County*** importance.

White-clawed crayfish

Suitable habitat was found during surveys for white-clawed crayfish. However, there are no records of the species occurring within the Easky system. Therefore white-clawed crayfish has not been included as a Key Ecological Receptor for the purposes of this impact assessment.

Freshwater Pearl Mussel

Suitable habitat was found during surveys for freshwater pearl mussel to inhabit the area in question and also a single specimen was found while conducting habitat suitability surveys within the Gowlan River. A further individual was found during targeted specialist surveys of the Gowlan River under licence in 2018. Full details of the survey and findings are provided in (confidential) Appendix 11-3. It is considered that the freshwater pearl mussel population (including the known downstream population in the Easky River) is considered to be a feature of ***County*** importance.

Geyer's Whorl Snail

Geyer's whorl snail (*Vertigo geyeri*) is a Qualifying Interest species for the Ox Mountains Bogs SAC. It is found in constantly wet habitats such as stable flushes and such habitats occur in the vicinity of the proposed development. Flush sites together with locations of *Vertigo geyeri* in the vicinity of the initial Black Lough Wind Farm Proposal were recorded by Evelyn Moorkens & Associates in 2011 (confidential Appendix 11-4). *Vertigo Geyeri* was reported to be found in samples from 4 of the 10 locations surveyed. These 4 locations are Sites 2 and 3, which are located on the western bank of the Easky River downstream of the proposed development, and Sites 8 and 9, which are located on the eastern bank of the Gowlan River to the west of the proposed development. The Evelyn Moorkens & Associates (2011) report also identifies sites where *Vertigo Geyeri* is known to exist from previous surveys.

A further survey was undertaken as part of the current proposal, notably covering all areas in the vicinity of the electrical connection route by Maria Walsh, an expert in the species. The report from this survey is provided as (confidential) Appendix 11-4. The report recorded suitable habitat in 3 locations, with the species confirmed to be present in 2 of those locations.

Because of the occurrence of the species in the wider area, including as a Qualifying Interest of the Ox Mountains Bogs SAC, it is considered that the vicinity of the Proposed Development Site supports a population of Geyer's whorl snail of ***International*** importance.

11.4.5. Key Ecological Receptors

A summary of the potential key ecological receptors with the zone of influence of the proposed development site is provided in Table 11-7.

Table 11-7: Potential Key Ecological Receptors

Key Ecological Feature	Evaluation
Ox Mountains Bogs SAC	International Importance
Ox Mountains Bogs pNHA	National Importance
Easky River pNHA	National Importance
FL1 Dystrophic Lakes	Local (Higher) value
GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland	Local (Higher) value
HH3 / HH1 Wet Heath / Dry Siliceous Heath Mosaic	International Importance
PB2 Upland Blanket Bog	International Importance
PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic	International Importance

Key Ecological Feature	Evaluation
Marsh saxifrage *Saxifraga hirculus*	International Importance
Three-ranked hump-moss *Meesia triqueta*	National importance
Watercourses	County Importance
Otter *Lutra lutra*	Local Importance – higher value
Irish hare *Lepus timidus hibernicus*	Local Importance – higher value
Common frog *Rana temporaria*	Local Importance – higher value
Common lizard *Zootoca vivipara*	Local Importance – higher value
Atlantic salmon *Salmo salar*	County Importance
Freshwater pearl mussel *Margaritifera margaritifera*	County Importance
Geyer's whorl snail *Vertigo geyeri*	International Importance

11.5. Assessment of Potential Environmental Effects

The Ecological Impact Assessment is undertaken in this section. The methodology set out above on how to undertake impact assessments is applied to Key Ecological Features which have been identified and described in Section 11.4.

Within the following sections, only those Key Ecological Receptors identified as having the potential to be affected by each phase of the proposed EIA Development are discussed. A consideration of the potential impacts of the proposed wind farm development is given throughout.

11.5.1. Do-nothing Impact

The Proposed Development Site has been described in terms of flora, fauna and birds in the paragraphs above. As described, the Proposed Development Site encompasses farmland that is currently managed through grazing, as well high-quality bog and heath habitats (within the Ox Mountains Bogs SAC). The area is considered likely to remain in the same use. Notably, significant areas of the electrical connection route qualify as Annex I habitat.

The 'do nothing' option would result in no change to the management of improved pasture that occurs in the northern part of the proposal or the areas within the Ox Mountains Bogs SAC, which are currently managed by sheep grazing.

11.5.2. Potential Impacts of the Construction Phase

The construction phase will involve some impacts upon ecological features along the electrical connection route where access will be required and poles will be required to be erected to carry the cables.

Potential impacts during the construction phase encompass both direct impacts and secondary impacts, which are summarised as follows:

Potential sources of direct impacts during the Construction Phase

- Excavation and temporary placement of material arising from setting of electrical connection poles; and
- Access by construction equipment, including access away from the proposed infrastructure location (compaction and other damage).

Potential sources of secondary impacts during the Construction Phase

- Stockpiling of materials on-site (run-off, erosion etc.).
- Collection / drainage of surface water runoff.
- Avoidance by mammals / fish and other species due to disturbance.

Direct Impacts

Potential Direct Impacts on Designated Areas During the Construction Phase

The proposed electrical connection route (overhead line) runs partly through the Ox Mountains Bogs SAC and pNHA (within the designated areas for 2.04km). The potential impacts on both the SAC and the pNHA are considered to be the same. Full details of these potential impacts are provided in a Natura Impact Statement (as Appendix 11-1). The draft guidelines on *The Information To Be Contained In Environmental Impact Assessment Reports* (EPA 2017) state "*A biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement, but it should refer to the findings of that separate assessment. The scoping process considers any other such assessments that apply to a project and reduces coverage of these issues in an EIAR accordingly*". For this reason. Information contained in the NIS is not repeated here in full, but sufficient information is provided in order to demonstrate the full conclusions of the EIAR chapter to a reasonable degree without requiring recourse to referencing the NIS during the reading of it.

Potential for direct impacts on the Ox Mountains Bogs SAC (and pNHA) are considered below. Potential secondary / indirect impacts are considered in section xxxx.

As detailed above, the electrical connection route (overhead line) runs through the Ox Mountains Bogs SAC over a distance of 2.04km.

Direct loss

There are 16 poles to be placed within Blanket Bog including Active Blanket Bog within the Ox Mountains Bogs SAC, and of these, at least 5 will require 2 side stays. The habitat loss associated with the pole stays is considered negligible, with only metal attachment points at the surface vegetation. Poles are no larger than 300mm diameter, and each pole therefore would result in a loss of 0.09m^2. Total habitat loss associated with this habitat is therefore considered to be no more than 1.44m^2.

For each pole, an excavation of 2-2.5m x 2-2.5m will be required in order to allow for the use of 1.5m long sleepers and bog boards to create a raft, with excavations being undertaken down to a depth of 3m. In addition, 1.5-2m x 1.5-2m excavations will be required at each stay location. In the case of Blanket Bog (including in mosaic with Wet Heath), this would result in excavation of an area of up to 140m^2. This area would then undergo restoration, with the exception of the 1.44m2 that will be taken up by the poles themselves.

The placement of 16 poles within Blanket Bog and Blanket Bog/Wet Heath habitat will therefore result in direct impact on 140m^2 in terms of habitat area through excavation. Following successful restoration, the placement of poles within this habitat will result in the loss of 1.44m2 of habitat.

Restoration success will depend on a strict approach to excavation, temporary storage and replacement of turves, acrotelmic and catotelmic peat and, potentially, mineral soils.

Compaction / Damage

The placement of poles and stringing of cables will require access to both get the materials to site and to undertake the works. Without an adequately planned approach, this has the potential to require multiple trips across blanket bog habitat. The conclusions from research suggest that 'repeated' use of trackways and that a 'chronic' level of disturbance could result in impact on the vegetation surface of blanket bog habitats.

Experience by the author of this EIAR chapter, garnered from work as an Ecological Clerk of Works during construction on wind farms requiring access over (and in some cases cabling within) Blanket Bog / Wet Heath habitat, the potential for impact largely relates to the following factors:

- Ground conditions (with areas of flush or softer habitat more easily impacted).
- Weather conditions (with prolonged wet spells increasing the risk of surface vegetation damage highly significantly).
- Machinery used (minimising use of vehicles such as tracked dumpers which, although low ground-pressure, can result in cutting into vegetation due to loading).

- Driver experience and expertise.
- Stringent supervision of works by a suitably experienced person.

It is therefore concluded that the proposal, without mitigation, has significant potential to result in damage to 'Active Blanket Bog' priority habitat as a result of compaction and surface damage. Potential impacts are likely to occur as a result of access to the site, along the construction route and in the vicinity of pole locations.

Although the potential impacts of the proposal would be limited to the area of the proposed route, and although potential impacts are likely to be reversible, it is concluded that, without mitigation, there is potential for damage to both structure and function of Active Blanket Bog priority habitat as a result of damage to the surface vegetation from access and construction activities.

The NIS concludes that the proposal would require a full suite of appropriate mitigation in order to avoid damage to blanket bog and associated habitats and any impact on the integrity of the SAC. It is considered that, without mitigation, there is potential for ***Significant*** impacts on the Ox Mountains Bogs SAC at the ***International*** scale. The potential impacts on the Ox Mountains Bogs pNHA are considered to be the same. It is therefore considered that, without mitigation, there is potential for ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale.

Mitigation in this regard includes a detailed access proposal which is provided in the accompanying NIS and other mitigation as detailed in the accompanying NIS and this chapter.

Potential Direct Impacts on Habitats During the Construction Phase

Table 11-8 outlines the habitat features associated with each section of infrastructure and includes an area measurement of habitat directly impacted on by the footprint of the works.

Table 11-8: Habitat Features Associated with Each Section of Infrastructure

Associated Infrastructure	Habitat Description	Key Ecological Receptor	Area / Distance Under Footprint
Buried cable	PB2 / HH3 – Upland Blanket Bog / Wet Heath Mosaic	Y	108 linear metres
	GA1 – Improved Grassland	N	231 linear metres
Overhead cable	PB2 / HH3 – Upland Blanket Bog / Wet Heath Mosaic	Y	91m^2 (area of total excavation prior to restoration)
	PB2 – Upland Blanket Bog	Y	29m^2 (area of total excavation prior to restoration)
	HH3 / HH1 – Wet heath / Dry Siliceous Heath Mosaic	Y	6.25m^2 (area of total excavation prior to restoration)

Note - Habitats that are identified as being Key Ecological Receptors for the purposes of this impact assessment are highlighted in grey.

Potential Direct Impacts on Dystrophic Lakes during the Construction Phase

Where dystrophic lakes and ponds occur beneath the electrical connection overhead lines, there is some potential for damage as a result of inappropriate access during construction.

Although damage is unlikely, considering that dystrophic lakes and ponds occur partly within the Ox Mountains Bogs SAC and that they are a Qualifying interest, it is considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on dystrophic lakes and ponds at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Direct Impacts on GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland during the Construction Phase

This habitat occurs within the Ox Mountains Bogs SAC, flanking both sides of the Gowlan River. It is not Annex 1 habitat or of particularly good quality in itself, being fairly dominated by soft rush *Juncus effusus* in many places. It has an important function however, in protecting the aquatic ecology within the Gowlan River in the Ox Mountains Bogs SAC, notably from any silty run-off. It also holds flushed areas that have the potential to be suitable for Geyer's whorl snail, a Qualifying Interest species for the site.

Although not important in itself, considering the value of the habitat in the context of protecting the aquatic environment, and potential to hold flushed habitat suitable for Geyer's whorl snail, it is considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland at the ***International*** scale.

Potential Direct Impacts on HH3 / HH1 Wet Heath / Dry Siliceous Heath Mosaic during the Construction Phase

This habitat occurs within the Ox Mountains Bogs SAC, at the south-western part of the proposed electric connection route, comprising Annex 1 habitat and Qualifying Interest features. There is a single pole planned at this location, likely to result in the permanent loss of a total of around 0.09m^2 of the habitat. Such a loss is not considered to be significant. However, there will be a requirement to excavate an area for the pole and to restore, as well as gaining access to the site with machinery. Such events have the potential to cause wider damage in the absence of mitigation in the form of appropriate methodologies. It is therefore considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on HH3 / HH1 Wet Heath / Dry Siliceous Heath Mosaic at the ***International*** scale. The likelihood of this impact occurring is ***Probable***.

Potential Direct Impacts on PB2 Upland Blanket Bog and PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic during the Construction Phase

These habitats have been grouped together since they frequently occur in mosaic. These habitats occur within the Ox Mountains Bogs SAC, along much of the proposed electric connection route, comprising Annex 1 habitat and Qualifying Interest features. Active Blanket Bog is a Priority Habitat under Annex 1 of the Habitats Directive. There are a total of 16 poles to be placed within Blanket Bog including in mosaic with Wet Heath within the Ox Mountains Bogs SAC, and of these, at least 5 will require 2 side stays. The habitat loss associated with the pole stays is considered negligible, with only metal attachment points at the surface vegetation.

For each pole, an excavation of 2-2.5m x 2-2.5m will be required in order to allow for the use of 1.5m long sleepers and bog boards to create a raft, with excavations being undertaken down to a depth of 3m. In addition, 1.5-2m x 1.5-2m excavations will be required at each stay location.

In the case of Blanket Bog (including in mosaic with Wet Heath), this would result in excavation of an area of up to 140m^2. This area would then undergo restoration, with the exception of the 1.44m^2 that will be taken up by the poles themselves. The placement of 16 poles within Blanket Bog and Blanket Bog/Wet Heath habitat will therefore result in direct impact on 140m^2 in terms of habitat area through excavation. Following successful restoration, the placement of poles within this habitat will result in the loss of 1.44m^2 of habitat.

However, the potential success of restoration will depend on the approach taken and the quality of workmanship. There will also be a need to gain access to the site with machinery. Such events have the potential to cause wider damage in the absence of mitigation in the form of appropriate methodologies. It is therefore considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase PB2 Upland Blanket Bog and PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic at the ***International*** scale. The likelihood of this impact occurring is ***Probable***.

Potential Direct Impacts on Watercourses During the Construction Phase

The only location where the works have potential to come into direct contact with watercourses is where the proposed electrical connection route crosses the Gowlan river and tributaries (including drains). There is no proposal to cross the Gowlan River except while pulling cables. However, this is essentially an 'embedded' mitigation measure and, for the purposes of assessment, such measures are not considered at this stage.

Impacts could potentially result from unregulated access into the river by machinery or personnel.
It is considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on watercourses at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Direct Impacts on Marsh Saxifrage Saxifraga hirculus during the Construction Phase
Marsh saxifrage occurs within the Ox Mountains Bogs SAC and is a Qualifying Interest of the SAC. A marsh saxifrage survey was undertaken in potentially suitable habitat (the environs of the proposed electrical connection route) in September 2018. Results from this survey were added to data obtained from the NPWS database to provide a full understanding of the species in the area. A total of 7 flush areas with potential to support the species were located in the wider area, with 4 of those found to hold the species. See Figure 11-5 in Appendix 11-5 (confidential data) for locations in comparison to the proposal. The species was not found in any location outside the previously known areas.

The species occurs, at the closest, some 68m south east of the Application Site (92m from the proposed electrical connection route and 97m from the closest proposed pole location).

In terms of direct impact, these areas could be damaged as a result of inappropriate access by machinery accessing or carrying out works.

It is therefore considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on marsh saxifrage at the ***International*** scale. The likelihood of this impact occurring is ***Extremely Unlikely***.

Potential Direct Impacts on Three-ranked hump-moss Meesia trigueta during the Construction Phase
Three-ranked hump-moss has previously been recorded at one of the same locations as marsh saxifrage. It is the only current known site for the species in Ireland. It was not recorded during field surveys in 2018.

The species has potential to occur in the same locations as marsh saxifrage. As detailed above, marsh saxifrage occurs, at the closest, some 68m south east of the Application Site (92m from the proposed electrical connection route and 97m from the closest proposed pole location).

In terms of direct impact, these areas could be damaged as a result of inappropriate access by machinery accessing or carrying out works.

It is therefore considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on three-ranked hump-moss at the ***National*** scale. The likelihood of this impact occurring is ***Extremely Unlikely***.

Potential Direct Impacts on Bat Species during the Construction Phase
Potential direct impacts on bat species from construction works are generally limited to loss roosts. There is no potential for bat roosts to occur in within the application site. There is therefore considered to be no potential for direct impacts on bats during the construction phase.

Potential Direct Impacts on Otter Lutra lutra during the Construction Phase
Potential direct impacts on otters from construction works are generally limited to loss of holts, although at an extreme level, construction operations directly over a holt have the potential to result in mortality. No otter holts were recorded during surveys. There is therefore considered to be no potential for direct impacts on otter during the construction phase.

Potential Direct Impacts on Irish Hare Lepus timidus hibernicus during the Construction Phase
There is considered to be no potential for direct impacts on Irish hare during the construction phase.

Potential Direct impacts on Common Frog Rana temporaria during the Construction Phase
Potential direct impacts on common frog during the construction phase are likely to be limited to direct mortality during access onto suitable habitat (notably bog habitats) by machinery. The extent of potentially suitable foraging habitat for the species in the area if is significant and the potential for direct mortality extremely limited. There will be no dewatering of spawning areas involved in the works. It is therefore concluded that potential direct impacts on common frog during the construction phase are considered ***not significant***.

Potential Direct Impacts on Common Lizard Zootoca vivipara during the Construction Phase
As with common frog, potential direct impacts on common lizard during the construction phase are likely to be limited to direct mortality during access onto suitable habitat (notably bog habitats) by machinery. The extent of potentially suitable foraging habitat for the species in the area if is significant and the potential for direct mortality extremely limited. Excavation within potentially suitable habitat is highly limited. It is therefore concluded that potential direct impacts on common lizard during the construction phase are considered ***not significant***.

Potential Direct Impacts on Atlantic Salmon Salmo salar during the Construction Phase
There is limited potential for direct impact on Atlantic salmon during the construction phase, limited to any potential direct contact with the works and watercourses holding suitability for spawning beds (impacts on water quality are considered under secondary impacts). The only location where the works have potential to come into direct contact with watercourses is where the proposed electrical connection route crosses the Gowlan river and tributaries (including drains). Any potential impact would be highly limited in extent. There is no proposal to cross the Gowlan River except while pulling cables. However, this is essentially an 'embedded' mitigation measure and, for the purposes of assessment, such measures are not considered at this stage.

Impacts could potentially result from unregulated access into the river by machinery or personnel.
It is considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on Atlantic salmon at the ***Local*** scale. The likelihood of this impact occurring is ***Extremely unlikely***.

Potential direct impacts on Freshwater Pearl Mussel Margaritifera margaritifera during the Construction Phase
A freshwater pearl mussel *Margaritifera margaritifera*, survey of the Gowlan River and tributaries was undertaken in 2018. Two individual mussels were recorded in the river, with one of them being within 12m of the Application Site. See Figure 11-5 in Appendix 11-5 (confidential data) for locations in comparison to the proposal.

Although unlikely, there is potential for direct impact on this rare animal as a result of crossing the river on foot or by machinery, or by drawing cables across the river.

It is considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on freshwater pearl mussel at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Direct Impacts Geyer's Whorl Snail Vertigo geyeri during the Construction Phase
Geyer's whorl snail occurs within the Ox Mountains Bogs SAC and is a Qualifying Interest of the SAC. A Geyer's whorl snail survey was undertaken in potentially suitable habitat (the environs of the proposed electrical connection route) in October 2018. Results from this survey were added to data obtained from the NPWS database and previous surveys undertaken by Evelyn Moorkens Associates in 2011 as part of a previous application to provide a full understanding of the species in the area.

In 2018, two new locations holding the species were identified in the area in addition to the 4 previously known locations. These locations are shown in Figure 11-5 of Appendix 11-5 (confidential data).

The species occurs, at the closest, some 64m south east of the Application Site (93m from the proposed electrical connection route and 97m from the closest proposed pole location).
In terms of direct impact, these areas could be damaged as a result of inappropriate access by machinery accessing or carrying out works.

It is therefore considered that, without mitigation, there is potential for ***Significant*** direct impacts during the construction phase on Geyer's whorl snail at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Secondary Impacts

Potential Secondary Impacts on Designated Areas during the Construction Phase

The proposed electrical connection route (overhead line) runs partly through the Ox Mountains Bogs SAC and pNHA (within the designated areas for 2.04km). The potential impacts on both the SAC and the pNHA are considered to be the same. Full details of these potential impacts are provided in a Natura Impact Statement (as Appendix 11-1). Potential for secondary impacts on the Ox Mountains Bogs SAC (and pNHA) include the release of sediments or pollutants such as hydrocarbons that have the potential to enter the designated areas by overland flow and affect either habitat, plant species or invertebrate Qualifying Interests, and interruption to current drainage / water flow patterns that provide the conditions suitable for plant or invertebrate Qualifying Interests. The above impacts have the potential to arise from cable trench work outside the SAC, for example.

Pollution as a result of sediment or hydrocarbon release, has the potential to impact on Ox Mountains Bogs SAC Qualifying interest features such as blanket bog, wet heath, and dystrophic lakes habitats, as well as the flushes that support marsh saxifrage and Geyer's whorl snail.

The NIS concludes that the proposal would require appropriate mitigation in order to avoid damage to blanket bog and associated habitats and any impact on the integrity of the SAC. It is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on the Ox Mountains Bogs SAC at the ***International*** scale. The potential impacts on the Ox Mountains Bogs pNHA are considered to be the same. It is therefore considered that, without mitigation, there is potential for ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale.

The Easky River pNHA supports Atlantic salmon. A significant pollution event during construction has the potential to result in impacts on the Atlantic salmon within the Easky River system that could, in turn, impact on the pNHA. It is therefore considered that, without mitigation, there is potential for ***Significant*** impacts on the Easky River pNHA at the ***National*** scale.

Potential Secondary Impacts on Dystrophic Lakes during the Construction Phase

The extent of dystrophic lakes habitat in the area has been set out above. There is potential for secondary impacts on this habitat as a result of pollution, notably from hydrocarbon spillage or silt-laden water from excavations.

Although damage is unlikely, considering that dystrophic lakes and ponds occur partly within the Ox Mountains Bogs SAC and that they are a Qualifying interest, it is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on dystrophic lakes and ponds at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland during the Construction Phase

This habitat occurs within the Ox Mountains Bogs SAC, flanking both sides of the Gowlan River. It is not Annex 1 habitat or of particularly good quality in itself, being fairly dominated by soft rush *Juncus effusus* in many places. It has an important function however, in protecting the aquatic ecology within the Gowlan River in the Ox Mountains Bogs SAC, notably from any silty run-off. It also holds flushed areas that have the potential to be suitable for Geyer's whorl snail, a Qualifying Interest species for the site. As with other habitats, the main potential secondary impact on these areas from the works would be as a result of pollution from hydrocarbon spillages or silt-laden water. Although not important in itself, considering the value of the habitat in the context of protecting the aquatic environment, and potential to hold flushed habitat suitable for Geyer's whorl snail, it is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland at the ***International*** scale.

Potential Secondary Impacts on HH3 / HH1 Wet Heath / Dry Siliceous Heath Mosaic, PB2 Upland Blanket Bog and PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic during the Construction Phase
These habitats all occur within the Ox Mountains Bogs SAC, comprising Annex 1 habitat and Qualifying Interest features. In all cases, the potential secondary impacts are limited to potential smothering of habitats from silt-laden water, and pollution from a hydrocarbon spillage. In the first instance (discharge of silt-laden water) such impacts are extremely unlikely and would be very limited within the Ox Mountains Bogs SAC, since excavations would be small and be unlikely to be open for sufficient time to fill with water. There is the potential for some impacts where the habitats occur and where cable trenching is proposed near the SAC. Potential pollution from hydrocarbon spillage is unlikely, but such events can have significant consequences.

Although limited in potential extent and unlikely, it is therefore considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on HH3 / HH1 Wet Heath / Dry Siliceous Heath Mosaic, PB2 Upland Blanket Bog and PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Watercourses during the Construction Phase
Secondary impacts on watercourses during the construction phase have the potential to occur as a result of pollution events or from uncontained run-off from unvegetated areas or fuel / hydrocarbon spillages. These particularly have the potential to occur within the main construction areas and could impact on the Gowlan or Easky Rivers.

It is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on watercourses at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Marsh Saxifrage Saxifraga hirculus during the Construction Phase
The locations of marsh saxifrage populations have been detailed above. Potential secondary impacts on these populations could occur as a result of hydrocarbon pollution events (since the species occurs within flushed areas that can be fed by overland flow, and hydrocarbon spillages are easily spread in such ways, or by disruption to the flows that feed the flushed areas that the species inhabits. In both cases, the likelihood of impact is low, and it is highly feasible to avoid such impacts through appropriate mitigation. However, in both cases, specific measures are required in order to avoid any potential for impact.

It is therefore considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on marsh saxifrage at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Three-ranked Hump-moss Meesia triqueta during the Construction Phase
The potential for secondary impact on three-ranked hump-moss is identical to that of marsh saxifrage and it is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on three-ranked hump-moss at the ***National*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Bats during the Construction Phase
There is not considered to be any potential for secondary impacts on bats during the construction phase.

Potential Secondary Impacts on Otter Lutra lutra during the Construction Phase
Potential secondary impacts on otters from construction works are generally limited to pollution events which have the potential to impact fish stocks in the Gowlan and Easky Rivers. The potential for such event has been outlined above in respect to watercourses and it is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on otter at the ***Local*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Irish Hare Lepus timidus hibernicus during the Construction Phase
Potential for secondary impacts on Irish hare during the construction phase are considered to be limited to loss of habitat. The proposal will result in the combined loss of around 1.46ha of potentially suitable foraging habitats (wet grassland, improved grassland and bog/ heath). When considered in context with the extent of suitable habitat in the area, however, it is considered that the loss of this area of suitable foraging habitat for the species is considered ***not significant***.

Potential Secondary Impacts on Common Frog Rana temporaria during the Construction Phase
Potential secondary impacts on common frog during the construction phase are likely to be limited to pollution of suitable terrestrial and aquatic habitats for the species. The potential for these is discussed in the sections above. Although, potential pollution is a significant concern with respect to habitats and species of particular conservation concern, the likely extent and spread of common frogs in the wider area at this location means that potential secondary impacts on common frog during the construction phase are considered ***not significant***.

Potential Secondary Impacts on Common Lizard Zootoca vivipara during the Construction Phase
As with Irish hare, potential secondary impacts on common lizard during the construction phase are likely to be limited to loss of suitable habitat (notably bog heath habitats). Such loss is limited to the minimal areas required for erection of cable poles and the substation and turbine infrastructure at Clookeelaun. When considered in context with the extent of suitable habitat in the area, however, it is considered that the loss of this area of suitable habitat for common lizard is considered ***not significant***.

Potential Secondary Impacts on Atlantic Salmon Salmo salar during the Construction Phase
As with other aquatic species found within the Easky and Gowlan Rivers, potential secondary impacts on Atlantic salmon from construction works are generally limited to pollution events which have the potential to impact on the Gowlan and Easky Rivers. The potential for such event has been outlined above in respect to watercourses and it is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on Atlantic salmon at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Freshwater Pearl Mussel Margaritifera margaritifera during the Construction Phase
As with other Atlantic salmon, potential secondary impacts on freshwater pearl mussel from construction works are generally limited to pollution events which have the potential to impact on the Gowlan and Easky Rivers. In addition, it is detailed in section xx that an individual freshwater pearl mussel was recorded in close vicinity (though upstream) to the proposed point where the overhead cable will cross the Gowlan River. Localised disturbance of sediment within the river in this area during cabling works, even if undertaken on foot, therefore has the potential to impact on the species. It is therefore considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on freshwater pearl mussel at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Secondary Impacts on Geyer's Whorl Snail Vertigo geyeri during the Construction Phase
Confidential Figure 11-5 shows the locations of Geyer's whorl snails recorded in the wider environs around the works. Confidential Appendix 11-4 describes the habitat requirements of the species (which includes a continued unpolluted water supply to those habitat areas). Potential secondary impacts on these populations could occur as a result of hydrocarbon pollution events (since the species occurs within flushed areas that can be fed by overland flow, and hydrocarbon spillages are easily spread in such ways, or by disruption to the flows that feed the flushed areas that the species inhabits. In both cases, the likelihood of impact is low, and it is highly feasible to avoid such impacts through appropriate mitigation. However, in both cases, specific measures are required in order to avoid any potential for impact.

It is therefore considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the construction phase on Geyer's whorl snail at the ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

Cumulative Impacts of the Construction Phase
The potential for cumulative impacts resulting from the construction phase of the EIA Development is considered to be limited to water quality changes within the Gowlan and Easky River systems. The proposal falls within an area that has a number of other consented or built wind farms as well as significant areas of forestry. There is therefore potential for a cumulative level of sediment discharge or nutrient peaks if run-off from areas of open ground from the proposal combines with run-off from active wind farm construction projects or recently felled forestry. This highlights the need to address the issue of pollution from run-off during the construction phase as detailed in the impact assessments of many of the features above.

11.5.3. Potential Impacts During the Operational Phase

Operational impacts of wind farms are largely limited to those on species and habitats affected by water quality and quantity (birds and bat species are considered in Chapters 12 and 13). Such issues can include ongoing pollution resulting from run-off from infrastructure or unvegetated areas, or disruption to flow or drainage patterns on which some habitats and species rely.

Potential Direct Impacts During the Operational Phase
Potential direct operational phase impacts of wind farms include:

- Impacts on adjacent habitats and fauna within adjacent watercourses from generation of silt-laden run-off due to bare ground and / or lack of balancing ponds and drainage associated with infrastructure.

Potential Direct Impacts on Designated Areas during the Operational Phase
As stated above, the proposal runs through the Ox Mountains Bogs SAC and pNHA for a length of 2km. Potential for direct impact on designated areas is considered to be limited to direct smothering of Qualifying Interest habitats and species with sediment from silt-laden water running off from areas left un-vegetated following completion of construction. The potential for this to occur is considered to be extremely limited and of a temporary nature. In the normal course of events, it is considered that such impacts are likely to be ***Not Significant***. However, inappropriate working practices either adjacent to, or within, the designated areas have the potential to leave areas unvegetated and result in small-scale impacts. The small-scale nature of such potential impacts needs to be seen in the context of the importance of the designated areas and their features, and such impacts could easily be avoided by appropriate working practices. Therefore, it is concluded that, without mitigation, there is potential for ***Significant*** secondary impacts during the operational phase on designated areas at the ***International*** scale. The likelihood of this impact occurring is ***Extremely Unlikely***.

Potential Direct Impacts on Terrestrial Habitats during the Operational Phase
Terrestrial habitats have been grouped together in this section to avoid duplication of potential impacts (with habitats the Ox Mountains Bogs SAC being covered in the section above), with potential impacts being limited to localised smothering of habitats with sediment from silt-laden water running off from areas left un-vegetated following completion of construction.

In the Cloonkeelaun area, habitats surrounding the proposal include blanket bog and blanket bog / wet heath mosaic. In this area, ongoing run-off holding mineral sediment from unvegetated areas into the surrounding habitat has the potential to change the nature of the habitat. Although likely to be localised and relatively temporary, it is considered that without mitigation, there is potential for ***Significant*** secondary impacts during the operational phase on designated areas at the ***Local (higher)*** scale. The likelihood of this impact occurring is ***Probable***.

Potential Direct Impacts on Watercourses and Aquatic Ecology during the Operational Phase
Potential for direct impact on watercourses and aquatic ecology is considered to be limited to direct smothering of species (such as freshwater pearl mussel) by sediment from silt-laden water running off from areas left un-vegetated following completion of construction, or the localised creation of high sediment conditions in rivers (potentially affecting salmonids for example). The potential for this to occur is considered to be limited and of a temporary nature. The potential for this has to be seen in the context of the considerable level of peat cutting and terrestrial disturbance in the area. Any sediment introduced in the watercourses as a result of the proposal has the potential to exacerbate

the level of sediment occurring from other factors. Although mitigation measures to address this are straightforward, it is concluded that, without mitigation, there is potential for ***Significant*** direct impacts during the operational phase on designated areas at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Potential Direct Impacts on Bats during the Operational Phase
The proposed electrical connection route runs across bog and heath habitat between the four turbines at Black Lough and the turbine at Cloonkeelaun. Much of the habitat is of limited suitability for bats and there are no potential roosts within this area.

Research and literature review by Eirgrid concluded "Survey results indicate that there was no significant association between likelihood of bat occurrence and distance from power lines of any voltage (110kV, 220kV and 400kV). Based on this, it can be concluded with some confidence that power lines do not have a deterrent effect on the more common resident Irish bats while in flight". It is therefore concluded that the overhead lines will not impact on bat populations in the area and that potential impacts on bat species during the operational phase of the proposal are considered ***Not Significant***.

Potential Direct Impacts on Terrestrial Mammals during the Operational Phase
There is considered to be no potential for significant direct impacts on other terrestrial mammals, including Irish hare, during the operational phase of the development.

Potential Secondary Impacts during the Operational Phase
Secondary Operational Phase impacts of wind farms are generally limited to impacts on nearby watercourses from continued generation of silt-laden run-off due to bare ground and / or lack of balancing ponds and drainage associated with infrastructure. This can potentially result in low level secondary impacts on downstream aquatic habitats and species, such as degradation of spawning beds (direct impacts on species as a result of this have already been addressed above).

Potential Secondary Impacts on Designated Areas during the Operational Phase
Secondary Operational Phase impacts on the Ox Mountains Bogs SAC and pNHA are likely to be limited to ongoing disruption of drainage flows to important features, such as the flushes that support marsh saxifrage and / or Geyer's whorl snail, and disturbance to terrestrial areas upslope of such features that could change the chemical composition of flow water. Such impacts could arise from inappropriate access with machinery or working practices during pole erection or cable stringing operations.

It is considered that, without mitigation, there is potential for ***Significant*** secondary impacts during the operational phase on the Ox Mountains Bogs SAC and pNHA at the ***National*** *to* ***International*** scale. The likelihood of this impact occurring is ***Unlikely***.

The distance of the Easky River pNHA from the proposal and the extent of the works means that Secondary Operational Phase impacts on the Easky River pNHA are considered ***Not Significant***.

Potential Secondary Impacts on Watercourses and Associated Downstream Ecology during the Operational Phase
Excavation for pole erection has some very limited potential to result in increases in silt-laden water entering the watercourses in the vicinity of the site and impacting on the suitability of the stream / river beds for spawning salmon for example. The potential for this to occur is considered to be of a very limited and temporary nature. However, as with direct impacts, the potential for this has to be seen in the context of the considerable level of peat cutting and terrestrial disturbance in the area. Any ongoing sediment introduction into the watercourses as a result of the proposal has the potential to exacerbate the level of sediment occurring from other factors. Although mitigation measures to address this are straightforward, it is concluded that, without mitigation, there is potential for ***Significant*** secondary impacts during the operational phase on designated areas at the ***County*** scale. The likelihood of this impact occurring is ***Unlikely***.

Cumulative Impacts during the Operational Phase
The potential for cumulative impacts resulting from the operational phase of the EIA Development proposal is limited to primary and secondary impacts on local aquatic ecology, notably taking account of terrestrial disturbance (ongoing peat cutting, forestry and existing wind farms) in the area. These potential issues have already been addressed above and considered to be significant due to the potential for cumulative impact.

Potential Impacts of the Decommissioning Phase
Decommissioning phase impacts are likely to be broadly similar to construction phase impacts, in terms of access to pole locations, pole removal and site reinstatement; and potential surface water quality impacts from ground disturbance, refueling and the storage of potentially hazardous materials onsite.

11.6. Mitigation Measures

11.6.1. Construction Phase Mitigation

Mitigation by Avoidance
Protection of Designated Areas

Within the Ox Mountains Bogs SAC / pNHA:

- Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW.
- There will be no vehicular or pedestrian access into or storage of materials within areas mapped as '7130P – Blanket Bog (Active)' in Figure 11-6 within the SAC, with the exception of a 40m stretch in the extreme southwest corner of the SAC. Access through this area will be minimised, micro-sited following a survey by the Project Ecologist / ECoW, and fully monitored by the Project Ecologist / ECoW.
- Pulling of ropes for cable stringing between poles where '7130P – Blanket Bog (Active) occurs will be walked around the habitat to the poles and then pulled through, avoiding any need for access into the habitat. This work will be fully supervised by the Project Ecologist / ECoW.
- There will be no access of any kind into Alkaline Flush, mapped as '7230' in Figure 11-6, or controlled zones for marsh saxifrage and Geyer's whorl snail as shown in Figure 11-7.
- A working corridor will be set out in advance of the works, identified by low impact markers. The setting out of the corridor will be preceded by a site walkover by an appropriately qualified ecologist to ensure that:
    - Habitat potentially aligning to 'Depressions on peat substrates of the *Rhynchosporion* (7150)*'* and 'Blanket Bog (Active) (7130P)' are excluded from the working corridor area.
    - All areas considered to be sensitive to retaining water flows to flushed areas used by Qualifying Interest features and rare species (marked on Figure 11-7) are avoided by the works.
    - The working area is reduced to the minimum required for the works, taking account of minimising rutting and compaction by vehicles.

For all works:
- There will be no dewatering of any excavations (including cabling trenches) to watercourses, including land drains. No dewatering is considered required as part of these works.
- A 50m buffer zone (as shown in Figure 11-7) will be in place either side of the Gowlan River. There will be no refuelling within or vehicular access into this area. Pedestrian access will be limited to pulling of pilot ropes for cabling and any water pollution control measures (such as silt fences).
- All winching of cables will be undertaken from outside the Ox Mountains Bogs SAC, with no cable drums or winches within the SAC. Cabling works within the SAC will be limited to pulling cable ropes by hand.

Protection of Watercourses, Aquatic Habitats and Species

- There will be no dewatering of any excavations (including cabling trenches) to watercourses, including land drains. In the unlikely event of dewatering being required, water will be pumped to the settlement ponds constructed for the wind farm, with diffuse overland drainage.
- Disturbed ground within the site will be actively revegetated with lifted and stored turves.
- The proposals to control potential pollution detailed within the Chapter 8 of this EIAR will be implemented in full. These include measures for developing appropriate drainage infrastructure, storage of potentially hazardous materials, de-watering operations, site management and the implementation of buffers to watercourses.
- There will be no vehicular access across the Gowlan River or tributaries.
- Hand pulling of ropes across the Gowlan River will be undertaken by throwing guide ropes across the river and not walking them across (with crossing of the river by pedestrians only undertaken at existing bridge points), to avoid potential direct impacts on freshwater pearl mussel.
- There will be no refuelling within 50m of any drain / stream on the site.
- An Ecological Clerk of Works (ECoW) will be employed from the commencement to completion of construction works. Primary roles for the ECoW will include the setting out and monitoring of the working corridor and review of pollution control measures and working practices during the active construction period as well as *ad hoc* input into site remediation.

Protection of Important Habitats

Habitat protection measures within the Ox Mountains Bogs SAC have been detailed above.

Protection of Important Species

Species protection measures with respect to Ox Mountains Bogs SAC Qualifying Interest species have been detailed above. In addition:

- If works are not undertaken by the end of 2019, the commencement of works will be preceded by a due diligence ecological walkover survey of the site infrastructure layout within the year prior to works commencing. The aim of the survey will be to identify any protected species (for example otter and badger) within the wider area and agree measures to protect them.

Mitigation by Reduction

Protection of Designated Areas

Within the Ox Mountains Bogs SAC:

- A working corridor will be employed for electrical connection works as follows:
  - Maximum 6m width for travel between pole locations.
  - Maximum 10m around pole locations.
  - 50m exclusion buffer around the Gowlan River (work by hand only within buffer zones).
- There will be no excavation of any sort excepting at the pole and guy wire locations and underground cabling sections (the latter is located outside the SAC only). At these locations, excavation will be limited to 2.5m square. Any excavated material (acrotelmic peat and turves, catotelmic peat and mineral soil) will be carefully excavated, temporarily stored separately on bog mats before being used to re-fill the excavation.
- The potential for damage to other Annex I / QI habitats will be minimised by a detailed access, delivery and working plan. A Construction Method Statement has been developed for the electrical connection route (Appendix 2 of the NIS). This incorporates the requirements for specific working methods in the SAC, including:
  - All heavy materials, including pole structures will be delivered by air (helicopter) to strategic locations within the working corridor to minimise movements with laden machinery.

- All machinery access will be undertaken with specialised low ground-pressure machinery. A strict hierarchy of machinery will be employed, with no unnecessary trips being undertaken with oversized machinery for the task:
    - Access to areas northeast of the Gowlan River will be undertaken using the existing track as far as feasible with movements away from the track only for access to specific pole locations. There will be no movements between poles where use of the existing track is feasible.
    - A single low-pressure excavator used for anchoring, stabilisation and works associated with pole erection only within the SAC (with machinery associated with cable pulling being set-up outside the SAC).
    - Ultra-low-pressure vehicles used for daily carriage of personnel / light materials and fuel if required (e.g. Argocat or similar).
- Access into and within the SAC will be limited to the routes shown in Figure 14 of the NIS. It will be limited to 2 entry points, one to the southwest and one to the northeast, with no vehicular river crossing allowed. The number of tracking trips will be limited to reduce potential for impact on vegetation surface as follows:
    - Low pressure excavator – single track trip to end of working area and back (2 tracked trips in total).
    - Ultra-low-pressure wheeled / rubber tracked machinery (Argocat or similar) – daily as required (monitored by Project Ecologist / ECoW).
    - Re-fuelling will need to be undertaken by hand on site to avoid the need for vehicles tracking out of the site or heavy bowsers being taken into site.

Protection of Important Habitats

- A working corridor will be employed for electrical connection works as follows:
    - Maximum 6m width for travel between pole locations.
    - Maximum 10m around pole locations.
    - 50m exclusion buffer around the Gowlan River (work by hand only within buffer zones).
- Working areas within wet grassland habitats at Black Lough and blanket bog / wet heath will be minimised, with side-casting of materials not permitted in these habitats. Within blanket bog / wet heath habitat at Cloonkeelaun, the working area will not exceed 5 metres from the proposed infrastructure.

Protection of Watercourses, Aquatic Habitats and Species

A site-specific Construction Method Statement has been developed (Appendix 2 within the NIS), which includes the following in respect of protection of watercourses, aquatic habitats and species:

- an active approach to silt control within the Proposed Development Site. In areas being actively worked, dedicated construction staff will be tasked to place silt fences in areas of risk of overland flow of silt-laden water. Silt fences must be visually checked on a weekly basis for efficacy, and daily in actively worked areas or during wet conditions. The ECoW will ensure adequate silt fences are erected and maintained.
- Specific areas for oil storage and refuelling, separated a minimum of 50m from adjacent watercourses and comply with legislation and best practice.
- Spill kits, fill point drip trays, bunded pallets and secondary containment units required to be deployed and used on site.
- A site-specific Incident Response Plan (as set out in the approved CEMP for the Black Lough Wind Farm.
- Works involving the use of chemicals which are potentially harmful to the aquatic environment undertaken in an appropriately contained area
- Disturbed ground within the site to be actively revegetated with lifted and stored turves.
- The recommendations provided within Guidelines on Protection of Fisheries During Construction Works in and Adjacent Waters (2016) to be implemented where relevant.

Mitigation by Restoration

Protection of Designated Areas
Within the Ox Mountains Bogs SAC:

- Excavations around poles and stays (within and outside the SAC) will be undertaken in the following manner to ensure restoration success:
    - All excavations will be supervised by the Project Ecologist / ECoW.
    - At each location a bog mat will be placed adjacent to the excavation to allow for temporary storage of excavated material.
    - Turves will be taken to a depth of 350-500mm to ensure viability for replacement.
    - Where feasible, the turves will be simply 'folded' over onto adjacent vegetation to allow for optimal restoration.
    - Any lifted turves will be stored separately and the correct way up on the bog mat.
    - Any remaining acrotelmic peat (peat down to a depth of up to 5-800mm from the vegetation surface) will then be excavated and stored separately on the bog mat.
    - Catotelmic peat (peat below a depth of up to 5-800mm from the vegetation surface) will then be excavated and stored separately on the bog mat.
    - Any till will then be excavated and stored separately on the bog mat.
    - Following installation of the pole infrastructure, the excavation will be filled, firstly with any till, then catotelmic peat, acrotelmic peat and then turves. Following the placement of till (which can be heavily tamped down), peat and turves will be gently tamped into place under supervision of the project ecologist / ECoW.
- Trench excavations (within the south-western underground section of the proposal) will be undertaken in the following manner to ensure restoration success and no potential for the creation of preferential sub-surface drainage (north-eastern underground works shall occur within the roadside):
    - Turves / acrotelm peat will be excavated to a minimum of 350mm using a trenching bucket and set to one side of the trench.
    - The turves will be placed immediately outside the side of the excavator tracks in order to avoid impact but to minimise the size of the working corridor.
    - Any remaining acrotelmic peat will be excavated to achieve a total trench depth of no more than 800mm and will be set to the opposite side of the trench from the turves / acrotelm peat. There will be no mixed storage of peat and mineral soil or clay. Any mineral arisings will be stored separately, closer to the trench than the peat to facilitate a clean approach to infilling.
    - The trench will be infilled using mineral arisings first (where they occur), followed by catotelmic peat and then acrotelmic peat and turves at the surface.
    - The turves will be placed the correct way up to cap the restored trench and gently tamped into placed with the excavator bucket. A small amount of peat will be kept back to fill any gaps between the turves. The final restoration of all sections of the trench will be checked by the Project Ecologists / ECoW and any remediation will be carried out as directed either by hand or by excavator, depending on the sensitivity of the area.
- In the absence of mitigation, there may be some potential for the cable route to create a preferential water pathway. This potential will be avoided by the use of dams installed in the trench at 30m intervals. Depending on the substrate, these will be created using plastic piling, impermeable subsoil material or dewatered catotelmic peat. These will be created as sub-surface 'bunds' and will project only to within 350mm of the surface. The approach will ensure that the implementation of these measures will not compromise the surface vegetation restoration.
- There will be no substrate used in the trench in blanket bog (including sand) for any purpose, including blinding, excepting that arising from the excavation itself.

Habitat Restoration
- Within blanket bog / wet heath mosaic at Cloonkeelaun, the approach to excavation and restoration as detailed above in respect of the Ox Mountains Bogs SAC will be applied.
- In all excavation, mineral soils, sub-soil and turves will be stored separately in order to facilitate habitat restoration.

- An ECoW will be employed from the commencement to completion of construction works; responsibilities will include ad hoc input into site remediation, including reseeding.
- Disturbed ground in the vicinity of drains or watercourses will be actively revegetated with appropriate site-typical vegetation immediately post construction.

11.6.2. Operational Phase Mitigation

Restoration

Restoration of Important Habitats

- All construction-phase restoration measures described in Section 11.6.1 will be assessed by the project Ecologist / ECoW and any further measures recommended will be carried out by the contractor and documented in a compliance report.
- A post-construction survey of the electrical connection route will be undertaken following completion of works. If determined appropriate, sheep will be excluded from the area for one year, using existing exclusion fences, to aid recovery of temporary vegetation compaction.

11.6.3. Decommissioning Phase Mitigation

Decommissioning phase impacts are likely to be broadly similar to construction phase impacts, in terms of disturbance through increased noise levels, ground clearance works, and reinstatement; and potential surface water quality impacts from ground disturbance, refueling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed in the construction phase will help ensure that all such impacts are avoided.

Therefore, it is proposed that a Decommissioning Plan be drafted 2 years prior to removal of the EIA Development infrastructure. This will be put into place containing specific actions aimed at protecting important habitats and species, including all the mitigation measures specified for the construction phase. These include limitations on the working corridor, pollution control, minimised impact on habitats, and specific working practices in the vicinity of watercourses and protected species.

These actions will relate to a revised map of important habitats prepared not more than two years prior to decommissioning, and species surveys undertaken not more than one year prior to decommissioning.

Mitigation by Avoidance

Watercourses

The Decommissioning Plan for the EIA Development will have an emphasis on the protection of surface water drainage from silt-laden runoff originating from bare ground, and on high quality habitat restoration to prevent ongoing potential for such runoff following the decommissioning stage.

Designated Areas

The Decommissioning Plan for the EIA Development will include measures for the protection of surface water drainage from silt-laden runoff originating from bare ground, and for high quality habitat restoration to prevent ongoing potential for such runoff following the decommissioning stage. Such measures will also be effective in avoiding decommissioning-stage impacts upon the Ox Mountains Bogs SAC and pNHA. These consist of actions to ensure revegetation of disturbed areas close to watercourses is completed as rapidly as possible.

11.7. Summary of Significant Effects & Residual Impacts

Table 11-9 provides a matrix which lists the Key Ecological Receptors which are considered to be within the zone of influence of the EIA Development and an evaluation of their importance. It also provides a summary of potential impacts and effects on these Key Ecological Receptors and the significance of these effects before mitigation. Finally, the table provides an outline of proposed mitigation measures relevant to each Key Ecological Receptor and the significance of any residual effects.

Before mitigation there is potential for significant effects on features which range from Local Importance (Higher Value) to International Importance.

The aspects of the proposal which, before mitigation have the potential to result in significant effects at the **International** scale, relate to the electrical grid connection aspects within the Ox Mountains Bogs SAC. The adoption of an overhead line approach for this aspect of the works has reduced the actual land take to a minimal level, and potential impacts associated with the works are likely to arise in the event of bad working practices such as uncontrolled access and inappropriate excavation and restoration. These impacts are fully detailed within the accompanying NIS and detailed mitigation proposed. One of the key mitigation measures is a detailed access, delivery and working plan for these works. A Construction Method Statement, incorporating such measures is provided in Appendix 2 of the NIS. The adoption of, and full compliance with, these measures is central to avoiding impact in this project.

Other potential impacts relate to aspects such as potential pollution (hydrocarbons and sediment release), and direct damage to habitats / species and localized habitat degradation. The potential for such impacts is associated with either inappropriate working practices, uncontrolled access, lack of sufficient or good quality restoration or re-vegetation. These issues, although frequently highlighted as potentially resulting in impacts significant at the International Scale (due to the existence of the SAC and its Qualifying Interest features), are easily addressed through appropriate controls (such as pollution control, working corridors, timing of works and restoration approaches) and supervision by an appropriately qualified Project Ecologist / Ecological Clerk of Works.

In terms of habitat loss, significant issues are limited to the loss of approximately 0.6ha of PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic at Cloonkeelaun outside the SAC. This is a permanent loss and will result in a significant residual impact at the **Local** scale. This is considered to be the only significant residual impact following the works and implementation of the proposed mitigation measures.

Table 11-9: Residual Impacts of the EIA Development

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
Ox Mountains Bogs SAC and pNHA	International	Construction phase	*Direct* – Overhead cabling operations potentially resulting in habitat loss / damage and compaction.	Loss of QI habitat (Blanket Bog and Wet Heath) (1.44m^2). Excavation of QI habitat (Blanket Bog and Wet Heath) (140m^2). Compaction / damage due to access along 2km route.	Potentially ***Significant*** impacts on the Ox Mountains Bogs SAC at the ***International*** scale. Potentially ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1). Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Works within the Ox Mountains SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	***Not Significant***
			Secondary – Localised smothering or pollution of habitats by hydrocarbons or silt. Pollution of flushes supporting QI species	Localised habitat damage. Reduction in suitability of areas to support QI species.	Potentially ***Significant*** impacts on the Ox Mountains Bogs SAC at the ***International*** scale. Potentially ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale		
		Operational Phase	*Direct* – Localised smothering of habitats by silt from unvegetated areas.	Change to QI habitats. Arising from sediment from open areas due to run-off.	Potentially ***Significant*** impacts on the Ox Mountains Bogs SAC at the ***International*** scale. Potentially ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale		
			Secondary – Disruption to drainage flows water quality due to	Change to QI habitats from water flow changes	Potentially ***Significant*** impacts on the Ox Mountains Bogs SAC at the ***International*** scale.		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			unvegetated areas.		Potentially ***Significant*** impacts on the Ox Mountains Bogs pNHA at the ***National*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Easky River pNHA	National Importance	Construction phase	*Direct* – None	NA	NA	Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2).	***Not Significant***
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Mortality of salmon or prey items, or juvenile fish within the river system.	Potentially ***Significant*** at the ***National*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Mortality of salmon or prey items, or juvenile fish within the river system. Low level impact – limited to area around wind farm only.	***Not Significant***		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
FL1 Dystrophic Lakes	Local (Higher) value	Construction phase	*Direct* – Direct damage through access by machinery and pedestrians during pole erection and stringing	Direct damage (eg rutting) of habitat	Potentially ***Significant*** at the ***International*** scale	Strict working corridor and access procedure for all works within the Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in	***Not Significant***
			Secondary – Pollution of habitats	Pollution, affecting indicator species	Potentially ***Significant*** at the ***International*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			by hydrocarbons or silt			each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1). No winch or cable drums within the Ox Mountains Bogs SAC. Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas / infrastructure	Change to substrate	Potentially ***Significant*** at the ***Local*** to ***International*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
GS3 / GS4 Dry Humid Acid Grassland / Wet Grassland	Local (Higher) value	Construction phase	*Direct* – Direct damage to habitat through machinery access	Potential impact on areas suitable for QI Geyer's whorl snail	Potentially ***Significant*** at the ***International*** scale	50m watercourse buffer in place on the Gowlan River and tributaries within the Ox Mountains Bogs SAC. No access allowed excepting for pulling of cables on foot. Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2).	***Not Significant***
			Secondary – Localised smothering or pollution of habitats by hydrocarbons or silt	Potential impact on areas suitable for QI Geyer's whorl snail	Potentially ***Significant*** at the ***International*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – None	NA	NA		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
HH3 / HH1 Wet Heath / Dry Siliceous Heath	International Importance	Construction phase	*Direct* – Direct damage through access by	Direct damage (eg rutting) of habitat. Damage as a result	Potentially ***Significant*** at the ***International*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be	***Not Significant***

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
Mosaic			machinery and pedestrians during pole erection and stringing. Requirement for excavation for single pole erection.	of ineffective restoration.		delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1). Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
			Secondary – Localised smothering or pollution of habitats by hydrocarbons or silt	Deterioration / change in habitat. Increase in negative indicator species.	Potentially ***Significant*** at the ***International*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Change to substrate	Potentially ***Significant*** at the ***International*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
PB2 Upland Blanket Bog	International Importance	Construction phase	*Direct* – Direct damage through access by machinery and pedestrians during pole erection and stringing.	Direct damage (eg rutting) of habitat.	Potentially ***Significant*** at the ***International*** scale	There will be no vehicular or pedestrian access into or storage of materials within areas mapped as '7130P – Blanket Bog (Active)' in Figure 10 (of the NIS) within the SAC, with the exception of a 40m stretch in the extreme south-west corner of the SAC. Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle	***Not Significant***
			Secondary – Localised smothering or pollution of habitats by hydrocarbons or	Deterioration / change in habitat. Increase in negative indicator species.	Potentially ***Significant*** at the ***International*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			silt			(for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1). No winch or cable drums within the Ox Mountains Bogs SAC. Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Change to substrate	Potentially ***Significant*** at the ***International*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic	International Importance	Construction phase	*Direct* – Direct damage through access by machinery and pedestrians during pole erection and stringing.	Direct damage (eg rutting) of habitat. Damage as a result of ineffective restoration.	Potentially ***Significant*** at the ***International*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach	Potential limited residual impact on of PB2 / HH3 Upland Blanket Bog / Wet Heath Mosaic at Cloonkeelaun (non-SAC) by cabling works.
			Secondary – Localised smothering or pollution of habitats	Deterioration / change in habitat. Increase in negative indicator species.	Potentially ***Significant*** at the ***International*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			by hydrocarbons or silt.			required (NIS section 4.2.3.1). The excavation and restoration and supervision approach required within the Ox Mountains Bogs SAC is also required for works within wet heath and blanket bog habitats outside the SAC (at Cloonkeelaun). Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	***Potentially significant*** at the ***Local*** scale
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Change to substrate	Potentially ***Significant*** at the ***International*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Marsh saxifrage *Saxifraga hirculus*	International Importance	Construction phase	*Direct* – Damage to habitat (eg rutting / compaction	Damage as a result of inappropriate access by machinery accessing or carrying out works	Potentially ***Significant*** at the ***International*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1).	***Not Significant***
			Secondary – Localised smothering or pollution of species by hydrocarbons or silt	Deterioration / change in habitat. Increase in negative indicator species. Potential loss of species.	Potentially ***Significant*** at the ***International*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
		Operational Phase	*Direct* – None	NA	NA	Absolutely no access (including pedestrian) to within 20m of any known or potential marsh saxifrage locations as shown on Figure 15 of the NIS). Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Change to substrate	Potentially ***Significant*** at the ***International*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Three-ranked hump-moss *Meesia triqueta*	National importance	Construction phase	*Direct* – Damage to habitat (eg rutting / compaction	Damage as a result of inappropriate access by machinery accessing or carrying out works	Potentially ***Significant*** at the ***National*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Strict excavation and restoration approach required (NIS section 4.2.3.1).	***Not Significant***
			Secondary – Localised smothering or pollution of species by hydrocarbons or silt	Deterioration / change in habitat. Increase in negative indicator species. Potential loss of species.	Potentially ***Significant*** at the ***National*** scale		
		Operational	*Direct* –	NA	NA		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
		Phase	None			Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Change to substrate	Potentially ***Significant*** at the ***National*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Watercourses	County Importance	Construction phase	*Direct* – Damage to habitat (eg bank rutting / damage to bed)	Damage as a result of inappropriate access by machinery accessing or carrying out works.	Potentially ***Significant*** at the ***County*** scale	No access within 50m of the Gowlan River and tributaries except on foot, and then for cable stringing only. Strict excavation and restoration approach required (NIS section 4.2.3.1). Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	***Not Significant***
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Reduction in the ecological carrying capacity of the river system.	Potentially ***Significant*** at the ***County*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from	Change to substrate	Potentially ***Significant*** at the ***National*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			unvegetated areas / infrastructure				
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Bat species	Local Importance – higher value	Construction phase	*Direct* – None	NA	NA	NA	NA
			Secondary – None	NA	NA	NA	NA
		Operational Phase	*Direct* – None	NA	NA	NA	NA
			Secondary – Displacement	Potential displacement of bats from the area	***Not significant*** Literature shows no significant association between power lines and bat distribution.	NA	***Not Significant***
Otter *Lutra lutra*	Local Importance – higher value	Construction phase	*Direct* – None	NA	NA	Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Strict excavation and restoration approach required (NIS section 4.2.3.1).	***Not Significant***
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Impact on otter prey species and reduction of carrying capacity of river for otters.	Potentially ***Significant*** at the ***Local*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Localised impact on otter prey species and reduction of carrying capacity of river for otters.	Potentially ***Significant*** at the ***Local*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Irish hare *Lepus timidus hibernicus*	Local Importance – higher value	Construction phase	*Direct* – None	NA	NA	NA	***Not Significant***
			Secondary – Loss of habitat	Loss of suitable foraging habitat	***Not significant*** The application site falls within a wider area with		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
					significant areas of suitable habitat. Suitable habitat to be lost is limited.		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – None	NA	NA		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Common frog *Rana temporaria*	Local Importance – higher value	Construction phase	*Direct* – Direct impact as a result of access by machinery	Direct mortality	***Not Significant***	NA	***Not Significant***
			Secondary – Pollution of suitable terrestrial and aquatic habitats for the species.	Degradation of suitable habitat	***Not significant*** Potential area of influence is limited within a very large area of potentially suitable habitat.		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – None	NA	NA		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
common lizard *Zootoca vivipara*	Local Importance – higher value	Construction phase	*Direct* – Direct impact as a result of access by machinery	Direct mortality	***Not Significant***	NA	***Not Significant***
			Secondary – Loss of habitat	Loss of suitable foraging habitat	***Not significant*** The application site falls within a wider area with significant areas of suitable habitat. Suitable habitat to be lost is		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
					limited.		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – None	NA	NA		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Atlantic salmon *Salmo salar*	County Importance	Construction phase	*Direct* – Damage to river bed	Damage as a result of inappropriate access by machinery accessing or carrying out works.	Potentially ***Significant*** at the ***Local*** scale	No access within 50m of the Gowlan River and tributaries except on foot, and then for cable stringing only. Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Strict excavation and restoration approach required (NIS section 4.2.3.1). All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	***Not Significant***
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Direct mortality. Impact on salmon prey species and reduction of carrying capacity of river for Atlantic salmon.	Potentially ***Significant*** at the ***Local*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Localised impact on salmon prey species and reduction of carrying capacity of river for Atlantic salmon.	Potentially ***Significant*** at the ***Local*** scale		
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				
Freshwater pearl mussel *Margaritifera margaritifera*	County Importance	Construction phase	*Direct* – Damage to river bed / mussels	Damage / direct mortality as a result of inappropriate access by machinery	Potentially ***Significant*** at the ***County*** scale	No access within 50m of the Gowlan River and tributaries except on foot, and then for cable stringing only. Pollution control measures as detailed in the	***Not Significant***

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
				accessing or carrying out works.		Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Strict excavation and restoration approach required (NIS section 4.2.3.1). All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
			Secondary – Pollution of watercourse downstream as a result of a pollution event	Direct mortality. Impact on river conditions and reduction of carrying capacity of river for freshwater pearl mussel.	Potentially ***Significant*** at the ***County*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from unvegetated areas	Impact on river conditions and reduction of carrying capacity of river for freshwater pearl mussel.	Potentially ***Significant*** at the ***Local*** scale		
		Decommissioning phase					
Geyer's whorl snail *Vertigo geyeri*	International Importance	Construction phase	*Direct* – Direct impact as a result of access by machinery	Direct mortality / damage to host habitat	Potentially ***Significant*** at the ***International*** scale	Strict working corridor and access procedure for all works within the SAC and all heavy materials, including pole structures will be delivered by air (helicopter) (NIS section 4.2.2.1). Only a single low-pressure (excavator) and ultra-low-pressure vehicle (for materials) used for the works. Excavator movements limited to one pass in each direction within working corridor. Pollution control measures as detailed in the Method Statement – Electrical connection between Black Lough and Cloonkeelaun (NIS Appendix 2). Strict excavation and restoration approach required (NIS section 4.2.3.1).	***Not Significant***
			Secondary – Localised smothering or pollution of species / host habitat by hydrocarbons or silt	Deterioration / change in habitat. Potential loss of species.	Potentially ***Significant*** at the ***International*** scale		
		Operational Phase	*Direct* – None	NA	NA		
			Secondary – Potential low-level impacts from washout of sediments from	Change to substrate in host habitat	Potentially ***Significant*** at the ***International*** scale		

Key Ecological Receptor	Evaluation of importance	Potential Impacts and their origin		Potential Effect	Potential Significance without Mitigation	Proposed Mitigation / Compensation	Residual Effects
			unvegetated areas			Absolutely no access (including pedestrian) to within 20m of any known or potential Geyer's whorl snail locations as shown on Figure 15 of the NIS). No access within 50m of the Gowlan River and tributaries except on foot, and then for cable stringing only. Works within the Ox Mountains Bogs SAC will be undertaken during a dry period (with Spring - Autumn preferred, taking account of the requirements to protect nesting birds as detailed in Chapter 12), as agreed with the Project Ecologist / ECoW All works within and adjacent to the SAC to be fully supervised by an appropriately qualified Project Ecologist / Ecological Clerk of Works.	
		Decommissioning phase	Potential impacts broadly similar to those of construction phase				

12.BIODIVERSITY - AVIAN ECOLOGY

12.1. Introduction

This chapter of the EIAR has been produced by Nelson Ecology Ltd, and evaluates the impacts of the proposed electrical connection (between Black Lough and Cloonkeelaun) on the ornithological interests in the area. The potential for cumulative impacts of the permitted wind farms (Black Lough and Cloonkeelaun) and grid connection route is assessed. Potential impacts on non-avian ecology, including habitats and non-avian species are considered separately in Chapter 11, Biodiversity – Flora & Fauna. This report details bird surveys of historical bird dynamics in the area and current bird surveys on-going in the Black Lough area.

Bird surveys were carried out in 2009, 2012 and 2018 to include three non-breeding seasons and one breeding season to comprehensively study bird activity at the planning application boundary and the adjacent wider area and adhere to best practise guidance (SNH, 2014). Bird surveys were also completed in adjacent projects that contribute to an overall compilation of bird information in the Black Lough and hinterland area. Carrowleagh Wind Farm has been studied for a considerable number of years and is adjacent to Cloonkeelaun and comes within the remit of Carrowleagh birds studies. Carrowleagh was surveyed for birds in 2005 and 2006 (Perry, 2006). The site has also been monitored from 2009 until 2014 (Wetland Surveys Ireland, 2016).

This chapter is supported by the following Technical Appendices, which will provide full details of the ornithological surveys:

- Appendix 12-1 Tables
- Appendix 12-2 Figures
- Appendix 12-3 Methods
- Appendix 12-4 References

During the course of the study no access difficulties were encountered, and no information gaps have been identified.

The proposed development site at Tawnamore and Cloonkeelaun is situated between Irish Grid Reference G377238 and G392256. The site is 8.8km south of the small town of Dromore West and 40km from Sligo town. The development area is situated adjacent to the Ox Mountains (Slieve Gamph) mountain range which runs southwest to northeast through counties Mayo and Sligo to the east of the site. The proposed development is an electrical connection (consisting of overhead line and underground cable) between T2 and the control building at Cloonkeelaun, crossing the Ox Mountains Bogs SAC. Figures 2-1 and 2-2 show the proposed development location.

12.1.1. Study Area

The planning application boundary has increased during the bird study timeframe. The assessment area and vantage point (VP) locations have remained the same to give a consistent study area through the assessment period. The assessment area included an 800m buffer and a wider area up to 2km during both breeding and non-breeding seasons to give comprehensive coverage of the planning application boundary and the wider local area. The VP range from the Black Lough studies covers a section of the wider area to Cloonkeelaun. The walkover is also within the section of the wider area of Cloonkeelaun. The Carrowleagh VP1 range also covered the Cloonkeelaun area in studies for bird movements and populations providing overlap with the area covered by the Black Lough VP.

12.1.2. Field Survey Methodologies

The survey methodologies utilised for the various field ornithological surveys are summarised below. These surveys adhered to relevant Scottish National Heritage guidance (SNH, 2014). More comprehensive survey method details can be found in Appendix 12-3.

Target Species
SNH (2014) provides a list of 35 species which are both of sufficient conservation concern and utilise habitats or have flight behaviours such as to give rise to potential damaging impacts from wind farms. Most of the list is also relevant to Ireland, with a few exceptions being species restricted to Scotland (e.g. breeding divers, golden eagle etc.).

The SNH list, with a few amendments relevant to Ireland, was used as a basis for bird survey assessment requirements, especially those of regional conservation concern; such species are termed 'secondary species'. Target and secondary species for surveys at the application site are summarised in Table 12-1.

Table 12-1: Target and Secondary Species

Target Species	Secondary Species
Hen Harrier	All other raptors
Peregrine Falcon	All notable non-passerines
Merlin	Particularly large flocks of any species
All breeding waders	---
All Wildfowl	---

Vantage Point Watches
One vantage point (VP) was used during surveys throughout the survey period from February to March 2009 and April to August 2009. Updated surveys were completed from September 2012 to February 2013 to adhere to concerns from NPWS on appropriate survey effort. Surveys have been completed in February and March 2018 and are continuing on a monthly basis from August 2018 to present and will continue until construction has been completed. The VP range take in all turbine locations and is situated to view any significant bird movements through the proposed wind farm area, including the proposed electrical connection. Large wildfowl and raptors were targeted in the VP surveys. The VPs are illustrated in Figure 12-4 and demonstrate the coverage provided.

A point within 2km of the Black Lough development site was chosen (Grid Ref G394244) to give a clear 180° view of the development area and electrical connection line. This point was far enough away from the development area to not be considered to be of disturbance to any birds within or flying through the immediate site. The winter vantage point watches were carried out in early morning and also an hour before dusk to incorporate roost watches for target species. A point in Carrowleagh (Grid Ref G372225) was selected in Carrowleagh which provides coverage of the Cloonkeelaun site and southern section of the proposed electrical connection.

Vantage point watches gave an elevated viewpoint in which to assess the time the bird takes to pass through the development area and gave an angle to be able to assess the height at which the birds are flying. Height is important to determine collision risk if necessary. Target species such as Hen Harrier and Greenland White-Fronted Geese may qualify for a collision risk assessment (Band et al 2007). This method assesses the species probability of collision with turbine blades through a collision risk model. Heights and timing of these species would have to be documented to enter into the collision risk model for analysis. Turbines T5 and T6 were located slightly outside the view of the Black Lough wind farm vantage point extent and on the edge of the walkover route but are covered by the Carrowleagh VP. The Carrowleagh surveys which were conducted in 2005/6 and 2009 to 2014 with VP1 of this project covering the T5/T6 area. Figure 12-4 shows the location of both the Black Lough and Carrowleagh VPs. Results of the Carrowleagh surveys were similar to that carried out at Black Lough, summaries of key species can be viewed at Appendix 12-1 Tables 12.8 to 12.17.

Breeding Bird Surveys
A summary of breeding bird surveys during each survey period (2009 breeding season) are provided below. Survey study areas adhered to those recommended within SNH guidance (where accessible).

Table 12-2: Breeding Bird Walkover Surveys

Survey	Area (Minimum)
Brown and Shepherd upland wader surveys to include all species.	Planning application boundary and 800m buffer zone from turbine locations.

Non-Breeding Bird Walkover Surveys
Winter walkover surveys were carried out in February and March 2009 (three visits). The dates, times and duration of each survey are logged in tables at Appendix 12-1. Updated surveys were carried out during the winter season in 2012/13 from September to January. Surveys are currently being completed monthly from August 2018. For the Cloonkeelaun area, the Carrowleagh bird monitoring and breeding bird surveys provide robust coverage of the proposed electrical connection. Similar results can be seen summarised in Appendix 12-1 tables 12.8 to 12.17.

The survey method of winter walkover was adapted from the Brown and Shepherd (1993) method (Gilbert *et al* 1998). This involved a timed walkover of the site attempting to reach all areas of ornithological interest, e.g. suitable Red Grouse habitat, Hen Harrier roosting habitat, forestry edges, streams and lakes. The development area and 800m buffer zone was focussed on and walked to within 200m of each point and the surrounding landholdings were also walked to within 200m of all points. Weather conditions were recorded. All birds were logged on suitable maps (1-5000), grid reference, time and height details were recorded for target species. Small areas within the site boundary could not be walked because of extremely wet and marshy bog habitat but these were small and most of the site was accessible. A map of walkover route available in Appendix 12-1 Figure 12-2.

Winter weather can be variable so it was determined preceding survey dates what days would be best for survey in advance. Days when the wind force would be below force 4 (Beaufort), days that had no rain or snow. Visibility had to be classed as very good in order to give an adequate view of the site and surrounding area. All weather conditions would be suitable in accordance with new SNH methods (SNH, 2014).

Purpose:
- To identify and log all wintering bird species.
- To adequately cover the entire site and focus on the development area.
- Locate target species.
- Assess bird communities using the site in winter

Red Grouse Tape Lure Surveys
Tawnamore and the surrounding Ox Mountains have historically held numbers of Red Grouse (Robert Lundy NPWS per com, Cummins *et al* 2009). It was decided to take an extra focus on the movements and numbers of Red Grouse in the area. The Red Grouse is a BoCC (Birds of Conservation Concern 2008-2013) red list species and has had a major decline in Northern Ireland 70% (Allen 2004) and has also had a decline of more than 70% in the south of Ireland (Lynas *et al* 2007, Cummins *et al* 2009).

A tape lure licence was obtained from the NPWS licensing unit to gain permission to tape lure Red Grouse. The licence is only valid during the winter season as it is illegal to tape lure Red Grouse during the breeding season. The tape lure method was taken from the 2007 Bird Watch Ireland field methods used in the national survey of Red Grouse (Cummins *et al* 2009). Male Red Grouse hold territories in their winter grounds in preparation for the breeding season and the use of a male recording of the territorial call provokes a response from any territorial male within 500m of the tape lure.

A digital recording of a male Red Grouse and its familiar territorial go-bak go-bak go-bak call was obtained from Bird Watch Ireland Red Grouse Officer Dr Sinead Cummings. The recording was played on a small stereo with enough power to make the call audible within 500m of each point. The call was played at 250m points through the site and any calling males that called back or flew towards the call would be registered on maps. Red Grouse can be flushed during walkover surveys if they are in the area and any birds flushed during walkover surveys were also logged onto maps. Red grouse tape lure survey details are available in Appendix 12-1.

Breeding Bird Walkover Surveys
Surveys for breeding birds were carried out at Black Lough from April to August 2009. The surveys were carried out two days per month in good weather conditions to give optimum results. The paths used to carry out the breeding bird surveys were chosen to give an overall coverage of the main breeding bird areas. Different areas of the site have had varying densities of breeding birds and the path was chosen to include these areas. Woodland, streams, rivers, lakes, hedgerows and the bog areas were all taken into account when designing the walkthrough course encompassing the landholding boundary and the 800m buffer zone. Other areas outside of the development area were also surveyed for breeding birds. These areas may have assemblages of birds that may not be associated with the development area but may be travelling through the area on feeding trips and may be indirectly affected by the development. Easky Lough (G445229) and Lough Ahusy (G395227) which have recorded important breeding birds such as the Red Listed Black Headed Gull and Red Throated Diver historically. The corridor of the proposed electrical connection was viewed on the edge of the walkover surveys.

During the 2009 breeding season the development area and 800m buffer zone were surveyed using a modified version of the Brown and Shepherd method for upland breeding waders (Gilbert et al 1998). This modification as advised also takes in the full range of other species within the site boundaries and buffer zones (SNH 2014). The licence for tape luring Red Grouse is only applied during the winter survey so this method also flushed Red Grouse to indicate breeding areas. Two walkover breeding bird surveys were completed in August 2016 to identify any existing additional BoCC that may be nesting within the site and 800m buffer. These surveys although not a complete breeding season survey did not identify any new up to date target species using the site and 800m buffer. The site was walked over in February and March 2018 and further in August 2018. The site has been surveyed monthly with walkover surveys since August 2018 and will continue until wind farm construction is completed.

NPWS staff, local gun clubs and adjacent landowners were consulted to establish numbers and species of breeding birds. This gives some historical significance to the species that may have been present in the area in the past but may not be there now or may be present in small numbers. The meetings with NPWS staff gave some up to date records of certain species that may or may not be utilising the site for wintering and breeding.

There were two focal areas for the survey methodologies to be taken into consideration. The first was the proposed development site or the proposed wind farm construction area which will be walked along with the immediate surroundings to assess if there are any species of note or high numbers of species. Secondly the wider areas were assessed while walking through the bog areas to the west and south to include the entire landholding and the corridor of the proposed electrical connection. These areas were associated with better quality habitat areas of the Ox Mountains Bogs SAC that may be more suitable for sensitive target species.

12.1.1. CIEEM Impact Assessment Methodology

The CIEEM Guidelines for Ecological Impact Assessment in the United Kingdom (CIEEM, 2016 2nd ed) (henceforth referred to as the CIEEM guidelines) form the basis of the impact assessment presented in this chapter. These guidelines, combined with relevant SNH guidance, set out a process of identifying the value of each ecological receptor and then characterising the impacts that are predicted, before discussing the effects on the integrity or conservation status of the receptor, proposed mitigation and residual impacts.

The initial action for any assessment of impacts is to determine which features should be subject to detailed assessment. The ornithological receptors to be the subject of more detailed assessment should be of sufficient value that impacts upon them may be significant in terms of either legislation or policy. The receptors should also be vulnerable to significant impacts arising from the development – such species are listed in SNH guidance, although as stated this list has been amended slightly to reflect the fact certain species included in the guidance are not relevant to Northern Ireland and some are recently relevant (introductions).

The CIEEM guidelines indicate a four stage process for impact assessment; scoping and setting a zone of influence, determining the value of the receptors, predicting/characterising impacts and determining the significance of these impacts.

Determining Value
The CIEEM guidelines recommend that the value of ecological receptors or features is determined based on a geographic frame of reference. For this project the following geographic frame of reference is used:

i) International; (World)
ii) National (Ireland);
iii) Regional (North West Ireland);
iv) County (Sligo); and
v) Local (within 2km).

Valuing Species
In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Rarity is an important consideration because of its relationship with threat and vulnerability although since some species are inherently rare, it is necessary to look at rarity in the context of status. A species that is rare and declining should be assigned a higher level of importance than one that is rare with a stable population.

Reference is also made to Birds of Conservation Concern Ireland 2014 (BoCC 2014) and other indicators of conservation status as appropriate, although it should be noted that the existence of a priority species does not necessarily imply any specific level of importance.

Where appropriate, the value of species is determined by using the standard one percent criterion method. Using this method the presence of >1% of the international population of a species is considered internationally important, >1% of the national population is considered nationally important, etc.

Predicting and Characterising Impacts
In accordance with CIEEM guidelines, when describing impacts reference is made to the following:

i) Confidence in predictions, i.e. the level of certainty that an impact will occur as predicted, based on professional judgement and where possible evidence from other schemes – this is based on a three point scale; certain/near certain, probable and unlikely.
ii) Magnitude – i.e. the size of an impact in quantitative terms where possible.
iii) Extent – i.e. the area over which an impact occurs.
iv) Duration – i.e. the time for which an impact is expected to last.
v) Reversibility – i.e. a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it. A temporary impact is one from which a spontaneous recovery is possible.
vi) Timing and frequency – i.e. whether impacts occur during critical life stages or seasons.

Both direct and indirect impacts are considered: direct impacts are changes that are directly attributable to a defined action, e.g. through collision with turbines. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or receptor, such as impacts on adjacent habitats due to hydrological changes.

Significance Criteria
In accordance with the CIEEM guidelines, a significant impact, in ecological terms, is defined as 'an impact (whether adverse or beneficial) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area, including cumulative and in-combination impacts.

The approach adopted here aims to determine an impact to be ecologically significant or not on the basis of a discussion of the factors that characterise it, i.e. the ecological significance of an impact is not dependent on the value of the feature in question. The value of a feature that will be significantly affected is used to determine the geographical scale at which the impact is significant, e.g. an ecologically significant impact on a feature of county importance would be considered to represent a significant impact at a county level. This in turn should be used to determine the implications in terms of legislation, policy and / or development control.

Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy and development control in determining the application.

12.2. Explanation of Baseline Conditions

12.2.1. Baseline Conditions

The proposed development is to erect an internal wind farm electrical connection to service 6 No permitted turbines at Black Lough and Cloonkeelaun. The proposed connection is 2.64km long, with 2.3km of overhead line mounted in wooden poles and 300m of underground cabling. The site is situated between Irish Grid Reference G377238 and G392256. It consists of managed farmland at the northern section and grades into blanket bog, crosses the Gowlan River and enters the Ox Mountains Bogs SAC. Approximately 2km of the overhead line is located within the Ox Mountains Bogs SAC. Underground cabling is used at either end so that overhead lines are not within the fall radius of the turbines (ESB safety specification).

The development site is open and unused for the most part; there is low intensity sheep grazing. Peat extraction is done by mechanical extraction at the Black Lough Wind Farm site. Sheep and cattle grazing also occurs in the agricultural fields within the site boundaries.

The landholding has a medium-size lake (Black Lough) and functioning farm with landowners living locally to the site. The wider landholding area has forestry at the southern edges and various bog streams and bog loughs throughout.

12.2.2. Scoping and Consultation

Table 12-3 summarises the pre-application scoping and consultations.

Table 12-3: Scoping Responses

Consultee	When	Format	Response	Comment
NPWS	2009	On site meeting	Details of historical bird numbers/distribution	Identification of nesting Red Grouse and other species territories.
NBN Gateway	2009, 2012, 2016	Online	Bird Database Records	none
National Biodiversity Data Centre	2012, 2016	Online	Bird Database Records	none

12.2.3. Desk Study

The locations and details of internationally designated sites within 10km are provided below. A detailed description is only provided for sites which are designated on account of, or partly because of their ornithological value.

The proposed development is an electrical connection, of which 2km of overhead portion passes through the Ox Mountains Bogs SAC.

The Ox Mountains Bogs SAC is a complex of blanket bog systems within and surrounding the Slieve Gamph, or Ox Mountain Range. Most of the SAC, which is 10570ha in area, is in County Sligo, with a small part in County Mayo. Lough Easky lies towards the center of the SAC. The SAC is somewhat fragmented, largely due to conifer plantations and areas of turbary.

Table 12-4: Designated Sites within 10km Radius

Site and Designation	Area (ha)	Distance and Direction from Site	Designation Characteristics
Internationally Designated Sites within 10km			
Ox Mountains Bogs SAC	10570.31	Within site boundaries (overhead electrical cable only)	Annex 1 Habitats, Geyers Whorl Snail
Knockalongy and Knockachree SAC	111.37	6.6km North east	Killarney Fern
Lough Nabrickeagh Bog SAC	271.94	9.5km South south west	Annex 1 Habitats
Lough Hoe Bog	3215.41	9.5km South west	Annex 1 Habitats, Geyers Whorl Snail, White-clawed Crayfish
River Moy SAC	15396.45	9.2km South west	Annex 1 Habitats, Brook Lamprey, Salmon, Otter

The Ox Mountains Bogs SAC is notable for the extensive tracts of active blanket bog, a priority habitat under the EU Habitats Directive. The bogs exhibit a range of types according to altitude, ranging from the lowland blanket bogs of Fiddandarry and Letterunshin, to the mountain blanket bog of Laughil. A special feature of these bog systems are the complexes of inter-connecting pool systems. Wet heath is widespread throughout parts of the site, particularly on the steeper mountain slopes. Lake habitats also occur within the SAC.

12.3. Ornithological Survey Results

12.3.1. Survey Data

Results of the ornithological surveys undertaken are summarised in this section. More detailed information can be found in Appendix 12-1.

Non-Breeding Bird Surveys (January to March 2009 and September to January 2012/2013, February -March and August to December 2018). Additional to the Black Lough bird surveys bird monitoring has been completed at Carrowleagh. Surveys were completed in 2005/6 and 2009-2014. Results show that there were up to 44 species registered during the winter season at the site and the surrounding area, eight that are BoCC amber list status and three (Red Grouse, Meadow Pipit and Golden Plover) are Red list status. Red Grouse and Golden Plover were found outside the direct development site and passing through on route.

Meadow Pipit, Red Grouse and Golden Plover are Red list BoCC status. Red Grouse and Golden Plover were found outside the direct development site and passing through on route. Red Grouse were only found on wider landholdings on the upland Plateau west and south west of the development site (Figure 12-4). No new species of conservation concern were found on site during non-breeding season surveys in 2012/13. Red Grouse and Golden Plover were still active in the local area adjacent to the development site. Meadow Pipit were found within the proposed site boundaries in medium numbers.

The Carrowleagh VP, indicated in Figure 12-4, has 6 years of bird study in total and has comparison list of species to the Black Lough bird studies. In the results section the Carrowleagh/Cloonkeelaun site survey results will be used to indicate any potential significant impacts to birds from the electrical overhead connection.

Birds were recorded within the non-breeding season timescale, it is not considered, based on their non-breeding timeframes, that they are non-breeding season species within the local area. These species were recorded within the non-breeding season period (September - February) but not within the main breeding season and considered non-breeding, passage individuals recorded during passage periods only. These species where Sand Martin, Swallow and Willow Warbler. Results are provided in Tables 12-5 to 12-7.

The results from Table 12.5 below show during the summering/breeding season at the proposed development site and surrounding landholdings registered 56 species in total. Three (Red Grouse Meadow Pipit and Herring gull) are classed as red list BoCC and 19 amber list BoCC.

Table 12-5: Birds Recorded during the Non-breeding Season 2009 and 2012/13

Species	BTO CODE	Date								
		07/02/09	28/02/09	21/03/09	16/09/12	01/10/12	10/12/12	20/12/12	05/01/13	06/01/13
CHAFFINCH	CH	3	6	---	2	5	11	8	2	6
CORMORANT	CA	---	---	---	---	1	1	1	1	1
FIELDFARE	FF	37	6	7	---	---	35	54	86	45
GOLDEN PLOVER	GP	28	74	17	5	4	8	12	---	33
HEN HARRIER	HH	1	---	---	---	---	1	---	---	---
HOODED CROW	HC	7	5	3	8	15	9	12	7	16
JACKDAW	JD	2	4	---	7	5	3	7	2	14
KESTREL	K	---	1	1	1	1	1	1	1	1
LINNET	LI	---	---	5	2	---	---	2	2	11
MAGPIE	MG	3	2	3	2	6	6	4	2	7
MALLARD	MA	---	---	4	---	---	---	2	---	2
MEADOW PIPIT	MP	4	2	10	18	15	6	12	22	9
PIED WAGTAIL	PW	---	---	---	---		2	2	1	2
RAVEN	RN	---	---	1	2	2	4	7	4	9
RED GROUSE	RG	1	---	---	---	---	2	2	---	2
REDWING	RE	3	5	---	---	---	1	9	10	---
ROBIN	R.	2	1	1	---	---	4	3	1	2
SAND MARTIN	HM	---	---	---	7	---	---	---	---	---
SISKIN	SK	2	6	3	---	4	---	2	---	---
SKYLARK	S.	---	---	5	2	1	---		2	---
SNIPE	SN	3	1	2	1	2	3	2	1	2
SPARROWHAWK	SH	---	---	1	---	1	---	1	---	---
STARLING	SG	47	12	---	---	70	34	9	6	25
STONECHAT	SC	2	2	---	2	4	---	---	---	---
SWALLOW	SL	---	---	---	8	2	---	---	---	---
WILLOW WARBLER	WW	---	---	---	3	1	---	---	---	---
WOOD PIGEON	WP	1	4	---	2	6	---	2	11	2

Table 12-6: Birds Recorded during the Breeding Season 2009

Species	BTO CODE	Date								
		17/04/09	25-24/04/09	03/05/09	23/05/09	22/06/09	30/06/09	16/07/09	18/07/09	27/08/09
LITTLE GREBE	LG	---	---	---	---	---	---	---	2	---
GANNET	GX	---	---	1	---	---	---	---	---	---
CORMORANT	CA	---	---	---	---	---	1	---	---	---
GREY HERON	H.	1	2	2	2	1	2	2	3	2
MALLARD	MA	---	2	2		2	8	---	---	4
TEAL	T.	---	---	2	5	---	2	---	---	---
SPARROWHAWK	SH	---	1	1		2	2	1	2	1
KESTREL	K.	1	1	1	2	2	2	1	2	2
RED GROUSE	RG	---	---	1	---	---	---	---	---	---
PHEASANT	PH	---	---	---	1	2	4	---	5	2
LINNET	LI		14	5	2	7	3	3	14	3
MEADOW PIPIT	MP	19	18	19	25	34	32	40	33	17
SKYLARK	S	13	5	8	15	15	10	5	7	3
CHIFFCHAFF	CC	---	---	---	2	4	2	2	2	---
WILLOW WARBLER	WW	---	---	4	5	6	5	4	12	---
HOODED CROW	HC	8	18	5	5	8	12	2	3	6
RAVEN	RN	3	2	3	4	5	6	4	6	3
BLUE TIT	BT	---	---	2	3	4	6	2	4	2
GREAT TIT	GT	---	---	4	5	2	2	2	6	1
ROBIN	R	---	2	3	5	4	6	5	3	5
DUNNOCK	D.	---	---	2	2	2	1	---	1	2
WOOD PIGEON	WP	2	3	4	8	10	11	3	12	3
SWIFT	SI	---	---	8	7	14	2	---	23	5
WREN	WR	1	2	4	10	9	14	8	9	9
BLACKBIRD	B.	2		2	2	4	2	4	2	2
SNIPE	SN	5	7	2	5	7	7	2	5	2
COMMON SANDPIPER	CS	---	---	2	2	2	2	2	2	---
GOLDCREST	GC	---	---	---	4	3	4	---	2	3
GOLDFINCH	GO	---	---	4	---	5	---	---	3	6
COMMON GULL	CM	---	4	2	---	2	3	---	---	5
HERRING GULL	HG	---	---	---	1		---	---	---	7
COLLARD DOVE	CD	---	---	---	1	2	2	2	2	---
JACKDAW	JD	9	3	---	5	15	2	2	13	---
SONG THRUSH	ST	---	2	---	1	2	---	1	---	3
MISTLE THRUSH	M.	---	---	---	2	1	---	2	---	3
CUCKOO	CK	---	---	1	1	1	---	---	---	---
SAND MARTIN	SM	8	23	5	78	63	35	43	21	13
HOUSE MARTIN	HM	16	---	12	2	---	---	---	---	5
SWALLOW	SL	14	18	18	14	22	27	27	37	16
GREY WAGTAIL	GL		2	2	2	4	4	2	2	---
PIED WAGTAIL	PW	2	2	4	4	4	4	2	2	---
STONECHAT	SC	4	4	2	2	4	2	2	3	---
WHEATEAR	W.	2	6	---	2	4	2	---	---	---
GRASSHOPPER WARBLER	GH	---	---	---	---	1	1	---	---	---
SEDGE WARBLER	SW	---	---	2	2	3	2	2	2	---
COAL TIT	CT	---	---	---	2	---	---	---	---	---
MAGPIE	MG	---	2	5	3	6	3	7	2	4
ROOK	RO	---	4	---	4	13	---	---	---	3
STARLING	SG	23	12	21	23	12	12	34	112	32
CHAFFINCH	CH	---	5	4	5	9	12	11	15	2
SISKIN	SK	---	---	4	---	5	2	9	10	---
REDPOLL	LR	---	---	---	---	---	2	2	3	---
REED BUNTING	RB	---	---	2	2	4	2	2	5	--
DIPPER	DI	---	2	2	2	2	2	4	1	1
HOUSE SPARROW	HS	---	8	8	23	5	2	---	11	5
SPOTTED FLYCATCHER	SF	---	---	---	---	---	---	2	3	2

Table 12-7: Birds Recorded during the Non-breeding Season 2018

Species	BTO CODE	Date							
		27/08/18	23/09/18	25/09/18	03/10/18	04/10/18	24/11/18	29/12/18	30/12/18
CORMORANT	CA	0	0	1	0	2	0	0	0
GREY HERON	H.	0	0	1	0	1	1	0	0
GOLDEN PLOVER	GP	0	0	0	0	0	16	8	9
MALLARD	MA	0	2	0	0	0	4	0	0
SPARROWHAWK	SH	0	0	0	1	0	0	0	0
KESTREL	K.	1	1	1	0	0	1	0	1
RED GROUSE	RG	0	0	1	0	2	0	0	0
PHEASANT	PH	0	0	0	0	1	0	0	0
LINNET	LI	5	0	0	0	0	0	8	2
MEADOW PIPIT	MP	15	8	14	12	6	8	2	3
SKYLARK	S	6	2	4	3	0	0	2	1
WILLOW WARBLER	WW	2	0	0	0	0	0	0	0
HOODED CROW	HC	5	7	4	12	9	12	4	3
RAVEN	RN	0	2	0	4	2	1	0	0
BLUE TIT	BT	0	0	0	3	0	0	4	0
GREAT TIT	GT	0	0	0	0	2	0	0	0
ROBIN	R	2	4	2	2	2	2	0	3
DUNNOCK	D.	2	0	0	1	0	1	0	0
WOOD PIGEON	WP	5	2	8	4	1	1	0	2
WREN	WR	6	5	4	7	3	3	3	2
BLACKBIRD	B.	2	2	5	4	6	2	1	3
SNIPE	SN	0	0	2	5	0	2	4	0
GOLDFINCH	GO	0	0	18	11	0	6	5	14
COMMON GULL	CM	2	0	0	0	4	0	0	0
HERRING GULL	HG	0	0	2	0	3	0	0	0
LESSER BLACK-BACKED GULL	LB	14	2	8	0	0	5	7	9
JACKDAW	JD	12	0	14	7	0	2	15	0
SONG THRUSH	ST	1	2	0	0	2	0	1	1
MISTLE THRUSH	M.	2	2	2	2	0	4	0	0
SAND MARTIN	SM	14	0	0	0	0	0	0	0
SWALLOW	SL	18	2	0	0	0	0	0	0
GREY WAGTAIL	GL	0	0	0	2	0	0	0	0
PIED WAGTAIL	PW	8	2	2	4	0	4	0	2
STONECHAT	SC	4	2	2	4	1	0	0	0
COAL TIT	CT	1	2	2	0	0	0	0	0
MAGPIE	MG	7	2	5	5	4	5	2	6
ROOK	RO	12	0	0	10	4	0	0	0
STARLING	SG	10	14	18	6	5	5	0	0
CHAFFINCH	CH	2	4	4	2	2	2	0	4
SISKIN	SK	0	0	0	4	0	0	6	4
REDPOLL	LR	0	0	0	4	2	8	4	0
REED BUNTING	RB	1	1	0	0	0	0	0	0
DIPPER	DI	2	0	1	0	1	0	0	0
HOUSE SPARROW	HS	18	5	7	6	6	0	0	7

12.3.2. Information Gaps

No significant information gaps have been identified.

12.4. Identification & Evaluation of Ecological Features Likely to be Affected

12.4.1. Valued Ecological Receptors

Sites Designated for Ornithological Interest
No sites have been designated because of their ornithological value within 10km of the proposed site. Greenland White-Fronted Geese, a protected and declining species in Ireland with high conservation value have been recorded in the wider area but none have been recorded in the Black Lough or Carrowleagh bird monitoring. No Greenland White-Fronted Geese where recorded during site surveys.

Species of Conservation Value - Non-Breeding Season
Of the 44 species recorded during the non-breeding seasons 14 are amber listed and 4, Red Grouse, Meadow Pipit, Grey Wagtail and Golden Plover are red listed BoCC. Golden Plover are EU Annex 1 listed species also.

Species of Conservation Value - Breeding Season
Of the 56 species recorded during the breeding season at the proposed site, 4 are red listed BoCC and 19 are amber listed. No new species were logged in two updated breeding bird walkover surveys in August 2016.

Hen Harrier
Hen Harrier is included on Annex 1 of the EC Birds Directive and BoCC Amber listed.

The planning application boundary area and surrounding Ox Mountains is suitable non-breeding habitat for Hen Harrier to forage and roost. Although there is extensive suitable habitat in the Ox Mountains there are very few records of Hen Harrier during the non-breeding season (NPWS per comms).

The proposed site area and wider adjacent lands are not a regular foraging area for Hen Harrier with only two registrations during the non-breeding season. Hen harrier were recorded only once near the proposed development area, the 1st record was recorded close to T5 on route and was not recorded in subsequent surveys.

Although Hen Harrier activity was low in the area the value of this species to the area could be high and for this it's of **County** value.

Red Grouse
Red Grouse is red listed on BoCC and a declining species in Ireland. The breeding population in Ireland has had somewhat of a decline with an estimated 70% decline in the past 40 years (Cummings et al 2009).

Populations are stable within the Ox Mountains and available habitat is abundant, it is determined that because of available widespread suitable habitat and a healthy population in the Ox Mountains Bogs SAC that Red Grouse are of **Local value**.

Golden Plover
Golden Plover is red listed Bird of Conservation Concern (BoCC) and Annex 1 of the EC Birds Directive. This species did not breed on site or within the 800m survey buffer zone. Up to 74 birds were recorded during the 2009, 2012 and 2016 non-breeding seasons. Numbers were recorded flying around the flat bog/farmland in the wider area and in the SAC.

The Irish non-breeding population of Golden Plover was estimated at 166,700 (Crowe et. al,2008). County populations are not known. It is unknown how many of these birds reside in County Sligo, or wider Ox Mountains area, although it seems likely that the peak of 74 birds recorded within the site and buffer zone represents considerably less than 1% of the Irish or even County populations. The records during the non-breeding period suggest that the proposed development site and buffer zone is not regularly inhabited, with small numbers inhabiting the area maybe as a stopover point infrequently. The proposed site and buffer zone are considered to be of **Local** value for Golden Plover.

Snipe

Snipe is an Irish Amber List species. The total estimate of pairs thought to reside in Northern Ireland during the breeding season is 1300 pairs. The local population is not known. The population of this species in Northern Ireland has had a 60% decline between 1987 and 2014 (Henderson et al 2000). Similar declines can be assumed from the all Ireland population.

Low productivity levels in Snipe populations as a result of predation of eggs and habitat destruction are currently the major limiting factor in their breeding success. This is believed to result from increased populations of predators (Foxes, Hooded Crows and Magpies), possibly brought about by reduced levels of control and increased feeding opportunities arising from higher stocking densities and other agricultural improvements.

It is suspected at least three pairs bred within the area south west of the proposed site area, outside the 800m buffer in 2009 with breeding activity (drumming) recorded in May. Small numbers were flushed during the breeding and non-breeding seasons while carrying out walkover surveys.

Assuming that the total Irish population of breeding snipe is 10,000^{+}, it is reasonable to assume the proposed site and buffer zone could be of **Local value**.

Other Target Species

A number of target species (as defined previously) were recorded on site and the importance of the site and buffer zones for these species is evaluated for each species. The importance of the planning application boundary and buffer zones for non-target species is evaluated generically below.

Passerines of Conservation Concern

A number of passerines of conservation concern were recorded as regularly occurring species within the planning application boundary and 800m buffer zone. Those identified during the course of the study period included Fieldfare, House Sparrow, Meadow Pipit (now Red Listed BoCC 2014) Skylark, Dunnock, Goldcrest, Grasshopper Warbler, Linnet, Mistle Thrush, Robin, Sand Martin, House Martin, Swift, Wheatear, Willow Warbler, Starling, Stonechat Spotted Flycatcher and Swallow. However, due to the wide availability of similar breeding and non-breeding habitats in the general area and the relatively medium numbers of each species recorded, the site and buffer zone is considered to be of **local** importance for these species.

Identification of Ornithological Features Subject to Detailed Assessment

In accordance with CIEEM guidelines, impacts are only assessed in detail for receptors of sufficient value that impacts may be significant (in terms of legislation or policy). For this assessment, impacts are assessed in detail only for receptors of at least County value, those included on the SNH list of species of conservation concern potentially subject to impacts from wind farm development (adapted for Ireland), i.e. target species, or where a breach of legislation could occur (e.g. damage to active nests).

Receptors which are **not** subject to further detailed assessment, and for which there is **no significant impact**:

i) Hen Harrier
ii) All other passerines of conservation concern

Receptors subject to detailed assessment in this chapter therefore include:

i) Red Grouse
ii) Snipe
iii) Golden Plover

12.5. Predicted Environmental Effects & Their Significance (Construction)

This section characterises and evaluates the significance of potential impacts on ornithological features during the construction phase of the wind farm development.

The main impacts on birds during construction are likely to include the following:

i) habitat loss (breeding and foraging);
ii) temporary disturbance/displacement during construction operations; and
iii) damage to active nests.

These impacts are assessed in turn below for each of the important bird species outlined previously.

12.5.1. Red Grouse

Habitat Loss
Red Grouse were identified to have possibly bred within the planned site development boundaries in the overhead electrical cable route and regularly foraged in the wider area. There is planned development in this area thus habitat will be lost. There is potentially suitable habitat within the development area but the area of loss is very small <0.1% of the wider area suitable habitat for breeding and foraging, the impact of foraging habitat loss upon this species is **not considered significant**. The confidence level of this prediction is **certain/near certain**.

Temporary Disturbance/Displacement During Construction
The main area that Red grouse where recorded through the survey period will not be developed as part of the proposed development. The likely impact on Red Grouse resulting from construction disturbance is **not considered significant**. The confidence in this prediction is again **certain/near certain**, for the reasons outlined above.

Damage to Active Nests
Breeding species may nest in suitable habitat within the overhead electrical connection route, there will therefore be impact associated with disturbance to nesting pairs unless mitigation is followed to identify nesting birds in the breeding season, if necessary mitigation is followed it is assessed that **no impact** associated with damage to active nests, at a confidence level of **certain/near certain.**

12.5.2. Golden Plover

Habitat Loss
This species does not breed on site, with all records during the non-breeding season. The area of habitat loss is small <1% of the land control area. The wider area holds a large expanse of suitable habitat.

Due to the wide availability of other areas in the vicinity of the site, the small amount of habitat in known foraging areas that will be lost and the relatively small number of birds that may be affected (maximum flock size was 74), impacts due to habitat loss associated with the application site are **not considered significant**. The confidence in this prediction is **certain/near certain**.

Temporary disturbance during construction
For the same reasons outlined above, impacts associated with temporary disturbance to Golden Plover during construction are **not considered significant**, at a confidence level of **certain/near certain.**

Damage to active nests
As stated previously, this species does not breed on site, with all records involving small infrequent numbers outside the application site boundaries. The wide availability of other suitable foraging areas in the vicinity of the site, the relatively small number of birds affected (max numbers - 74), the limited time period in which birds are present at the site and infrequent movements, impacts due to disturbance/displacement during the operational phase are **not considered significant**. The confidence in this prediction is **certain/near certain.**

12.5.3. Snipe

Habitat Loss
A least three pairs of Snipe were identified to have potentially nested within the direct development area in association with the electrical cable area that crosses the SAC. A development buffer zone of 400m around the potential snipe territories will be implemented which protects these territories.

The development has undergone various layout changes that have moved away from potentially suitable nesting and foraging Snipe areas thus further protecting potentially valuable nesting habitat in the area

Due to the abundance of other suitable breeding habitat within 2km, combined with the relatively small area to be lost as consequence of the proposed site development, the impact of foraging habitat loss upon this species is **not considered significant**. The confidence level of this prediction is **certain/near certain**.

Temporary disturbance during construction
In the absence of studies relating specifically to breeding Snipe through construction activities, studies relating to disturbance from operational turbines are considered the most comparable for this assessment (although as these studies are not directly comparable caution should be exerted when drawing conclusions) A study by Pearce-Higgins (2009) on disturbance rates at operational windfarms indicates that 400m from construction is the limit for disturbance for breeding Snipe.

The occupied territories identified were within the direct development site area in relation to the overhead electrical connection through the SAC and during the construction period may be disturbed unless appropriate mitigation is followed. The abundance of suitable habitats in the wider area will lessen impacts from the construction period.

Due to the development buffer zones around Snipe nesting territory (and construction distances from potential favoured nesting areas) the likely impact on Snipe resulting from construction is **not considered significant**. The confidence in this prediction is again **certain/near certain**, for the reasons outlined above. The confidence in this prediction is **certain/near certain.**

Damage to active nests
Due to the development buffer zones around Snipe nesting territory (and thus recently favoured nesting areas) the likely impact on Snipe resulting from damage to active nests is **not considered significant**. The confidence in this prediction is again **certain/near certain**, for the reasons outlined above.

12.5.4. Other Species

In the absence of mitigation, it is possible that disturbance of nesting birds or damage to active nests (primarily passerines) may occur during construction. Such impacts are **not significant** in terms of the conservation status of any of the bird species that may be impacted. Passerine species generally have high background mortality and fecundity rates and populations are quick to recover from short term disturbance. The confidence in this assessment is **certain / near certain.**

12.6. Predicted Environmental Effects & Their Significance (Operation)

This section characterises and evaluates the significance of potential impacts on ornithological features during the 25-year operational phase of the development. Particular attention is paid to adverse impacts resulting from the displacement of birds due to disturbance from wind farm operation and from collision with turbines. These issues are considered separately below, where appropriate, for the identified species. As the electrical connection will not result in bird disturbance/displacement or collision, the issues are discussed in terms of cumulative impacts with the permitted wind farm (6 No turbines are Black Lough and Cloonkeelaun).

12.6.1. Disturbance/Displacement - Background

Displacement by the overhead electrical connection is not a factor. The overhead will be infrequently visited. As such disturbance/displacement is discussed in terms cumulative impact of the turbines which the overhead line will serve. Disturbance/displacement of birds may arise close to the turbines when birds use these areas less often than would be expected, potentially reducing the carrying capacity of an area for particular species.

Potential sources of disturbance to birds during the operation of the scheme include turbine operation, both in terms of visual disturbance and noise disturbance and increased human activity during maintenance activities.

Reductions in the density of breeding birds around wind farms (presumed to be due to turbine operation) have been identified at distances between 100m to 800m from turbine locations for key species (Pearce-Higgins *et al*. 2009 and 2012). There is some potential for disturbance to birds due to increased human activity for turbine (and other wind farm infrastructure) maintenance purposes. However, this generally involves infrequent or low-level disturbance and is restricted to areas adjacent to tracks and turbine bases. Furthermore, birds on site will be somewhat habituated to the presence of humans due to farming activities and recreational activities currently taking place.

Red Grouse
Red grouse may potentially breed on site in association with the overhead line route, however there is suitable habitat within the site footprint that may be subject to species disturbance. Red Grouse habituate well with wind turbine developments frequently being recorded within complete turbine developments (T Nelson per obs), using the turbine development area without signs of long-lasting disturbance. Mitigation in the form of identifying and implementing disturbance buffer zones should be implemented in the SAC. Impacts due to disturbance/displacement associated with wind farm operation is **not considered significant** and from the overhead line, **imperceptible**. The confidence in this prediction is **certain/near certain**.

Golden Plover
As stated previously, this species does not breed on site, with all records involving small infrequent numbers within the application site boundaries. The wide availability of other suitable foraging areas in the vicinity of the site, the relatively small number of birds affected (max numbers - 74), the limited time period in which birds are present at the site and infrequent movements, impacts due to disturbance/displacement associated with wind farm operation are **not considered significant** and from the overhead line, **imperceptible**. The confidence in this prediction is **certain/near certain.**

Snipe
The Pearce-Higgins study (2009) on disturbance of breeding birds around upland wind farms demonstrated significant avoidance of turbines by breeding snipe at distances of up to 400m.

Due to the wide availability of suitable breeding habitats for this species both on and off site, and the protection of habitats occupied by Snipe afforded by the a 400m buffer zone, impacts relating to the disturbance/displacement of Snipe are **not considered significant** and from the overhead line, **imperceptible**. The confidence in this assessment is **certain/near certain.**

12.6.2. Collision Risk

Although conclusions are mostly based on wind farms located away from high concentrations of bird activity or on casually found victims with no correction for corpses that are overlooked or removed by scavengers the indications from studies so far (e.g. Crockford, 1992, Benner, 1993, Winkleman, 1994, Percival, 2000) are that collisions with moving turbine blades are relatively rare events. Nevertheless, birds that collide with a turbine are likely to be killed. This may in turn affect the viability of bird populations, particularly when populations are small. Collision risk with the overhead line is imperceptible.

The level of collision with turbines will depend on the extent to which birds are displaced and the ability of birds to detect and manoeuvre around rotating turbine blades. The extent to which birds are able to avoid collision with turbines has not yet been adequately quantified for all species and therefore there are a number of uncertainties in predicting collision mortality. As such, confidence in predictions of impact significance here is subject to some uncertainty and is therefore only considered **probable.**

Snipe
Snipe were recorded flying over the site boundary or 800m buffer zone in free flight. There was one survey day were a single male was displaying (drumming) within the site boundary. Therefore there is potential for Snipe to be at risk from collision when in display. The number of Snipe registered during walkover surveys of the proposed site area and 800m buffer zone resulted in very low numbers during the breeding season and 1-4 recorded during walkovers in the non-breeding season within the site boundaries.

The potential loss of numbers to collision is **not considered significant**. The confidence in this prediction is **probable.**

Red Grouse
Red Grouse are not known to fly at turbine collision risk height, therefore Red Grouse are not at risk from collision.

The potential loss of numbers to collision is **not considered significant**. The confidence in this prediction is **probable**.

Golden Plover
With only 11 registrations over 2 non-breeding seasons and only four registrations at turbine collision height it is assessed that potential collision risk from turbines in the proposed site are extremely low.

The potential loss of numbers to collision is **not considered significant**. The confidence in this prediction is **probable.**

12.7. Predicted Environmental Effects & Their Significance (Decommissioning)

This section characterises and evaluates, insofar as is possible, the significance of potential impacts on important bird species during the decommissioning of the proposed scheme.

It is difficult to predict impacts which would arise from decommissioning and the confidence in all predictions is considered to be **probable or uncertain**, due to the length of the operational period (25 years) and because the future composition of the bird community is not known.

In the absence of mitigation, decommissioning could cause temporary impacts through disturbance similar to those predicted to occur during the construction period, albeit the magnitude of impacts are likely to be lower during decommissioning as ground works will be less extensive. Beneficial impacts may also occur through the removal of infrastructure and the reinstatement of topsoil.

Adverse impacts for those species present at the time of decommissioning are likely to be temporary, decommissioning taking approximately one week for the overhead line and approximately nine months for the other wind farm infrastructure. Such impacts are **not anticipated to be significant**.

Surveys would be undertaken prior to decommissioning to inform an up to date assessment of potential impacts on important bird species. Even if impacts are considered unlikely to be significant, based on current legislation, damage to active nests, or disturbance to species while breeding, could represent an offence and mitigation may therefore be required.

The significance of beneficial impacts on birds due to the reinstatement of semi-natural habitats is difficult to quantify. Although reinstatement is likely to have a beneficial impact, given the small areas affected this is **not considered likely to be significant** for any important bird species based on current survey information.

12.8. Mitigation, Compensation & Monitoring

This section presents specific mitigation, compensation and enhancement measures to be adopted through the different phases of the development.

It is important as part of any environmental impact assessment, wherever possible, to clearly differentiate between mitigation, compensation and enhancement and these terms are defined here as follows:

i) Mitigation is used to refer to measures to avoid, reduce or remedy a specific adverse impact in situ. Mitigation is only required for adverse impacts assessed as being significant or where required to ensure compliance with legislation.
ii) Compensation is used to refer to measures proposed in relation to specific adverse impacts but where it is not possible to fully mitigate for adverse impacts in situ. Compensation is only required for adverse impacts assessed as being significant or where required to ensure compliance with legislation.
iii) Enhancement is used to refer to measures that will result in beneficial ecological impacts but which do not relate to specific significant adverse impacts or where measures are required to ensure legal compliance

12.8.1. Construction Mitigation Measures

Damage to Active Nests
In the absence of mitigation there is a risk that nests (of any species) could be damaged or destroyed during construction and decommissioning activities. This could result in a breach of Legislation.

Prior to and during construction works, in order to ensure compliance with the legislation, all potential nesting habitat will be checked for nests by a suitably qualified ornithologist prior to ground works taking place.

Ecological Clerk of Works
As detailed in the CEMPs for Black Lough and Cloonkeelaun wind farms (approved by Sligo County Council), an Ecological Clerk of Works (ECoW) will be employed for the duration of the construction period to assess baseline conditions pre-construction and liaise with construction staff. The role of the ECoW will report to the construction management team.

The duties of the ECoW are as follows:

- Providing advice to ensure legal compliance with respect to nesting birds.
- Ensuring that the terms of the CEMP, e.g. appropriate exclusion zones around the nests of sensitive species, and adhered to by all contractors working on the site.
- Ensuring suitable measures are in place to protect retained or created habitats.
- Undertaking the necessary pre-construction protected species surveys, obtaining any licences (approach sensitive nesting birds) and supervising the implementation of any mitigation measures required.

- Liaison with contractors and construction staff working on site.
- Providing regular reports and maintaining regular contact with nature conservation organisations and any other relevant stakeholders.
- Providing regular on-site advice with respect to any ecological issues that arise.

12.8.2. Operational Mitigation Measures

Monitoring
Ornithological survey should be carried out in years 0 (Year before construction), 1 (during construction) and subsequent years 3, 5, 10 and 15 by an appropriately experienced Ornithologist. This will allow assessment of any further impacts to new potential nesting of key species to be assessed prior to construction and appropriate mitigation measures enforced. Surveys will include:

- Vantage point watches 36 hours per VP per season (SNH 2014).
- Walkover surveys to include the application site and 800m buffer.
- Raptor watches out to 2km

12.9. Cumulative Impacts

There are other operational and proposed wind farm developments within significant distance of the development area to allow a barrier effect or cumulative impact. The nearest existing/proposed wind farm is within 500m of the proposed site. The scale of the proposed site and associated infrastructure is small and will not have a major cumulative effect. Mitigation measures for infrastructure must be included to ensure no barrier effects are added to the development. No migration routes or regular movement routes of birds through the site have been identified during extensive surveys of the Black Lough and Carrowleagh areas. Mitigation measures will ensure that any cumulative impacts at the proposed site **will not be significant**.

Grid Connection
The grid connection route will have a section of overhead cable which may have implications for breeding birds and bird movements. A 2.5km section of overhead line will be located approximately 500m to the west of the proposed electrical connection. The overhead cables will be located over an area of cutover bog that has the same bird assemblages as the Black Lough study area.

During construction of the overhead grid connection and grid located underground may disturb breeding birds during the breeding season. If construction is to go ahead in the breeding season, then it is advised that appropriate bird surveys would be carried out prior to construction commencing to identify nesting birds. Surveys should be on-going during any construction in the bird breeding season to identify and impose appropriate mitigation measures in the form of buffer zones in relation to nesting birds.

The impacts to breeding birds from disturbance during construction should be short in time and the loss of habitat will be minimal along the grid connection route. Habitat loss will be minimal for a limited period and returned to appropriate conditions after construction.

This report has concluded that impacts from the proposed development will not be significant to birds. It is assessed as similar bird assemblages and no species of potential risk to overhead cables will be at risk from the grid connection route and thus cumulative impacts from the grid connection will **not be significant**.

12.10. Residual Impacts

No significant negative ornithological residual impacts on the ornithological interest of the site and surrounding area are predicted as a result of the proposed development.

Table 12-8: Summary of Potential Significant Effects and Proposed Mitigation

Receptor	Value	Source of Impact	Nature of Impact on Receptor	Significance of Impact	Proposed Mitigation	Residual Significance
Potential Construction Impacts						
		Habitat loss due to construction.	I,P	No significant impact. Rational: Insignificant amount of foraging habitat will be lost.	Identification of nests during breeding season and application of 400m buffer zones.	Not significant. Confidence in prediction: Certain/near certain
		Temporary Disturbance/Displacement during Construction	I,T	No significant impact. Rational: Negligible area of foraging will be disturbed during construction.		Not significant. Confidence in prediction: Certain/near Certain
Red Grouse	Local	Damage to active nests.	D,P	No significant impact. Rational: No nesting recorded on site.	Monitoring pre and during construction phase. Appropriate mitigation to be implemented by ECoW if nesting occurs.	Not significant. Confidence in prediction: Certain/near certain
		Habitat loss due to construction.	I,P	No significant impact. Rational: Insignificant amount of foraging habitat will be lost.		Not significant. Confidence in prediction: Certain/near certain
		Temporary Disturbance/Displacement during Construction	I,T	No significant impact. Rational: Negligible area of foraging will be disturbed during construction.		Not significant. Confidence in prediction: Certain/near Certain
Golden Plover	Local	Damage to active nests.	D,P	No significant impact. Rational: No nesting recorded on site.	Monitoring pre and during construction phase. Appropriate mitigation to be implemented by ECoW if nesting occurs	.
		Habitat loss due to construction.	I,P	No significant impact. Rational: Insignificant amount of foraging habitat will be lost.	Identification of nests during breeding season and application of 400m buffer zones.	n/a
		Temporary Disturbance/Displacement during Construction	I,T	No significant impact. Rational: Negligible area of foraging will be disturbed during construction.		
Snipe	Local	Damage to active nests.	D,P	No significant impact. Rational: No nesting recorded on site.	Monitoring pre and during construction phase. Appropriate mitigation to be implemented by ECoW if nesting occurs	Monitoring pre and during construction phase. Appropriate mitigation to be implemented by ECoW if nesting occurs.

Receptor	Value	Source of Impact	Nature of Impact on Receptor	Significance of Impact	Proposed Mitigation	Residual Significance
Potential Operational Effects						
Red Grouse		Disturbance, Displacement	I,P	No significant impact. Rational: Negligible area of foraging habitat will be lost due to development.	n/a	Not significant. Confidence in prediction: Certain/near Certain
Golden Plover		Disturbance, Displacement	I,P	No significant impact. Rational: Negligible area of foraging habitat will be lost due to development.	n/a	Not significant. Confidence in prediction: Certain/near Certain
Snipe		Disturbance, Displacement	I,P	No significant impact. Rational: Negligible area of foraging habitat will be lost due to development.	n/a	Not significant. Confidence in prediction: Certain/near Certain
Collision						
Red Grouse		Collision	D,P	Not significant	n/a	Not significant. Confidence in prediction: Probable
Golden Plover		Collision	D,P	Not significant	n/a	Not significant. Confidence in prediction: Probable
Snipe		Collision	D,P	Not significant	n/a	Not significant, Confidence in prediction: Probable

13. MATERIAL ASSETS

This chapter of the EIAR describes the material assets associated with the site and its environs, the potential impacts of the proposed development thereon and the proposed mitigation measures to avoid or reduce potential impacts. It assesses the cumulative impact on material assets of the proposed electrical connection with the permitted and operational wind farms in the area, as well as the permitted grid connection to Glenree.

13.1. Material Assets in Existing Environment

Material assets are described in the EPA guidelines[1] as '*resources that are valued and that are intrinsic to specific places are called 'material assets'. They may be of either human or natural origin and the value may arise for either economic or cultural reasons. Examples of natural resources of economic value include assimilative capacity of air and water, non-renewable resources (e.g. minerals, soils, quarries and mines), renewable resources (hydraulic head, wind exposure)*.

Many of the aspects of material assets are addressed in other chapters of the EIAR, including:

- The natural environment, such as the Ox Mountains Bogs SAC, is discussed in Chapter 11.
- The cultural assets (archaeology, monuments, historical sites, etc.) are discussed in Chapter 10.
- Geological heritage in Chapter 7.
- Transportation infrastructure in Chapter 6.
- Landscape in Chapter 3.
- Tourism and house prices in Chapter 4.

Other material assets associated with the site and its environs are discussed below.

13.1.1. Wind Energy Resource

Wind energy has the following attributes:

- It is the country's biggest energy resource.
- It is clean, renewable and sustainable as a means of electricity generation.
- It is a cost-effective energy options for reducing global warming.
- The operation of a wind farm has practically zero emissions.

The proposed electrical connection passes through a designed SAC (Ox Mountains Bogs) and will facilitate the export of power to the national grid. Although an exposed area, with good wind speeds, SAC's would typically not be suitable for siting wind turbines. As such, the proposed electrical connection would not compromise the development of a wind farm at the site in the future.

13.1.2. Electricity Resource

Government targets for electricity generation from renewables require an additional 3,900MW of installed wind farm capacity. In GATE 2, 1,450MW was processed. The Black Lough Wind Farm, of 12.5MW capacity, is included in the GATE 3 connections and transferred to the ECP-1 list in August 2018. Having local embedded generation capacity is a benefit to the electricity transmission and distribution networks – there are less losses associated with local embedded generation as the power generated is largely consumed locally.

13.1.3. Forestry Resource

There is no commercial forestry within the site. Forestry resources will not be affected by the proposed development.

13.1.4. Agricultural Resource

The site is largely unspoilt blanket bog with very low agricultural potential.

13.1.5. Industrial Minerals and Rocks

Extraction activities in the area are limited to the harvesting of peat, both on a commercial basis and hand-cutting of smaller plots, and the extraction of gravel from borrow pits for bog road construction. According to the Directory of Active Quarries, Pits and Mines in Ireland[39], there are no pits or mines in the vicinity of the site. Notwithstanding the limited potential for mineral occurrence, the location of the site within a SAC makes it unattractive for the extractive industry.

13.2. Potential Impacts on Material Assets

The development of the electrical connection will have positive and negative impacts upon the material assets in the receiving environment.

13.2.1. Positive Impacts on Material Assets

The proposed electrical connection will facilitate the export of electricity generated at the Black Lough Wind Farm. As such, it is an indirect positive impact, as in addition to reducing harmful atmospheric emissions, wind energy is an indigenous, secure and sustainable resource in contrast to fossil fuels, which are ultimately unsustainable. Current rates of use of fossil fuels (coal, oil and gas) are 300,000 times greater than the rate at which these fuels are naturally created. The development of wind energy slows down this depletion and offers an alternative power source.

The permitted connection route (see Figure 2-4) between Black Lough and Cloonkeelaun is approximately 6.92km long, all of which is underground and mostly along the road verge. Construction of the connection along public roads will have a temporary negative impact on the local road network, with some short-term traffic disruptions expected. This will be avoided by the proposed development.

13.2.2. Negative Impacts on Material Assets

Tawnamore is not an important area for tourists nor is it a designated amenity area. Tourism is recognised in the Sligo CDP as playing an important contribution to the socio-economics of the County and is strongly encouraged. The scenery of County Sligo is the primary tourist attraction. There are a range of attractions from mountains, lakes, rivers, coastline, woodlands etc. with their associated activities including trekking, hill walking, mountaineering, fishing, sailing etc. Utility poles and lines are seen as unattractive intrusion on the landscape. However, the proposed development is remote, will not be seen from the main tourist routes and so will not detract from the tourism potential of the area.

The Ox Mountains Bogs SAC is a natural resource through which the proposed development will pass. The potential impacts were assessed, and a NIS prepared (Appendix 11-1). The NIS '*concludes that if the mitigation measures specified for this specific development are implemented, …….., the proposal will not, in the light of best scientific knowledge, adversely affect the integrity of the Ox Mountains Bogs SAC or any Natura 2000 site either alone or in combination with any other plans or projects'.*

In addition, it has been agreed by the landowner to block two man-made drains running through the SAC near the route of the electrical connection. The NIS concludes '*this will be of significant benefit to the management of the area and will complement the specific Conservation Objectives for Blanket Bog and Wet Heath for the site (NPWS 2016a) which both include 'Area increasing, subject to natural processes' as the conservation target for 'Habitat Area'. The Blanket Bog notes on this target state "It should be noted that further restoration of Blanket Bog would be required in order to fulfil the targets for peat formation and hydrology presented below'.*

13.3. Mitigation Measures

There are no mitigation measures required.

13.4. Conclusions on Material Assets

Wind energy is one of Ireland's largest, commercially viable energy resources, and is also a clean, renewable, and sustainable means of electricity generation. The proposed electrical connection will facilitate the construction of a 12.5MW wind farm. The overall impact of the electrical connection on the material assets of the area is therefore positive.

14.INTERACTION OF THE FOREGOING

The impacts of the proposed development have been assessed for the various aspects of the environment, as discussed in the preceding chapters. While these assessments are not conducted in isolation, their focus is on the specific aspect of the environment under consideration. This chapter reviews all the aspects of the environment and identifies interactions between them. Table 14-1 summarises the interactions for both the construction phase (C) and operational phase (O) of the proposed electrical connection. Each aspect of the environment is listed on the left column and the top row. The interactions are discussed in terms of the impacts associated with the aspect of the environment listed in the column with the aspects of the environment listed across the row. For example, the impacts of the electrical connection associated with landscape are discussed in terms of their interaction with each of the other aspects of the environment. The interaction is therefore not necessarily reciprocal.

Table 14-1: Interaction Matrix

	Phase	Landscape	Noise	Population & Human Health	Traffic	Soils & Geology	Hydrology	Climate / Climate Change	Cultural Heritage	Biodiversity – Flora & Fauna	Biodiversity - Avian Ecology	Material Assets
Landscape	C											
	O											
Noise	C											
	O											
Population & Human Health	C											
	O											
Traffic	C											
	O											
Soils & Geology	C											
	O											
Hydrology	C											
	O											
Climate / Climate Change	C											
	O											
Cultural Heritage	C											
	O											
Biodiversity- Flora & Fauna	C											
	O											
Biodiversity - Avian Ecology	C											
	O											
Material Assets	C											
	O											

Legend

- No Significant Interaction
- Negative Interacting Impact
- Positive Interacting Impact
- Neutral Interacting Impact

14.1. Impact Interactions

14.1.1. Landscape

The landscape impacts associated with electrical connection are not envisaged to have a significant interaction with other aspects of the environment.

14.1.2. Noise

Noise is one of the aspects of the environment considered in terms of its impact on human beings. There will be increases in noise during the construction phase, but no significant noise emissions are envisaged during the operation phase. Noise during construction may deter wildlife from using the site. During the operational phase wildlife usage of the site is expected to return to normal.

14.1.3. Population & Human Health

Human beings are discussed in terms of settlement pattern, public health, and recreation and amenity. These aspects of the discussion do not have any significant interaction with other aspects of the environment.

14.1.4. Traffic

There will be an increase in traffic for a short period of time during the construction phase, with insignificant traffic volumes during the operational phase. Additional HGV traffic during construction will have a temporary negative impact on the landscape, in terms of HGV movements; it will increase traffic noise on the roads leading to the site; it will increase dust and emissions associated with HGVs and therefore impact air quality; it will have a negative interaction (inconvenience) with local road users; and will temporarily displace wildlife using the site.

14.1.5. Soils, Geology & Hydrogeology

The predicted impacts on soils and geology associated with electrical connection are not significant and are not envisaged to have a significant interaction with other aspects of the environment.

14.1.6. Surface Water / Hydrology

Incident rainfall could result in erosion of exposed soils impacting on water quality of the receiving streams and rivers. These impacts of the development on the surface water quality could impact on other users of surface water in the downstream catchment. Although no surface water users were identified, there may be unregistered abstraction points. In a similar way, it could impact on the aquatic habitats. So, for the construction phase, there is a potential negative interaction with soil & geology, ecology and human beings (as potential users of surface water downstream of the site).

14.1.7. Climate / Climate Change

There are no impacts envisaged on climate during the construction phase of the proposed development. The interaction of climate / climate change is more associated with the wind farm itself. And while the electrical connection will facilitate the export of electricity from the wind farm, it will itself have any significant interaction with other aspects of the environment.

14.1.8. Cultural Heritage

No negative impacts are predicted for archaeology and cultural heritage. Hence, there are no interactions envisaged on the other aspects of the environment.

14.1.9. Ecology

The loss of habitat and removal of vegetation associated with construction of electrical connection will have a knock-on negative impact on landscape. This will be at its worse during the construction stage. The restoration of trenches and backfilling of excavations with excavated materials will soften this impact, so a neutral interaction is assigned for the operational phase.

The removal of vegetation will also expose soils to erosion which (if not mitigated) could impact on surface water quality during construction. Again, with ongoing restoration, these impacts will be mitigated, so a neutral interaction is assigned for the operational phase.

The loss of habitat and displacement of wildlife during the construction phase may have a negative knock-on effect for avian fauna using the site for either nesting or foraging. This negative interaction is not envisaged during the operational phase.

14.1.10. Avian Ecology

The impacts associated with avian fauna are not predicted to have any significant interaction with other aspects of the environment. The temporary displacement of raptors from the site during construction could increase the numbers of prey species, but for the short construction period, this is considered insignificant.

14.1.11. Material Assets

Impacts on material assets and their interaction occur during both the construction phase and operation phase. During construction, there will be an increase in traffic which will have a negative interaction with the roads, as considered a physical material asset.

The alternative use of the land resource has a positive impact for the landowners involved during the operational phase.

14.2. Conclusions on the Interaction of the Foregoing

The interactions of all environmental factors indicate an overall positive development capable of supporting a clean, renewable and sustainable energy source for the region. The main impacts have been discussed in the preceding chapters and appropriate remedial measures are presented where necessary. The construction of the electrical connection will have no significant impacts on the environment in isolation or in combination with the associated wind farm. The overall conclusion of this EIAR is that the proposed electrical connection is the most viable for the overall wind farm project.

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